

An Analysis of International Diversification Benefits and Market Co- movements from a South African Perspective

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Abstract

Globalization has had a profound impact on financial markets and the effects on increasing equity return correlations from a U.S. perspective are well documented in previous literature. With increased return correlations, diversification benefits are diminished over time for investors. Few studies have examined the effects of globalization on developing economies, and more specifically, South Africa. This report looks into the performance of the JSE Top40 relative to other major economies from 1999 through to the beginning of 2013. The study identifies whether return correlations are increasing for South African investors and how this affects their global diversification benefits and whether global diversification still remains beneficial. The results suggest that developing economies have exhibited superior performance on a raw returns and risk adjusted basis relative to developed economies. The results are instructive that from a South African perspective, no significant trends of increasing return correlations are evident. Developing economies are found to exhibit lower return correlations than developed economies, and in some instances negative correlations exist among the developing economies. This leads to a strong conclusion that South African investors seeking to maximise returns and minimize risk should diversify, particularly in developing economies. The benefits of diversification are unlikely to be eroded for South Africans over the foreseeable future based on these findings.

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Definition of Terms

BOVESPA 50: Liquid Brazilian stock market index

BRL: Brazilian Real

BSE 30: Liquid Indian stock market index

Carry Trade: Strategy of investing in high yield currencies and funding long positions by shorting low yielding currencies

Developed market portfolio: An equally weighted portfolio comprising of an investment in each of the four developed economies studied.

Developing market portfolio: An equally weighted portfolio comprising of an investment in each of the four developing economies studied.

Domestic Perspective: Returns from a South African perspective

EuroStoxx50: Liquid European Union stock market Index. 12 of the 17 Eurozone economies are represented in the EuroStoxx50, namely: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain.

FTSE100: Liquid U.K. stock market index

FX: Foreign currency

GBP: Great British Pound

International perspective: Returns from a dollarized, U.S. perspective

IRP: Indian Rupee

JSE Top 40: Liquid South African stock market index

Mixed Portfolio: From the domestic perspective, the portfolio comprises of an investment in South Africa as well as in the four developed economies in equal weightings. From the international perspective, the portfolio comprises of an investment in the U.S. as well as each of the four developing economies in equal weightings.

Nikkei 225: Liquid Japanese stock market Index

RBL: Russian Ruble

RTS 50: Liquid Russian stock market index

SPX500: Liquid U.S. stock market index

USD: U.S. Dollar

ZAR: South African Rand

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1. Introduction

Asset allocation is at the core of every investment strategy. The more effectively a portfolio manager can allocate resources, the more efficient the returns will be to their portfolio. At the core of efficient investment is diversification. As Markowitz (1959) illustrated, the goal of any investor should be to obtain an investment lying on the efficient frontier, obtaining maximum returns for a minimum level of risk.

While global diversification strategies have been a popular means of reducing country specific risk, the globe is shrinking and globalization is becoming more prevalent. This heightened level of globalization has caused academics to question what effects it could have on diversification strategies (Asness, Israelov & Liew, 2011; Bekaert, Hodrick & Zhang, 2009; Baele & Inghelbrecht, 2009). Furthermore these studies have pointed to increased correlation of equity returns between countries. Despite the increased globalization, findings have indicated international diversification strategies remain effective, particularly over the long run (Asness *et al*, 2011) although the benefits are diminishing. Furthermore, investors have been found to exhibit a bias to their domestic market (Fench & Poterba, 1991; Asness *et al*, 2011). By having this bias, investors could be forgoing the benefits of effective international diversification benefits (if any are found). However, if local market real returns are high enough to outperform global markets on a risk adjusted basis, the home bias would be an advantage and not a disadvantage.

At the first glance, over the past fifteen years, the JSE has boasted impressive returns to any investor. Despite labour unrest and political concerns, the JSE has surged ahead of most major global indices regarding annual returns. These impressive returns generated by companies reveal only part of the picture though. While at a glance, the South African economy appears to have seen over a decade of success, factoring in of additional macro-economic variables such as inflation and currency fluctuations may change the picture. The question begging for answering is: How has the JSE performed in *real* terms in relation to other major stock market indices?

To accurately evaluate and implement a diversification strategy, it is paramount that a portfolio manager understands the behaviour of the assets under consideration. While studies have documented that equity indices globally are facing increased return correlations (Baele & Ingelbrecht, 2009; Bekaert *et al*, 2009), the vast majority of these studies have focused on the U.S. markets and have examined return correlations from a U.S. perspective.

Little research has delved into how these findings translate to South African investors and how they affect South African portfolio managers. In particular, given the volatility of the ZAR (Grandes, Peter & Pinaud, 2003; Terblanche, 2008), as well as the higher inflation rate that South Africa experiences as opposed to the U.S., results are likely to be very different. When currency fluctuations as well as inflation are factored in, the performance of the JSE relative to other indices could produce disconcerting results. It is possible that all of the surges in the index value have been due to a drop in the currency value, making South Africa cheaper to foreign investors. The potential currency devaluations could have led to high

inflation rates and as a result, diminishing real returns despite impressive index performance. Developing markets are documented to have lower correlations among themselves and the global economies as opposed to developed economies (Driessen & Laeven, 2007). Little research has explored how the correlations among developing markets have changed, further highlighting the importance of this research report, as it attempts to fill a gap in literature.

Returns on indices have also been found to be correlated more highly in bear markets than during times of bull markets (Asness *et al*, 2011). In times of economic crisis' investors are prone to flock to safer holding investments and abandon those in riskier economies (Yotopoulos & Sawada, 1999). The flight to hard currency often overemphasizes the loss incurred to domestic emerging market investors as their wealth is diminished both through stock price drops and currency depreciation (Barr & Kantor, 2005; Yotopoulos & Swada, 1999). The results of the study will further indicate the extent to which the South African equity and FX markets were affected by the 2008 financial crisis, as opposed to more developed economies. Furthermore, the study will shed light on how an internationally diversified investor would have been affected as opposed to one who invested only domestically on a real returns basis.

The study implicitly examines whether the Fischer relation holds in international markets in terms of currency, when comparing the returns of the JSE to those of other major indices. After factoring in both currency and inflation rate changes, the returns across all countries should be indifferent (Alexius, 2001; Horobet, Dumitrescu & Dumitrescu, 2009). If this relation does not hold, it implies that investors can earn excess real returns by exploiting parity violations. The study thus seeks to answer five questions:

- On a real returns basis, how has the JSE performed relative to other major financial markets?
- Are the real returns offered by the JSE becoming more correlated with those of other major economies?
- How do the diversification benefits of carry-trades and FX compare to the diversification benefits of international indices?
- How are the correlations between FX and equity indices changing over time?
- In light of the above questions posed, should domestic South African investors diversify globally?

The remainder of the report will be structured as follows: Section 2 will lay out the implications and potential caveats of the study. Section 3 will explore previous literature on the relevant subjects, Section 4 will explain the data and methodology that will be used, Section 5 presents results while section 6 offers a summary of the findings, before concluding in section 7.

2. Literature Review

2.1. International Diversification and the Covariance of Geographical Returns

In his seminal paper on diversification, Markowitz (1952) explains that an investor should be concerned with maximising returns and minimising the risk that he exposes himself to. He states further that diversification cannot eliminate all of a securities return variance due to the inter-correlation that security returns exhibit. That being said, it can still greatly reduce the risk that an investor exposes himself to. Markowitz (1952) is careful to emphasise that the adequacy of diversification is not solely dependent on the number of securities held, but rather on the correlations between the securities that one holds. In trying to minimize portfolio variance, it is critical to invest in securities with a low covariance among themselves. It is also emphasised that if an investor invests in two portfolios with *equal* variances, the investor's variance of his overall portfolio will be lower than the individual portfolio variances so long as the securities in each portfolio are neither identical nor perfectly correlated with one another.

The findings of Markowitz (1952) give a strong justification for international diversification in an indirect manner. If an investor holds securities in a foreign market, he is able to diversify his domestic markets' systematic risk. Li, Sarkar and Wang (2003) examine the diversification benefits of emerging markets, subject to the portfolio constraints of no short selling. They look at returns from a U.S. investor's perspective and they examine 15 countries: The G7 economies as well as 8 developing markets¹. Their results unsurprisingly reveal far higher returns for most of the emerging economies although this comes with higher standard deviations of their returns. They also found that the emerging markets had lower correlations among both themselves than the G7 countries while the G7 countries are found to have higher correlations among themselves. They noted that the U.S. equity market does not in fact lie on the efficient mean-variance frontier and that global diversification significantly enhanced portfolio efficiency. Furthermore, they found that when short-selling constraints were imposed on U.S. investors, diversification benefits from investing in the G7 countries declines substantially but the benefits accrued by emerging market diversification remained strong. They further found that global integration is diminishing international diversification benefits but it has not eliminated them.

Results similar to Li *et al* (2003) are obtained by Driessen and Laeven (2007). They examine 52 countries over the sample period of 1985 to 2002 and examine diversification benefits, primarily from the perspective of local market investors. As such, they do not focus only on U.S. dollar returns, but rather on both local currency returns and U.S. dollar returns. They also measure international diversification benefits when both short selling constraints are enforced and when they are ignored. They use a Sharpe Ratio criterion and find that international diversification increased Sharpe Ratios on average from 10% to 21% on average, across the countries in their sample size. The higher the Sharpe Ratio, the better the portfolio performance as a higher Sharpe Ratio indicates greater returns per unit of risk the

¹ The 8 emerging economies included in the study were: Argentina, Brazil, Chilli, Mexico, South Korea, Thailand, Hong-Kong and Singapore.

investor takes. Relaxing short selling constraints on developing markets had very little influence on their results as they found that the optimal portfolio allocation consisted of a positive investment in each different developing country in their sample. That being said, the Sharpe Ratios were reduced when short selling constraints were introduced on all markets. Sharpe Ratios were found to increase only to 18% as opposed to 21% when no short selling constraints were enforced. Their results also highlighted that international diversification benefits were larger for developing markets, due primarily to them not being as integrated with global financial markets as the developed markets are. Global diversification benefits were finally found to be higher when measured in local currency as opposed to U.S. dollars, with the Sharpe Ratios per region generally being higher. That being said, the expected returns were higher when measured in U.S. dollars as opposed to local currencies on average. This could be due to the strong performance of the USD relative to developing market currencies. It should be highlighted that the sample period covered included the Asian crises which would adversely affect higher risk currency returns.

As the globe has shrunk due to accelerating technology developments, investors have become better able to invest abroad and gain the benefits of international diversification. Investors have also been able to take advantage of markets where capital market developments have not been extensive allowing them to exploit mispricings and earn excess returns (Ibbotson *et al.*, 1982). Ibbotson *et al.* (1982) performed a study on international returns from a U.S. investors perspective and found that foreign market returns outperformed U.S. market returns in both the equity and the bond markets. They looked into return co-movements and found that within Europe, returns seemed highly correlated.

While global integration is on the rise, logically one would expect that returns across geographical borders are to become more correlated and the benefits of international diversification are being eroded. Heston and Rouwenhorst (1994) were one of the first academics to tackle the subject. They examined the co-movements of 12 European markets over a 14 year time period. They applied a dummy variable model to test for country and industry effects and they found that while industry correlations may be higher, country factors seemed to be more important drivers in international return co-movements and volatilities. They also noted that currency movements accounted for barely any of the country effects that they observed regarding international diversification.

A study conducted by Griffin and Karolyi (1998) looked at the relative importance of industry and country factors when emerging markets were included in the sample. Regarding diversification they confirmed the results of Heston and Rouwenhorst (1994), finding that cross country diversification is more effective than cross industry diversification.

Cavaglia, Brightman and Aked (2000) challenged this result, looking into a fourteen year period and using a model similar to that of Heston and Rouwenhorst (1994) which held factor volatilities fixed over time. They also used only developed countries in their sample, stating the inclusion of emerging economies could skew the results. Emerging economies are less integrated with the globe and more volatile, thus giving country factors a bias. This finding was confirmed by Baca, Garbe and Weiss (2000), who found that from 1995 onwards,

industry factors became increasingly important relative to country factors and both papers felt that cross-industry diversification would offer better risk reduction than cross country diversification.

More recently Bekaert *et al.* (2009) disputed the findings that industry factors are becoming more important, re-establishing the importance of country factors and geographical diversification. They looked into a 25 year time period and developed new models that, unlike the Heston-Rouwenhorst (1994) model, allowed for time variation in volatilities and betas. They found that within Europe, return correlations are showing increasing trends (confirming the results of Ibbotson *et al* (1982)) but globally, no significant trend could be found. They further found that using geographical diversification was still more effective than industry diversification. They further concluded that previous results in studies, such as those by Baca *et al* (2000), had used too short a time period and that the correlation changes they found were temporary and influenced by the tech bubble.

Baele and Inghelbrecht (2009) conducted a similar study and looked at correlations between countries and industries over a 30 year period. They too found that country specific risk was higher than that of industry specific risk, also using a time-varying beta model and also concluded that geographical diversification was superior to that of industry correlations, although global diversification benefits are slowly diminishing. Their results also highlighted the fact that returns are more correlated during recessions, thus it would seem diversification lets investors down when they need it most.

Asness *et al* (2011) confirm this result, although they reject the relevance. Their study was conducted over a 58 year period from 1950 to 2008. They look at returns from the perspective of a local investor in 22 different countries, factoring in both currency changes and inflation changes to their returns. They highlight that investors should typically take a longer term view and not focus on inevitable short term crashes stating that investors should fear long, drawn out bear markets far more than a sudden crash. Their results prove that international diversification works in reducing losses, especially over the long run, despite the short run the benefits being limited. Furthermore, they reveal that equal weighting of portfolios yields far better diversification benefits than a market capitalization weighted portfolio. This is primarily attributed to the huge size of the U.S. market in part (Asness *et al.*, 2011).

2.2. International Crises

Looking at economic crises and how investors react to them, Krugman (1991) states that there are two main types of international crisis that occur in economies. The first is a currency crisis, which he states is generally the result of central bank policy or actions while the other is a contagion crisis whereby real assets lose value. A contagion crisis occurs when markets globally crash together. Krugman (1991) states that contagion crises are often the result of investor irrationality and not the fault of the central bank. They are often triggered by herding behaviour. He sheds insight on the different repercussions of the two types of

crisis stating that a contagion crisis generally leads to worldwide deflation whereas a currency crisis often leads to high inflation in a region or country.

Dornbusch (1991) writes that if a large market suffers economically, this naturally has a spill over effect to smaller markets. The spill over effect can happen for multiple reasons: Firstly it can be driven by the herding behaviour alluded to by Krugman (1991). Secondly, when large economies enter a recession, global demand falls, harming all of the major trade partners of the economy. When the U.S. suffers from an economic depression, most global economies will naturally be affected due to the great impact that the U.S. has on international sentiment and production. As such, investors in smaller and less stable economies will take flight to what they perceive as better stores of value and invest in U.S. treasury bills, dollar bank deposits or gold. Consequently smaller economies suffer disproportionately as they lose currency and market value while more developed, larger economies will see a rise in their currency despite stock markets falling.

Yotopoulos & Sawada (2000) develop a model that looks into currency demand and devaluations. Their findings also suggested that the lower the per capita GDP of an economy, the softer the currency is likely to be. The authors define a soft, speculative currency as a currency which has a high substitution rate (one will sell it off quickly in times of uncertainty) and it has little store of value. As such, an investor purchasing speculative currencies are purely holding them in the hope of a shorter term gain, not to preserve capital value. Their results further indicate that the less safe-holding value a currency holds and the more speculative the currency is, the more undervalued the currency is likely to be. This implies that investors will place a significant risk premium on holding currencies of riskier economies. Furthermore, they note that domestic residents in more developed economies with 'hard currency' do not hedge their currency risk by holding 'soft currencies', but rather by holding other hard currencies. All the while domestic residents in economies with soft currencies will hedge their currency risk by holding hard currencies. This further adds to the undervaluation of soft currencies.

Building on the theory that investors typically search for a store of value in times of economic crisis, Judson (2012) examines the demand for the USD from 1989 until the end of 2011. His study provides quantitative insight and evidence as to when dollar demand peaks in terms of the economic cycle. The results of his study confirm that dollar demand increases amid every crisis. The first dollar demand spike in his study was around the collapse of the Berlin wall, followed by the Argentinian crisis of 1999 through 2002. The events of September 11, 2001, showed another significant increase in dollar demand as did the 2008 collapse of Lehman Brothers.

Benigno (2011) looked at whether the USD demand has changed over years, especially with the rise of the Euro from 1999. He notes that while the Euro has rapidly been growing in popularity as a reserve currency, it has been at the expense of all currencies *except* the USD, whose demand has remained very stable over the past decade. He also highlighted that despite the fact that most of the financial crisis turmoil around 2007-2009 was triggered by the U.S., dollar demand increased and the dollar rose. Furthermore, he highlighted that the

USD peaked in value relative to other currencies at the time when the financial markets were suffering the most tension. Benigno (2011) felt that this confirmed the dollar remained the 'safe haven' of the financial world for the time being. The Eurozone sovereign debt crisis of 2009 has also severely compromised the credibility of the EUR.

2.3. Currency Return Correlations with Equity Returns

Currency movements can affect the market index in different ways depending on the composition of the market. If aggregate revenues on the local index are earned from foreign revenue while costs are local costs, then depreciation in the exchange rate would cause an increase in the returns on the local market. An example of this is the resource sector on the JSE (Barr & Kantor, 2005; Afordofe, 2011). Such stocks are currency hedge stocks. If the aggregate costs are denominated in foreign currency while revenues are in local currency, then depreciation in the exchange rate will have an adverse effect on the market index level. An example of this is the clothing and retail industry in South Africa and these stocks are termed currency-play stocks. Stocks that have primarily domestic currency costs and revenues denominated in domestic currency will have an unambiguous reaction to depreciation in the currency. The banking sector is such an example. A previous study conducted by Barr and Kantor (2005) find that in general these stocks decline in response to a currency depreciation.

Kornienko (2010) found a positive relationship between stock market returns and currency returns when 19 developed markets were analysed. They compared the currency basket of a country along with the market index and found that a strong positive correlation exists. Furthermore, they noted that the equity markets were always more volatile than the bilateral exchange rate between two economies in their sample. The study further highlighted that equity returns are not driven by relative currency returns, but rather by relative short run and relative long run consumption growth shocks across markets.

One of the first comprehensive studies that examined both equity and foreign exchange correlations was undertaken by Sheedy (1997). The study found that correlations in equity markets are reasonably stable over time and are not exhibiting increasing trends. Furthermore, her study suggested that many prior studies who had documented increasing correlations had focused too heavily on a short time period around the stock market crash of 1987. During this period, there was a brief contagion crisis where equity markets were highly correlated but it was not long lived. Regarding currency markets, variation in currency return correlations were found to be far stronger. Furthermore, correlations in currency markets were found to be significantly higher. Diversification of currency risks generally suggest that most of the portfolio allocation would simply be placed in the currency with the lowest volatility. However, regarding equity markets her study strongly supported the benefits of geographical diversification.

The finding by Sheedy (1997) regarding high variation in the correlations of currency returns are supported by Rangel (2011) who examined the dynamics involved in currency market movements. The study found that over the period of 1999-2010 correlations on excess

currency returns increased by roughly 50% based on a sample of 29 currencies. Excess returns were defined as the realized returns from buying FX forward one month in the forwards market and selling it one month later in the spot market. Unsurprisingly the results were indicative of higher correlations over the crisis period around 2008. When looking into the determinants of currency idiosyncratic volatility, inflation and long term real GDP growth are identified as having the most explanatory power. In particular, higher levels of inflation (and its corresponding volatility) and lower levels of real GDP growth were found to lead to higher idiosyncratic currency volatility.

Maysami, Howe and Hamzah (2004) found a positive relationship between market indices and exchange rates in Singapore. They postulate that if a currency is expected to appreciate, the economy attracts an inflow of resources, bolstering the market index due to increased foreign investment. Furthermore, they state that in Singapore a stronger currency aided in driving down their imported input costs. They posit that a stronger currency limits imported inflation and is such is seen as a positive sign in the Singapore economy.

Dimitrova (2005) analysed the relationship between the USD and the U.S. stock market from 1990 through to August 2004 after noting a strong uptrend in the U.S. equity market while the dollar was depreciating against other major currencies. His results were however weak although the conclusion was in line with most international literature: over the entire sample period analysed there was a positive correlation between the foreign exchange and equity markets. The results further indicated that a one percentage drop in foreign exchange markets led to a less than one percentage decline in equity markets. He concluded that central banks pursuing a policy to strengthen their currency would most likely have a positive impact on stock markets. This conclusion however would depend on whether the country is import or export driven. It would also be dependent on the type of companies making up the broad equity markets, such as whether they are currency hedge or currency play companies. Another important factor is that short term and long term effects may not be the same. In the short run while tighter monetary policy may cause equities to decline, in the longer run the stronger currency may lead to cheaper debt financing, allowing for companies to expand at an accelerated rate.

A study conducted by Patrol, Wald and Wu (2014) looked into the effects that announcement of a currency devaluation has on equity markets in economies that do not follow a floating exchange rate system at the time of the devaluation announcement. They found that equity markets decline in value before the announcement is made and continue to devalue for another thirty days after the announcement. However, after this time, they find a reversal in the trend and that the equity markets begin gaining value again. They also note that devaluations harm developing markets far more than what they harmed developed markets. The higher the inflation rate of the economy or the worse the state of the current account, the more pronounced the drop in equity markets are. This is to be expected by parity relations.

Cho, Choi, Kim and Kim (2012) looked primarily into the equity-forex return correlations among 12 emerging markets and 9 developed markets. Their sample period covered 14 years from 1996 through to 2009 and they used weekly returns. Their results revealed that in all

instances except with the U.S., Japan and Switzerland a positive equity-forex correlation exists. These results were also consistent with Hochstotter and Weskamp (2012) and Campbell (2010). They also documented an increase in these correlations, stating that in the first half of the sample the average correlations across their sample was 0.117 while in the second half, the average correlations were more than double at 0.292. They further documented that from the perspective of an emerging market investor, currency returns are generally positively correlated with the emerging markets stock returns. The study further documented that the correlations between stocks and currencies are not only positive, but also stronger than when compared with the developed markets. They concluded that a 'flight to quality' reaction of investors is important in determining the correlations between currency and stock returns. Thus the risk on, risk off sentiment of investors can again be seen to be a large driver in return correlations.

Hochstotter and Weskamp (2012) studied the co-movements of stock indices with foreign exchange markets. They used an array of different methodologies including a linear regression, vector auto-regression and GARCH models. They looked at a period from 1999 till the end of 2011 using, daily price data of over 30 countries. They found a strong positive correlation between currency and equities in all markets except the U.S., Japan and Switzerland where the correlation was negative. This was attributed to them being reserve currency markets which investors would flock to when capital preservation was demanded. They also noted that correlations are less stable and generally weaker among emerging markets as opposed to the more developed markets. They further noted that the correlations found between equity and FX markets added on average a required risk premium of roughly 6% across their sample.

2.4. FX Risk Premiums, Carry-Trades and Parity Theorems Revisited

A popular method of using FX as an asset class which provides additional diversification benefits and strong risk-based returns has been that of carry-trades. Carry-trade strategies involve investing in high yielding currencies (which are expected to depreciate due to their inflation differential) while simultaneously taking short positions in low yielding currencies in markets with low inflation.

Carry-trade strategies can be profitable only in an environment where the *Uncovered interest rate parity* (UIP) theorem is violated. If UIP holds perfectly, the currencies will appreciate and depreciate by exactly what their inflation differentials suggest. Consequently, the extent to which UIP is violated is fundamental to determining the extent to which carry-trades can be profitable. UIP is built upon the premise of *Purchasing Power of Parity* (PPP) and the Fisher Relation (Fisher, 1930). In frictionless capital markets, one should be able to obtain any good at the same price across any geographical region. If this basic relation does not hold, it lays the ground works for arbitrage, whereby an individual can buy a good in Country A for a lower price and resell it in Country B at a higher price. The conversion of currencies should have no effect on the *real* price of the asset. This is the premise for the fundamental PPP theory (Chowdhry, Roll & Xia, 2005).

Mathematically, PPP is presented as follows:

$$\bullet \quad \frac{S_t}{S_{t+1}} = \frac{(1+I_d)}{(1+I_f)} \quad (1)$$

S_t represents the spot rate at the beginning of the time period, denoted as domestic units of currency per unit of foreign currency. S_{t+1} represents the spot rate at the end of the period. I_d represents the domestic inflation rate, while I_f represents the foreign inflation rate.

It is obvious that due to transaction costs, transportation costs and geographical barriers PPP cannot hold perfectly and studies have consistently shown this (Chowdhry *et al.*, 2005; Rogoff, 1996). However, relative PPP indicates that the *relative* price changes across countries should be identical. Relative PPP postulates that changes in the exchange rate should equal the concurrent inflation differential between two countries (Chowdhry *et al.*, 2005). Many previous studies conducted have found that parity theorems generally hold in the long run but not in the short run (Flood & Taylor, 1988; Ibbotson, Carr & Robertson, 1982; Rogoff, 1996). However a comprehensive study undertaken by Chowdhry *et al.* (2005) found that relative PPP held reasonably in the short run (contrary to previous findings) as well as in the long run if inflation rates were extracted from stock-prices (using a time series analysis) as opposed to using CPI data.

The Fisher Effect states that real returns across countries should be equal and thus that real interest rates offered by banks should be the same. The nominal interest rate is seen as the sum of the real interest rate and the expected inflation rate. Any change in the nominal interest rate is seen to be due to a change in inflation expectations (Fama & Schwert, 1977). Inflation changes should thus have no effect on real returns as it is factored into the nominal returns.

Mathematically, the Fisher relation is stated as follows:

$$\bullet \quad R = \frac{1+N}{1+I} \quad (2)$$

The real rate of return is denoted by ' R ' while ' N ' and ' I ' denote the nominal interest rate and the inflation rate respectively.

It logically follows that inflation and returns should exhibit a positive relationship. However, numerous studies (Fama & Schwert, 1977; Canova & Nicolo, 2000; Solink, 1983) have documented negative relationships between inflation rates and stock returns (both with expected and unexpected inflation rate changes). An explanation put forward for the violation of the Fisher effect regarding stock returns is that movement in stock prices cause a negative revision of inflation expectations (Solink, 1983). Fama and Schwert (1977) offer an alternate explanation due to realized inflation and economic activity exhibiting a negative relationship while a positive relationship between economic activity and stock prices. Riley (1997) further confirms that inflation has a negative impact on stock prices by using a Du Pont analysis and showing that inflation harmed profits, ROE and consequently real returns. Consequently, it has been concluded in numerous studies that stocks are a bad inflation

hedge. The results of these studies suggest that a country suffering from high inflation (such as South Africa) will suffer the adverse effects of inflation far more than more stable, developed markets.

A study by Firth (1979) found that, contrary to most studies on the subject, the Fisher effect did in fact hold after looking at a 21 year time period in the United Kingdom. Furthermore Eita (2012) conducted a study on the JSE which revealed surprising and contrary results. Eita (2012) examined returns on the JSE over a 28 year period and found that South African stocks did provide an effective hedge against inflation unlike in the USA and many other developed markets (excluding the U.K.). These results obtained on the JSE by Eita (2012) have been generally been supported by previous studies on the JSE such as those by Roome (1986) and Bethlehem (1972) who conducted the first study regarding inflation and stock returns on the JSE. The results regarding the Fisher hypothesis thus seem dependent on the country examined and no outright rejection or acceptance of the theory can be claimed. Kuttner (2009) goes so far as to say that inflation appears to follow a random walk, much like stocks, after finding that stock returns had very little power in forecasting inflation rate changes in Asian markets.

Building on from the PPP theory and the Fisher effect is that of the interest rate parity theorem, which come in two forms, namely covered interest parity (CIP) and uncovered interest parity (UIP). CIP states that the differential of the forward exchange rate over that of the spot rate will equal the differential in nominal interest rates offered by the two countries in question (Horobet *et al.*, 2009). Similarly, UIP states that the differential of the prevailing spot rate over the expected spot rate at $t + 1$ will equal the differential of the nominal interest rates in the two respective countries. In words, these theories imply that no excess returns should be made by investing in a foreign currency. If the Fisher relationship holds (which is open to debate), real returns across countries should be the same, implying only inflation will cause a change in exchange rates between two countries (Solink, 1983; Horobet *et al.*, 2009).

The UIP formula is presented as follows:

$$\bullet \quad \frac{S_t}{E(S_{t+1})} = \frac{(1 + N_d)}{(1 + N_f)} \quad (3)$$

As with PPP, UIP has been found to hold better in the long run than in the short run (Alexius, 2001; Flood & Taylor, 1997). Chinn and Meredith (2004) conducted a study among the G7 countries over 5 and 10 year holding periods and found that UIP held better the longer the holding period. This could be attributed to short run volatilities and shocks in the market that need to be smoothed out. UIP tests however primarily focus on risk-free interest rates or government bond rates as opposed to stock markets. Furthermore, a country risk premium often needs to be factored in if one country is perceived riskier than the other (Chinn & Meredith, 2005; Mehl & Cappiello, 2007). However, this does not alter the premise of UIP regarding the currency return factor: countries with higher interest rates (and by implication inflation) should exhibit depreciating exchange rates (Chinn & Meredith, 2004; Chinn & Meredith 2005; Flood & Taylor, 1997).

Using interest rates as a proxy for anticipated inflation, studies by Horobet *et al* (2009) found that interest rates indicated the direction of the exchange rate movement, but not the extent. Furthermore Mehl and Capiello (2007) found that UIP held reasonably over the medium and long term in developed economies but it failed regarding emerging economies. They put this down to the possibility of the high risk premium often needed to be added to emerging markets and the volatile nature of the emerging market returns. These high premiums in part explain the profitability experienced by carry-trade strategies.

Burnside, Eichenbaum, Kleshchelski and Rebelo (2006) study currency speculation profitability, specifically by studying carry-trade strategies. In their analysis they attempt to answer why currencies that trade at a forward premium tend to depreciate and violate UIP. They find that while in theory currency-speculation strategies and carry-trades provide high Sharpe Ratios and seem to have uncorrelated returns with broad risk factors, the actual realized profit from carry-trades is smaller than expected. They state that this is largely due to transaction costs and that price pressure limits the size of the positions that can be taken. Thus while small positions would generate large profitability in relative terms, if a large investor or manager or a multi-billion dollar fund wanted to profit in a meaningful way that would influence his funds' performance, it becomes far more complicated. In smaller volatile markets when large orders are placed for speculative currencies, bid/ask spreads rise rapidly along with the price volatility and this can cause the weighted average cost of the investment to be far greater than anticipated. This leads to a decline in the realized profitability of the carry-trade. Their results did indicate that carry-trades aid in diversification, due to their low correlations with broad risk factors.

Burnside, Eichenbaum and Rebelo (2008) highlight the diversification benefits resulting from carry-trade strategies. Their sample period comprises of data from January of 1976 up until 2007 and they examined 23 currencies relative to the USD. They further examined three strategies: the first carry trade strategy accounted for bid-ask spreads and an equally weighted portfolio of currencies. The second strategy consisted of an equally-weighted portfolio, where each currency was assigned the same weight relative to the USD while the third strategy looked into a 'high-low' strategy where a position was only taken in a currency trading with the highest forward premium relative to the USD each month. Their results indicated that the diversified equally-weighted portfolio substantially outperformed the 'high-low' portfolio, with Sharpe ratios rising by as much as 50%. The results further indicated that when non-diversified portfolios were examined, volatility was substantially higher for the single-currency trades (as much as 52%) and that the mean returns were low, while the data exhibited excessive levels of leptokurtosis. However, the returns were far more normalized and the distributions tended closer to normality of the equally-weighted portfolio. The authors did emphasize that in times of an economic downturn, the diversification benefits of the equally weighted portfolio are diminished, although over the entire sample period they were substantial.

A study conducted by Handley (2008) again found that from a dollarized perspective, carry-trade strategies were highly effective and offered substantial diversification benefits. The study found that when fixed income returns (based off cash deposit investments in FX),

equity investments and carry-trade strategies were compared among the G10 countries, carry-trades offered the lowest correlation with the other asset classes and produced the highest Sharpe ratios. Handley (2008) emphasized that incorporating carry-trades into a portfolio would yield a reduction in the portfolio risk and correlation.

Burnside (2011) studies the returns to carry-trades and examines 20 different countries over the sample period of 1976 through 2010. The study notes that traditional stock-pricing models are unable to explain the high returns generated by carry-trades. Burnside (2011) states that different risk factors appear to drive currencies as opposed to equities. Differing risk drivers could explain the low correlations between carry-trade and equity market returns. The paper found that over the 2008 financial crises, correlations did increase between carry-trades and equity markets, although the covariances were still not high enough to explain the returns to carry-trades.

