AN INVESTIGATION INTO THE RELEVANCE OF INTERNATIONAL PORTFOLIO DIVERSIFICATION FROM A SOUTH AFRICAN PERSPECTIVE

BY

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Abstract

Diversification is one of the more familiar concepts in finance because of its ability to curtail risk towards investors. However, for diversification to be efficient, the assets combined should have inversely related price movements. In the same light, previous research done on international portfolio diversification has consistently found that having investments diversified across different global markets that have low to medium correlations helps to get as close to an optimal portfolio as possible. However, previous research also indicates that both global financial integration and exogenous shocks increase correlations among international markets, hence negating the benefits of international portfolio diversification to an extent. Therefore, with global integration on the rise, coupled with economic and political instability in some BRICS nations, the research examines these factors and gauges the current viability of international portfolio diversification from the perspective of a South African investor. A quantitative methodology is used for the research. As correlation coefficients between markets are one of the safe predictors as to whether there will be a diversification benefit, the research entails an analysis of the correlations between the Johannesburg Stock Exchange (JSE) All-Share Index and SSE composite index for China; IBOVESPA for Brazil which represent the financial markets of emerging nations as well as the S&P 500 index of the United States of America and the United Kingdom's FTSE 100 index which represent the financial markets of developed nations in the research. The correlation patterns between these indices are tracked to examine whether they have increased over the years as well as their reactions to a number of exogenous shocks that have occurred over the past ten years. The limitation encountered while doing the research is the absence of readily editable historical data for the stock indices on the internet. The data spreadsheets available on websites such as YahooFinance.com are in a CSV format and the process of converting such data into usable excel formats is complex. The research will educate the basic South African citizen looking to invest financially whether it is currently beneficial to diversify their portfolios beyond South Africa's stock market, after considering the constraints bundled with international portfolio diversification. With costs of investing internationally such as hiring investment portfolio managers and currency conversion costs being high,

it is important for investors planning to invest internationally to have sufficient knowledge about how the current global political and economic climate affects their investments.

Declaration

I declare that ***An Investigation into the Relevance of International Portfolio Diversification from a South African Perspective*** is my own work, that it has not been submitted for any degree or examination in any other university, and that all the sources I have used or quoted have been indicated and acknowledged by complete references.

Mark Buwembo October 2019

Signed:…… ……

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List of Acronyms

APT	Arbitrage Pricing Theory
BRICS	Brazil, Russia, India, China, South Africa
FTSE 100	Financial Time's Stock Exchange 100 index
Ibovespa	Índice Bovespa
IPD	International Portfolio Diversification
JSE	Johannesburg Stock Exchange
JSE ALSI	Johannesburg Stock Exchange All Share Index
MPT	Modern Portfolio Theory
OECD	Organisation for Economic Co-operation and Development
S&P 500	Standard and Poor's 500 index
SSE Composite	Shanghai Stock Exchange Composite index

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Chapter 1: Introduction

1.1 Background

The research seeks to investigate whether international portfolio diversification (IPD) is currently an effective investment strategy to be implemented by South African nationals. Like any other investment strategy, IPD has its limitations thus making it important to weigh these limitations against its potential benefits in order to gauge its applicability within an emerging market such as South Africa.

Diversification is a concept that is not new to finance by any means. It refers to an approach that involves mixing a variety of individual investments within a portfolio with the main objective of managing risk (Oglesby, 2007). While the expected return of a portfolio will most times be lower than that of a single asset (Businesstech, 2018), a portfolio reduces the concentration of risk that comes with individual assets. This serves best when the portfolio is made up of many inversely correlated assets (Toudas et al., 2009).

Despite the several different views that asset managers may have on diversification, many converge on the idea that investments should not be restricted to a single currency. IPD takes the concept of mitigating risks on investments even further by including foreign investment instruments as part of the portfolio (Zhang et al., 2018). International diversification has become a preferential investing strategy among many South African investors over the past decade partly due to the fact that the South African rand has gradually weakened over time. This means that South Africans investing offshore will get wealthier on aggregate if the rand depreciates against other currencies.

Like all emerging markets, investing in South Africa comes with additional risk since emerging markets have less policy and political certainty, higher unemployment rates, socio-economic instability and higher currency volatility (Naumoski, 2012). However, as their economies and infrastructure develop over time at faster growth rates than developed markets (Gibley, 2019), emerging markets offer greater investment opportunity compared to developed markets such as the United States of America. This is because the world's most advanced

economies that possess more conservative risk are expected to generate lower returns in comparison to the returns generated by the riskier frontier and emerging markets as implied by the traditional risk-return trade-off which asserts that higher risk generates higher returns (Wang et al., 2017).

On the other hand, investing offshore reduces the systematic risk that comes with exposing all your investments to the same market. It broadens the eligible instruments for an investment portfolio as an investor can look at the same types of investment options internationally that are available domestically.

Besides mitigating risk, IPD provides growth opportunities for investors. For example, the JSE's market cap of $1.11 trillion (StockMarketClock, 2019) is concentrated in a handful of companies and is minuscule when compared to the global market cap of above $80 trillion (Edwards, 2017) in which no single stock accounts for 1%. In addition to this, international investors stand to gain currency exchange profits as foreign exchange rates are perpetually changing.

Based on the Modern Portfolio Theory (MPT) by Harry Markowitz, for IPD to be effective, the national stock markets from which the different individual investments are selected should have low to medium correlations[1]. According to Evans and McMillan (2009), high financial correlations imply reductions in the realisable benefits of portfolio diversification. It has been further stated in a number of studies including Goetzmann et al. (2001) and Beine et al. (2010) that the correlation between different markets tends to increase due to a couple of factors including global financial integration and exogenous shocks such as wars or drought.

Financial integration is a process through which financial markets in regional or global economies are closely linked together through various ways such as information sharing among financial institutions, sharing of cutting-edge technology as well as the elimination of restrictions pertaining to cross border financial operations (Zhang and Matthews, 2019).

[1] The words 'correlations' and 'co-movements' are used interchangeably throughout the research.

Recent empirical studies claim that global integration tends to increase the correlation between national stock markets. Jose Tavares (2009) concluded that analogous development in two different economies causes an increase in the co-movement of their stock returns. On a study done on Pakistan and India, Mobeen and Muhammad (2016) found that in addition to economic integration, an increase in the gap of inflation rates between countries also increases returns' co-movement among stock markets.

Exogenous shocks[2] are unpredictable events that occur outside of an economy and produce a significant change within the economy (Sali and Stephen, 2011). These shocks can range from technology shocks that affect productivity to inflationary shocks that can lead to a loss in the purchasing power of a nation's currency. Exogenous shocks are capable of causing considerable financial crises as they trigger herd mentality or irrational behaviour among investors who sell off assets due to panic thus causing a steep decline in the value of assets. Sushil and Sunil (2000) define herd mentality as the susceptibility of investors to copy and go along with what other investors are doing. Exogenous shocks also tend to increase the correlation among stock markets as reported by Yavas (2007) who found that correlations between the Japanese and U.S. markets as well as the U.S. and German markets both increased following the 9/11 terrorist attacks.

The trade wars started by the U.S. President Donald Trump imposing tariffs against countries such as Turkey and China are referred to as an exogenous shock that is likely to affect the effectiveness of international investing as a number of international stock markets are facing increased uncertainty. In addition to the trade wars, the research presents other turbulent periods such as the Libor scandal, as well as Brexit as exogenous shocks with the potential to change the cross-market correlations. In addition to these turbulent periods, South Africa's political stability is currently uncertain with some political parties vowing to go to court over the votes of the recently concluded general elections on the 8th of May 2019.

[2] The words 'exogenous shock' and 'crisis' are used interchangeably throughout the research.

The research will look at IPD from the perspective of a South African investor. It will consider factors such as financial integration and exogenous shocks to assess whether the benefits of diversifying portfolios internationally still hold.

1.2 Research Problem

Stock markets are a major route for both private and government-owned corporations to raise capital as well as pay off debt and therefore movements in the stock market can have a substantial impact on the economy. Even individuals who do not directly own shares in companies are likely to be affected by the activity in stock markets through their pension funds (Pettinger, 2018). However, investors and investment managers alike face substantial challenges in constructing portfolios that offer attractive returns for comfortable levels of risk. Investors have a better chance of constructing optimal portfolios through international diversification of their portfolios. However, factors such as increasing stock market integration and exogenous shocks are said to increase correlations of the returns of assets across different global stock markets thus jeopardising the benefits to be had from internationally diversifying portfolios.

While there has been research done in the past to review the correlation of assets' performance across European stock markets, very limited research has been conducted to review the relationship between the performance of assets on the South African stock market and that of other global stock markets. Therefore, to deduce whether IPD is a worthwhile strategy for South African to consider, the research aims to review the relationship between the performance of the South African stock market and the performance of other global stock markets.

1.3 Research Question and Objectives

1.3.1 Research Question

To what degree are the returns of assets on the South African stock market correlated with the returns of assets on other global stock markets?

1.3.2 Objectives

To review the existing literature on IPD.

To explore the variables that affect the effectiveness of IPD as an investment strategy.

To assess whether the correlations between South Africa's stock market and the stock markets of other countries are increasing.

To make practical recommendations to South Africans towards investing offshore.

1.4 Significance of the Study

The research intends to gauge the viability of IPD as an investment strategy from the perspective of South African investors. With the majority of existing literature focusing on Western world countries such as the U.S. and Germany, and less empirical studies having been done on the effectiveness of international diversification from the perspective of investors in emerging markets, the research aims at narrowing the existing knowledge gap. In addition, research has shown that home bias is more present in emerging markets compared to developed markets (Kim et al., 2014) and therefore the research will provide knowledge to the South African layman on why international investing can be advantageous.

1.5 Research Hypothesis

The research hypothesis is split into developed market hypotheses and emerging market hypotheses.

The developed market hypotheses are as follows below:

H_0: There are no statistically significant long-run benefits for South African investors to reap from internationally diversifying their portfolios into developed markets.

H_1: There are statistically significant long-run benefits for South African investors to reap from internationally diversifying their portfolios into developed markets.

On the other hand, the emerging market hypotheses are as follows below:

H_0: There are no statistically significant long-run benefits for South African investors to reap from internationally diversifying their portfolios into emerging markets.

H_1: There are statistically significant long-run benefits for South African investors to reap from internationally diversifying their portfolios into emerging markets.

1.6 Delimitation of Study

The research will look at IPD from the perspective of an investor in an emerging market and does not intend to cover the relevance of the investment strategy to investors from developed markets. It will consider the investment patterns, choices made, and risks faced by South African investors who are residing within the country and will exclude South African nationals living outside of the Republic of South Africa. With regard to investment portfolios, the term "assets" will be used to refer to financial assets only, with real assets left out of the research's scope. The research aims to make an assessment on the correlation between South Africa's stock market and the stock markets of both developed markets as well as emerging markets by use of stock indices. The research will be delimited to four stock indices in addition to the JSE ALSI, with two of them set out to represent stock markets of emerging markets while the other two will represent the stock markets of developed markets.

1.7 Outline of the Study

The research is organized as follows. The first chapter presents the background of the study, the research problem and objectives, as well as the research hypothesis.

The second chapter gives a review of the literature on IPD comprising of factors that can influence the application and efficiency of this investment strategy, arguments as to whether diversifying portfolios internationally is an effective investment strategy, as well as the current economic and political challenges within South Africa that can constrain the investment strategy's efficient use by South African investors.

The third chapter focuses on the methodology used to analyse data and justify the choice variables used in the analysis.

The fourth chapter lays out the findings generated by means of the prior described research methods and chapter five concludes the arguments tested in this discussion and provides recommendations to South African investors as well.

Chapter 2: Literature Review

2.1 Introduction

Diversifying of portfolios internationally as an investment strategy has become more popular globally due to the promise of higher risk-adjusted returns. Grubel (1968) and Levy and Sarnat (1970) are some of the empirical studies that have presented evidence of the benefits of combining foreign stocks together in a portfolio. According to Steinberg (2018), IPD increased by a significant margin in the United States of America and other advanced economies between the years 1995 to 2011, while it increased just slightly in the less developed markets. In their study of a few countries in the 1990s, Amadi and Bergin (2008) also realised an increase in IPD and suggested that a reduction in fixed costs of purchasing assets in the foreign market could be an explanation for the rising trend of IPD.

Harry Markowitz, a Nobel prize-winning economist, created an investing model for building personal asset portfolios in which investors attempted to take the minimum possible systematic risk levels to obtain the maximum possible returns. This meant that if returns were constant between assets, the investors would opt for the assets with the lower risk levels for their portfolios (Cockerham, 2019). This investment model came to be known as MPT and is a core model around which many investment styles have been formed. Some asset types such as stocks have relatively high levels of individual risk but according to MPT, if these assets are combined with several other assets such as bonds, a portfolio whose risk is lower than some of its underlying assets can be formed (Thune, 2018).

In the same light, foreign stocks can be relatively risky due to exchange rate risk or political risk but when combined with other assets in a portfolio, they can add to the portfolio's returns without substantially changing the portfolios total risk (Reiss, 2017). Based on this theory, a global portfolio becomes appealing to hold because when it is properly diversified, it can either reduce your risk to a small extent or increase your returns while maintaining the same level of risk (Moore, 2018). Bartram and Dufey (2001) also explain that IPD has the potential to succeed as an investment strategy due to the fact that the industrial composition of national

markets is different across countries. Therefore, international portfolios can take advantage of the fact that they are built up with assets from different industries that are less than perfectly correlated.

Stock market liberalisation, which is defined by Henry (2000: 529) as "a decision by a country's government to allow foreigners to purchase shares in that country's stock market" has enabled investors to hold financial assets in both their domestic stock markets as well as in foreign stock markets (Kinuthia and Etyang, 2014) thus making IPD even more appealing. Hui et al. (2007) state that is also worth considering the inclusion of other assets besides stocks when drafting an international portfolio since international bond markets have exhibited the ability to improve the benefits of diversifying portfolios internationally. Due to the fact that economic policy is not fully dependent on the state of the national economy, foreign bonds remain attractive even when the correlations between markets increase marginally (Odier and Solnik, 1993).

While controversy still exists among investment professionals regarding the benefits of IPD when compared with the costs, Yavas (2007) reaffirms the belief that international equity diversification recommendations are widely dependant on the existence of low correlations among stock markets. He goes on to state that if for any reason cross-country market correlations are increasing as some studies have shown, then the benefits of IPD may be overstated.

The objective of this chapter is to present a review of the existing literature on the theoretical concept of IPD. The chapter presents a look at the emergence of IPD over recent decades, its application as an investment strategy, its underlying theories as well as its current general perception. The chapter goes further and also discusses the factors that can cause variabilities in the co-movements of stock markets thus influencing the application and effectiveness of IPD as an investment strategy. The final section of this chapter brings into focus some of the ways IPD falls short as an efficient investment strategy as well as the factors that can limit IPD from being effective in an emerging market such as South Africa. The section also discusses the political and economic challenges currently present in South

Africa as these macro factors have the potential to cause major swings in stock prices and thus have the ability to affect entire investment portfolios.

2.2 The Concept of International Portfolio Diversification

Makridakis and Wheelwright (1974) asserted that investors require the ability to foresee the interrelations between the price movements of different countries' stock exchanges in order for them to realise the potential gains from diversifying portfolios internationally. According to them, this is possible if the relationships among the different stock markets and their price movements are stable over a decent amount of time thus enabling the investor to select a well-diversified portfolio based strictly on past performance patterns. However, their empirical analysis revealed that interrelationships among stock markets are unstable over time thus making the future relationships among markets nearly impossible to accurately predict. However, this is of little concern as this research is not interested in predicting future relationships, but rather studying and using the previous relationships between the chosen country stock indices to determine if IPD has been efficient over the past few years in attaining gains for investors.

Therefore, correlations between the stock markets are essential to study when considering the idea of IPD. Fapetu and Aluko (2017) tested the iShares MSCI Emerging ETF in comparison to the iShares MSCI World ETF and found no evidence of cointegration between emerging markets and developed markets. They concluded that IPD was beneficial for investors holding financial assets in both emerging and developed markets in their portfolios. For IPD to be efficient, it is important to assess not just the correlations between only 2 countries but to analyse the correlations from a multi-country perspective. As Bergin and Pyun (2016: 53) asserted, "…the optimal share of country i's portfolio in the assets of a foreign country j depends not just on the correlation of returns between countries i and j, but also on the broader set of correlations with other countries."

Makridakis and Wheelwright (1974) stated that for any gains from IPD to realisable, the correlations between the price movements of the used stock exchanges must be less than one. If the correlation happens to be one, this means

that the stock markets have a perfect positive relationship meaning that their prices would move in perfect unison thus totally negating the usefulness of diversification. Longin and Solnik (1995) found that international correlations between markets had been increasing steadily from the year 1960 to 1990 and stated that correlations increased in periods of high volatility.

However, Christoffersen et al. (2014) found that in emerging markets, their correlation with developed markets was slightly higher than their correlation with other emerging markets. This led them to the conclusion that even though the benefits of IPD had decreased for both developed and emerging markets, the level of diversification benefits remained higher when portfolios were diversified between emerging markets. Similarly, Aloui et al. (2011) analysed the daily return data from Brazil, Russia, India, China and the U.S. to confirm high levels of correlation between the U.S. and each of the named countries' markets. However, they found that correlations were stronger for markets dependant on commodity prices compared to finished-product export-oriented markets.

Miralles-Marcelo et al. (2015) asked the question as to whether IPD benefits were still substantial after considering the increasing market correlations and thus sought out alternative investment strategies that could provide better returns. Their study concluded that it was indeed possible to outperform the IPD strategy by building portfolios that contained accurately predicted expected returns and variances. On the other hand, You and Daigler (2010) disagreed with the entire concept of IPD benefits being dependant on consistently low correlations amongst international stock indices as they felt that relying only on constant correlations was a shallow and oversimplified approach. In addition to conditional correlations, they examined possible trade-offs of standard deviation with correlation and the tail risk of portfolios in their study of IPD benefits. They concluded that evaluating diversification based exclusively on constant cross-market correlations was fallacious since diversification benefits vary with time and also depend on the country employed.

A couple of factors have been highlighted as determinants of stock market correlations with global financial market integration usually ranking high on the

list. Global integration links several markets in more ways than one and has the positive effect of improving welfare. As trade barriers among different countries are reduced, the capital-poor countries are less constrained by their inadequacy of capital as they are able to tap into the global pool of savings thus enabling them to move closer to developed markets in their economic development levels (Schularick and Steger, 2010). On the downside, global integration likens the trends amongst global stock markets as they become more positively correlated thus hindering the realisation of optimal returns from internationally diversified portfolios (Beine et al., 2010).

