Exchange Rate Volatility and the Returns on Diversified South African Investment Portfolios

Murendeni Mulamu

Student Number: 14m1496

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RHODES UNIVERSITY, MAKHANDA

Supervisor: Prof. Hugo Nel

Co-Supervisor: Dr. S.A. Khumalo

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DEDICATION

I would like to dedicate this thesis to my late grandmother, Vho – Mashudu Tshilidzi Nengovhela. Even though she did not receive a formal education, she never stopped sharing her support, wisdom, love and always encouraged me to study. May her soul continue to Rest in Peace.

DECLARATION

I Murendeni Mulamu do hereby declare that except for references specifically indicated in the text and such help as has been provided to me by my supervisors, that this thesis is wholly my own work and has not been submitted at any other University or Technikon for any degree purposes.

Signed______________________ on this 15th day of December 2021.

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ABSTRACT

Globalisation has made it much easier to invest in foreign countries. This creates endless options accessible to investors, including exploiting opportunities for investment in international economies. Although foreign investment portfolio diversification provides significant opportunities for financial returns, exchange rate volatility may play a prominent role when investing in foreign markets. Since the introduction of a floating exchange rate system, together with the inflation-targeting monetary policy framework in South Africa, there has been significant volatility in the exchange rate, far more than during the previous dispensations. This, however, creates a strong need to consider how the unpredictable nature of the exchange rate affects these investments.

The purpose of this study is to analyse the effect of exchange rate volatility on the returns on diversified South African investment portfolios. This research examined whether there is a homogenous relationship between South African (domestic) portfolios and the internationally diversified portfolios. In addition, the study investigated the long-run relationship between the exchange rate volatility and both domestic portfolios and the internationally diversified portfolios for the period 2007-2019. To achieve these goals, a panel ARDL model was employed.

This study found that exchange rate volatility does not account for a significant portion of returns on investment portfolios fluctuations. Moreover, the relationship is not homogenous because returns on domestic investment portfolios react positively to the exchange rate volatility, whereas returns international investment portfolios respond negatively/positively to the exchange rate volatility depending on whether the relationship is short or long run. This study will contribute to the existing literature, and it is important for investors intending to diversify their investment portfolios both domestically and internationally using different mutual funds in South Africa.

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LIST OF ACRONYMNS

ADF	Augmented Dickey-Fuller
ARDL	Autoregressive Distributed Lag
APT	Arbitrage Pricing Theory
CAPM	Capital Asset Pricing Model
CEE	Central and Eastern Europe
CPI	Consumer Price Index
DFE	Dynamic Fixed Effect
DMF	Domestic Fund
DW	Durbin-Watson
ECM	Error Correction Model
EMH	Efficient Market Hypothesis
EMU	Economic and Monetary Union
ERI	Exchange Rate Index
ERV	Conditional Volatility
%ERV	% change in conditional volatility
ETF	Exchange Traded Fund
EUR	Euro
EViews	Econometric Views
FDI	Foreign Direct Investment
GARCH	Generalised Autoregressive Conditionally Heteroskedastic
GBP	Great British Pound
GDP	Gross Domestic Product
IBSA	India Brazil South Africa
IMF	International Monetary Fund
INF	Inflation rate
IPS	Im, Pesaran and Shin test
ITF	International Fund

JB	Jarque-Bera
JPY	Japanese Yen
LLC	Levin, Lin and Chu test
LOP	Law of One Price
MG	Mean Group
PMG	Pooled Mean Group
MW	Maddala and Wu test
MPT	Modern Portfolio Theory
NAV	Net Asset Value
PP	Philip-Perron
PPP	Purchasing Power Parity
RET	Returns on investment portfolios
RWH	Random Walk Hypothesis
SARB	South African Reserve Bank
SML	Security Market Line
USD	United States Dollar
VAR	Vector Autoregressive model
ZAR	South African Rand

CHAPTER ONE: INTRODUCTION TO THE STUDY

1.1 Introduction and Background of the Study

The globalisation trend has undeniably influenced today's modern world; it has also made it much easier to invest in foreign countries (Selimi, 2012). Investors now have endless options accessible to them in their investment activities, including exploiting opportunities for investment in international economies. Although foreign investment portfolio diversification provides significant opportunities for financial returns, exchange rate volatility may play a prominent role when investing in foreign markets. This, however, creates a strong need to consider how the unpredictable nature of the exchange rate affects these investments (Ray, 2013).

Over the past decades, South Africa has introduced multiple exchange-rate systems. The exchange rate policies have developed from fixed exchange rate (1945 to 1985), the dual exchange rate (1986 to 1995), the managed floating exchange rate policy (1996 to 2000) and the freely floating exchange rate regime (since 2000) (Van der Merwe & Mollentze, 2012; Mtonga, 2011; Patrick & Nyatanga, 2018). South Africa's external value of the currency is now defined in the foreign-exchange market by supply and demand conditions. This, however, has resulted in higher and sudden fluctuations in the exchange rate (Van der Merwe, 2004). Since the introduction of a floating exchange rate system, together with the inflation-targeting monetary policy framework, there has been significant volatility in the exchange rate, far more than during the previous dispensations (Mlambo, 2013).

The increase in globalisation in the 1990s has led to a significant boom of portfolio flows into emerging markets (Schmukler, 2004). Railo (2000) states that the profound interest has been placed on foreign portfolio diversification due to the recent globalisation of economies. According to Ray (2013), the growing interest in international portfolio diversification can be explained in three ways. First, diversified foreign portfolios minimise risk. Secondly, it presents tremendous growth opportunities and, lastly, gives investors several different alternatives. Although investing outside of South Africa can present opportunities, international investing comes with some disadvantages not found in the South African marketplace. Investing in global economies tends to introduce new threats to investors, though it can be a positive factor for long-term investment. Investors must also bear the risk from exchange rate volatility to widen their investment scope into global economies (Kose et al., 2007). These risks include currency risks resulting from fluctuations in the exchange rate. Variations in these currency values, whether the home currency or the foreign currency, can either enhance or reduce the returns associated with investments.

1.2 Problem Statement

South Africa is one of approximately 65 countries in the world that adopted a free-floating exchange rate regime in 1995 (IMF, 2014). Under the floating exchange rate system, emerging economies like South Africa are often exposed to high exchange rate fluctuations due to a large influx and outflow of surplus money instigated by monetary easing. Although these fluctuations are usually short term, they still expose the currency to a high level of volatility. According to Mlambo (2013), currency volatility has been identified as one of the factors hindering South African economic growth. Almost every part of the South African economy has been impacted by the volatile nature of the Rand, including the equities market.

Due to the changing global environment and volatile exchange rate, it is therefore important to understand the relationship between the exchange rate of the rand and South African investment portfolios from the viewpoint of a portfolio manager or an investor. Understanding the relationship between the exchange rate and investment portfolios would help investors to hedge the portfolio risk and to know where to invest. Several studies in developed and developing countries have examined the effect of exchange rates on stock markets returns, bond markets and money markets. However, there are few studies that have examined the relationship between exchange rate volatility and investment portfolios. In the South African context, there is a lack of studies on the relationship between exchange rate volatility and South African investment portfolios. From the few studies that exist, there seems to be no consensus on the type of relationship, whether it is positive or negative, nor if the two variables influence each other. Therefore, this study aims to investigate how exchange rate volatility affects the returns of both domestic and internationally diversified investment portfolios in South Africa.

1.3 Goals of the Research

The primary aim of the study is to analyse the effect of exchange rate volatility on the returns on diversified South African investment portfolios.

In pursuit of this aim, the following objectives apply:

1. To investigate the effect of exchange rate volatility on domestic portfolio investments.
2. To investigate the effect of exchange rate volatility on international portfolios investment.

1.4 Hypotheses

Objective 1:

Ho: Exchange rate volatility has no significant impact on the returns of domestic investment portfolios

H_1: Exchange rate volatility has a significant impact on the returns of domestic investment portfolios

Objective 2:

Ho: Exchange rate volatility has no significant impact on the returns of international investment portfolios

H_1: Exchange rate volatility has a significant impact on the returns of international investment portfolios

1.5 Methods, Procedures and Techniques

The study follows a post-positivist paradigm. Following the research by Abid et al. (2014), Sgammini (2016) and Ziobrowski & Ziobrowski (1995), the sampling design for this study was consist of 10 investment portfolios in South Africa. The investment portfolios was grouped into two groups of five domestic investment portfolios and five international ones. To achieve the goals of the study, monthly data from January 2007 until December 2019 for the exchange rate volatility and the Net Asset Value (NAV) of the chosen South African investment portfolios was collected from various databases such as Thomson Reuters (2020), SARB (2020), Alexander Forbes (2020) and FundsData Online (2020). The return was calculated using the NAV of each investment portfolio. A GARCH model was used to derive volatility measures. Moreover, a panel Autoregressive Distributed Lag (ARDL) econometric technique was employed to establish if there is cointegration amongst the return on investment portfolios and the exchange rate volatility (specific details will be covered in chapter 4).

1.6 Significance of the study

Due to recent changes in the global financial markets, exchange rates have begun to fluctuate aggressively in a way that has created both negative and positive impacts on countries throughout the world. The instability in the exchange rate has affected the South African economy, including the stock markets. Although several studies have been done on the extent to which exchange rate movement affect diversified investment portfolios, empirical evidence is inconsistent. Understanding the relationship between exchange rate volatility and diversified investment portfolios is critical to the investment community and policy makers in this rapidly changing global climate. Furthermore, this study will contribute to the existing literature in two ways. Firstly, as per the author's knowledge, very few studies have been conducted to examine the impact of exchange rate volatility on diversified investment portfolios in South Africa. Secondly, improved understanding of the volatility spillover effect between the exchange rates and diversified investment portfolios, and thus the degree of their integration, will broaden the information set available for decision-making to portfolio managers, investors, multinational companies, and policymakers.

1.7 Structure of the Thesis

The study will be outlined in the following manner. Chapter 2 reviews the existing literature on the exchange rate and the South African exchange rate policy. Chapter 3 covers an overview of an investment portfolio with a specific focus on asset allocation, portfolio management and diversification of investment portfolios, as well as the review of existing literature on the exchange rate and investment portfolios. Chapter 4 covers the methodology employed in this study, giving attention to method, sample size data and econometric analysis. Chapter 5 provides the results and discussion of the findings. Lastly, Chapter 6 is the summary, conclusion, and recommendations.

CHAPTER TWO: A REVIEW OF THEORIES UNDERLYING INVESTMENT PORTFOLIOS

2.1 Introduction

Individuals can distribute their income among current consumption, productive investment, and financial investment. However, after consumption and productive investment decisions have already been made, they are now left with the portfolio (financial) decision and how to allocate the residual income to financial and/or real assets to maximise the most desirable return. Reilly & Brown (2012) state that when net income is higher than current consumption needs, this provides an incentive to invest. According to Bartram & Dufey (2001), individuals have vast options of forms in which wealth can be held, including; non-liquid holding of commodity futures, gold coins, real estates as well as bonds, stocks, money market securities and cash equivalents. Investment theory, then, involves the concepts that allow investors to rationally distribute their wealth between the various investment alternatives (Bartram & Dufey, 2001).

According to Reilly & Brown (2012), the definition of investment considers the time over which the investment is made, the inflation rate during this time period and the uncertainty faced by investors. Sairam (2016) pointed out that investment considers either time or risk or both. Investment can, therefore, be formally defined as the funds invested today over a period of time with the aim of deriving future payments that will compensate the investor for the duration over which the funds is invested, the anticipated rate of inflation and uncertainty of the future payments (Reilly & Brown, 2012). The role of time in the investment process is also emphasised by Levišauskaite (2010), who described the investment as the act of employing funds over the long term in order to increase investors' wealth. Sairam (2016) defined investment as funds employed with the aim of earning a favourable return on it. In simple terms, investment is a process that involves the utilisation of money in order to make more money (Sairam, 2016).

Given the vast options available to investors for investment, investors can invest their funds directly in either of the classes or range of classes through Exchange Traded Funds (ETFs) and Mutual Funds (Bartram & Dufey, 2001). An investor who prefers to invest in a variety of classes through diversification can minimise the risk involved rather than investing in a single asset class (SEC, 2008). This type of investing is referred to as an investment portfolio. There are two types of investment portfolio approaches that are commonly used. The First is the equity portfolio approach, which mainly includes higher risk and returns. Second is the bond approach, which is mostly described as being less risky and generates lower returns than the equity portfolio approach (Reilly & Brown, 2012). Both approaches are important in understanding of portfolio investment, but for the purpose of this study, we will only explore the equity portfolio approach.

The next sections discuss the investment portfolio in detail. It shall include a review of the modern portfolio theory (MPT), the efficient Market Hypothesis (EMH), the capital asset pricing model and the arbitrage pricing model. It further discusses the investment management strategies, differentiating between passive versus active management strategies and secondly, the equity portfolio strategy. Lastly, diversification of investment portfolio is discussed, focusing on the importance of asset allocation and its strategies and the distinction between domestic and international investments.

2.2 Modern Portfolio Theory

The foundation for Modern Portfolio Theory (MPT) was established by Harry Markowitz (1952), who is known as the father of MPT. The MPT is an investment framework for selection and building of an investment portfolio based on optimising anticipated portfolio return and simultaneously mitigating portfolio risk (Mangram, 2013). According to Elton & Gruber (1997), Markowitz formulated portfolio theory as a choice of the mean and variance of a portfolio of assets. The fundamental theorems underlying the mean variance portfolio theory include holding constant variance, maximizing expected return, and holding constant expected return to minimize variance (Elton & Gruber, 1997). These two theorems led to the development of an efficient frontier from which the investors could select their ideal portfolio based on distinct risk return preferences. Basically, the theory emphasises that assets cannot only be chosen based on their unique characteristics, instead, an investor must consider how each asset moved in accordance with all other assets. In addition, taking account of such co-movements, a portfolio could be built with the same expected return and less risk than a portfolio built by disregarding interactions among securities.

In the past decades, portfolio selection theory has evolved, and many approaches for managing risks while mounting portfolio performance have been brought. Rubinstein (2002) notes that it is important to divide into equal parts an investment portfolio that is exposed to more risks into smaller parts rather than to risk the whole portfolio. This suggests that an investor also need to consider focusing on the diversification process in order to substantially minimise portfolio risk. With that said, it is important to understand the philosophy of risk and return since the aim of an investor is to achieve high returns at the lowest risk possible. According to Elton et al. (2013), MPT operates under the following assumptions: (1) there are no transaction fees when buying and selling assets, (2) investors can take any position in the market, (3) investors are rational players, (4) investors share the same information, they are price takers and are able to manage risk through diversification, (5) investors' psychology does not influence the market and investors usually want to optimise anticipated returns while mitigating risk.

Modern Portfolio Theory states that reasonable and higher returns are not possible without taking a certain degree of risk. The return from investment can be received in the form of dividends or capital gains. Risk is defined as the probability that the actual return could be different from the expected return and is usually measured by the standard deviation of the returns (Howells & Bain, 2008). The two main types of risk are systematic and unsystematic risk. Liem (2015) defined systematic risk as an undiversifiable risk, market risk or volatility. Systematic risk is caused by uncontrollable factors that impact the whole market, and that can lead to, for example, changes in the interest rate, inflation rate and asset prices. On the other hand, the unsystematic risk arises due to factors that affect a specific company or an industry, not the whole market. Unsystematic risk can be reduced through diversification; section 2.7 elaborates more on the diversification of an investment portfolio.

As discussed above, the two principles of portfolio theory led to the formulation of the efficient frontier framework. Assuming that individuals can lend and borrow at a riskless rate (for example, government bonds) when investors make investment decisions, they are faced with a trade-off between risk and return., and in order to decide which is the best trade-off, they have to apply portfolio theory by employing the efficient frontier framework (Omisore et al., 2012). The efficient frontier helps demonstrate an efficient portfolio to rational investors. This form of portfolio generates maximum returns at the lowest feasible risk and is also known as the optimal risky portfolio.

Figure 2.1 below shows the efficient frontier of risky assets. The vertical axis demonstrates the rate of return of the portfolio (ERp), and the horizontal axis shows the risk, as measured by the standard deviation (σ) and the line curve is the frontier showing possible return for given a risk. On the graph, the minimum variance portfolio point represents the maximum diversification and is the best point where individual investors can position themselves. Omisore et al. (2012)

noted that portfolios are only efficient when on the frontier, and if a portfolio is below the efficient line, it is referred to as a risky and not optimal risk/return option.

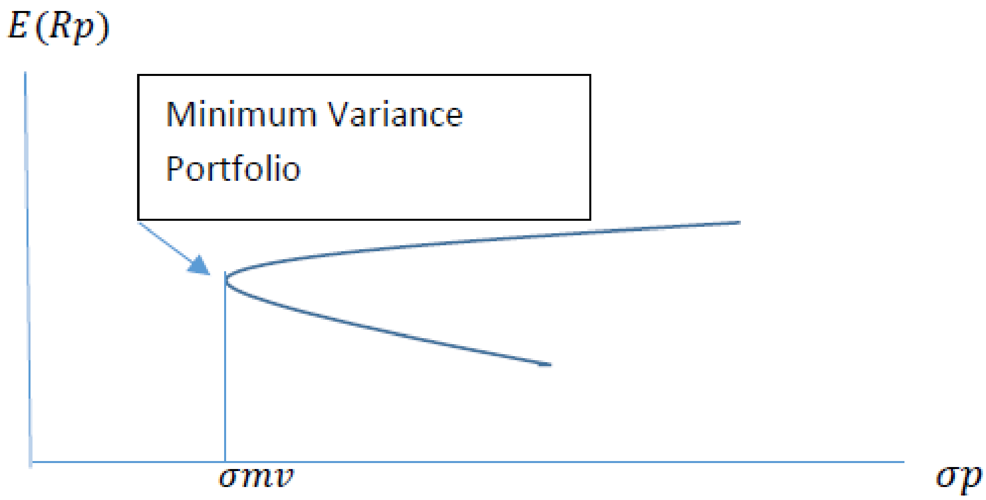

Figure 2.1: Efficient Frontier of Risky Assets.

Source: Best (2010)

Tobin (1958) expanded the efficient frontier framework by integrating a risk-free asset into the process. The development of the framework allowed investors to now be able to create an efficient portfolio that is made of both risky and risk-free assets. Moreover, these developments affect the efficient of the frontier in a way that it now provides new possibilities where the diversified portfolio dominates all other risky assets. The outcome is demonstrated by a straight line called the Capital Market Line (CML) (figure 2.2).

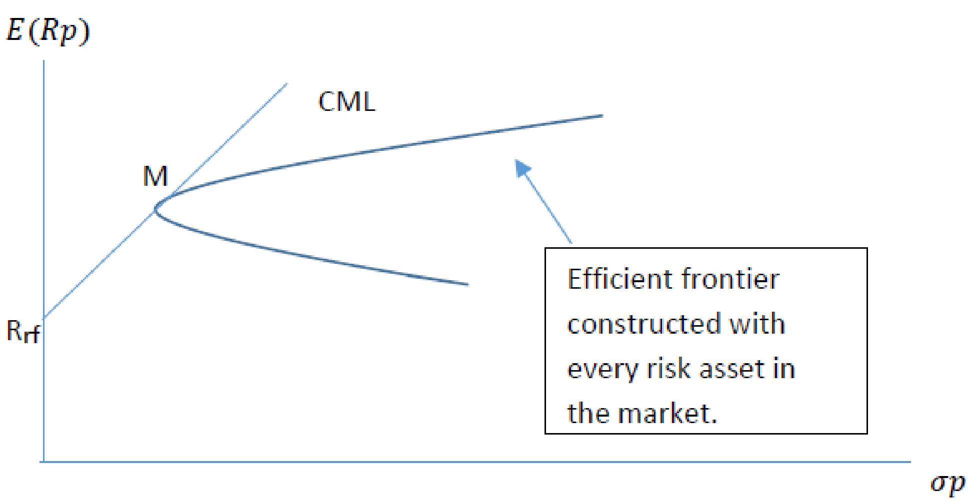

Figure 2.2: The Capital Market Line.

Source: Best (2010)

Figure 2.2 above show the efficient frontier together with the capital market line. The above diagram shows that an individual investor can obtain an optimal portfolio, which lies between CML and efficient frontier and is called a point of tangency. The set of points that lie on the CML specifies a portfolio that comprises portfolio M and risk-free security. On the graph, portfolio M is described as the market portfolio with risky assets that provide the maximum anticipated return over the risk-free interest rate. According to Omisore et al. (2012), such portfolios give better capital allocation and are efficient. Any portfolio below the CML is identified as inefficient since a portfolio on the CML provides a higher expected return on a similar risk level.

2.3 Efficient Market Hypothesis

The Efficient Market Hypothesis (EMH) concept is significant to this research because it is another subject that governs an investment's risk and returns. An efficient capital market is defined as a market where asset prices fully reflect all available information concerning its economic value (Malefo, 2015). According to Elton et al. (2013), this information includes historical data on asset prices along with current economic conditions and inside information on the company’s operation. This ensures that no individual investor can exploit specific information that would give them an advantage over other players when trading in stocks. However, the consequence following an efficient market is that it is difficult for investors to attempt to obtain higher returns consistently without taking a higher risk. Furthermore, the theory supports the concept that investors are unable to generate abnormal profits from investing in these financial assets because of the instantaneous and continuous adjustment of asset prices in the market (Ţiţan, 2015). Lo (2013) states that EMH is associated with the framework of the random walk hypothesis (RWH). The random walk hypothesis was formally formulated by Kendall & Hill (1953), and it states that asset prices will exhibit a random walk.