In one of the most recent studies regarding diversification by utilizing carry-trades Das, Kadapakkam and Tse (2013) looked into a carry-trade strategy that exploits UIP violations. The strategy involves taking long positions in high-yielding currencies while taking short positions in low yielding currencies among G10 countries. They found the carry trade strategy to have a far lower correlation with the S&P500 than more traditional asset classes and found it to be a highly effective investment strategy. Furthermore, it exhibited strong performances during the 2008 financial crisis. Their conclusion emphasized the importance of investors continually adopting and incorporating new asset classes into their investment portfolios to continue to exploit uncharted diversification benefits.

3. Data and Methodology

This study examines eight global markets. Four of these markets were from developed economies, namely the U.S, Japan, the U.K., and the Eurozone. These markets formed a Developed market portfolio. The four markets which were examined from developing economies are Brazil, Russia, India and South Africa and these markets were used to form a Developing market portfolio. The reasoning for these choices was that the developed economies chosen are the four largest financial economies globally while the four emerging markets chosen are all part of the BRICS group, which are considered strong emerging economies. South Africa is also tied heavily to these counterparts and as a result, this highlights their relevance for inclusion. China was not included due to their exchange control systems and dual class of equity listings. The specific indices which were examined are the S&P500, the FTSE100, the Eurostoxx50 and the Nikkei225 for the developed economies while for the developing economies the RTS50, Bovespa50, BSE30 and the JSE Top40 were studied. It should be noted that the Eurozone comprises of 17 member countries, although the

EuroStoxx50 (which will be the proxy for the Eurozone) only comprises of the 12 core Eurozone Economies.²

All index data was obtained in the form of the domestic currency of the relevant market. All data was obtained from DataStream and the sample period examined spanned 14 years from January 1999 up until the close of January 2013. The data period was chosen due to the Euro being introduced on the 1 January 1999. The data period further captured important events of financial markets in recent history, namely the credit bubble and the subsequent crash that followed in 2008 as well as the dot com bubble and the subsequent global recession of 2001-2003. Such occurrences are instructive with regard to how the JSE top40 performed relative to its developed and developing market counterparts during various stages of the economic cycle.

In addition to examining the previously mentioned stock indices, the currencies of each market were also examined. The exchange rate performance of the rand relative to its counterparts was examined as well as how currencies and stock markets move in relation to one another. With the USD being considered the reserve currency of the world (Yotopoulos & Sawada, 1999; Judson, 2012), it is instructive to see how investors viewed it during various stages of the economic cycle as opposed to the ZAR.

Real returns were firstly computed from a South African investor's perspective (hereafter referred to as the domestic perspective). Stock market returns and currency returns of the various markets were considered (following the methodology of Asness *et al* (2011)) as well as domestic monthly inflation. Monthly Consumer Price Index (CPI) data was used for the inflation rate term (Fama & Schwert, 1977; Chowdhry *et al*, 2005). Currency results are all presented in the format of ZAR/Foreign Currency. All returns were subsequently deflated by the South African CPI in order to examine the true buying power that all investments returned to a South African investor. Ultimately investors are concerned about real returns as opposed to simply nominal returns. As such, their domestic inflation rate must be considered for all investments. If parity theorems hold, the inflation rate differential between South Africa and the foreign markets of their investments should be reflected in the currency changes (Chinn & Meredith, 2004).

Real returns were thereafter calculated from the perspective of a U.S. investor (hereafter referred to as the international perspective). This allowed real return co-movements between each market to be examined on a global scale. As such, all returns were dollarized and deflated by U.S. CPI. The methodology applied as such is similar to Drissen and Laeven (2007) as well as Asness *et al* (2011) and it allows for an interesting comparison between domestic returns as opposed to global dollarized returns. All data was computed on a monthly basis in line with studies by Bekaert *et al* (2009), Baele and Inghelbrecht (2009) and Asness *et al* (2011). Daily or weekly returns could not be examined due to CPI data only being released monthly. All empirical tests conducted were applied to both data sets of real returns computed where applicable.

² Refer to the 'Definition of Terms' for guidance on which economies from the Eurozone and represented by the EuroStoxx50.

Diversification benefits were examined in numerous ways. The first was by examining the standard deviations of returns over the sample periods (in line with Bekaert *et al*, (2009) and Baele and Inghelbrecht, (2009)) and by Sharpe Ratio testing as performed by Das *et al* (2013). The risk free rate used was the South African 3-month cash deposit rate for the domestic perspective and the 3-Month U.S. cash deposit rate for the international perspective. The Sharpe Ratio is defined as:

$$\bullet \quad \frac{R_p - R_f}{\sigma_p} \quad (4)$$

R_p gives the real portfolio return while R_f represents the real riskless rate and σ_p will represent the portfolio risk. In light of the findings of Asness *et al* (2011), portfolios were tested on an equal-weighted basis. Thereafter, the longest losing streak in months of each market and portfolio was calculated as well as the maximum drawdown. The longest losing streak represents the longest streak of consecutive monthly losses which a portfolio or economy suffered. The maximum drawdown refers to the lowest value that the portfolio reached, as a percentage of the initial investment made into it. In addition to this, the loss ratio (losing months as a percentage of total months) and the average worst returns over the sample period were also computed (Asness *et al* 2011). The average worst returns refer to the average of the bottom 25th percentile of monthly returns. The maximum cumulative loss streak suffered by the portfolio was also calculated, where the largest decline in portfolio value from a subsequent peak resulting from a streak of losses has been studied.

A final check on the effects of diversification was similar to the methodology of Asness *et al* (2011) by applying Value at Risk (VaR) methodologies to each of the economies and portfolios formed. VaR calculates a loss that should only be exceeded a certain percentage of the time (traditionally 5% or 1%), depending on your risk limit (Favre & Galeano, 2002). Specifically however, Modified Value at Risk (MVaR) has been applied, due to its advantages over the standard VaR calculation. The MVaR does not assume a normal distribution as with the standard VaR calculations and it is rather based on the distribution of the series under review. As such, it accounts for skewness and kurtosis (Favre & Galeano, 2002; Hens & Heusser, 2009). VaR will be calculated as follows:

$$\bullet \quad \text{VaR} = (z\sigma_p)V \quad (5)$$

The letter z represents the t-critical value for the desired risk level. σ_p simply represents the standard deviation of the portfolio returns. ‘V’ represents the monetary value invested in the portfolio. MVaR will be defined as:

$$\bullet \quad \text{MVaR} = \left[\mu - \left(z + \frac{1}{6}(z^2 - 1)S + \frac{1}{24}(z^3 - 3z)K - \frac{1}{36}(2z^3 - 5z)S^2 \right) \sigma_p \right] V \quad (6)$$

The mean return for the period is represented by μ . K will represent the excess kurtosis of the return series while ‘S’ will represent the skewness of the series. The MVaR of the South African economy was contrasted to those of the other economies, as well as those of the portfolios formed. Diversification benefits were computed by comparing portfolio MVaR to

that of the absolute or non-diversified MVaR. The reduction in the MVaR value represents the diversification benefits (Hens & Heusser, 2009).

In calculating the MVaR of the portfolios containing multiple assets, correlation matrices were applied. In essence, there were five steps involved in the process.

- Step 1: The weighted MVaR of each return series for each individual economy constituted the portfolio was calculated (using equation 6). This was then modelled in a matrix form as given below:

$X = [v_i \ v_j \ ... \ v_x]$ where v simple represents the weighted MVaR of each economy.

- Step 2: The correlation matrix of each return series was calculated and represented in matrix form:

$$Y = \begin{bmatrix} \rho_i & \cdots & \rho_y \\ \vdots & \ddots & \vdots \\ \rho_j & \cdots & \rho_z \end{bmatrix}$$

- Step 3: Matrix X and Y are multiplied together as follows, resulting in matrix Z:

$$Z = [v_i \ ... \ v_x] * \begin{bmatrix} \rho_i & \cdots & \rho_y \\ \vdots & \ddots & \vdots \\ \rho_j & \cdots & \rho_z \end{bmatrix}$$

- Step 4: Matrix Z is multiplied by the transposed matrix X:

$$ZX = [Z] * [X]^{Transpose}$$

- Step 5: The square root of matrix ZX is calculated, giving the portfolio MVaR:

$$MVaR = \sqrt{[ZX]} \quad (7)$$

The process described results in the diversified MVaR of the portfolio. The non-diversified MVaR is simply the sum of the MVaR's of each economy constituting the portfolio.

While each risk metric alluded to will aid in quantifying the benefits of diversification, the metrics shed light on different aspects of diversification. Measures such as the Maximum loss, the loss streak and the cumulative loss streak represent point in time measures which highlight the worst returns and worst performance suffered by the portfolio over a particular time period during the sample period. In contrast, the percentage of losing months, maximum drawdown, average worst loss, the Sharpe Ratio and the MVaR metrics look at poor returns over the entire sample period as opposed to simply focusing or bringing to light the worst time period for the portfolio. The point in time measures will illustrate how portfolios and economies performed during severe market downturns or a crisis, while the aggregated measures will provide direction as to how portfolios and economies performed over long run from a risk perspective. Aggregated measures provide more insight on the long run benefits of diversification while point in time measures will provide insight on the benefits of diversification during a market crisis.

If market returns exhibit increasing co-movement trends (as found by Baele & Inghelbrecht (2009)), it confirms that for South African investors, the benefits of global diversification are slowly decreasing. To test this hypothesis, co-movements were examined between South Africa and both the Developed market portfolio and the remainder of the Developing market portfolio as well as between the Developed portfolio and the Developing portfolio³. Return co-movements of South Africa with the Global portfolio were also examined. This array of results allowed for a comparison of how co-movements are changing in and among different markets and allowed for the comparison in the behaviour of developed and developing market. Similar tests were applied to the data when examined from the international perspective.

Co-movements between each market's currency and index were further examined. This was done to better understand the relationship between currencies and market indices (Hochstotter & Weskamp, 2012; Ning, 2010). For the South African market, the ZAR/Rand Basket return was used each month, as the ZAR is naturally perfectly correlated with itself. From the U.S. perspective, the USD/Dollar Basket (Dollar Index) was used to explore the co-movements of the USD relative to the SPX 500.

To examine how market co-movements have been evolving over time methodology similar to that of Das *et al* (2013) was applied whereby 12-month rolling correlations were calculated for each economy and portfolio formed. Furthermore a simple linear time trend test was applied to the data.

The model was defined as follows:

$$\bullet \quad \gamma_t = \alpha_0 + \beta T_t + \varepsilon_t \quad (8)$$

The change in the rolling correlations each month is represented by γ_t . The intercept is given by α_0 while T_t represents the change in each time period. β represents the loading factor on time and its coefficient is instructive as to whether co-movements are increasing or decreasing over time. Finally the error term is represented by ε_t . A t-test was performed on T_t to test for significance of time on the effects of co-movements. Durbin-Watson test statistics indicated that the data contained high levels of auto-correlation and as such, Prais-Winsten regressions were applied to the data in addition to the simple linear regression. Prais-Winsten regressions reduce auto-correlations and improve estimator efficiency. Mathematically, the Prais-Winsten regression is calculated as follows:

$$\bullet \quad \sqrt{1 - \rho^2} \gamma_t = \alpha \sqrt{1 - \rho^2} + (\sqrt{1 - \rho^2} X_1) \beta + \sqrt{1 - \rho^2} \varepsilon_1 \quad (9)$$

In equation 9, ρ represents the coefficient of first order of auto-correlation while the remaining variables remain as previously defined. The Prais-Winsten regression makes use of quasi-differencing. This entails regressing Y on X in the differenced form, where a proportion of the value (= to ρ) in the previous time period is subtracted from the variable in

³ The remaining economies comprising of the Developing market portfolio are: Brazil, Russia and India.

the current time period. For a detailed explanation of the mathematics behind the Prais-Winsten regression, refer to Gujarati and Porter (2009).

The sample period of 14 years was further divided into two separate sub-samples of seven years each to explore whether correlations are changing over time, similar to the study done by Cho *et al* (2012). Correlation coefficients were compared across each sample period and the Fisher Z-transformation (Fisher, 1915) was applied to the correlation coefficients to test for a statistical difference between the correlations from each respective sample period. The Fisher transformation is mathematically presented as follows:

$$\bullet \quad Z_{(\rho)} = \frac{1}{2} \ln \frac{1+\rho}{1-\rho} \quad (10)$$

The first step transforms the correlation coefficient into a standard z-normal distribution. Once the coefficient has been transformed, the following equation is used to compute a Z-critical value:

$$\bullet \quad Z_{crit} = \frac{Z_{(\rho_1)} - Z_{(\rho_2)}}{\sqrt{\frac{1}{n_1-3} + \frac{1}{n_2-3}}} \quad (11)$$

$Z_{(\rho_1)}$ represents the transformed correlation coefficient from the first half of the sample, while $Z_{(\rho_2)}$ represents the transformed correlation coefficient from the second half of the sample period. The Z-critical value was then used to determine the significance of the difference in the correlation coefficients.

4. Results

4.1. Summary Statistics

Table 1: Summary Statistics of Returns from a Domestic Perspective

	Mean	Median	Standard Deviation	Variance	Kurtosis	Skewness
USA	-0.01%	-0.22%	5.60%	0.31%	0.06	0.16
Eurozone	-0.14%	-0.61%	5.68%	0.32%	1.11	0.33
Japan	-0.08%	0.52%	5.70%	0.32%	0.59	-0.09
U.K.	-0.10%	-0.24%	5.18%	0.27%	0.88	0.36
RSA	0.73%	0.69%	5.67%	0.32%	0.11	-0.12
Brazil	0.93%	0.66%	9.90%	0.98%	0.36	0.04
Russia	2.39%	1.87%	11.40%	1.30%	2.72	0.82
India	1.13%	1.57%	10.00%	1.00%	1.28	0.10
Developed	-0.08%	-0.18%	4.55%	0.21%	1.01	0.16
Developing	1.29%	1.64%	5.45%	0.30%	1.33	-0.29
Mixed	0.08%	0.05%	4.47%	0.20%	0.77	0.12
Global	0.60%	0.81%	3.89%	0.15%	0.75	-0.05

Table 1 looks at the summary statistics of each real return series invested in from a South African investor's perspective. Thus currency fluctuations are factored into the returns before deflating them by South African CPI. Summary statistics for the return series' analysed show that most of the portfolios exhibited leptokurtosis and deviations from normality. The most extreme case of leptokurtosis was found in the Russian return series, where excess kurtosis was found to be 2.72 and skewness was 0.82. Russia however did exhibit both the highest mean and median monthly returns of 2.39% and 1.87% respectively. The monthly standard deviation was also the highest, at 11.40% per month. The USA had the lowest degree of leptokurtosis, with modest excess kurtosis of only 0.06 while having an unimpressive mean return of only -0.01% per month while the median was even more disappointing at -0.22%. The U.S. was the second least volatile market, with volatility of only 5.60% per month, while the U.K. was the least volatile at 5.18% per month. South Africa boasted a mean return of 0.73% with the median at 0.69% while having excess kurtosis of only 0.11. The equally weighted Global portfolio had a mean monthly return of 0.60% while the median was at 0.81% and excess kurtosis of 0.75 was found. The portfolio denoted 'Mixed'⁴ comprises of an investment in each of the developed economies as well as in the South African market. This would imply that each of the five economies in the Mixed portfolio receives a weighting of 20%. The inclusion of this portfolio throughout the results presentation is important as it is unlikely than an investor's portfolio would not include their domestic market. The Mixed portfolio had marginally positive mean and median returns while it exhibited lower amounts of excess kurtosis and skewness as opposed to the stand alone Developed portfolio. Volatility was also marginally lower than the Developed Portfolio, at 4.47% per month.

Table 2: Summary Statistics of Returns from an International Perspective

	Mean	Median	Standard Deviation	Variance	Kurtosis	Skewness
USA	-0.01%	0.56%	4.58%	0.21%	0.72	-0.48
Eurozone	-0.10%	0.05%	5.67%	0.32%	0.77	-0.44
Japan	-0.05%	0.30%	5.72%	0.33%	0.00	-0.38
U.K.	-0.06%	0.15%	5.06%	0.26%	1.29	-0.39
RSA	0.91%	1.17%	7.73%	0.60%	0.41	-0.44
Brazil	1.55%	1.69%	10.93%	1.19%	3.24	0.40
Russia	2.53%	2.90%	12.01%	1.44%	2.32	0.30
India	1.30%	2.02%	9.17%	0.84%	0.54	-0.07
Developing	1.57%	2.49%	7.01%	0.49%	1.86	-0.31
Developed	-0.05%	0.33%	4.71%	0.22%	1.06	-0.64
Mixed	1.26%	1.99%	6.22%	0.39%	1.87	-0.42
Global	0.76%	1.45%	5.43%	0.29%	1.84	-0.56

Table 2 represents the summary statistics from the international perspective (U.S. investors' perspective). It is again interesting to note that even when all of the returns examined are dollarized, the developed markets still achieved a negative mean return in every instance.

⁴ Definition presented in the 'Definition of Terms'

Furthermore, the developed market return series' were consistently negatively skewed, with the median always being positive and greater than the mean. The Eurozone again had the lowest mean return. Out of the developed economies, the U.K. exhibited the greatest leptokurtosis, with excess kurtosis of 1.29. This is in contrast to the domestic perspective, where the Eurozone had the highest degree of excess kurtosis out of the developed economies.

Russia again had the highest mean return of 2.53% per month while having excess kurtosis of 2.32 and 0.30. Brazil displayed the most volatility clustering, with excess kurtosis of 3.24, while boasting an impressive mean return of 1.55%. From the international perspective, South Africa had a mean return of 0.91%, which is greater than when viewed from the domestic perspective. The median return was also higher from the international perspective although excess kurtosis was higher at 0.41 (as opposed to 0.11) highlighting the effects that the volatile ZAR had on the return series properties. The results further highlight the higher monthly volatility of developing market returns, with Russia again being the most volatile market. The developed market returns all displayed volatility of less than 6% per month, with the U.S. again being the most stable.

The Developing market portfolio had a similar mean return from the international perspective as when viewed from the domestic perspective (1.29% when viewed from the domestic perspective versus 1.57% when viewed from the international perspective), although the median was far higher from the international perspective. Furthermore, the Global portfolio produced superior mean and median returns from the international perspective although the return series was far more leptokurtic, with excess kurtosis being 1.84 and opposed to 0.75.

From the international perspective, the Mixed portfolio is constructed using the same principles as when viewed from the domestic perspective, although the constituents of the portfolio are different. The Mixed portfolio consists of an equal weighted portfolio made up of the four developing economies, as well as the U.S. Each economy received a 20% weighting in the portfolio to keep the principles of equal weighting. This enables a mixed view from the U.S. investors perspective between developing markets and their own domestic market. The portfolio exhibited negative skewness and a respectable mean return of 1.26% per month. The Mixed portfolio from the international perspective represents an investment in the developing markets, as well as in the U.S. The Mixed portfolio exhibited more a slightly larger deviation from normality than the stand alone Developing portfolio with excess kurtosis of 1.87 and skewness of -0.42.

4.2. Return Correlations

Table 3: Real Return Correlations from a Domestic Perspective

	<i>USA</i>	<i>Eurozone</i>	<i>Japan</i>	<i>U.K.</i>	<i>RSA</i>	<i>Brazil</i>	<i>Russia</i>	<i>India</i>
USA	1							
Eurozone	0.55	1						
Japan	0.33	0.57	1					
U.K.	0.51	0.92	0.55	1				
RSA	0.52	0.57	0.50	0.58	1			
Brazil	-0.19	-0.37	-0.27	-0.36	-0.17	1		
Russia	0.15	0.12	0.14	0.12	0.46	0.12	1	
India	-0.16	-0.18	-0.08	-0.15	0.05	0.27	0.37	1

Table 3 shows the correlation between the real returns of the different economies being studied from the domestic perspective. The results indicate that South Africa and Brazil have a negative correlation in returns of -0.17 while the next lowest correlation regarding South Africa is with India, with a modest correlation of only 0.05. South Africa has the highest correlation with the U.K. (0.58) followed closely by the Eurozone (0.57). The results are surprising in some regards, as they show that South Africans (who are in a developing market) are likely to gain more diversification benefits by investing in other developing markets than by investing in more developed economies. At the same time though, the finding is consistent with previous literature regarding lower correlations between developing markets (Driessen & Laeven, 2007). Furthermore, the Eurozone is the largest trading partner to South Africa, largely explaining the high correlations exhibited.

It should be noted that between the Eurozone and the U.K., an extremely high correlation of 0.92 was produced; indicating that investing in both of these economies would most likely provide little benefits in risk reduction. The results further confirm that Brazil and India generally have the lowest correlations with the other economies and consequently are likely to produce the greatest diversification benefits.

Table 4: Real Return Correlations from an International Perspective

	<i>USA</i>	<i>Eurozone</i>	<i>Japan</i>	<i>U.K.</i>	<i>RSA</i>	<i>Russia</i>	<i>Brazil</i>	<i>India</i>
USA	1							
Eurozone	0.86	1						
Japan	0.62	0.59	1					
U.K.	0.85	0.94	0.59	1				
RSA	0.72	0.75	0.68	0.79	1			
Russia	0.60	0.57	0.49	0.62	0.62	1		
Brazil	0.29	0.33	0.19	0.35	0.28	0.34	1	
India	0.19	0.20	0.26	0.26	0.19	0.26	0.21	1

Table 4 presents the correlation of returns between the different economies from the international perspective. It is immediately obvious that when the return series' are dollarized, the developed economies exhibit far higher correlations than when returns were viewed from the South African perspective. The U.K. and the Eurozone have the highest correlation of 0.94, followed by the high correlation between the U.S. and the U.K. at 0.85 and between the U.S. and the Eurozone at 0.86. These results are consistent with previous studies, which have emphasised the higher correlations between developed markets as opposed to developing markets (Driessen & Laeven, 2007; Bekaert *et al*, 2009). Driessen and Laeven (2007) also emphasise the higher correlations between dollarized returns, as opposed to those of emerging market currencies.

Furthermore, when results are viewed from the International Perspective, no negative correlations are found. It is also curious to note that South Africa and the U.S. had a correlation of 0.72 from the international perspective, as opposed to the 0.52 that was found from the domestic perspective. These results further denote that it is likely that diversification benefits will be found to be greater for South African investors as opposed to U.S. investors. Most of the world's trade happens in USD's because it is the reserve currency of the world and the U.S. is the largest economy. As such, this is likely to drive the higher correlations produced from the International perspective.

The lowest return correlations are found with India. India and the U.S. had a correlation of only 0.19 and India and the RSA also had a return correlation of only 0.19. The highest return correlation that India exhibited with any economy was 0.26. South Africa again has the highest correlation with the U.K. followed by the Eurozone. These results are similar to the results of table 2, although the magnitudes of the correlations in table 3 are far larger than in table 2.

It is important to note that the study conducted by Li *et al* (2003) revealed lower correlations. Their study revealed monthly return correlations of only 0.50 between the U.S. and the U.K. while Japan and the U.S. produced a correlation of only 0.25. Brazil and the U.S. had a correlation of 0.13 while they found that Brazil and Japan had a returns correlation of 0.10. Their study covered an earlier time period though, examining returns between 1976 through to 1999, prior to the formation of the Euro. This could be indicative of increasing return correlations, as documented by numerous authors, which could be partly due to the formation of the euro (Bekaert *et al*, 2009; Baele & Ingelbrecht, 2009; Driessen & Laeven, 2007). The study by Fadhlauoi, Bellalah, Dherry and Zouaoui (2009) revealed dollarized return correlations lower than those of table 4 although they were higher than Li *et al*'s (2003). It must be considered that Fadhlauoi *et al* (2009) used daily returns and only a six year time period from 2000 through 2006 and neither Fadhlauoi *et al* (2009) or Li *et al* (2003) deflated returns by CPI.

4.3. Real Returns

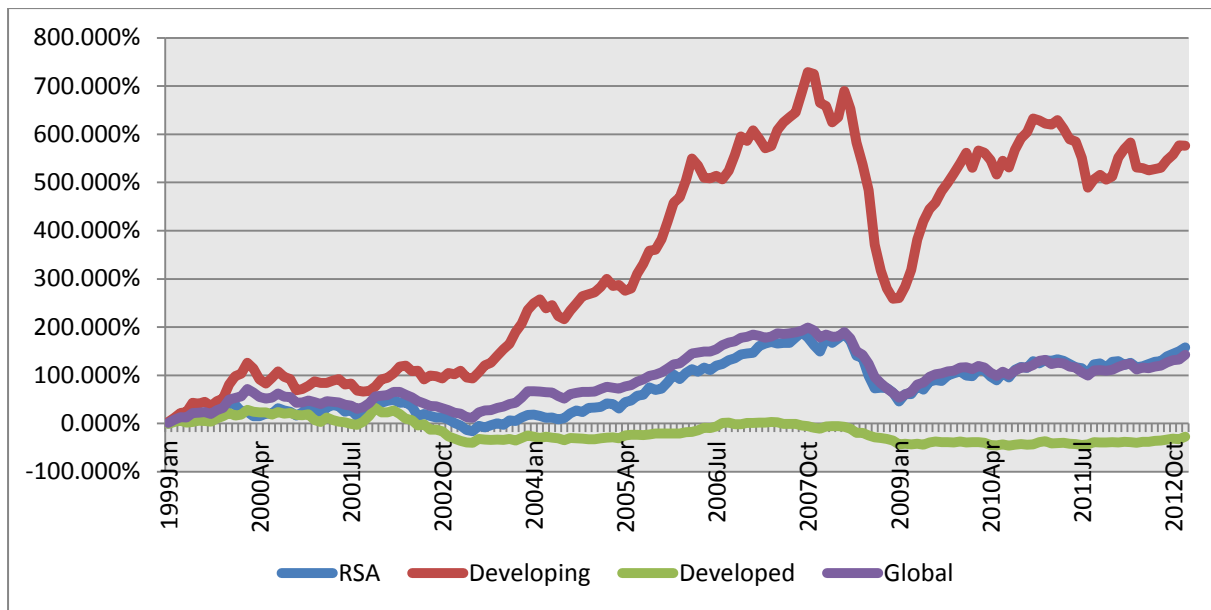


Figure 1: Real returns from the Domestic Perspective

Figure 1 shows the real returns to South African investors over the sample period for the South African economy, the Developing market portfolio, the Developed market portfolio and the Global market portfolio. The graph clearly suggests the highly successful performance of the developing markets examined, while the developed markets can be seen to have clearly underperformed, with returns over the sample period in fact being negative. The South African market tracked the global market returns very closely, with the two return series' tracking one another almost perfectly. The results also indicate that the developed markets never fully recovered from the dot com bubble and the subsequent recession of 2001. As the developed markets were beginning to gain traction again, the financial crisis of 2007-2008 and the recession that followed took hold, further driving the returns into negative territory. The graph also provides a very clear picture of the far higher volatility experienced in the developing markets over 2008 and how much faster they were able to recover, although none of the portfolios represented in figure 1 were fully able to recover to their highs before the financial crises struck. Appendix A contains a full array of graphs for each individual economy examined, providing a clearer picture on how the separate markets have performed. It should also be noted that the phenomenal results seen in the Developing market portfolio are largely driven by the outstanding performance of the Russian economy.

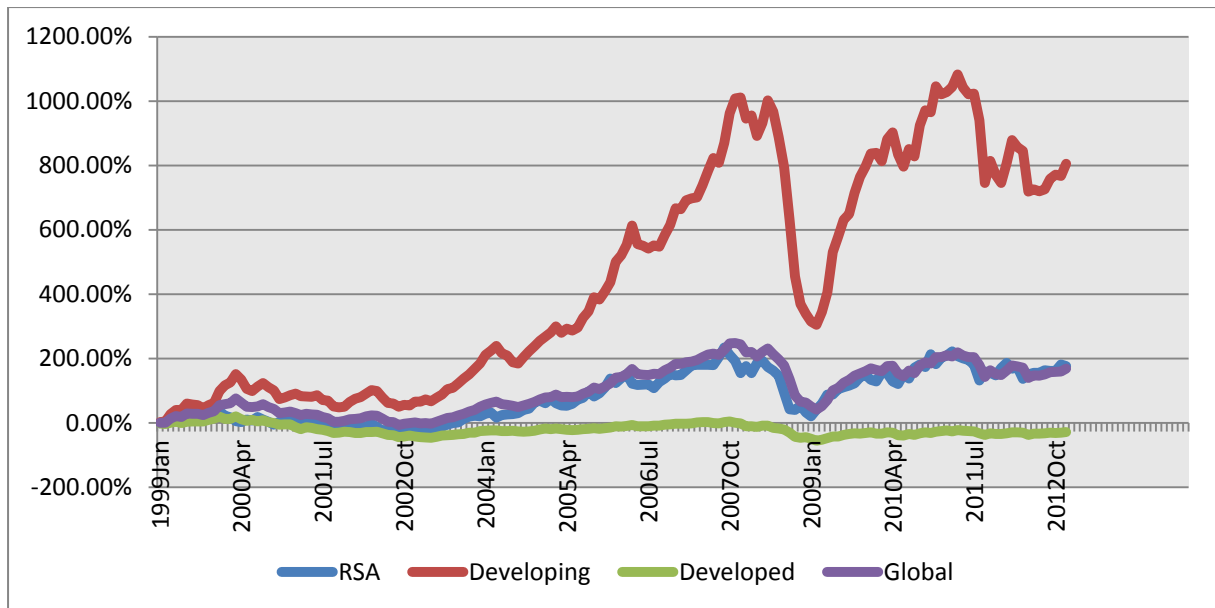


Figure 2: Real returns from an International Perspective

Figure 2 shows the real returns from the international perspective as opposed to the Domestic Perspective. The graph represents similar findings to that of figure 1 except that the Developing market portfolio returns are higher in figure 2 than in figure 1. Another interesting difference is that the Developed market portfolio appeared to have less negative returns. In general, the graphs seem to point towards that dollarized returns being slightly higher. This has some interesting implications, as it suggests that the U.S. investors benefited from foreign exchange currency movements by more than domestic South African investors did. This is surprising considering the two recessions that occurred during the sample period (the dot com bubble of 2001 as well as the banking crises of 2008), which would have boosted demand for the USD relative to ‘softer’ emerging market currencies (Sawada & Yotopoulos, 2001).

Table 5: Raw Returns from the Domestic and International Perspective

	Domestic Perspective	International Perspective
USA	-1.97%	-1.45%
Eurozone	-3.54%	-3.29%
Japan	-2.92%	-2.80%
U.K.	-2.76%	-2.44%
RSA	7.00%	8.15%
Brazil	5.41%	13.25%
Russia	23.57%	26.29%
India	7.82%	11.95%
Developing	14.63%	18.47%
Developed	-2.22%	-2.57%
Mixed portfolio	-0.26%	14.41%
Global	6.54%	7.89%

Table 5 presents the raw real annual returns of each economy and portfolio examined, from both a domestic and international perspective. The most obvious and concerning results are those pertaining to the developed economies. Both from a domestic and international perspective, negative cumulative real returns were achieved over the sample period examined. This result is concerning as it indicates any investment in a developed economy index could not even hold its initial value in real terms. This is in sharp contrast to the Developing market portfolio, which achieved outstanding 14.63% per annum from a domestic perspective while achieving an even more impressive 18.47% from an international perspective. The Global portfolio exhibited returns of 6.54% from the domestic perspective and 7.89% from the international perspective. Looking at South Africa, a respectable return of 7.00% was achieved over the sample period examined domestically while internationally South Africa was even more appealing, yielding 8.15%. The Mixed portfolio yielded a reasonably flat real return over the period of -0.26% from the domestic perspective while the Mixed portfolio returned 14.41% from the International perspective. It should again be highlighted that from the domestic perspective, the Mixed portfolio comprises of the developed economies as well as South Africa, while from the International perspective the Mixed portfolio is comprised of developing economies as well as the U.S.

The outstanding results obtained by the developing markets are largely attributable to Russia, which achieved a return of 23.57% from the domestic perspective and 26.29% from the international perspective. The phenomenal result is driven both by the exceptional return delivered by the RTS50 as well as the RBL holding its value reasonably well against the USD and the ZAR despite the far higher inflation rate experienced in Russia. This is consistent with the findings of Das *et al* (2013) who highlighted that high yielding currencies often have a lower inflation differential than what parity would suggest. Annualized inflation rates as well as inflation differentials are presented in Appendix C. Brazil appeared to be the worst performing of the developing economies to a South African investor followed by India, while from the international perspective South Africa was the worst performing developing economy, followed by India.

Among the developed economies, the U.S. appeared to be the best performer, although a South African would have still earned a negative return of -1.97% per annum. It thus seems that investing even in developed market safe haven currencies would not have been a profitable currency hedge for South Africans, although factoring in bank deposit rates may change the picture, which will be explored at a later stage in section 4.5 and tables Table 16 and Table 17. Regarding every economy and portfolio formed, the cumulative returns over the sample period are higher from the international perspective as opposed to the domestic perspective. This is consistent with the results of Driessen and Laeven (2007) and Cho *et al* (2012), which emphasised that dollarized expected returns were higher than local currency returns of domestic markets.