In a study to explore the extent to which the increase in global market volatility was caused mainly by a convergence of cash flows resulting from economic integration or discount rates as a repercussion of financial integration, Baele and Soriano (2010) found that the rise in global market volatility was largely due to increased financial integration. Berger et al. (2011) concluded that developed and emerging markets were less likely to provide diversification benefits in comparison to frontier markets due to how integrated they were. They linked their conclusion to the lack of evidence of increasing levels of integration in frontier markets while developed and emerging markets displayed increasing levels of integration over time. This reaffirms the theory that there is an inverse relationship between levels of global financial market integration and the benefits realised from IPD.

On a global level, Mobarek (2013) cited the size differential of stock markets, import dependence, difference in annual GDP growth rate as well as the time trend as the statistically significant variables linked to the gradual change in stock markets integration. Longin and Solnik (1995) went further and stated that some microeconomic variables such as dividend yield and interest rates held information about future volatility and correlation thus making international correlations somewhat predictable. The economic structure among countries is also a determining factor in IPD. In their study of twelve countries to assess the linkages between stock market returns, Făt and Dezsi (2012) found that the countries that were alike in terms of economic development had the highest levels of correlations.

According to Steinberg (2018), home bias also influences IPD to a significant extent. He says that the significant levels of increments of IPD found in the advanced economies are partly due to the significant decline of home bias in the advanced economies. Conversely, home bias has not fallen in emerging markets thus keeping the increments in IPD implementation rather low. Bergin and Pyun (2016) also point out that investors' bias towards home assets also accounts for ineffective diversification. They state that even when investing abroad, many investors seem to favour countries with returns more correlated with home assets due to a preference for familiarity. The transaction costs incurred to diversify across borders are also important when considering the overall viability of IPD. Faruqee et al. (2004) stated that transaction costs and information asymmetry are major determinants in designing international portfolios. The transactions costs differ significantly basing on whether active or passive portfolio reallocation is used. Rowland (1999) found that while active portfolio reallocation yields immediate diversification benefits, it is very costly. Passive portfolio reallocation, on the other hand, incurs minimal costs but its diversification benefits are realised over a much longer time period. This makes it important to know when to switch from active to passive portfolio reallocation as the transaction costs start to increase.

2.2.1 Financial Integration

Ferguson et al. (2009) define financial integration as a process through which a significant number of national markets grow simultaneously. This means that political and geographical borders cease to hinder financial activity so that agents can transact with each other similarly regardless of whether they are situated within the same region or in different regions. Technical progress in information technology and risk management, as well as financial liberalization and deregulation, are some of the mechanisms that are implementable to remove obstacles to IPD and thus move the financial integration process forward.

Financial integration and IPD operate hand in hand and reinforce one another through a feedback loop. Firstly, financial integration opens the door to enable IPD as some sort of financial integration should have happened prior in order for stock investments across borders to take place. However, when integration starts to rise

higher, correlations between financial markets significantly increase and start to negatively impact the potential benefits of IPD. For example, Chandar et al. (2009) realised a surge in global stock market liberalizations towards the end of the 20th century and this surge was succeeded by two main observations. Firstly, the number of firms from emerging markets that cross-listed their shares on foreign stock exchanges increased substantially. Secondly, a number of financial crises broke out shortly after inclusive of the Mexican peso crisis in 1994, the 1997 Asian financial crisis and the 1998 Russian financial crisis.

Syriopoulos (2006: 297) stated that "international portfolio diversification is less effective across the cointegrated markets because the investment risk cannot be reduced, and portfolio returns can exhibit a volatile behaviour to internal and external shocks." Bartram and Dufey (2001) also believe that the benefits potentially realisable from IPD may not be as substantial as earlier studies claimed due to the rise of economic interdependence among countries around the globe that has increased co-movement between domestic and foreign securities markets. They assert that the correlation between a country's securities market's movements and the movements of the securities markets of other countries is inversely related to its economic and political independence. Saqib et al. (2019) are in agreement as they state that as a result of less integration in the previous decades, correlations among stock indices of countries were generally weak and this offered a conducive climate to benefit from IPD.

However, financial integration can have both stabilizing and destabilizing consequences to the economy at large. For example, the integration of global capital markets enables firms to raise capital abroad through cross-listings or initial public offerings (Bell et al. 2012). Fecht et al. (2007) speculate that as financial integration increases, the stabilizing effects in general will be more important than the destabilizing effects. The research is therefore tasked to review a variety of literature in order to gauge the accuracy of this statement and also to assess the effects that financial integration currently has on internationally diversified portfolios from a microeconomics standpoint.

Studies on African stock markets reveal that despite their steady growth, most of them remain small and illiquid thus limiting their economic impact (Farid, 2013). Farid's research implies that these limitations can be overcome by encouraging countries within the same region to enhance collaboration between their national stock exchanges or by encouraging integration through regional stock exchanges such as the West African Regional stock exchange in Côte d'Ivoire that was established in 1998.

According to Mataranyika (2014), African countries are significantly unconnected to each other and to the rest of the world as well. Mataranyika holds the opinion that Africa as a continent has the potential to grow its economies through enhancing regional integration. A study done by Saville and White (2013) on the African Economic Integration index states that in comparison to other African countries, South Africa's economy is more integrated with the rest of the global economy. By 2014, South Africa had risen in the economic integration rankings by about 3 points to 66.7 points, with a few other countries in the Southern African region rising as well inclusive of Zambia which rose to 37.2 points and Mozambique to 42.5 points (Mataranyika, 2014). Therefore, the South African economy stands to gain more or lose more compared to other African countries depending on which side the consequences of integration lean. This makes it more pressing to analyse the benefits of global financial integration and whether these benefits justify the costs incurred as well as the potential hindrances that it can spring towards South Africa's economic development process.

Financial integration can improve financial markets' stability as the loosening of capital controls can provide access to a wider assets range and hence help investors to diversify risk. On top of that, the increment in the size of markets that results from financial integration can increase market liquidity thereby increasing the market's ability to recover from shocks. According to Denis et al. (2002), increased integration of global capital markets over time has made IPD more convenient for investors by reducing the associated costs. Ferguson et al. (2009) believe that the benefits of financial integration could potentially be twice as great as the potential reduction in the cost of capital and could enhance competition and productivity which could result in better pricing of financial instruments. It could also enable an

improvement in the sharing of income and consumption risks over time. However, they state that these benefits would most likely be reaped by developed markets while many emerging and frontier markets that lack sound macroeconomic policies and good economic institutions would be unable to taste these benefits of financial integration.

Domestic incentives such as trade liberalization make regions more attractive for foreign investors and as such can potentially lead to an increase in investment towards African economies. Ahmed et al. (2007) studied the capital inflows to South Africa and stated that trade liberalization had the potential of increasing both the level of foreign direct investment inflows as well as the portion that foreign direct investment accounted for in the country's total capital. Sub-Saharan Africa enjoyed significant growth over the past decade with the value of portfolio equity flows growing to $15 billion in 2006 while bond flows to the region increased between 2006 and 2007 by more than 340 per cent due to enhanced foreign direct investment (Brambila-Macias and Massa, 2010).

It goes without saying that there is a need to also carefully assess the potential hindrances to development that financial integration can bring about as well as their potential magnitude. Agénor (2003) views financial integration from the perspective of a country initiating the integration process rather than from the perspective of individual investors and reviews literature to try and analyse whether the integration benefits outweigh the short-run risks. Firstly, he argues against the theory that financial liberalization enables countries through the use of capital markets to hedge against idiosyncratic and global risks. According to him, the alleged benefits of global risk-sharing, and consumption smoothing are merely an illusion for small developing countries since they barely get access to these markets and if they at all manage to, they only do so during economic upturns. This implies that small frontier and emerging markets would still feel significant negative effects of an economic downturn, regardless of the extent of their financial integration. Secondly, he points out that during periods of growth, cross-border capital flows are limited to a small number of recipient countries. Bhattacharya et al. (1997) assert that a small amount of foreign capital flows to Sub-Saharan Africa with the majority of them flowing to just a few countries like South Africa and Nigeria.

Additionally, financial integration can potentially instigate financial instability through a number of ways. Firstly, an increase in integration increases the correlation of asset price movements thus leaving countries more vulnerable to the instabilities of other countries, also known as cross-border contagion. If two countries are integrated, it becomes easier for a shock to move from one country to the other. Beine et al. (2010) stress that financial integration increases the probability of international equity markets jointly crashing during periods of intense crisis. Brambila-Macias and Massa (2010) found that the direct impact of the 2007 global financial crisis was less severe in Sub-Saharan Africa in comparison to developed markets due to the fact that Sub-Saharan countries were less integrated into the global financial system. Regardless, the global financial crisis' minimal spread into the Sub-Saharan region still led to a reduction of private capital inflows to Sub-Saharan Africa thus showing how significant contagion effects can be.

However, the study done by Devereux and Yu (2014) gives a marginally different opinion on the way financial integration affects cross-border contagion. While Devereux and Yu agree that financial integration increases global leverage which in turn increases the frequency of financial crises in any given country and thus contagion, they go on to point out that financial integration actually cushions a country from said crises. They assert that the impact of a crisis in an economy with integrated international financial markets is much less severe than that in an economy with a market structure without any financial interaction between countries. Therefore, financial integration requires one to consider the trade-off between the probability of crises and the severity of crises.

Popov and Udell (2012) state that financial integration links regional banking industries as well thus creating additional potential risks. Shocks to the capital of a bank that is internationally active can easily be spread across borders thus making the effects of large financial shocks difficult to contain locally. Their research reveals that negative shocks were transmitted to the balance sheets of European banks during the early stages of the 2008 financial crisis thus weakening the supply of credit from the banks to individuals and businesses alike. Devereux and Yu (2014) are in agreement with this as they also state in their study that financial integration significantly increases the odds of balance sheet recession occurring in

a given country. Nolt (2016) defines balance sheet recession as a type of economic recession that occurs when net private savings are high, yet interest rates are substantially low hence slowing down economic growth. High levels of private-sector debt trigger individuals and firms to focus on saving by repaying debt rather than spending or investing.

Secondly, financial integration can indirectly encourage investment into the same asset types in specific regions thus causing international financial imbalances.

Boyce and Ndikumana (2001) go on to say that financial liberalization as a means to financial integration can increase capital flight which hampers economic growth in poorer countries due to lack of sufficient capital. According to their research based on a sample size of 25 Sub-Saharan African countries, the cumulative capital flight from those African economies amounted to more than $285 billion in 1996. Moreover, if the capital markets are susceptible to irrational optimism during bull markets and excess pessimism during bear markets, then the benefits derived from capital inflows can be cancelled out by the large and sudden outflows.

On a study done on twelve Asian equity markets to identify their levels of integration with Japan's equity market, Johnson and Soenen (2002) found that a greater disparity in inflation rates, GDP, real interest rates, as well as a higher import share, negatively affected the stock market comovements between country pairs. On the other hand, they found that a greater direct investment by Japan into these Asian countries as well as an increase in export share by these Asian countries into Japan all increased comovements between the country pairs. Therefore, this implies that a bigger differential in inflation rates, real interest rates as well as GDP rates between country pairs amounts to a lower correlation coefficient between their stock markets consequently increasing the diversification benefits recognisable between these countries. Contrarily, a bigger amount of direct foreign investment from one country to another increases the correlation between the two countries' stock markets and hence lessens benefits recognisable from diversifying an investment portfolio between such two countries.

Făt and Dezsi (2012) state that gains can be achieved by investors through IPD only if the different markets invested in are not substantially integrated and they

conclude that if integration between markets is proved to be present, the potential of IPD is limited. In conclusion, Agénor (2003) implores national and international policymakers to design policies that curtail the short-term risks and augment the long-term gains from financial liberalization because global financial integration can enhance long term economic growth especially if the capital inflows largely consist of foreign direct investment.

2.2.2 Home Bias

In spite of the fact that IPD can yield compelling gains, investors still hold an incommensurate amount of foreign equities (Amadi and Bergin, 2008). French and Poterba (1991) showed that Japanese investors held only 1.9 per cent of their equity in foreign stocks while U.S. investors held 6.2 per cent in foreign stocks in the year 1989. U.K investors held 18 per cent of their equity in foreign stocks of which their foreign stock holdings were almost all held in either the U.S., Japan or continental Europe. Taking into account the size of the global market, their research proved that investors were significantly under-diversifying their portfolios in the international market and thus potentially missing out on higher returns as well as reduced risks towards their portfolios.

Previous studies point out that foreign equities have a higher turnover rate than domestic equities and Dey (2005) concludes that stock portfolios with higher turnover rates generate higher returns. Therefore, the perplexing preference of domestic assets over foreign assets by investors is known in finance as the home bias puzzle and has been documented by a variety of authors including Daly and Vo (2012); Mondria and Wu (2013) and Solnik and Zuo (2017). Home bias is not limited to international investing only as investors still have a tendency to drift towards firms geographically located in their region even when it comes to domestic investing (Lippi, 2016). Coval and Moskowitz (1999) also found that U.S. fund managers tend to gravitate towards firms that have their headquarters within the country.

Cooper et al. (2013) discovered that home bias had gradually fallen in OECD countries but remained unchanged in non-OECD countries. It is therefore important to understand the determinants of home bias as it is not only detrimental to the

effectiveness of IPD but also has a noticeable negative impact on the welfare in emerging markets (Bekaert and Wang, 2009) as it increases the cost of capital. More so, a study done by Vermeulen (2013) revealed that investors from countries that have lower levels of home bias experience significantly larger benefits from cross-border portfolio diversifications during financial crises. He attributed these larger benefits to the better return performance and bigger reduction in the total volatility of these investors' portfolios.

Home bias is a phenomenon that is important to analyse and try to solve as it is widely believed that the phenomenon is more recurrent in emerging markets such as South Africa. Byoung et al. (2014) did an extensive study on forty-two countries between the years 2001 and 2011. Twenty of the sampled countries were emerging markets while the other twenty-two were developed markets and the study revealed that home bias in both stock and bond markets was significantly higher in emerging markets compared to the developed markets.

A number of studies have unsuccessfully attempted to explain the causes of home bias. Withholding taxes and other high transaction costs incurred when purchasing assets in foreign markets are one frequently stated explanation for home bias. However, Amadi and Bergin argued against this explanation since the turnover rate of assets held in foreign markets is significantly higher than that of domestically double-taxed assets. They went on to reason that if high transaction costs were indeed an accurate explanation for investors low interest in foreign equity holdings, then the turnover rate among foreign assets would be lower in turn.

In addition to the high turnover rate of foreign equities, Tesar and Werner (1995) cited the high volume of cross-border capital flows as another deterrent of the transaction costs explanation of the home bias puzzle. From a slightly different standpoint, Rowland (1999) reasoned that on average, the portions of foreign assets held by investors is small. He concluded that the turnover rate of foreign assets is higher than that of domestic assets not because the quantity of foreign assets traded is more substantial, but because of the small size of foreign asset holdings. Warnock (2002) also claimed that foreign equity turnover rates were significantly lower than previously disclosed and were more comparable to domestic turnover rates.

However, after analysing transaction costs data in 41 markets, he too agreed that high transaction costs were not a sufficient explanation for the home bias puzzle.

There are a number of empirical studies as well that claim that domestic investors make higher profits than foreign investors when trading in domestic equities and this could help explain why investors would prefer to hold domestic equities over foreign ones. For example, Shukla and Van Inwegen (1995) found that U.S. mutual funds investing in the U.S. outperformed UK mutual funds also investing in the U.S. Kalev et al. (2008: 2388) assessed the trading profitability of domestic and foreign investors based on the Helsinki Stock Exchange during the period of 1999 and 2004. According to them, "cross-listed and especially internationally well-known stocks are more likely to receive foreign investors' attention than single-listed stocks" while in terms of trade, the local investors can transact at more favourable prices compared to foreign investors hence gaining more from the overall standpoint.

Likewise, Hau (2001) used an electronic trading platform of the German Security Exchange known as Xetra to investigate the trading profits of professional stock traders across eight European countries. In addition to the realization that closeness to the corporate headquarters of the traded stock created an information advantage to traders, his study also revealed that foreign traders in non-German speaking financial centres generated less trading gains from their German stock trades in comparison to the domestic German traders.

Sercu and Vanpée (2007: 2) grouped their explanations for home bias into institutional-based explanations and behavioural-based explanations with the institutional-based explanations consisting of "…hedging possibilities against domestic risks, trading costs and border controls, information asymmetries, and country-level and firm-level governance" while the behavioural-based explanations included "…familiarity, patriotism and overconfidence."

In their study done on home bias in Japan, Hiraki et al. (2003) created doubt about institutional investors' willingness to prioritise curbing home bias. Their study revealed that institutional investors that were connected to Japanese corporate groups invested significantly in firms within the same corporate group regardless

of their poor performance. This can be cited as an example osf an institutional-based explanation for home bias.

However, Van Nieuwerburgh and Veldkamp (2009) were not convinced that information asymmetries were a valid explanation to home bias as they argued that if domestic investors indeed had less information about foreign assets, they would then have an incentive to attain foreign information to reduce their payoffs' uncertainty. According to Salehizadeh (2003), not only would they have an incentive, but they would also have a number of available experienced fund managers that they could liaise with for this information and thus rectify home bias in the end.

However, Mukherjee et al. (2018: 9-10) point out that information asymmetries do not only comprise of lack of necessary information, but also the inability to process the required information. "As a result of investor's limited capabilities of processing information, the foreign asset (equity) is perceived less attractive than it would be if the investor had optimal information skills and were able to evaluate the domestic and foreign risky assets jointly." According to Salehizadeh (2003), information asymmetries can also arise due to the lack of credibility of the financial information in a given country in regard to foreign assets. It is commonly believed that domestic investors have private or local information regarding their home markets that is inaccessible to foreign investors. This arises from the fact that the locals have an unrivalled knowledge of domestic companies as well as the domestic economic conditions (Albuquerque et al., 2003).

Eichler (2012) also made the assumption that rational investors' investment decisions are dependent on valid accessible company information and went on to point out that home bias could thus be reduced through more comprehensive disclosure of information by companies.

Barriers for foreign investment as an explanation for home bias is arguable as almost all countries have liberalized their financial markets over the past few decades. In regard to behavioural-based explanations, Strong and Xu (2003) made a distinction between relative and absolute optimism. They defined absolute optimism as a scenario where investors possess more optimism about their home

market than they do about foreign markets. On the other hand, relative optimism is where investors have more optimism about their home market than investors from other countries do. Their study supports behavioural explanations of the home bias puzzle as they found that the fund managers from Japan, U.S. and Europe exhibit noteworthy relative optimism towards their home equity markets. In their study of Turkish investors, Sahin et al. (2016) also found that behavioural factors were more responsible for home bias than institutional factors. Their research revealed bilateral familiarity and cultural distance as the main explanations for home bias. Turkish investors favour investing in familiar countries with cultural proximity regardless of whether or not these markets lack sound corporate governance and diversification feasibility.