The EMH indicates that constructing a diversified portfolio will only produce a return that is comparative to that of the market. Fama (1970) states that a market that functions in such a way is referred to as efficient. The assumptions underlying the concept of efficient markets include the following: (1) new information about asset prices occurs in a random fashion; (2) the securities prices adjust rapidly to new information; (3) The market players are rational when evaluating security prices for profit; (4) There are many investors, and these investors cannot outperform the market.

The EMH is divided into three forms; the weak, semi-strong and the strong form (Fama, 1970). The weak form of EMH implies that the current prices of financial securities should, at any time, include all the existing past financial information. Under this form, a series of historical prices and the bulk of data does not offer information that can be used by investors to generate abnormal returns. Therefore, an attempt to time the market by technical analysts based on investigating past market price movements is made futile. The semi-strong form assumes that all existing information on a market, including historical information (also incorporating the weak form of EMH), is fully reflected in financial asset prices. This means that no trader in the financial assets market has any form of information advantage. In addition, the prices change instantly, and without biases to include any other new public information that comes out on the market, thus, the use of fundamental or technical analysis cannot offer an advantage to investors. Finally, the strong form of EHM which states that prices include all available public and private information on a market. Therefore, this form of EMH incorporates both past financial information (weak form) and all new public information (semi-strong form) and those investors are unable to generate higher returns than the returns made from the whole market.

2.4 Capital Asset Pricing Model

When investing, investors always look for an appropriate return that corresponds with the investment's risk. It is, therefore, crucial for this investment to be evaluated before making an investment decision. There are several methods used in financial analysis to measure the required return on investments. According to Al-Afeef (2017), the most important of these methods is the Capital Asset Pricing Model (CAPM). The CAPM was developed by Black (1972), Lintner (1965), Sharpe (1964) and is based on required return measurement on the number of factors; correlation and the nature of the relationship between stock returns and market index return, moreover, the investment risk which the model divided it into systematic and unsystematic risk (Al-Afeef, 2017). The CAPM is based on the Modern Portfolio theory.

The model states that the one risk that requires pricing by investors is a systemic risk since it cannot be diversified away; thus, the CAPM measures the risk when forecasting the return. The return is measured by the risk-free interest rate asset, the beta, which signifies a measurement of the amount of market risk captured within the specific asset and market risk premium (Elton et al., 2014). The model proposes that the assets should be priced based on their market risk, not total risk. The CAPM is based on the following assumptions: (1) there are no transaction costs incurred when purchasing and selling assets; (2) the securities are "infinitely divisible".

This implies that, despite their wealth, individuals can buy into any investment. (3) absence of taxes and the charges of financial brokerage. This implies that they are not taxed on investment returns. (4) all investors evaluate the assets in a similar way, are risk averse and have the same expectations. (5) there is perfect competition in that individuals are price takers, and they cannot influence security prices. (6) borrowing and lending are carried out in line with the risk-free rate of return. Investors are reimbursed for systematic risk since they hold diversified portfolios (Al-Afeef, 2017; Elton et al., 2014).

If all assumptions hold the model is in equilibrium, and the anticipated return can be computed mathematically as follows (Al-Afeef, 2017):

$$E(R_i) = R_f + \beta_i(R_m - R_f) \quad \text{......} \quad (2.1)$$

Where R_j is the expected return for asset j, R_f is the risk-free interest rate, β_j is the beta coefficient and R_m is the return on the market portfolio.

The CAPM states that beta is the only source of risk that can justify the change in anticipated return on the securities since all other risk factors can be excluded through the process of diversification. Equation 2.1 is the Security Market Line (SML) curve equation, and the results from the equation are shown in figure 2.3 below. The security market line is the line between market risk and anticipated return, and it indicates the cost of investment.

Figure 2. 3: Security Market line

Source: Kenton (2020)

The horizontal axis from figure 2.3 above represent the beta, and the vertical axis shows the expected return. The model states that the market equilibrium is at a point where priced securities are on the SML (Malefo, 2015). All securities above the SML are said to be undervalued since they yield a high-expected return for the same market risk. Malefo (2015) further states that any assets below the line are considered overvalued because they yield a lower expected return for the same market risk. In addition, the investment of a risk averse investor would be positioned lower on the line compared to a typical risk taker.

Although the CAPM can be a good model in determining the expected return on an investment, the model is based on unrealistic assumptions and restrictions (Malefo, 2015). For example, the assumption that borrowing and lending are carried out in line with the risk-free rate of return is not an exact reflection of the real world. This is because investors normally hold a higher risk than the government. Roll (1977) questioned the testability part of the CAPM with respect to the use of market index as a proxy for the portfolio and concluded that is it untestable. Roll (1977) put forth the argument that it is not possible to know the true composition of the market portfolio since it requires a composition of well-defined securities that are tradable and non-tradable at a precise value. In addition, when validating the CAPM, the use of a market portfolio rather than an index is subject to misspecification errors. These critiques led to the formulation of the multi factor-pricing model called the Pricing Theory to assist in overcoming the shortcomings of the CAPM.

2.5 Arbitrage Pricing Theory

The Arbitrage Pricing Theory (APT) was developed by Ross (1976) as an alternative model to the CAPM, as it incorporates other risk factors to address the limitations of the CAPM. The model is rooted in the philosophy that economic factors such as real interest rate and inflation can possibly impact the return variations of the assets (Malefo, 2015). The primary source of these factors can be traced to the macroeconomic factors that are within the market and affect all market securities, with the second source connected to the unsystematic risk that impacts particular assets (Ross, 1976). Therefore, as opposed to the CAPM, the APT does not rely only on systematic risk as the only origin of risk. Alternatively, the model recognises the existence of the effect of other variables in describing the returns on asset, thus, making it the best mathematical model to explain the relation between the risk and return of the assets. The APT estimates the expected yield on an asset value through evaluating the sensitivity of stocks to risk factors and employs the rate of return as the asset's cost. Moreover, in the case of the price deviating, the arbitrage corrects the situation.

Ross (1976) defined the assumptions underlying the APT and are as follows: (1) capital markets are highly competitive, and there are no market frictions, such as transaction costs, taxes or short-selling constraints; (2) returns on the asset are determined by systematic factors; (3) all investors are risk-averse, and wealth maximisers; (4) there exists adequate securities to diversify away company's specific risk; (5) In a perfectly functioning market, there should be no arbitrage opportunities that persist; lastly, unlike the CAPM, the APT does not rely on a market portfolio. The model can be shown mathematically as follows:

$$E(R_i) = R_f + \beta_i(E(RF_1) - R_f)) + \ldots + \beta_n(E(RF_n) - R_f)) + \varepsilon_i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (2.2)$$

Where $E(R_i)$ is the expected return level for stock i, R_f is the risk-free rate, β_i is the sensitivity of asset i, $E(RF_n) - R_f)$ is the expected risk premium for risk factor and ε_i is the error term.

This theory is rooted in the law of one price. This implies that in practice, two portfolios that share a similar risk-return profile should cost the same. If this is not the case, opportunities for investors to yield riskless profit from arbitrage will arise. As a result, an individual investor would be allowed to short sell a portfolio with a low return for a portfolio with a higher return (Spaulding, 2017). Even though the APT is considered a better model than the CAPM, it is limited in practical terms. This is because of its key limitation that the theory does not provide information about the risk factor that is relevant when estimating the return on asset, as the various risk factors that are included are different across countries. To correct for such limitations, Berry et al. (1988) state that the factors employed must meet the following requirements: first, the risk factor must be able to impact the return of stocks. Second, the risk factor must be random - unforecastable to the market. Finally, all appropriate factors should specify a negative or positive value.

2.6 Investment Management strategies

The investment world is vast and offers investors endless opportunities to grow their funds. Several researchers, such as Elton et al. (2014), Law et al. (2020) and Reilly & Brown (2012), have identified numerous investment management strategies that are available to investors. These all form part of investment portfolios; however, this study will only explore the equity investment portfolios. The primary reason behind giving attention to only equity investment portfolios is because it is the frequently used investment portfolio. Yochim & Benson (2020) states that investment management strategies are created to build a portfolio of bonds, stocks and other investments based on the goals of an investor. Although there are numerous investment strategies that investors can employ, this study shall discuss the two main types, namely the active and passive management strategies.

2.6.1 Passive versus active management strategies

Investment strategies are an important part of any investors' crucial portfolio when an individual aim is to meet a financial goal. Investment strategies can vary significantly from a fast-growth strategy in which an investor focuses on capital appreciation to a safe strategy where wealth protection is the priority (Chen, 2018). There are two types of investment management approaches: active and passive portfolio management strategies. Both portfolio strategies offer different investment philosophies; while active management assumes that market returns can be surpassed, passive management finds that attempting to do so is futile (Law et al., 2020). Fahling et al. (2019) note that regarding outperformance analysis of active versus passive equity fund investing, the findings are not completely consistent. Several studies conducted argue that investing in passive funds will usually bring higher net returns than investing in active funds. Moreover, most literature suggests that active management exhibits lower performance in comparison to passive funds (Fahling et al., 2019).

The primary goal of active portfolio management is to surpass the returns of its underlying benchmark index (Elton et al., 2014). The idea behind active management is that a skilled portfolio manager can select certain securities for a portfolio that will exceed the returns reported by its benchmark index. The decisions of the fund managers are informed by current market dynamics, company-specific fundamentals, economic and political events. In other words, active management is the art of market timing and stop picking. Law et al. (2020) defined active management as the active selection of stocks for the generation of excess return, also known as alpha (the difference between the actual return and the expected return).

The fund manager creates and oversees a blend of a portfolio that aims to outperform certain benchmarks at a fee. Law et al. (2020) state that active management uses different quantitative techniques to overtake the benchmark index. This includes several phases such as forecasting expected return on assets, consistent monitoring of alpha, risk analysis and portfolio rebalancing. Those who believe in active management do not abide by the efficient market hypothesis and plan to benefit from certain mispriced stocks. Investors are drawn towards an active investment strategy due to the possibility of higher than the index return. The drawback that investors may face with active management is higher transaction costs and turnover, particularly when the performance is poor and the continuous rebalancing of the portfolio. Active management may be challenging because of the possibility of managers making imprudent choices which can hinder the return. As a result, passive portfolio management is mostly employed by several fund managers.

The investment philosophy behind passive portfolio management is based on the Efficient Market Hypothesis (Fahling et al., 2019). As discussed above, this theory explains that all investors always have access to all information without internal information that can be useful to a certain market segment. Therefore, there is little room, if any, for an investor to beat the market, consequently making active management less effective. As a result, passive portfolio management focuses on cost reduction through a buy-and-hold approach that includes low turnover in the portfolio (Law et al., 2020). Kremnitzer (2012) states that the most easily constructed passive portfolio is a portfolio that holds all securities in the index exactly in the proportion represented in the market index. From the above information, it is evident that both approaches are able to manipulate asset holding to create abnormal returns. Elton et al. (2013) argue that both strategies are efficient in short-run and the portfolio theory suggests that they are both valuable and efficient.

2.6.2 Equity portfolio management strategies

There are many ways to approach equity portfolio management strategies. Some fund managers prefer to build an equity investment portfolio with one stock at a time (Reilly & Brown, 2012). Other managers prefer quantitative approaches by using computer programs to evaluate market conditions in order to find undervalued stocks. The success of an investment portfolio depends primarily on the stocks that the investment manager has chosen. Investment managers can surge the wealth of the investor through sector and asset allocation decisions (Reilly & Brown, 2012). Managers can choose to create two separate index portfolios, one made up of stocks, and the other made up of bonds. They may also decide to change the allocation between these two indexes, depending on market conditions and expected future movements.

The investment world has provided asset management companies around the world with plentiful opportunities. Their options include investing in active or passive equities. For many years there have been single stock investment approaches, but over the past few years, investment approaches in the form of index funds and exchange traded funds (ETF) have gained most momentum. These two investment approaches form part of the passive equity portfolio management strategy. As discussed in section 2.6.1, passive investing entails replicating the performance of a specific benchmark. Thus, passive equity portfolio managers choose to replicate the benchmark and therefore make asset allocation decisions that achieve this objective. The passive strategy is violated if the investor attempts to outperform the benchmark (Reilly & Brown, 2012).

Reilly & Brown (2012) listed three basic techniques that can be used to build a passive index portfolio: namely sampling, full replication and quadratic optimisation. Most studies reveal a number of techniques that can be used to construct a passive investment portfolio, but investment managers often employ their own techniques (Grinold & Kahn, 2000). According to Zorin & Borisov (2002), full replication is defined as the construction of an investment portfolio in which the investment made in every component of the index correlates to the respective component's market share. Replication can either be partial or full. Partial replication enables an investor to invest in a restricted number of securities to track the benchmark. The second approach, sampling, is linked to partial replication because an investor is not allowed to purchase as many stocks as with full replication. Reilly & Brown (2012) said that the advantage with sampling approach is that an investor is subject to lower costs and the rebalancing of the portfolio is much easier due to the lower variety of stocks. Lastly is the quadratic optimisation, which is a form of linear programming that is mostly dependent on the assumption that historical trends will continue in future (Grinold & Kahn, 2000). This approach involves the collection of historical data on price changes and the correlation between securities and input into a computer program which are then used to determine the portfolio composition that will lessen tracking error with the benchmark (Grinold & Kahn, 2000).

Active equity portfolio management approach carries more risk than passive management approach. The investment manager must try to beat the market, which can be somewhat of a difficult task. Two broad approaches can be used to pursue an active equity investment strategy, namely, fundamental and quantitative (Fabozzi, 2006). Both strategies seek to outperform a passive benchmark, for instance, a broad equity market index, but they tend to make different investment decisions. The use of human judgment in analysing information and making investment decisions is underlined by fundamental approaches, while quantitative methods seem to focus more on rules-based quantitative models. Levišauskaite (2010) states that the fundamental approach can be employed through a top-down or bottom-up approach. According to Reilly & Brown (2012), a top-down analysis starts with the country as a whole and moves down to the asset allocation sector, where individual securities are chosen. On the other hand, the bottom-up approach needs less analysis because individual securities are selected without any country or sector analysis.

Fabozzi (2006) states that besides the two broad approaches, investors can also employ the technical and attribute investing approaches. Technical approaches are constructed from historical data. The investment manager records historical market trends, levels of trade and other primary indicators in a computer system (Fabozzi, 2006). Then, the system results recommend which stock to purchase and which stock to sell. The attribute investing approach involves buying stocks based on research around certain attributes and characteristics of companies. By analysing attributes such as key ratios, investors are able to make a well-informed decision and thereby ensuring a more cost-effective investment portfolio (Reilly & Brown, 2012).

2.7 Diversification of investment portfolios

The theory underlying the diversification of investment portfolios is the Modern Portfolio Theory (MPT). As discussed in section 2.2 above, MPT states that reasonable and higher returns are not possible without taking a certain degree of risk. However, to reduce risk, investors can diversify their investment portfolio. The next sections will review the diversification of investment portfolios in detail.

2.7.1 The importance of asset allocation

Asset allocation is one of the essential components of a successful investment strategy. When constructing an investment portfolio, the decision on how to weigh different assets classes in a portfolio in a way that provides the potential for the best investment return for the risk you're willing to accept is called asset allocation. Asset allocation establishes the structure of an investor's portfolio and sets out a strategy of explicitly classifying where to invest one's money (Baird, 2014). Asset allocation is the process of dividing a portfolio of investments into various asset classes, such as stocks, bonds and cash (Vyakaranam, 2020). Sharpe (1992) defined asset allocation as the allocation of an investor's portfolio across a number of main asset classes. Selecting the right asset allocation depends on several factors, such as the time horizon and the investor's risk tolerance (Seagler, 2020). Time horizon is the number of months or years until your financial goal is reached. An investor saving up for a long-time horizon, for instant saving up for retirement, tend to invest in riskier assets since they have a long-time horizon. In contrast, those with short term horizon often invest in less risky assets. Risk tolerance is the ability and willingness to lose some or all your original investment in exchange for higher returns. An investor who may be willing to take on higher risk in order to get a higher return is said to be an aggressive investor, while conservative investors may stick to low-risk investments aimed more at preserving capital (Seagler, 2020)

Asset allocation is important because it allows investors to lower risk by diversifying. Historically, asset classes in a portfolio usually do not move uniformly, and this is because market conditions leading to one asset class outperforming during a given period can cause another to underperform (Seagler, 2020). For this reason, the low correlation between the returns in a portfolio reduces portfolio volatility. According to Baird (2014), proper asset allocation has the ability to improve investment performance and reduce overall portfolio volatility. Selecting the right asset allocation also help investors to make sure that their portfolio is ideally positioned to achieve a goal. According to Seagler (2020) when constructing a portfolio, investors must bear in mind that asset allocation account for 88% of returns' volatility. This implies that asset allocation is more important than stock picking when it comes to achieving financial goals (Seagler, 2020). Graniero (2018) added that a portfolio with an adequate allocation of assets could ease market movements. Asset allocation is also important because it allows investors to maintain a long-term viewpoint and prevent reacting to market conditions without thinking (Baird, 2014). In other words, most investors appear to follow the most profitable segments of the market and missed almost half the positive market performance by trying to time when to buy and sell (Baird, 2014). Fortunately, there are strategies in place to help investors allocate their investments appropriately.

2.7.2 Asset allocation strategies

Section 2.3.2 emphasised that it is important to allocate assets appropriately into different asset classes in order to ensure the accurate construction of an optimal investment portfolio. There are several techniques that investors can employ to help them achieve an appropriate asset allocation. The most common strategies identified by Alden (2020), Dziwok (2014) and Sharpe (1987) include strategic asset allocation and tactical asset allocation. Reilly & Brown (2012) states that both strategies should use an asset mix that represents an investor's objectives and takes account of their risk tolerance as well as time horizon.

Strategic Asset allocation (also known as policy asset allocation) is an allocation within the portfolio into the main asset classes in line with the long-term goals of an investor (Amenc & Le Sourd, 2003). This strategy is not intended to beat the market, but to build an asset mix that will develop an optimal balance between anticipated return and investor's risk tolerance for the long-term horizon (Dziwok, 2014). Eychenne et al. (2011) also noted that the risk and return requirements for the various asset classes must be determined in order to implement strategic asset allocation. According to Blake et al. (1998), strategic asset allocation often involves long-term expectations of asset class returns, volatilities, and correlations as inputs, and for that reason, it is viewed as a passive investment strategy (buy-and-hold strategy).

Although strategic asset allocation decision is expected to be successful in the medium and the long term, the allocation might be modified and adjusted in view of the changing investment opportunities. Investors may find it necessary to engage in short-term tactical deviations. According to Dziwok (2014), tactical asset allocation aims to add value to strategic asset allocation through searching for short-term opportunities that can be offset by a return from the financial market. Sharpe (1987) also mentioned that the aim of tactical asset allocation is to take advantage of inefficiencies in the prices of securities in various asset classes. A tactical method is focused on overweighing those asset classes, which are undervalued and underweighting those overvalued asset classes (Dziwok, 2014). Tactical asset allocation can be defined as a moderately active strategy because when desired short-term returns are obtained, the overall portfolio is rebalanced back to strategic asset allocation. According to Dziwok (2014), both forms of asset allocations are specifically related to time (the investment horizon) that determines the fundamental decision. While the strategic asset allocation process allows controlling long-term goals, tactical asset allocation strategy seek out opportunities to increase the return in short and medium terms.

2.7.3 Domestic versus international investments

Asset allocation fundamentally means portfolio diversification. When allocating assets in a portfolio, investors may choose to allocate their assets both domestically and internationally with the goal of maximising the risk-adjusted returns. International diversification mainly entails buying assets in markets outside the domestic economy. The foundation for international diversification was first established by Herbert Grubel (1968). Grubel (1968) drew on Markowitz's MPT and broadened the theory to global markets. The main argument raised by Grubel (1968) is that the international diversification of portfolios is the source of a whole new type of world welfare benefits from international economic integrations. However, this does not seem to be entirely true several years later, primarily due to today's highly interconnected global economy. The following research supports this notion.

Although there has been an increase in access to financial markets across the globe, most investors still prefer to hold the majority of their investments denominated in domestic assets (Abid et al., 2014). According to French & Poterba (1991), it is widely known that cross-border diversification of equity portfolios provides potential benefits to investors; however, most investors still keep the majority of their wealth in the domestic market. Substantial research has shown that investors allocate a fairly large fraction of their wealth to domestic equities because of a phenomenon known as the "home bias" (Chan et al., 2005). The reason for this home bias illustrated by investors represents one of the unresolved puzzles in the financial literature, mainly because significant financial benefits can be gained through international diversification. However, studies such as Chan et al. (2005); Coval & Moskowitz (1999) and Grinblatt & Keloharju (2001) suggest that home bias may be part of a broader phenomenon in which investors show a preference for familiar companies, the firm's language, culture, and distance from the investor. French & Poterba (1991) concluded that the reason behind home bias remains investors preference rather than institutional limitations.

Eun & Lee (2010) observe that diversification of developed and emerging markets has shown a decline in mean-return distances recently, in conjunction with increasing dependencies. In their study, they included a data set from both developed and emerging markets, and their results show that these have a negative impact on the benefits of international investment. Sharing the same views is Christoffersen et al. (2012); in their research, they explored diversification benefits for a developed and two emerging markets data set. Their findings suggest increasing dependencies over time on developed and emerging markets. If this notion is valid in practice, investors would be more hesitant to invest internationally, as external shocks tend to have a holistic effect on all investments, whether denominated in foreign or domestic markets.