This finding has strong implications for carry-trade strategies and suggests a violation of UIP. If U.S. investors benefit *more* from foreign investment than developing market South African investors, it implies that the USD depreciated relative to its inflation differential with the foreign markets by more than it should have (or it appreciated by less than it should have,

depending on the economy it is being compared to). Put another way, investors in developed markets gain from foreign developing market investments because the foreign currency devalues by less than the inflation differential suggests it would, providing real returns to the developed market investor. These findings are consistent with the findings of Das *et al* (2013) and Burnside (2011) regarding the excess returns than can be achieved by utilizing a carry-trade strategy. A possible explanation for the impressive currency performance of developing markets could pertain to capital flows. If investors are feeling bullish or are seeing strong development in developing markets, this will cause capital inflows and attract investment, bolstering up the currency. This could lead to a currency appreciation in excess of what the inflation differential would suggest.

4.4. Diversification Benefits

Table 6: Sharpe Ratio Analysis

	Domestic Perspective			International Perspective		
	Excess Annualized Return	Excess Annualized Volatility	Sharpe Ratio	Excess Annualized Return	Excess Annualized Volatility	Sharpe Ratio
USA	-4.71%	18.60%	-0.25	-1.59%	15.29%	-0.10
Eurozone	-6.24%	18.88%	-0.33	-3.29%	19.06%	-0.17
Japan	-5.63%	18.94%	-0.30	-2.84%	19.23%	-0.15
U.K.	-5.48%	17.15%	-0.32	-2.50%	16.96%	-0.15
RSA	4.04%	18.19%	0.21	7.30%	26.21%	0.28
Brazil	2.49%	33.50%	0.07	12.00%	37.29%	0.32
Russia	20.22%	38.68%	0.52	23.95%	41.03%	0.58
India	4.84%	33.85%	0.14	10.81%	31.21%	0.35
Developing	11.49%	18.08%	0.64	16.86%	23.71%	0.71
Developed	-4.95%	14.98%	-0.33	-2.22%	15.73%	-0.14
Mixed	-3.03%	14.70%	-0.21	13.25%	17.13%	0.77
Global	3.60%	12.67%	0.28	7.32%	18.23%	0.40

Table 6 presents the excess annualized real returns as well as the excess annualized volatilities for each portfolio and economy being examined. The excess return is measured as the index return minus the 3 month cash deposit rate of return that could have been earned. The cash deposit rate however is not entirely free of all volatility so as such, excess volatility is reported. The cash deposit rate does however have a very low rate of volatility, especially in comparison to that of the market index. From the Domestic Perspective, the cash deposit rate of South Africa is used, deflated by inflation while from the international perspective; the real U.S. 3 month cash deposit rate is applied.

From the Domestic Perspective, a notable finding is that in all instances pertaining to the developed economies, the Sharpe Ratio is negative. This result implies that domestic investors were being punished for taking on excess risk. The real annualized risk free return that domestic investors could have obtained was found to be 2.87%. The poorest performing economy in terms of the Sharpe Ratio was found to be the Eurozone, with an excess annual

return of -6.24% and volatility of 18.88%, leading to a negative Sharpe Ratio of -0.33. The U.S. was the strongest performing of the developed economies, although it still had a negative excess return of -4.71% with a volatility of 18.0%. The U.K. was found to be the least volatile of all the markets examined, with excess return volatility of only 17.15%.

Regarding South Africa, the market yielded excess annualized real returns of 4.04% over the cash deposit rate while excess annualized volatility was 18.19%. This led to a Sharpe ratio of 0.21. This is substantially higher and far superior to any of the developed markets. Russia unsurprisingly had the highest Sharpe Ratio, at 0.52 driven by its annualized excess return of 20.22%. The high return though was coupled with extreme volatility of 38.52%, limiting the impressive Sharpe Ratio.

The Sharpe Ratios for diversified portfolios lends support to diversification benefits, although primarily among developing markets. The Developing market portfolio boasted the most impressive Sharpe Ratio of 0.64, driven by a strong annualized excess return of 11.49% and moderate volatility of 18.08%. The Global market portfolio exhibited strong performance, with a Sharpe Ratio of 0.28, supported by a respectable excess return 3.60% per annum while having the lowest volatility of 12.67%. The Mixed portfolio offered an improvement over the Developed portfolio, although the Sharpe Ratio remained negative, due to the negative annual returns.

From an international perspective, all of the Sharpe Ratios of the developed nations were found to be negative, indicating that investors of those markets would have gained higher returns by investing in the risk free asset over the market. It is also curious to note that from the international perspective, the developed market excess returns are always higher than when viewed from the domestic perspective. This is in line with the findings of table 5, which showed that real raw returns were always higher when returns were dollarized. The higher excess returns, indicate that U.S. investors were being rewarded more by investing in developed market indices above simply investing in cash locally. The higher returns from a dollarized perspective are consistent with the findings of Driessen and Laeven (2007). The result is largely driven by the lower risk-free rates offered in the U.S. as opposed to in South Africa. The lower the cash rate offered by banks to investors, the lower the market index return has to be to generate positive excess returns. In The U.S., investors typically received a riskless rate averaging at 2.76% over the sample period, while South African investors received a riskless rate averaging at 8.97% (refer to table 1C in Appendix C).

In all instances, the Sharpe Ratios from the international perspective appear to be higher than when viewed from the domestic perspective. This could be driven by the fact that U.S. investors benefited from taking on risk, especially arguably foreign exchange risk, more than South African investors. Despite the differences in results, some findings remain consistent between the international and domestic view. Russia remained the best performing economy, with a Sharpe Ratio of 0.58 and the Developing market portfolio again had an impressive Sharpe ratio at 0.71. However, the best performing portfolio from the international perspective was found to be the Mixed portfolio, which boasted an impressive Sharpe Ratio of 0.77. This again confirms the superiority of diversifying in more developing economies.

The result was driven by a high annual excess return of 13.25% and a moderate volatility of 17.13%.

Another interesting difference is that the volatility of all the portfolios formed were *lower* from the domestic perspective versus the international perspective. When looking at the individual economies though, the volatilities were similar regardless of the perspective which they are examined from. This again highlights the greater diversification benefits obtained by developing market investors. The results further give strong support for investors to diversify more among developing economies than among developed economies.

Table 7: Diversification Measures from a South African Investors Perspective

	Max Loss (Monthly)	Loss Streak: Months	Max Drawdown	Cumulative Loss Streak	% Losing Months	Average Worst Loss
USA	-15.38%	5	-50.00%	-33.27%	52.38%	-8.54%
Eurozone	-15.60%	11	-54.08%	-46.81%	54.17%	-9.45%
Japan	-15.19%	8	-53.20%	-50.66%	46.43%	-8.73%
U.K.	-11.74%	8	-51.15%	-31.99%	55.36%	-8.10%
RSA	-15.76%	5	-16.15%	-39.44%	44.46%	-8.04%
Brazil	-30.81%	9	-31.79%	-50.93%	47.62%	-13.59%
Russia	-24.83%	9	29.16%	-73.14%	39.88%	-13.87%
India	-27.11%	5	-42.83%	-50.09%	42.26%	-15.26%
Developing	-19.38%	8	2.95%	-54.53%	36.91%	-7.75%
Developed	-12.63%	8	-45.79%	-39.34%	55.36%	-7.01%
Mixed	-12.40%	10	-35.24%	-41.27%	50.00%	-6.76%
Global	-12.50%	12	1.20%	-44.36%	38.69%	-5.55%

Table 7 suggests that diversification benefits presented to South African investors are not as clear cut as one may have originally envisioned⁵. The economy that suffered from the largest single month loss was Brazil, with real returns plummeting by just over 30%. This was caused by a plunge of the BOVESPA by as well as a dive in the BRL. The economy that had the smallest single monthly loss was that of the U.K. while South Africa suffered a maximum single loss of 15.76%. This loss was smaller than all of the maximum losses experienced by the developing economies while being marginally larger than all of the losses that South African investors would have suffered by investing in the developed economies.

The largest single loss that would have been experienced if all funds were invested in a developed economy was found to be 12.63% while in the Developing market portfolio it would have been 19.38%. The Mixed portfolio had the smallest single loss of -12.40%, just beating the Global portfolio which had a maximum single loss of -12.50%. It should be noted that in the study conducted by Asness *et al* (2011) their worst single month returns for the developed economies were generally found to be larger (-21.40% loss for the U.S. for example). Asness *et al* (2011) studied returns from a dollarized U.S. investor's perspective

⁵ Refer to pg. 15 for reference on the definition of each risk metric

and utilized a longer time period of 1950 through to 2008 which is almost certain to account for the differences in results. Consistencies are still evident between the studies though, especially due to both the results in table 7 and the findings by Asness *et al* (2011) that developed markets single worst monthly returns are consistently lower than those of developing markets. The Mixed portfolio produced results very similar to those of the Developed market portfolio.

Looking at the longest streak of losing months in a row produces unexpected results. The Global portfolio had the most consecutive months of negative returns out of all the portfolios and economies, followed closely by an investment in the Eurozone with consecutive losses being at 12 and 11 months respectively. South Africa, the USA and India had the fewest consecutive losses (5 losing months in a row), while the Developed and the Developing market portfolio both suffered 8 losing months in a row.

The cumulative loss streak (CLS) refers to the largest compounded series of losses resulting from a losing streak. As such, the CLS can be seen as the loss that an investor would have incurred had they had the worst timing of their investment, and invested at the start of the worst losing streak. In other words, the CLS shows the portfolio value erased from a losing streak of months. Russia suffered by far the largest CLS with the portfolio reaching a 73.14% loss at one stage while the smallest CLS was experienced by the U.K. at 31.99%. The South African market suffered a CLS of 39.44% while the Developed and Developing market portfolios suffered CLS of 39.34% and 53.54% respectively. The Global portfolio suffered a CLS of 44.36%. Thus the benefits regarding global diversification are not as large as would be expected. A non-diversified South African investor would have in fact suffered a smaller CLS on his portfolio than one who had globally diversified. The Mixed portfolio yielded a CLS of -41.27%, offering neither an improvement over the RSA stand-alone portfolio or the Developed market portfolio. An interesting observation is that the CLS of every developed economy investment occurred during the dot com bubble recession, while the CLS of every developing economy occurred through the 2008 financial crises. This could be indicative of the ‘flight to quality’ response by investors increasing and the currency appreciation of developed economies benefiting investors in developing markets more over time. As a result, over 2008, it is possible that the currency appreciation of a South African’s investment in developed economies was larger than it was during the dot com bubble, creating a buffer against their losses through the 2008 crises.

The maximum drawdown column refers to the lowest value that the portfolio reached, as a percentage of the initial investment over the entire sample period. This provides further interesting and surprising insights. The Eurozone was the poorest performing economy with a maximum drawdown in portfolio value of -54.08%. South Africa outperformed all of the developed markets in this regard, with a maximum drawdown of -16.15%. The Russian economy again had outstanding results, with the *lowest portfolio value* being 29.16%. This is driven by the very high return that the portfolio experienced in the first month of investment (The RTS50 gained just under 27% while the RUB gained nearly 3%). That, coupled with the fact that no subsequent loss was large enough to reverse the series of gains that the portfolio experienced early on, drove this exceptional result. This indicates that an investment made in

January 1999 in the RTS50 would never have dropped below its initial value. Neither the Global market portfolio nor the Developing market portfolio dipped under 0%. This is again largely influenced by the impressive performance of Russia. Further expanding on the performance of the Russian economy, is that the explosive growth experienced was driven almost entirely by the rapid rise of energy prices over the sample period and their powerful presence in the oil market.

Looking into the percentage of losing months that each economy and portfolio suffered over the sample period, the results are slightly more heartening. The percentage of losing months as a proportion of total months was found to be 44.46% for South Africa, while the Global portfolio suffered a far lower proportion of losses, with only 38.69% of months yielding negative returns. Surprisingly, to a South African, the U.K. market suffered the highest proportion of negative yielding months, with the 55.38% of the months producing losses. Overall, the Developed market portfolio performed poorly, with negative returns 55.36% of the time while the Developing market portfolio was substantially better with negative returns only 36.91% of the time. In this instance, diversifying among the developing economies would have produced the most benefits. This finding is consistent with what the correlation matrices would suggest, considering that South Africa had far lower correlations with the other developing markets as opposed to those of the developed markets.

The average worst loss (AWL) explores the average of the bottom 25th percentile of returns that the portfolio experienced from the end of January 1999 through to January 2013. Once again, the results are indicative of benefits to global diversification, with the AWL being reported at -5.55% for the Global portfolio. The Developed market portfolio had slightly less impressive results with the AWL being -7.01% while the Developing market portfolio suffered AWL of -7.75%. The Mixed portfolio had the second smallest AWL at only -6.76%. None of the individual economies had AWL's as small as those reported for more diversified portfolios. The South African economy had an AWL of -8.04% while the Indian economy suffered the most in this regard, reporting an AWL of -15.26%. South Africa had the smallest of the AWL's out of the individual economies, followed by the U.K. with an AWL of -8.10%.

The results are broadly consistent with diversification benefits being evident to South African investors. However, the results are surprising, as both the Mixed and the Developing market portfolios regularly outperformed that of the Global portfolio. The surprise is that it appears South Africans do better by diversifying *either* by using other developing economies or by using only developed economies. The former finding is surprising as most developing economies suffer more from contagion during crises (Bekaert *et al*, 2009). That being said, it is consistent with the lower correlations found between South Africa and the other developing markets and it ties in with the results from table 6 relating to the Sharpe Ratios. The results also seem to signify that the U.S. is the least volatile or risky market to South Africans. This result could be driven by the strong demand for the USD (Benigno, 2011; Yotopoulos & Sawada, 2000).

Table 8: Diversification Measures from an International Perspective

	Max Loss (Monthly)	Loss Streak: Months	Max Drawdown	Cumulative Loss Streak	% Losing Months	Average Worst Loss
USA	-17.28%	5	-56.68%	-30.94%	44.64%	-7.89%
Eurozone	-20.48%	7	-56.68%	-47.10%	49.45%	-9.47%
Japan	-18.11%	7	-53.22%	-37.12%	49.41%	-9.60%
U.K.	-19.38%	10	-57.51%	-55.97%	49.41%	-8.37%
RSA	-26.54%	6	-24.61%	-52.12%	41.01%	-13.59%
Brazil	-25.23%	6	-46.73%	-67.73%	40.48%	-11.85%
Russia	-34.44%	8	29.91%	-78.78%	38.01%	-16.08%
India	-24.14%	6	-21.73%	-48.35%	43.45%	-16.08%
Developed	-18.81%	7	-55.20%	-41.52%	48.81%	-8.05%
Developing	-24.04%	9	2.25%	-63.21%	38.69%	-10.02%
Mixed	-22.69%	9	1.12%	-60.51%	39.88%	-9.11%
Global	-21.43%	9	-6.64%	-57.34%	40.47%	-8.52%

Table 8 reveals a wide array of results regarding diversification benefits, when real returns are examined from the U.S. perspective. It is immediately obvious that in very few instances did the portfolios consisting of multiple economies exhibit superior results than those produced by the U.S. Regarding the maximum monthly loss experienced, the U.S. had the lowest result, with a maximum loss of -17.28%. This could be due to the higher volatilities experienced in returns when any foreign investment was made, as indicated by table 6. Consistent with the domestic perspective results, the Developed market portfolio suffered a smaller single maximum loss when compared to the Developing market portfolio. Inconsistent with the results of table 7 though is the fact that the Global portfolio suffered a larger maximum loss than the Developed portfolio in table 8. The maximum losses experienced almost always higher from the international perspective than the domestic perspective, be it for the individual economies or the portfolios formed. Brazil and India are the only exception to this finding.

When looking at the losing streaks of the portfolio, again the U.S. investors did not receive many diversification benefits. The worst loss streak suffered by the U.S. economy was 5 months in a row, while the Global portfolio suffered 10 losing months in a row. The pure Developing portfolio as well as the Mixed portfolio also suffered 9 losing months in a row while the Developed market portfolio suffered 7 losses in a row. The worst performing economy by this measure was the U.K. with 10 losses in a row, in sharp contrast to the findings of the domestic perspective. South Africa suffered 6 losses in a row when viewed from the international perspective, which is similar to the results obtained from the domestic perspective.

The maximum drawdown (which refers to the lowest value that the portfolio reached as a percentage of the initial investment) measure gives some relief to the lack of benefits accumulating to U.S. investors. The U.S. portfolio suffered a maximum drawdown of -56.68% while the Developed market portfolio offered a marginal improvement, with a

maximum drawdown of -55.20%. The Developing market portfolio again offered outstanding performance, with the maximum drawdown being only 2.25% while the Mixed portfolio performed almost as well, with a maximum drawdown of 1.12%. This outstanding result signifies that an investment in either of these portfolios would have at no stage entered into negative territory. This result is again driven by the phenomenal performance of Russia.

The CLS (which should be highlighted refers to the largest decline in portfolio value at a given point in time resulting from a streak of losing months) results are disappointing for U.S. investors. The worst cumulative loss that would have been suffered by U.S. investors was -30.94%, while the CLS for the Global portfolio was -57.34%. The Developing market portfolio suffered a severe CLS of -63.21% while the Mixed portfolio fared slightly better with a CLS of -60.51%. South Africa had a CLS of -52.12% when viewed from the international perspective, which is substantially worse than when viewed from the domestic perspective. Again, Russia had the greatest CLS, driven by the high volatility of the RTS50, with a CLS of -78.78%. This result highlights the volatility of the Russian economy, indicating that at its worst stage the portfolio lost over three quarters of its value. An interesting finding is that the CLS for every economy was experienced during the 2008 financial crises. This highlights the severe contagion effect caused by the financial meltdown. The result is in contrast to the findings from the domestic perspective, where the developed economies experienced their CLS during the dot com bubble and the subsequent recession. The result highlights that developing market investors likely benefited strongly from their foreign currency investments in developed economies throughout 2008. For the U.S. investors, their currency appreciation would have decreased their forge in currency investment returns and their local returns would have remained largely unaffected.

Regarding the results of the percentage of losing months, there are no major differences between the various economies examined. The U.S. had negative returns 44.60% of the months during the sample period while South Africa had losing months 41.01% of the time. Russia had the lowest proportion of negative returns, with only 38.01% of the months resulting in losses. Looking at the portfolios, Developing market portfolio was the most impressive with only 38.61% of months resulting in losses.

The U.S. had the lowest AWL, at only -7.89%. For the U.S., the AWL was marginally lower from the international perspective as opposed to the domestic perspective. The Global portfolio had an AWL of -8.52%, while the Developed market portfolio suffered an AWL of -8.05%. The Developing market portfolio and the Mixed portfolio had AWL's of -10.02% and -9.11% respectively. From the international perspective, India and Russia jointly suffered the highest AWL's of -16.08% monthly. The results indicate that the AWL's are higher from the international perspective than the domestic perspective.

The results of table 8 reveal large differences in diversification benefits between developed and developing economies. The diversification benefits accruing to U.S. investors can clearly be seen to be of a smaller magnitude as opposed to the benefits which accrue to South African benefits. The findings are not too surprising when the higher correlations between developed economies are considered. The results also show consistencies with previous

studies conducted, with look into the diversification benefits accruing to developing market investors as opposed to developed market investors (Driessen & Laeven, 2007; Mansourfar, Mohamad & Hassan, 2010).

Table 9: MVaR Results for Single Economies

	Domestic Perspective	International Perspective
	95% MVAR	95% MVAR
USA	-9.21%	-7.45%
Eurozone	-9.34%	-9.30%
Japan	-9.39%	-9.44%
U.K.	-8.52%	-8.28%
RSA	-8.61%	-11.31%
Brazil	-15.13%	-16.32%
Russia	-15.67%	-16.73%
India	-15.28%	-13.73%

The results of table 9 present the MVaR in % terms suffered by each of the economies. This result is based primarily off their historic 14 year sample period and the results represent the worst loss level that should only be breached five times out of every one hundred months. The MVaR is a powerful toll in identifying the magnitude of losses which a portfolio is likely to experience. The MVaR allows for the return distribution to be accounted for better than the standard VaR methodology due to its incorporation of the Skewness and Kurtosis of a return series. It should be emphasised that in table 9, the results indicate the losses that a portfolio is likely to experience only 5% of the time.

From the domestic perspective, the country with the highest monthly MVaR is Russia. Every month there is a 5% chance that a loss of -15.67% or more of the portfolio asset value could be realized. The safest portfolio is again found to be the U.K. portfolio, which has an MVaR of only -8.52%. From the international perspective, the MVaR's are reasonably similar to those of the domestic perspective. However, notable differences are that the U.S. market is less risky when viewed from the international perspective (-7.45% as opposed to -9.21%), which is most likely due to the lack of exchange rate volatility and risk. South Africa has a far higher MVaR from the international perspective as opposed to the domestic perspective which is also consistent with lower exchange rate volatility.

To assess the impacts of diversification using the MVaR framework, the correlation matrix approach needs to be applied to each *portfolio*. This approach measures the undiversified MVaR that the portfolio faces, as well as the portfolio MVaR that results from diversification benefits when each of the economies constituting a portfolio of assets which are not perfectly correlated with one another.

Table 10: MVaR Diversification Benefits of Portfolios

Diversification Benefits	Domestic Perspective	International Perspective
95% MVAR Globally Diversified	-6.31%	-8.82%
95% MVAR Globally Undiversified	-11.55%	-11.57%
Net Benefit	-45.35%	-23.74%
95% MVAR Mixed Diversified	-6.88%	-9.29%
95% MVAR Mixed Undiversified	-9.01%	-13.11%
Net Benefit	-23.64%	-29.13%
95% MVAR Developing Diversified	-7.58%	-10.24%
95% MVAR Developing Undiversified	-13.99%	-14.52%
Net Benefit	-45.81%	-29.47%
95% MVAR Developed Diversified	-7.04%	-7.81%
95% MVAR Developed Undiversified	-9.11%	-8.61%
Net Benefit	-22.71%	-9.28%

Table 10 reports diversification benefits using the MVaR approach by applying the correlation matrices, to assess how the MVaR is reduced due to imperfect correlations of each economy. Looking at the results from the domestic Perspective, a few interesting results stand out. Firstly, the portfolio with the highest monthly MVaR, expressed as a % of assets invested, is the Developing market portfolio with an MVaR of -7.58%. This however, is still smaller than the MVaR of any individual economy examined, clearly highlighting the benefits of diversification. Furthermore, the undiversified MVaR for the Developing market portfolio is -13.99%, indicating that diversification reduced the MVaR by 45.81%.

The smallest MVaR is given by the globally diversified portfolio, with a MVaR of -6.31%. The undiversified MVaR was -11.55%, indicating that diversification offered a 45.35% risk reduction regarding the MVaR. The greatest net diversification benefit resulted from the Developing market portfolio, which fractionally beat the Global portfolio, offering a net benefit of a 45.81% reduction in the MVaR. The diversified MVaR of the Developing market portfolio was -7.58% while the undiversified MVaR had been just short of 14%. These results confirm the power of international diversification, especially among developing markets (Driessen & Laeven, 2007). The result is likely to be driven by the far lower correlations given by developing markets as opposed to the more developed economies.

The Developed market portfolio had a net diversification benefit of 22.71%, which was marginally worse than the Mixed portfolio, which had a net benefit of 23.64%. The greater volatility of the Developing market portfolio can be seen to have a negative effect on the results, as the diversified MVaR of the Developing portfolio is -7.58%, which is marginally higher than the MVaR's of both the Developed and the Mixed portfolio. As such, although diversification among the developed markets may not be as beneficial as among the developing markets, the overall risks pertaining to developed markets are still lower.

Analysis of diversification benefits regarding the reduction in the MVaR of portfolios from the international perspective indicates that in each case, the diversification benefits are smaller than when viewed from the Domestic Perspective. In addition to the diversification benefits being smaller and the MVaR's being reduced by a smaller magnitude, the absolute MVaR's are larger from the international perspective as opposed to the domestic perspective. This is again consistent with previous findings that diversification benefits to developing market investors are greater than those of developed market investors. The result is heavily influenced by the increased correlations among developed markets among themselves and the rest of the global economy.

The MVaR of the Developed market portfolio was by far the smallest, with a loss of -7.81% or more only happening 5% of the time after accounting for diversification benefits. Net diversification benefits among the developed economies were found to be minimal though, with only a 9.28% reduction in the MVaR. Diversification benefits among the developing markets were the largest, with the MVaR being reduced by 29.47%. This result confirms the findings of Driessen and Laeven (2007) as well as Li *et al* (2003). The results are generally similar to those of the Domestic Perspective. The 95% MVaR of the Mixed portfolio are very similar to those of the pure Developing portfolio. The undiversified MVaR of the Mixed portfolio is -9.29% while the undiversified MVaR was found to be -13.11%.

The results point to an important finding: namely that while diversification does bear benefits, these benefits are primarily achieved only in the long run when the entire distribution of returns are examined. In the worst months, when maximum losses, maximum portfolio drawdowns and losing streaks are examined, diversified portfolios did not conclusively outperform individual economies. However, when more aggregated results are examined, the benefits become clearer, such as the MVaR analysis, Sharpe Ratio analysis and the AWL. This finding thus confirms the findings of both Asness *et al* (2011) and Baele and Ingelbrecht (2009) that diversification seems to fail investors when they need it most, (in market crashes), although over the longer term it is highly effective. This finding is consistent between both the domestic view and the international view. Aggregated measures provide a more holistic view of the data due to the fact that they span a longer time period and utilize more data points. Measures which refer to a single event or which focus on a more isolated period (such as the CLS or the maximum loss) can be heavily influenced by anomalies or erratic investor behaviour which leads to outlier events occurring.

4.5. Currency and Index Effects Compared

Table 11: Real Currency Return Correlations Domestic Perspective

	ZAR/USD	ZAR/EUR	ZAR/YEN	ZAR/GBP	ZAR/BRL	ZAR/RUB	ZAR/IRP	TWB
ZAR/USD	1							
ZAR/EUR	0.27	1						
ZAR/YEN	0.39	0.72	1					
ZAR/GBP	0.31	0.83	0.72	1				
ZAR/BRL	-0.73	-0.48	-0.47	-0.43	1			
ZAR/RUB	-0.24	-0.51	-0.4	-0.52	0.32	1		
ZAR/IRP	-0.38	-0.77	-0.75	-0.79	0.53	0.57	1	
TWB	-0.79	-0.58	-0.58	-0.56	0.82	0.33	0.61	1

Table 11 reveals how differently the currencies of each economy behave in respect to the ZAR. The final column and row in the correlation matrix (TWB) represents the ZAR trade-weighted currency basket and the returns that would be obtained if it was investable. The trade-weighted currency basket is used as it is the only way in which the movements of the ZAR and the real returns of the ZAR can be tracked from the perspective of a South African investor. A bilateral rate of the ZAR/ZAR could not be used as the ZAR is naturally perfectly correlated with itself. However, use of the TWB allows the real returns of the ZAR to be measured against real returns of other currency investments from the perspective of a South African. The TWB will represent the true buying power of the ZAR in relation to the major trading partners of South Africa. If a trade of ZAR's for USD's is yielding positive returns it is not possible to tell whether this is due to the depreciation of the ZAR or the appreciation of the USD. The use of the TWB allows for the ZAR to be compared with an array of currencies. As such, if the TWB is increasing, the ZAR is appreciating and imports will become cheaper, allowing for increased buying power of the ZAR. If the TWB is decreasing, the inverse will hold.

It is immediately clear that the developed economy currencies are all positively correlated with one another while the developing market currency returns are all negatively correlated with the developed market currencies, while being positively correlated with one another. The results indicate how differently investors view developing and developed markets and how currency substitutions affect markets (Sawada & Yotopoulos, 2001). The ZAR exhibits the most negative correlation with the USD (-0.79) while having the highest positive correlation with the BRL (0.82).

Table 12: Real Market Index Correlations Domestic Perspective

	SPX	EuroStoxx	Nikkei	FTSE	JSE	BOVESPA	RTS	BSE
SPX	1							
EuroStoxx	0.84	1						
Nikkei	0.63	0.6	1					
FTSE	0.87	0.89	0.60	1				
JSE	0.66	0.58	0.57	0.67	1			
BOVESPA	0.05	0.10	0.11	0.01	0.03	1		
RTS	0.55	0.54	0.48	0.53	0.53	0.15	1	
BSE	0.10	0.12	0.18	0.01	0.07	0.15	0.20	1

Analysis of the real index returns from the various economies under consideration from the domestic perspective reveal further surprising results. A word of caution when interpreting the results of table 12: no currency fluctuations are accounted for so the return correlations shown above would be un-attainable. The results are reported to allow a decomposition of currency and index effects, so that a reader and prospective investor can better gauge how their real returns are affected differently by market index effects and currency effects.

The returns of the SPX500, FTSE100 and Eurostoxx50 show high positive correlations. This is hardly surprising considering the highly documented integration of the developed economies (Bekaert *et al*, 2009; Baele & Ingebrecht, 2009). The FTSE100 and the Eurostoxx50 show the highest correlation of 0.89. It is interesting to note that the results in table 12 show far higher correlations among the developed markets than those of table 3, which account for both currency and market effects. The only exception is the correlations between the U.K. and the Eurozone. The large discrepancies in the correlation differences make sense, considering the results of table 11, which show that currency returns are generally less correlated than market index returns concerning developed economies. The differences show that the fluctuations of the ZAR and the movement of currencies enhance diversification benefits to South Africans if they are considering investing in developed economies. The U.S. real return correlations with South Africa in table 3 was 0.52 while in table 11 the correlations between the stand alone index returns are 0.66.

Brazil remains the least correlated market with South Africa when no currency effects are factored in, similar to the results of table 3. Table 12 shows a correlation of 0.03 between South Africa and Brazil, but when currency effects are factored in, the correlation drops to to -0.17, as shown in table 3. The result between South Africa and the developing economies are in sharp contrast to those of the developed economies. Due to the positive currency correlations shared by the developing economies (shown clearly in table 11), stand along market index returns are in fact *less* correlated than when total real returns are examined, as in table 3. As such, diversification benefits among developing economies are reduced by their currency correlations, unlike among the developed economies.

Table 13: Real Currency Return Correlations from the International Perspective

	USD/EUR	USD/YEN	USD/GBP	USD/ZAR	USD/BRL	USD/ RUB	USD/IRP	DI
USD/EUR	1							
USD/YEN	0.22	1						
USD/GBP	0.64	0.10	1					
USD/ZAR	0.44	0.08	0.36	1				
USD/BRL	0.24	-0.09	0.24	0.27	1			
USD/RUB	0.52	-0.01	0.48	0.39	0.28	1		
USD/IRP	0.49	0.08	0.42	0.46	0.40	0.51	1	
DI	-0.63	-0.23	-0.63	-0.3.	-0.10	-0.38	-0.41	1

Table 13 shows the currency return correlations from the international U.S. perspective. The final column and row, ‘DI’, represents the U.S. trade-weighted dollar index. This allows the differences in the movements of the USD relative to its major counterparts to be examined in the same manner that the ZAR rand basket was used.

The results reveal some stark contrasts to those of table 11, which examined how the currency returns were correlated for South African investors. Firstly, it is immediately surprising to note that the USD moved *negatively* in relation to every other currency examined. This is most likely attributable to the reserve currency status that the dollar has (Beningo, 2011; Judson, 2012; Yotopoulos & Sawada, 2000). As such, during any period of ‘risk-off’ trade sentiment, investors are likely to flock to the USD above any other currency, and move out of it during ‘risk-on’ periods.

The highest negative correlation was surprisingly found to be with the EUR. This though is likely driven by the fact that the Eurozone is the primary trade partner of the U.S. (Cooper, 2013), so naturally it would have the greatest effect on the U.S. dollar index. The EUR and the GBP are found to be the most highly correlated currencies from the international perspective, exhibiting a positive correlation of 0.64. From the international perspective, the real currency return correlations between the U.S. and South Africa was found to be -0.30, which is far higher than the correlation exhibited between the USD and the ZAR from the domestic perspective (-0.79). This is likely to be driven by the very different constituents and their respective weightings in the trade-weighted currency baskets between the two very different economies. The Dollar Index will not comprise of the same currencies in the same weightings as the ZAR trade-weighted basket and as such a difference in the return correlations can be expected between the international and the domestic perspective.

Table 14: Real Market Index Return Correlations from the International Perspective

	SPX	Eurostoxx	Nikkei	FTSE100	JSE	Bovespa	RTS	BSE
SPX	1							
EuroStoxx	0.84	1						
Nikkei	0.62	0.59	1					
FTSE	0.86	0.88	0.60	1				
JSE	0.65	0.58	0.56	0.66	1			
Bovespa	0.04	0.08	0.10	0.00	0.02	1		
RTS	0.55	0.54	0.48	0.53	0.53	0.15	1	
BSE	0.10	0.11	0.17	0.00	0.07	0.15	0.2.	1

The results of table 14 are unsurprisingly very similar to those of table 12. The only difference between the real return correlations will be as a result as a difference in the CPI rates of South Africa and the U.S., as naturally the *nominal* index returns are the same regardless of whether you are observing the international or domestic perspective.