Morse and Shive (2011) stated that just like patriotism plays a role in the home bias in consumer products, it is also an overlooked explanation to the home bias puzzle in IPD. Their study found that investors hailing from more patriotic countries tend to invest less in foreign equities and prefer to invest in domestic equities. Pradkhan (2016) backs this explanation up as his study found compelling evidence that patriotism discourages domestic investors from holding foreign equity positions in the form of bonds and thus increases home bias.

Anderson et al. (2011) examined global equity holdings of about 25,000 institutional portfolios from over 60 countries to analyse how culture in nations impacts home bias and international portfolio allocations. The measures of culture used included masculinity, uncertainty avoidance and long-term orientation. Their study brought forward evidence that institutional investors based in countries with high a high degree of uncertainty aversion were more prone to home bias as they preferred to invest at home while institutional investors based in countries with high masculinity levels and long-term orientation were more prone to overconfidence and exhibited less home bias in their portfolio allocations. Investors originating from countries with high masculinity scores invested more in foreign markets because they believed that they were better processors of foreign market information in comparison to the institutional investors from other countries.

Massé (2017) cites ambiguity aversion as another plausible behavioural explanation for home bias. He makes the distinction between risk and ambiguity, pointing out that the probability of an outcome differing from the expected one is known for risky events while said probability is unknown for ambiguous events. Therefore, ambiguity-averse individuals prefer known risks to unknown risks and will favour investing in asset alternatives where the probability distribution of the possible outcomes is known. Massé did a statistical analysis based on domestic U.S. investors and his study revealed that investors allocate a lower portion of their equity in the international market due to ambiguity aversion. However, his regression analysis showed that ambiguity aversion as an individual explanation is not significant enough to fully explain the home bias puzzle.

However, Sercu and Vanpée (2007) contend that behavioural-based explanations for home bias are hard to measure and distinguish. Therefore, they conclude in agreement with Glassman and Riddick (2001) that none of these explanations is individually sufficient to justify home bias and therefore portfolio choices can only be explained by a combination of rational and irrational behaviour.

Konishi (2007) asserts that global integration could actually be a solution to home bias. He investigates the impact that Nasdaq's withdrawal from Japan had on the wealth of shareholders of companies that had been listed on Nasdaq Japan before its termination. Nasdaq's expansion into Japan and Europe in 2000 and 2001 respectively increased global integration as it created a 24-hour global securities marketplace that would aid foreigners to trade in domestic stocks and vice versa. In summary, Konishi's empirical analysis shows that the termination of Nasdaq Japan had a negative effect on shareholders' wealth of companies that had been listed on Nasdaq Japan hence proving that the integration of world stock markets could facilitate cross-border stock investments thus reducing the home bias.

2.2.3 Exogenous Shocks and Contagion

Varangis et al. (2004) define an exogenous shock more specifically as an unpredictable event that causes a significant change in the value of a financial variable from its intrinsic trend. The occurrence of these exogenous shocks results in an increase in the volatility across financial markets and when markets have

become more integrated, external factors have a bigger impact on each specific market. They assert that in comparison with developed markets, exogenous shocks occur more frequently in emerging markets and their effects are more persistent.

Exogenous shocks can arise in the form of wars, natural disasters such as drought and epidemic diseases, inflation in commodity prices as well as unexpected changes in government policies or spending and tax levels (Lotterman, 2014). While investors focus more on the economic fundamentals of an industry and thus make more thought-out buy and sell decisions during periods of low volatilities, they are less discriminating in selling their assets during periods of high volatility (Liu, 2019). Such investor behaviours have been said to play a role in spreading crises among stock markets during periods of high volatility and thus substantially increasing financial market co-movements. According to Bae et al. (2003: 718-719) "…this means that if panic grips investors as stock returns fall and leads them to ignore economic fundamentals, one would expect negative returns to be contagious in a way that small negative returns are not."

Schwebach et al. (2002) believe that IPD becomes inefficient at the time in which it is needed the most due to the high correlations among international financial markets during periods of high market volatility. During the 2008 financial crisis, not only did stock prices fall significantly, but asset classes that had historically exhibited contrary performance to each other moved in tandem as well making diversification even more inefficient (The Motley Fool, n.d.). It is therefore important to investigate inter-linkages among financial markets during periods of crisis as they significantly impact the potential benefits of IPD to investors.

While the majority of empirical studies find that periods of crisis indeed lead to increased linkages between stock markets, some studies state that stock markets' cross-correlations remain unchanged during periods of crisis. For example, Aluko et al. (2018) assessed the relationship between the Nigerian stock market and the developed stock markets of U.S., UK, Germany, France and Japan before, during and after the global financial crisis to identify whether the crisis linked the stock markets. Their tests found that the Nigerian stock market and the stock markets of U.S., UK, Germany and France remained unlinked in the pre-crisis, crisis and post-

crisis periods, with only Japan's stock market being linked with that of Nigeria and only in the post-crisis period.

In contrast, Amonlirdviman and Carvalho (2010: 1303) implied that the expected large gains from IPD may not be achievable because "…correlations are higher in market downturns than in upturns." Since stock market correlations are high during periods of high volatility, this implies that the potential of risk diversification across stock markets is very limited, yet it is one of the main purposes of diversification. Like Amonlirdviman and Carvalho, a good number of authors have repetitively implied that crisis periods influence stock market comovements with many researchers stating that global crises increase the correlation between different stock markets. Schwebach et al. (2002) investigated the correlations and volatility of 11 markets after the 1997 Asian financial crisis. They found that both the correlations and volatilities among these 11 markets increased significantly during the crisis and substantially lowered the potential for benefits from IPD.

Chiang et al. (2007) carried out a study in which they analysed the daily returns of nine Asian stock markets between the years 1990 and 2003. They found that there was a contagion effect after the 1997 Asian financial crisis. Contagion is described as the transmission of market changes or disturbances from one regional market to another (Baur, 2012) and is more prominent in higher correlated economies. Baur and Schulze (2005) assert that the transmission of crises from one country to another automatically strengthens the linkages between the countries' markets and reduces the potential of benefits resulting from IPD.

Kenourgios et al. (2011) probed for financial contagion in their study of four emerging equity markets and two developed markets namely; Brazil, Russia, India, China, U.K and the U.S. during different financial crises. They confirmed that crises spread in each case from the country of origin to the other countries. In addition, their study revealed that the effects of financial contagion were greater in emerging stock markets than in developed stock markets. Chiang et al. (2007) identified two phases in which the Asian crisis occurred. In the initial phase, the crisis displayed a pattern of gradually increasing correlations across the nine studied Asian stock

markets while in the second phase, the behaviours of investors converged, and the correlations skyrocketed.

However, Forbes and Rigobon (2002) did a study on a number of crises including the 1987 U.S stock market crash, the 1994 Mexican peso crisis as well as the 1997 Asian financial crisis. When they tested each of the above-named crises based on adjusted correlation coefficients, they found that there was essentially no contagion. They concluded that although there were high levels of market comovements in all named crisis periods, these high market comovements were simply a continuation of the strong market linkages and integration that had existed prior. Bekaert et al. (2005) as well found no evidence of additional contagion as a result of the Mexican crisis. However, contrary to Forbes and Rigobon, their study discovered substantial increments in residual correlations during the 1997 Asian crisis, especially in Asia. According to Kaminsky and Schmukler (2002), the financial markets in emerging nations are also affected by sovereign debt ratings. This debt rating affects both the bonds being rated as well as stocks and thus impacts the markets of the rated countries and induces contagion across these countries.

Therefore, it is worth considering whether the presence of high correlations between markets is sufficient proof of contagion. Bekaert et al. (2005) assert that while correlations are expected to be higher during periods of high volatility from a purely statistical standpoint, this increase in correlations of market returns does not necessarily reveal the presence of contagion. They define contagion as a scenario in which the market correlations transcend what is expected from economic fundamentals. Baig and Goldfajn (1999) state that if markets are historically cross-related, then it would be expected for a sharp change in one market to cause a change of a similar magnitude in the other market. Therefore, if changes did occur in these markets during a crisis period but without a notable increase between the markets' correlation, then it would be safe to say that the markets were simply reacting to each other as per their historical relationship. Therefore, a case for contagion would only be made if the correlations between the markets changed significantly ensuing the onset of a crisis. For example, their study looks at the financial markets of Thailand, Malaysia, Indonesia, Korea and the Philippines, many of which showcase significant amounts of historical co-

movement. Their study found that only six out of the ten tested country pairs exhibited a significant increase in the cross-border co-movements during the crisis period. Their study went further by setting up dummy variables using daily news to test the impact that country-specific news, as well as cross-border news, have on the spread of crises. Similar to Dungey et al. (2010), they found that markets experiencing financial crisis experience an increase in their sensitivity to foreign news and this plays a role in cross-border contagion.

Saqib et al. (2019) found that during the global financial crisis, there was a notable transmission of the crisis's effects from the U.S. stock market to the stock markets of Malaysia, Korea, Russia, India, China and Pakistan, all of which are emerging markets. That led them to draw an inference that the volatility in the U.S. stock market influences the returns of the named emerging stock markets. Similarly, Baur (2012) investigated the spread of the 2007 global financial crisis from the financial sector into the real economy. He analysed different sectors in a sample of 25 major developed and emerging markets. He found that the effectiveness of portfolio diversification was limited as no region or sector was resistant to the effects of the crisis in the long run. Both emerging markets and developed markets were affected by the shocks associated with the crisis. However, he also found that different sectors felt the effects of the shocks differently. For example, the healthcare sector, the telecommunications sector and technology sectors felt the effects of the crisis significantly less than the financial sector implying that investors could maintain a decent amount of diversification effectiveness by distinguishing between these sectors.

Calvo (1996) accredits the presence of herd mentality in emerging markets as a reason for cross-market contagion. Investors charge into ventures without adequate information and appreciation of the risk-reward trade-offs and then flee to safer havens at the first sign of trouble. According to Bikhchandani et al. (1992), this can be a result of information asymmetry between investors causing the uninformed investors to decide to follow the trading patterns of the informed traders. In addition to this, since investors cannot easily monitor the state of each market due to the high associated costs, they will simultaneously pull out of a group of related markets when they sense tension in just one of the markets. Investors then follow each other

as they pull their money out of the markets thus causing cross-market distress. Kim and Wei (2002) point out that herd mentality among foreign portfolio investors may have played a role in accelerating the spread of the effects of the 1997 Asian financial crisis.

Similarly, Kyle and Xiong (2001) assert that contagion can be induced by investors themselves. When investors incur huge investment losses in a country undergoing a crisis, they may be forced to sell their financial assets in other countries to meet margin calls and consequently trigger equity price drops in these countries.

In emerging markets, some publicly listed stocks are ineligible for purchase by foreigners (Boyer et al., 2006). Boyer et al.'s study separates the stocks of emerging markets into two categories namely; stocks that are accessible for purchase by foreigners and those that are not accessible for purchase by foreigners. Using these categories, they compare the extent to which the returns of accessible and inaccessible stock indices move concurrently with the returns of a crisis country's index. Their empirical study reveals increased co-movement between the indices during periods of high volatility with accessible stock index returns having higher co-movements than the inaccessible stock index returns with the stock index returns of the crisis country. They state that if contagion is based on economic fundamentals, the increment in the crisis country's stock co-movement with accessible stocks should be indistinguishable from the co-movement with inaccessible stocks. However, if the crisis country's stocks experience a higher increase in co-movement with accessible stock returns in comparison to their co-movement increase with inaccessible stock returns, then the contagion is investor based. This leads them to the conclusion that crises spread through the asset holdings of international investors rather than through changes in economic fundamentals.

While Forbes and Rigobon (2002) believe that crises impact the correlations among financial markets only temporarily, a greater percentage of empirical studies suggest that the events of contagion can last much longer than anticipated. Markwat et al. (2009) state that crises occur in a domino-like pattern because according to them, global crises do not materialize instantaneously but are usually antedated by

national or regional crises. Therefore, they recommend that in order to know how to effectively hedge their risks, it is of utmost importance for investors to predict whether a crisis will remain local or spiral out into a global crisis.

Studies such as Saqib et al. (2019) and Vermeulen (2013) suggest overweighing international portfolios with assets from those markets that are less cointegrated with the stock markets of developed markets because the stock markets that possess limited contagion effects can help to lower risk. Vermeulen stresses that is more important to hold uncorrelated assets during periods of high volatility than to hold uncorrelated assets during tranquil markets since it is more beneficial to reduce uncertainty when the amount of uncertainty is particularly large.

2.3 Limitations of International Portfolio Diversification

Just like any other investment strategy, IPD too faces its fair share of limitations. There are a number of unpredictable scenarios that can affect the ease with which IPD can be implemented by investors as well as others that affect the potential gains that are realisable from IPD. While diversification can limit the downside of a portfolio by averaging out the risk and volatility across a group of securities (The Motley Fool, n.d.), diversification often puts a cap on the upside potential of a portfolio (Cyriac et al., 2012). This is because as the level of diversification increases, the returns of the portfolio are more likely to mimic the market average. Additionally, internationally diversified portfolios have more investments to follow and trade, more layers of diversification strategies to adhere to and thus consume more time compared to less diversified portfolios. Faulkenberry (n.d.) points out that over-diversification is disadvantageous as the quality of a very diverse portfolio is bound to suffer due to combining inferior investments with good investments resulting in below-average returns.

Moreover, Sercu and Vanpée (2008) discovered in their study that the implicit costs incurred to invest in stocks of emerging markets are significantly higher when compared to those incurred when investing in the stocks of developed markets. This is a result of the less developed financial markets, higher inflation and underdeveloped information channels present within emerging markets and this

consequently limits the potential gains from international portfolios because the financial assets of emerging markets do in fact offer superior returns compared to those of developed markets.

In addition to the implicit costs, Cameron (2014) states that there are also several explicit costs incurred such as commissions, acquisition charges and custodial fees, some of which are higher when buying and selling international stocks. International portfolios may also require the payment of taxes and foreign exchange fees which further water down the realisable gains. Since tax laws vary from country to country, Bartram and Dufey (2001) state that the tax rates payable on the returns on an international portfolio such as capital gains, interest and dividends will also vary from country to country. In addition to the differences between country tax rates, a significant number of countries also levy withholding taxes on the dividends and interest of investors that do not reside within their countries. Governments implement withholding taxes as a tool to limit tax evasion since they cannot always directly and accurately assess the total incomes of foreign residents. However, Oosthuizen (2014) states that withholding taxes can lead to investors being double taxed on their foreign incomes when they declare such income in their resident countries.

Bartram and Dufey (2001) claim that there is also a sizable increase in the transaction costs incurred to purchase securities in foreign markets compared to domestic markets. In addition to the costliness of the access to foreign financial markets, information required by financial intermediaries to efficiently trade in foreign markets is harder to come across. Furthermore, not only is the data provided in the public financial statements of foreign companies limited, but the available information can be difficult to analyse and interpret due to the difference in reporting standards and practices among countries. Bartram and Dufey go on to state that in addition to the administrative costs paid by individual investors to their fund managers, these individual investors incur higher costs as the financial institutions also pass the costs of data transfer across domestic banks and foreign financial institutions onto their customers.

Solnik (1995) points out the tendency of governments to sometimes resort to extreme measures such as imposing exchange controls during periods of monetary crisis as another possible limitation on IPD. Governments can put such exchange controls into effect by impeding the conversion of domestic funds into foreign currencies for the purpose of purchasing foreign securities. When countries limit the sale and purchase of currencies, their aim is to stabilise their economies through restricting the inflows and outflows of currency and this not only increases the exchange rate volatility but also freezes capital invested by foreign investors. Bartram and Dufey (2001) also point out that while governments are usually quick to place restrictions on undesired capital inflows and outflows to solve their monetary problems, they are less enthusiastic in removing such controls once the underlying problem has been solved. Since securities purchases tend to be among the first classes of international transactions subjected to exchange controls and the last to be discharged from them, the diversity range of an international portfolio can be limited as domestic investors lose the ability to freely buy and sell foreign securities indefinitely. Solnik cites France and the U.K as examples of governments that turned to such extreme measures in recent times during periods of monetary crisis.

Diversifying a portfolio internationally opens the investment portfolio up to foreign investment risks. There is a risk of loss when investing globally and foreign investment risk encompasses different types of international risk factors such as interest rate risk as well as currency risk (Kuepper, 2019). Bartram and Dufey (2001) also point out political risk and currency risk as other factors that can significantly limit IPD. They claim that currency risk accounts for about 10 to 15 per cent of the total risk of equities and that the percentage representation of currency risk in the total risk of bonds is even higher. Currency risk, also known as exchange rate risk, is defined as the possibility of losing money due to changes in the relative valuation of currencies (Kuepper, 2019). Since foreign securities are denominated in foreign currency terms and dividends are thus paid in foreign currencies (Kirchhoff, n.d.), an international portfolio has an exposure to unexpected changes in the exchange rates of the respective currencies which can create either gains or losses when the profits or dividends from the investments are

converted from the foreign currencies into the respective domestic currency. For example, if the U.S. dollar depreciated against the South African rand, a South African investor's investment in U.S. stocks would be worth less in South African rands.

Exposure of international portfolios to political risk is inevitable due to the fact that international securities are usually traded in a sovereign political jurisdiction different from that of the investor (Bartram and Dufey, 2001). Huang et al. (2015: 393) define political risk, also known as country risk, as "the risk that arises as a result of the potential actions of governments and other political forces within and across nations…" Similarly, Bartram and Dufey (2001: 115) define political risk as "local government policies that lower the actual (after-tax) return on the foreign investment or make the repatriation of dividends, interests, and principal more difficult." They group political risks into three categories namely: transfer risks which mainly restrict capital flows; ownership-control risks which place restrictions on corporate ownership and operational risks which curtail management activity.

There is a risk of loss when changes in government policies occur or when political leaders who have the power to amend policies are changed. Some of these government policies that could affect an international portfolio include but are not limited to; government expropriation of assets and changes in tax policy such as imposition or increment of withholding taxes within a country. For example, a change in monetary policy can alter inflation and interest rates which can in turn affect stock prices (Ontario Securities Commission, 2018). The U.S., in particular, has had a somewhat unpredictable pattern of changes in its policies since President Donald Trump's inauguration in 2017 and this is expected by many to continue through his term of office. Gupta et al. (2017) state that US monetary policy announcements affect emerging markets significantly impacting their exchange rates, equities' prices and bond yields and therefore unpredictable US policy changes can further increase the volatility of not only US equities, but that of an international portfolio as a whole. Marsh (2018) points out the UK's uncertain attempt to leave the European Union as well as the Catalonia political crisis in Spain as political risks within the European continent and these too can have an impact on an international portfolio diversified into said countries.