Although the research by Christoffersen et al. (2012) and Eun & Lee (2010) suggests that international diversification appears to have lost its value in recent years due to the highly integrated global economy, some studies indicate that international diversification may still be beneficial. Li et al. (2003) found that international diversification can still be beneficial when equity investors are prohibited from short selling in emerging markets. Eun et al. (2010)

introduced a new strategy to international investing in order to improve portfolio performance. The new investment strategy implemented by Eun et al. (2010) can also increase the performance of the portfolio. This research demonstrates that there is evidence that foreign diversification is beneficial.

Vermeulen (2011) measured the returns of internationally diversified portfolios before and during the global financial crisis and found that portfolios that were internationally diversified provided significantly higher returns during the crisis. Abidin et al. (2004) found that domestic portfolios and portfolios with foreign diversity were performing differently when risk and specific economic crises were observed. Ziobrowski & Ziobrowski (1995) also examined the impact of exchange rate volatility on portfolios that are internationally diversified and found that portfolios that maintain more of their funds domestically appeared to be less vulnerable to exchange rate volatility than extremely internationally diversified funds. Backlund (2011) evaluated the currency risk to find ways of managing the risk posed by the volatility of the exchange rate.

2.8 Conclusion

This chapter gives an overview of the main theoretical and empirical literature which underpins this study. The theoretical part of this chapter outlined the different investment management strategies, the importance of asset allocation and strategies used to allocate assets in a portfolio and the international versus domestic diversification of an investment portfolio. The following chapter shall discuss the theory underlying the exchange rate.

CHAPTER THREE: A REVIEW OF EXCHANGE RATE THEORY AND POLICY

3.1 Introduction

This chapter provides a summary of existing literature on exchange rates, including the basic introduction to the exchange rate theory, with a specific emphasis on the South African economy; mainly the development and transformation of the South African exchange rate regime; the volatile nature of exchange rates, as well as the factors that increase exchange rate volatility. The knowledge of the exchange rate policies and exchange movements helps to shed light on understanding the reason why the exchange rate has been volatile.

The chapter is divided into five separate sections. The first section gives an overview of the theory of exchange rate, focusing mainly on the conceptualisation of the exchange rate and the determinants of the exchange rate. Before going on to volatility, the second section provides the basic introduction to exchange rate theory. The third section outlined of the exchange rate policies in South Africa. The fourth section emphasises the volatile nature of the exchange rate. Within this section, attention is given to exchange rates as a potential risk factor for investors, followed by a discussion of factors that increase the volatility of the exchange rate. The fifth empirical evidence on the exchange rate and investment portfolio is outlined. The chapter ends with some closing remarks and a summary.

3.2 Exchange rate theory

3.2.1 The conceptualisation of exchange rate

Theory indicates that no country in the world is entirely independent and that companies frequently participate in trade outside the borders of the domestic market (Sgammini, 2016). The liberalisation of international trade has allowed companies access to external markets (Dogru et al., 2019). The interest in international trade is due to its advantages such as; increased market opportunities, benefiting from currency exchange, economies of scale, cost reduction, risk spread, enhanced operational efficiency and longer product lifespan (Sgammini, 2016).

Companies within the national market who wish to take advantage of gains from international trade need to determine the value of their domestic currency on the foreign market. This can be achieved by using exchange rates. An exchange rate between two currencies is defined as the rate at which one currency will be exchanged for another (Krugman et al., 2018). Thus, the exchange rate establishes how much one currency can be bought with another. However, that rate can be interpreted through different perspectives. The two most common means of describing exchange rates are the nominal and the real exchange rate (Abel et al., 2008).

3.2.1.1 Nominal Exchange rate

The nominal rate is based on how much of one currency another currency can buy (Beckmann et al., 2020). Therefore, it is not adjusted for inflation. In addition, Inflationary pressures in each country are not removed or compensated for when considering a nominal exchange rate (Abel et al., 2008). The nominal exchange rate shows how many units of one currency can be purchased with a single unit of the domestic currency—suggesting that it is merely a ratio that displays the value of one currency in terms of another (Motsumi et al., 2008). For example, if the ZAR/USD is equal to R15 ($1 = R15), one USD can be purchased with R15. Abel et al. (2008) suggest that the nominal exchange rate is insufficient for describing the buying power of the currency.

3.2.2 Determinants of the exchange rate

Several studies such as (Vural & Müge, 2019; Kia, 2013; Twarowska & Kąkol, 2014; Jager, 2012; Patel et al., 2014; and (Parveen et al., 2012) highlighted a broad range of key fundamental factors which determine a country's exchange rate. A number of fundamental factors established in those studies are highly correspondent with one another and include economic variables as well as non- economic variables. The economic factors include interest rates, economic growth, inflation rates, capital speculation, Government debt and balance of payment. Non-economic factors identified include political risk, psychological factors, natural disasters and policy approaches. The research by Kia (2013) argues that the exchange rate is determined mainly by macroeconomic variables such as money supply, interest rate, inflation, Gross Domestic Product (GDP) and the government deficit of that particular country. Sharing the same sentiment is Parveen et al. (2018), who added that inflation has a negative impact on the exchange rate because when inflation increases, the value of the currency is reduced. To add on what Parveen et al. (2018) and Kia (2013) found, (Patel et al., 2014) identified that the debt of the country, speculators, capital account, political stability and economic performance, as well as macroeconomic and geopolitical events, also determine the exchange rate. Moreover, Twarowska & Kąkol (2014) pointed out that the exchange rate is also determined by non-economic factors such as political risk, natural disaster, policy approaches and psychological factors.

It is evident from the existing literature that exchange rates tend to depend on a considerable number of determinants. In the context of South Africa, De Jager (2012:7) argues that a variety of factors in the financial sector, the fiscal sector, the real sector, the international sector, commodities prices as well as trade terms influence the South African exchange rate. The South African Reserve Bank (SARB, 2016) states that inflation, the international economy and natural disasters are also determinants of South Africa's exchange rate. We can conclude from previous studies that the widely accepted determinants of exchange rate are countless. However, for the purpose of this study, we will only discuss the following: interest rate, inflation differential, the inflow and outflow of the funds, international competitiveness and non-competitiveness, and political stability and economic performance.

3.2.2.1 Interest rate

A number of studies agree that the interest rate is one of the main factors that determine the exchange rate. (Patel et al., 2014) states that the increase in domestic interest rate relative to other countries would result in investors investing money in the domestic country because investors will be aiming for a higher return that comes with a high interest rate. They further elaborated that a higher interest rate is an appreciation for money inflow, and therefore, the demand for domestic currency would increase. Sharing the same sentiment is Twarowska & Kąkol (2014), who stated that if a country maintains its interest rates relatively high, it usually attracts sizeable short-term capital flows, and that country's currency appreciates.

3.2.2.2 Inflation deferential

Theoretically, the exchange rate should reflect inflation and productivity trends (Twarowska & Kąkol, 2014). This is because inflation plays a significant role in the valuation of the currency of any country (Patel et al., 2014). Inflation reduces the value of a currency's purchasing power, having the effect of an increase in prices. In theory, the relationship between inflation and exchange rate is measured by the Purchasing Power Parity (PPP) (Omondi, 2017). Müge & Vural (2018) states that the purchasing power theory is rooted in the law of one price, which postulates that the domestic price of a given basket of goods is the same across countries when converted into the same currency. The exchange rate is determined by the relative changes in domestic and foreign prices (Müge & Vural, 2018). An increase in the price level in the domestic country causes depreciation of their currency, as the more expensive products at the domestic market encourage consumers to import products from abroad, and thus the supply of currency increases.

3.2.2.3 Inflow and outflow of the funds

The state of the international economy primarily influences the inflow and outflow of funds because it involves foreign exchange supply and demand (Müge & Vural, 2018). In the event of excess domestic currency demand, the exchange rate is most likely to appreciate, and the opposite is true. According to Wesso (2001), South Africa highly depend on international economies. Therefore, when other economies such as China slow down, South Africa is also affected (SARB, 2016). This implies that the exchange rate of South Africa and most developing countries are thus dependent on international economies to ensure that local currency demand is higher, which could lead to a stronger currency.

3.2.2.4 International competitiveness and non-competitiveness

International competitiveness relies heavily on factors such as efficiency, human resources expertise, technological growth, developments in production costs and innovative management (Kia, 2013). These factors also relate indirectly to the balance of payments since highly competitive companies or countries could have far more exports because of lower prices. Higher exports could lead to an exchange rate appreciation as demand rises. A number of measures to improve the competitiveness of international economies were described by Dahlman (2007). These measures comprise embracing globalisation and integration, technological development, developing state-directed technologies and strategic use of foreign investment.

3.2.2.5 Political stability and economic performance

Twarowska & Kąkol (2014) said that political factors also play a role in determining the exchange rate. Moreover, countries with stable governments can improve economic growth because investors invest their money in countries with strong economic performance (Patel et al., 2014). Patel et al. (2014) further argue that political and economic instabilities tend to cause loss of confidence in foreign investors, and that will affect economic growth, and money will flow out of the country. The benefit of having a stable political climate is that a sustained appreciation of exchange rates will result. However, the movement of the exchange rate depends mainly on the balance of payments, and in particular, the current account.

3.3 The effect of Exchange Rate fluctuations

Previous literature has found conflicting empirical support for the relationship between exchange rate exposure and its theoretical determinants, as well as evidence that exposure is of minor economic significance (Williamson et al., 2005). Economic exposure to exchange rate movements is defined as the regression coefficient of the firm's real value on the exchange rate across states of nature (Jorion, 1990). For instance, if a South African investor assumes that the domestic inflation is non-random, therefore, exposure can be determined by the slope coefficient of a linear regression of the Rand value of the firm on the exchange rate (Jorion, 1990). Adler & Dumas (1984) highlighted that in the sense that stock prices and exchange rates are determined simultaneously, the concept of exposure is subjective. Therefore, breaking down the value of the firm into a component fully linked with the exchange rate and an orthogonal component does not suggest that exchange rates and stock prices are casually related, but rather, it is simply a statistical decomposition.

The basic methodology that is used to measure the exchange rate exposure is a simple linear regression of stock returns in an exchange rate variable. This methodology was adopted from Adler & Dumas (1984), and it states that the correlation between the asset's value and the exchange rate is used to determine an asset's exposure to exchange rate fluctuations. It is as follows:

$$R_{jt} = \alpha_j + \beta_j R_{Mt} + \delta_i R_{FXt} + \varepsilon_{jt} \quad \text{(3.1)}$$

Where R_{jt}, R_{Mt}, and R_{FXt} denote the stock return, the return on the market index and the change in the exchange rate variable (index), respectively.

The correlation between endogenous variables such as exchange rates and stock prices depend on the type of shocks affecting the economy. For instance, exposure may only show the impact of monetary factors on both exchange rates and stock prices simultaneously. The portfolio balance approach can be used to explain further this impact. The portfolio balance approach explains the behaviour of the floating exchange rate and its impact on bonds. This theory states that any change in the economic conditions of a country will have a direct effect on the supply and demand for domestic and foreign bonds. As a result, the shift in the demand/supply for bonds will, in turn, impact the exchange rate between the domestic and foreign economies. Since the portfolio approach uses financial assets, they tend to adjust faster to economic conditions news than the traditional approaches that employ tradable goods (Majaya, 2016).

Foreign exchange exposure can be broadly classified into the effect of exchange rate randomness on (a) the value of net monetary assets with fixed nominal payoffs and (b) the value of real assets held by the firm. Expanding on the monetary approach, this theory defines the nominal exchange rate and links it to monetary fundamentals. Fluctuations in the exchange rate may be due to changes in the money supply. This is because a change in the supply of domestic money results in a change in price levels, and a change in price levels results in a change in the exchange rate. Siregar (2011) states that the monetary approach focuses on the monetary policies of two countries in order to determine their currency exchange rate. In addition, this approach employs two dynamics to determine an exchange rate, the price dynamics and the interest rates dynamics. In general, the main focus of the monetary policy in a country is on the money supply, which is determined by the amount of money in circulation and the level of interest rates. Countries that tighten their monetary policies reduce the amount of money in circulation, and their currencies appreciate. Contrary, those that apply expansionary monetary policies are faced with inflationary pressures due to an increase in money supply, and this usually results in a depreciation of the currency exchange rate.

Previous empirical exposure literature has mostly focused on measuring exposure and ensuring that it is consistent with theoretical determinants of exposure. Thus, studies such as Jorion (1990) investigated the effect of exchange rate on stock returns using multinational companies and found evidence of significant exchange rate exposure. This shows that stock returns are the main determinant of exchange rate exposure for large U.S. multinational firms. On the other hand, other studies done in the US by Bartov & Bodnar (1994) found no evidence of concurrent exposure for U.S. multinationals but with evidence of lag relation. Furthermore, He & Ng (1998) found a significant contemporaneous relationship between stock returns and exposure, but Japanese companies do not respond to past exchange rate movements. Additionally, Bodnar & Gentry (1993) found that between 20 and 35 per cent of industries have statistically significant exchange rate exposures, and exchange rate volatility helps influence industry returns at an economy-wide level. Results from Williamson et al. (2005) provide evidence that exchange rate volatility does affect firm value and that exchange rate movements have a considerable economic impact on differences in average stock returns. In a sample of companies from eight non-US nations, including Japan, Dominguez & Tesar (2001) discovered no relation between stock returns and exposure.

Another result of the empirical exposure research is that exchange rate fluctuations do not account for a significant portion of stock return volatility. Despite the fact that exchange rates are not the focus of the studies, Bartov & Bodnar (1994) and Jorion (1990) indicate that exchange rates do not explain a significant portion of the volatility in individual stock returns. Griffin & Stulz (2001) found that exchange rate volatility explains only a small portion of the variation in foreign industrial stock returns in a range of settings, and they conclude that exchange rate volatility is of limited economic significance.

3.4 Exchange rate policy

In integrated international economies, the exchange rate is the most important price in the economy. Hsing (2016) argues that the exchange rate movement can have a massive impact on economic growth, inflows and outflows of funds, employment as well as the well-being of individuals. However, governments can regulate the price of foreign currency as well as the stability of this price through their exchange rate policies (Steinberg & Walter, 2013). Steinberg & Walter (2013) further argue that policymakers can promote global competitiveness and enhance domestic macroeconomic stability by implementing appropriate exchange rate policies. Sharing the same views is Van der Merwe (2004), who argued that monetary policymakers need to closely monitor the developments of the exchange rate in order to make correct decisions. This implies that having an inadequate exchange policy would result in a misaligned exchange rate. Unfortunately, misaligned exchange rates increase unemployment, reduce economic growth and sometimes results in a financial crisis (Steinberg & Walter, 2013). Unstable exchange rates can make it difficult for economic agents to prepare for the future, thus discouraging investments (Steinberg & Walter, 2013).

After the fall of the Bretton Woods par value system (as discussed below), a wide variety of exchange rate systems were adopted. Each country had to choose the exchange rate system that was best suited for its need. The choice of exchange systems became a decision facing policymakers nearly in all economies around the world. Heller (1978) states that this choice is important to a country because it determines the conduct of its domestic and international economic policy. Choosing an appropriate exchange rate regime for a country depends on its characteristics which differ from one country to another. Heller (1978) argued that the choice of exchange rate regime is based on five factors, which include the size of the country, its openness, the degree of international financial integration, inflation, and the foreign trade pattern. Policymakers had to choose from various exchange rate regimes such as independent floating/flexible, fixed exchange rate and a variety of intermediate regimes such as adjustable peg or crawling peg (Van der Merwe, 2004). Sekantsi (2007) states that several countries adopted the floating exchange rate system regardless of its vulnerability to exchange rate volatility, which is a threat to the development of international trade and macroeconomic stability. South Africa is one of the countries that adopted the flexible exchange rate policy. As with other countries with a flexible exchange rate policy, the South African exchange rate has been excessively volatile. The ongoing fluctuation of the Rand has been mostly blamed on the exchange rate regime that South Africa adopted. The following section shall outline the exchange rate policy of South Africa.

3.4.1 South Africa's exchange rate policy

In South Africa, establishing an effective foreign exchange market has been relatively difficult and long journey. Over the past decades, South Africa has introduced multiple exchange-rate systems with the goal of providing a competitive exchange rate that promotes more exports and fewer imports, growing foreign direct investment, generating more job opportunities, improving the balance of payments position and eventually sustaining stable growth (Patrick & Nyatanga, 2018). South Africa has moved from crawling peg, fixing the Rand to the US dollar, a managed float, a dual exchange rate regime and ultimately to a formal free-floating exchange rate regime in 2000 (Gossel & Biekpe, 2012). According to Eun et al. (2012), South Africa has also employed a dual exchange rate system during the period 1985 to 1995. However, the present policy rendered the South African Rand vulnerable to global shocks and volatility in the foreign exchange values of leading currencies, particularly the dollar (Patrick & Nyatanga, 2018). This has also led to South Africa's business confidence reaching a 32-year low and losing investment grading from two of the world's largest investment rating agencies: Standard and Poor's and Fitch (Patrick & Nyatanga, 2018). Numerous studies such as Van der Merwe (1996), Patrick & Nyatanga (2018), Gossel & Biekpe (2012), Mtonga (2011) and Van der Merwe & Mollentze (2012) discussed the evolution of South Africa's exchange rate policies from 1945 to 2019. They pointed out that South Africa has undergone many policy adjustments. South Africa's exchange rate policies have developed from fixed exchange rate (1945 to 1985), the dual exchange rate (1986 to 1995), the managed exchange rate policy (1996 to 2000) and the freely floating exchange rate regime (2000 to 2015) (Van der Merwe &

Mollentze, 2012; Mtonga, 2011). The following section reviews the evolution of South Africa's exchange rate policies and will be split into five periods.

3.4.1.1 Period 1: Fixed exchange rate regime (1945 to 1971)

Soon after World War II (1939-1945), almost every country across the world implemented a fixed exchange rate policy in an effort to balance the global financial markets (Mtonga, 2011). South Africa also adopted the fixed exchange rate policy, and the South African currency was pegged to the pound sterling, and in 1945 it became part of the sterling zone (Van der Merwe, 1996). Rossouw (2009) states that at the outbreak of the Second World War, South Africa remained a part of the sterling area and was thus forced to recognise the region's exchange control arrangements. When the Second World War came to an end, South Africa, together with other founding members, became part of the Bretton Woods monetary agreement (Wang, 2009). The currencies across the world were now pegged against the USD under the Bretton Woods system, and the USD was in turn linked to gold at a fixed price of 35 USD per fine ounce (Van der Merwe, 1996). Rossouw (2009) states that South Africa continued to use the South African pound and only introduced the South African Rand (ZAR) in 1961 after leaving the commonwealth and becoming the Republic of South Africa. The new ZAR was priced at 50% of the old pound and was, therefore, set at 1.40 USD or 1.24414 grams of gold. In Summary, South Africa employed a fixed exchange rate during this period.

3.4.1.2 Period 2: Fixed, Crawling and Dual exchange rate regime (1971 to 1985)

Although countries such as the US, Germany and Canada moved towards the use of a flexible exchange rate system during the early stages of this period, South Africa was still using the fixed exchange rate system. Van der Merwe & Mollentze (2012) argue that during that time, South Africa's foreign market was underdeveloped and could not be able to succeed because most of the country's foreign transactions were carried out in dollars. This period was also marked by a significant worsening of the balance of payments deficit. In September 1975, South African authorities devalued the Rand by 17.9% to improve the balance of payments (Patrick & Nyatanga, 2018). By the end of the 1970s, the shifting of economic conditions and the worsening of the balance of payments deficits trends led the government to employ a commission of inquiry called the De Kock Commission, which was formed in 1977 (Van der Merwe, 1996). The commission found that at that time, the South African exchange rate regime was defective and not favourable to economic expansion and attaining a positive balance of payments and a stable economic climate (Gidlow, 1995). The commission suggested that South Africa should implement the unitary exchange rate policy (Van der Merwe, 1996).

Patrick & Nyatanga (2018) state that the main objective of this system was to establish a competitive foreign exchange rate market in South Africa where the Rand may find its own level subject to the restricted intervention of the Reserve Bank. Van der Merwe (1996) states that further measures were taken to establish a foreign exchange market in South Africa that was free of government interference. In pursuit of a more flexible exchange rate system, the South African monetary authority decided to implement a dual exchange rate regime from 1979 until 1983. This implied that the use of two separate exchange rates in South Africa, the financial ZAR and the commercial ZAR, where the commercial Rand rate was fixed. In contrast, the financial Rand rate was permitted to float freely (Patrick & Nyatanga, 2018). Nevertheless, the dual exchange rate system was eliminated in 1983. After this, the Rand continued to be stable until the later months of 1983, when the decline in the price of gold, the debt crisis and increased political instability resulted in a substantial rand depreciation (Bah & Amusa, 2003). During that time, South Africa also witnessed a major decline in GDP.

3.4.1.3 Period 3: Dual exchange rate regime (1985 to 1995)

For the greater part of this period, the dual exchange rate regime was maintained, and the managed-floating ZAR was only introduced in early 1995 (Mtonga, 2011). Patrick & Nyatanga (2018) mentioned that the political climate in South Africa inhibited the growth of the foreign exchange market in late 1984. This was due to political instability, sanctions and possibly the South African debt crisis (Van der Merwe & Mollentze, 2012). Furthermore, South Africa was forced to return to direct control measures to manage the exchange rate and control the influence of capital flows on monetary reserves (Van der Merwe & Mollentze, 2012). The period from 1985 until 1995 was characterised by the introduction of an informal inflation-targeting framework followed by a managed floating exchange rate regime in 1995 (Patrick & Nyatanga, 2018). There were, however, several times when South Africa rejected the De Kock Commission's suggestions and again instituted more tight foreign exchange regulations (Aron et al., 1997). The De Kock Commission suggested a free-floating exchange rate system without exchange controls. Nevertheless, South Africa's monetary authority reinstated the financial ZAR (back to a dual exchange-rate regime) and tightened residents' exchange controls. The re-introduction of the dual exchange rate regime persisted until the unification of the Rand in 1995 (Aron et al., 1997).