A comparison of the correlations observed in table 4 and table 14 reveal far smaller differences than when table 3 and table 13 were compared. The results imply that the USD impacts return correlations by less than the ZAR. This is most likely the result of a lower volatility of the USD as opposed to the ZAR. Although the differences are very small, the return correlations are generally lower in table 14 as opposed to table 4. This is most likely driven by the fact that in table 12, all currencies were negatively related to the USD. In addition to the negative correlation to the dollar index, all of the currency returns were positively correlated with one another, except the YEN with the BRL and RUB. As such, when factoring in both currency and market index returns, correlations are reduced as opposed to when only the indices are examined.

Table 15: Currency and Equity Index Real Return Correlations

	Domestic Perspective		International Perspective	
	No Deposit Rate	Deposit Rate	No Deposit Rate	Deposit Rate
USA	-0.07	-0.22	-0.26	-0.27
Eurozone	-0.26	-0.27	0.03	0.02
Japan	-0.48	-0.48	-0.27	-0.28
U.K.	-0.33	-0.33	0.08	0.07
RSA	0.02	0.01	0.11	0.10
Brazil	-0.11	0.20	0.18	0.16
Russia	-0.20	-0.07	0.21	0.21
India	0.03	0.03	0.09	0.08

Table 15 shows the correlations between the real index returns with those of the real currency returns making up each investment from both the domestic and the international perspective. Column 1 and 3, denoted ‘no deposit rate’, show the correlations between the monthly index

and monthly currency real returns assuming that the currency was not invested in a 3 month interest bearing account. This is to test the pure currency effect resulting from any investment in a foreign market index. Column 2 and 4, denoted 'deposit rate', assume that investments in foreign currency were invested in a foreign interest bearing account⁶. This is to prevent inflation unfairly penalizing the results. Furthermore, an investment in a foreign currency would be placed in an interest bearing account if it is not placed in the market. For inflation to not have an overwhelming impact, it is important to account for interest rates to allow for a fair comparison of currency performance.

By looking at results from either the international or the domestic perspective, it is clear that both the 'deposit rate' and no deposit rate results are very similar both quantitatively and qualitatively. The only exception is for Brazil from the domestic perspective. This is primarily due to the high interest rates offered by the banks being very high and the BRL holding value relative to the ZAR reasonably well, as will be shown in Table 16. Cash deposit rates are presented in Appendix C should the reader wish to explore the rates of each economy. Due to the similarities in the results, the 'deposit rate' figures will be focused on. This is primarily to prevent the effects of inflation being double counted on an investment biasing the correlations upwards. The risk free deposit rates should approximately eliminate the eroding impact of inflation.

The monthly return correlations between the indices and the currencies reveal sharp differences between the domestic and the international perspective. From the domestic perspective, the foreign currencies, relative to the ZAR, generally move in opposite directions to the foreign market indices. The strongest negative correlation is between the Nikkei225 and the Yen, with a negative monthly return correlation of -0.48 to a South African investor. India, South Africa and Brazil exhibited positive correlations, with Brazil showing the strongest positive correlation of 0.20. The Eurozone and the U.K. both show strong negative correlations between the currencies and the market indices while the effect in the U.S. is far smaller, with a negative correlation of only -0.07. These findings are generally consistent with Cho *et al* (2012), although the correlations are generally lower.

⁶ *It is imperative to note that for Brazil, due to the extreme volatility and high interest and inflation rates, all calculations were performed from the 1 January 2000, not the 1 January 1999, in table 15 as well as in table 16 and 17. Interest rates were as high as 45% in 1999.*

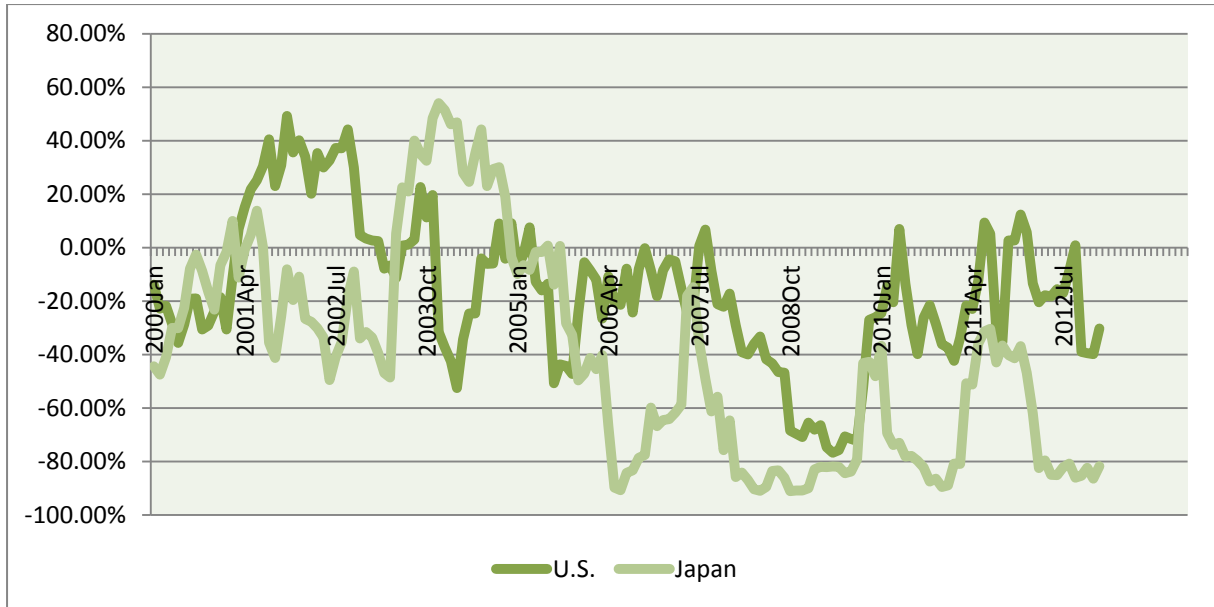


Figure 3: Correlation between market indices and currencies in the U.S. and Japan from a Domestic Perspective

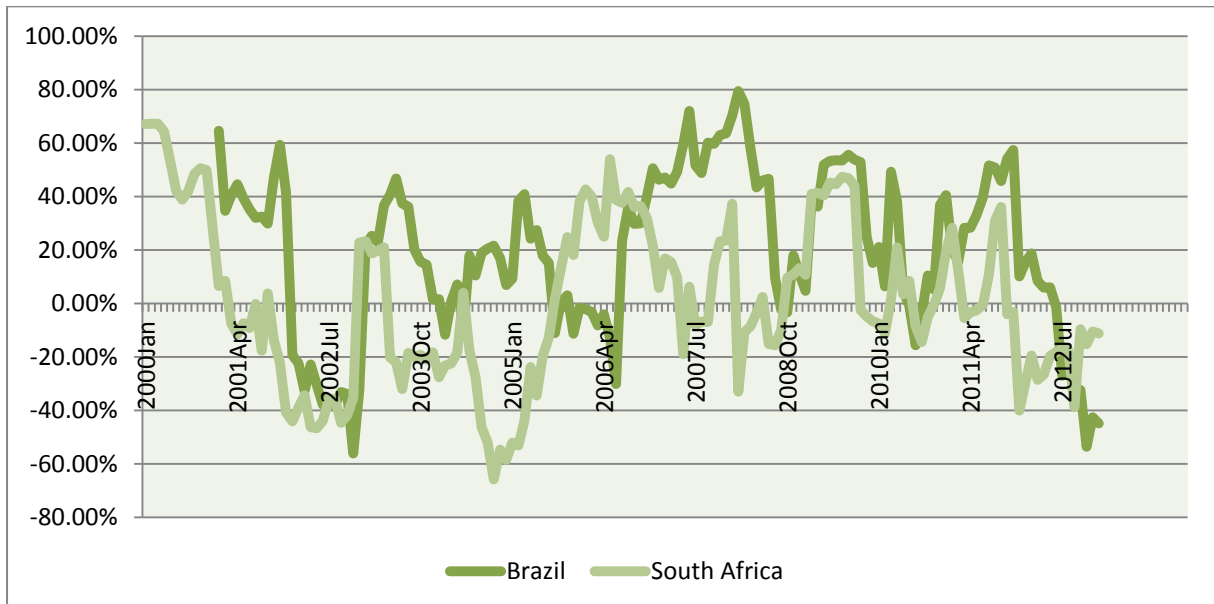


Figure 4: Correlation between market indices and currencies in South Africa and Brazil from a domestic perspective

Figure 3 primarily focuses on the U.S. and Japan, for more comparative results with studies such as those by Campbell (2010), Cho *et al* (2012) and Hau and Rey (2006). Figure 3 presents 12-month rolling covariances of index and currency returns over the sample period. Graphs on each economy examined are presented in Appendix E for the interested reader.

The rolling correlations were calculated by looking at the correlation in currency and market index returns of an economy over the first 12 months of the sample period and then rolling the calculation forward through time. As such, a smoothed 12 month correlation view is presented by the graph, where each subsequent data point includes the following month and drops the first month from the previous calculation.

Figure 3 suggests that from 2007 through 2009 the currencies and market indices moved in opposite directions more than over any other period for the developed markets. Figure 4 shows a complete contrast in results, indicating that during the periods of recessions, the correlations between the developing markets' currencies and indices were at their highest. Brazil and South Africa are presented as a result of Brazil having the highest positive index/currency correlation while South Africa was examined due to the primary focus of the study being on South Africa. This highlights the flight to quality reactions by investors during recessions and global crises, consistent with the findings of Cho *et al* (2012) and Campbell (2010).

The results from the international perspective indicate that generally a positive currency and index return correlation exists in foreign market investments to the U.S. investor. The U.S. and Japan continue to exhibit negative correlations between their market indices and their currencies. The strongest positive correlation is found within Russia (0.21), followed by Brazil (0.16). It is also interesting to note that from the international perspective, the U.S. exhibits a marginally stronger negative correlation between the USD and the SPX500 as opposed to when viewed from the domestic perspective, while the YEN and Nikkei225 exhibits a weaker negative correlation.

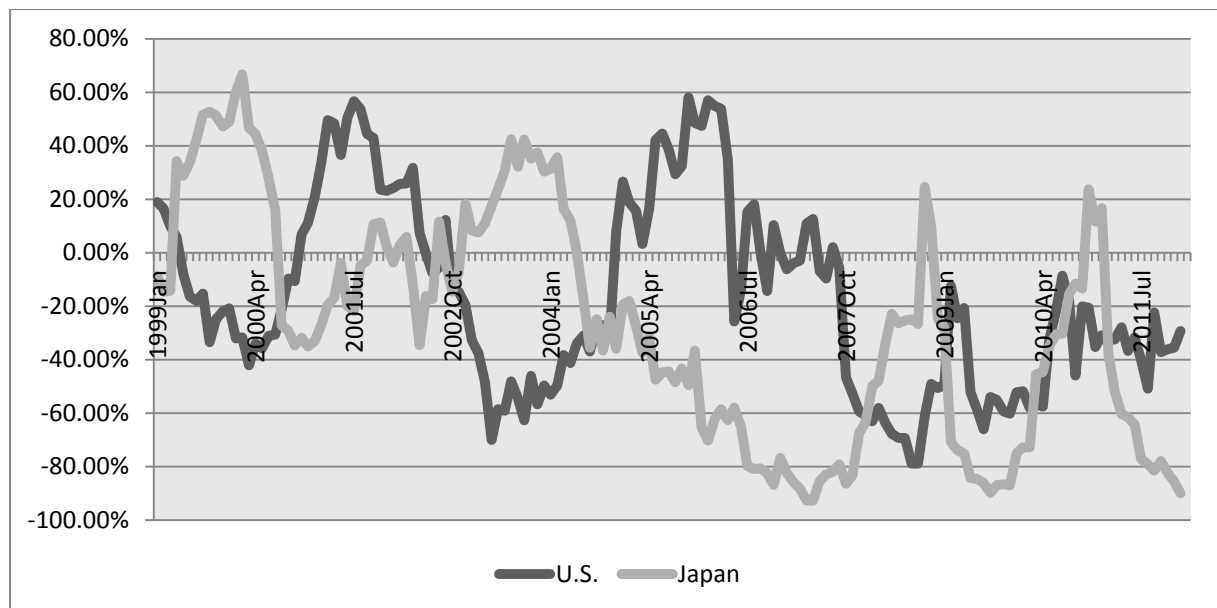


Figure 5: Correlations between market indices and currencies in U.S. and Japan from an international perspective

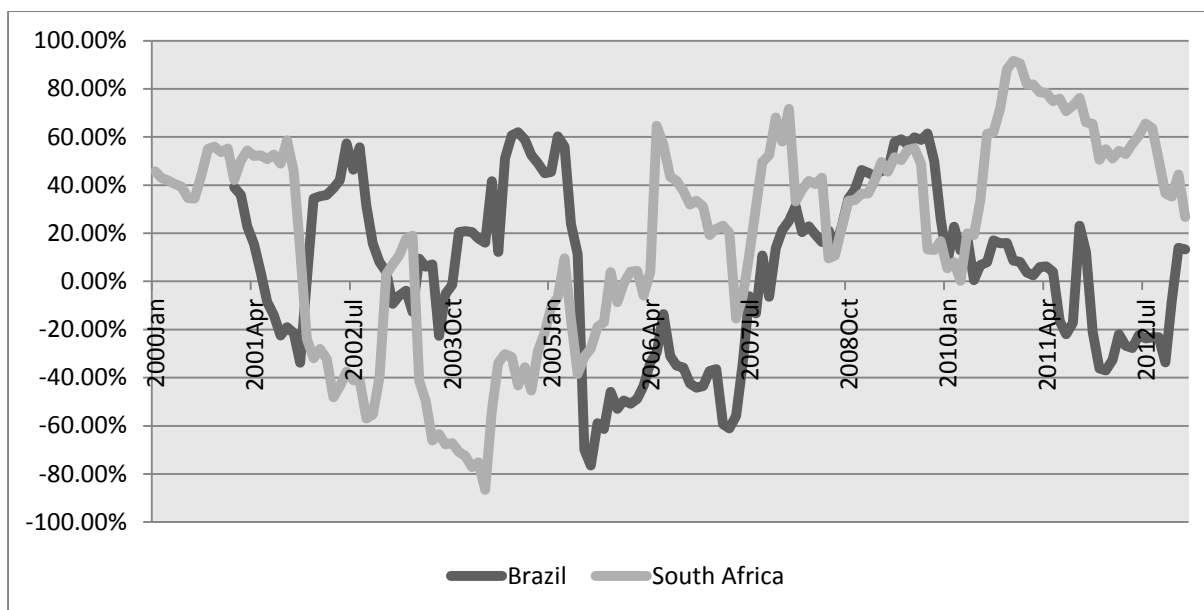


Figure 6: Correlations between market indices and currencies in Brazil and South Africa from an international perspective

Both figures' 5 and 6 show results similar to those of figures' 3 and 4. It is clear that from the international perspective, the U.S. and Japan continue to exhibit the powerful negative correlations between their currencies and market indices. Yet again, these negative correlations are far stronger during recessions, when investors seek safe investments. Figure 6 shows that the correlations are again strongest and the most positive during times of recessions when looking at developing markets. This is due to the currencies devaluing as well as the markets as investors sell off their risky positions. The correlations are stronger and more positive in general among the economies examined from the international perspective, as opposed to the domestic perspective.

The results are consistent with previous studies and findings conducted, regarding how equity markets and currency markets move with one another (Cho *et al*, 2012; Hau & Rey 2006). The results further highlight that currencies and markets tend to move with one another, except among economies with currencies that are seen to preserve value and withstand crises, such as the USD and YEN. Investors typically appear to flock to these currencies when financial crises strike and abandon higher yielding, riskier currencies. The results also indicate that the comovements of market indices and currencies are stronger from the perspective of a U.S. investor as opposed to a South African investor in a developing economy. This result could be driven by the mannerism in which the USD moves in relation to other currencies as opposed to the ZAR. It also could be influenced by the greater stability offered by the USD as opposed to the ZAR. The results have important implications for risk reduction and asset allocation, which is expanded upon in section 5.

Table 16: Currency and Index Real Returns Compared: Domestic Perspective

	Currency		Cash Deposit		Index	
	Annual Return	Annual Volatility	Annual Return	Annual Volatility	Annual Return	Annual Volatility
USA	-3.07%	15.26%	-0.39%	15.40%	-4.54%	15.91%
Eurozone	-1.69%	16.17%	0.95%	16.25%	-7.38%	16.50%
Japan	-1.08%	18.75%	-0.86%	18.76%	-7.37%	20.13%
U.K.	-3.20%	16.38%	0.54%	16.46%	-5.18%	14.72%
RSA	-9.05%	11.71%	2.87%	0.78%	7.00%	19.66%
Brazil	-6.09%	13.20%	7.63%	13.68%	8.35%	29.57%
Russia	-8.16%	21.07%	3.62%	21.60%	22.43%	38.96%
India	-6.80%	15.18%	-0.45%	15.22%	9.20%	30.53%
Developing	-7.09%	12.20%	3.72%	10.25%	-5.82%	18.93%
Developed	-1.81%	13.57%	0.51%	14.00%	14.69%	14.96%
Global	-3.75%	3.71%	2.78%	4.26%	3.76%	15.29%
Carry Trade	-	-	3.21%	23.66%	-	-
CT USD Funded			1.71%	23.72%		

Table 16 presents the annual returns and volatility resulting from each index and currency. This allows for an individualized analysis of the effects that currencies and the market indices are having on total returns. It further allows for identification of the driving source behind returns and volatilities of an investment in each economy. The differing effects that currencies and markets have on returns can again be imperative regarding how an investor should structure their portfolio. From the domestic perspective, the results are disheartening, due to the array of negative returns seen, especially among the currencies.

The annualized returns for a pure currency investment (in a non-interest bearing account) indicate that in every instance, the currency returns are negative. The most negative return came from Russia, where the currency devalued by -8.16% relative to the ZAR on an annualized basis. Furthermore, the RUB/ZAR exchange rate yielded an annualized volatility of 21.07%. As such, having both the lowest return and the highest volatility, the RUB appeared to be the poorest performing currency out of the sample examined. The currency return that offered the least negative yield to a South African investor was the YEN, with an annualized return of -1.08%. Interestingly, the least volatile currency returns were produced from Brazil, with the BRL having an annualized volatility of 13.20%. The results insinuate that from the domestic perspective, a carry-trade strategy for a South African would *not* have been very profitable.

Looking at the results from the 'Currency Cash Deposit' columns represents the returns that a South African investor would have obtained by investing in a foreign currency and leaving it in a foreign bank account. These returns are then deflated by South African CPI to see the real returns on a currency investment that a domestic investor would have obtained. The results are substantially more impressive than those of the pure 'Currency' column. It is immediately obvious that Brazil boasted abnormally high returns in relation to the other

economies examined. An investment in a Brazilian 3-month cash deposit in Brazil would have yielded an annual return of 7.63%. This outstanding return was coupled with a low volatility of merely 13.68%, aided by the low volatility of the BRL/ZAR exchange rate. An investment in a Russian or Indian bank deposit would have yielded negative annual returns of 3.62% and -0.82% respectively to a domestic investor. Among the developed economies, the best performing economy as far as deposit investments are concerned, was the Eurozone, with an annual yield of 0.94% per annum. Japan had the *lowest* return of -0.86%. Considering the YEN was the strongest pure currency investment, the result is surprising. The poor performance of Japanese bank deposits (despite a strong currency performance) is primarily driven by the near 0% interest rates offered by Japanese banks. The deposit rates offered by other economies relative to Japan were better able to overcome the poor pure currency performance.

The results for South Africa reveal surprising findings. The ZAR Rand basket can be seen to have devalued by an annual rate of just over 9% in real terms, as measured by the ZAR trade-weighted currency basket. As such, it is the poorest performing currency out of the sample examined. The volatility is lower, but this is to be expected as it is measured against a basket of currencies, whereas the returns on the other currencies examined are bilateral exchange rates. Deposits in the bank revealed substantially better results, indicating that cash deposits yielded an annual return of 2.87%. The low volatility of 0.78% per annum shows the volatility of the cash deposit rate. If an investment could be made into the ZAR basket and invested in an interest bearing account, the annual ZAR return would have been -0.89% and volatility would have been 11.83%.

The findings demonstrate that a carry-trade strategy would be profitable to South African investors, although only marginally so. Studies conducted from a U.S. perspective documented highly profitable carry-trade strategies which outperform the SPX500 both in terms of higher return and lower risks (Burnside *et al*, 2006; Burnside, 2011; Das *et al*, 2013). Two variations of the carry-trade strategy were tested. The first variation of the carry trade involves domestic investors borrowing in all four low yielding currencies and investing in the portfolio of high yielding currencies. The second variation looks at the carry-trade if it is funded purely out of the USD (thus the investors borrows only in USD's) and the proceeds are invested in the high yielding currencies.

Domestic investors in South Africa obtain a modest positive return of only 3.21% per annum if they take long positions in developing market currencies and short positions in developed market currencies. Furthermore, for the annual volatility of 23.66%, indicates volatility levels much the same as equity index investments. As such, the return of simply investing in the bank would have been only marginally inferior to undertaking a carry-trade strategy on an absolute return basis. On a risk adjusted basis, the cash deposit investment would be superior. Tables 18 and 19 in section 4.6 to follow provide additional information regarding the carry-trade performance. If the carry-trade strategy is undertaken by using only the USD as the funding currency and investing in the remaining four high yielding currencies, the strategy was found to be even less profitable. The strategy provided an annual return of 1.71%

coupled with marginally higher volatility of 23.72%, indicating that carry-trades offer poor returns for domestic investors.

Focusing purely on the market indices it must be emphasised that the 'Index Return' column *does not* factor in any currency fluctuations and exchange rate risk. It is purely the real return an investor is obtaining from the market index component of their investment. The poorest performing indices in terms of annualized returns are the Eurostoxx50 (-7.38%) and the Nikkie225 (-7.37%). The result is interesting considering that the Eurozone and Japan had the strongest currency performance. This highlights the negative correlation between the returns of the currencies and market indices of developed economies, as evidenced in table 15. Additionally, the difference in volatility between the indices and currencies are far smaller among the developed nations than the developing economies. The developing economies' market indices are substantially more volatile than their currencies while among the developed economies, the volatilities are very similar in magnitude.

The strongest performing index is undoubtedly Russia (22.43%), followed by India. Among the developing economies, the JSE Top40 had the lowest annual return (7%), although this was coupled with the lowest volatility of 19.66%. Overall, the FTSE100 had the lowest volatility, at 14.72%, although the return performance was disappointing at -5.18% per annum. The best performing developed market was the U.S., with an annual return of -4.51% while having the second lowest volatility of 15.91%. The results signify that for developed economies, market index performance has dragged down their overall return performance, as indicated in columns 5 and 6. The overall returns produced by developing economies have been driven primarily by the market indices, while the currencies have tapered total returns achievable. The driving forces behind the total returns for the developed and developing economies are as such entirely opposites and have implications for how investors should construct their portfolios, which is expanded upon further in section 5.

Table 17: Currency and Index Real Returns Compared: International Perspective

	Currency		Currency Cash Deposit		Index	
	Annual Return	Annual Volatility	Annual Return	Annual Volatility	Annual Return	Annual Volatility
USA	-4.19%	5.92%	0.24%	0.57%	-1.35%	15.86%
Eurozone	-1.20%	10.75%	1.45%	10.76%	-4.61%	16.37%
Japan	-0.75%	9.83%	-0.52%	9.84%	-4.27%	20.07%
U.K.	-2.70%	8.82%	1.05%	8.79%	-2.13%	14.65%
RSA	-5.12%	16.73%	3.39%	16.89%	10.58%	19.57%
Brazil	-2.21%	18.42%	12.25%	18.10%	11.97%	29.57%
Russia	-4.24%	9.55%	8.05%	11.87%	26.52%	39.03%
India	-4.00%	7.15%	2.54%	7.10%	12.99%	30.54%
Developed	-1.33%	7.27%	0.80%	9.86%	-3.67%	15.09%
Developing	-3.40%	9.48%	7.01%	7.34%	15.51%	18.86%
Global	-2.89%	7.38%	3.94%	7.58%	7.29%	15.32%
Carry Trade	-	-	6.16%	9.08%	-	-
CT USD Funded	-	-	6.60%	10.23%		

Table 17 reports the performances of currencies, foreign cash deposits and market indices from the international perspective. The first column yet again highlights the fact that of the individual currencies, the ZAR was the poorest performing, losing -5.12% per annum to the USD. In real terms, the YEN performed the best relative to the USD, while the Dollar Index was found to lose -4.19% per annum over the sample period, when inflation was factored in. Interestingly, the USD/IRP showed the lowest volatility out of any bilateral exchange rate, of only 7.15%. The BRL and ZAR were the most volatile currency pairs with volatility of 15.42% and 16.73% respectively. Touching on the currency volatilities in table 17, they are far lower than those reported in table 16, showing that currency returns relative to the USD are far more stable than those relative to the ZAR. The BRL is the only exception, having a volatility of only 13.20% when examined from the domestic perspective in table 16 while have volatility of 18.42% from the international perspective.

The results for a foreign currency investment in a bank deposit suggest that only in Japan, would a negative return have been earned. The result is again likely driven by the abnormally low interest rates offered by Japanese banks. Brazil would have offered the best return of 12.25%. This result is driven by the fact that during the first half of the sample period, Brazil consistently boasted interest rates of more than 15%-24% while having an inflation rate of only 8% - 18%. Additionally, the BRL held its value very well when compared to the USD and was the best performing developing market currency. All these factors in combination contributed to the notable return presented in table 17.

In all instances it can be seen than an investment in the emerging markets would have yielded annual returns higher than if an investment were made into the developed market currencies. Brazil and South Africa both offered annual returns of 3.39% to a U.S. investor while India

offered a return of 2.54%. The best developed market was found to be the Eurozone, which offered a return of 1.45% per annum. Furthermore, had a U.S. investor invested in local cash deposits, they would have received a return of 0.24% per annum, which is substantially lower than what an investor could have received by investing in any of the developing market currencies. The volatility of the cash deposit investments was again found to be substantially lower than when viewed from the South African perspective, except for Brazil.

The results of table 17 are in line with previous carry-trade papers (Das *et al*, 2013; Burnside *et al* 2006, Handley, 2008), documenting respectable positive returns to a U.S. investor. The results signify that an annualized real return of 6.16% would have been realized, with a volatility of only 9.08%. This is substantially better than the return offered by the SPX500. When the carry-trade strategy was implemented using the USD as the funding currency, the results were very similar to those of when the investor borrowed from each developed market. The annual return was slightly higher, at 6.60% per annum while the volatility was 10.23% per annum. Both variations of the carry-trade strategy indicate highly profitable returns to U.S. investors, consistent with previous literature (Burnside, 2011; Das *et al*, 2013). Additionally, the results point towards the carry-trade strategy being exceedingly more profitable than the carry-trade strategy for South African investors. This result is potentially supported by the lower volatility of the USD versus the ZAR and the weaker performance of the USD relative to other currencies. The findings consequently highlight the violation of UIP, where high yielding currencies do not depreciate by as much as what their inflation rate differentials suggest that they should. This drives greater currency returns to U.S. investors relative to those of South African investors. A more in depth analysis of the diversification benefits of carry-trade strategies will follow in section 4.6.

The final column looking at the market indices are similar qualitatively and quantitatively of table 16. However, the reader will notice that the index returns are consistently higher to the U.S. investor, as opposed to the South African investor. This is driven by the lower inflation rates in the U.S. It is again highlighted that among the developed economies, the currencies outperformed the indices while among the developing economies; the indices substantially outperformed their currencies. That being said, the interest rates offered by developing markets are substantially higher than those offered by developed markets, even when they are deflated by inflation (for interest and inflation rate data refer to Appendix C). As such, carry-trade strategies remain profitable; although an investment in developing market indices still outperform the carry-trade strategies when pure returns basis (not accounting for risk).

4.6. Diversification benefits of Carry-Trades

Table 18: MVaR and Sharpe Ratio Measures for Carry-Trade Strategies

Carry Trade		Excess Returns	Excess Volatility	Sharpe Ratio	MVaR
Domestic Perspective	Carry Trade	0.70%	23.67%	0.03	-10.20%
	USD Funded	-0.76%	23.00%	-0.03	-10.35%
International Perspective	Carry Trade	6.12%	8.52%	0.72	-3.55%
	USD Funded	6.56%	9.64%	0.68	-3.49%

Table 18 presents the Sharpe Ratios as well as the MVaR risk measures for the carry-trade strategies. The Sharpe Ratios for the carry-trades are sub-optimal and disappointing. When the carry-trade is funded out of the portfolio of developed market currencies, the Sharpe Ratio is marginally positive at 0.03. This is driven by low excess returns of only 0.70% per annum and excess volatility of 23.67%. The carry-trade funded by borrowing in USD's exhibits a negative Sharpe Ratio of -0.03, indicating that a domestic investor would have been better off investing in international equities or even in riskless cash deposits. The results again highlight that carry-trade strategies are not highly effective for domestic investors.

Focusing on the MVaR's, from the domestic perspective it can be seen that each month, the carry-trade strategy has a 5% likelihood of losing 10.20% or more while when the carry-trade is funded purely by borrowing in USD's, the MVaR is slightly worse at -10.35%. When compared with the MVaR's of the equity investments, this is very high, particularly in comparison to the diversified portfolios (presented previously in tables 9 and 10). The MVaR's are higher than for any of the portfolios formed and are higher than any of the developed economies equity indices, or the JSE Top40.

From the International perspective however, the MVaR's are exceptionally low. When the carry-trade is funded out of a combination of the developed market currencies, it is a mere -3.55% per month, while a carry-trade funded purely out of the USD has a MVaR of -3.49% per month. This result is substantially lower than the MVaR's for any of the individual economies presented in table 9 and it is less than half that of any of the diversified portfolios presented in table 10. This result shows the stark contrast between the effectiveness of using a carry-trade strategy as a means to reduce portfolio risk between developed market investors and developing market investors. In addition, the low risk of the carry-trade strategies confirm the results of Burnside *et al* (2008), Handley (2008) and Das *et al* (2013) which all highlight the lower risk that carry-trade investments offer to U.S. investors as opposed to investments in equities, specifically the SPX500.

The Sharpe Ratios from the international perspective are far more impressive than when viewed from the domestic perspective. The carry-trade strategy funded out of the portfolio of low-yielding currencies produced an excess return 6.12% and volatility of only 8.52%. This led to an impressive Sharpe Ratio of 0.72, which is only fractionally higher than that produced by investing in the Developing market portfolio (0.71) and slightly lower than the Sharpe Ratio of 0.77 produced by investing in the Mixed portfolio (see table 6). The Sharpe ratio resulting from the carry-trade funded out of the USD was slightly lower at 0.68, due to marginally higher excess volatility of 9.64%, despite a higher excess return of 6.56%. It is worth noting the massive divergence in volatility between carry-trades from the U.S. investor's perspective as opposed to the South African investor's perspective, highlighting the riskiness of the ZAR. It is also worth noting that the volatility of the carry-trades from the international perspective are substantially lower than the volatility resulting from equity index investments, although the annualized returns are also lower when compared with the developing markets and portfolios comprising of developing markets.

Table 19: Diversification Benefits of Carry-Trade Strategies

		Max Loss	Loss Streak	Cumulative Loss Streak	Max Drawdown	% Losing Months	Average Worst Loss
Domestic Perspective	Carry Trade	-23.41%	7	-44.89%	-51.56%	44.05%	-13.44%
	USD Funded	-26.00%	6	-44.09%	-61.64%	43.45%	-10.12%
International Perspective	Carry Trade	-7.46%	5	-17.92%	-12.17%	35.12%	-5.87%
	USD Funded	-10.57%	6	-21.52%	-16.43%	34.52%	-6.21%

Table 19 shows the results of the risk measures when they are applied to the carry-trade strategies. Carry-trade strategies are presented when funded out of the four low yielding currencies (USD, EUR, YEN and GBP) as well as when funded purely out of the USD from both the domestic perspective and the international perspective (Since the USD is a low yielding currency and many studies look at carry-trades funded purely out of the USD). Long positions are taken in the high yielding currencies (RUB, BRL, ZAR and IRP).

When the results of the carry-trade from the domestic perspective is compared to a the results of table 7 where equity investments are focused on, the results suggest that diversification in global equity markets would have provided more benefits to South African investors than carry-trade strategies. The results regarding the carry-trade strategies being funded out of a combination of low yielding currencies, or the USD alone are very similar. When compared with the results of table7 and the diversification benefits regarding international equity investments, the findings are almost identical.