Additionally, instabilities with the potential to affect the returns of an investment are grouped under political risks as well. Political scenarios such as a military coup or an act of war or terrorism would almost immediately cause a downturn in the economic activity within a country and thus cause a fall in the securities prices. For example, Nigeria which is Africa's largest economy with its 2017 Gross Domestic Product estimated at $376.3 billion (Businesstech, 2017) would ideally be a good market for South African investors to diversify their portfolios into. Nigeria has one of the continent's largest stock exchanges with the Nigerian Stock Exchange having a market capitalization of $38.06 billion (StockMarketClock, 2019). However, Bax et al. (2019) point out the nation's ongoing war against Islamist militants as well as the clashes between farmers and herders that killed more than 2,000 people in 2018 (Al Jazeera, 2018) as political risks that are all worth considering.

Furthermore, a number of African countries continue to struggle with elections and political succession battles causing even more economic uncertainty. More than a year after Robert Mugabe resigned from his 37-year presidential rule, Zimbabwe is facing dire economic crisis with a short supply of fuel, food and medicines in addition to doctors and teachers protesting to have their salaries paid in hard currency rather than electronic funds due to the country's liquidity challenges and low supply of foreign exchange (News24, 2018). Likewise, Kenyan president Uhuru Kenyatta emerged victorious in 2017 from a controversial rerun of the elections after the general presidential elections were contested and annulled by the Kenyan Supreme court due to electoral irregularities (BBC News, 2017) while Nigeria recorded an all-time low turnout in the 2019 general elections with only a third of the 73 million eligible voters showing up to vote. Oladipo (2019) states that Nigeria's nationwide turnout has been on a gradual decline since 2003 and that this could be indicative of the people's diminishing faith the country's political establishment and its ability to deliver their needs. Similarly, the Gabon constitutional court retallied votes for the 2016 Gabon presidential elections after violent protests broke out following the announcement of the initial election results (The Guardian, 2016). Cote d'Ivoire as well still faces general uneasiness ahead of the 2020 presidential poll due to a rift between the country's two largest political parties (Ross and Aboa, 2018).

Therefore, investors holding international portfolios are further exposed to default risk as a result of the unpredictable government actions coupled with general political and economic uncertainty within foreign countries. In regard to this research, default risk is defined as the risk that an issuer of a bond may fail to make the required coupon or principal payments at maturity (Investing Answers, n.d.). Since well-diversified portfolios contain different asset classes inclusive of bonds, a default on bonds' coupons and principal payments would disrupt a portfolio's cash flows as a whole. Although a decline in equity prices is the most immediate and recognisable impact, emerging and frontier countries that possess higher risk factors experience diminished foreign direct investment as well which can set off a chain reaction of other issues (Christy, 2019). A decline in foreign direct investment can slow down economic growth which could have an effect on a country's capability to repay its debt thus negatively impacting the bond market.

Capital market regulations are present in different forms in a number of countries with financial institutions and pension funds being subject to rules and regulations that further complicate the process of buying and selling foreign securities by institutional domestic investors. "Most commonly, capital market controls manifest themselves in form of restrictions on the issuance of securities in national capital markets by foreign entities, thereby making foreign securities unavailable to domestic investors" (Bartram and Dufey, 2001: 120). Some countries restrict the amount of foreign investment doable by domestic investors as well as the percentage ownership that foreigners can have in national companies.

2.4 Political and Economic Challenges Facing South Africa

The political and economic challenges of a nation play a role as well in the effectiveness of IPD as an investment strategy. By this juncture, the research has pointed out just how responsive stock markets can be to predictions of tensions within an economy. The challenges within a country can cause a gradual increase in the volatility of domestic stocks thus making it more crucial for the local investors to hedge against investment risk by including a proportionate amount of foreign assets in their portfolios. South Africa, just like many emerging markets still has a long way to go to catch up to the economic stability of the developed

markets as it is still clogged with a number of different inefficiencies within the economy, some of which are resultant from the political operations.

First and foremost, South Africa's economic growth rate has been less than satisfactory over the past years. Walker (2018) says that the South African economy has had an average annual growth rate of only 1.4% over the past decade which is well behind what an emerging market should have with other emerging markets such as China and India averaging annual growth rates of approximately 6.6% and 7.4% respectively (Businesstech, 2018). In addition to this, the accumulated debt burden has increased over the years due to the high rate of government borrowing. Adding insult to injury, Fitch and S&P which are two of the major credit rating agencies downgraded South Africa's sovereign debt rating to sub-investment grade status in 2017 (Cronje, 2019).

Wilkinson (2014) suggests that one of the main advantages that emerging markets have over developed markets is the fact that their populations comprise mostly of young individuals who can boost the labour force. However, he says this can also be a source of instability due to the high unemployment rates and wage stagnation which are characteristic of many emerging markets inclusive of South Africa where the unemployment rate has increased to 27.6% in 2019 (Businesstech, 2019). Wilkinson states that civil uprisings and riots can arise as a result of unemployment among the youths. In an article, Jadwat (2019) ranks unemployment as the number one challenge that South Africa faces in 2019 as she reasons that it is the genesis of a couple of other challenges such as an increase in crime. The South African crime rate remains relatively high and a constant source of tension as it has pushed many civilians into investing their hard-earned income to acquire the costly services of the rapidly expanding private security industry. According to Jadwat, South Africa currently has one of the largest private security industries in the world with more than 9,000 registered companies and around 450,000 registered active private security guards.

Mobius (2017) lists education as another challenge that is closely tied with the challenge of unemployment. He blames budget constraints, poor administration and corruption for the challenges faced such as overcrowding and low standards,

especially within government schools. On the other hand, the private schools that offer higher quality education facilities are not affordable for many. Therefore, the country is tasked with increasing the availability of good quality education institutions that charge relatively affordable fees since education immensely influences the nation's unemployment rate as well as its economic advancement.

In an overview of the different challenges different emerging markets face, a report by PWC (2013) stresses the need to improve the technical skills of the population in South Africa to battle wage stagnation and unemployment. Alongside the risk of social conflicts, PWC also points out that South Africa still faces challenges of trading across borders. In addition to the time required to compile documents and get approval, the costs associated with trading internationally are still relatively high in South Africa. These challenges tend to promote home bias and thus directly counter the application of IPD within the country.

Marrian (2019) points to the less than ideal productivity of capital expenditure especially by state-owned institutions as another challenge. She gives an example of the decline in electricity within the South African economy despite the substantial investments pumped into Eskom with the purpose of increasing the capacity of electricity generated. The Reserve bank predicts that close to 100,000 jobs could be lost by the end of 2019 if the load-shedding within the country is not solved. It is reported that some of the productivity inefficiencies stem from the dominance that state-owned entities enjoy due to the presence of market structures that limit competitiveness and maintain a degree of monopolistic positions. In its 11th edition, the World Bank (2018) reports that various economic sectors in South Africa have received protection from foreign competition for a long time through sanctions as well as industrial policy support and this has not only limited growth but also brought about lacklustre performance within some organisations.

Productivity inefficiencies also stem from corruption which has plagued many South African institutions inclusive of public hospitals, schools, government offices as well as private corporations. For example, Lungisa (2017) points out that about 12 billion rand in the government's employee pension fund was lost in the Steinhoff case in which accounting irregularities and other fraudulent actions took centre

stage in causing the scandal. According to the Corruptions Perceptions Index reported by Transparency International, South Africa has scored an alarming average of 46.97 points between 1996 and 2016 (Georgieva, 2017). For clarity, the Corruptions Perception index uses a scale ranging from 0 to 100, where 0 represents the highest possible level of corruption while 100 represents a clean nation totally free of corruption (Transparency International, n.d.). Therefore, South Africa's index average that is below the 50-point mark directly affects the confidence that investors have in the domestic stocks.

There are a couple of long-standing unresolved issues in South Africa that could possibly cause tension in the near future and thus increase the volatility of the national stock market as investors' confidence declines. One of the outstanding ones currently is the land reform initiative for which the government has come under considerable pressure due to its failure to promptly deliver the proposed initiative. In 2015, former president Jacob Zuma declared his intention to seek a ban on foreign land ownership and cut the limit for total land possession to 12,000 hectares per individual (Mobius, 2017). The government's proposed means of doing so was through buying the excess land above the limit from the owners and then redistributing it. However, the land reform process was halted by the constitutional court for a number of months in order for the land Restitution bill to be fixed first. The proposed land reform law will be applied to agricultural land and will, as a result, create uncertainty about the future performance of the agricultural sector which is one of South Africa's key economic sectors contributing about 3% of the country's Gross Domestic Product (Brand South Africa, 2018).

Inequality is another issue that is frequently talked about and is still a long way from being resolved. Despite South Africa possessing arguably the best infrastructure in Africa and a relatively good GDP per capita in comparison to many other Sub-Saharan countries (World Bank, 2017), it has one of the most notable cases of extreme wealth versus extreme poverty. The income distribution is where the most glaring inequality is sighted with an estimate of 60% of the South African population earning less than R42,000 annually while 2.2% of the population generates an income above R360,000 per annum (Jadwat, 2019). Using the Gini coefficient, the World Bank (2019) ranks South Africa as one of the most unequal

countries in the world with a Gini coefficient of 63%. The Gini coefficient is a measure of inequality ranging from 0 representative of a scenario where all citizens have the same level of access to resources, to 100 which represents perfect inequality where all resources are held by one individual. In comparison, the figure of the Gini coefficient for most European countries ranges between the mid to high 20s, while it is around 40 for the U.S. (Walker, 2018). The government picked up the Black Economic Empowerment (BEE) policy as a way to try to promote equality in the workplace as well as battle unemployment. However, the initiative has also drawn criticism with many people claiming that it has marginalised small businesses and resulted in the enrichment of individuals many of whom are tenderpreneurs, rather than addressing the needs of the broader masses (Anthea, 2013).

2.5 Conclusion

This chapter discussed the concept of IPD. It started off by presenting a historical background on the concept and how it has gradually risen into focus as an investment strategy for both individual investors as well as institutional investors. This was followed by discussions on how the concept of IPD can be effectively implemented as well as the main fundamentals to consider before attempting to implement it. It should be noted that correlations between stock markets are the most essential fundamental to consider before implementing IPD as an investment strategy. Makridakis and Wheelwright (1974) assert that in order for any gains to be realisable from an internationally diversified investment portfolio, the correlations between the price movements of the used stock exchanges should be low or medium.

The next section of this chapter provided information about the three major factors that cause variabilities in the correlations between stock markets and as a result, affect the effectiveness and application of IPD. These three major factors are; financial integration, home bias and exogenous shocks. The chapter provided definitions for these factors, their causes, as well as an in-depth discussion on how they influence the application and effectiveness of IPD.

This chapter then presented a discussion of how IPD can be limited as an investment strategy and how it can be ineffective within an emerging market such as South Africa. It went on to highlight the political and economic challenges currently faced in South Africa that have the potential to deter the application of IPD by South African investors.

Chapter 3: Research Methodology

3.1 Introduction

A quantitative approach is used as it is useful in the assessment of statistical data to discover patterns and bring to light facts in research (DeFranzo, 2011). In order to maximise the potential gains from IPD, future relationships among the financial markets of different nations must be predicted (Watson, 1980) and this can be done through the assessment of historical correlation coefficients. Other empirical studies that made use of correlation coefficients to study movements and linkages between financial markets include Becker et al. (1990); King and Wadhwani (1990); Lee and Kim (1993); Ramchand and Susmel (1998); Loretan and English (2000) and Forbes and Rigobon (2002).

The study initially does a statistical examination of the sample indices' individual performance using different performance measures. As the core step towards estimating IPD benefits, the research also comprises of the calculation and comparison of correlation coefficients between the returns of the JSE ALSI and four different market indices representative of the markets of Brazil, China, U.S. and the UK. Stock markets that have medium to low correlations between them are preferable for diversifying an investment portfolio because they provide a better hedge against investment risk as the price movements of assets in one market can offset adverse price movements of the assets in another market.

The use of correlations coefficients is also an accurate way of testing for contagion during crisis periods as well as integration between markets as shown by Forbes and Rigobon (2002: 2223) who asserted that "…correlation coefficients are conditional on market volatility." Baur and Schulze (2005) point out that comparing the correlation amongst financial markets during periods of turbulence with the correlation of those same financial markets during tranquil periods is a standard approach to test for contagion amongst financial markets. Wang and Thi (2013) used correlation coefficients in their study to probe whether China really survived the Asian financial crisis as many economists had believed. Similarly, Baig and Goldfajn (1999) used correlation coefficients to probe for evidence of contagion

among the financial markets of 5 Asian countries during the Asian financial crisis of 1997.

The research methodology is marginally limited in its assumption that the correlations between the markets have a stable and predictable pattern over time, yet correlations can in fact change. However, since market integration is more likely to increase than to decrease over time, it is safe to assume that even if the market correlations are not stable over time and do in fact change, they are more likely to increase than to decrease.

The software used for the research are Microsoft Excel and IBM SPSS Statistics. The IBM SPSS Statistics software is used specifically to run a regression analysis while all the other data calculations are done using Microsoft Excel. The next section presents the sample data used to analyse whether benefits from IPD still exist from a South African perspective and if so, to determine whether these benefits will still be sustainable in the near future.

3.2 Sample Data

The research uses historical data collected from databases such as the Bloomberg terminal as well as online websites such as FRED Economic Data, Investing.com and Yahoo Finance. Secondary data in the form of spreadsheets containing historical monthly opening and closing prices for different sample indices as well as the yields of different governments treasury bills are collected on a monthly frequency and used in the statistical analysis. Data collection on a daily frequency was overlooked because stock exchanges close on public holidays which differ from country to country (Cliffe, 2019) and therefore this would create an uneven sample size among the different indices.

The study period is a 10-year period running from 1st July 2009 to 30th June 2019. The study duration is sufficient to analyse and identify the pattern of movements in the correlations between the different stock indices' returns. In addition to this, a comparison is drawn up between the different indices to assess if correlations have indeed risen over the years with the said rise in global integration.

The JSE ALSI is a South African market capitalisation index representing South Africa's stock market. The other indices in the research include the S&P 500 and the FTSE 100 representing the developed markets of the United States of America and the United Kingdom respectively. On the other hand, the IBOVESPA representative of Brazil's stock market and SSE Composite Index representative of China's stock market are used in the research to depict emerging markets.

Brazil and China are selectively placed in the country sample to represent emerging markets since they are BRICS member countries and therefore have close ties to South Africa. On the other hand, not only do the U.S. and UK have some of the strongest and most stable currencies worldwide, they are also some of the major controllers of the global stock market with the U.S. and UK's stock markets accounting for about 40% and 4.49% of the world market cap respectively (Seeking Alpha, 2018) thus making them suitable proxies for developed markets in the research.

A closer look is taken at the correlation coefficients between the indices during periods of exogenous shocks as well. Non-probability sampling is purposively used to select just a few exogenous shock periods to be studied as selecting the shock periods by random may not enable the research to have a representative sample.

Four exogenous shocks which all occurred within the study period are used in the research as they are all believed to have had an effect on each of the selected countries' stock markets. They include the Libor scandal that commenced in 2012 after a number of financial institutions and international banks were incriminated in a scheme that involved manipulating the London Interbank Offered Rate for their own benefits (McBride, 2016); Brexit which began on 23rd June 2016 after 52% of the people participating in the UK European Union membership referendum voted to withdraw from the European Union (BBC News, 2018); the resignation of the former South African president Jacob Zuma on 14th February 2018 after receiving intense pressure to step down from his own political party (News24, 2018) and lastly, the trade war between China and the United States of America which intensified in April 2018 after China announced its plans to impose 25% trade tariffs

on a number of US goods as retribution for similar tariffs imposed by the US on about 1,300 Chinese products (BBC News, 2018).

3.3 Hypothesis Development

The research forms hypotheses based on theoretical principles and prior studies that point towards international diversification benefits being limited due to the increasing global stock market correlations over time as a result of increased global economic and financial integration (King et al., 1990; Goetzmann et al., 2001; Chesnay and Jondeau, 2003).

Correlations are said to be stronger as they move closer to +1 or -1. Correlation coefficients of ± 0.7 and above are considered to be strong (Balentyne and Mindrila, 2013; Rumsey, n.d.). On the other hand, correlation coefficients that lie between ± 0.5 and ± 0.7 are considered to be moderate, while those that lie below ± 0.5 are considered to be weak. The stronger a positive correlation coefficient is, the more limited the potential diversification benefits are.

Many studies suggest that any correlation coefficient below +1 provides some sort of diversification benefit since the markets would not be perfectly positively correlated. However, after factoring in the extra costs incurred such as currency conversion costs and costs of hiring investment portfolio managers, a correlation coefficient that is just slightly below +1 does not cut it to consider IPD a worthwhile investment strategy.

Therefore, for purposes of these hypotheses, the case for IPD being a worthwhile investment strategy can only be argued for if the correlations between South Africa's stock market and the sampled stock markets are not positively strong (i.e. are below +0.7) and are statistically significant.

3.3.1 Developed Market Hypothesis

Despite the fact that developed markets possess less investment risk from a policy, political and corporate governance perspective, this comes at the expense of realisable returns and thus offering potentially smaller payoffs from investments (Money Lion, 2018). More so, a number of studies such as Cha and Oh (2000) and

Syriopoulos (2007) have shown that cointegration between emerging stock markets and developed stock markets has increased over time. Therefore, the null hypothesis states that there are no statistically significant long-run benefits for South African investors to reap from internationally diversifying their portfolios into developed markets.

Contrarily, the alternative hypothesis states that there are statistically significant long-run benefits for South African investors to reap from internationally diversifying their portfolios into developed markets.

To test the hypotheses, a one-tailed test is run using Fisher's Z transformation at the 5% level of significance. This method is the most suitable to test the correlations' statistical significance seeing as the correlation being tested against is a non-zero value (Thorndike, 2007).

The developed market hypotheses can be described using the formulas below:

$$H_0: \rho \geq 0.7$$

$$H_1: \rho < 0.7$$

Where: H_0 = null hypothesis

H_1 = alternative hypothesis

ρ = the population's correlation

3.3.2 Emerging Market Hypothesis

While emerging markets offer higher returns as a result of their fast-pace monetary growth in order to catch up to developed markets, their returns are significantly volatile. Investing internationally in emerging markets increases the riskiness of the potential returns even further as the aspect of exchange rate risk is introduced (Hauser et al., 1994). While the cointegration among emerging stock markets is generally expected to be lower than the cointegration among developed stock markets, it is still crucial to test that the cointegration between emerging stock markets has not increased to an inapt magnitude. Therefore, the null hypothesis states that there are no statistically significant long-run benefits for South African

investors to reap from internationally diversifying their portfolios into emerging markets.

Contrarily, the alternative hypothesis states that there are statistically significant long-run benefits for South African investors to reap from internationally diversifying their portfolios into emerging markets. The hypotheses are tested with a one-tailed test using Fisher's Z transformation at the 5% level of significance.