3.4.1.4 Period 4: Unitary exchange rate: Managed Floating Exchange Rate Regime (1995 to 2000)

In March 1995, the financial Rand was abolished, and South African adopted a managed exchange rate system, where market forces decided the spot exchange rate (Patrick & Nyatanga, 2018). This was done with the aim of accomplishing long-term goals of complete financial liberalisation and reintegrating South Africa's economy into the global economy. Even though the Rand was no longer linked to the US dollar or other currency, the Reserve Bank continued to engage in the market by buying and selling US dollars and controlling the exchange rate (Mtonga, 2011). The Rand remained stable for 11 months after a managed floating exchange-rate regime was adopted. According to Mtonga (2011), this period was characterised by a calm political climate. There was an increase in foreign direct investment, enhanced economic performance and a rise in economic growth.

3.4.1.5 Period 5: Unitary Exchange Rate- Free Floating Rand, With Inflation Targeting Framework of Monetary Policy (2000 to current)

The South African Reserve Bank switched from an exchange-rate targeting policy system to an inflation rate targeting policy framework during the year 2000 (Patrick & Nyatanga, 2018). Following this, there was a radical transition to a freely floating exchange rate regime, and this was in line with achieving the basic principles of inflation targeting policy (Patrick & Nyatanga, 2018). Mtonga (2011) argues that even though South Africa had operated at a system where the exchange rate is determined by the market forces before 2000, it was found that the move towards inflation targeting framework in 2000 limited the efforts of the preceding year. The South African Reserve Bank pointed out that the policy aimed to allow the currency to be determined by the market (SARB, 2016). South Africa enjoyed sustained economic growth, rates registering a growth of 5.6% per annum in 2006, since the implementation of inflation targeting framework policy (World Bank, 2020). In 2007, however, economic growth started to slow down, dropping to 3.2% p.a in 2008. In 2009, growth in GDP decreased further to 1.5%. Although economic growth recovered quickly in 2010 after the global financial crisis, it has remained sluggish since 2011, declining annually (World Bank, 2020). One of the main reasons blamed for the slow growth of South Africa was the uncertainty of political climate and the loss of investor confidence (Patrick & Nyatanga, 2018).

South Africa is still employing a flexible exchange rate system as of 2020. In addition, South Africa's floating exchange rate policy has contributed to far more currency volatility than the past fixed and dual regimes. The following section will discuss the exchange rate volatility.

3.5 Exchange rate volatility

In South Africa, the external value of the currency has been defined in the foreign-exchange market by supply and demand conditions. This, however, has resulted in higher and sudden fluctuations in the exchange rate (Van der Merwe, 2004). Since the introduction of a floating exchange rate system together with the inflation-targeting monetary policy framework, there have been significant fluctuations in the exchange rate (Mlambo, 2013). According to Van der Merwe (2004), the exchange rate in South Africa has shown a comparatively high degree of volatility in recent years. Although there exist numerous pieces of literature on exchange rate volatility, it is essential to note that the meaning of the term is not uniform. Zakaria & Abdalla (2012) defined exchange rate volatility as a measure of the fluctuations in an exchange rate. Hopper (1997) defined exchange rate volatility as the degree of variation of the value of the domestic currency expressed in terms of another currency. Zakaria & Abdalla (2012) state that the exchange rate volatility can provide an indication of how much an exchange rate tends to change within a given time period. Therefore, an exchange rate is known as volatile if the domestic currency value, as expressed in terms of another currency, always appears to rise and fall.

The volatility of the exchange rate is usually calculated from the standard deviation of movements of the exchange rate (Serenis & Tsounis, 2012). Clearly, it is a variable that cannot be observed and therefore, its measure is a matter of serious contention. The literature does not, however, agree on what is the most acceptable measure. According to Zakaria & Abdalla (2012), the two most commonly used measures of exchange rate volatility in financial calculations include historical and implied volatility. Historical volatility is measured from the past values of an exchange rate, and it is a fair indicator of potential future changes when the financial markets and economies have not gone through structural changes. On the other hand, implied volatility is a forward-looking measure and is estimated from the market participants estimates of what is expected to happen in the future (Zakaria & Abdalla, 2012).

3.5.1 Volatility of the rand against major currencies

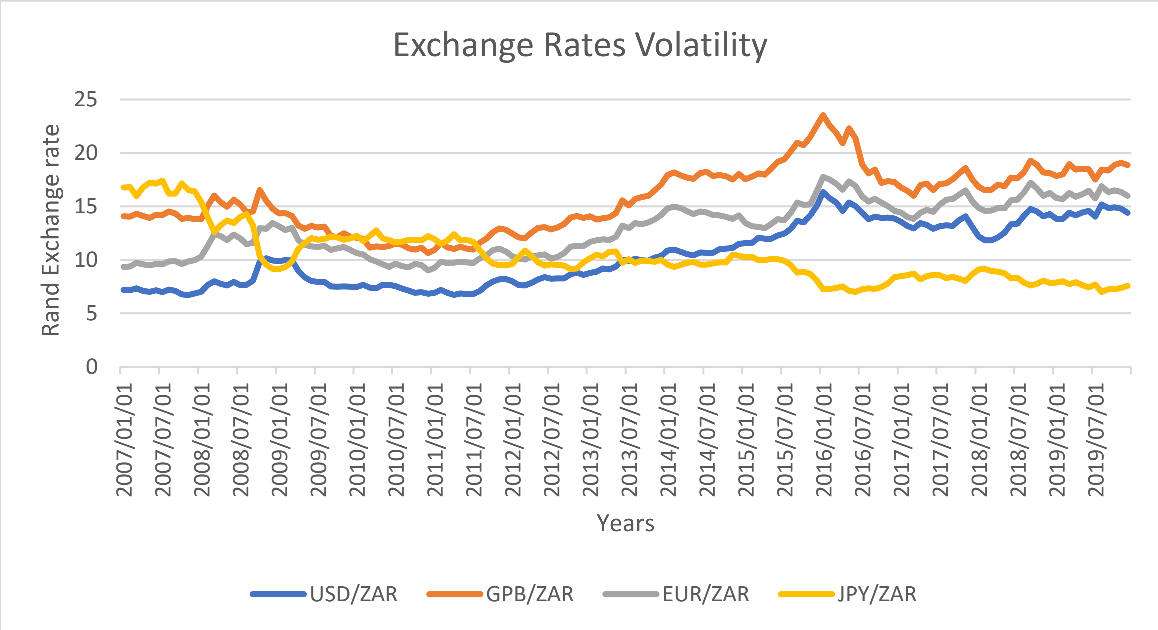

Figure 3.1: Exchange rate Volatility

Source: Compiled by the Author, data from SARB (2020) and Thomson Reuters (2020)

Figure 3.1 the graph shows the trends of the exchange rate of the Rand against major currencies and some indication of the volatility thereof can be gleaned. This study used the nominal exchange rate for different international investing partners. Given the mutual funds that are employed by this study, the common investing partners are Europe, the United States of America, Japan, and the United Kingdom. Hence, the selected exchange rates trend is discussed. From the beginning of the study period in 2007, the rand was weak compared to the Japanese Yen, 1 JPY equated to approximately R16. One GPB/ZAR and EUR/ZAR equated to R14 and R9 respectively at the beginning of the period, while one USD equated to R7, which was the strongest correlation of them all. During the global financial crisis, between 2008 and 2009, the rand depreciated against the USD, EUR and GBP. Interestingly, during the same period, the rand appreciated against the JPY. At the end of 2009, going to mid-2013, the rand strengthened against the USD, EUR and GBP, but the opposite movement was reported since the rand depreciated against the JPY.

Moving forward, the rand depreciated against the GBP, reaching its maximum of about R25 towards the end of 2015. During the same period, the USD and EUR also strengthened against the rand, reaching their pick of about R17 and R18, respectively. On the contrary, the rand strengthened against the JPY, recording its minimum of about R7 during the same period. From

2016 until the end of the period, the rand value against USD, EUR and GBP fluctuated in the same fashion, with GBP being the strongest currency. On the other hand, the rand value remained relatively stable against the JPY during the same period. It is interesting to note that the JPY was the strongest currency against the rand at the beginning of this period, but in the end, it was the weakest currency amongst all the other three.

The graph above represents the volatile nature of the rand exchange rate against the exchange rates of its international investing partners. This rand volatility is affected by the balance of payments, inflation, interest rate, and investor confidence. The rand volatility may also be due to different major international market activities that occurred during the study period. The first was the 2007–2009 global financial crisis which is measured as the worst global economic crisis since the Great Depression. The MSCI (Morgan Stanley Capital International) World Index lost over 9% during the financial crisis of 2009. An economic fallout resulted from a diplomatic spat between the United States and Turkey in 2018. The taper tantrum in 2013. The 2012 panic about Greece exiting the Eurozone “Grexit” just before the elections in Greece. Eurozone crisis in 2011, investors abandoned emerging market assets such as the Rand as US bond yields rose above 3%, lowering Rand's value. These are just a few examples that had a significant impact on the rand's value during the period of the study.

3.5.2 Exchange rate risk

Exchange rate volatility is also known as a measure of risk. This implies that higher volatility is associated with a higher risk, and such usually impact negatively. Exchange rate volatility usually impacts negatively on the economy (Mlambo, 2013). Zakaria & Abdalla (2012) highlighted that exchange rate volatility could also have an impact on asset pricing, portfolio optimisation, option pricing, or overall risk management. Bearing in mind that volatility generates risk, as Zakaria & Abdalla (2012) said, it is necessary to consider the risks posed by the exchange rate volatility and also to explore the factors that influence the volatility of the exchange rate.

Recently, the exchange rate risk seems to have become more prominent as investors are increasingly buying and selling foreign assets. This has led to a lot of research on the risk posed by exchange rate volatility. Traditionally, risk is defined as the uncertainty of returns. It stems from investors being unsure of the future, and it measures the probability of loss in comparison to expected returns. In the case of portfolio management, it is the probability that there is a difference between the actual return and the expected return (Howells & Bain, 2008:172). From an economic perspective, exchange rate risk is a possibility that a foreign currency's domestic buying power will vary from its expected value on a given future date (Mrša et al., 2013). Reilly & Brown (2012) described exchange rate risk as the uncertainty that investors face when purchasing securities denominated in foreign currencies. Exchange rate risk can also be defined as fluctuations occurring in profit margins or prices of foreign currency-denominated assets that are hedged openly or imperfectly (Crouhy et al., 2014). These fluctuations can lead to lower returns from foreign assets and have the potential to disadvantage a firm or investor. Crouhy et al. (2014) state that the imperfect correlation in the fluctuations of currency values and the fluctuations of international interest rates are the two major causes of exchange rate risk. Shehu (2011) defined exchange rate risk as the sensitivity of investor funds returns and the market value of companies to unforeseen exchange-rate movements. According to Shehu (2011), both local and transnational companies are subject to exchange rate risk. While multinational companies tend to be more exposed to exchange rate risk, local companies also tend to be affected by fluctuations in exchange rates.

A company operating with some degree of international interest and at risk of exchange rate fluctuations may face some or all of the following exposures. There are three main categories to classify exposure to foreign exchange. The first is translation exposure which measures the effect of the change in the exchange rate on the financial statements of a firm (Mrša et al., 2013). According to Harris & Kaur (2013), firms and investors with foreign countries assets, revenue, stocks and liabilities, which are expressed in foreign currency, frequently have financial losses when the assets must be returned to the local currency. If the exchange rate is subject to unforeseen fluctuations when these assets, revenues, stocks, and liabilities need to be converted into the local currency, the investor or firm is subject to translation risk. The second foreign exchange exposure is transaction exposure. Countries and investors operating in foreign countries are more prone to transaction exposure than are local firms. According to Mrša et al. (2013), transaction exposure ascends when a firm has entered into financial obligations with another firm in a foreign country. Exchange rate fluctuations, which, in turn, translate into exchange rate risk through transactional exposure, can, therefore, affect the firm’s income from the transaction. Lastly is the economic exposure. The concept of economic exposure supports Shehu' (2011) claim that local companies are often vulnerable to exchange rate risk, even though they do not actively operate or invest in a foreign country. Mrša et al. (2013) said that economic exposure happens when exchange rate fluctuations affect the market value of a company. This implies that, even though a firm operates only in local markets, exchange rate movements will indirectly affect the output of that company.

3.5.3 Causes of Exchange rate volatility

Increasing financial integration has been perceived as a factor linked to higher instability in the exchange rate. Calderón & Kubota (2017) argued that this is due to greater sensitivity to shocks of financial prices. In Section 2.2.2 of this study, it was noted that the exchange rate is determined by fundamental factors such as fund inflow and outflow, inflation differentials, the international economy, and political/economic events. While the exchange rate typically fluctuates beyond its primary determinants, macroeconomic forces, market sentiment, as well as global shocks, and speculation could cause the currency exchange rate to move outside its underlying determinants (Sugiharti et al., 2020).

According to Stančík (2006), factors that contribute to exchange rate volatility vary between countries. Morana (2009) highlighted factors that contribute to the volatility of exchange within the G7 countries and found that macroeconomic factors such as inflation, output and short-term interest rates and money growth all contribute to the volatility of the exchange rate. Stančík (2006) studied the EMU countries and found that the country openness, speculations and major regime changes all contribute to the volatility of exchange rates in those countries. Giannellis & Papadopoulos (2011) added that the political climate and the type of regime the country adopted contribute to the volatility of the exchange rate in EMU countries. In Ghana, it was concluded that output is the main cause of exchange volatility in the short run (Alagidede & Ibrahim, 2016). Moreover, it was also found that money supply, government expenditure growth, foreign direct investment (FDI), terms of trade adjustments and long-run output are factors causing exchange rate volatility in Ghana (Alagidede & Ibrahim, 2016). Zakaria & Abdalla (2012) studied the exchange rate volatility in Arabian countries and found that it is mostly created by the proportion of hedgers versus speculators, uncertainty, information and central bank actions. Calderón & Kubota (2017) argued that exchange rate volatility could also be caused by non-monetary factors such as productivity shocks, demand shocks, and labour supply shocks. Sugiharti et al. (2020) said that exchange rate volatility is seen as a source of global imbalances and it could possibly lead to market uncertainty, unfavourable balance of trade, volatility in profits of traders, increase in risk, inflation uncertainty, and impacts on production and transaction cost.

Mokoma (2014) examined the volatility of the South African exchange rate and argued that volatility is also caused by factors such as interest rates, Foreign Direct Investment (FDI), the balance of payments, GDP, terms of trade, inflation rates and speculations. A study by Mpofu (2016) pointed out that both real and monetary factors determine the volatility of exchange in South Africa. Mpofu (2016) mentioned that the monetary factors that cause exchange rate volatility include the money supply, gold price and output. Moreover, Mpofu (2016) also found that real factors such as openness, commodity prices and output have a higher degree of influence. It is evident from existing literature that most findings correspond with one another on the causes of exchange rate volatility.

3.6 Existing empirical evidence on Exchange rate and investment portfolios

The effect of exchange rate volatility on investment portfolios has received considerable attention since the collapse of the Bretton Woods System in 1971 and the adoption of floating exchange rates in 2000, both in the theoretical and empirical literature. However, there is no empirical consensus either on the existence of the relationship between investment portfolios and exchange rate volatility or on the direction of the relationship. Although the following studies did not all focus specifically on domestically versus internationally diversified investment portfolios, sufficient empirical evidence can be found on the relationship.

3.6.1 Studies from developed economies

Solnik (1974) studied the notion of domestic versus international portfolio diversification based on the sample from 1966 to 1971. The main purpose of the study was to establish whether risk reduction can be achieved through portfolio diversification. The study included seven European countries and the US, and it was found that the market risk is significantly higher for a US portfolio than for an internationally diversified portfolio (Solnik, 1974). This implies that international diversification of investment portfolios is better than domestic diversification. The research also puts considerable emphasis on increased exchange rate risk, which is generated as a result of international diversification. However, the study showed that the trade-off generated by diversifying an investment portfolio internationally has greater benefit than risk.

Jorion (1990) investigated the effect of exchange rate risk on the return of U.S. multinational firms based on a market model supplemented with a multilateral exchange rate index. This study described the exchange rate as being the main source of uncertainty for multinationals, being normally ten times unstable as inflation and four times unstable as interest rates. The findings revealed that the relationship between stock returns and exchange rate differs systematically across multinationals. Furthermore, it was found that the correlation between stock returns and the value of the dollar is positive (Jorion, 1990).

Based on a sample during 1995-2005, Stålstedt (2006) examined exchange rate risk from a portfolio investor's point of view. The main focal point of the study was to investigate how exchange rate volatility affects the risk and return of a portfolio invested in Sweden when the investor is situated in Japan, the United Kingdom, or the USA. It was found that in 2005, the portfolio created a return of 34,36% and risk of 7.7% (Stålstedt, 2006). The results from the study showed that the risk for international investors was increased, between 1.95% – 410.52% and the actual return decreased due to weakening currencies against Sweden currency (Krona). This, however, indicates that today's markets are highly correlated due to globalisation. Stålstedt (2006) concluded that investors attempting to benefit from international diversification should just accept that exchange rate volatility is a factor that is unpredictable and difficult to control. Therefore, investors should focus on finding other financial strategies to protect their investments.

Gyntelberg et al. (2009) examined how investment influences the value of the Thailand currency, Thai baht, over a sample period 2005 to 2006. It was found from the study that investment patterns can influence the value of the currency. The findings from the study imply that it is not always the case that exchange rate movements influence investment return, risk and patterns, and this is of utmost importance to the central banks. Although the study was based on the data from Thailand, the findings still highlight the link between exchange rate and investments.

In the case of emerging countries, Horobet & Ilie (2010) investigated the impact that exchange rate volatility has on the risk-return profile of investments in developing countries. The developing countries studied include the Czech Republic, Hungary, Poland, Romania, Russia and Turkey, all from Central and Eastern Europe (CEE). The main purpose of the study was to examine the importance of exchange rate volatility from the viewpoint of a US dollar investor. This was done by observing how the fluctuations of the selected countries' currencies against the US dollar contribute to the total risk of investments and the returns. Horobet & Ilie (2010) found that exchange rate volatility was not an external factor for the volatility of CEE markets when returns are denominated in US dollars. This implies that exchange rate volatility contributes positively to the investment risk in CEE markets. Horobet & Ilie (2010) also found that during the global financial crisis, September 2008, the exchange rate volatility was higher than normal periods, and the correlation between the market in the US and that of the studied countries was much lower. Horobet & Ilie (2010) concluded that due to the low correlations between the markets during global financial instability, US investors could still benefit from investing in CEE countries.

3.6.2 Studies from developing economies

Using panel data cointegration techniques, Diallo (2015) examined the relationship between the real effective exchange rate volatility and domestic investments. The study included middle and low-income countries during the period 1975 to 2004. Diallo (2015) found that the real effective exchange rate volatility has a robust negative effect on investment.

Coming to South Africa, Maepa (2016) evaluated the existence of the long and short-run links among the exchange rate and different types of investments in South Africa from 1970 to 2014. Using techniques such as the Vector Autoregressive model (VAR), a multivariate Johansen cointegration approach and Granger causality test, it was found that there exists a short-run relationship between exchange rate and investments. Moreover, Maepa (2016) also found that there was a long-run relationship between the exchange rate and investments in South Africa. An interesting finding by Maepa (2016) was that the long-run relationship was found to be negative. Although the study did not pay attention to the fluctuations of the exchange rate, it is still evident that there exists a relationship between the exchange rate and investment in South Africa.

Sikhosana & Aye (2018) used monthly data from 1996 to 2016 to examine the interactions between real exchange rate volatility and stock returns in South Africa. Using Multivariate Exponential Generalised Autoregressive Conditionally Heteroskedastic (EGARCH) model together with other GARCH family models (GJR GARCH and APARCH), it was found that there exists a bi-directional relationship between equity returns and real exchange rate volatility in the short run. Kumar (2013) used the same methodology to investigate the interactions between exchange rate volatility and stock returns of IBSA (India, Brazil, South Africa) nations. Kumar (2013) also found that in the short run, there is a bi-directional relationship between equity returns and real exchange rate volatility.

Research by Sgammini (2016) investigated the effect of exchange rate volatility of returns of Mutual funds in South Africa. Using monthly data from 2006 to 2016, it was found that in many cases, the exchange rate volatility has no interactions with investment portfolios in the long-run. Sgammini (2016) also found a uni-directional relationship between investment portfolio and exchange rate. Moreover, in the short run, investment portfolios are influenced by the exchange rate. In the South African case, Sgammini (2016) concluded that exchange rate risk could be diversifiable since the investment portfolio returns for both domestic and international portfolios react differently given the exchange rate fluctuations.

3.7 Conclusion

This chapter provided an overview of the theoretical literature concerning the exchange rate, the South African exchange rate policy, and the volatile nature of the exchange rate. It was important to provide an overview of the rand exchange rate developments because it is by analysing them that we can understand the causes of its volatility. The South African exchange rate has been characterised by excessive volatility since the move to inflation targeting in the year 2000. Empirical evidence concluded that the volatility of the exchange rate was mainly determined by the fundamental factors such as interest rate differentials, inflation differentials and the BOP. The key factors, which play a role to exchange rate volatility, seem to be inflation rates, interest rates, FDI, money supply, the balance of payments, speculations, and GDP. The empirical section of this chapter explored whether explores whether existing studies suggest that exchange rate volatility influences investment portfolios. The following chapter shall discuss the methodology and research design that will be employed by this study.