Particularly, when the Global market portfolio is compared to that of the carry-trade results presented in table 19, the global market index offers superior diversification benefits in every measure, except the loss streak. This is likely to be driven by the high volatility of the ZAR relative to the other currencies. Carry-trades have also been described as picking up pennies in front of a truck: the gains are often frequent but small compared with the losses which can be substantial although infrequent. This result can be seen by looking at the high maximum monthly losses of the carry-trade strategies as well as the maximum drawdown results, especially for the carry-trade funded purely out of the USD.

When the results of the carry-trade are compared with the other diversified portfolios formed in table 7, the results are reasonably mixed. The carry-trade strategy consistently appears superior regarding the loss streak and the CLS measure, although the equity portfolios are generally superior based on the remaining measures. The maximum single month loss suffered by the carry-trade strategy is higher than any of the portfolio measures presented in table 7 and it is larger than almost of the single economies, except for Russia, India and Brazil. In summary, the results seem to suggest that to South African investors, carry-trades are not as profitable as literature pertaining to U.S. investors would have suggested (Burnside *et al* 2006; Burnside *et al* 2008; Handely, 2008). Furthermore, while they do offer reasonable diversification benefits, they are generally inferior to a diversified equity market portfolio. Additionally, while the carry-trades to domestic investors may offer risk reduction, they do not offer high returns, as evidenced by the Sharpe Ratios and the results of table 16.

From the international perspective, the results for the carry-trade strategies are reasonably similar, although in each instance the carry-trade strategy funded by a combination of the developed market currencies performed better than the carry-trade funded purely out of the USD. The result is interesting although it could be driven by a number of factors. Firstly, by taking short positions in a number of currencies, the short positions as well as the long positions will be diversified. If the USD goes through a period of depreciation or appreciation and the entire short position is in the USD, this will have a far greater impact on the profitability of the carry-trade as opposed to if the short-position is funded out of multiple currencies. Secondly, borrowing costs in all of the developed economies are exceptionally low. The average borrowing costs in both the Eurozone and Japan were lower than in the U.S., adding profitability to the carry-trades involving short positions in these economies. This would heighten the expected monthly returns, which would diminish maximum drawdowns and the other loss measures.

The lower risk involved in the carry-trade strategies for U.S. investors is immediately obvious. For both types of carry-trade strategies, the various measures of diversification are all superior to any of the diversification measures for any of the diversified portfolios presented in table 8, except for the maximum drawdown measure. The maximum drawdown for the globally diversified equity portfolio as well as the Mixed portfolio was superior (smaller) to the maximum drawdown measure presented by both of the carry-trade strategies.

A notable finding is that both aggregated risk measures, such as the loss ratio, the maximum drawdown and the AWL are lower as well as the point-in-time measures, such as the CLS and maximum loss. The results thus highlight that even in times of a crises or economic downturn, when diversification typically fails investors; a carry-trade can still be highly effective for U.S. or developed market investors. This finding is in line with numerous previous studies, such as that by Das *et al* (2013) and Burnside *et al* (2008).

In summary the findings pertaining to carry-trades indicate that from the international U.S. investor's perspective, they can be a highly effective tool for diversification. While the returns offered are impressive, they are not as impressive as the returns produced by developing markets and portfolios formed comprising of developing markets. However, the risk of the carry-trade strategies appears to generally be less than those of equity investments. From the domestic perspective however, carry-trades are unimpressive and offer little if any benefits above simply investing in riskless assets such as cash. While there is some evidence of diversification benefits, they are limited and the returns offered by carry-trade investments are subdued.

4.7. Comovement Trends

4.7.1. Real Return Comovements from a Domestic Perspective

Table 20: Rolling Correlations of Real Returns from a Domestic Perspective

		Linear Regression				Prais-Winsten Regression			
		Intercept	Time T-Stat	DW T-Stat	MSE	Intercept	Time T-Stat	DW T-Stat	MSE
Final Returns	RSA/Developed	14.47	-0.72	0.17	0.25	3.84	-0.42	1.92	0.10
	RSA/Developing	0.20	4.56	0.23	0.28	0.54	0.79	2.23	0.13
	RSA/Globe	12.09	0.30	0.18	0.28	3.21	-0.11	1.95	0.11
	Devi/Devd	1.50	-0.26	0.13	0.38	0.32	0.01	2.08	0.14
Equity Returns	JSE/Developed	19.35	1.84	0.22	0.19	5.70	-0.12	1.79	0.09
	JSE/Developing	4.77	2.53	0.32	0.25	1.82	0.49	2.26	0.14
	JSE/Globe	16.12	2.13	0.28	0.19	5.10	0.24	2.26	0.10
	Devi/Devd	6.75	5.24	0.23	0.25	2.24	1.11	2.07	0.18
Currency Returns	ZAR/Developed	-46.39	1.81	0.35	0.13	-11.66	1.10	2.17	0.08
	ZAR/Developing	18.69	-0.17	0.27	0.11	5.31	-0.25	2.09	0.10
	ZAR/Globe	-11.31	-3.71	0.38	0.19	-3.82	-1.21	2.36	0.11
	Devi/Devd	-46.39	1.81	0.27	0.11	-11.93	-0.05	1.99	0.06

Table 20 shows the statistical significance of the time trends when 12-month rolling correlations of real returns were examined from a domestic perspective. The variable t-statistics and Durbin-Watson test statistics are reported for both a linear regression as well as a Prais-Winsten (PW) regression. Data is presented on real final returns, equity returns in isolation and currency returns in isolation. A linear regression was originally run on all of the data, although high levels of autocorrelation contaminated the data. As such, a PW regression was examined as it adjusts for first order auto-correlation. The PW regression largely eliminated traces of auto-correlation, as indicated by the DW test statistics, which all tendered towards 2. The data exhibited reduced intercepts when the PW regression was run in all instances, although they remained high due to the fact that all intercepts are based on the correlation coefficient of the previous 12-month period. First differencing was further applied to the data with both the linear and PW regressions and while it erased all traces of autocorrelation, it also rendered all trends and t-statistics completely insignificant and thus it appeared to be inappropriate. The regression coefficients are reported in Appendix G.

Table 21: Real Return Correlations over Sub-Periods from a Domestic Perspective

	Real Returns			Equity Index Returns			Currency Returns		
	1999-2013	1999-2006	2006-2013	1999-2013	1999-2006	2006-2013	1999-2013	1999-2006	2006-2013
RSA/Global	0.63	0.59	0.69	0.61	0.55	0.68	-0.44	-0.37	-0.51
RSA/Developing	0.27	0.17	0.39	0.36	0.30	0.43	0.26	0.28	0.26
RSA/Developed	0.66	0.66	0.66	0.69	0.66	0.74	-0.77	-0.79	-0.74
Devi/Devd	0.20	0.17	0.27	0.56	0.50	0.65	-0.84	-0.86	-0.82

Table 21 divides the sample period in two parts and examines the correlation between South Africa and each portfolio (as well as between the Developing market portfolio and the Developed market portfolio, denoted ‘Devi/Devd’). This allows for an increase in correlations to better be identified, similar to the study conducted by Cho *et al* (2012) and Bekaert *et al* (2009). In Appendix D, correlations between each economy for final returns, equity index returns and currency returns, are further shown over the two sub-periods. This allows for a more detailed comparison of the changing correlations. It should be noted that in table 21, none of the correlation coefficients were found to be statistically different from the first half of the sample period to the second half, using Fishers Z-transformation. The Fisher transformation Z-scores are reported in Appendix F.

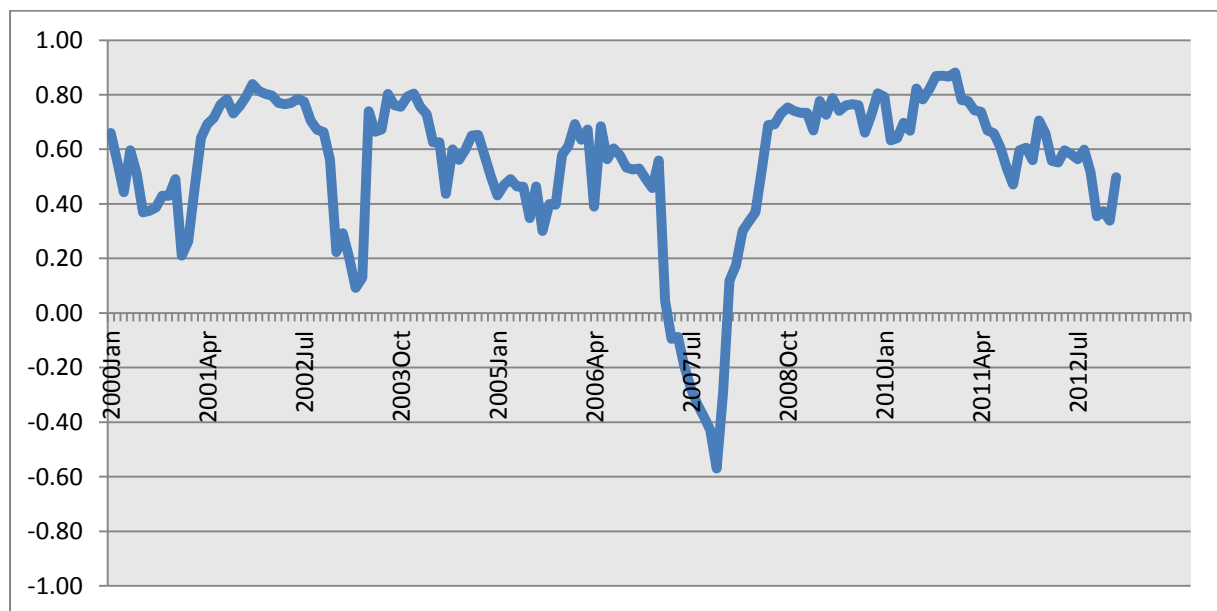


Figure 7: Final Return Rolling Correlations between RSA and the Globe

Figure 7 presents the real return correlations between South Africa and the remainder of the Global portfolio invested in. From the graphical representation it would seem that there has been no real change in correlations between South Africa and the rest of the globe, although short run spikes and dips are evident. In particular, a large decline in correlations was experienced from 2007 through to the start of 2008, before drastically rising. The sharp increase in correlations occurred through the financial crises, which is unsurprising considering the contagion effect that it wrought on global markets. The real return

correlations peaked around 2011, almost reaching 0.90. The results of figure 7 when viewed in conjunction with table 20 and table 21 lead to some interesting conclusions regarding the South Africa and the global economy when examining the final real returns. The Linear and the PW regression give slightly conflicting results. The linear regression indicates a marginally positive but insignificant t-stat of 0.30. The PW regression on the other hand suggests that the time coefficient is insignificant but marginally negative, with t-statistics of -0.11 respectively. This would seem to imply that no definitive change in return correlations has occurred between South Africa and the global markets. Looking at table 21, the results indicate that the correlation between South Africa and the globe have remained reasonably stable and positive, with a correlation coefficient of 0.63 over the entire period. Over the first half of the sample period, correlations were 0.59 and they increased to 0.69 in the second half. Results examining the correlations between South Africa and each individual economy over the first and second half of the sample period are further presented in Appendix D. The findings insinuate that in every instance except with Japan and the U.K., correlations were marginally higher in the latter half of the sample period. The results would imply a marginal in correlations between South Africa and the globe, albeit they are weak and statistically lacking in significance.

Looking at the correlation between the JSE and the remaining global market equity indices in isolation (as opposed to including currency effects) reveals similar findings. Table 20 suggests that the linear regression model found a significant increasing time trend between the market index correlations, producing a t-stat of 2.13. However, the PW regression had a highly insignificant result, bringing into question the strength of the linear regression results, particularly in light of the low DW-stat (indicating excessive positive auto-correlation). The results of table 21 though indicate that the correlations of the JSE Top40 were 0.61 over the entire sample period, while being insignificantly higher in the latter part of the sample period as opposed to the former. When comparing the JSE Top40 real return to each economy's individual indices real returns, the results indicate that generally correlations have increased from the first half of the sample period to the second half, although the differences are reasonably small, as shown by table 3D and table 4D in Appendix D.

The currency results point towards very different findings to that of the market indices. Table 20 indicates that the linear regression produced a highly significant negative t-stat of -3.21. The PW regression further indicated a negative relationship, although the result was far weaker with the t-stat holding a value of only -1.21. Table 21 further shows that correlations between the ZAR and the currency returns of the remaining global economies have declined over the sample period, with correlations in the latter period being -0.51 while in the first half, they were at -0.37. It would seem as such that the ZAR is becoming less correlated with the remainder of the global economy. It is important to bear in mind that in comparing the currency return correlations from the domestic perspective, the returns on the ZAR currency basket are compared to the bilateral exchange rate returns that a South African investor would achieve by investing in a foreign currency.

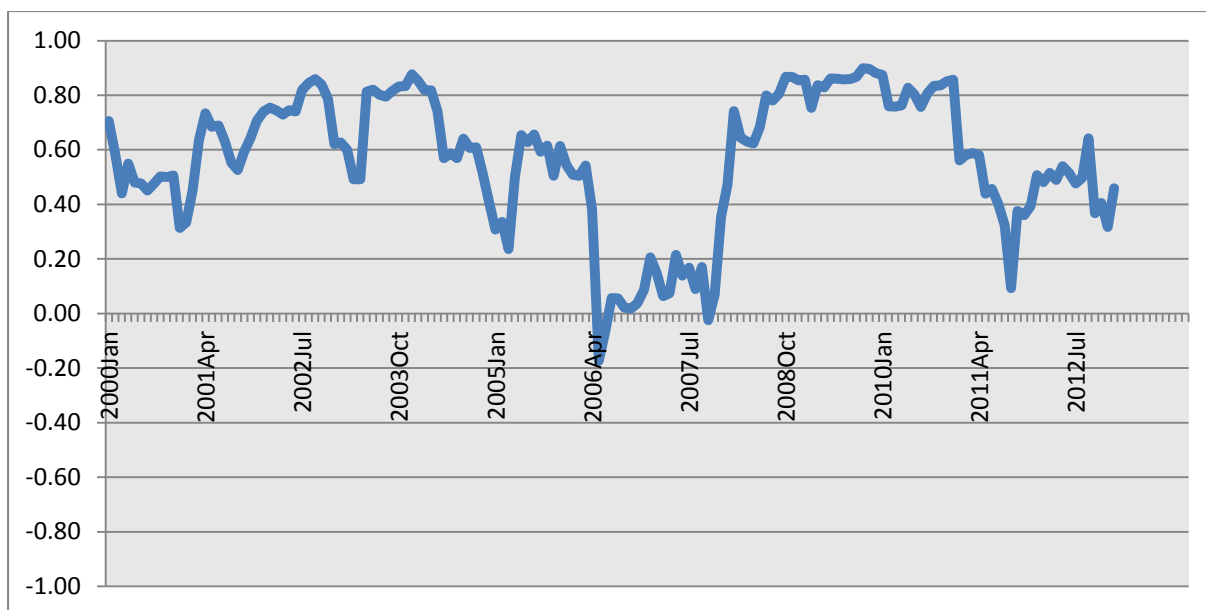


Figure 8: Final Return Rolling Correlations between RSA and the Developed portfolio

Figure 8 represents the rolling correlations between the real returns of the South African economy and those of the Developed market portfolio from a Domestic perspective. Figure 8 looks reasonably similar to figure 9, although the dip in real return correlations occurs earlier and is more sustained. Correlations pick up quickly around the beginning of 2008 and they remain elevated through till 2011, where they begin a sharp decline again. Correlations peaked just under 0.90 during 2008 after bouncing back from a low point of under -0.17 during 2006.

Results from the regression analysis suggests that a negative trend is being exhibited between South African returns and those of the more developed markets, although the results are statistically weak, with neither time-coefficients having a significant t-statistic from either regression. When looking at the sub-periods, both in the former and the latter sub-periods the correlations are 0.66, indicating no change over time. When viewed together, the results highlight that there is no significant trend of increasing or decreasing correlations between the real returns of South Africa with those of the developed markets.

The linear and PW regression analysis of the equity return correlations indicates a positive but insignificant time trend. Table 21 shows a small rise from the correlations of the first half the sample to the second half, although the rise is small, with correlations rising from 0.66 to 0.74. Regarding currency returns, it can be seen that the ZAR has maintained persistent, high negative correlation with developed market currencies, in line with expectations. The correlations have marginally increased, from -0.79 to -0.74. The linear regression results point towards a significant increase in correlations at the 10% level, with a t-statistic of 1.81. The result is not supported by the PW regression, which produced a weak t-statistic of only 1.12. When examining correlations of each individual economy, (refer to Tables 5D and 6D in Appendix D), the ZAR can be seen to have become less correlated with each developed economy currency, except for the GBP, where it increased from -0.59 to -0.45.

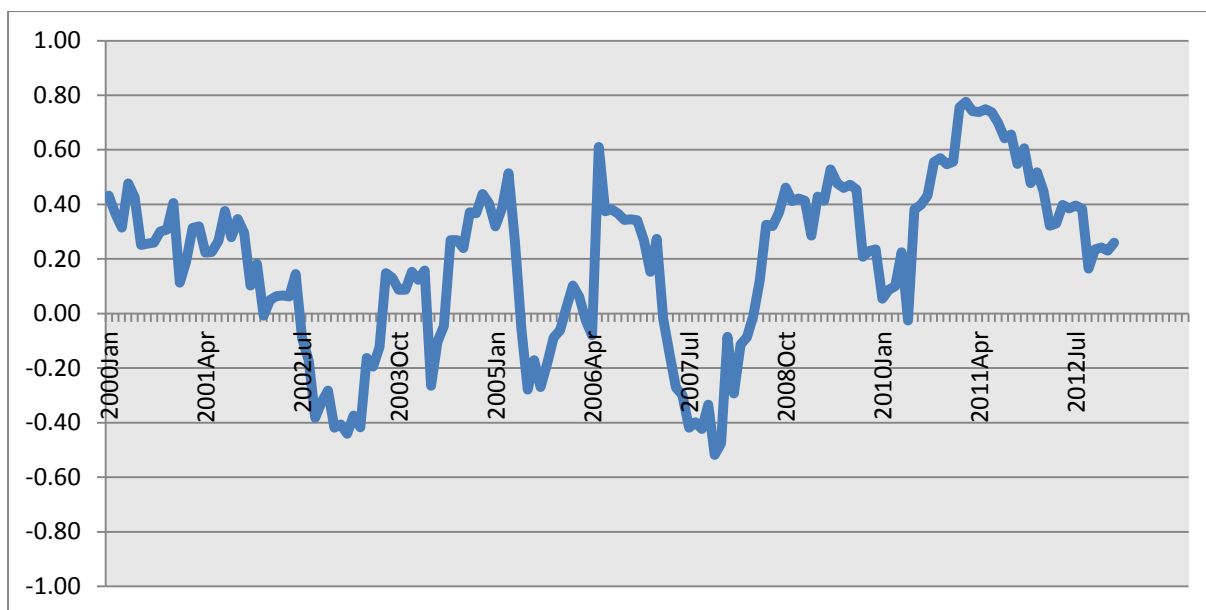


Figure 9: Final Rolling Correlations between RSA and the Developing portfolio

Figure 9 shows the real return correlations between South Africa and the remainder of the Developing markets. The graph shows substantially more volatility in the return correlations and furthermore, it shows a lower degree of correlations on average. This is not surprising, considering the results of table 3, which showed the lower degree of correlations between South Africa and the developing markets, as opposed to the developed markets. Return correlations were negative around 2002 and 2003 and again there was a sharp drop from 2007. Correlations again rose sharply in 2008 and peaked around 2011, just shy of 0.80.

The regression results of table 20 suggest that a positive trend in correlations can be seen between South Africa and the remaining developing economies. The trend has a significant t-statistic of 4.56 for the linear regression, although the PW regression retains an insignificant but positive t-statistic of 0.79. The results of table 21 further signify that return correlations have been increasing over the sample period, with the entire sample rendering a correlation of 0.27, while in the first half correlations are as low as 0.17 and they increase to 0.39. When using the Fisher Z transformation, the result approaches significance at the 10% level, with a z statistic of -1.54. The results appear to be driven by increased correlations of the equity indices, as opposed to the currencies. The equity indices appear to exhibit increasing correlations as shown by both table 20 and 21. The linear regression finds a strong positive time trend, although the significant t-statistic is not supported by the PW regression. This indicates that the significant trend could again be driven by auto-correlation in the return series'. In table 21, return correlations between the developing market indices and the JSE Top40 rise from 0.30 up to 0.43. This highlights the lower degree of correlation among the developing economies and South Africa, as opposed to when the Developed economies were examined.

Regarding the currency effects, the ZAR exhibits a positive correlation with the Developing market portfolio currencies. That being stated, the correlation is reasonably low, at 0.28 for the entire sample period. Furthermore, the currencies appear to be exhibiting marginal

declining correlations over time, although the relationship is statistically weak and insignificant.

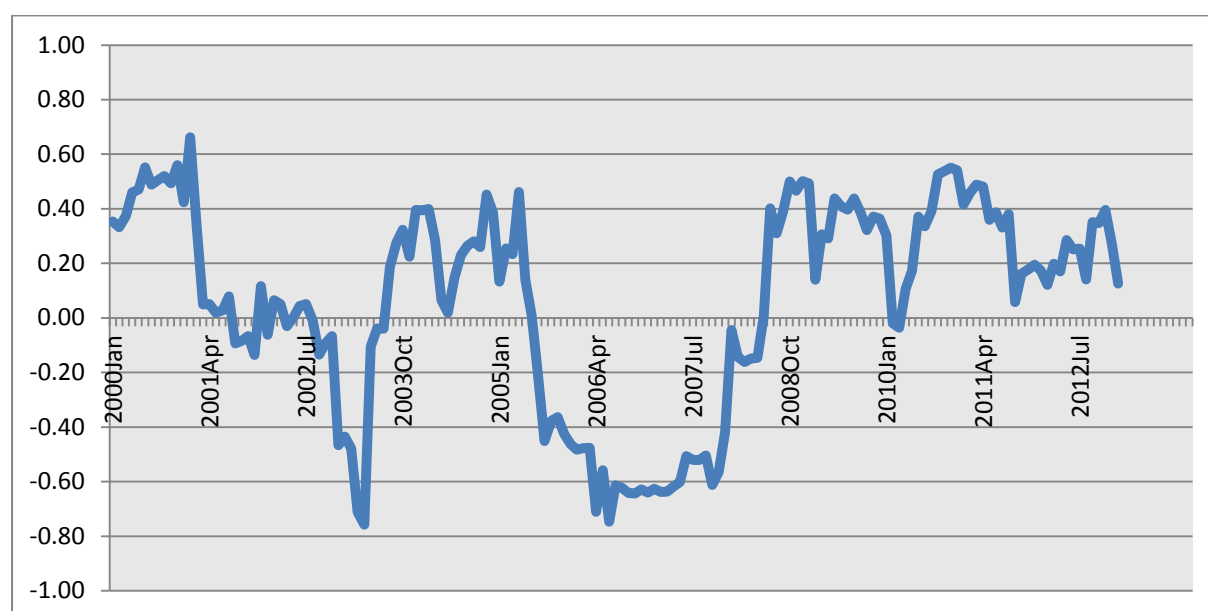


Figure 10: Final Return Rolling Correlations between Developed and Developing Markets

Figure 10 presents the rolling return correlations between the Developed market portfolio and that of the Developing market portfolio when viewed from the domestic perspective. It can be seen that during economic unease, such as around 2001 and 2008, return correlations climbed higher, while during periods of rapid expansion, correlations generally were lower. Furthermore, the correlations between the two portfolios are lower than when the single economy of South Africa is compared to either the Developed or the Developing market portfolio, highlighting the diversification benefits.

The regression analysis of table 20 points towards there being no trend whatsoever regarding increasing or decreasing correlations, with t-statistics for both the linear regression and the PW regression remaining almost entirely flat. Table 21 shows that return correlations did increase though, despite their insignificance. Correlations in the first half of the sample period were a mere 0.17 and increased to 0.27 in the latter half.

Equity indices exhibited increased correlations, with the first half correlations between the two portfolios being 0.50 and rising to 0.62 by the end of the sample period. The linear regression further signified that equity indices are becoming more correlated over time, with a significant t-statistic of 5.24. The PW regression only produced a t-statistic of 1.11 on the time coefficient, weakening the statistical significance. The currency returns of the two portfolios were found to further suggest a negative correlation, highlighting the ‘flight-to-quality’ response of investors (Yotopoulos & Sawada, 1999). Furthermore, the correlations of the currencies appeared to be remaining almost entirely unchanged and highly negative over time, as indicated by table 20 and table 21. As such it appears unlikely that any significantly different trends will emerge with currency return correlations between developed and developing economies in the near future.

4.7.2. Real Return Comovements from an International Perspective

Table 22: Rolling Correlations of Real Returns from an International Perspective

		Linear Regression				Prais-Winsten Regression			
		Intercept	Time T-Stat	DW T-Stat	MSE	Intercept	Time T-Stat	DW T-Stat	MSE
Final Returns	USA/Developed	40.96	2.93	0.29	0.12	12.56	0.86	2.23	0.10
	USA/Developing	14.41	6.02	0.21	0.2	4.19	1.27	1.78	0.09
	USA/Globe	19.05	4.56	0.22	0.19	5.46	0.97	1.89	0.08
	Devi/Devd	13.98	10.71	0.34	0.17	4.80	3.35	1.99	0.06
Equity Returns	SPX/Developed	45.90	1.77	0.27	0.11	13.84	0.37	2.07	0.05
	SPX/Developing	4.51	4.68	0.16	0.3	1.61	0.62	1.81	0.18
	SPX/Globe	15.12	4.22	0.19	0.21	4.23	0.73	1.85	0.09
	Devi/Devd	7.10	5.72	0.25	0.24	2.39	1.37	2.15	0.11
Currency Returns	USD/Developed	-23.67	-2.74	0.26	0.15	-6.61	-0.82	1.76	0.11
	USD/Developing	3.18	-8.30	0.18	0.36	1.17	-2.44	1.81	0.12
	USD/Globe	-4.70	-6.19	0.18	0.28	-0.69	-1.92	1.89	0.15
	Devi/Devd	1.39	7.90	0.15	0.29	0.35	1.84	1.94	0.07

Table 22 shows the regression results run on the 12-month rolling correlations between the U.S. and the various portfolios under examination from the international perspective. Both a linear regression as well as a Prais-Winsten regression was again utilized, as the DW-statistics on the linear regression highlight the high levels of positive auto correlation among the data. The PW regression can be seen to again have rendered the DW-statistics all near to 2, indicating that the auto-correlation is largely eliminated. The MSE's of the PW regression are also consistently lower than those of the linear regression, highlighting its superiority. Regression results for the final real returns from the international perspective are presented, as well as the results for the equity indices and the currency returns. This allows for better identification of the driving factor between any changes in trends, if any are found.

Table 23: Real Return Correlations over Sub-Periods from an International Perspective

	Final Returns			Equity Returns			Currency Returns		
	1999-2013	1999-2006	2006-2013	1999-2013	1999-2006	2006-2013	1999-2013	1999-2006	2006-2013
USA/Developed	0.87	0.81**	0.90**	0.86	0.83	0.88	-0.67	-0.62	-0.72
USA/Developing	0.63	0.51**	0.74**	0.51	0.43*	0.63*	-0.35	-0.08***	-0.52***
USA/Globe	0.79	0.71**	0.85**	0.72	0.64**	0.81**	-0.54	-0.39**	-0.65**
Devi/Devd	0.71	0.57***	0.81***	0.55	0.48***	0.64***	0.46	0.26**	0.59**

*, **, *** indicates a significant difference at the 10%, 5% and 1% levels respectively.

Table 23 presents the return correlations between the U.S. and each portfolio under examination from the international U.S. perspective. The sample period is again split into two 7 year periods, with the final return correlations, the equity return correlations and the currency return correlations all being presented.

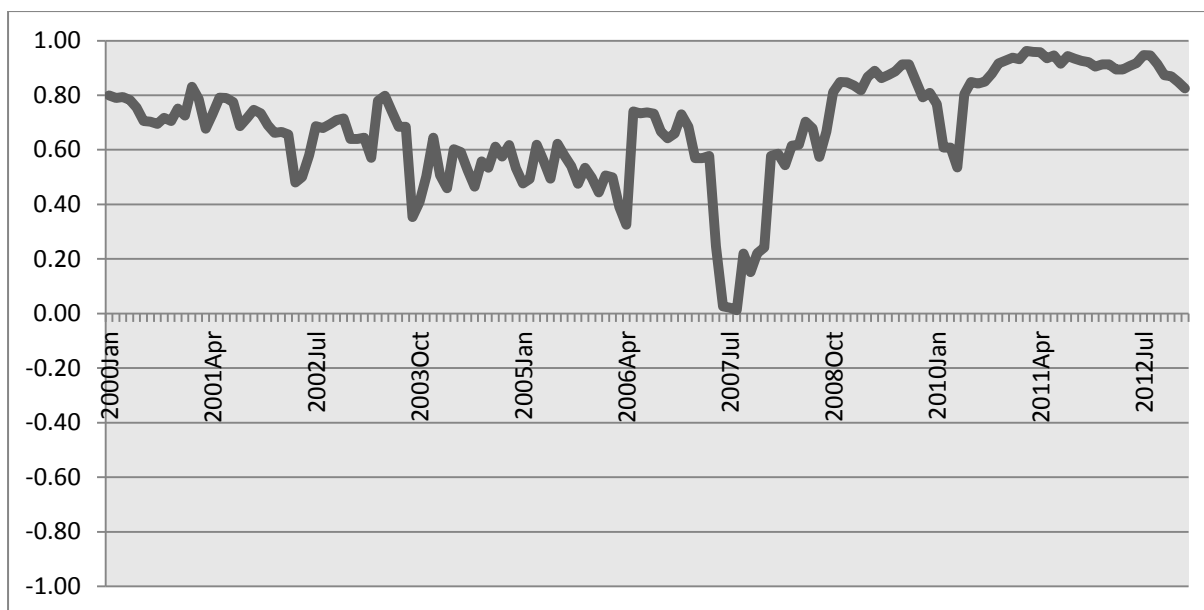


Figure 11: Rolling Correlations between the USA and the Global portfolio

Figure 11 shows the rolling correlations between the U.S. and the remainder of the Global market portfolio from the international perspective. The graph suggests that from 2000 through to 2008, return correlations were steadily decreasing. Around 2007 a sharp decline occurred, before the familiar rise in correlations from 2008. The results further seem to indicate that from 2008 onwards, correlations have been steadily rising. Correlations around 2010 and 2011 peaked at nearly 0.95, indicating excessive correlations between the USA and the global markets when real dollarized returns are examined.

The regression analysis reveals that while a positive significant time trend does exist from the perspective of the linear regression, no definitive trend can be confirmed from the perspective of the PW regression. Table 23 though reveals that a large increase of 0.14 can be seen in return correlations between the USA and the globe, with the first half return correlations being 0.71 and increasing to 0.85 in the second half of the sample period. The return correlations over the entire sample period were 0.79, highlighting that the USA is far more correlated with global markets than South Africa (full sample period correlations were only 0.63). This is in line with expectations and studies which suggest that developed markets are more correlated with the globe than developing markets (Driessen & Laeven, 2007; Cho *et al*, 2012). The increase in correlations was further found to be significant at the 1% level after applying the Fisher Z-Transformation.

When the equity index returns are viewed in isolation, the results are similar to the final return results. An increasing trend does appear to exist, although it is statistically weak by the standards of the PW regression. Furthermore, first half sample correlations between the SPX500 are 0.64, while rising substantially to 0.81 in the second half of the sample period. Regarding the currency returns, the results are very different. Both the linear and the PW regression disclose a significant decreasing trend in correlations between the USD's Dollar Index and its global counterparts. First half sample period return correlations were -0.39 and they declined to -0.65 over the sample period. The results thus seem to suggest that over time,

the USD appears to be becoming significantly less correlated with other global currencies, while the indices appear to be exhibiting mild increasing correlations over time. It should again be noted that in comparing the currency return correlations from the international perspective, the returns on the Dollar Index are compared to the bilateral exchange rate returns that a U.S. investor would achieve by investing in a foreign currency.