The emerging-market hypotheses can also be described using the formulas below:

$$H_0: \rho \geq 0.7$$

$$H_1: \rho < 0.7$$

3.4 Measures for Data Analysis

The returns' calculations are based on indices quoted in their respective domestic currencies. This is because differences in currency exchange rates do not affect the calculated index returns. Because asset returns are not normally distributed and calculations using simple returns do not take into account the effects of compounding, the research calculates the indices' returns logarithmically. Illustrated below is the formula that is used to calculate the indices' respective monthly returns:

$$Monthly\ Return = \ln\left(\frac{P_1}{P_0}\right) \quad (1)$$

Where: P_0 = the monthly opening price of the index

P_1 = the monthly closing price[3] of the index

ln = natural log

[3] The research uses closing prices rather than the adjusted closing prices to calculate index returns. This is because while the adjusted closing price accounts for other factors such as stock splits or new stock offerings that might affect the index price after the market closes, the closing price represents an index's raw price at the time the market closes.

3.4.1 Performance Measurement

The indices are assessed individually, and their performances are evaluated and compared against one another. Firstly, the mean return is derived for each index as an average of the monthly returns during the entire study period. The formula used to calculate mean monthly returns is as follows:

$$Mean\ Monthly\ Return = \frac{\Sigma R_i}{N} \quad (2)$$

Where: R_i =monthly return on an index

N = the total number of months for which an index's returns are collected

It is short-sighted to only consider the returns of the indices when analysing and comparing their performances thus making it important to calculate each index's standard deviation as well. The standard deviation of an index represents the variability in the index's returns. Therefore, an index with a higher standard deviation is considered to possess more risk than an index with a lower standard risk. Standard deviation can be calculated using the formula below:

$$Standard\ deviation = \sqrt{\left[\frac{\Sigma(R_i - \bar{R}_\iota)^2}{N-1}\right]} \quad (3)$$

Where: $\bar{R}_\iota$ = mean monthly return of an index

The returns and standard deviations are then compounded annually since compounded figures present a more detailed picture of how the original amount of an investment is cumulatively affected by a series of gains and losses over a period of time (Chen, 2019).

The compounded annual returns and annualised standard deviations are calculated for each index using the formulas below:

$$Compounded\ annual\ return = \left(1 + \frac{\Sigma R_i}{N}\right)^n - 1 \quad (4)$$

$$Annualised\ standard\ deviation = Standard\ deviation \times \sqrt{n} \qquad (5)$$

Where: n = number of periods in a year

However, it is not sufficient to rely solely on simple performance metrics since they do not take into account the level of investment risk. Risk-adjusted returns are more accurate performance measures as they present an investment's return relative to the amount of risk said investment has taken over a given period of time (Chen, 2018).

The Sharpe ratio, developed by economist William F. Sharpe is one of the more familiar performance measures for portfolios (Sharpe, 1994). The Sharpe ratio measures the amount of compensation that investors receive for the risk they've taken on by calculating the investment's excess return in excess of the risk-free rate, per unit of standard deviation.

To analyse the risk-adjusted returns of each index, the Sharpe ratios are calculated using the formula below:

$$Sharpe\ ratio = \frac{R_I - R_f}{S_I} \qquad (6)$$

Where: R_I = Compounded annual return of the index

R_f = Risk-free rate of return

S_I = Annualised standard deviation of the index

The risk-free rate of return is the rate of return on an investment with no risk of loss. It is, therefore, the lowest return that an investor expects on any investment because the investor is unwilling to take on additional risk unless the potential rate of return exceeds the risk-free rate (Borad, 2018). Long term government bond yields or the current treasury bill rate are the most commonly used proxies for the risk-free rate. In practice, the risk-free rate is hypothetical because all investments contain some form of risk. However, treasury bills and bonds are the closest that an investment can get to being risk-free due to the fact that they are backed by the government and

therefore contain significantly low default risk since governments rarely default on their debt obligations, even in times of intense economic stress.

The study uses the compounded annual yield of the three-month treasury bills of each index's country of origin as their respective risk-free rates. The respective three-month treasury bill yields are collected on a monthly frequency from the Bloomberg terminal. These yields are then compounded to derive an annual figure representative of the risk-free rate. For example, yields for the US three-month treasury bill were collected for the entire study period and compounded annually to derive the risk-free that was used as a benchmark against the S&P 500 index while the compounded annual yield for the South African three-month treasury bill represented the risk-free rate when comparing with the JSE ALSI.

Therefore, an investment with a higher Sharpe ratio is considered to have superior performance as the higher Sharpe ratio indicates higher returns generated per unit of risk. On the other hand, a negative Sharpe ratio results from an investment having a return below the risk-free rate and does not bear any useful meaning (Hargrave, 2019).

3.4.2 Pearson Correlation Test

The relationships between the sampled stock indices are established by the use of correlation coefficients. Using the monthly returns of the indices, the Pearson's correlation coefficient formula is used to calculate the correlation between the stock indices. Pearson's correlation coefficient is one of the most commonly used measures of linear dependency and is suitable when dealing with two random variables (Ly et al., 2018). Baur and Schulze (2005) are also in agreement as they assert that linkages among financial markets can be efficiently estimated using Pearson's correlation coefficient. The formula for Pearson's correlation coefficient is illustrated below:

$$r = \frac{N(\Sigma \mathrm{xy}) - (\Sigma x)(\Sigma y)}{\sqrt{(N\Sigma x^2 - (\Sigma x)^2)(N\Sigma y^2 - (\Sigma y)^2)}} \quad (7)$$

Where: r = correlation coefficient.

y = the dependent variable which in this case will be the monthly returns of the JSE ALSI.

x = the independent variable which in this case will be the monthly returns of one of the other sample indices.

The value of the correlation coefficient always lies between the range of -1 and +1. A correlation coefficient of +1 is indicative of a perfect positive relationship meaning that for every increase or decrease in one variable, there is an equally proportionate increase or decrease in the other variable. Contrarily, a correlation coefficient of -1 is indicative of a perfect negative relationship meaning that for every increase in one variable, there is an equally proportionate decrease in the other variable (Gideon, 2007). Therefore, assets or stock markets that have a correlation coefficient of +1 move in the same exact direction while those with a correlation coefficient of -1 move in opposite directions. A coefficient of zero means that the variables are not related at all.

Consequently, correlation coefficients that are closer to zero or that are negative are preferential when diversifying portfolios. Therefore, for international diversification benefits to be attained, a South African investor would have to invest in countries whose stock markets have low to medium correlations with the stock market of South Africa.

It is also important to note that correlation does not equate to causation (Crossman, 2019). Therefore, while there may be a strong correlation between any two stock markets, this does not necessarily mean that the returns and volatility of one stock market are caused by the other.

3.4.3 Graphical Analysis

The price comovements among stock indices can also be tracked by plotting a time series of price data onto a given graph. The research uses line graphs to compare the magnitudes of price movements of the different stock indices from a common starting point. Indexing of data to a common starting point enables accurate comparisons of general movements such as growth rates in numeric data that has

largely varying magnitudes (Federal Reserve Bank of Dallas, n.d.). The formula used to index data to a common starting point is as follows below:

$$\bar{x}_t = \left[\frac{x_t}{x_0}\right] \times 100 \quad (8)$$

Where: $\bar{x}_t$ = the new indexed value of the variable

x_t = the raw data value in a given time period

x_0 = the raw data value in the initial time period

3.4.4 Fisher's Z Transformation

It is important to test the statistical significance of the calculated correlation coefficients seeing as they are derived from a sample period representative of a much larger time period.

While T-tests are usually used to test null hypotheses where the hypothesized population correlation is equal to zero, Fisher's Z transformation is useful in testing a null hypothesis that a generated correlation coefficient is significantly different from a hypothesized non-zero value (Thorndike, 2007). Since correlation coefficients lie between the restrictive range of +1 and -1, the sample distribution is symmetrical when ρ = 0 because the sample deviations can materialise in either direction of 0. However, the sample distribution becomes asymmetrical as ρ moves away from 0 due to the fact that one end of the sampling distribution becomes more restricted than the other because of the limiting range of +1 and -1. Fisher's Z transformation fixes this problem of asymmetry by transforming the generated correlation coefficient into a Z-score to normalize the sampling distribution.

To transform the correlation coefficient, the formula below is used:

$$Z_F = 1/2 \ln\left(\frac{1+r}{1-r}\right) \quad (9)$$

Where: Z_F = Z-score

r = Pearson's correlation coefficient

The normalized sampling distribution will have a standard error of:

$$\sigma Z_F = \frac{1}{\sqrt{(N-3)}} \quad (10)$$

Where: σZ_F = standard error of Z-score

N = sample size

Therefore, to test the null hypothesis, firstly both the generated correlation coefficient and the hypothesized population correlation being tested against are transformed into Z-scores using formula (9) and then tested using the formula below:

$$Z = \frac{Z_{Fr} - Z_{F\rho}}{1/\sqrt{N-3}} \quad (11)$$

Where: Z_{Fr} = the transformed value of the generated correlation coefficient

$Z_{F\rho}$ = the transformed value of the hypothesized correlation coefficient

Z = Z-value

The Z-value obtained in formula (11) is compared against a critical value to decide whether to reject the null hypothesis or not. Since the hypothesis test being run is a lower tailed test at the 5% significance level, a critical value of -1.645 is used for the research (LaMorte, 2017).

A Z-value that exceeds the critical value indicates that the sample correlation is statistically significant and therefore the null hypothesis must be rejected. On the other hand, the researcher fails to reject the null hypothesis if the Z-value does not exceed the critical value as this implies that the sample correlation is not statistically significant. Additionally, if Fisher's Z transformation test is run in Microsoft Excel, P-values are generated as well and they can also be used to make an inference on the statistical significance of a given correlation coefficient. A P-value that is less than the significance level of 5% signifies statistical significance while a P-value above 5% signifies that the correlation coefficient is statistically insignificant.

3.4.5 Regression Analysis

A regression analysis is performed under the Arbitrage Pricing Theory (APT) model. APT revolves around the notion that it is possible to forecast an investment's returns by establishing the linear relationship that lies between the investment's expected returns and various macroeconomic factors that account for systematic risk (Hayes, 2019). The research implements the APT model to establish which sectors are most influential towards the performance of the stock markets of each of the sample countries. This enables the researcher to provide recommendations to South African investors interested in IPD in regard to which foreign sectors would be the best alternatives for investment.

The regression is used to test 10 sectors that are common to all the stock markets of Brazil, China, UK and the U.S. in order to discover which sectors are most influential in driving the performance of their respective national stock markets. The different 10 sectors tested include; consumer discretionary, consumer staples, energy, financial, health care, industrials, information technology, materials, telecommunication services and utilities.

The equation for the regression run on each national stock index is as follows:

$$R_i - R_f = \alpha_p + \beta_{fin}(R_{fin} - R_f) + \beta_{ind}(R_{ind} - R_f) + \ldots + \beta_n(R_n - R_f) + \varepsilon \quad (12)$$

Where: R_i = monthly return on the index

R_f = risk-free rate

α_p = the index's abnormal return

β_{fin} = sensitivity of the index's performance to movements in the financial sector's risk premium

R_{fin} = monthly return on the financial sector

β_{ind} = sensitivity of the index's performance to movements in the industrials sector's risk premium

R_{ind} = monthly return on the industrials sector

ε = standard error

When running the regression, the equation is extended to include all the previously named 10 sectors.

3.5 Conclusion

This chapter provided an in-depth examination of the methods implemented, as well as the procedure that the research followed to empirically present the relationships within the variables of interest. This chapter also gave a brief background of the methods used in the research as well as an explanation of the implications of the potential results from the research. The succeeding chapter presents the findings of the analysis using the methods discussed above, along with discussions that support the research's arguments.

Chapter 4: Empirical Results

This section presents a discussion of the results generated from the research methods tasked to fulfil the research's objectives.

4.1 Performance Analysis

Table 1 displays a simple assessment of the individual indices' performances over the 10-year study period with the use of the arithmetic mean monthly returns and standard deviations. During the study period running from July 2009 to June 2019, the S&P 500 index averaged the highest monthly return of 0.88% followed by the JSE ALSI with a mean return of 0.76%. The SSE Composite generated the lowest mean monthly return of 0.01% during the period of study followed by the FTSE 100 with a mean return of 0.49%.

The results from the mean monthly returns are not aligned with the general belief that less developed markets provide greater returns in comparison to more developed markets. However, the risk measures are in line with the theory that emerging market investments possess more risk than developed market investments with the highest monthly average standard deviation values derived belonging to the Ibovespa index of Brazil and SSE Composite index of China having values of 5.69% and 7.01% respectively. On the other hand, the developed market indices had less volatile returns for the period under study with the FTSE 100 having the lowest monthly average standard deviation of 3.39% while the S&P 500 had the third-lowest monthly average standard deviation of 3.70%.

However, the arithmetic mean return is a rather simplistic measure that lacks some accuracy as a performance measure due to the fact that it does not take into account the effects of compounding from period to period. Therefore, it is essential for the research to implement further performance measures in support of the prior used method.

Table 2 presents more comprehensive performance measures for the analysis and comparison of the indices' performance in the form of annually compounded returns, standard deviations and Sharpe ratios since risk-adjusted returns present a

more accurate measure stemming from their ability to incorporate risk into an investment's return.

In comparison to mean returns, compounded returns present a more accurate analysis of an investment's performance over a given period of time. Compounded returns display the cumulative effect that losses and gains over time have on an original investment and are therefore less likely to overestimate or underestimate the decline or growth in an investment's actual returns due to the fact that the returns' volatilities are accounted for (Chen, 2019).

Table 1. Average monthly returns and standard deviations

Index	Mean Return	Standard Deviation
Ibovespa	0.58%	5.69%
S&P 500	0.88%	3.70%
SSE Composite	0.01%	7.01%
FTSE 100	0.49%	3.39%
JSE ALSI	0.76%	3.43%

Table 2. Compounded annual returns, annualised standard deviations, Sharpe ratios and risk-free rates

Index	Compounded return	Annualised Standard deviation	Risk-free rate	Sharpe ratio
Ibovespa	7.19%	19.72%	12.48%	-0.27
S&P 500	11.11%	12.81%	0.48%	0.83
SSE Composite	0.11%	24.27%	2.85%	-0.11
FTSE 100	6.03%	11.76%	0.41%	0.48
JSE ALSI	9.54%	11.90%	6.59%	0.25

The compounded return and standard deviation values followed the trend of the monthly values, with the S&P 500 having the highest compounded return of 11.11% and the SSE Composite having the lowest compounded return of 0.11%. Similar to the results from Table 1, the results from Table 2 reflected that the emerging markets indices possessed the most risk, with the Ibovespa and SSE Composite registering the highest annualised standard deviations of 19.72% and 24.27% respectively.

Utilising the risk-free rates, the Sharpe ratios calculated revealed that the S&P 500 remained the best performing index on a risk-adjusted basis with a Sharpe ratio of 0.83. However, contrary to the compounded return measure, the FTSE 100 outperformed the JSE ALSI with a Sharpe ratio of 0.48 which was nearly double the JSE ALSI's Sharpe ratio of 0.25. The SSE Composite and Ibovespa both had negative Sharpe ratios as a result of their respective compounded annual returns being less than their respective risk-free rates.

In conclusion, while the compounded returns present rather mixed results of the indices' performances, the Sharpe ratios integrate the indices' risk levels with their respective return levels and show that the developed market indices performed better than the emerging market indices during the study period.

4.2 Testing for a Pattern in the Linear Relationship Between Stock Markets Over Time

As referenced in the literature review, many studies point out that financial market integration is a phenomenon that has continued to increase gradually over time. The research earlier pointed out the increase in stock market integration as one of the factors that could potentially be most detrimental to IPD as an investment strategy, especially within an emerging market such as South Africa. Therefore, the research tests for a pattern of increment or reduction in correlations between the sample stock markets to provide some insight as to whether stock markets have substantially become more integrated overtime. To test this, the price comovements between the

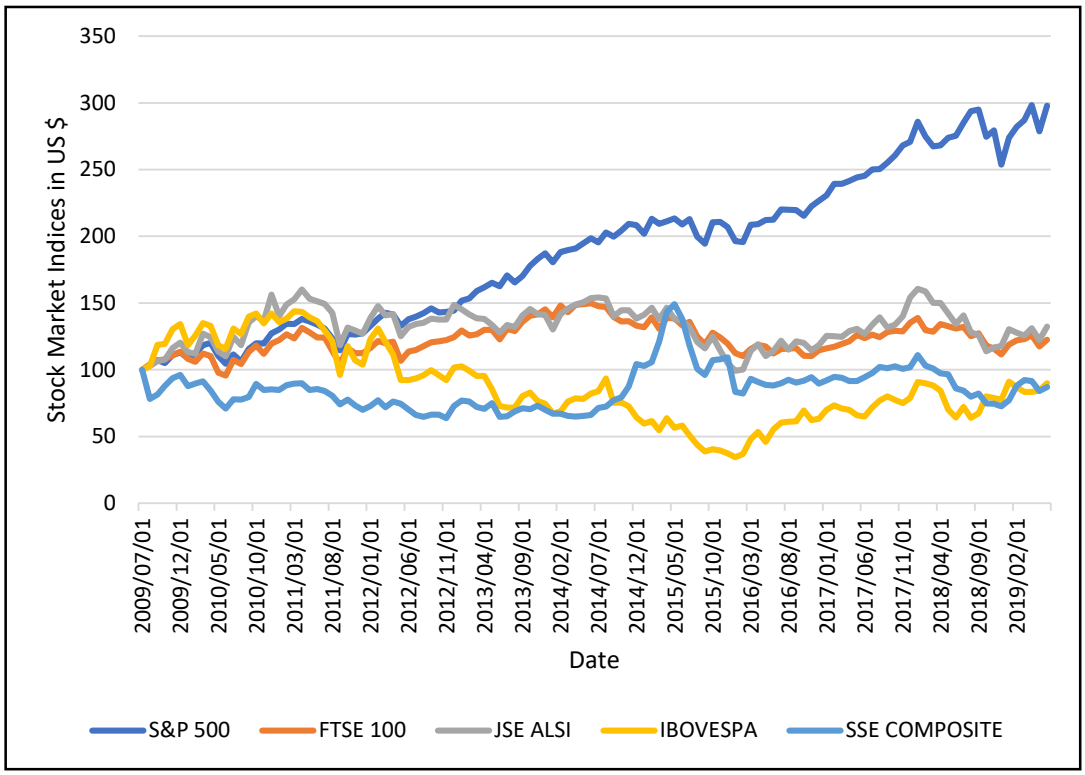

Figure 1. Co-movements among the stock indices' prices. This figure graphs the closing price movements of the sample stock indices denominated in U.S. dollar values between the period of July 2009 and June 2019. The data used in the above figure is indexed to 100 to a common starting point of 31st July 2009.

sample indices as well as their correlation coefficients are analysed and checked for gradual increments over the 10-year study period.