CHAPTER FOUR: RESEARCH METHODOLOGY, DESIGN AND DATA

4.1 Introduction

The chapter outlines the empirical approach employed in analysing the relationship between the South African exchange rate's volatility and the returns on selected diversified South African investment portfolios. The objective of this chapter is to provide a framework from which the empirical results are formulated, analysed, and discussed. The chapter is structured as follows; section 4.2 research paradigm, section 4.3 research design 4.4 causality test 4.5 conclusion.

4.2 Research Paradigm

The study follows a post-positivism paradigm. The post-positivistic paradigm encourages the triangulation of qualitative and quantitative approaches that examine the variety of facts that can be researched through various kinds of investigations but respecting and valuing all findings as the important components for the development of knowledge (Fischer, 1998). Post-positivism was developed to improve the limitations within the positivism/neo-positivism paradigm. Post-positivism protests against the limitations of positivism which solely identifies itself with empiricism and rejects the existence of individual/subjective perspective of the evidence. Fischer (1998) states that post-positivist research attempts to investigate the phenomena, and it believes that the absolute truth is nowhere to be found; therefore, individual research makes its unique conclusions. The aim of this approach is not to disapprove the scientific/quantitative elements of positivism but rather to have a good understating of the direction of the research from multi-method perspective.

Chilisa & Kawulich (2015) states that in the post-positivism paradigm, the goal of the research is to predict results, test a hypothesis, or find the strength of relationships between variables or a cause and effect relationship. Hence this study aims to find a relationship between the exchange rate volatility and South African investment portfolios; by testing if the returns on domestic and internationally diversified investment portfolios share a long run homogenous relationship with the exchange rate volatility. This research adopts a quantitative method as it permits for statistical analysis of the exchange rate volatility and South African investment portfolios. Chilisa & Kawulich (2015) defined a quantitative approach as a set of hypotheses that can be investigated in order to draw results and conclusions. Moreover, the study will be able to report on comparisons and comment on the statistical significance of the findings. The advantage of using quantitative data analysis is that it permits the study to remain as objective as possible while generating reliable findings. Finally, it allows the research to be comparable to other related studies.

4.3 Research design

The study employs a panel data approach because of its popular use in financial literature. A number of studies, including Humpe & McMillan (2020); Khan et al. (2020); Rafindadi & Yosuf (2013) and Salisu & Isah (2017), all used panel data approach. The advantage of a panel data approach is that it can model both the individual and common behaviours of groups. This implies that panel data can model both cross-sectional and time-series data. This is relevant to this study because it would allow the examination of the relationship between returns on both domestic funds and international funds and exchange rate volatility, but also give findings on the relationship between individual variables. Although the funds used in this study have different fundamental characteristics, panel data controls for such heterogeneity eliminating the risk of obtaining biased results. In addition, panel data comprises more information, more variability, less collinearity among the variables, more degrees of freedom and more efficiency than pure time-series data or cross-sectional data (Baltagi, 2005). Finally, Panel data can identify and quantify statistical effects (fixed and random effects) that are not detectable with pure time series or cross-sectional data.

4.3.1 Sample and sampling methods

The study used monthly data from January 2007 until December 2019 for the Net Asset Value (NAV) returns of the investment portfolio and exchange rates. The exchange rates data was captured from the South African Reserve Bank database (SARB, 2020) and (Thomson, 2020). The main reason for the selected timeframe is data availability, and the study plans to capture the period of the global financial crisis period. The investment portfolios were identified from FundsData Online (2020) and Alexander Forbes (2020); after that, their structure of asset allocation, commencement date and size of the fund were obtained from Thomson Reuters (2020). Lastly, data for each qualifying investment portfolio was collected from Thomson Reuters (2020) for the sample period. Statistical tools, namely, Econometric Views (EViews 11) and Stata software, were used to analyse the data.

The selection process focuses on investment portfolios that invest the majority of their funds in equities. The dataset comprises five domestic investment portfolios and five internationally diversified portfolios. These investment portfolios were selected according to the following conditions:

a) The fund should have existed for the entire sample period, from January 2007 until December 2019. The main reason for the selected timeframe is data availability, and the study plans to capture the period of the global financial crisis.
b) The equity funds used to represent domestic investment portfolios should allocate most of their funds within South Africa, meaning more than 50% of its assets should be invested in South Africa.
c) The equity funds used to represent internationally diversified portfolios should allocate the majority (more than 50%) of their funds in countries other than South Africa.

Table 4. 1: Domestic Investment Portfolios

Domestic Fund Name	Launch date	Equity Asset Allocation (%)	Fund Size (Billions of Rands)	Domestic Component (%)
Absa Select Equity Fund	23/02/2004	98,30%	2,22	86,24%
Allan Gray equity fund	01/10/1998	94,40%	32,1	62,30%
Ninety One equity fund	30/06/2000	98,98%	9,43	71,59%
Nedgroup investments value fund	28/11/1997	88,10%	1,18	100%
Old mutual albaraka equity fund	29/03/1992	98,05%	1,86	64%

Source: Thomson Reuters (2020)

Table 4. 2: International Investment Portfolios

Fund Name	Launch date	Equity Asset Allocation (%)	Fund Size (Billions)	International Component (%)
Absa global value feeder fund	29/09/2000	92,37%	667,49 (million)	95,41%
Allan gray-orbis global equity feeder fund	01/04/2005	99,63%	21,54	99,63%
Ninety One Global Strategic equity feeder fund	30/06/2000	95,91%	4,09	95,91%
Nedgroup Investments Global Equity Feeder Fund	28/10/2001	97,19%	14,46	97,85%
	02/06/2000	95,93%	18,09	95,93%

Source: Thomson Reuters (2020)

4.3.2 Model Specification

The research made use of the panel ARDL method adopted from Humpe & McMillan (2020). Humpe & McMillan (2020) employed a panel ARDL model to examine the long-run relationship between macroeconomic variables and the stock market returns.

This study modified Humpe & McMillan (2020) model. The explanatory variables included in this study's model are: conditional volatility, % change in conditional volatility, prime overdraft rate and inflation rate. A dummy variable was included to capture whether a portfolio is classified as domestic or international. This dummy is used as an option to run separate regression for domestic and international, not as a variable in the model. The value of one specifies a domestic investment portfolio and zero for international investment portfolios. Therefore, we specify the following model

$$Ret_{it} = \alpha_0 + \alpha_1 EXCH_{it} + \alpha_3 Pr_{it} + \alpha_4 INF_{it} + \varepsilon_{it} \quad \text{……………………………………… (4.1)}$$

Where Ret_{it} is the dependent variable of returns on investment portfolios in period t for fund *i*. α_0 is the intercept term representing the mean returns of an investment portfolio. The term $EXCH_{it}$ is the logarithm of the exchange rate volatility which had two measures; conditional volatility (ERV) and % change in conditional volatility (%ERV), Pr_{it} is the prime interest rates, INF_{it} is the inflation rates and ε_{it} is the random error term.

4.3.3 Definition of variables

4.3.3.1 Rate of Return

The net returns are measured by the dependent variable, the NAV of investment portfolios. The value of the NAV is calculated by subtracting the value of the fund's liabilities from the value of its assets, and then divide the outcome by the number of shares outstanding. The Net Asset Value of each investment portfolio was obtained from Thomson Reuters (2020). This research will measure the returns from the NAV using the following formula:

$$Ret_{it} = \frac{NAV_{i,t2}}{NAV_{i,t1}} - 1 \quad \text{(4.2)}$$

Where, Re_{it} is the portfolio return at period t; $NAV_{i,t1}$ is the net asset value of portfolio i at time 2 and $NAV_{i,t2}$ is the net asset value of portfolio i at time 1. Equation 4.2 will be calculated as a percentage and on a monthly basis, adopted from (Ljungberg & Halonen, 2012).

4.3.3.2 Exchange rate Index (ERI)

This study used the nominal exchange rate for different international investing partners. Given the mutual funds that are employed by this study, the common investing partners are Europe, the United States of America, Japan, and the United Kingdom. Therefore, the study used the GBP/ZAR, EUR/ZAR, USD/ZAR, and JPY/ZAR exchange rates. To get the Exchange Rate Index (ERI), the four exchange rates quotes were equally weighted, and an average monthly quote was then used. The exchange rate index was calculated as follows:

$$ERI = \frac{CR_1 + CR_2 + CR_3 + \ldots + CR_q}{N} \quad \text{(4.3)}$$

Where CR_1 is conversion rate which is the ratio between two currencies and N is the number of conversional rates being calculated.

Two exchange rate volatility measures were used: conditional volatility (ERV) and percentage change in conditional volatility (%ERV). Conditional volatility models are used extensively in modelling financial series. In this case, it is the volatility of the exchange rate index. GARCH model was then used to extract conditional variance and conditional standard deviation. In a

GARCH model, conditional volatility was conditioned on past values of itself and of model errors. The GARCH model is explained in full on section 4.3.4.1.

4.3.3.3 Inflation

Inflation is a macroeconomic variable that measures the rate at which a general price level will increase over time. The rise in the general level of prices reduces the purchasing power where a unit of currency effectively buys less than it did in previous periods. It is measured using the Consumer Price Index (CPI), which denotes good basket consumed over time. Inflation can be calculated using the following formula:

$$Inflation = \frac{CPI_2 - CPI_1}{CPI_1} \text{ .... } (4.4)$$

It is expected that the returns on an investment portfolio share a negative relationship with inflation. If the inflation rate is higher than the return rate on the investment, it is losing real value. This is because inflation erodes the value of investment returns over time. The variable is adopted from the study by Eita (2012) that aimed at finding the relationship between stock markets returns and inflation in South Africa.

4.3.3.4 Interest rate

Interest rate is also one of the macroeconomic variables and has a huge impact on the whole of the economy. This study will make use of the prime overdraft interest rate because it is important in determining the level of investment in the economy. Interest rates are relevant to this research because they define the degree of borrowing by investors, which impact the investment. In recent years, interest rate policies have become an important factor in directing macroeconomic policies; therefore, any changes in interest rates can influence returns on stock markets (Mlambo, 2013). Generally, a cut in prime rates would make the market react positively. This is because a cut in banks' lending rates increases the demand for borrowing, and investors will now have money to invest in companies driving up the share prices. A negative relationship between stock market price/return may also be due to the fact that a cut in repo rate (which influence the cut in prime rate) signals that inflation is under control and the government is controlling its fiscal deficit. The variable is adopted from the study by Mlambo (2013), who make use of the interest rate variable to establish the relationship between exchange rate and stock market volatility.

4.3.4 Estimation Techniques

4.3.4.1 ARCH and GARCH Models

Over the last few decades, a large body of theoretical and empirical research has focused on modelling and predicting stock market volatility. The motivation for this investigation stems from the fact that in finance, volatility is an important concept (Abdullah et al., 2018; Naik et al., 2020). Volatility is used to measure the risk of financial assets and is assessed by the variance of return or the standard deviation (Abdullah et al., 2018). The GARCH and ARCH models are the two popular non-linear models in finance and are used for modelling and forecasting future volatility.

a) Autoregressive Conditionally Heteroscedastic (ARCH) Model

One of the foundations of the ARCH model is that it deals with the non-stationarity (time-variant mean) and stationarity (time-invariant mean). The key feature of the ARCH is the volatility pooling or volatility clustering, which explains why asset prices tend to fluctuate dramatically. The Engle (1982) test for ARCH effects is used to determine whether the class model is suitable for the data before estimating the GARCH model (Naik et al., 2020). When calculating the ARCH test, high-frequency data such as quarterly, monthly, weekly, or daily data should ideally be used. The existence of the ARCH is tested by regressing the squared residuals on p-lag, where p is a constant that the user specifies. The following equations illustrate the ARCH (1) model:

$$y_t = \beta_1 + \beta_{2x2t} + \beta_{3x3t} + \beta_{4x4t} + u_t$$

$$u_t + v_t \sigma_t v_t \quad \sim N\ (0,1)$$

$$\sigma^2{}_t = \alpha_0 + \alpha_1 u^2{}_{t-1} \quad (4.5)$$

Equation 4.5 could be expanded to encompass the general situation of q-lags of squared errors, and this model is known as the ARCH (q), which is expressed as equation 4.6 below.

$$\sigma^2{}_t = \alpha_0 + \alpha_1 u^2{}_{t-1} + \alpha_2 u^2{}_{t-2} + \ \alpha_q u^2{}_{t-q} \quad (4.6)$$

Where v_t is normally distributed with unit variance and zero, u_t is also normally distributed with variance $\sigma^2{}_t$ and zero mean.

b) Generalized Autoregressive Conditional Heteroscedasticity (GARCH)

The GARCH model was established by Bollerslev (1986). This model differs from other models such as the least square model in that it assumes a homoscedastic (continuous random disturbance) relationship between the dependent and independent variables (Nerlekar, 2020). When the GARCH model is used it uncovers the volatility measures which can be used to forecast residuals. The conditional variance in this model is dependent on its prior lags. In its most basic form, GARCH (1,1) is modelled as:

$$h_t = \gamma_0 + \delta_1 h_{t-1} + \gamma_1 u^2{}_{t-1} \qquad (4.7)$$

The GARCH model is expressed in its general form as GARCH (p, q), which is stated as equation 4.8 below.

$$h_t = \gamma_0 + \delta_1 h_{t-1} + \ldots + \delta_p h_{t-p} + \gamma_1 u^2{}_{t-1} + \ldots + \gamma_q u^2{}_{t-q} \qquad (4.8)$$

Where h_t is the conditional variance, $\gamma 0$ is a constant, p is the number of residuals and q is the degrees of freedom.

These two models were used in this study to describe the conditional volatility of the exchange rates over a time period. They were used to extract the exchange rate volatility from the exchange rate index. According to the literature review, the GARCH (1,1) model is superior to and outperforms the other GARCH models (Nerlekar, 2020). In addition, this is the most widely used model in practical applications. Therefore, this study adopted the GARCH (1,1) model to understand time varying volatility of the exchange rate index of the four major currencies.

4.3.4.2 Unit Root Stochastic Process

Stochastic Processes is a family or collection of random variables ordered in time. A stochastic process is said to be stationary if the mean is constant, the variance is constant, and the covariance is also constant over time. Stationary time series are time-invariant and tend to return to their mean, and fluctuations around the mean have a constant amplitude. If non-stationary, an inference can only be made for the period under review and can’t be generalised to other time periods; hence can’t be used for forecasting. A stochastic process (variable or series) with a mean of zero, constant variance and serially uncorrelated is called a purely random or white noise process. This means E(Yt) = 0 and Var(Yt) = $1/(1- \rho^2)$.

Consider a Random Walk Model (RWM):

$Y_t = \rho Y_{t-1} + U_{t;}$ …………………………………………………………………… (4.9)

$-1 \leq \rho \leq 1$

From the above equation, Y_t is said to be a random walk, ρ is the correlation coefficient which lies between 1 and -1, and U_t is the white noise error term. If ρ = 1, we get a RWM without a drift, that is, $Y_t = (1)\ Yt_{-1} + U_{t.}$ we are faced with the unit root problem; the stochastic process is non-stationarity. However, if IρI ≤ 1, the time series Y_t is stationary.

A stochastic process Yt is assumed to have a unit root problem if its first difference, *$(Y_t$-$Y_{t-1})$,* is stationary. In practice, if the unit root exists, it indicates that the time series under consideration is non-stationary, except the reverse is the case. In contrast, there is no tendency for a series with a unit root to return to the long-run deterministic path, and the variance of the series depends on time. A series with a unit root suffers permanent effects from random shocks, thus, following a random walk. This implies that adopting a time series that contain unit root in regression analysis may exhibit misleading results.

There are different ways of testing unit roots in time series. This includes the Durbin-Watson (DW) test, Dickey-Fuller (DF) test (Dickey & Fuller, 1979), Augmented Dickey-Fuller (ADF) test (Dickey & Fuller, 1981) and Philip-Perron (PP) (Phillips & Perron, 1988) test, among others. It is recommended that before pursuing a formal test to plot the time series under consideration, to evaluate the probable characteristics of the series and run the regression. According to Nkoro & Uko (2016), a series that trends upwards displays that the mean of the series has been changing over time. In addition, if the Durbin-Watson (DW) statistic is very low and has a high R^2, this may mean that the series is not stationary.

There are several ways of testing unit roots; the two most popular strategies for testing stationarity include the Augmented Dickey-Fuller (ADF) and Philip-Perron (PP). Dickey & Fuller (1979) showed that the coefficient of Y_{t-1} follows a τ (tau) statistic instead of t-stats and that the critical values depend on the type of equation being tested. ADF test was developed to improve the challenges within the DF test. Such challenges include the sensitivity to the way it is conducted; that is, if a wrong functional model is used for testing, the size of the test may be inappropriate, leading to incorrect conclusions. Philip-Perron (PP) is normally used for confirmation of the results. Phillips & Perron (1988) developed a more comprehensive theory of unit root non-stationarity. The Philip-Perron (PP) tests are similar to ADF tests, but they incorporate an automatic correction to the DF procedure to allow for autocorrelated residuals. This implies that the PP is able to deal with the problem of autocorrelation, which is the main issue in ADF and DF. Philip-Perron tests usually give the same conclusions as the ADF tests, and the calculation of the test statistics is complex. The main criticism of Dickey-Fuller and Philip-Perron tests is that the power of the tests is low if the process is stationary but with a root close to the non-stationary boundary.

Although the DF, ADF and PP unit root tests are efficient in a time series, they lack power in distinguishing the unit root null from stationary alternatives. Therefore, in recent years, the use of panel unit root tests has become very common among empirical researchers with access to a panel data set. This research will employ a panel unit root test adapted from (Levin & Lin, 1992, 1993; Levin et al., 2002). Employing panel data unit root tests is one way of increasing the power of unit root tests based on a single time series (Maddala & Wu, 1999). Within the panel unit root testing context, there are two generations of tests. Menegaki (2018) states that the first generation of tests suggests that cross-sectional units are cross-sectionally independent, while this principle is relaxed in the second generation of panel unit root tests which allows cross-sectional dependency. Previous studies on first generation panel unit root tests make different assumptions about the unit root process. Studies such as Hadri (2000), Im et al. (2003), Levin & Lin (1992, 1993) and Maddala & Wu (1999) tests assume that there is a unit root process across cross-section units, that is, cross-sections are homogenous. On the other hand, Pesaran (2003) tests assume a heterogeneous cross-section formation. The goal of the second-generation panel unit root tests is to address the shortcoming of cross-sectional dependence in the first-generation tests. The second generation tests are based on the heterogeneity assumption (Menegaki, 2018).

(a) First generation panel unit root tests

As stated above, first generation panel unit root tests are based on the assumption that the data is independent and identically distributed (i.i.d.) across individuals (Barbieri, 2006; Choi, 2001). This study will employ the main three first-generation unit root tests mentioned above. All tests are based on the following Augmented Dickey-Fuller regression adapted from Guillaumin (2009):

$$\Delta x_{jt} = \alpha_j + \beta_j t + \rho_j x_{jt-1} + \varepsilon_{jt} \quad \text{......} (4.10)$$

Where: j= 1, 2, ..., N is the individual, for each individual t = 1,2, ..., T time-series observations are available, ε_{jt} is the error term and is i.i.d, α_j and β_j allow for fixed and unit specific time trends for each j. The unit root null hypothesis is:

H_0: $\rho_j = 0 \; \forall$ j

The alternative hypothesis differs according to the test used.

(Levin & Lin (1992, 1993) and Levin et al. (2002) assume homogenous autoregressive between individual, i.e. $\rho_j = \rho$ for all j, the alternative hypothesis is:

$H_a : \rho_j = \rho < 0, \forall j$

They assume that the fixed effects are captured by inter-individual heterogeneity.

The paradigm of Levin & Lin (1992, 1993) is expanded by Im et al. (2003) to allow heterogeneity in the value of the autoregressive coefficient. The alternative hypothesis is then defined as:

$H_a : \rho < 0$, j = 1, …, N_1 and $\rho_j = 0, j = N_1 + 1, \dots, N$

This test include an individual j= 1, …, N_1 where x_{jt} is stationary and individual j = N_1 + 1, …,N where x_{jt} is non-stationary. The t-statistic is an average and can be computed as follows:

$\hat{t} = \frac{1}{N} \sum_1^N t_j$ …………………………………………………………………… (4.11)

Where t_j is the individual ADF t-statistics for the unit root test.

Based on research by Fischer (1932) and Maddala & Wu (1999) suggested joining the p-values of the t- statistic for a unit root in the respective cross-sectional unit. The test statistic of Maddala & Wu (1999) is as follows:

$MW = -2 \sum_{j=1}^{N} \ln (p_j)$ ………………………………………………………………… (4.12)

Where p_j is the p-value of the t-statistic of the ADF test.

This study will only adopt the first-generation panel unit root test because the second generation is not available on EViews software. In conclusion, the unit roots test is needed to decide the number of times a variable/series has to be differenced to attain stationarity. This is what determines integration: A variable Y of order d, I(d) is said to be integrated if it reaches stationarity after differencing d times (Engle & Granger, 1987). The next section will discuss the cointegration test.