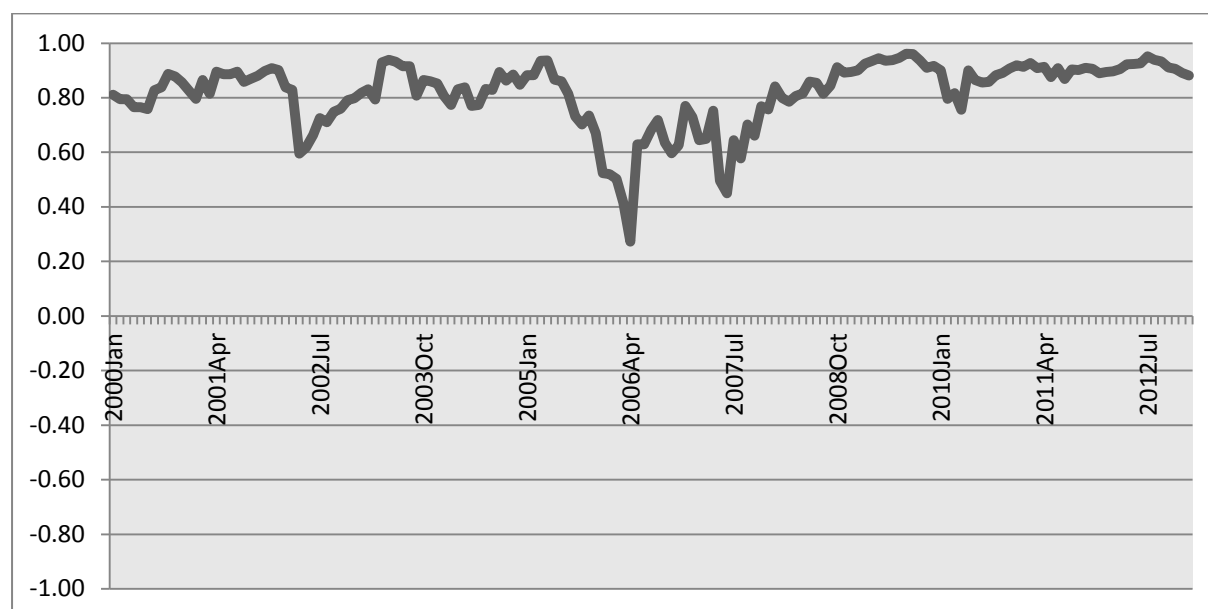


Figure 12: Rolling Correlations between the USA and the Developed portfolio

Correlations between the USA and the Developed market portfolio are unsurprisingly high. The correlations are also far higher than those of South Africa with either the Developing or the Developed market portfolio. The lowest return correlation exhibited between the USA and the Developed markets is just shy of 0.30 while the peak around 2009 is as high as 0.95. Graphically, correlations can be seen to have been stable up until 2005, before declining until the end of 2006. From 2006 onwards, an upward trend reemerges, with correlations surpassing their levels prior to 2005.

The PW regression reveals that, no significant change in correlations has occurred over the sample period. The time coefficient is weak with a t-statistic of only 0.86. The linear regression lends support to a rise in correlations, although the result is questionable due to the DW-test statistic of 0.21. Table 23 indicates that correlations have increased, although this is to be expected due to the sharp decline happening just prior to 2006. The increase in the real return correlations is significant at the 5% level, with correlations increasing just over 10%, from 0.81 up to 0.90. However, neither the equity return correlations of the SPX500 with the developed market indices, nor the correlation of the USD with the developed market currencies was found to exhibit any significant trends. Table 23 though did demonstrate that the correlation between the SPX500 and the remaining developed market indices has increased marginally (although insignificantly), while the USD has become weakly less correlated with the remaining developed market currencies.

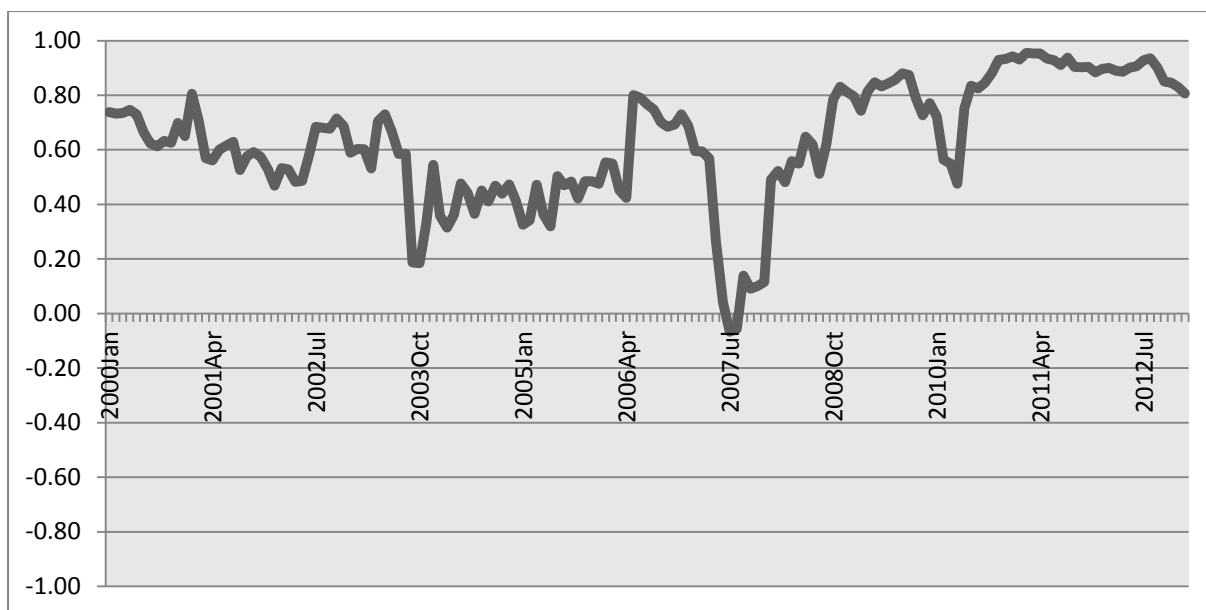


Figure 13: Rolling Correlations between the USA and the Developing portfolio

Figure 13 represents the rolling correlations between the U.S. and the Developing market portfolio. In line with expectations, correlations are lower than when compared to Figure 12 and higher when compared to Figure 9 (Driessen & Laeven, 2007; Cho *et al* 2012). Real return correlations can be seen to have increased slightly, although from the start to the end of the period, the increase has only been from 0.75 to 0.80.

The linear regression produces a highly significant t-statistic of 6.04 on the time coefficient and while the PW regression approaches significance, no definitive result can be concluded that correlations are rising. Table 23 further shows that correlations over the sample period rose from 0.51 in the first half, up to 0.74 in the second half. The increase in correlations is found to be significant at the 5% level and the return correlation over the entire sample period between the U.S. and the Developing market portfolio was found to be 0.63. The equity return correlations present a similar result to those of the final return correlations, although the results are marginally weaker, while remaining positive. The currency returns however reveal a strong negative correlation over time. Both the linear regression and the PW regression produced highly negative t-statistics of -8.30 and -2.44 respectively. Furthermore, the correlation of the Dollar Index with the Developing market currencies was found to be -0.06 in the beginning half of the sample period and declined sharply to -0.52. This decline in currency return correlations is highly significant even at the 1% level.

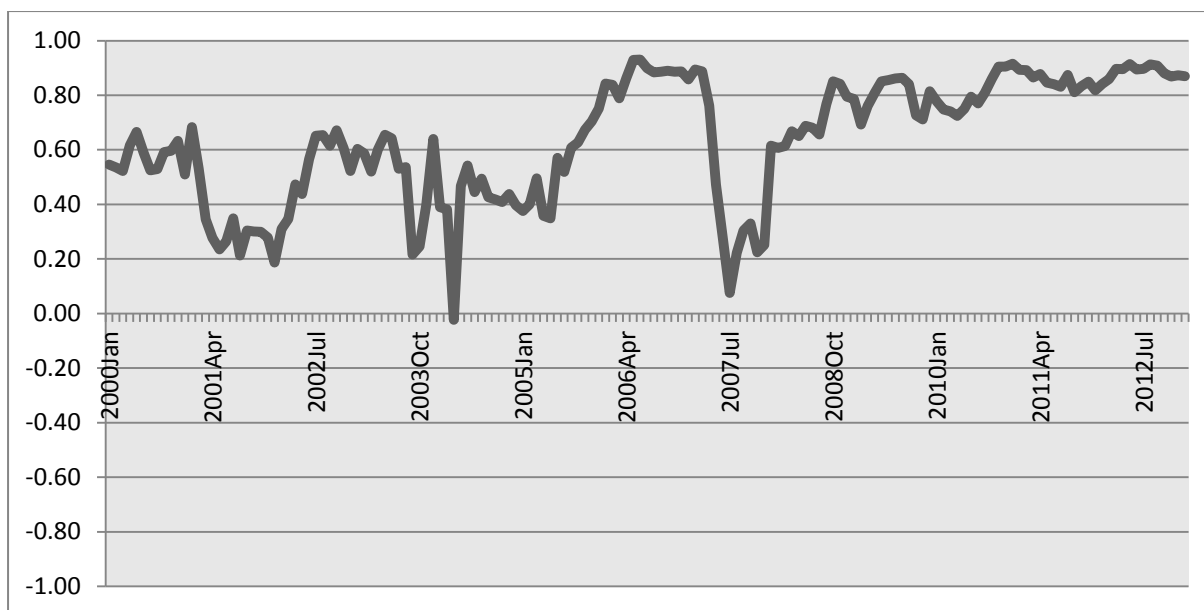


Figure 14: Rolling Correlations between the Developing portfolio and the Developed portfolio

Figure 14 shows the rolling return correlations between the developed and the Developing market portfolio. Figure 14 reveals interesting findings, namely that from the U.S. perspective the developed and the Developing market portfolio exhibit higher correlations than when viewed from the South African perspective (see Figure 10). Furthermore, it is curious to note that from the U.S. perspective, return correlations were at their highest around 2006 through 2007, when yet from the domestic perspective, during this time period return correlations were at their lowest. This highlights how investors move in and out of investments in the USD and the ZAR at opposite times.

Table 22 further reveals that a highly significant increase in correlations between the two portfolios exists. The linear regression produces a t-statistic north of 10, while the PW regression confirms the highly significant result at the 1% level with a t-statistic of 3.35 on the time coefficient. Table 23 further reveals that real return correlations increased from 0.57 to 0.81 between the first and the second half of the sample period. This is substantially higher than the return correlations reported in table 23, where first half correlations were 0.17 and rose to only 0.27 in the second half. Furthermore, from the International perspective, the difference in correlations was found to be highly significant, even at the 1% level.

Analysis of the equity index correlations and the currency correlations reveal more interesting results. Equity index correlations can be seen to follow a mild, insignificant positive time trend. The real driving factor in the increasing correlations between the two portfolios appears to be the rising correlations between the currency returns. The PW regression produces a t-statistic of 1.84, which is significant at the 10% level. Furthermore, table 23 shows that currency return correlations rose from 0.26 up to 0.59 over the sample period examined while the equity index return correlations rose from only 0.48 to 0.64. The result could be indicative that investors are shifting more and more towards hedging solely with the USD in times of risk-off trade, as opposed to other hard currencies, as suggested by Benigno (2011). This result would further explain the decline of the correlations with the USD and

both the developed and the developing market currencies. It could be that from a U.S. perspective, all currency investments could be moving in tandem against the USD. This would lend strong support to diversification benefits of foreign investments for U.S. investors, particularly with carry-trades.

4.7.3. Index/Currency Return Correlation Trends

Table 24: Regression Results from the Domestic Perspective

Regression Results	Linear Regression				Prais-Winsten Regression			
	Intercept	Time T-stat	DW T-Stat	MSE	Intercept	Time T-stat	DW T-Stat	MSE
USA	1.17	-5.95	0.26	0.25	0.11	-1.54	1.96	0.13
Eurozone	-2.65	-3.15	0.14	0.34	-1	-0.27	1.78	0.13
Japan	0.68	-10.21	0.16	0.31	-0.39	-1.97	1.82	0.12
U.K.	-1.69	-7.86	0.18	0.28	1.01	-1.29	2.05	0.12
RSA	0.39	-0.32	0.24	0.30	0.77	-0.71	2.11	0.15
Brazil	3.32	0.66	0.26	0.31	1.64	-0.75	1.90	0.15
Russia	-6.10	7.88	0.29	0.25	-2.09	2.70	2.07	0.13
India	-1.83	2.89	0.37	0.28	0.60	-0.21	1.97	0.16

Table 25: Regression Results from the International Perspective

Regression Results	Linear Regression				Prais-Winsten Regression			
	Intercept	Time T-stat	DW Test Stat	MSE	Intercept	Time T-Stat	DW Stat	MSE
USA	1.42	-5.21	0.16	0.33	0.42	-1.32	1.91	0.13
Eurozone	-14.71	16.44	0.22	0.22	-3.87	4.58	1.73	0.10
Japan	-10.90	4.26	0.17	0.33	0.79	-2.61	1.92	0.13
U.K.	-11.02	12.43	0.15	0.27	-2.56	3.06	2.05	0.10
RSA	6.44	-2.41	0.13	0.39	0.22	0.66	1.69	0.14
Brazil	1.99	-1.29	0.18	0.34	0.72	-0.46	1.81	0.14
Russia	-10.03	18.90	0.42	0.22	-3.41	6.67	1.67	0.13
India	8.02	-6.49	0.36	0.24	2.00	-1.52	1.81	0.14

Table 26: Currency/Index Return Correlations over the first and second half

	Domestic Perspective		International Perspective	
	1999-2006	2006-2013	1999-2006	2006-2013
USA	-0.02**	-0.40**	-0.07**	-0.44**
Eurozone	-0.14**	-0.43**	-0.30***	0.30***
Japan	-0.09***	-0.75***	0.11***	-0.59***
U.K.	-0.17**	-0.50**	-0.24***	0.29***
RSA	-0.08	0.13	-0.17***	0.41***
Brazil	0.12	0.27	0.12	0.20
Russia	-0.16	0.09	-0.11***	0.44***
India	-0.03	0.10	0.24	0.02

*, **, *** indicates a significant difference at the 10%, 5% and 1% levels respectively.

Table 24 and table 25 look at the time trends between equity and currency return movements from the domestic and international perspective respectively of each economy examined. Table 26 divides the sample period in two, and examines how the equity and currency return correlations have changed from the first 7 years through to the next 7 years. The full period correlations have been presented in table 15 previously.

From the domestic perspective, the PW regression results suggest that only with Russia and Japan can any significant trend be identified. The analysis signifies that in Japan, a strong negative trend (at the 5% level) is exhibited between the currency and equity return correlations. Furthermore, in table 26, the equity/currency return correlations in the first half of the sample period is -0.09, while declining right down to -0.75 in the second half of the sample period. The results of the Fisher Z-Transformation further confirmed that the difference was significant at the 1% level, indicating a huge decline in currency/equity return correlations in Japan.

Russia exhibited a strong positive increase in equity/currency return correlations, with a significant time-trend t-stat of 2.70. The increase in correlations however, was not confirmed by table 26. The correlations were found to rise from -0.16 in the first half of the sample period, to 0.09 in the second half. The Z-transform t-statistic just missed significance at the 10% level, with a value of 1.61. The U.S. can be seen to be approaching a negative significant trend in table 24, based on the PW t-statistic on the time coefficient of -1.54. In Table 26, the difference in the first half and second half correlations was found to be significant at the 5% level, indicating that the U.S. currency and equity return correlations may be declining over time.

Table 26 further revealed that among both the U.K. and the Eurozone, currency and equity return correlations are declining over time. However, the PW regression did not support the significance of the findings, although the linear regression did. It thus seems evident that in every developed market under examination, equity and currency return correlations are declining over time, when viewed from the domestic perspective. Among the developing markets, although the trends are weaker and generally lack significance (except in the case of Russia); it appears that equity and currency returns are becoming more correlated over time. These findings are in support of studies by Hochstotter and Weskamp (2012), Cho *et al* (2012) and Maysami *et al* (2004).

From the international perspective, changes in correlations appear to be more significant and more extreme than when viewed from the domestic perspective. The strongest trend was identified in Russia, where a highly significant t-stat of 6.67 was found on the time coefficient. Table 26 confirmed that correlations increased from -0.11 in the first half of the sample period up to 0.44 in the second half. This increase, as with the PW regression, was found to be highly significant at the 1% level.

Both the Eurozone and the U.K. showed significant increases in correlations, with the PW regression producing t-stats of 3.06 and 4.58 respectively on the time coefficients. For Europe, the Euro and the Eurostoxx50 return correlations increased significantly from -0.30

to 0.30 between the first and the second half of the sample period. The U.K showed rising currency/equity return correlations of -0.24 up to 0.29.

Japan showed declining correlations, with a time coefficient t-stat of -2.61. Over the first and second half of the sample period, correlations declined significantly from 0.11, right down to -0.59. Table 26 further reveals that correlations in South Africa have risen significantly, when viewed from the dollarized perspective, although the results are not supported by the PW regression. Furthermore, table 26 indicates that correlations in the U.S. have declined between the Dollar Index and the SPX500. The result though is not supported significantly by the PW regression, although a negative trend does appear to exist.

The results are thus very different from the international perspective than the domestic perspective. From the international perspective, among the U.S. and Japan are correlations declining, while both the Eurozone and the U.K. showed *increasing* correlations. This could be driven by the reduced investor confidence in the Eurozone and the U.K, where investors would rather invest safely in the USD or the YEN. From the international perspective, India can also be seen to have declining equity/FX correlations while from the domestic perspective, all developing markets exhibit increasing correlations. In general, the results are broadly consistent with those of numerous previous studies (Hochstotter & Weskamp (2012); Cho *et al* (2012); Maysami *et al* (2004); Kornienko (2010)).

5. Summary and Discussion

In light of the array of results presented in section 4, a reconciliation of the study findings with the objectives of the study is required. Focusing attention on the first question posed: How has the JSE performed in real terms in relation to the other major markets examined?

The results presented suggest that developed markets have had disappointing returns over the sample period. It would seem that an investor would have been better off by investing in either developing markets, or simply in the local riskless assets. The strong performance of developing markets is largely attributable to the strong potential of economic growth in these economies. Investors have taken an advantage of the low equity valuations, causing an inflow of funds into emerging markets, bolstering equity prices and returns. This is evident by the tremendous growth in the market capitalization of emerging markets. Ernest and Young (2012) document a tenfold increase in the market capitalization of the BRICs. The report further states that The BRICs economies typically had a market capitalization to GDP ratio of around 20-25% in the 1990s. This ratio has increased to closer to 40% experiencing a capitalization increase of 40% over the past 15 years. This is consistent with the findings of table 17 which shows that the Developing market portfolio stock indices experienced a compound return in excess of 15% per annum on a real returns basis. Investors in the 1990's typically demanded a greater discount on developing market stocks than what is being demanded more recently. Increased trading and investment activities in developing markets have likely resulted in greater liquidity, lowering the required liquidity premium. As prices have risen in developing economies and stagnated in developed markets, a greater convergence of market prices and valuation ratios has surfaced (Ernest and young, 2012).

Another possibility for the superior performance of developing markets over their developed market counterparts is that both the dot com bubble and the banking crises of 2007-2008 originated in Developed Markets. While the spill-over effects certainly harmed global economies, the worst results were felt in the markets from where they originated.

Markets also have been shown to exhibit higher performance when viewed from the international perspective as opposed to the domestic perspective. This is primarily driven by the high inflation rates of South Africa as opposed to the U.S., which erodes the real returns. Furthermore, the ZAR currency did not depreciate as much as what the inflation differential would suggest it should. This has led to currency returns resulting from foreign investment being sub-optimal to what would be required, given the high inflation rate.

Results further indicate that from the domestic perspective, South Africa has had a performance superior to the developed economies, while being an average performer amongst the developing economies. From the international perspective, South Africa was the weakest performing developing market economy. The JSE Top40 was marginally worse than the other developing market indices on a real returns basis, although on a risk adjusted basis (as measured by the Sharpe Ratio) it was the second best performing index (after Russia). The ZAR was the most disappointing of all the currencies examined although when bank deposit rates were accounted for too, the IRP was the worst developing market currency, followed by the ZAR. When currency investments were invested in an interest bearing account, the developing market currencies consistently outperformed the developed market currencies.

Delving deeper into why South Africa has lagged in performance amongst its developing market counterparts, the statistics speak for themselves. South Africa has experienced a declining growth in exports and has the GDP of roughly only one quarter of both India and Russia (Sandrey, Fundira, Vink, Jensen, Viljoen & Nyhodo, 2013). South Africa additionally has substantially lower productivity levels than its BRIC counterparts (Sandrey *et al*, 2013) and the highest unemployment rate at around 25%. The World Bank database (2012) reports that Brazil, Russia and India all had unemployment rates typically between 3.6% and 6.5% at the end of 2012. These impressive levels of unemployment must be treated with caution though, as the labour force participation ratio in Brazil, India and South Africa is typically around only 50%, indicating that unofficial unemployment figures could be nearly doubled.

The results as such highlight that, from both the domestic and the international perspective, developing economies presented the superior investment opportunity over the sample period. This finding holds for whether an investor wants to invest in currencies or in the market indices. The findings also highlight that UIP theorems do not hold, although inflation differentials do insinuate the direction that a currency will move. Developing markets can be seen to have greater deviations from parity, as presented by Table 16 and Table 17. These findings are consistent with Mehl and Capiello (2007) and Horobet *et al* (2009).

Expanding on the finding of UIP being violated, the results brought interesting findings to light, regarding carry-trade strategies. While carry-trade strategies to domestic investors were marginally profitable, on a risk adjusted basis the returns were poor. Additionally, the

diversification benefits accruing to domestic investors undertaking a carry-trade strategy were at best equal to those of a diversified equity portfolio. Generally, the results indicated that carry-trade strategies offered limited diversification benefits to domestic investors and that they did not live up to the results of previous studies (Das *et al*, 2013; Burnside *et al* 2008) although this is largely driven by the volatility of the ZAR. From the international perspective, the benefits of carry-trades could be seen in a stronger light. Carry-trade strategies proved to be highly beneficial to international investors, whether funded out of a portfolio of low yielding currencies or purely by the USD. Carry-trades offered both impressive returns at low risk levels, lending support to findings that UIP does not hold.

Investors should caution extrapolating the strong relative performance of emerging markets too far into the future though. Brazil, South Africa and Russia have all been experiencing declining GDP growth over the past decade, with growth rates for both economies both sitting around 2%. In addition, Russia has a strong dependency on its natural resources, particularly oil, and has consistently ranked as one of the world's largest oil producers (Benedictow, Flaertoft & Lofsnaes, 2010; Ernst & Young, 2012; Beck, Kamps & Mileva, 2007). While Russia had a strong dependency and high correlation with the oil price, the correlation has been declining since 2002 which could have a positive impact on their long run growth outlook (Beck *et al*, 2007). In addition, Appendix G reports the one year performance of each economy from 1999 through to January of 2013. From the tables, it can be seen that during the economic crises of 2008, the developing markets shed far more value, both from the international perspective and the domestic perspective. Despite recovering far quicker than the developed economies, Tables 1H and 2H show that during 2011 and 2012, the developing economies have had inferior performance. Consequently, it is possible that over the next decade, developed markets may be where the smart money is moving to, as it is likely that most of the under-valuations in developing markets have been corrected.

When examining whether real return correlations have increased over time, results from the international perspective are broadly consistent with those of Bekaert *et al* (2009), Baele and Ingelbrecht (2009) and Heston and Rouwenhorst (1994). The results suggest that there is a mild but insignificant increase in correlations between the U.S and the other global economies. The strongest result found signified that developing and developed economies are exhibiting increased correlations. This is an indication that globalization and greater economic interest in developed economies could eliminate mispricing inefficiencies. Furthermore, investors will most likely begin to experience reduced benefits of global diversification among the emerging markets over time, although at present the benefits remain strong. The results further demonstrate that while equity indices are exhibiting mild but generally insignificant increased correlations, the USD seems to be exhibiting decreased correlations with the other global currencies.

From the domestic perspective, almost no change in correlations can be identified. The only result approaching significance is an increased correlation between South Africa and the remaining developing economies. This could be influenced by enhanced trade relations between South Africa and its developing market counterparts, leading to greater integration of the nation's capital markets. The correlations can further be seen to be lower for South

Africa than for the U.S., indicating that South African investors are inclined to increased diversification benefits. This is consistent with Li *et al* (2003) and Driessen and Laeven (2007). The lower correlations could be as a result of the smaller degree of integration between South Africa and the globe as opposed to the U.S. and the globe.

When looking into the correlations between the currency returns and the index returns of each economy, the results indicate that currencies and indices are becoming more correlated, except among the U.S. and Japan. This is consistent with Hochstotter and Weskamp (2012) and Cho *et al* (2012). These findings, as well as the findings indicating that the USD is becoming less correlated with other currencies, point towards investors relying more on the safe haven investments in times of recessions. Investors appear to be reacting in an increasingly risk averse manner during times of recessions, driving larger negative correlations between the currency and equity investments of stable economies. At the same time, currency and index correlations are increasing among riskier economies. These findings point towards investors investing in riskier markets and higher yielding investments (such as equities) when they are optimistic and feeling bullish. At the same time, when investors feel bearish and sentiment is low, they invest in strong economies low risk and low yielding assets, such as bonds or cash. This drives the returns on the currencies up, as demand for hard currencies rises, while there is a significant decline in the demand for all equities and high yielding investments: developed and developing markets alike.

The findings bring the final and primary question of the study into focus: should South African investors diversify? The results strongly point towards benefits in international diversification, although particularly among developing economies. From the domestic perspective, the real return correlations are lowest among the developing economies with South Africa and Brazil even exhibiting a negative correlation. When the MVAR's were analysed, the greatest diversification benefits were found amongst the Developing market portfolio. The Developing market portfolio furthermore produced the highest Sharpe Ratio. While investing in the Global portfolio would be beneficial, the benefits would be primarily driven by the developing economies. Investments made into the developed market economies would have offered risk reduction benefits, but not to the same extent as investments in the Developing economies. This result is likely to be driven by the lower correlations among the developing economies. Furthermore, the developing economies offered strong positive returns, in addition to lower risk. Consequently, an investment in the Developing market portfolio could be seen to reduce risk and amplify returns. In contrast, an investment in the Developed market portfolio or the Mixed portfolio (developed economies with South Africa) exhibited negative returns. Thus while risk may be reduced, returns are also severely compromised.

Further adding fuel to the benefits of developing market diversification is the finding that South African markets are lagging behind their developing market counterparts. As such, despite South Africans having enjoyed healthy returns over the sample period, declining economic growth, a deteriorating trade balance and declining labour participation emphasise the need for more diversified holdings. It is possible that South Africa and the JSE will not

continue to be able to sustain the healthy growth it has seen over the past 14 years if the economic climate does not change.

Despite the results pointing towards the benefits of international diversification, especially among the developing economies, investors need to caution against the superior benefits of developing market benefits being eroded over time. As the developing markets gain more traction and market capitalization in global markets, the changing correlations over time indicate that they will begin to behave more and more like developed markets. In addition, with slowing growth in developing economies and signs of recovery in more developed markets becoming apparent, the relative attractiveness of emerging market diversification could diminish.

In delving deeper into international diversification, the study also helps identify how investors should diversify and which classes of investments investors should consider. South African investors can be seen to benefit most from an investment in equity investments in developing economies. An investment purely in currencies or low yielding assets would not benefit South African investors as much as a purely high yielding investment (such as equities). From the domestic perspective, the results suggested that the currencies and the indices of developed economies are becoming less correlated. The implications that follow are that an investment combining interest bearing developed market accounts or riskless assets (such as government bonds) as well as developed market indices could yield greater diversification benefits over time. An investment portfolio comprising of riskless developed market investments, developed market indices and developing market equities could prove to be highly successful, based on the findings. Extending the asset base of investors to incorporate bonds, commodities and a larger sample of economies could be an avenue for future research.

For U.S. investors, the results signify that diversification benefits remain strong, particularly among developing economies. While diversification may be beneficial, the benefits are not as great as those amassed to South African investors. The results are also indicative though that over time, diversification benefits among developing economies will slowly be diminished. This is primarily driven by the gradual rise in return correlations experienced between the U.S. and developing markets. A combination of an investment in the U.S. markets and the Developing market portfolio offered the highest risk adjusted returns to U.S. investors, with the highest Sharpe Ratio. Diversification benefits examined using the MVaR approach also highlighted this as a highly effective diversification strategy for U.S. investors. With results being indicative of increasing return correlations over time between the U.S. and developing economies, the benefits that were experienced over the past 14 years may begin to diminish. However, the study postulates that focusing on carry-trade strategies may be a viable and superior alternative. This hypothesis is driven by the finding that the USD is becoming less correlated with other major currencies.

Out of all the investment options available to U.S. investors in this study, a carry-trade strategy was only mildly inferior to an investment in developing market indices when evaluated based on Sharpe Ratios. Focusing purely on the risk component, the carry-trade

strategy had annualized volatility of only 9.08% while the investment in the Mixed portfolio (U.S. economy combined with the Developing market portfolio) had volatility of nearly double, at 17.13%. A word of caution though relating to the carry-trade strategies must be mentioned due to the rising correlations between developed and developing market currencies. The increasing trend in currency return correlations to the U.S. investor between a portfolio of developed market currencies and a portfolio of developing market currencies suggests that over time, carry-trades are likely to offer diminished diversification benefits. However, the results also indicated that the USD by itself is becoming less correlated with all other currencies. Thus a carry-trade funded purely out of the USD is likely to yield stronger diversification benefits in the future than a carry-trade strategy funded out of a portfolio of low yielding currencies. The diversification benefits of carry-trades funded by the USD alone will increase if the trend of larger negative correlations between the USD and other global currencies persist. A combination of a portfolio comprising of both a carry-trade component and developing market indices could prove to yield the highest returns at the lowest levels of risk for U.S. investors.

An important point that demands attention is the trend of declines in interest rates across almost all economies. Even more of a concern, is the fact that the difference between interest rates less inflation is also declining over time (refer to graphs in Appendix I). Post 2009, seven out of the eight economies have a *negative* difference between interest rates and inflation. Only Japan has a positive difference at the end of 2012 between interest rates and inflation (which is helped by their deflationary environment). The trend among developing nations is not as severe as among the developed nations, with differentials being only marginally negative. This implies that an investment in riskless securities or cash deposits is losing real buying power value over time. The finding suggests that investors in global economies are being forced to look towards riskier securities in a search for yield, or in foreign markets. The results further denote that a carry-trade strategy is likely to continue to be more and more profitable over time, particularly if the trend of negative interest less inflation differentials persist. The result cannot be extrapolated too far into the future, as among the developed economies under consideration, interest rates are already all below 1%. With rates well below their long run average the effects of rates rising need to be considered. An increase in rates can play out in one or two ways. If rates rise in developed markets by a larger margin than in developing economies, the carry-trade profitability will decline substantially as borrowing costs will rise. If rates increase by a larger amount or if rates rise quicker in developing economies, the carry-trade strategy will become even more profitable. This is due to the borrowing costs remaining subdued while the returns increase.

6. Conclusion

In conclusion, the results are highly indicative of international diversification holding substantial benefits, particularly for South Africa investors. The report further is instructive and explicit that investments in developing markets appear to produce the most beneficial risk/reward trade-off. Benefits of currency investments and carry-trades are not as beneficial to South Africans as they are for U.S. investors and neither are they as effective as investments in equity portfolios. In addition, the findings are suggestive that while

diversification holds benefits, these benefits are constrained to the long run. In the short run, when markets are distressed it is unlikely that a diversified portfolio will perform much better than a more concentrated portfolio. When individual worst loss scenario analysis is performed, diversified and concentrated portfolios performed in a similar fashion, while when more aggregated and averaged loss measures are applied, diversified portfolios exhibited a strong outperformance over concentrated portfolios.

Developing economies substantially outperformed developed economies on both an absolute returns basis as well as on a risk/reward basis. South Africa can evidently to be seen to have had lagged in performance when compared with the other developing economies while out of the developed markets, Europe appeared to be the weakest. The JSE Top40 was a strong performer regarding market growth and returns, but the ZAR dampened the shine of Africa's strongest economy as an investment opportunity to international investors.

No unambiguous, powerful trends exist regarding increasing real return correlations from the South African perspective could be identified. However, a general mild increase in correlations is evident; particularly among the developing economies. While investors may have enjoyed superior developing market benefits for the past 14 years, the benefits are likely to diminish over time. Developing economies are becoming more integrated with those of developed markets and as their financial systems evolve, investors may be forced to look harder and harder in their search for yield.

Potential caveats of the study include that the time period chosen may bias the results or cause abnormal results. The dot com bubble occurred around the start of the sample period and the financial crisis of 2008 will no doubt have profound impact on the results which may not be conducive to more normal market conditions. The reasoning for not utilizing a longer period is due to the structural break that occurred in South Africa after the 1994 elections as well as the Euro only being introduced in 1999. An additional concern is that CPI baskets used to represent inflation do not comprise of the same constituents depending on the country. Basket constituents are also adjusted over time, thus there is a lack of absolute consistency which is very difficult to adjust for. These factors could lead to a disparity of results. Finally, capital controls could reduce the effectiveness of any results found. Capital controls limit the amount of capital that South African investors can invest offshore. At the time of writing this report, South African investors cannot send more than R4 million offshore annually without obtaining special clearances. Additionally, only natural persons over the age of 18 and in good tax standing can make use of the R4 million allowance. It does not apply to legal entities or trusts, which will complicate investment decisions for investors with large portions of their capital in trusts.