Figure 1 illustrates the degree of comovements among closing prices[4] of the sampled stock indices over the study period. Between the years 2009 and 2012, all the stock indices except the SSE Composite had their prices moving very closely together and in the same direction for the most part. After 2012, there was less co-movement among the indices' prices with the S&P 500's price continually rising throughout the period while the Ibovespa experienced a deteriorating price for the majority of the time period after 2012. However, the JSE ALSI and the FTSE 100 maintained very close price co-movements from the start throughout the entire period, while the SSE Composite that experienced negative price movements for the first half of the study period rose in the second half of the period and followed

[4] The stock indices' U.S. dollar closing prices were obtained from the Bloomberg terminal.

the directional movements of the JSE ALSI and the FTSE 100 for majority of the remaining period.

In addition to analysing the indices' price trends, the correlation coefficients among all the sample indices were measured during equal time intervals and observed for patterns of increments or reductions. The 10-year study period was subdivided into equal time intervals of two years as seen in Table 3.

Table 3. Correlations between the stock indices during different periods of time

Panel A. Correlations for the period of July 2009 to June 2011

	JSE ALSI	FTSE 100	S&P 500	Ibovespa	SSE Composite
JSE ALSI	1.000				
FTSE 100	0.824	1.000			
S&P 500	0.831	0.893	1.000		
Ibovespa	0.745	0.817	0.797	1.000	
SSE Composite	0.504	0.388	0.451	0.517	1.000

Panel B. Correlations for the period of July 2011 to June 2013

	JSE ALSI	FTSE 100	S&P 500	Ibovespa	SSE Composite
JSE ALSI	1.000				
FTSE 100	0.691	1.000			
S&P 500	0.600	0.886	1.000		
Ibovespa	0.668	0.703	0.734	1.000	

SSE Composite	0.636	0.461	0.361	0.506	1.000

Panel C. Correlations for the period of July 2013 to June 2015

	JSE ALSI	FTSE 100	S&P 500	Ibovespa	SSE Composite
JSE ALSI	1.000				
FTSE 100	0.634	1.000			
S&P 500	0.477	0.670	1.000		
Ibovespa	0.510	0.304	0.443	1.000	
SSE Composite	0.016	0.019	-0.060	-0.026	1.000

Panel D. Correlations for the period of July 2015 to June 2017

	JSE ALSI	FTSE 100	S&P 500	Ibovespa	SSE Composite
JSE ALSI	1.000				
FTSE 100	0.300	1.000			
S&P 500	0.601	0.641	1.000		
Ibovespa	0.312	0.378	0.435	1.000	
SSE Composite	0.270	0.288	0.626	0.510	1.000

Panel E. Correlations for the period of July 2017 to June 2019

	JSE ALSI	FTSE 100	S&P 500	Ibovespa	SSE Composite
JSE ALSI	1.000				
FTSE 100	0.533	1.000			
S&P 500	0.469	0.612	1.000		
Ibovespa	0.034	0.061	0.191	1.000	
SSE Composite	0.260	0.503	0.575	0.252	1.000

The research is tasked with investigating the patterns of the linear relationships between stock markets over time. However, the research does not register a pattern of increments or reductions in the correlations that exist between the stock indices. The results derived from Table 3 are rather inconclusive. Excluding the SSE Composite's correlation with the JSE ALSI and the FTSE 100, all the indices' correlations reduced in the second time interval seen in Panel B, while all of the indices registered significant decreases amongst their correlations in the third time interval as seen in Panel C. This is contrary to the theory that stock markets become more correlated as the integration of financial markets increases over time.

Additionally, the results of the fourth- and fifth-time intervals displayed in Panel D and Panel E respectively are mixed. For example, the JSE ALSI experienced a decrease in its correlations with the FTSE 100 and the Ibovespa between 2015 and 2017 while its correlations with the S&P 500 and the SSE Composite increased within the same time interval. However, between 2017 and 2019, the JSE ALSI experienced an increase in its correlation with the FTSE 100 while its correlations with all the other indices declined.

Table 3 presents no evidence that the increased market integration has a predictable effect over time on the correlations between the stock indices that would impede the effectiveness of IPD.

If anything, the increments between the stock indices are more explainable by the high volatility experienced in exogenous shock periods. As seen in Figure 1 in the period between 2009 and 2012 as well as in Panel A displaying the interval between 2009 and 2011, the correlations between majority of the indices were higher compared to the succeeding time period shown in Panel B. It can be reasoned that the higher correlations in the first interval period were simply an after effect of the 2008 financial crisis which is believed to have had effects stretching into the earlier years of the first interval period of July 2009 to June 2011 (Oxenford, 2018). This prompts the research to analyse the correlations among the stock indices during the study's sample shock periods as well.

4.3 Analysis of the Correlations Between South Africa's Stock Market and each Sample Stock Market

Since the focus of the research is on the perspective of South African investors, the following sections' centre of attention is the correlations that lie between the South African JSE ALSI and each sample stock index. The cross-correlations that exist between the other non-South African stock indices are not discussed going forward. Therefore, in order to analyse the viability of IPD in a South African context, the research analyses the correlations that the S&P 500, FTSE 100, Ibovespa and SSE Composite each have with the JSE ALSI in the long term using the entire duration of the study period as well as in the short term by assessing the sample duration of shock periods.

First, scatter plots are implemented to have an idea of what to expect and establish whether the JSE ALSI has any sort of linear relationship with each of the sample stock indices. Figure 2 below displays the scatter plots giving a visual presentation of the linear relationships present between the returns of the JSE ALSI and each sample stock index during the entire duration of the study period.

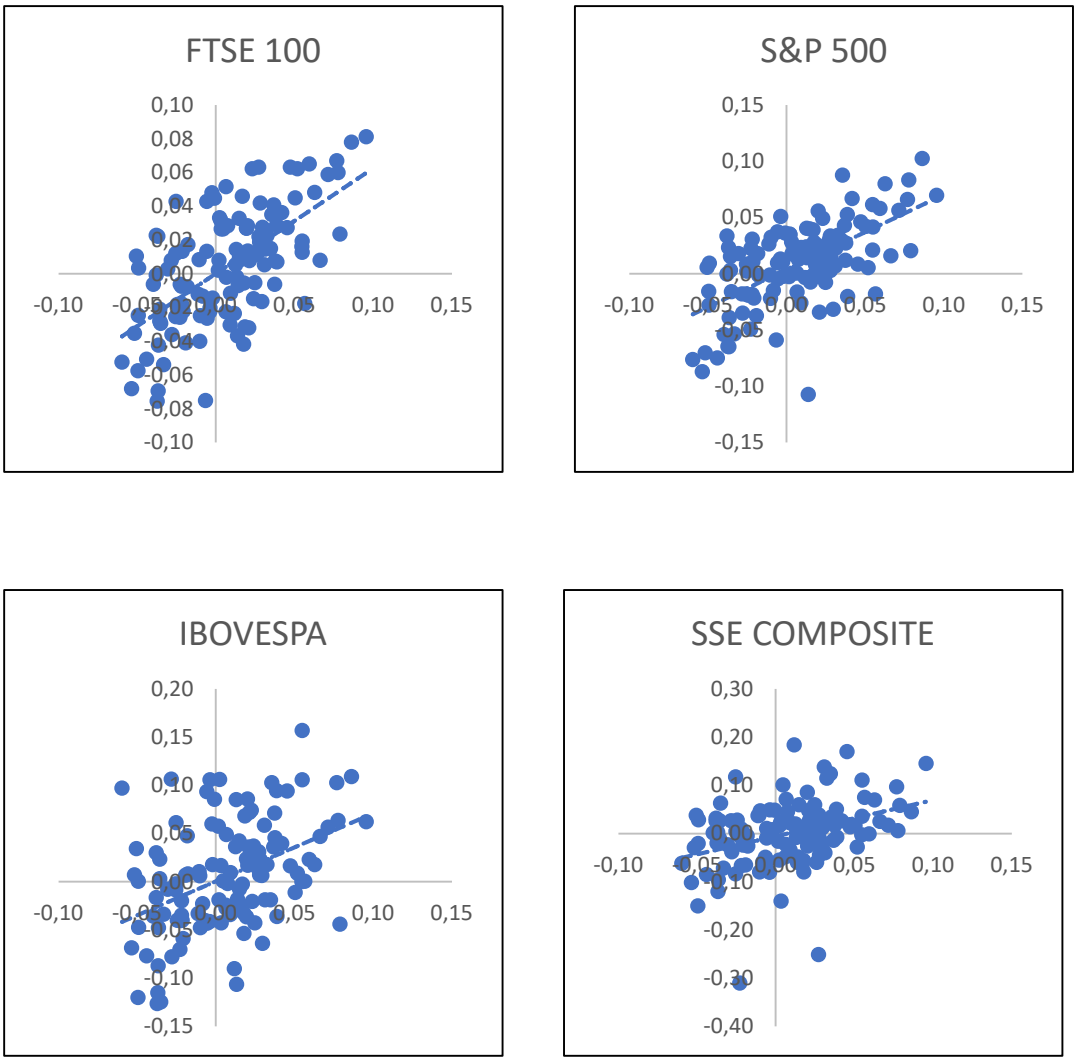

Figure 2. Scatter plots showing the relationships that the JSE ALSI's returns have with each stock index.

An uphill pattern moving from the left to the right side of a scatter plot indicates a positive relationship between the independent and dependent variables while a downhill pattern from the left to the right side of a scatter plot is indicative of a negative relationship between the variables (Rumsey, n.d.). A line of best fit can be drawn through the data points of a scatter plot to better visualise the relationship between the data points.

Figure 2 shows that all the sample stock indices had positive linear relationships with the JSE ALSI between the period of July 2009 and June 2019 as the lines of best fit for each scatter plot have positive slopes. It is also important to note that the

steeper the slope of the line of best fit is through the data points, the greater the correlation is between these data points. Based on this information, it is safe to say that the FTSE 100 had the highest correlation with the JSE ALSI since the line of best fit through their data points evidently has the steepest slope. On the other hand, the line of best fit through the data points of the SSE Composite scatter plot had the least steep slope meaning that the among all the sample stock indices, the JSE ALSI's correlation was lowest with the SSE Composite.

In order to get a more in-depth analysis of the linear relationships identified in Figure 2, Table 4 illustrates the coefficients as well as the levels of significance of the correlations between the monthly returns of the JSE ALSI and each index in the research sample for the entire study period of July 2009 to June 2019. Similar to Figure 2, the results of Table 4 show that all the indices had a positive correlation with the JSE ALSI. While negative correlations would be preferred, the existence of positive correlations does not entirely negate the benefits of IPD since negative correlations between stock markets are more theoretical rather than practical at this point in time due to global integration.

Table 4. Correlations between the JSE ALSI and each stock index for the full study period of July 2009 to June 2019

Index	r	P-value	Z-value
FTSE 100	0.632	0.092	−1.330
S&P 500	0.618	0.058	−1.574
Ibovespa	0.424 **	0.000	−4.489
SSE Composite	0.366 **	0.000	−5.236

* and ** indicate statistical significance at the 5% and 1% levels respectively.

As seen in Table 4, the FTSE 100 and S&P 500 indices had the highest correlation coefficients with the JSE ALSI. Despite the developed market stock indices having the highest positive correlations with South Africa's JSE ALSI, these correlations were below +0.7 and thus still not considered strong enough to totally negate the

usefulness of IPD. However, both of the FTSE 100 and S&P 500's correlations with the JSE ALSI were not statistically significant with respective Z-values of -1.330 and -1.574 as well as P-values of 0.092 and 0.058 respectively. Therefore, the research failed to reject the developed market null hypothesis because there was no evidence to disprove the existence of strong positive correlations between the developed market indices and JSE ALSI in the long run.

On the other hand, the Ibovespa and SSE Composite indices that served as proxies for the stock markets of emerging markets, had relatively low positive correlation coefficients with the JSE ALSI with the Ibovespa of Brazil having a correlation with the JSE ALSI of 0.424 (Z-value = -4.489, P-value = 0.000) while the SSE Composite index of China had the lowest correlation with the JSE ALSI with a coefficient of 0.366 (Z-value = -5.236, P-value = 0.000). Both of these correlation coefficients were statistically significant at the 1% significance level and therefore the researcher rejected the emerging market null hypothesis.

Therefore, South African investors would not realise long-run benefits from diversifying their portfolios into developed markets while they would reap benefits in the long run from diversifying their portfolios into emerging markets. This implies that IPD as an investment strategy would be more beneficial to South African investors if they overweighed their international portfolios with assets from emerging markets.

4.4 Investigating the Correlations Between the Sample Stock Markets During Shock Periods

The analysis period for each shock period begins three months prior to the initial occurrence date of the shock in order to observe the effects if any of market signalling as well as speculation among investors. Since the shock periods do not have conclusive end dates, the research uses a sample duration ranging between 12 and 16 months for the different shock periods. To investigate the impact that exogenous shocks have on the effectiveness of IPD to South African investors, the research implements rolling correlations to check the trend of the JSE ALSI's

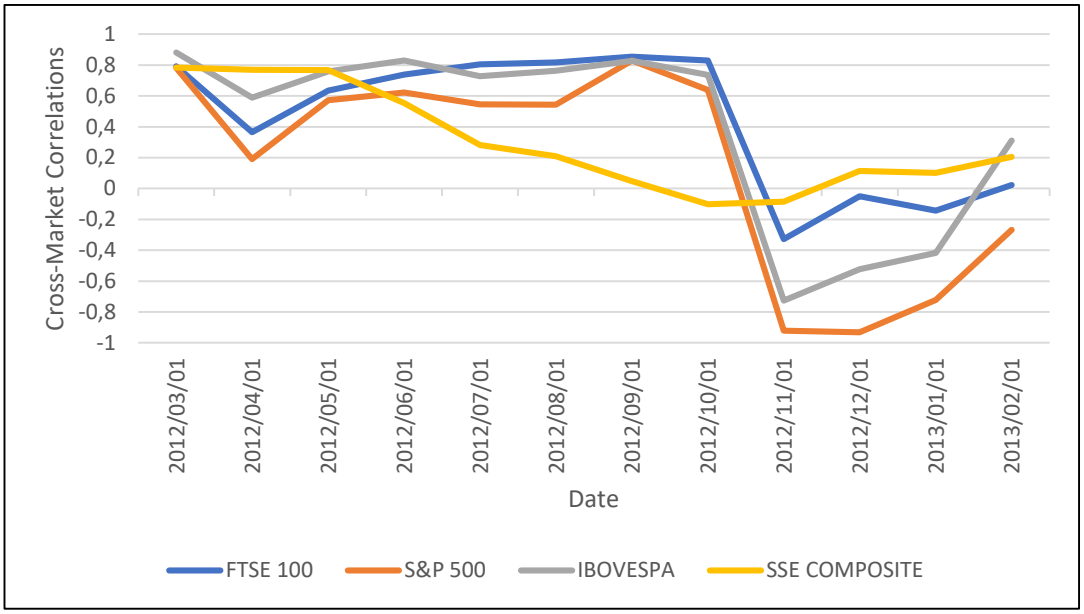

Figure 3. Cross-market rolling correlations during the Libor scandal. The rolling correlations between the JSE ALSI and each sample stock index are calculated as the six-month moving averages between the indices' returns.

correlations with each sample stock index during the shock periods. Furthermore, the Pearson correlation coefficients for the entire sample duration of each shock period are calculated and tested for statistical significance.

Figure 3 illustrates the trend of the correlations that existed between the JSE ALSI and the other sample stock indices during the Libor scandal. The Libor scandal is linked to a commencement date of June 2012 when Barclays bank formally admitted to misconduct and accepted to pay fines totalling to $450 million in settlements with the U.S. and British regulators in regard to their role in manipulating the Libor rates (Reuters, 2013). As seen in Figure 3, the JSE ALSI's correlation with each of the other stock indices was gradually decreasing between March and April of 2012. However, the JSE ALSI's correlations with the FTSE 100, S&P 500 and Ibovespa all experienced a sharp increase in the month of April, two months prior to Barclays' admission to misconduct which is evidence of some degree of market signalling and herd mentality effects. The correlations mentioned prior continued to gradually increase throughout the period and reached their peak in September of 2012 after which they all experienced a drastic decline and ended the period in the region of moderate negative and moderate positive correlation coefficients. However, the JSE ALSI's correlation with the SSE Composite

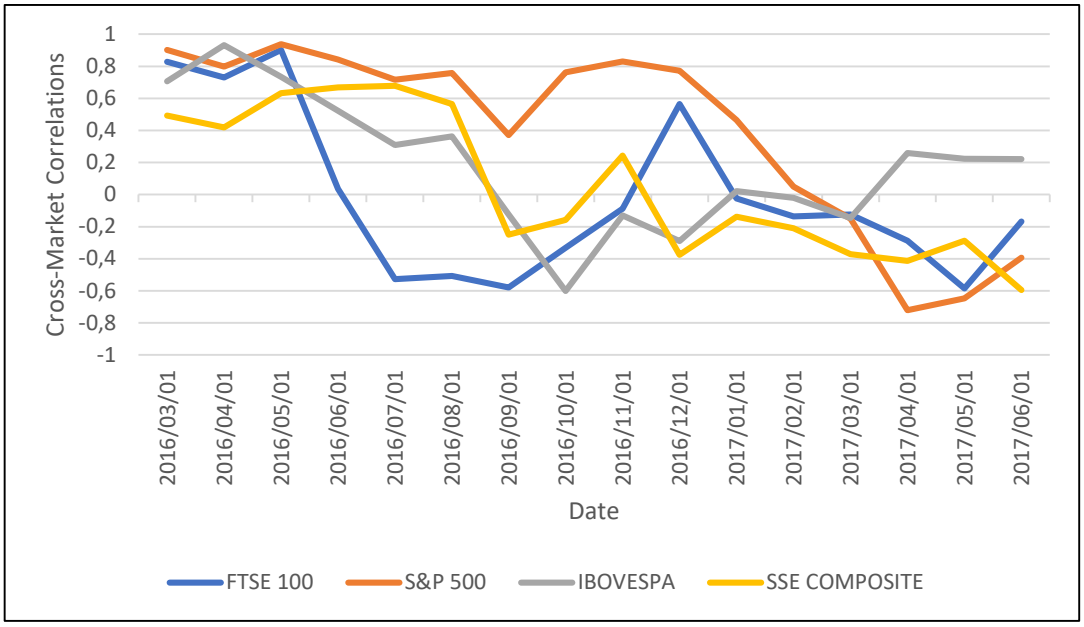

Figure 4. Cross-market rolling correlations during Brexit. The rolling correlations between the JSE ALSI and each sample stock index are calculated as the six-month moving averages between the indices' returns. The Brexit period analysis is a 16-month period starting from March 2016, three months prior to the Brexit referendum that saw leave campaigners win with a 51.9% majority vote on 23rd June 2016 (BBC News, 2018), through the 29th of March 2017 when Britain's then prime minister Theresa May triggered the legislation that commenced Britain's withdrawal process from the European Union (Onyanga-Omara, 2017).

experienced a decreasing trend for the majority of the Libor scandal period and ended the shock period in the region of moderate positive correlation coefficients as well.