4.3.4.3 Hausman test

Hausman (1978) tested the null hypothesis of homogeneity based on the comparison between the Mean Group (MG) and the Pooled Mean Group (PMG) estimators. The Mean Group estimator was proposed by Pesaran & Smith (1995). MG is less informative because it averages the data by calculating the coefficient means, and it examines the distribution of the estimated coefficients across groups. It shows that parameters are freely independent across the groups. The PMG was proposed by Pesaran et al. (1999), and it is an intermediate estimator between the MG and Dynamic Fixed Effect (DFE). It involves both pooling and averaging the sample. It allows the intercept, short-run coefficients, and error variances to differ freely across groups, but the long run coefficients are homogeneous. The difference between the MG and PMG estimator is that MG provides consistent estimates of the mean of the long-run coefficients, but these will be inefficient if the slope homogeneity holds. In comparison, PMG estimators are consistent and efficient under the assumption of long-run slope homogeneity. The null hypothesis for the Hausman test is MG and PMG estimates are significantly different; PMG is more efficient. If the p-value is greater than 5 percent, the null hypothesis cannot be rejected, and we then use the PMG. If the p-value is less than 5 percent, reject the null hypothesis and use the MG.

4.3.4.4 Panel ARDL

The research will make use of the panel ARDL model, which is a widely adopted model in financial analysis. The panel ARDL model is used when the goal of the study is to identify possible long-run relationships between variables. The research by Khan et al. (2020), Rafindadi & Yosuf (2013) and Salisu & Isah (2017) all used the panel ARDL model in their analysis. The ARDL model was first introduced by Pesaran & Shin (1995) to resolve the problem of cointegration analysis when variables of different orders are integrated. Pesaran & Pesaran (1997), Pesaran et al. (1999) and Pesaran et al. (2001) further developed the panel model that is adopted by this study.

Ogbokor (2015) said that the ARDL is an effective model because it is not sensitive to sample size, and it allows for simultaneous estimation of the short-run and long-run components of the model. Pesaran & Pesaran (1997) note that the ARDL method is more flexible and can be applied irrespective of whether the variables are of a different order and that sizes of the t-tests from an estimator that uses an ARDL approach are much more reliable. Pesaran & Pesaran (1997) also concluded that the ARDL method is adequate to simultaneously correct for residual serial correlation and the problem of endogenous regressors, thus giving ARDL an advantage over other approaches to cointegration. Lastly, the ARDL takes preference because of the exceptional power of its estimates being found to be more efficient and reliable in small samples than those from the Johansen technique.

ARDL model specification that was introduced by Pesaran & Shin (1995) and is described as ARDL(p, q, …., q) model:

$$Ret_{it} = \alpha_0 + \sum_{j=1}^{p} \lambda_{ij} Re_{i,t-j} + \sum_{j=0}^{q} \delta'_{ij} X_{i,t-j} + \varepsilon_{it} \quad \text{.................................} \quad (4.13)$$

Where Re_{it} is the NAV returns and is the dependent variable; X_{it} is a (4x1) vector of our explanatory variables, and ε_{it} is the error term. The above model (Equation 4.13) is used to establish the relationship between returns on diversified South African investment portfolios and exchange rate volatility.

4.3.4.4.1 Error Correction Model (ECM)

When a long-run relationship between variables is established, the ECM is needed to determine the time it will take to adjust to equilibrium (Sgammini, 2016). The ECM, which is applicable to Equation 4.13, is given as follows:

$$\Delta Ret_{it} = \varphi_i (Re_{i,t-1} - \alpha_{0i} - \alpha' i X_{it}) + \sum_{j=1}^{p-1} \lambda^*_{ij} \Delta Re_{i,t-j} + \sum_{j=0}^{q-1} \delta^*_{ij} \Delta X_{i,t-j} + \varepsilon_{it} \; . \; (4.14)$$

Where: $\varphi_i = -(1 - \sum_{j=1}^{p} \lambda_{ij})$; $\alpha_i = -(\sum_{j=0}^{q} \delta_{ij} / \varphi_i)$; $\lambda^*_{ij} = -\sum_{m=j+1}^{p} \lambda_{im}$, j = 1,2,…,p – 1 and $\delta^*_{ij} = -\sum_{m=j+1}^{p} \delta_{im}$, j = 1,2,…,p – 1.

This method permits that the intercepts, short-run coefficients and error variances to vary across the cross-sections while determining the long-run parameters and the speed of adjustment to equilibrium. Based on the previous studies by Abidin et al. (2013) and Sgammini

(2016), it is expected that most of the investment portfolios would not share a long-run relationship with the exchange rate.

4.3.4.5 Cointegration Test

The concept of cointegration was first formalised by Granger (1981) and Engle & Granger (1987), which provide tests and estimation procedures to estimate the existence of a long-run relationship between exchange rate volatility and the returns on diversified South African investment portfolios. Nkoro & Uko (2016) states that the cointegration test study how time series, maybe non-stationary, which tends to drift far away from equilibrium, can be paired such that workings of equilibrium forces will ensure they do not drift too far apart. Cointegration basically keeps the long-run information of the time series intact. In other words, cointegration comprises a stationary linear combination of variables that are independently non-stationary but integrated to order, I (1). Nkoro & Uko (2016) further defined cointegration as an econometric phenomenon that imitates the presence of a long-run equilibrium between the underlying economic time series that converges over time. Testing cointegration is an important step in deciding whether a model empirically shows a significant long-term relationship. If there exists no cointegration among the underlying variables, it becomes imperative to continue to work with differenced variables instead, but the long-run data will be missing. Although there are several tests for cointegration, the focal point of this study will be on the panel cointegration tests that is used through the panel Autoregressive Distributed Lag cointegration technique.

(a) Panel cointegration test

Pedroni (1999, 2004) developed seven tests for testing cointegration in the panel context. Panel cointegration strategies are proposed to enable researchers to selectively pool information concerning long-run relations from across the panel while allowing the related short-run dynamics and fixed effects to be heterogeneous across various panel members (Pedroni, 1999). The null hypothesis for the panel cointegration test states that for each member of the panel, the variables under consideration are not cointegrated. On the other hand, the alternative hypothesis states that for each member of the panel, there exists a single cointegration vector; however, this cointegration vector may not be the same for each panel member. The advantage of these tests is that they allow fixed effects and dynamics to be different across panel members and the cointegrating vector to be different across members under the alternative hypothesis

(Pedroni, 1999). This is valuable because incorrectly imposing homogeneity of the cointegrating vectors in the regression may give spurious results.

When constructing and implementing tests for panel cointegration, the regression residuals from hypothesised cointegration regression are calculated as follows:

$y_{j,t} = \alpha_j + \delta_j t + \beta_{1j}x_{1j,t} + \beta_{2j}x_{2j,t} + \cdots + \beta_{Mj}x_{Mj,t} + e_{j,t}$ ………………………. (4.15)

$$\Delta y_{i,t} = \sum_{m=1}^{M} \beta_{mi}\, \Delta \mathcal{X}_{mi,t} + \eta_{i,t}$$

$$\hat{e}_{i,t} = \widehat{\Upsilon}_i \hat{e}_{i,t-1} + \hat{\mu}_{i,t}$$

$$\hat{e}_{i,t} = \widehat{\Upsilon}_i \hat{e}_{i,t-1} + \sum_{k=1}^{K} \widehat{\Upsilon}_{i,k}\, \Delta \hat{e}_{i,t-k} + \hat{\mu}^{*}_{i,t}$$

Where m= 1,2, . . ,M refers to the number of regression variables, t= 1, 2, . . ,T refers to the number of observations over time, i= 1,2, . . . ,N refers to the number of individual members in the panel and k= 1,2, . . . ,K is the number of lags in the ADF regression.

The seven tests are grouped into two categories: group-mean statistic, which combine the individual variable test statistic and panel statistics that pool the statistics along the within-dimension (Pedroni, 1999, 2004). Within both categories, there are nonparametric (ρ and t) and parametric (augmented Dickey–Fuller [ADF] and v) test statistics.

The following equations can then be used to construct the seven statistics (Pedroni, 1999).

Panel υ: $T^2 N^{\frac{3}{2}} \left(\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{11i}^{-2}\hat{e}_{i,t-1}^{2}\right)^{-1}$

Panel ρ: $T\sqrt{N} \left(\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{11i}^{-2}\hat{e}_{i,t-1}^{2}\right)^{-1} \sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{11i}^{-2}(\hat{e}_{i,t-1}^{2}\Delta\hat{e}_{i,t} - \hat{\lambda}_i)$

Panel t: $\left(\hat{\sigma}_{N,T}^{2} \sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{11i}^{-2}\hat{e}_{i,t-1}^{2}\right)^{-\frac{1}{2}} \sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{11i}^{-2}(\hat{e}_{i,t-1}^{2}\Delta\hat{e}_{i,t} - \hat{\lambda}_i)$

Panel ADF: $\left(\hat{s}_{N,T}^{*2} \sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{11i}^{-2}\hat{e}_{i,t-1}^{*2}\right)^{-\frac{1}{2}} \sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{11i}^{-2}\, \hat{e}_{i,t-1}^{*2}\Delta\hat{e}_{i,t}^{*}$

Group ρ: $T\frac{1}{\sqrt{N}} \sum_{i=1}^{N} \left(\sum_{t=1}^{T}\hat{L}_{11i}^{-2}\hat{e}_{i,t-1}^{2}\right)^{-1} \sum_{t=1}^{T} (\hat{e}_{i,t-1}\Delta\hat{e}_{i,t} - \hat{\lambda}_i)$

Group t: $\frac{1}{\sqrt{N}} \sum_{i=1}^{N} (\hat{\sigma}_i^2 \sum_{t=1}^{T} \hat{e}_{i,t-1}^2)^{-\frac{1}{2}} \sum_{t=1}^{T} (\hat{e}_{i,t-1}\Delta\hat{e}_{i,t} - \hat{\lambda}_i)$

Group ADF: $\frac{1}{\sqrt{N}} \sum_{i=1}^{N} (\sum_{t=1}^{T} \hat{s}_i^{*2} \hat{e}_{i,t-1}^{*2})^{-\frac{1}{2}} \sum_{t=1}^{T} \hat{e}_{i,t-1}\Delta\hat{e}_{i,t}$

The test statistics are then adjusted so that they are distributed as N(0, 1) under the null hypothesis. The adjustments made to the statistics differ depending on the number of regressors, the time trends and the type of test statistics included.

The panel v statistic goes to positive infinity, while the other test statistics go to negative infinity since the null of no cointegration is rejected. According to Neal (2014), the null hypothesis is rejected if enough of the individual cross-sections have statistics that are "far away" from the theoretical means if they were created under the null hypothesis. The relative power of each test statistic is not completely clear, and the statistics may produce conflicting results. When $T < 100$, the group and panel ADF statistics have the best power properties, while the panel v and group statistics perform relatively poor (Pedroni, 2004). Additionally, the ADF statistics perform better if the errors follow an autoregressive process (Neal, 2014).

4.4 Causality test

Granger causality test was first introduced by Granger (1969) in order to establish the direction of causality among two linked variables. There are three possible scenarios in which a Granger-causality test can be applied: (a) In a simple Granger-causality test, there are two variables and their lags, (b) In a multivariate Granger-causality test, more than two variables are included because it is supposed that more than one variable can influence the results, (c) Finally, Granger-causality can also be tested in a VAR framework (Foresti, 2007).

The first scenario is explained well by Lin (2008), who highlighted the two assumptions underlying the granger causality test. First, the granger causality test assumes that the future cannot cause the past. The past predicts the present or future. Second, a cause contains unique information about an effect not available elsewhere. According to Lin (2008), the Granger causality test can be expressed mathematically as follows:

Xt is said not to Granger cause Yt if for all h > 0

$F(Y_{t+h}/\Omega_t) = F(y_{t+h}/\Omega_t - X_t$ ………………………………………………… (4.16)

Where: F is the conditional distribution; Ω_t is all information in the series, and X_t and Y_t are the two variables.

The interpretation of equation 4.13 can be defined as variable X does not granger cause variable Y if variable X cannot help in predicting additional values of variable Y.

One of the fundamental criteria for using Granger causality tests in econometrics is the stationarity of a vector autoregressive (VAR) time series representation. The Granger method to the question of whether ERV causes RET is to evaluate how much of the present value of the second variable can be explained by previous values of the first variable. RET is said to be Granger-caused by ERV if ERV aids in the prediction of RET, or, equally, if the coefficients of the lagged ERV are statistically significant in a regression of RET on ERV. The following vector autoregressive (VAR) model can be used to empirically test for causality in the Granger sense, adopted from (Salman & Shukur, 2004):

$$lnRET_t = a_0 + \sum_{i=1}^{k} a_i \; lnRET_{t-i} + \sum_{i=1}^{k} b_i \; lnERV_{t-i} + e_{1t} \quad \text{......................} \quad (4.17)$$

$$lnERV_t = c_0 + \sum_{i=1}^{k} c_i \; lnRET_{t-i} + \sum_{i=1}^{k} f_i \; lnERV_{t-i} + e_{2t} \quad \text{........................} \quad (4.18)$$

where: Ln ERV_t is the log of exchange rate volatility; Ln RET_t is the log of returns on investment portfolios. e_{1t} and e_{2t} are innovations and are used to be white noise with zero mean. Using the Schwarz information criteria, the number of lags, k, was determined to be four.

Based on the estimated OLS coefficients for the equations (4.14) and (4.15), four different hypotheses about the relationship between RET and ERV can be formulated (Foresti, 2007):

1. Unidirectional Granger-causality from RET to ERV. In this case, return on investment portfolios increases the prediction of exchange rate volatility but not vice versa. Thus $\sum_{i=1}^{k} b_i \neq 0$ and $\sum_{i=1}^{k} f_i = 0$.
2. Unidirectional Granger-causality from ERV to RET. In this case, the exchange rate volatility increases the prediction of the return on investment portfolios but not vice versa. Thus $\sum_{i=1}^{k} b_i = 0$ and $\sum_{i=1}^{k} f_i \neq 0$.
3. Bidirectional (or feedback) causality. In this case $\sum_{i=1}^{k} b_i \neq 0$ and $\sum_{i=1}^{k} f_i \neq 0$, this means that the exchange rate increases the prediction of the return on investment portfolios and vice versa.

4. Independence between ERV and RET. In this case, there is no Granger causality in any direction, thus $\sum_{i=1}^{k} b_i = 0$ and $\sum_{i=1}^{k} f_i = 0$.

As a result, finding one of these results appears to be a viable method for detecting the causal relationship between exchange rate volatility and returns on investment portfolios.

4.5 Conclusion

This chapter discussed the research methodology employed by this study. It explained how different funds used were collected, the statistical and econometric methods used to fulfil the primary objective of analysing the empirical relationship between exchange rate volatility and the returns on diversified South African investment portfolios. The next chapter presents the discussion on the results and findings of this research.

CHAPTER FIVE: PRESENTATION AND DISCUSSION OF RESULTS

5.1 Introduction

The purpose of this chapter is to investigate the empirical relationship between exchange rate volatility and the returns on diversified South African investment portfolios over the period of January 2007 until December 2019. The chapter focuses on the return of five investment portfolios in South Africa and five internationally diversified portfolios and how the exchange rate volatility influences them. To strengthen the model, additional control variables such as inflation rate, interest rate and a dummy variable was used to explain the relationship between investment portfolios and exchange rate. This chapter is divided into five sections. The first section is the graphical analysis of the return on the investment portfolio and the exchange rate trend. Followed by descriptive statistics for both returns on investment portfolio and exchange rate volatility. The key descriptive statistic includes the mean, standard deviation, Kurtosis, skewness and Jarque-Bera test statistics. The third section of this chapter discusses the correlation analysis between the exchange rate index and the return on a diversified South African investment portfolio. Unit root test and the cointegration analysis are discussed in the fourth section. The fifth section discusses the ADRL model and, lastly, the causality tests.

5.2 Stylised facts

5.2.1 Trend analysis of the Exchange rate index

As discussed in chapter 3 of this study, South Africa adopted the free-floating exchange rate regime from the year 2000. Other countries (USA, UK, European Union and Japan) that constitute the exchange rate index used in the study also adopted the free-floating exchange rate regime. A free-floating exchange rate system is characterised by much more volatility than a fixed exchange rate regime. Figure 5.1 demonstrates how volatile the exchange rate index (ERI) has been over the past 13 years.

Figure 5.1 represents the trend of the ERI from January 2007 until December 2019, which is the sample period of the study. The figure is subdivided into three periods. The first period demonstrates the movement of the ERI during the Global Financial Crisis between January 2007 and January 2010. The second breakdown represents a period of lowest rates between June 2010 and December 2012. Period three illustrates the last sample period, January 2013 to December 2019.

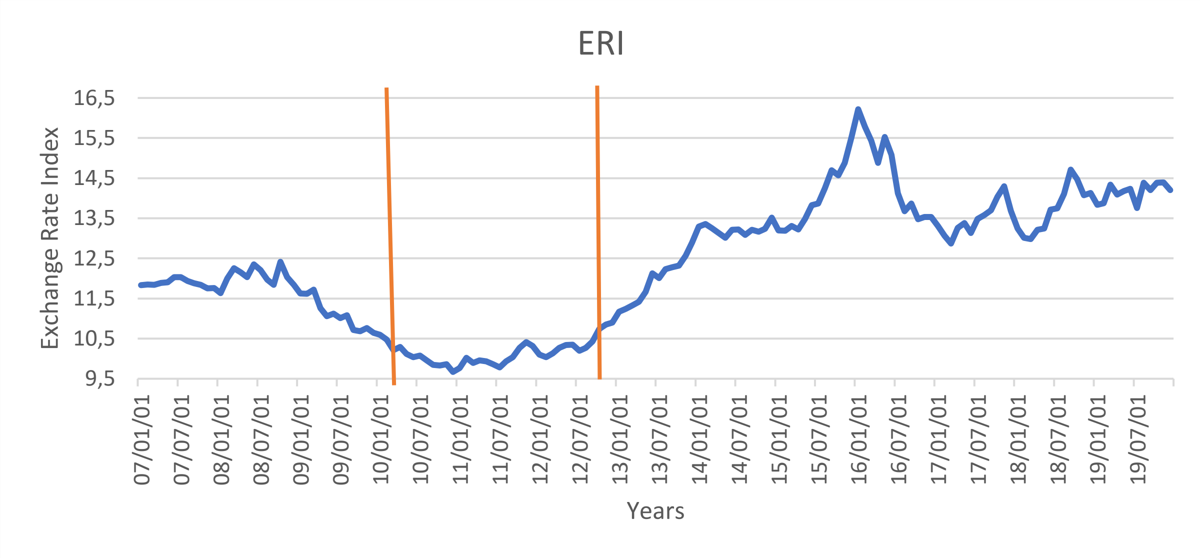

Figure 5. 1: Exchange rate Index

Source: Compiled by the Author, data from SARB (2020) and (Thomson Reuters, 2020)

The first period (Jan 2007 – June 2010) started at a rate of 11,83 in January 2007, and at the end of June 2010, the exchange rate index was at 10,31. At the beginning of 2008, the exchange rate index declined, reaching 11,5. Minor fluctuations followed between February 2008 through July 2009. From August 2009 until 2010, there was a downward trend. Between June 2010 to July 2012, the exchange rate reached the lowest rate of approximately 9,5. The lower rates persisted all through the period. At the beginning of the third period, from early 2013 until January 2016, there was an upward trend. A period of moderately stable exchange rate index was between Jan 2014 until June 2015. During this period, the exchange rate index ranged between 12,5– 13,5. The highest exchange rate index of 16,4 was reached in January 2016. However, going forward, the trend was mostly upward, and there were major fluctuations. Overall, the exchange rate index appreciated by 2,37 percent from 11,83 in January 2007 to 14,20 in 2019.

5.2.2 Trend analysis of South African Investment portfolios.

The graphical analysis of the returns of South African investment portfolios is broken down into two distinct groups. The first group represents domestic funds, with most of its asset allocation within South Africa. The second group illustrates international funds with most of its asset allocation outside of South Africa. Graphical analysis strategy provides a general overview of how these portfolios have been performing from January 2007 to December 2019.

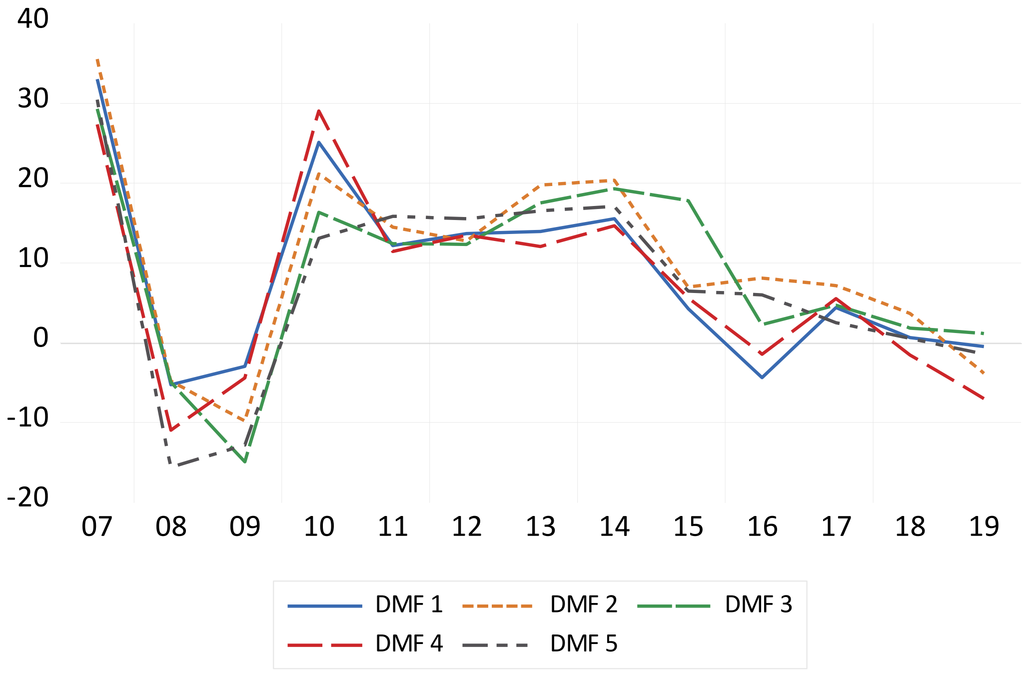

Figure 5. 2: NAV Returns (%) for Domestic Investment Portfolios

Source: EViews output, data from Thomson Reuters (2020)

Figure 5.2 above demonstrate how domestic funds have been performing for the past 13 years. At the beginning of 2007, all the five domestic funds started at almost the same return, approximately 30%. Allan Gray Equity fund (DMF2) led with the highest return of roughly 35% in January 2007. Towards the end of 2007, all returns on domestic funds declined sharply, reaching -10% at the beginning of 2008. Old mutual albaraka equity fund (DMF 5) decreased significantly in October 2008, reaching a loss of approximately -20%. This was during a period of Global Financial crisis, and it was expected for all funds to underperform. In mid-2009, all domestic funds started recovering and regained their positive trend. Nedgroup investments value fund (DMF 4) had the highest return of approximately 30% in March 2010. They were followed by Absa Select Equity Fund (DMF1) with a return of 27%. Moving to the end of 2010 onward, the returns for all domestic funds kept fluctuating around positive values. Throughout 2015, Ninety One equity fund (DMF 3) was the best performing domestic fund with a return of approximately 20%. From then onwards, all domestic funds had periods with negative returns and positive returns. Overall, the returns for all domestic funds have declined by approximately 35%, from almost 30% in January 2007 to nearly -10% in December 2019.