An avenue for future research would be for an extended sample size, containing more global economies and additional asset classes. A further avenue for future research would be to determine the driving factors behind the changing correlations, particularly among the currencies relative to the USD. A larger portfolio comprising of a mix between cash investments, carry-trade strategies and equities could further add depth and insight into how

investors should best structure their portfolios to exploit the maximum benefits offered by diversification.

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A. Appendix A: Real Returns of Each Economy Examined from the Domestic Perspective

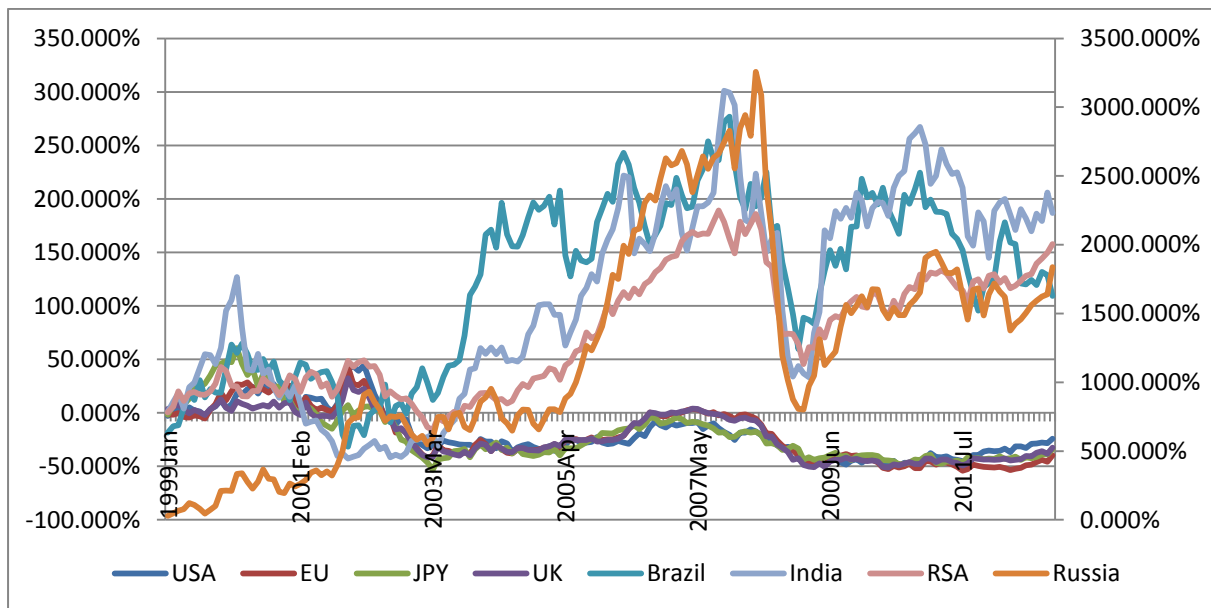


Figure 1A: Real Returns from the Domestic Perspective⁷

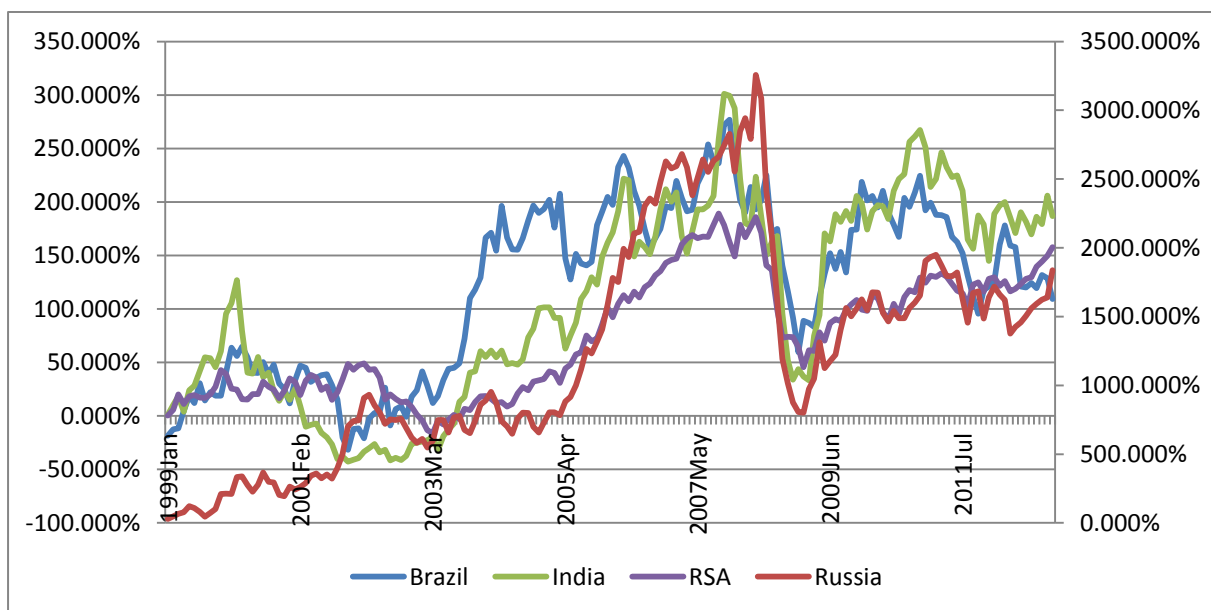


Figure 2A: Real Returns of the Developing Economies from the Domestic Perspective

⁷ Russia is placed on a secondary axis in all Appendix A and B due to its substantial returns relative to the remaining economies examined.

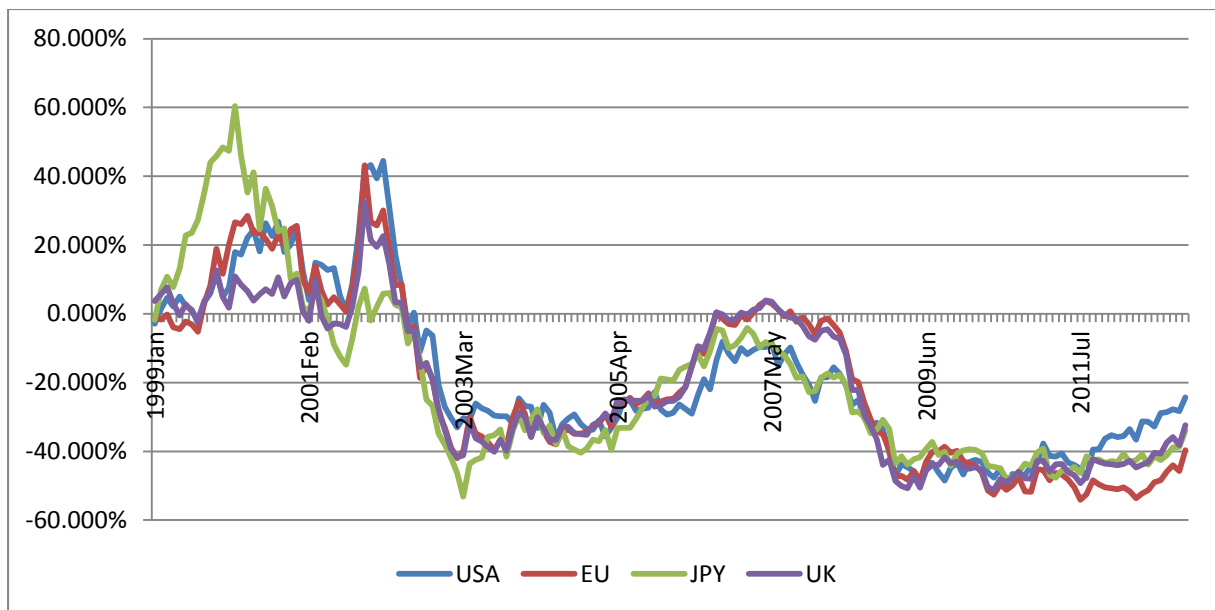


Figure 3A: Real Returns of the Developed Economies from the Domestic Perspective

B. Appendix B: Real Returns of Each Economy Examined from the International Perspective

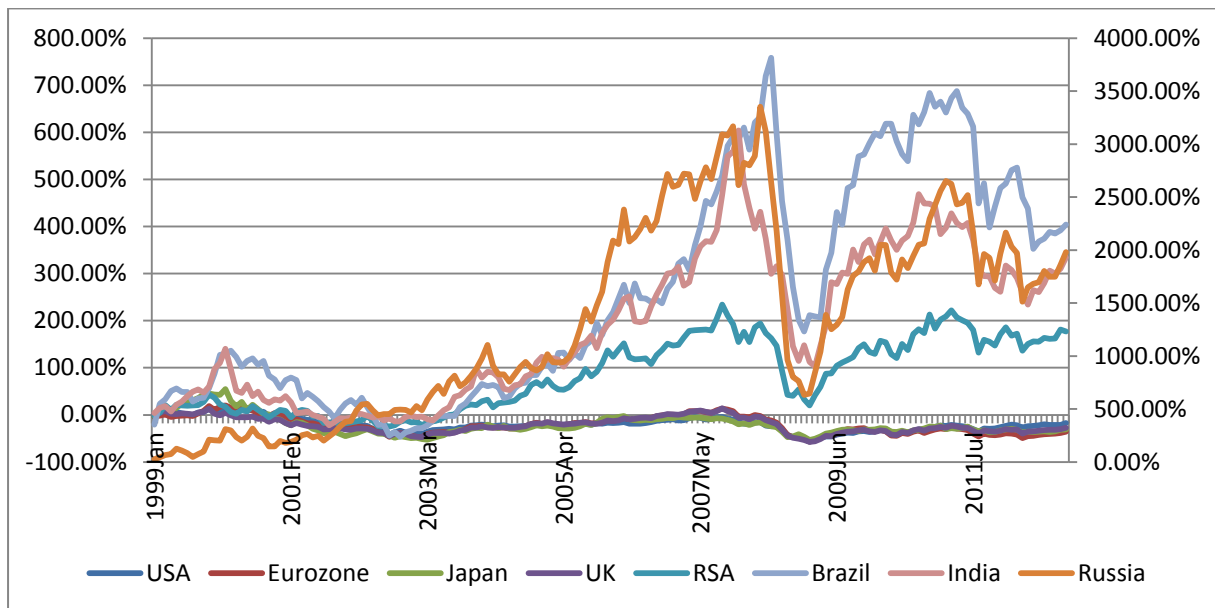


Figure 1B: Real Returns from International Perspective

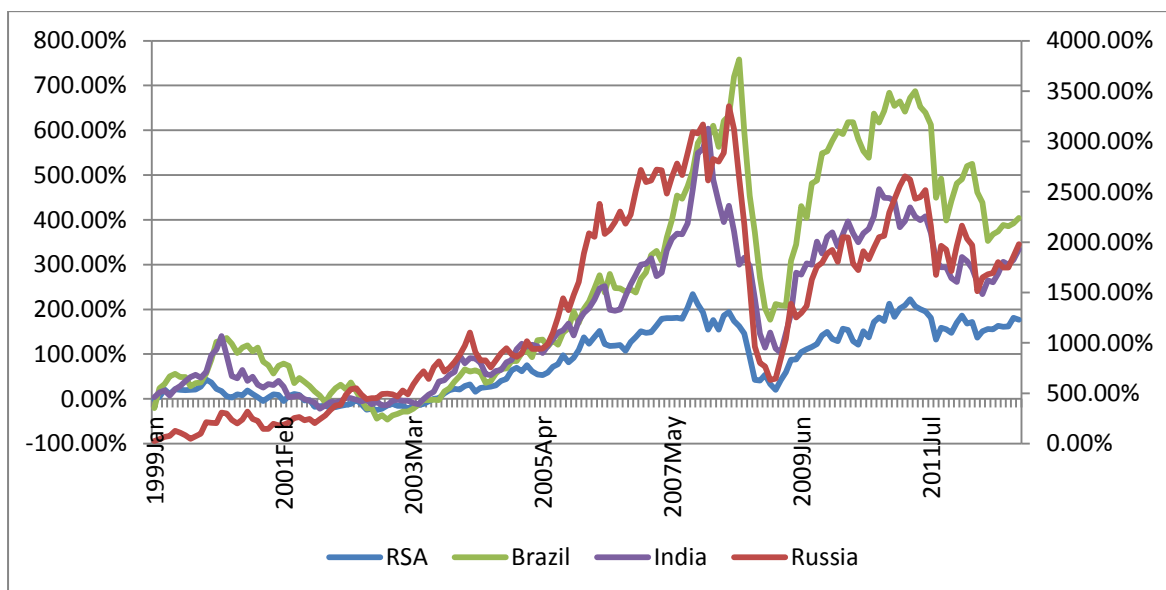


Figure 2B: Real Returns of the Developing Economies from the International Perspective

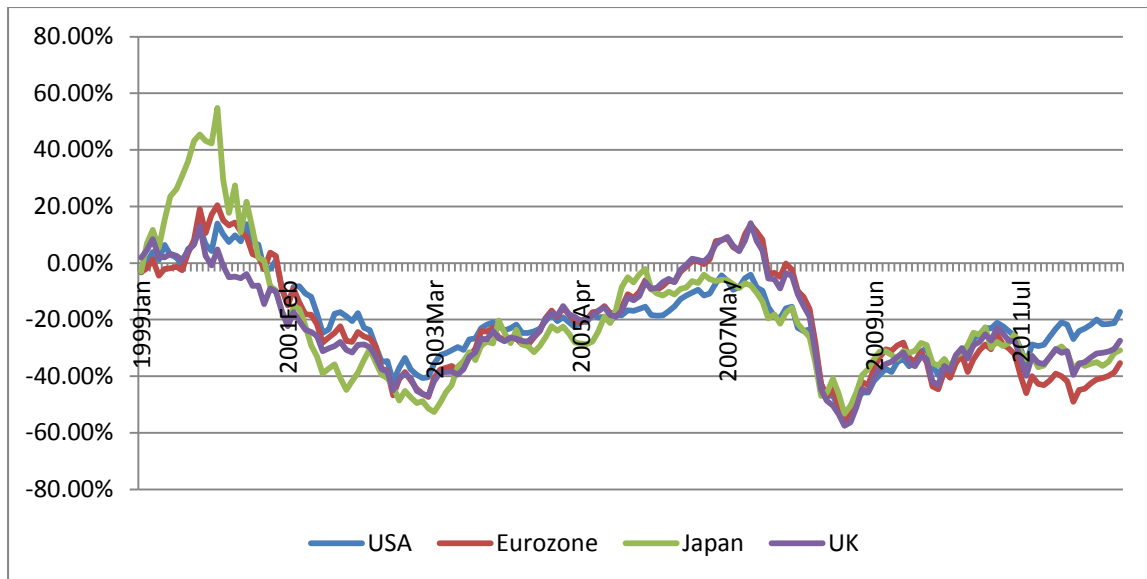


Figure 3B: Real Returns of the Developed Economies from the International Perspective

C. Appendix C: Annualized Inflation Rates, Inflation Differentials and Interest Rates of Each Economy

Table 1C: Annualized Inflation Rates and Inflation Differentials

Economy	Inflation	RSA Inflation Differential	USA Inflation Differential	Annualized Deposit Rate
USA	2.51%	3.34%	-	2.76%
Eurozone	2.09%	3.77%	0.42%	2.69%
Japan	-0.28%	6.24%	2.80%	0.23%
U.K.	2.20%	3.66%	0.30%	3.86%
India	6.68%	-0.70%	-3.91%	6.81%
Brazil	6.69%	-0.70%	-3.91%	16.04%
Russia	12.73%	-6.03%	-9.06%	9.97%
RSA	5.94%	-	-3.23%	8.97%

D. Appendix D: Return Correlations from the Domestic and International Perspective

Table 1D: Real Return Correlations from the Domestic Perspective over the First 7 Years

	<i>USA</i>	<i>Eurozone</i>	<i>Japan</i>	<i>U.K.</i>	<i>RSA</i>	<i>Brazil</i>	<i>Russia</i>	<i>India</i>
USA	1							
Eurozone	0.55	1						
Japan	0.31	0.55	1					
U.K.	0.53	0.93	0.56	1				
RSA	0.47	0.55	0.56	0.59	1			
Brazil	-0.28	-0.47	-0.32	-0.45	-0.29	1		
Russia	0.48	0.46	0.42	0.49	0.52	-0.18	1	
India	-0.14	-0.31	-0.1	-0.32	-0.02	0.31	0	1

Table 2D: Real Return Correlations from the Domestic Perspective over the Final 7 Years

	<i>USA</i>	<i>Eurozone</i>	<i>Japan</i>	<i>U.K.</i>	<i>RSA</i>	<i>Brazil</i>	<i>Russia</i>	<i>India</i>
USA	1							
Eurozone	0.55	1						
Japan	0.39	0.61	1					
U.K.	0.48	0.89	0.54	1				
RSA	0.61	0.6	0.39	0.58	1			
Brazil	-0.02	-0.19	-0.17	-0.2	0.01	1		
Russia	0.29	0.53	0.26	0.55	0.66	0.08	1	
India	-0.19	-0.03	-0.06	0.04	0.12	0.22	0.21	1

Table 3D: Equity Return Correlations over the first 7 Years from Domestic Perspective

	<i>SPX</i>	<i>EuroStoxx</i>	<i>Nikkei</i>	<i>FTSE</i>	<i>JSE</i>	<i>BOVESPA</i>	<i>RTS</i>	<i>BSE</i>
SPX	1							
EuroStoxx	0.83	1						
Nikkei	0.5	0.45	1					
FTSE	0.84	0.88	0.44	1				
JSE	0.61	0.53	0.52	0.6	1			
BOVESPA	0.01	0.11	0.06	-0.02	-0.02	1		
RTS	0.50	0.48	0.36	0.48	0.45	0.12	1	
BSE	-0.01	0.00	0.17	-0.09	0.07	0.18	0.18	1

Table 4D: Equity Return Correlations over the Last 7 Years from Domestic Perspective

	<i>SPX</i>	<i>EuroStoxx</i>	<i>Nikkei</i>	<i>FTSE</i>	<i>JSE</i>	<i>BOVESPA</i>	<i>RTS</i>	<i>BSE</i>
SPX	1							
EuroStoxx	0.86	1						
Nikkei	0.73	0.74	1					
FTSE	0.89	0.9	0.73	1				
JSE	0.72	0.65	0.62	0.75	1			
BOVESPA	0.11	0.07	0.17	0.05	0.1	1		
RTS	0.67	0.64	0.65	0.67	0.67	0.18	1	
BSE	0.20	0.24	0.18	0.11	0.07	0.11	0.23	1

Table 5D: Currency Return Correlations over the first 7 Years from Domestic Perspective

	<i>ZAR/USD</i>	<i>ZAR/EUR</i>	<i>ZAR/YEN</i>	<i>ZAR/GBP</i>	<i>ZAR/BRL</i>	<i>ZAR/RUB</i>	<i>ZAR/IRP</i>	<i>TWB</i>
ZAR/USD	1							
ZAR/EUR	0.21	1						
ZAR/YEN	0.27	0.78	1					
ZAR/GBP	0.31	0.9	0.77	1				
ZAR/BRL	-0.82	-0.49	-0.47	-0.55	1			
ZAR/RUB	-0.27	-0.52	-0.48	-0.51	0.37	1		
ZAR/IRP	-0.35	-0.82	-0.8	-0.85	0.62	0.55	1	
TWB	-0.79	-0.59	-0.54	-0.68	0.89	0.36	0.66	1

Table 6D: Currency Return Correlations over the Final 7 Years from Domestic Perspective

	<i>ZAR/USD</i>	<i>ZAR/EUR</i>	<i>ZAR/YEN</i>	<i>ZAR/GBP</i>	<i>ZAR/BRL</i>	<i>ZAR/RUB</i>	<i>ZAR/IRP</i>	<i>TWB</i>
ZAR/USD	1							
ZAR/EUR	0.35	1						
ZAR/YEN	0.50	0.69	1					
ZAR/GBP	0.30	0.75	0.70	1				
ZAR/BRL	-0.64	-0.48	-0.47	-0.31	1			
ZAR/RUB	-0.22	-0.51	-0.36	-0.59	0.26	1		
ZAR/IRP	-0.41	-0.71	-0.72	-0.72	0.43	0.67	1	
TWB	-0.80	-0.56	-0.62	-0.45	0.76	0.31	0.55	1

Table 7D: Real Return Correlations from the International Perspective over the first 7 Years

	<i>USA</i>	<i>Eurozone</i>	<i>Japan</i>	<i>U.K.</i>	<i>RSA</i>	<i>Russia</i>	<i>Brazil</i>	<i>India</i>
USA	1							
Eurozone	0.82	1						
Japan	0.50	0.40	1					
U.K.	0.80	0.91	0.42	1				
RSA	0.60	0.57	0.59	0.65	1			
Russia	0.52	0.38	0.36	0.45	0.46	1		
Brazil	0.24	0.29	0.08	0.25	0.15	0.22	1	
India	-0.01	0.03	0.22	0.05	0.09	0.18	0.17	1

Table 8D: Real Return Correlations from the International Perspective over the first 7 Years

	<i>USA</i>	<i>Eurozone</i>	<i>Japan</i>	<i>U.K.</i>	<i>RSA</i>	<i>Russia</i>	<i>Brazil</i>	<i>India</i>
USA	1							
Eurozone	0.90	1						
Japan	0.78	0.81	1					
U.K.	0.89	0.96	0.79	1				
RSA	0.82	0.86	0.81	0.87	1			
Russia	0.71	0.78	0.68	0.80	0.80	1		
Brazil	0.37	0.40	0.36	0.47	0.43	0.52	1	
India	0.36	0.33	0.30	0.41	0.26	0.35	0.26	1

Table 9D: Equity Return Correlations from the International Perspective over the first 7 Years

	<i>SPX</i>	<i>EuroStoxx</i>	<i>Nikkei</i>	<i>FTSE</i>	<i>JSE Top</i>	<i>BOVESPA</i>	<i>RTS</i>	<i>BSE</i>
SPX	1							
EuroStoxx	0.44	1						
Nikkei	0.52	0.51	1					
FTSE	0.88	0.43	0.59	1				
JSE Top	0.83	0.49	0.61	0.84	1			
BOVESPA	-0.02	0.16	0.06	-0.11	-0.02	1		
RTS	0.09	0.04	-0.04	-0.04	-0.01	0.17	1	
BSE	0.48	0.37	0.46	0.48	0.51	0.18	0.12	1

Table 10D: Equity Return Correlations from the International Perspective over the Last 7 Years

	<i>SPX</i>	<i>EuroStoxx</i>	<i>Nikkei</i>	<i>FTSE</i>	<i>JSE Top</i>	<i>BOVESPA</i>	<i>RTS</i>	<i>BSE</i>
SPX	1							
EuroStoxx	0.74	1						
Nikkei	0.65	0.62	1					
FTSE	0.90	0.73	0.75	1				
JSE Top	0.86	0.73	0.72	0.89	1			
BOVESPA	0.24	0.18	0.07	0.11	0.2	1		
RTS	0.07	0.17	0.1	0.05	0.11	0.11	1	
BSE	0.64	0.65	0.67	0.67	0.67	0.23	0.18	1

Table 11D: Currency Return Correlations from the International Perspective over the First 7 Years

	<i>USD/EUR</i>	<i>USD/YEN</i>	<i>USD/GBP</i>	<i>USD/ZAR</i>	<i>USD/RUB</i>	<i>USD/BRL</i>	<i>USD/IRP</i>	<i>DI</i>
USD/EUR	1							
USD/YEN	0.38	1						
USD/GBP	0.73	0.33	1					
USD/ZAR	0.29	0.35	0.23	1				
USD/RUB	0.24	0.14	0.15	0.21	1			
USD/BRL	-0.01	-0.05	-0.02	0.03	-0.16	1		
USD/IRP	0.25	0.32	0.26	0.28	0.18	0.12	1	
DI	-0.56	-0.36	-0.58	-0.17	-0.32	0.15	-0.33	1

Table 12D: Currency Return Correlations from the International Perspective over the Last 7 Years

	<i>USD/EUR</i>	<i>USD/YEN</i>	<i>USD/GBP</i>	<i>USD/ZAR</i>	<i>USD/ RUB</i>	<i>USD/BRL</i>	<i>USD/IRP</i>	<i>DI</i>
USD/EUR	1							
USD/YEN	0.09	1						
USD/GBP	0.59	-0.06	1					
USD/ZAR	0.56	-0.14	0.46	1				
USD/RUB	0.64	-0.08	0.62	0.50	1			
USD/BRL	0.52	-0.15	0.53	0.58	0.59	1		
USD/IRP	0.59	0.00	0.48	0.58	0.56	0.67	1	
DI	-0.69	-0.12	-0.66	-0.41	-0.44	-0.42	-0.48	1

E. Appendix E: Graphical Representation of Equity/Index Return Correlations

Equity/Currency Rolling Return Correlations from the Domestic Perspective

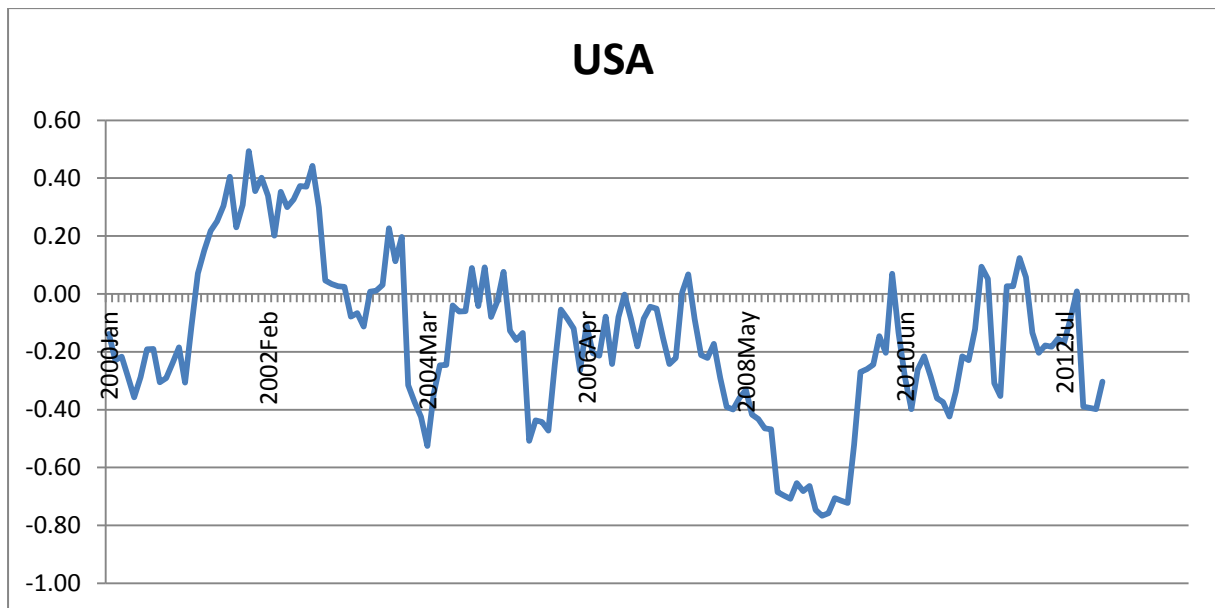


Figure 1E: USA Equity/Currency Return Correlations from the Domestic Perspective

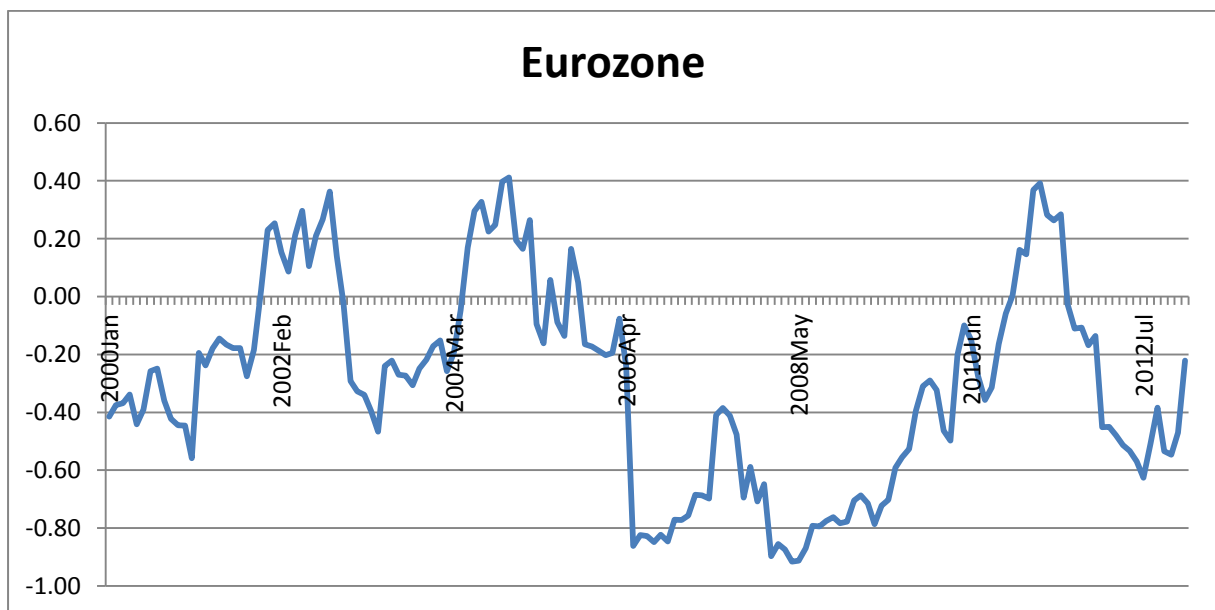


Figure 2E: Eurozone Equity/Currency Return Correlations from the Domestic Perspective

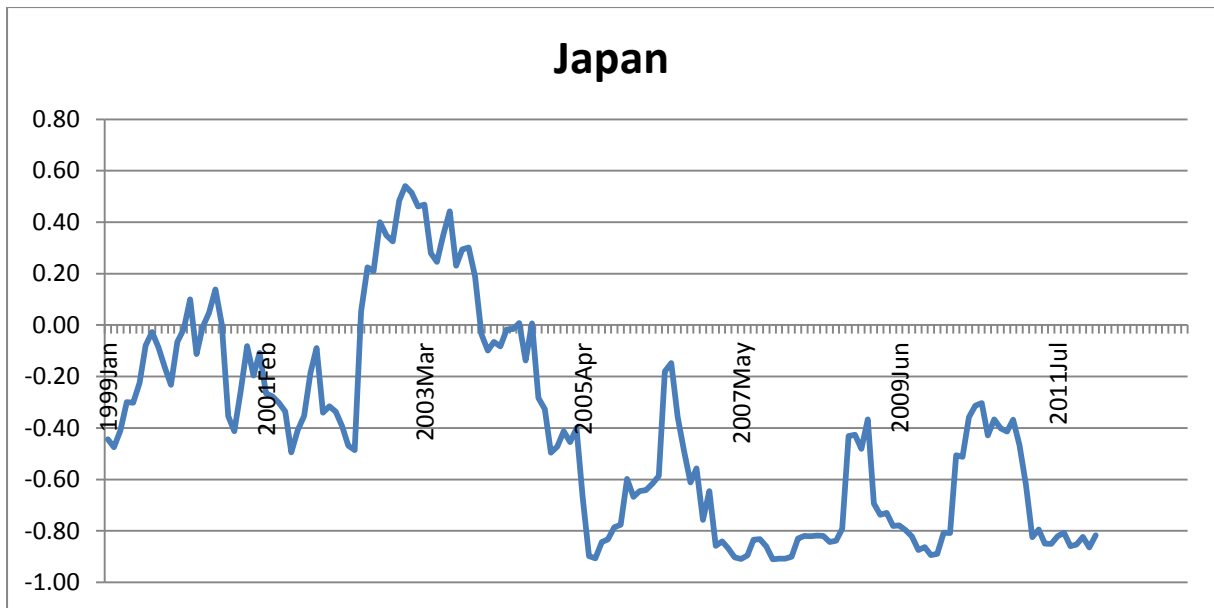


Figure 3E: Japanese Equity/Currency Return Correlations from the Domestic Perspective