As displayed in Figure 4, the JSE ALSI had very strong positive correlations with all the sample stock indices between the months of March and May of 2016. However, the majority of these correlations started to gradually decline in the months leading up to the Brexit referendum vote with the JSE ALSI's correlation with the FTSE 100 plummeting into negatives within said months. The JSE ALSI's correlations with all the sample stock indices were unstable and fluctuated throughout the shock period. Its correlations with the Ibovespa, FTSE 100 and SSE Composite were negative for a significant portion of the shock period. On the other hand, despite the JSE ALSI having negative correlations with the S&P 500 in the final three months of the shock period, these correlations were positively high for a significant portion of the shock period.

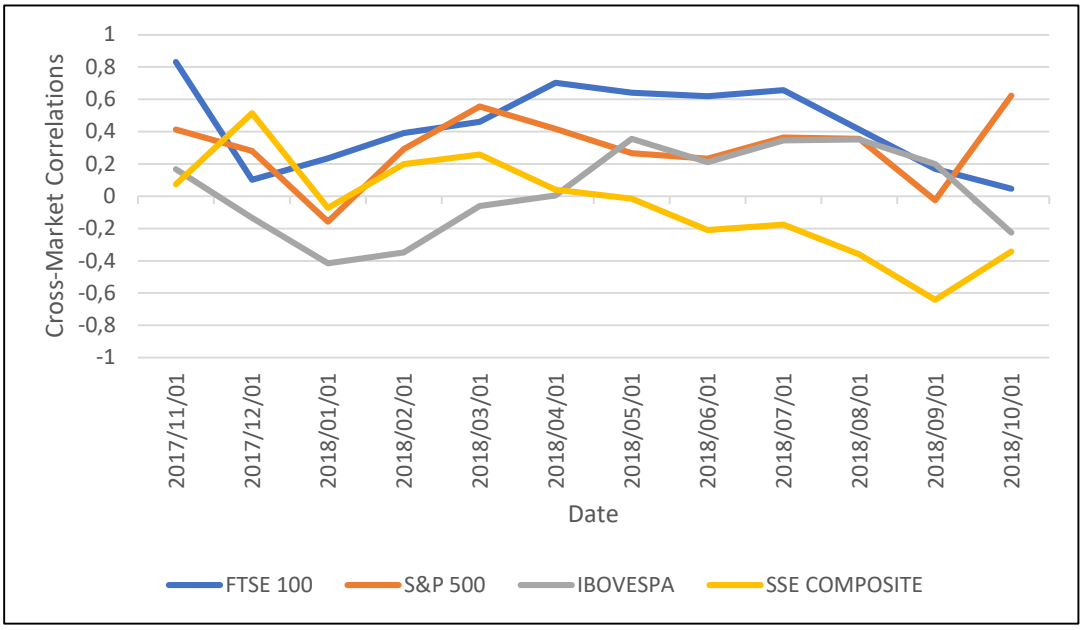

Figure 5. Cross-market rolling correlations during Zuma's resignation scandal. The rolling correlations between the JSE ALSI and each sample stock index are calculated as the six-month moving averages between the indices' returns.

The resignation of former South African president Jacob Zuma was assumed to be a sign of pending political instability within the country. To assess whether such speculations influenced investor decisions as well as stock markets at large, the correlations between the JSE ALSI and each of the sample stock indices in Figure 5 are studied for a one-year period commencing on November 2017, three months before Jacob Zuma announced his resignation. The JSE ALSI's correlation with the FTSE 100 experienced a steep decline within the first month of the shock period and then turned around in the second month to move in the opposite direction and remained positive and high for the majority of the period. While the JSE ALSI's correlation with the S&P 500 was moderately positive for the majority of the shock period only experiencing a steep increase in the month of September 2017, its correlations with the SSE Composite and the Ibovespa fluctuated throughout the shock period trending between a range of moderate positive correlations and negative correlations.

Figure 6 displays the trend of the JSE ALSI's correlations with each sample stock index during the period of the U.S. and China trade war. The portion of time studied for the U.S. and China trade war is a one-year period commencing in January of

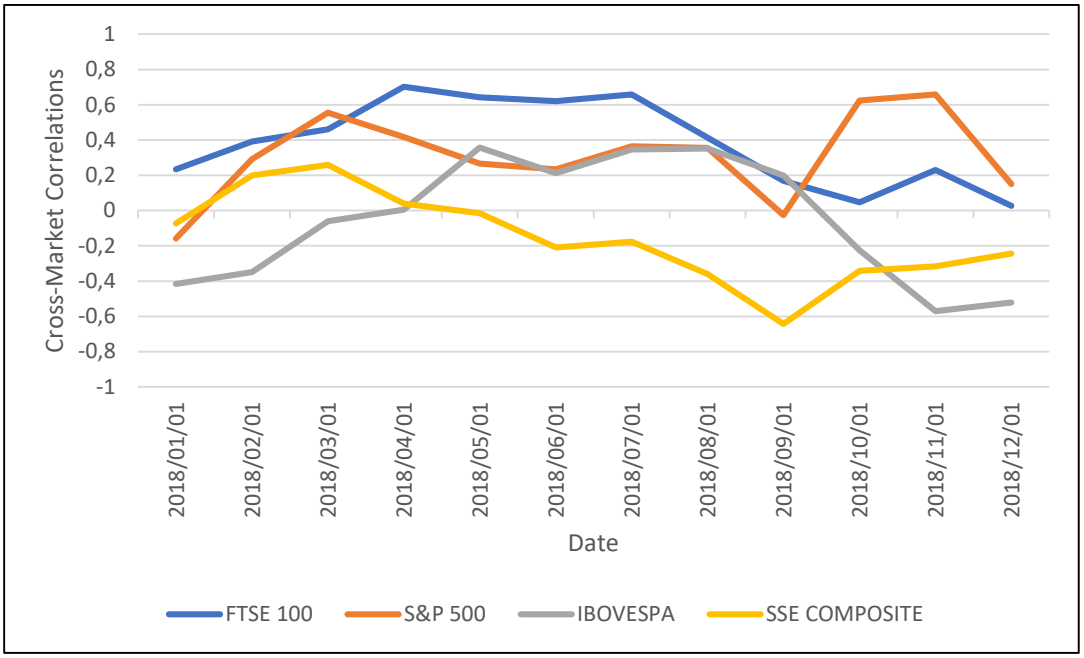

Figure 6. Cross-market rolling correlations during the U.S. and China trade war. The rolling correlations between the JSE ALSI and each sample stock index are calculated as the six-month moving averages between the indices' returns. The research points to a start date of 22nd March 2018 for the trade war. On 22nd March 2018, U.S. president Trump signed a memorandum that directed for the imposition of tariffs on Chinese products and also ordered for a dispute case to be filed against China for discriminatory licensing practices (Wong and Koty, 2019). China followed up in retaliation on 2nd April 2018 by imposing tariffs on U.S. products with an estimated value of USD 3 billion.

2018. The JSE ALSI experienced an upward movement in its correlations with all the sample stock indices during the entire three months period preceding the initial announcement on 22nd March by the U.S. to impose tariffs on Chinese products. The JSE ALSI had moderate positive correlations with the Ibovespa and the S&P 500 for the majority of the period with its correlations with the S&P 500 experiencing a sharp increase between the months of September and November. The JSE ALSI's correlations with the FTSE 100 were positive and strong for the majority of the shock period while its correlations with SSE Composite remained moderate for the entire sample period of the shock despite experiencing slight increments between January and March of 2018.

The effects of market signalling are visible in Figures 3 and 6 which display an increment in the cross-index correlations during the months preceding the initial occurrence of the shocks. However, the JSE ALSI's correlations with the sample

stock indices reacted differently to the different shock periods. Firstly, the emerging market stock indices generally maintained moderate correlations ranging between moderate positive and negative correlations with the JSE ALSI throughout significant durations of the U.S. and China trade war, Brexit and Zuma's resignation scandal. While the Ibovespa's correlations with the JSE ALSI displayed a pattern of reaction to the exogenous shocks where they usually experienced increments in either the months leading up to the initial shock occurrence or in the months succeeding the initial shock occurrence as seen in Figures 3, 5 and 6, the SSE Composite did not establish a pattern of reaction to the occurrence of these exogenous shocks.

The FTSE 100 had strong positive correlations with the JSE ALSI for a significant portion of time during the Libor scandal, Zuma's resignation scandal as well as during U.S. and China trade war. However, its correlation with the JSE ALSI was dynamic throughout the Brexit period fluctuating as high as +0.9 in May 2016 and as low as -0.59 in May 2017. On the other hand, the S&P 500 correlations with the JSE ALSI ranged between moderate positive correlations and weak negative correlations for the majority of the time during the U.S. and China trade war as well as the Zuma resignation scandal while they trended from strong positive correlations to strong negative correlations during the Libor scandal and Brexit.

Table 5 displays the correlations between each sample stock index and the JSE ALSI for the entire sample duration of each of the shocks. During the sample period of the Libor scandal, the Ibovespa and the FTSE 100 were the highest correlated with the JSE ALSI with correlation coefficients of 0.630 and 0.614 respectively. However, neither of these correlations were statistically significant as their respective P-values of 0.354 and 0.324 were above the 5% level of significance while both their Z-values of -0.375 and -0.455 were also below the critical value of -1.645, therefore implying that neither of these correlations could consistently remain below +0.7 for the full sample duration of the Libor scandal. However, both the S&P 500 and the SSE Composite had statistically significant moderately positive correlations with the JSE ALSI for the entire sample duration of the Libor scandal period with correlations of 0.300 (Z-value = -1.673, P-value = 0.047) and

0.306 (Z-value = −1.654, P-value = 0.049) implying the presence of short-run benefits from diversifying portfolios into the markets of U.S. and China even during the Libor scandal.

Table 5. Correlation coefficients, P-values and Z-values between the JSE ALSI and each stock index during the sample shock periods

Index	r, P, Z	Libor Scandal	Brexit	Zuma Resignation	Trade Wars
FTSE 100	**r**	0.614	-0.099**	0.419	0.396
	P	(0.324)	(0.000)	(0.103)	(0.089)
	Z	−0.455	−3.486	−1.263	−1.344
S&P 500	**r**	0.300 *	0.385 *	0.515	0.197 *
	P	(0.047)	(0.048)	(0.186)	(0.023)
	Z	−1.673	−1.663	−0.892	−2.004
Ibovespa	**r**	0.630	0.211 **	-0.099 **	-0.129 **
	P	(0.354)	(0.009)	(0.002)	(0.001)
	Z	−0.375	−2.356	−2.898	−2.991
SSE Composite	**r**	0.306*	0.124 **	-0.153 **	-0.224 **
	P	(0.049)	(0.004)	(0.001)	(0.001)
	Z	−1.654	−2.679	−3.064	−3.285

P-values are reported in parentheses.

* and ** indicate statistical significance at the 5% and 1% levels respectively.

The correlations between the JSE ALSI and each of the sample stock indices were all statistically significant during the sample period of Brexit with the S&P 500, Ibovespa and SSE Composite having moderate positive correlations with the JSE ALSI of 0.385 (Z-value = −1.663, P-value = 0.048), 0.211 (Z-value = −2.356, P-value = 0.009) and 0.124 (Z-value = −2.679, P-value = 0.004) respectively while the FTSE 100's correlation with the JSE was a weak negative correlation of −0.099 (Z-value = −3.486, P-value = 0.000).

As displayed in Table 5, the emerging market stock indices both had weak negative correlations with the JSE ALSI that were statistically significant for both the entire sample duration of the U.S. and China trade war as well as Zuma's resignation scandal. The developed market stock indices both had moderate positive

correlations with the JSE ALSI for the period of Zuma's resignation scandal however both of these correlations were statistically insignificant.

The results of the analysis of the JSE ALSI's correlations with the sample stock indices during the different shock periods provide evidence that not only can IPD be effective even in periods of high volatility, but there can be benefits in investing in developed markets as well in the short run. This is backed by the statistically significant moderate positive correlations that the S&P 500 had with the JSE ALSI during the Libor scandal, Brexit and the U.S. and China trade war, as well as the FTSE 100's statistically significant negative correlation with the JSE ALSI during Brexit.

4.5 APT Regression Model

Table 6 depicts the APT model regression results for the S&P 500, FTSE 100, Ibovespa and SSE Composite indices. The regressions ran on each index generate a high R-square indicating that a significant portion of the variations in each index's performance can be explained by the variations in the 10 sector risk factors.

The analysis of the regression results focusses on the beta coefficients and significance levels of the various sectors. A bigger beta coefficient indicates that the respective sector plays a bigger role in explaining the performance shifts in its respective national stock index. A sector with a p-value that is greater than 0.05 indicates statistical insignificance and this means that the sector's role in determining the changes in its respective national stock index's performance is negligible. Contrarily, a sector with a p-value that is less than 0.05 indicates statistical significance.

All of the 10 sectors are statistically significant to the performance of the S&P 500 with each sector having a p-value below 1%. Furthermore, each of the sectors has a positive beta coefficient indicating that the S&P 500's performance is positively correlated to the movements in each sector's performance. The information technology sector has the biggest beta coefficient in the S&P 500's regression followed by the financial sector with coefficients of 0.216 and 0.146 respectively, meaning that these sectors are the biggest drivers of the S&P 500's performance.

Table 6. Regression results from the multi-sector APT model

	S&P 500	FTSE 100	Ibovespa	SSE Composite
Alpha	0.000 (0.854)	0.000 (0.987)	0.017 (0.106)	-0.001 (0.106)
Consumer Discretionary	0.121 ** (0.000)	0.126 ** (0.000)	0.037 (0.360)	0.079 ** (0.003)
Consumer Staples	0.097 ** (0.000)	0.170 ** (0.000)	0.019 (0.723)	0.027 (0.233)
Energy	0.084 ** (0.000)	0.159 ** (0.000)	0.111 ** (0.001)	0.077 ** (0.000)
Financial	0.146 ** (0.000)	0.210 ** (0.000)	0.328 ** (0.000)	0.276 ** (0.000)
Health Care	0.137 ** (0.000)	0.099 ** (0.000)	-0.016 (0.477)	0.025 (0.143)
Industrials	0.100 ** (0.000)	0.073 ** (0.000)	-0.079 (0.205)	0.151 ** (0.000)
Information Technology	0.216 ** (0.000)	0.003 (0.512)	-0.019 (0.456)	0.073 ** (0.000)
Materials	0.032 ** (0.000)	0.084 ** (0.000)	0.135 ** (0.000)	0.077 ** (0.001)
Telecommunication Services	0.019 ** (0.000)	0.052 ** (0.000)	-0.026 (0.482)	0.041 * (0.018)
Utilities	0.041 ** (0.000)	0.035 ** (0.000)	1.660 (0.104)	0.113 ** (0.000)
R-squared	0.998	0.994	0.881	0.990
No. of observations	120			

P-values are reported in parentheses.
* and ** indicate significance at the 5% and 1% levels respectively. The sector returns are calculated from their respective closing prices retrieved from the Bloomberg terminal.

The FTSE 100 has a positive correlation with each of the 10 sectors as depicted by each sector's positive beta coefficient. More so, the information technology sector is the only one that is insignificant to the index's performance with all the other

sectors having p-values below the 1% significance level. On the other hand, only three of the ten sectors are significant to the performance of the Ibovespa namely; the energy, financial and materials sector, all statistically significant at the 1% level. Therefore, the Ibovespa's performance is mainly driven by the energy, financial and materials sectors.

In regard to the SSE Composite, only the consumer staples sector and health care sector are insignificant to the index's performance. The telecommunication services sector is positively correlated to the SSE Composite and statistically significant at the 5% level while all the sectors are significant at the 1% level and positively correlated to the SSE Composite as well. In order to benefit more out of IPD, South African investors are recommended to invest in the foreign country sectors that are not statistically significant or that have the smallest beta coefficients. This is because these sectors have the least influence on the performance of their respective national stock markets' performance and thus further enhance diversification.

4.6 Conclusion

This chapter aimed at presenting an empirical analysis of how effective IPD can be to South African investors. In order to predict how effective IPD can be in the future, the chapter investigated the impact that increments in financial integration, as well as exogenous shocks, had on the linear relationships between the South African stock market and the stock markets of other nations. A multi-sector regression analysis was also done to determine which sectors are the most influential in determining the performance of their respective national stock markets.

In the proceeding chapter, the research as a whole is brought to a conclusion with a discussion of the empirical findings and the implications that these findings have on the usability of IPD by South African investors.

Chapter 5: Conclusion and Recommendations

Due to the increasing number of both active and passive participants in the financial market, the decision to implement IPD can be vital to investors in emerging markets such as South Africa. Investors' need to maximise portfolio returns while minimising the portfolio's risk makes the effective and operational implementation of IPD an even more important topic than the decision to implement the strategy itself.

The second chapter of the research discussed the concept of IPD in its entirety, as well as some of its predictor variables from the viewpoint of different empirical studies done by various scholars. From the literature review, it was noted that stock market cross-correlations are the highest-ranking fundamental on the priority scale when implementing IPD. The research examined financial integration and exogenous shocks as the main predictors of IPD's effectiveness. The impact that financial integration had on the stock markets cross-correlations in the long-run was investigated while exogenous shocks were tested for their short-term impact on stock market cross-correlations. The JSE ALSI was used in the research as a proxy for the South African stock market and its correlations with other stock indices were tested over the 10-year study period for correlation strength as well as statistical significance as a means of gauging the practicality of diversifying investment portfolios across different national stock markets.

The research developed an emerging market hypothesis as well as a developed market hypothesis in order to draw a more detailed inference towards the justifiability of IPD to South African investors. While there was sufficient evidence to reject the emerging market null hypothesis, there was no conclusive evidence to reject the developed market null hypothesis thus implying that while South African investors would be able to realise long-term benefits from diversifying their portfolios into emerging markets, they would be unable to reap long-term benefits from diversifying their investment portfolios into developed markets. This is in agreement with Christoffersen et al. (2004) who asserted that the realisable diversification benefits are higher when portfolios are diversified between emerging countries.

One of the research's main tasks was to analyse the impact that financial integration has on the feasibility of IPD as an investment strategy from a South African investor's perspective. The research did not find conclusive evidence of increasing correlations over time between the sample stock markets despite a number of prior studies asserting that financial markets have become substantially more integrated over the years.