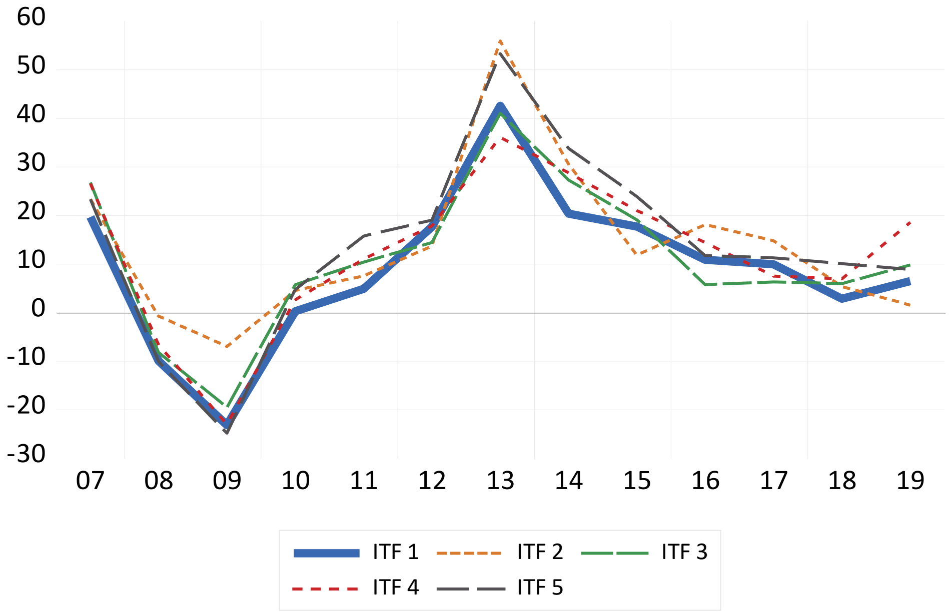

Figure 5. 3: NAV Returns (%) for International Investment Portfolios

Source: EViews output, data from Thomson Reuters (2020)

Comparing figure 5.2 and figure 5.3, it is visible that international investment portfolios outperform domestic investment portfolios. This is shown in Figure 5.3, which illustrates more positive trends and a positive return for all international funds. At the beginning of our sample period, all international funds started at a return of approximately 25%, with Nedgroup Investments Global Equity Feeder Fund (ITF 4) having the highest return of 28%. However, they all immediately started declining gradually from June 2007, reaching their minimum return (loss) of approximately -30% in May 2009. Old Mutual global equity fund (ITF 5) had the most loss during this period. This was during the period of the Global Financial Crisis, and both international and domestic funds were underperforming and making a loss. Interestingly, both international and domestic funds made approximately the same loss of 30% during this period. Towards the middle of 2009, all international funds started recovering and making a profit, with Allan gray-Orbis global equity feeder fund (ITF 2) leading. Moving from 2010 onwards, all international funds maintained a positive trend, and they all reached their pick in 2013. Allan gray-Orbis global equity feeder fund (ITF 2) outperformed all other international funds with the return of 58%, followed Old mutual global equity fund (ITF 5), and the least performing fund was Absa global value feeder fund (ITF 1). After picking, there was a sharp decline for all international funds and towards the end of 2016. At the end of the sample period, international fund 4 was leading, and ITF 2 was at the bottom. Overall, the return for international funds declined by approximately 15%, from 25% in January 2007 to 10% in

December 2019. Although there are periods were domestic funds outperformed international funds, the majority of the time, internationally diversified funds realised higher returns than domestic funds.

The general observations from figures 5.1, 5.2 and 5.3 are that due to the adverse holistic effect of the global financial crisis, the movement of the returns of domestic and internationally diversified funds was strongly correlated with the movement of the exchange rate over the 2007/2009 period. The exchange rate index depreciated significantly at the same time as the decrease in the NAV returns of all the funds during the period 2007/2009 suggests that, during the period of the global financial crisis, both the returns and the exchange rates experienced a negative movement.

5.3 Descriptive Statistics

This section discusses the main descriptive statistics linking to the 10 South African investment portfolios as well as the exchange rate index. Describing statistics is essential because it explains what your sample conveys. Table 5.1, 5.2, 5.3 below illustrates the descriptive statistics of the conditional volatility, % change in conditional volatility and returns of investment portfolios. First are the measures of central tendency, which include the mean (an average value) and the median being the middle value after arranging observations. Second is the measures of dispersion which measures how data is spread out using standard deviation. Lastly are the measures of normality, where the study focuses on Kurtosis and skewness. This allows capturing returns and measuring the volatility well.

Kurtosis measures the shape of the distribution of the series. There are three forms of Kurtosis. First is Mesokurtic, which is the normal distribution with the Kurtosis of three. If it is Leptokurtic, it has a positive kurtosis suggesting that there are higher values than the sample mean. Platykurtic has negative Kurtosis (flatted curve) with lower values than the sample mean. Skewness measures the degree of asymmetry of the series. Normal skewness indicates that the distribution is symmetric around its mean and has a skewness value of zero. Positive skewness implies that the distribution has a long right tail showing that there are higher values than the sample mean. In contrast, negative skewness implies a distribution with a long left tail meaning that there are lower values than the sample mean. Moreover, the Jarque-Bera test statistic measures the difference between Kurtosis and skewness of a series with those of the normal distribution. The null hypothesis for the Jarque-Bera test is normal distribution, while the alternative is not normally distributed. Finally, the probability is an absolute value indicating whether the null hypothesis should be rejected.

5.3.1 Full sample descriptive statistics

Table 5. 1: Descriptive statistics for the full sample.

	ERV	%ERV	RET
Mean	0.073089	4.475532	43.93495
Median	0.048219	-5.648518	13.96815
Maximum	0.384809	122.0459	425.6645
Minimum	0.005026	-19.33425	1.592000
Std. Dev.	0.065203	25.80511	83.57695
Skewness	2.106007	1.968154	3.057529
Kurtosis	8.419705	7.456811	11.74723
Jarque-Bera	3023.165	2268.785	7309.094
Probability	0.000000	0.000000	0.000000

Source: EViews output, data from SARB (2020)

Table 5.1 shows the descriptive statistics of the full sample. The return on investment portfolios recorded a mean of 43,93. The mean of conditional volatility (ERV) and % change in conditional volatility (%ERV) is 0,0733 and 4,5495. The overall maxima return is 425.6645, and maximum conditional volatility and % change in conditional volatility is 0,384 and 122,04, respectively. The minimum value, which indicates the lowest return, is 1,592. Minimum ERV was 0,0050 with %ERV of -19.33425. The median return of ERV, %ERV and RET is 0.048344, -5.633796 and 27.92790, respectively.

Traditionally, it is expected that a higher average mean is associated with a higher standard deviation. The table reveals that it is true in the case of the current study because the standard deviation of 83,576 is associated with the return maximum return of 425,66. ERV, %ERV reported the standard deviation of 0.065 and 25.805, respectively.

All variables reported a positive skewness, meaning that the distribution has a long right tail showing that there are higher values than the sample mean. Moving to Kurtosis, all variables display a positive kurtosis higher than three, and they are referred to as Leptokurtic. The Jarque-Bera statistic for all domestic funds, ERV and %ERV show that they are statistically significant at a 5% level. It can be concluded that all variables are not normally distributed by rejecting the null hypothesis.

5.3.2 Domestic funds descriptive statistics

Table 5. 2: Descriptive statistics of returns on domestic and international funds

	RET (domestic)	RET (international)
Mean	74.55813	12.91146
Median	27.92790	6.846500
Maximum	425.6645	70.35930
Minimum	2.207300	1.592000
Std. Dev.	108.4690	15.37102
Skewness	1.946070	2.131089
Kurtosis	5.541690	6.900539
Jarque-Bera	697.7888	1063.999
Probability	0.000000	0.000000

Source: EViews output, data from SARB (2020)

Table 5.2 shows the descriptive statistics of returns on domestic (left side) and international (right side) funds. The table above reveal that the domestic funds outperform international funds. The highest mean return generated by the domestic fund is 74.55813, while that of the international fund is 12.91146. This implies that overall, domestic funds outperformed international funds by approximately 61,64. Moreover, the overall standard deviation values for domestic funds are above that of international funds, meaning that higher return is associated with higher risk. This is not surprising because it is expected for portfolios with higher returns to have a higher risk. Conditional volatility for both domestic and international portfolios were almost the same. International funds reported a maximum return value of 70.35930, whereas domestic funds maximum return is 425.6645, a difference of about 355,30. Both domestic and international funds had the same measures of normality. The skewness indicates that all funds are skewed to the right. The Kurtosis reveals that all funds have returns that are both heavily positive. Finally, the Jarque-Bera statistics reveal that all returns are not normally distributed for both domestic and international funds.

5.4 Correlation Analysis

This section elaborates on the type of relationship the four variables of interest share. This relationship will be explained by running a correlation analysis of all the four variables under consideration.

Table 5. 3: Exchange rate volatility and return on investment portfolios correlation matrix

Correlation Probability	ERV	%ERV	INF	PRIME	RET
ERV	1.000000 -----				
%ERV	-0.152119 0.0000	1.000000 -----			
INF	-0.062318 0.0830	0.036615 0.3087	1.000000 -----		
PRIME	0.014312 0.6908	0.113573 0.0015	0.251810 0.0000	1.000000 -----	
Returns	0.128900 0.0003	-0.004123 0.9088	-0.037110 0.3022	-0.092981 0.0096	1.000000 -----

Source: EViews output, data from Thomson Reuters (2020) and SARB (2020)

Table 5.3 provides information about the correlation analysis. Correlation is the determination of a linear relationship between two distinct variables; in this case, the conditional volatility, % change in conditional volatility, inflation, prime rate and returns of South African investment portfolios. A correlation value closer to +1 implies that there is a strong positive relationship between two distinct variables, whereas a correlation value closer to -1 mean that there is a stronger negative relationship. Conditional volatility exhibits a weak negative correlation with % change in conditional volatility and inflation. On the other hand, ERV has a weak positive relationship with both returns on investment portfolios and the prime rate. % Change in conditional volatility shows a weak positive correlation with inflation and prime rate and a weak negative correlation with returns on investment portfolios. Inflation has a weak positive relationship with the prime rate and a weak negative relationship with returns on investment portfolios. Lastly, the prime rate shows a negative relationship with returns on investment portfolios.

The significant relationships only exist amongst conditional volatility and % change in conditional volatility, ERV and Returns, %ERV and INF, %ERV and Prime, Inflation and

Prime, Prime and returns. This is seen by the probability values that are all lower than the critical level of 5 percent. Returns on Investment portfolios share a positive relationship with conditional volatility, while a negative relationship exists between returns and inflation, % change in conditional volatility and the prime rate. A positive relationship indicates that as the exchange rate increases (depreciates), so does the returns on investment portfolios. While a negative relationship indicates that as the inflation, prime rate or % change in conditional volatility decreases, the returns on investment portfolios will increase. These results are supported by Diallo (2015), who found the effects of exchange rate volatility on investment are nonlinear.

5.5 ARCH Models

This section used the ARCH model to test the usefulness of employing historical exchange rate data when forecasting movements of the exchange rate. The first step before estimating the GARCH models was to test for ARCH effects, and the results are presented in Appendix A. The ARCH test explains why the exchange rates tend to be fluctuate drastically (Abdullah et al., 2018). When ARCH effects are present, it indicates that the GARCH model is appropriate for the data sample and when no ARCH effects are present, it indicates that the GARCH model is not the best model for the data sample. The ARCH effects results (Appendix A) revealed that the exchange rate has ARCH effects. Furthermore, the probability of the ARCH term [RESID (-1) 2] is 0.0000, which is less than 1%, indicating that the ARCH term is significant and, as a result, can predict volatility. Moreover, it implies that the exchange rate from the previous day affects the exchange rate of the current day.

5.6 Unit root and Cointegration tests

5.6.1 Unit root test

Table 5.5 and 5.6 shows the panel first generation unit root tests results for all four variables in the regression, the NAV return on investment portfolios, exchange rate index, real interest rate and inflation rate. A panel unit root test is used to determine whether the variables are stationary at level I(0) or if the variable only becomes stationary at the first difference I(1). If all variables become stationary at the first difference I(1), it may be possible that the variables are integrated, which would require a cointegration test. As discussed in chapter 4 that for an ARDL model to be employed, no variables should be I(2); therefore, unit root results often help identify whether there is no I(2) in the regression. After testing for stationarity, the intercept and the trend were both significant (results on appendix A) for all variables except for % change in conditional volatility (%ERV) which only the Intercept was significant, therefore the stationary test was included in the study.

Table 5. 4: First-generation panel unit root tests (level)

Variables	Model	LLC	IPS	ADF Fisher Chi-square
RET	Trend and Intercept	-2.97185** (0.0015)	-0.05391 (0.4785)	15.1317 (0.7688)
ERV	Trend and Intercept	0.59947 (0.7256)	-2.32220** (0.0101)	30,4354 (0.0631)
Prime	Trend and Intercept	-3.08740** (0.0010)	-1.04820 (0.1473)	18.3635 (0.5635)
INF	Trend and Intercept	10.7829 (1.00000)	-1.49203 (0.0678)	21.5497 (0.3654)
%ERV	Intercept	-32.1656*** (0.0000)	-29.4168*** (0.0000)	630.999*** (0.0000)

Notes: Statistically significant at the: 10% level (*), 5% level (**), 1% level (***)

Source: EViews output, data from Thomson Reuters (2020) and SARB (2020)

Table 5. 5: First-generation panel unit root tests (1st Difference)

Variables	Model	LLC	IPS	ADF Fisher Chi-square
D(RET)	Trend and Intercept	-429901*** (0.0000)	-34.8544*** (0.0000)	650.481*** (0.0000)
D(ERV)	Trend and Intercept	-44.8032*** (0.0000)	-35.1743*** (0.0000)	693.900*** (0.0001)
D(Prime)	Trend and Intercept	-4.15803*** (0.0000)	-6.08797*** (0.0000)	71.4743*** (0.0000)
D(INF)	Trend and Intercept	139.551 (1.0000)	-16.7755*** (0.0000)	279.394*** (0.0000)

Notes: Statistically significant at the: 10% level (*), 5% level (**), 1% level (***)

Source: EViews output, data from Thomson Reuters (2020) and SARB (2020)

The results from table 5.4 and 5.5 above were obtained through panel unit root tests, namely, LLC (Levin et al., 2002), IPS (Im et al., 2003) and ADF Fisher Chi-square (Maddala & Wu, 1999). If the variable has a root unit, the series is labelled as non-stationary. The null hypothesis for the LLC, IPS and MW test is stated as a series that has a unit root/non-stationarity. At level LLC test demonstrated that variables NAV returns, Prime and %ERV are statistically significant at the 1 percent level; therefore, we reject the unit root null hypothesis. ERV and inflation without trend were insignificant; therefore, we fail to reject the unit root null hypothesis. In the case of the IPS test, we have concluded that variables ERV and %ERV are statistically significant at the 10% percent level and 1%, respectively. Accordingly, we reject the unit root null hypothesis. NAV returns, Prime and INF are all insignificant; therefore, we fail to reject the unit root null hypothesis. ADF Fisher Chi-square test has pointed out that variables NAV returns, Prime and INF are statistically significant at the 1 percent level; therefore, we reject the unit root null hypothesis. With intercept and trend, NAV returns, Prime, ERV and INF are all insignificant; therefore, we fail to reject the unit root null hypothesis. Finally, %ERV is significant at a 1% level: therefore, rejecting the unit root null hypothesis.

Based on the results of panel unit root tests above, we can conclude that variables NAV return, Prime, Inflation, ERV and %ERV; therefore, we reject the unit root null hypothesis, implying that the data is stationary and that there is a long-term integration relationship between tested variables. Overall, the variables appear to be I(1), with the exception of %ERV that was I(0).

5.6.2 Panel Cointegration test

After the unit root tests, the results verified that some variables were I(0) and I(1), one of the fundamental requirements of the panel ARDL model. Humpe & McMillan (2020) states that if the variables are of mixed order of integration, then a cointegration test should be conducted; we will apply Pedroni (1999) cointegration tests.

A Hausman (1978) test was estimated to decide which model between the Mean Group(MG) and Pooled Mean Group(PMG) has the better results. The Hausman test is applied, and the results indicate that the probability value is greater than 5 percent level and, therefore, insignificant. The null hypothesis that PMG is efficient cannot be rejected. Therefore, it can be concluded that the Pooled Mean Group model is appropriate for this study.

Table 5. 6: Pooled Mean Group Panel ADRL estimations of 10 mutual funds

Variable	Coefficients	Std. Error	Probability
Long Run Equation			
%ERV	-0.000191	0.008161	0.9813
INF	0.353582	0.514524	0.4921
Short Run Equation			
ECT	-0.047761	0.002163	0.0000
D(%ERV)	-0.000202	0.001104	0.8546
D(INF)	-0.331326	0.182953	0.0703
C	1.067191	0.731869	0.1450

Notes: Statistically significant at the: 10% level (*), 5% level (**), 1% level (***)

Source: EViews, data from Thomson Reuters (2020) and SARB (2020)

This study used a pooled mean group estimator for panel ARDL cointegration to establish the type of relationship between returns on the investment portfolio and % change in conditional volatility over the last 13 years. Table 5.6 presents the results of the ARDL model; the model consists of 1530 observations, and the maximum dependent lag of four was selected automatically using the Akaike information criteria (AIC). The selected model is ARDL (1,1,1). In the long run, % change in conditional volatility and inflation are all statistically insignificant at the 5 percent level. The inflation coefficient is positive, while the coefficients of % change in conditional volatility are negative. The coefficient of the % change in conditional volatility and inflation are statistically insignificant, and this means that they both do not have an impact on investment return in the long run.

In the short run, the Error correction term is negative and significant; this implies that if variables under consideration move out of equilibrium in the short run, they will converge in the long run. The Coefficient of the EC term indicates that the adjustment process is very rapid, and over 80% of the previous year's disequilibrium in return on investment portfolios from its equilibrium path will be corrected in the current month. In the short run % change in conditional volatility and inflation are statistically insignificant. The coefficient of %EVR and inflation are all negative in the short run. However, since the coefficient of the %EVR and inflation are statistically insignificant, it implies that they both do not have an impact on investment return in the short run.

Table 5. 7: Pooled Mean Group Panel ADRL estimations for Domestic investment Portfolios

Variable	Coefficients	Std. Error	Probability
	Model 1 ARDL (1,1,1)		
	Long run		
ERV	-6.174584	4.589893	0.1790
INF	0.441305	0.753186	0.5581
	Short run		
ECT	-0.048627	0.003763	0.0000
D(ERV)	2.537127	3.191334	0.4269
D(INF)	-0.467944	0.362332	0.1969
	Model 2 ARDL (1,1,1)		
%ERV	-0.010834	0.014237	0.4469
INF	0.319864	0.798757	0.6889
	Short run		
ECT	-0.046220	0.003944	0.0000
D(%ERV)	0.001628	0.000862	0.0593
D(INF)	-0.468496	0.368446	0.2039

Notes: Statistically significant at the: 10% level (*), 5% level (**), 1% level (***)

Source: EViews, data from Thomson Reuters (2020) and SARB (2020)

Table 5.7 presents the results of the Pooled Mean group ARDL models for domestic and investment portfolios. The models consist of 765 observations each, and the maximum dependent lag of four was selected automatically using the Akaike information criteria (AIC). The selected models are ARDL (1,1,1). Starting with the domestic funds in model 1, the results show that in the long run, the coefficient of inflation is positive, while the coefficient of conditional volatility is negative. All variables are statistically insignificant in the long run. The error correction term is negative and significant; this implies that if variables under consideration move out of equilibrium in the short run, they will converge in the long run. In the short run, the coefficient of ERV is positive, while that of inflation is negative. Overall, the return on domestic investment portfolios shares no relationship with exchange rate volatility and inflation in the long and short run since they are statistically insignificant.

Table 5. 8: Pooled Mean Group Panel ADRL estimations for international investment Portfolios

Variable	Coefficients	Std. Error	Probability
	Model 1 ARDL (1,2,2)		
	Long run		
%ERV	0.029189	0.013418	0.0299
INF	-0.827983	0.845865	0.3280
	Short run		
ECT	-0.051546	0.004724	0.0000
D(%ERV)	-0.002676	0.001451	0.0656
D(%ERV(-1))	-0.000164	0.001216	0.8926
D(INF)	-0.139142	0.073205	0.0577
D(INF(-1))	0.167885	0.051780	0.0012

Notes: Statistically significant at the: 10% level (*), 5% level (**), 1% level (***)

Source: EViews, data from Thomson Reuters (2020) and SARB (2020)

Figure 5.8 presents the results of the Pooled Mean group ARDL models for international investment portfolios. The models consist of 765 observations each, and the maximum dependent lag of four was selected automatically using the Akaike information criteria (AIC). The selected models are ARDL (1,2,2). In the long run, the coefficient of inflation is negative, while the coefficient of % change in conditional volatility is positive. Percentage change in conditional volatility is statistically significant at a 5% level, while that of inflation is statistically insignificant. The error correction term is negative and significant; this implies that if variables under consideration move out of equilibrium in the short run, they will converge in the long run. In the short run, all coefficients are negative. Exchange rate volatility and inflation, together with their lags, are statistically insignificant. This means that either %ERV or inflation influences the investment portfolio in the short run.

Table 5. 9: Cross-sectional short-run results from PGM Model.

	Domestic Funds			International Funds		
Variable	Coefficients	Std. Error	Probability	Coefficients	Std. Error	Probability
	DFM 1			ITF 1		
ECT	-0.047554	0.000658	0.0000	-0.046017	0.000431	0.0000
D(%ERV)	-0.000173	1.49E-07	0.0000	0.000754	1.56E-07	0.0000
D(INF)	-0.030261	0.000859	0.0001	-0.062407	0.000917	0.0000
	DMF 2			ITF 2		
ECT	-0.055548	0.000679	0.0000	-0.051058	0.000484	0.0000
D(%ERV)	0.001529	0.000389	0.0292	-0.009205	1.48E-05	0.0000
D(INF)	-1.921718	2.488811	0.4963	-0.450743	0.094865	0.0177
	DMF 3			ITF 3		
ECT	-0.054765	0.000599	0.0000	-0.056752	0.000556	0.0000
D(%ERV)	0.004545	8.40E-06	0.0000	0.000235	5.39E-07	0.0000
D(INF)	0.010570	0.053662	0.8564	-0.102028	0.003319	0.0001
	DMF 4			ITF 4		
ECT	-0.035640	0.000593	0.0000	-0.042254	0.000413	0.0000
D(%ERV)	0.000967	1.10E-05	0.0000	0.000139	3.37E-07	0.0000
D(INF)	-0.338759	0.070472	0.0171	-0.082324	0.002106	0.0000
	DMF 5			ITF 5		
ECT	-0.041645	0.000482	0.0000	-0.046378	0.000447	0.0000
D(%ERV)	2.92E-05	1.35E-06	0.0002	-0.000844	3.58E-06	0.0000
D(INF)	-0.065601	0.008600	0.0047	-0.269987	0.022563	0.0013

Notes: Statistically significant at the: 10% level (*), 5% level (**), 1% level (***)

Source: EViews, data from Thomson Reuters (2020) and SARB (2020)

The short-run cross-sectional results for domestic vs international are illustrated in Tables 5.9. These findings show which variables have a short-term impact on the investment portfolio's returns. In addition, the probabilities of the variables in each regression analysis are represented in these tables. In the case of domestic portfolios, all error correlation terms are negative and significant, meaning that if variables under consideration move out of equilibrium in the short run, they will converge in the long run. Percentage change in conditional volatility shares a negative significant short run relationship with returns on domestic fund 1. A negative relationship between the %ERV and returns on the investment portfolio means a 1 percent decrease in interest rate will increase the investment portfolio return by 0.000173 percent. The other four domestic portfolios share a positive significant short run relationship with the exchange rate volatility. This means that an increase in % change in conditional volatility will result in an increase in returns of the investment portfolios. Only three domestic funds share a negative and significant relationship with inflation (DMF 1, 4 and 5). The coefficients of DMF 2 and 3 are insignificant; therefore, short run relationship does not exist.

All international funds share a significant relationship with %ERV, indicating that there exists a short run relationship between the two variables. The nature of the relationship the two variables share varies with each fund. For instance, international funds 1, 3 and 4 share a positive relationship with %ERV, whereas international funds 2 and 5 share a negative relationship with %ERV. On the other hand, inflations share a negative and significant relationship with all international funds. Compared to short-run analysis between the domestic and international investment portfolios, it is clear that the inflation and %ERV influence. In the case of domestic funds, only %ERV influences all the returns on domestic funds.

5.7 Causality test

This section explains the causality relationships between the four variables used in this research. The null hypothesis of the granger causality test states that return on investment portfolios does not granger cause exchange rate volatility. In contrast, the alternative hypothesis states that return on investment portfolios does granger cause exchange rate volatility. If the p-value is greater than 5 percent, we fail to reject the null hypothesis, and if the p-value is lower than 5 percent, we reject the null hypothesis.

Table 5. 10: Full sample causal relationship between the variables of interest.

Null Hypothesis:	F-Statistic	Prob.
%ERV does not Granger Cause ERV	4.51671	0.0111**
ERV does not Granger Cause %ERV	21.5169	6.E-10
INF does not Granger Cause ERV	0.85190	0.4268
ERV does not Granger Cause INF	3.73197	0.0242**
PRIME does not Granger Cause ERV	9.40797	9.E-05
ERV does not Granger Cause PRIME	12.8996	3.E-06
RET does not Granger Cause ERV	1.83353	0.1602
ERV does not Granger Cause RET	1.69542	0.1839
INF does not Granger Cause %ERV	3.08218	0.0461**
%ERV does not Granger Cause INF	2.26184	0.1045
PRIME does not Granger Cause %ERV	9.50486	8.E-05
%ERV does not Granger Cause PRIME	12.1176	6.E-06
RET does not Granger Cause %ERV	0.20575	0.8141
INF does not Granger Cause RET	0.98570	0.3734
PRIME does not Granger Cause INF	39.8726	1.E-17
INF does not Granger Cause PRIME	2.77406	0.0627
RET does not Granger Cause INF	0.63620	0.5294
INF does not Granger Cause RET	2.97590	0.0513
RET does not Granger Cause PRIME	1.94348	0.1436
PRIME does not Granger Cause RET	6.37058	0.0018***

Notes: Statistically significant at the: 10% level (*), 5% level (**), 1% level (***)

Source: EViews output, data from Thomson Reuters (2020) and SARB (2020)

Table 5.10 above illustrate full sample results of pairwise granger causality tests between the variables of interest. The results in the case of exchange rate volatility suggest that a uni-directional relationship exists between conditional volatility and % change in conditional volatility as well among conditional volatility and inflation. At a 5 percent level of significance, we reject the null hypothesis and conclude that the % change in conditional volatility does cause conditional volatility; but the conditional volatility does not cause % change in conditional volatility. On the other hand, we reject the null hypothesis and conclude that the conditional volatility does cause inflation; but inflation does not granger cause conditional volatility. A casual uni-directional relationship exists between inflation and % change in conditional volatility. At a 5% level of significance, we reject the null hypothesis and conclude that inflation does cause % change in conditional volatility; but % change in conditional volatility does not cause inflation. Another casual uni-directional relationship exists between the prime rate and returns on investment portfolios. At a 5% level of significance, we reject the null hypothesis and conclude that prime rate does cause returns on investment portfolios; but returns does not cause interest rate. The case of other variables is different and interesting because there exists no causal relationship between returns Prime and ERV, RET and ERV, Prime and %ERV, RET and %ERV, Prime and Inflation, RET and Inflation. Therefore, the null hypothesis cannot be rejected, and we can conclude that those variables do not Granger cause each other.

The causality test results for all individual funds can be found in appendix B. The results revealed that exchange rate volatility does not have any influence on either domestic or international funds returns. This was shown by statistically insignificant causality results.

5.8 Conclusion

This chapter presented the empirical findings in line with the empirical objectives of this study. The chapter started by graphically illustrating the degree of exchange rate volatility as well as the NAV return on investment portfolios. The descriptive statistics were also examined of the three variables; conditional volatility, % change in conditional volatility and return on investment portfolios. The three variables were found to either have a negative or positive tail and were not normally distributed. The correlation analysis revealed a mixed relationship between the variables of interest.

First, we derived the volatility of exchange rates through ARCH model. A panel unit root test was performed, and it was found that conditional volatility, return on investment portfolios, inflation, and the interest rate was not stationary at level, but % change in conditional volatility was stationary at level. However, all the variables were stationary at first difference. The results from the panel cointegration test revealed that % change in conditional volatility, inflation and return on investment portfolios are cointegrated; therefore, they share a long run relationship. A Hausman test was performed, and it was concluded that Pooled Mean Group is efficient and suitable for this study. A Pooled Mean group panel, ARDL estimation results, indicated that in the long run, % change in conditional volatility and inflation have no impact on investment portfolio return. In the short run, the % change in conditional volatility and inflation were statistically insignificant in determining the return on investment portfolios. The cross-sectional relationship between domestic and international investment portfolios showed the relationship between the return on portfolios and exchange rate volatility is non-linear. Lastly, the causality test results revealed a uni-directional relationship between the interest rate and returns on investment portfolios; inflation and %ERV, ERV and %ERV.

The models above reveal that the effects of exchange rate volatility on investment are non-linear. However, these results are similar to some studies that were done in the past. Diallo (2015) found that the exchange rate volatility has a strong negative impact on investment. A positive relationship between exchange rate volatility and investment was found by Horobet & Ilie (2010). In theory, an increase in inflation results in an increase in NAV prices; therefore, the relationship between inflation and return on investment is valid. This is supported by the studies of Eita (2012) and Khumalo (2013), who investigated the relationship between inflation and stock returns in South Africa.

These results are contrary to the research by Sgammini (2016) but supported by Diallo (2015), who found a positive relationship between exchange rate volatility and domestic investments. Backlund (2011) concluded that companies are exposed to exchange risk, irrespective of whether the company is trading internationally or only domestically. This is true provided that the results of this study. Although Ziobrowski & Ziobrowski (1995) indicated that the exchange rate risk is non-diversifiable, the results of this study seem to illustrate some gains in diversification.

This study concludes that exchange rate volatility does not account for a significant portion of returns on investment portfolios fluctuations. The results of this study are not anything surprising because the previous studies on the effect of exchange rate volatility on returns of investment portfolios found mixed results. As discussed in Chapter 3, studies such as Bartov & Bodnar (1994); Dominguez & Tesar (2001); Griffin & Stulz (2001); Jorion (1990) and Williamson et al. (2005) all found that exchange rate volatility only explains a small portion of the variation in the returns of stocks. Lastly, it was concluded that exchange rate volatility is of limited economic significance. These results support our null hypothesis that exchange rate volatility has no significant impact on returns of South African diversified investment portfolios.

CHAPTER SIX: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 Summary

The main goal of this study has been to determine the effect of exchange rate volatility on the returns of diversified South African investment portfolios. This is an interesting topic because it could allow investors to know the impact that exchange rate volatility plays on both domestic investment portfolios and internationally diversified investment portfolios. The exchange rate in South Africa has been characterised by substantial volatility in the past years after the formal adoption of a free-floating exchange regime in 2000. The floating exchange rate system appears to expose the currency to major fluctuations than a fixed exchange rate regime. Although these fluctuations seem to be short term orientated, they still have a large influence in the financial markets.

To achieve the goal of this study, several evaluations were done—first, the review of the theory underlying investment portfolios. Second, the review of the theoretical framework on the exchange rate. The review of exchange rate literature was necessary as this provides a basis for understanding the exchange rate theory, what determines the exchange rate and knowing the types of the exchange rate. Furthermore, reviewing the literature gives an understanding of the exchange rate policy implemented by South Africa. Additionally, how the volatile nature of the exchange rate can cause risk on the return of diversified South African investment portfolios. Lastly is the overview of the existing literature on the relationship between investment portfolios and exchange rates.

6.2 Key findings

An empirical analysis of the effect of the exchange rate volatility on returns of South African diversified investment portfolios was conducted, and the empirical models were specified. It was observed that the findings obtained presented mixed opinions regarding the relationship that exists between the exchange rate and return on investment portfolios. The study period was from 2007 to 2019, and it was examined using the panel data approach. The variables used in the study include returns on both domestic and international investment portfolios, the conditional volatility, % change in conditional volatility, the South African prime overdraft rate and the South African inflation rate. Descriptive statistics were conducted to illustrate the information about the three major variables; conditional volatility, % change in conditional volatility and returns on investment portfolios. The findings revealed that the three main variables had positive skewness, and the Kurtosis showed fat tails with Jarque-Bera statistics that are statistically significant (variables are not normally distributed). The study employed a Pooled Mean Group panel ARDL model to estimate the impact of exchange rate volatility on investment portfolio returns. The key findings are summarised below.

First, the correlation analysis results revealed a weak relationship between exchange rate volatility and conditional volatility, ERV and Returns, %ERV and INF, %ERV and Prime, Inflation and Prime, Prime and returns. This implies that the variables might not be linearly related. This weak relationship was also confirmed by the coefficients of panel ARDL model estimations, where in the short run, the overall coefficient of the % change in conditional volatility was insignificant in both the short run and long run. These are interesting findings because it means that both the short run and long run exchange rate volatility has little to no effect on investment portfolios returns.

Second, A pairwise granger causality tests between the variables of interest. The overall results indicated a uni-directional relationship between % change in conditional volatility and conditional volatility, conditional volatility and inflation, inflation and % change in conditional volatility, prime rate and returns on investment portfolios. Interestingly, there was no relationship found between either conditional volatility or % change in conditional exchange volatility and the returns on diversified investment portfolios. This implies that the exchange rate volatility does not influence the return on diversified investment portfolios. In the case of individual funds, both returns on domestic funds and international funds do not share a causal relationship with exchange rate volatility.

The return on investment portfolios was seen to be impacted by macroeconomic variables such as the inflation rate and interest rate of South Africa. The overall returns reveal that in the short run, inflation shares a negative relationship with return on investment portfolios, whereas, in the long run, they share a positive relationship. This implies that higher inflation leads to an immediate fall in the return of investment portfolios as it is likely to signal lower interest rates. In theory, an increase in inflation results in an increase in NAV prices; therefore, the relationship between inflation and return on investment is valid.

The ARDL model estimation results for individual investment funds revealed that all domestic funds indicate a positive relationship between exchange rate and return on investment portfolios in the short run. In contrast, a mixed relationship was observed with all international funds. Return on domestic investment portfolios tends to decrease in response to a strengthening of South African Rands. In contrast, returns on international investment portfolios tend to decrease/increase in response to a strengthening of South African Rands, depending on the macroeconomic variable. These results are good in terms of diversification, and this means that the return on international diversification is increased by the strengthening of a currency.

6.3 Policy Recommendations

The stock markets play an important role in the economic growth and development of the country. Therefore, it is vital for the South African Reserve Bank, the National Treasury, and other regulators to implement prudent macroeconomic policies that promote growth. Based on the findings of this study, regulators must implement appropriate macroeconomic policies to control inflation and interest rates. This may include short-term implementation of a contractionary monetary policy, the government providing support to important sectors of the economy such as agriculture, as well as other inflationary drivers such as fuel prices. The findings also revealed that the exchange rate volatility does not have a significant impact on the return of investment portfolios, hence no influence on the market return. Thus, government should not be eager to protect the rand against the major currencies.

However, investors, bankers and portfolio managers still need to be watchful on the spillovers from the foreign exchange rate into the stock market. Although there is a weak relation between exchange rate volatility and returns on investment portfolios in South Africa, this does not necessarily mean that investors and portfolio managers should ignore the developments between these two variables. Various ways to protecting the stock market from the negative effects of exchange rate volatility must be implemented. These instruments would subsequently be utilised to further mitigate the risk of exchange rate fluctuations. Uncertainty caused by exchange rates is a pressing issue in South Africa and many other countries with flexible exchange rate regimes.

6.4 Recommendation for Future Research

This study examined the relationship between exchange rate volatility and investment portfolio using monthly data. However, it would be interesting to explore this relationship using daily or weekly data. This is because using more frequent observations better captures the dynamics, provide more useful results and improve the significance of the study than monthly data.

Second, a study that includes more South African funds in order to determine the effect of exchange rate volatility on returns of diversified South African investment portfolios. Furthermore, South African studies that analyse how exchange rate volatility affects the behaviour of investors to invest in certain stocks or how low returns vs high returns funds are affected by the movement of the exchange rate or the extent to which exchange rate volatility affect different asset classes. Lastly, a case study of any African countries comparing how the returns on investment portfolios differ after the adjustment of the exchange rates.

6.5 Limitations of the study

This study tried, by all means, possible to ensure that the findings are valid and reliable. However, the main limitation may be that the selected investment funds dataset used in this study may be considered small in comparison to the overall number of funds existing in the financial market.

6.6 Conclusion

This chapter presented the study's main findings and discussed the recommendation and limitations of the study given the study period. In a nutshell, this study found that exchange rate volatility does not account for a significant portion of returns on investment portfolios fluctuations. Furthermore, there is no homogenous relationship between South African – based (domestic) portfolios and the internationally diversified portfolios. This is because the return on both investment portfolios reacts differently to the volatility of the exchange rate. The domestic portfolios react positively to the exchange rate volatility while the internationally diversified portfolios react negatively/ positively to the volatility in the exchange rate depending on whether the relationship is in the short or long run.

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8. APPENDICES

Appendix A

Table A1:

Heteroskedasticity Test: ARCH

F-statistic	22.19286	Prob. F(1,152)	0.0000
Obs*R-squared	19.62021	Prob. Chi-Square(1)	0.0000

Notes: Statistically significant at the: 10% level (*), 5% level (**), 1% level (***)

Source: EViews output, data from Thomson Reuters (2020) and SARB (2020)

Table A.2: ARCH model variance equation

Variable	Coefficients	Std. Error	t-stats	Probability
C	0.044550	0.010258	4.343153	0.0000
RESID^2(-1)	0.356636	0.075704	4.710930	0.0000

Notes: Statistically significant at the: 10% level (*), 5% level (**), 1% level (***)

Source: EViews output, data from Thomson Reuters (2020) and SARB (2020)

Appendix B

Table B.1: Causal relationship for domestic investment portfolios.

Pairwise Granger Causality Tests
Date: 11/29/21 Time: 14:48
Sample: 2007M02 2019M12
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
PRIME does not Granger Cause RET	765	4.23078	0.0149
RET does not Granger Cause PRIME		1.46148	0.2325
INF does not Granger Cause RET	765	2.21744	0.1096
RET does not Granger Cause INF		0.64277	0.5261
%ERV does not Granger Cause RET	765	1.49339	0.2253
RET does not Granger Cause %ERV		0.22164	0.8013
ERV does not Granger Cause RET	765	0.64639	0.5242
RET does not Granger Cause ERV		1.84085	0.1594
INF does not Granger Cause PRIME	765	1.38248	0.2516
PRIME does not Granger Cause INF		19.8710	4.E-09
%ERV does not Granger Cause PRIME	765	5.67856	0.0036
PRIME does not Granger Cause %ERV		7.19772	0.0008
ERV does not Granger Cause PRIME	765	6.42866	0.0017
PRIME does not Granger Cause ERV		4.68856	0.0095

%ERV does not Granger Cause INF	765	1.38812	0.2502
INF does not Granger Cause %ERV		2.79166	0.0619
ERV does not Granger Cause INF	765	1.85987	0.1564
INF does not Granger Cause ERV		0.42456	0.6542
ERV does not Granger Cause %ERV	765	10.2052	4.E-05
%ERV does not Granger Cause ERV		11.6362	1.E-05

Source: EViews output, data from Thomson Reuters (2020) and SARB (2020)

Table B.2: Causal relationship for foreign investment portfolios.

Pairwise Granger Causality Tests
Date: 11/29/21 Time: 14:30
Sample: 2007M02 2019M12
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
PRIME does not Granger Cause RET	765	5.40188	0.0047
RET does not Granger Cause PRIME		1.58218	0.2062
INF does not Granger Cause RET	765	2.68908	0.0686
RET does not Granger Cause INF		1.40192	0.2468
%ERV does not Granger Cause RET	755	1.02077	0.3608
RET does not Granger Cause %ERV		0.00432	0.9957
ERV does not Granger Cause RET	765	10.2352	4.E-05
RET does not Granger Cause ERV		1.21580	0.2970
INF does not Granger Cause PRIME	765	1.38248	0.2516
PRIME does not Granger Cause INF		19.8710	4.E-09
%ERV does not Granger Cause PRIME	755	6.80200	0.0012
PRIME does not Granger Cause %ERV		3.68246	0.0256
ERV does not Granger Cause PRIME	765	6.42866	0.0017
PRIME does not Granger Cause ERV		4.68856	0.0095
%ERV does not Granger Cause INF	755	1.10727	0.3310
INF does not Granger Cause %ERV		0.76855	0.4641
ERV does not Granger Cause INF	765	1.85987	0.1564
INF does not Granger Cause ERV		0.42456	0.6542
ERV does not Granger Cause %ERV	755	11.3172	1.E-05
%ERV does not Granger Cause ERV		0.15097	0.8599

Source: EViews output, data from Thomson Reuters (2020) and SARB (2020)