Similar to Knif et al. (2005), the research's empirical analysis revealed that the correlations between national stock markets were more susceptible to national or global occurrences that caused large increases in stock market volatilities. However, the JSE ALSI's correlations with the different sample national stock indices reacted differently to the different exogenous shocks. While a number of stock indices experienced increases in their correlations with the JSE ALSI either before or after the initial occurrence of an exogenous shock, a good portion of the indices' correlations with the JSE ALSI were not only weak, but also statistically significant on average for the entire sample duration of some of the exogenous shock periods as shown in Table 5. While the developed markets are not expected to reap benefits for South African investors in the long run, the S&P 500 and FTSE 100's correlations with the JSE ALSI during exogenous shock periods made a case for investing in developed markets within the short-run. The correlation of the FTSE 100 and the JSE ALSI for the entire sample duration of Brexit was negative and statistically significant while the S&P 500 had weak statistically significant positive correlations with the JSE ALSI for the entire sample duration of the Libor scandal, Brexit and the U.S. and China trade wars. Therefore, if implemented properly, investing in developed markets possesses the potential of providing short-term insulation against investment risk and improved portfolio returns during periods of high volatility as well.

Similar to Forbes and Rigobon (2002), the research finds that exogenous shocks do not have a consistent pattern of how they impact stock markets. The research results show that different exogenous shocks impact different stock market cross-correlations differently depending on the country of origin of the shock. In conclusion, the empirical results of the research show that IPD is still justifiable as an investment strategy to be implemented by South African investors as there are

still reasonable diversification benefits to be realised even during periods of exogenous shocks and despite the growing global financial integration.

Lastly, the research provides recommendations to South African investors willing to implement IPD. An APT multi-sector regression model implemented in the research displayed that the performances of the different national stock markets were not influenced equally by the different stock market sectors. The financial sector was the most influential in driving the performances of the FTSE 100, Ibovespa and SSE Composite while it ranked second in driving the S&P 500's performance. As seen in the significant levels in Table 6, the information technology sector had no identifiable linear relationship with the performance of both the FTSE 100 and Ibovespa while both the consumer staples and health care sectors had no identifiable linear relationship with both the Ibovespa and SSE Composite.

The benefits of IPD can be enhanced by restricting foreign assets in an investment portfolio to stock market sectors that have minimal influence in the performance of their respective national stock markets. Therefore, when diversifying their portfolios into foreign markets, South African investors are recommended to look out for the foreign stock market sectors that have a weak or negligible linear relationship with their respective national stock market and invest in those.

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Appendices

Appendix A: Stock Index Returns for the Study Period

Date	JSE ALSI	FTSE 100	S&P 500	Ibovespa	SSE Composite
2009/07/01	0.0955	0.0811	0.0699	0.0622	0.1455
2009/08/01	0.0273	0.0632	0.0302	0.0310	-0.2512
2009/09/01	-0.0007	0.0448	0.0362	0.0853	0.0480
2009/10/01	0.0566	-0.0175	-0.0179	0.0004	0.0750
2009/11/01	0.0201	0.0286	0.0558	0.0857	0.0854
2009/12/01	0.0283	0.0419	0.0146	0.0227	0.0266
2010/01/01	-0.0365	-0.0423	-0.0390	-0.0476	-0.0958
2010/02/01	0.0033	0.0315	0.0281	0.0167	0.0234
2010/03/01	0.0715	0.0589	0.0563	0.0564	0.0169
2010/04/01	-0.0039	-0.0225	0.0131	-0.0413	-0.0807
2010/05/01	-0.0535	-0.0680	-0.0871	-0.0688	-0.1020
2010/06/01	-0.0332	-0.0537	-0.0534	-0.0338	-0.0721
2010/07/01	0.0768	0.0671	0.0661	0.1025	0.0969
2010/08/01	-0.0396	-0.0063	-0.0540	-0.0359	0.0011
2010/09/01	0.0777	0.0601	0.0836	0.0636	0.0055
2010/10/01	0.0326	0.0226	0.0342	0.0176	0.1148
2010/11/01	-0.0054	-0.0262	-0.0044	-0.0431	-0.0574
2010/12/01	0.0594	0.0651	0.0581	0.0230	-0.0009
2011/01/01	-0.0227	-0.0063	0.0224	-0.0403	-0.0062
2011/02/01	0.0274	0.0221	0.0291	0.0121	0.0386
2011/03/01	-0.0021	-0.0143	-0.0021	0.0177	0.0075
2011/04/01	0.0194	0.0269	0.0253	-0.0364	-0.0072
2011/05/01	-0.0083	-0.0133	-0.0148	-0.0229	-0.0594
2011/06/01	-0.0218	-0.0074	-0.0184	-0.0348	0.0091
2011/07/01	-0.0208	-0.0222	-0.0217	-0.0591	-0.0242
2011/08/01	-0.0065	-0.0751	-0.0587	-0.0404	-0.0495
2011/09/01	-0.0439	-0.0506	-0.0747	-0.0768	-0.0855

2011/10/01	0.0863	0.0779	0.1025	0.1089	0.0452
2011/11/01	0.0142	-0.0070	-0.0032	-0.0247	-0.0489
2011/12/01	-0.0255	0.0121	0.0085	-0.0021	-0.0841
2012/01/01	0.0550	0.0194	0.0417	0.1055	0.0358
2012/02/01	0.0148	0.0329	0.0398	0.0423	0.0596
2012/03/01	-0.0219	-0.0177	0.0307	-0.0200	-0.0667
2012/04/01	0.0249	-0.0053	-0.0075	-0.0427	0.0594
2012/05/01	-0.0372	-0.0754	-0.0647	-0.1262	-0.0204
2012/06/01	0.0169	0.0460	0.0391	-0.0024	-0.0643
2012/07/01	0.0260	0.0114	0.0124	0.0315	-0.0603
2012/08/01	0.0203	0.0134	0.0196	0.0171	-0.0261
2012/09/01	0.0126	0.0053	0.0240	0.0363	0.0200
2012/10/01	0.0388	0.0070	-0.0201	-0.0362	-0.0077
2012/11/01	0.0279	0.0144	0.0028	0.0072	-0.0444
2012/12/01	0.0309	0.0053	0.0069	0.0587	0.1377
2013/01/01	0.0231	0.0623	0.0492	-0.0204	0.0410
2013/02/01	-0.0214	0.0133	0.0110	-0.0399	-0.0050
2013/03/01	0.0021	0.0080	0.0354	-0.0188	-0.0556
2013/04/01	-0.0306	0.0029	0.0179	-0.0078	-0.0234
2013/05/01	0.0789	0.0235	0.0206	-0.0441	0.0581
2013/06/01	-0.0495	-0.0575	-0.0157	-0.1201	-0.1503
2013/07/01	0.0473	0.0632	0.0461	0.0162	0.0140
2013/08/01	0.0209	-0.0319	-0.0340	0.0361	0.0476
2013/09/01	0.0376	0.0077	0.0275	0.0455	0.0330
2013/10/01	0.0367	0.0408	0.0431	0.0360	-0.0140
2013/11/01	-0.0113	-0.0121	0.0264	-0.0332	0.0370
2013/12/01	0.0314	0.0147	0.0229	-0.0187	-0.0404
2014/01/01	-0.0279	-0.0360	-0.0349	-0.0781	-0.0381
2014/02/01	0.0503	0.0449	0.0422	-0.0112	0.0167
2014/03/01	0.0185	-0.0315	0.0079	0.0681	-0.0092
2014/04/01	0.0195	0.0271	0.0053	0.0238	-0.0023

2014/05/01	0.0150	0.0095	0.0206	-0.0075	0.0084
2014/06/01	0.0239	-0.0148	0.0187	0.0370	0.0045
2014/07/01	0.0067	-0.0020	-0.0162	0.0488	0.0707
2014/08/01	-0.0057	0.0132	0.0374	0.0933	0.0104
2014/09/01	-0.0350	-0.0293	-0.0160	-0.1246	0.0627
2014/10/01	0.0094	-0.0116	0.0234	0.0095	0.0216
2014/11/01	0.0046	0.0265	0.0242	0.0006	0.1010
2014/12/01	0.0118	-0.0236	-0.0033	-0.0900	0.1837
2015/01/01	0.0298	0.0275	-0.0315	-0.0639	0.0118
2015/02/01	0.0386	0.0288	0.0526	0.0945	0.0502
2015/03/01	-0.0255	-0.0253	-0.0179	-0.0084	0.1174
2015/04/01	0.0454	0.0273	0.0086	0.0940	0.1697
2015/05/01	-0.0491	0.0034	0.0095	-0.0472	0.0283
2015/06/01	-0.0101	-0.0400	-0.0218	0.0062	-0.0799
2015/07/01	0.0034	0.0265	0.0177	-0.0426	-0.1400
2015/08/01	-0.0366	-0.0693	-0.0649	-0.0871	-0.1201
2015/09/01	0.0091	-0.0303	-0.0257	-0.0342	-0.0338
2015/10/01	0.0627	0.0482	0.0799	0.0177	0.0693
2015/11/01	-0.0379	-0.0008	-0.0002	-0.0165	0.0318
2015/12/01	-0.0244	-0.0181	-0.0189	-0.0400	0.0277
2016/01/01	-0.0228	-0.0257	-0.0493	-0.0703	-0.3104
2016/02/01	0.0015	0.0022	-0.0024	0.0576	-0.0159
2016/03/01	0.0548	0.0127	0.0614	0.1567	0.1110
2016/04/01	0.0226	0.0108	0.0042	0.0742	-0.0198
2016/05/01	0.0131	-0.0018	0.0143	-0.1063	-0.0081
2016/06/01	-0.0253	0.0430	0.0023	0.0612	0.0043
2016/07/01	0.0023	0.0333	0.0348	0.1061	0.0161
2016/08/01	-0.0106	0.0085	-0.0010	0.0103	0.0375
2016/09/01	-0.0178	0.0172	-0.0014	0.0080	-0.0260
2016/10/01	-0.0282	0.0079	-0.0178	0.1064	0.0262
2016/11/01	-0.0098	-0.0248	0.0324	-0.0476	0.0467

2016/12/01	0.0064	0.0516	0.0174	-0.0275	-0.0482
2017/01/01	0.0374	-0.0061	0.0121	0.0712	0.0172
2017/02/01	-0.0378	0.0229	0.0336	0.0301	0.0255
2017/03/01	0.0152	0.0082	-0.0073	-0.0255	-0.0054
2017/04/01	0.0292	-0.0164	0.0092	0.0064	-0.0254
2017/05/01	-0.0057	0.0429	0.0097	-0.0420	-0.0096
2017/06/01	-0.0357	-0.0280	0.0032	0.0030	0.0267
2017/07/01	0.0663	0.0081	0.0159	0.0469	0.0251
2017/08/01	0.0213	0.0079	-0.0022	0.0718	0.0261
2017/09/01	-0.0182	-0.0078	0.0180	0.0475	-0.0051
2017/10/01	0.0547	0.0162	0.0212	0.0002	-0.0029
2017/11/01	0.0065	-0.0225	0.0006	-0.0245	-0.0229
2017/12/01	-0.0025	0.0481	0.0107	0.0600	-0.0024
2018/01/01	-0.0037	-0.0203	0.0509	0.1056	0.0491
2018/02/01	-0.0192	-0.0409	-0.0371	0.0067	-0.0651
2018/03/01	-0.0492	-0.0245	-0.0278	0.0003	-0.0207
2018/04/01	0.0519	0.0622	0.0055	0.0087	-0.0280
2018/05/01	-0.0369	0.0222	0.0233	-0.1150	0.0026
2018/06/01	0.0178	-0.0054	-0.0001	-0.0537	-0.0801
2018/07/01	0.0129	0.0145	0.0403	0.0850	0.0122
2018/08/01	0.0176	-0.0417	0.0281	-0.0325	-0.0561
2018/09/01	-0.0505	0.0104	0.0059	0.0342	0.0379
2018/10/01	-0.0596	-0.0522	-0.0761	0.0969	-0.0616
2018/11/01	-0.0357	-0.0210	0.0156	0.0235	-0.0111
2018/12/01	0.0139	-0.0368	-0.1072	-0.0183	-0.0596
2019/01/01	0.0357	0.0352	0.0877	0.1027	0.0341
2019/02/01	0.0348	0.0151	0.0300	-0.0188	0.1241
2019/03/01	0.0075	0.0285	0.0128	-0.0018	0.0451
2019/04/01	0.0279	0.0189	0.0336	0.0097	-0.0108
2019/05/01	-0.0518	-0.0352	-0.0702	0.0071	-0.0292
2019/06/01	0.0418	0.0362	0.0669	0.0397	0.0262

Appendix B: APT Regression Model Results

Appendix B1: S&P 500 Multi-sector Regression

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.999[a]	.998	.998	.001529444640295

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.160	10	.016	6830.477	.000[b]
	Residual	.000	109	.000		
	Total	.160	119			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	2.836E-5	.000		.185	.854	.000	.000					
	Consumer Discretionary risk premium	.121	.008	.143	14.651	.000	.104	.137	.932	.814	.056	.153	6.531
	Consumer Staples risk premium	.097	.008	.083	12.193	.000	.081	.113	.701	.760	.047	.318	3.145
	Health Care risk premium	.137	.006	.136	21.437	.000	.125	.150	.799	.899	.082	.366	2.736
	Industrials risk premium	.100	.009	.127	11.277	.000	.082	.117	.939	.734	.043	.115	8.723
	Information Technology risk premium	.216	.006	.270	37.125	.000	.204	.227	.885	.963	.142	.277	3.610
	Materials risk premium	.032	.006	.047	5.303	.000	.020	.045	.883	.453	.020	.186	5.378
	Telecommunication Services risk premium	.019	.004	.022	4.211	.000	.010	.028	.508	.374	.016	.550	1.819
	Utilities risk premium	.041	.005	.039	8.109	.000	.031	.051	.327	.613	.031	.623	1.606
	Financials risk premium	.146	.006	.199	25.516	.000	.135	.157	.877	.926	.098	.240	4.158
	Energy risk premium	.084	.004	.130	20.549	.000	.076	.093	.773	.892	.079	.364	2.746

a. Dependent Variable: S&P 500 risk premium

Appendix B2: FTSE 100 Multi-sector Regression

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.997[a]	.994	.993	.002875905839045

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.140	10	.014	1688.825	.000[b]
	Residual	.001	109	.000		
	Total	.141	119			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	4.475E-6	.000		.016	.987	-.001	.001					
	Financials risk premium	.210	.009	.300	24.435	.000	.193	.227	.788	.920	.187	.391	2.560
	Consumer Discretionary risk premium	.126	.013	.137	9.886	.000	.100	.151	.783	.688	.076	.304	3.285
	Consumer Staples risk premium	.170	.011	.186	15.991	.000	.149	.191	.718	.837	.123	.433	2.309
	Energy risk premium	.159	.007	.254	22.139	.000	.145	.173	.772	.904	.170	.448	2.230
	Materials risk premium	.084	.005	.190	17.577	.000	.075	.094	.679	.860	.135	.505	1.980
	Industrials risk premium	.073	.012	.079	5.974	.000	.049	.097	.792	.497	.046	.337	2.968
	Utilities risk premium	.035	.009	.038	3.913	.000	.017	.052	.489	.351	.030	.623	1.604
	Telecommunication Services risk premium	.052	.007	.074	7.373	.000	.038	.065	.574	.577	.057	.583	1.716
	Health Care risk premium	.099	.009	.114	11.363	.000	.082	.116	.571	.736	.087	.585	1.709
	Information Technology risk premium	.003	.004	.006	.658	.512	-.006	.011	.443	.063	.005	.722	1.384

a. Dependent Variable: FTSE 100 risk premium

Appendix B3: Ibovespa Multi-sector Regression

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.939[a]	.881	.870	.020697918286544

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.345	10	.035	80.553	.000[b]
	Residual	.047	109	.000		
	Total	.392	119			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	.017	.010		1.629	.106	-.004	.037					
	Energy risk premium	.111	.033	.252	3.399	.001	.046	.175	.873	.310	.112	.200	5.010
	Materials risk premium	.135	.029	.236	4.610	.000	.077	.194	.774	.404	.152	.419	2.387
	Industrials risk premium	-.079	.062	-.099	-1.275	.205	-.201	.044	.749	-.121	-.042	.181	5.511
	Consumer Discretionary risk premium	.037	.040	.071	.920	.360	-.043	.116	.783	.088	.030	.186	5.384
	Consumer Staples risk premium	.019	.052	.023	.355	.723	-.085	.122	.713	.034	.012	.268	3.734
	Health Care risk premium	-.016	.022	-.031	-.713	.477	-.060	.028	.511	-.068	-.024	.569	1.758
	Financials risk premium	.328	.052	.596	6.326	.000	.225	.430	.897	.518	.209	.123	8.117
	Information Technology risk premium	-.019	.026	-.035	-.747	.456	-.071	.032	.523	-.071	-.025	.493	2.028
	Telecommunication Services risk premium	-.026	.036	-.039	-.706	.482	-.098	.046	.677	-.067	-.023	.362	2.759
	Utilities risk premium	1.660	1.013	.059	1.639	.104	-.348	3.667	.134	.155	.054	.857	1.167

a. Dependent Variable: Ibovespa risk premium

Appendix B4: SSE Composite Multi-sector Regression

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.995[a]	.990	.989	.007274580243335

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.559	10	.056	1055.977	.000[b]
	Residual	.006	109	.000		
	Total	.565	119			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-.001	.001		-1.629	.106	-.003	.000					
	Energy risk premium	.077	.021	.094	3.772	.000	.037	.118	.888	.340	.037	.150	6.656
	Materials risk premium	.077	.022	.100	3.528	.001	.034	.120	.921	.320	.034	.117	8.565
	Industrials risk premium	.151	.021	.187	7.375	.000	.111	.192	.935	.577	.071	.146	6.872
	Consumer Discretionary risk premium	.079	.026	.088	3.057	.003	.028	.130	.881	.281	.030	.114	8.786
	Consumer Staples risk premium	.027	.022	.027	1.200	.233	-.017	.070	.763	.114	.012	.179	5.589
	Health Care risk premium	.025	.017	.029	1.475	.143	-.009	.059	.609	.140	.014	.249	4.020
	Financials risk premium	.276	.017	.333	16.051	.000	.242	.310	.890	.838	.155	.218	4.597
	Information Technology risk premium	.073	.019	.104	3.777	.000	.035	.112	.767	.340	.037	.124	8.083
	Telecommunication Services risk premium	.041	.017	.057	2.403	.018	.007	.074	.776	.224	.023	.167	5.977
	Utilities risk premium	.113	.022	.114	5.053	.000	.069	.158	.902	.436	.049	.183	5.452

a. Dependent Variable: SSE Composite risk premium