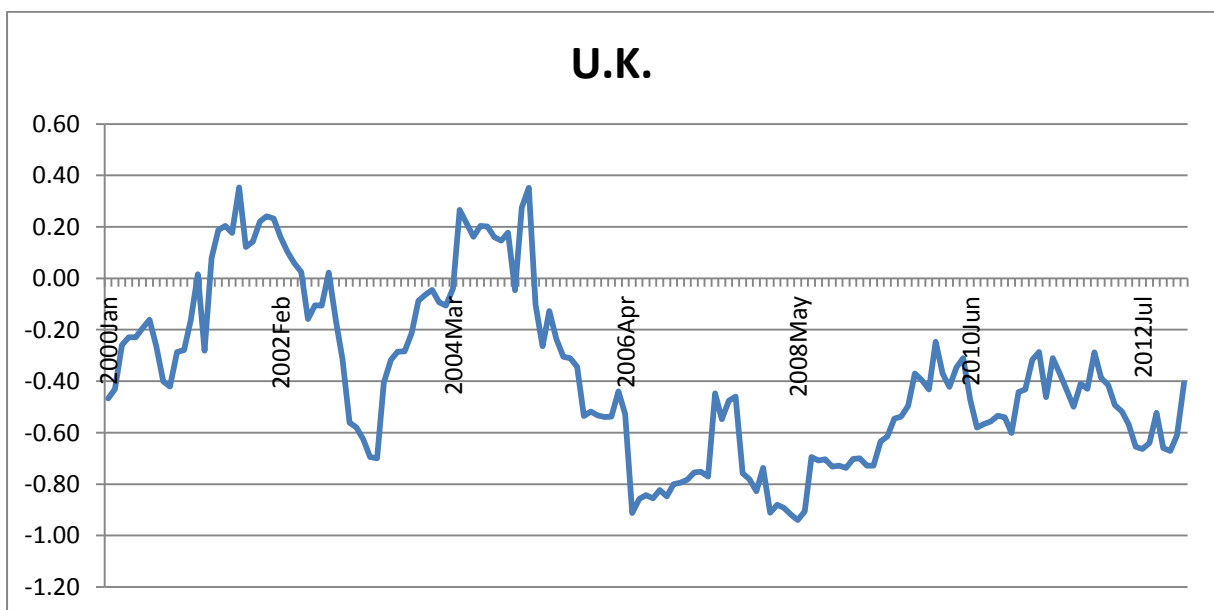


Figure 4E: U.K. Equity/Currency Return Correlations from the Domestic Perspective

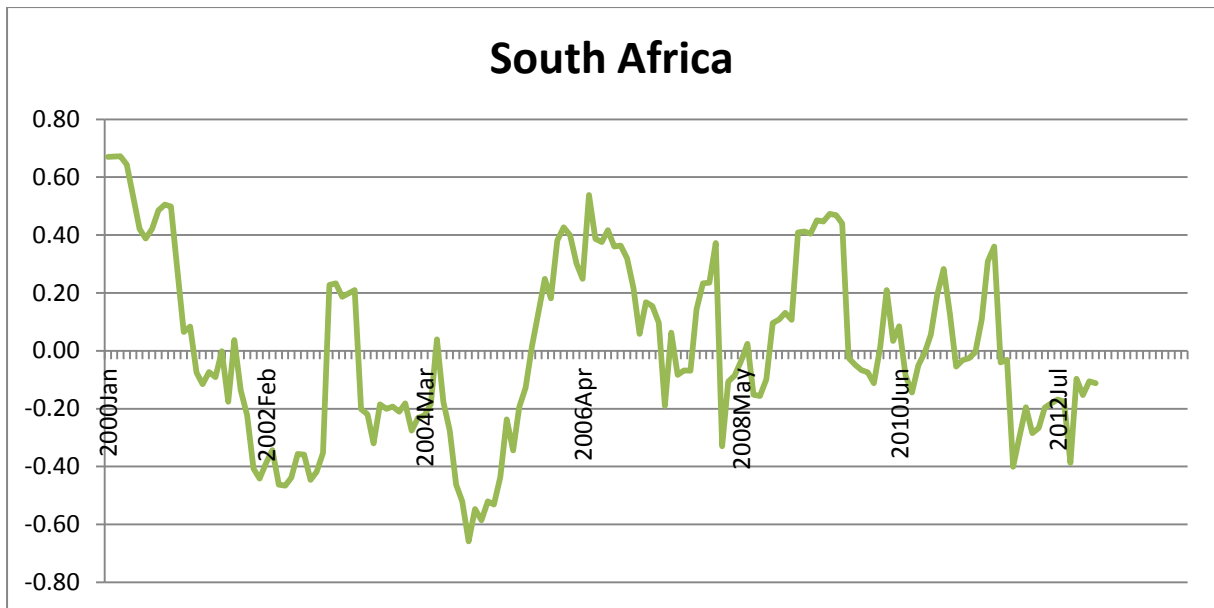


Figure 5E: South African Equity/Currency Return Correlations from the Domestic Perspective

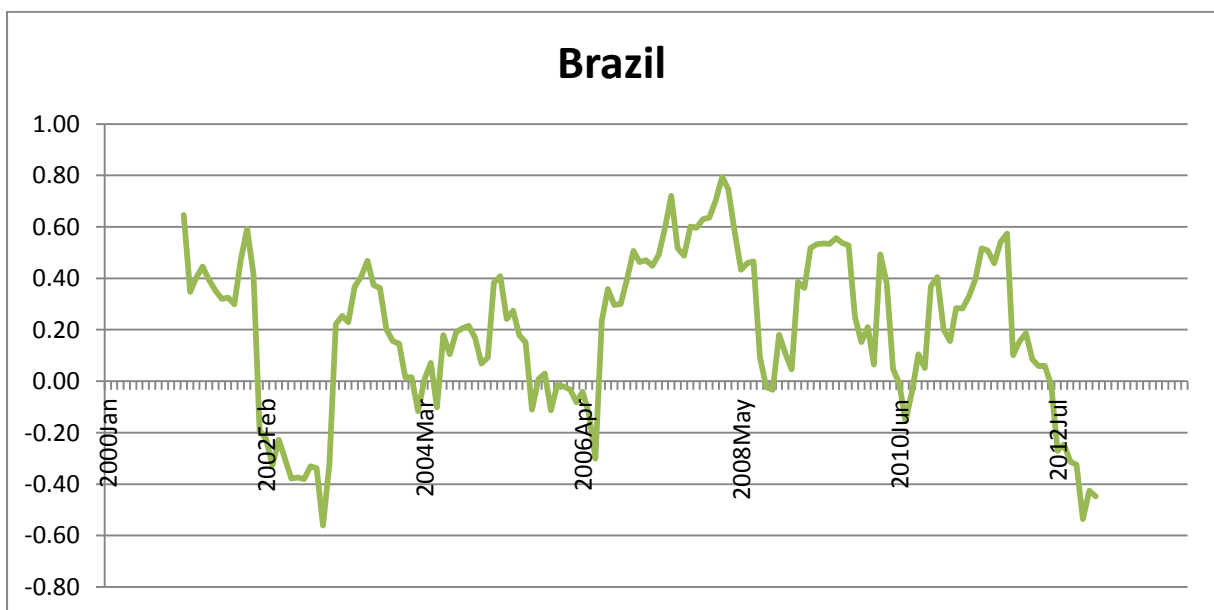


Figure 6E: Brazilian Equity/Currency Return Correlations from the Domestic Perspective

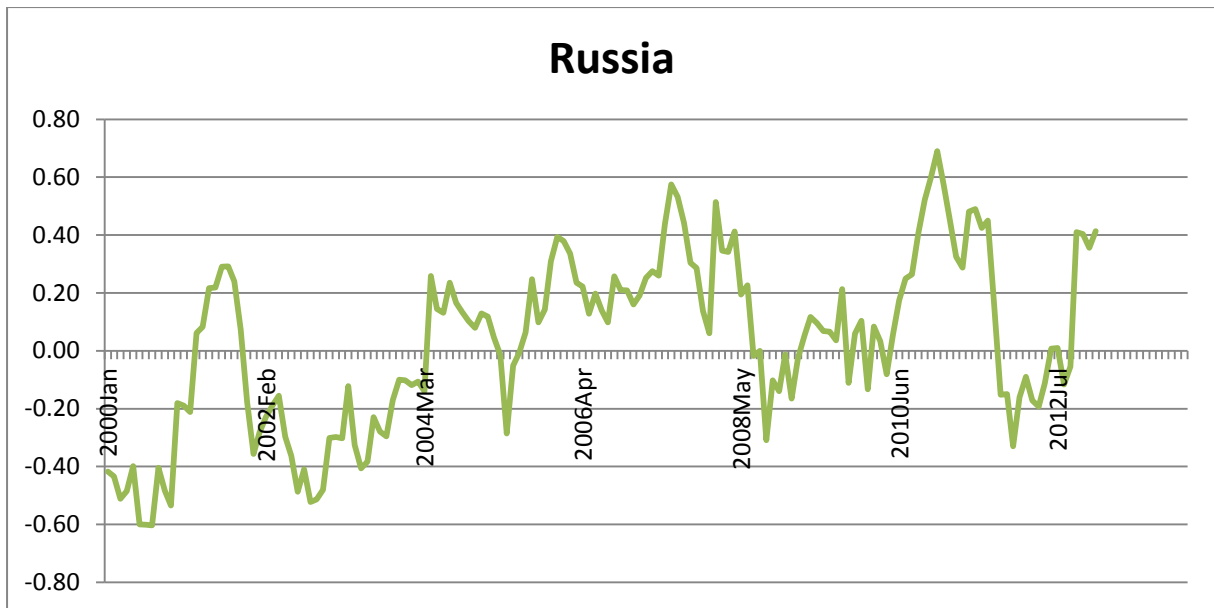


Figure 7E: Russian Equity/Currency Return Correlations from the Domestic Perspective

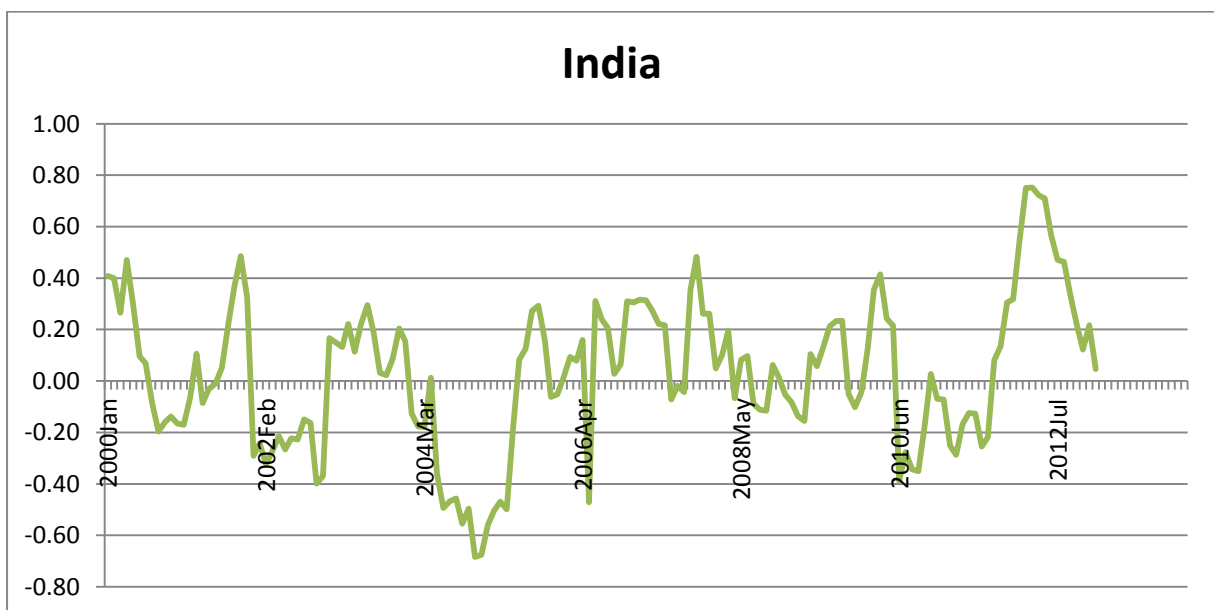


Figure 8E: Indian Equity/Currency Return Correlations from the Domestic Perspective

Rolling Correlations between Indices and Currencies from the International Perspective

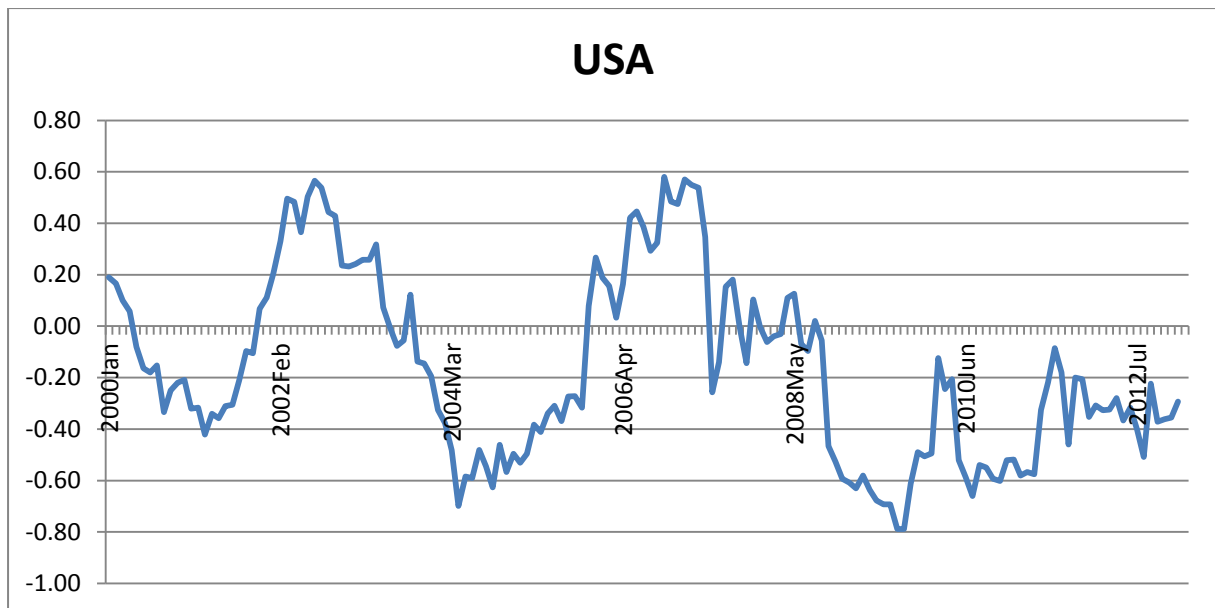


Figure 9E: U.S. Equity/Currency Return Correlations from the International Perspective

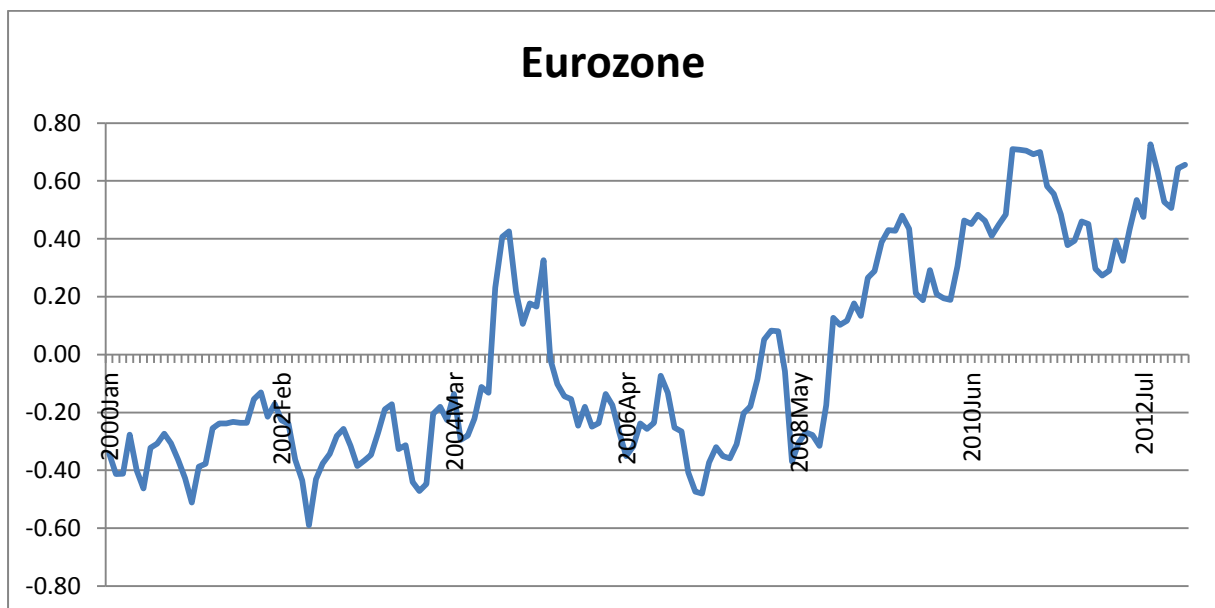


Figure 10E: Eurozone Equity/Currency Return Correlations from the International Perspective

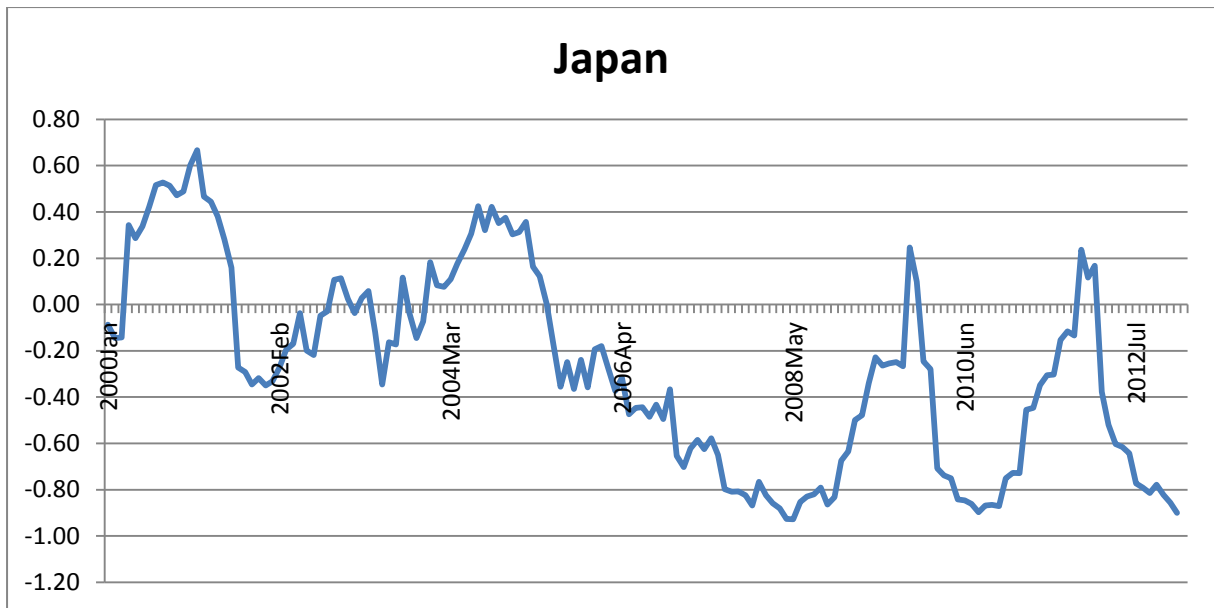


Figure 11E: Japanese Equity/Currency Return Correlations from the International Perspective

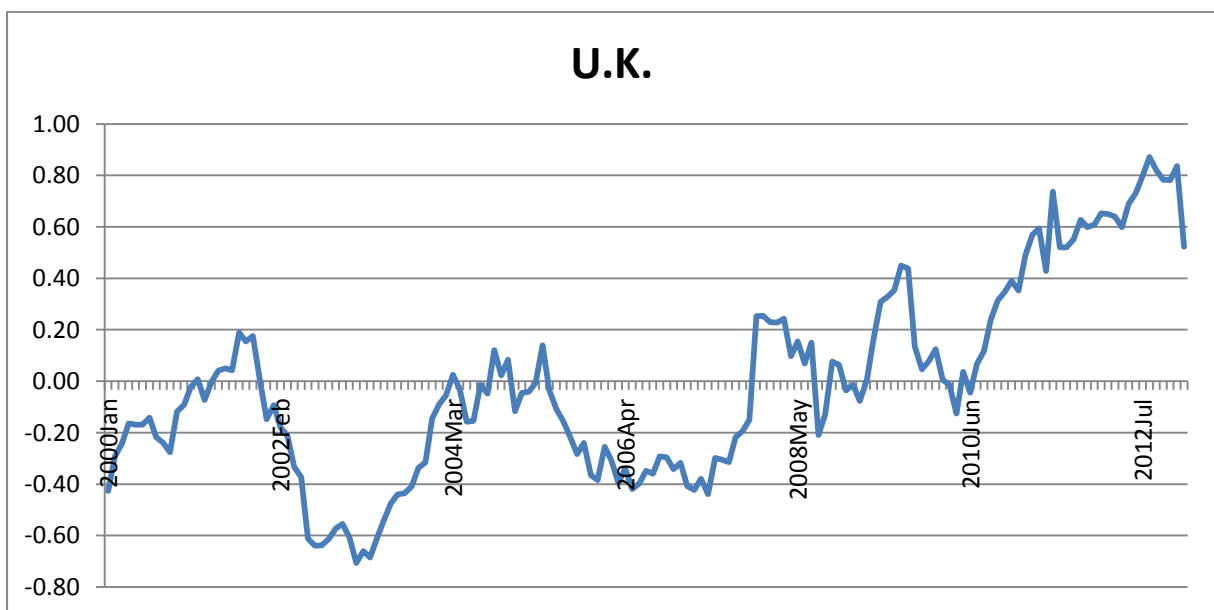


Figure 12E: U.K. Equity/Currency Return Correlations from the International Perspective

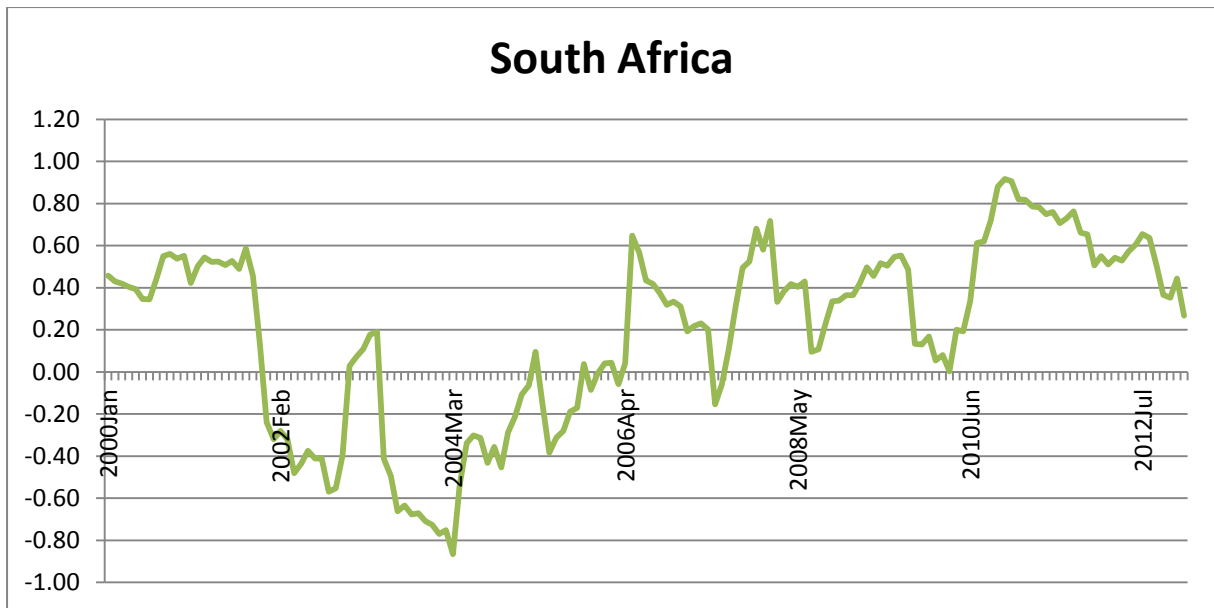


Figure 13E: South African Equity/Currency Return Correlations from the International Perspective

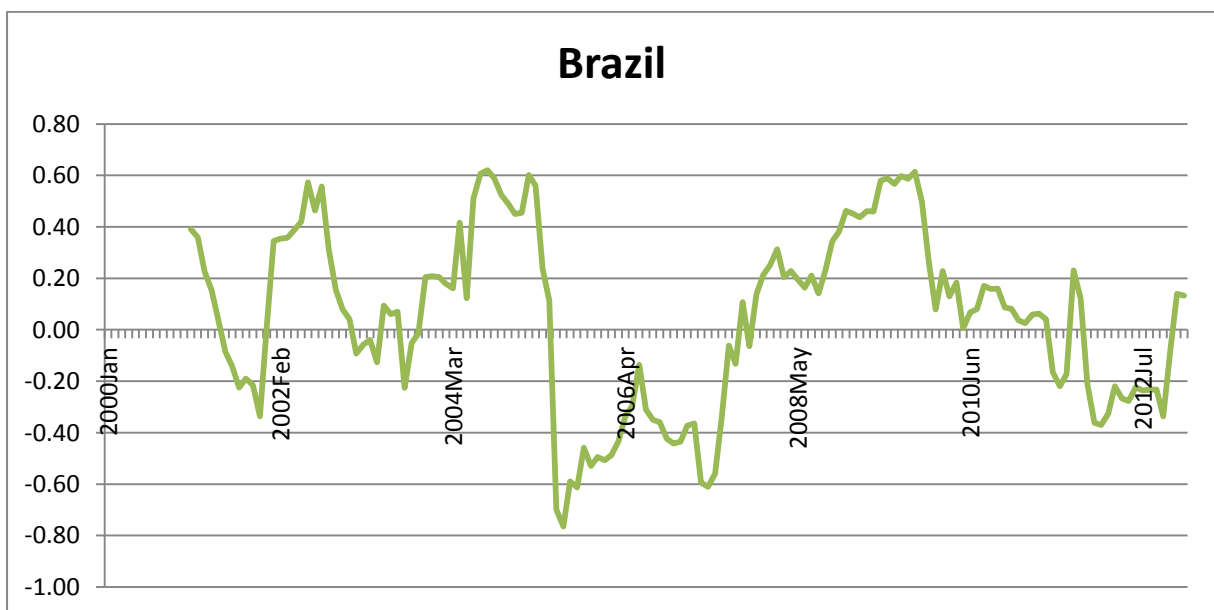


Figure 14E: Brazilian Equity/Currency Return Correlations from the International Perspective

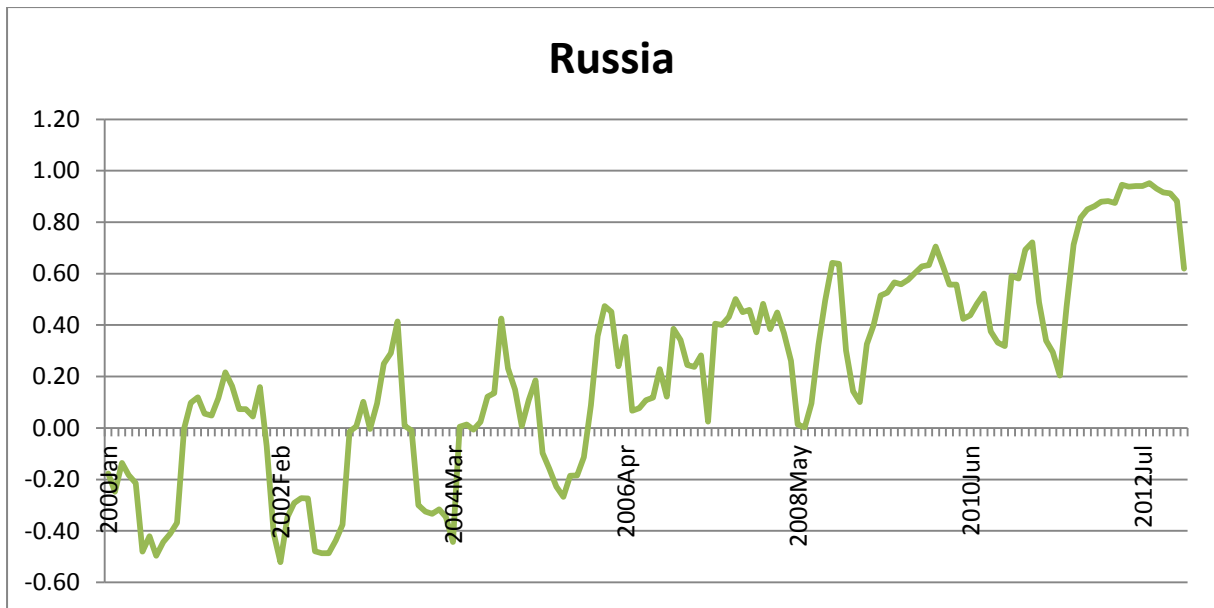


Figure 15E: Russian Equity/Currency Return Correlations from the International Perspective

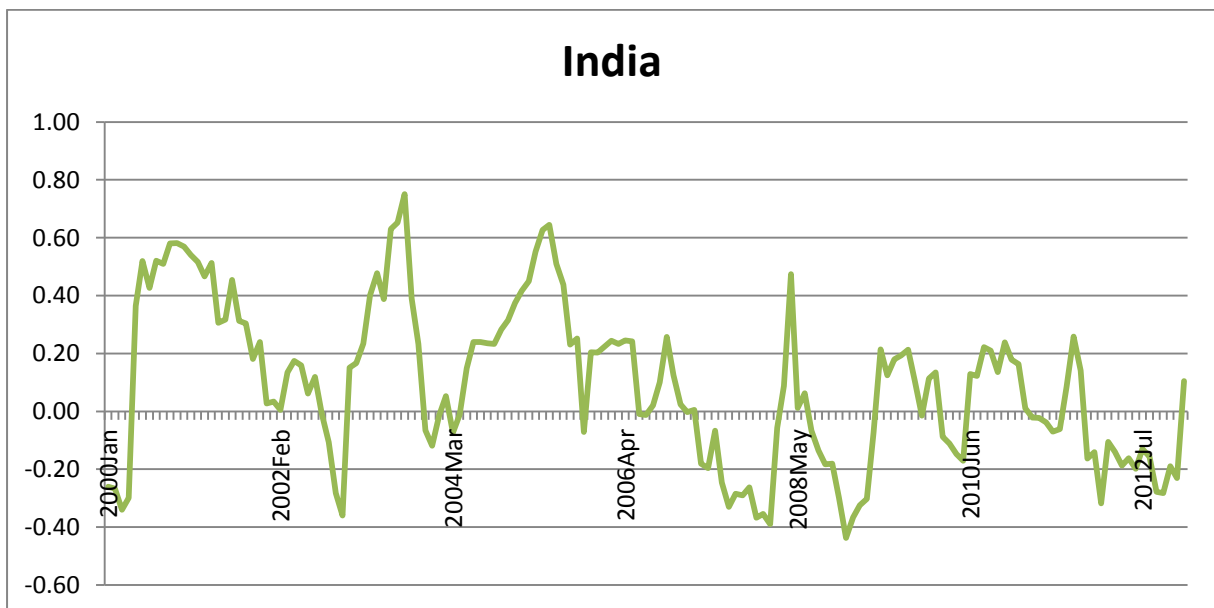


Figure 16E: Indian Equity/Currency Return Correlations from the International Perspective

F. Appendix F: Fisher Transformation Z-critical Values

Table 1F: Fisher Transformation Z-critical Values

Portfolio	Domestic Perspective			International Perspective		
	Real Returns	Index Returns	Currency Returns	Real Returns	Index Returns	Currency Returns
Global	-1.08	1.34	1.11	-2.35	-2.35	2.31
Developing	-1.53	-0.96	-0.77	-2.2	0.12	1.16
Developed	0.01	-1.00	0.14	-2.47	-1.79	3.16
Devi/Devd	-0.67	-1.44	-0.87	-3.05	-2.73	-2.62

Table 2F: Fisher Z Transformation Statistic for Index/Currency Return Correlations

Country	Domestic Perspective	International Perspective
USA	2.57	2.56
Eurozone	2.03	-3.94
Japan	5.61	5.06
U.K.	2.40	-3.46
RSA	-1.34	-3.87
Brazil	-0.96	-0.53
Russia	-1.61	-3.71
India	-0.83	1.43

G. Appendix G: Single Year Returns from January 1999- January 2013

Table 1G: Single Year Returns from the Domestic Perspective

	USA	Eurozone	Japan	U.K.	RSA	Brazil	Russia	India
1999	4.96%	11.66%	48.36%	4.79%	39.24%	40.85%	212.43%	95.54%
2000	19.11%	12.51%	-24.71%	4.83%	-3.01%	-20.62%	16.64%	-41.23%
2001	14.63%	0.83%	-12.26%	10.52%	6.07%	-21.50%	130.70%	-48.56%
2002	-49.19%	-47.29%	-36.84%	-45.65%	-29.26%	41.18%	-18.75%	26.60%
2003	3.62%	11.61%	13.95%	8.03%	16.63%	85.12%	40.50%	114.51%
2004	-12.14%	-9.44%	-10.15%	-5.10%	13.80%	27.96%	-13.69%	25.60%
2005	6.56%	11.27%	27.68%	10.28%	49.65%	3.84%	103.54%	29.85%
2006	27.43%	32.61%	14.95%	34.55%	22.07%	-3.47%	58.84%	14.66%
2007	-17.08%	-5.57%	-16.59%	-7.86%	1.41%	13.14%	-0.92%	29.16%
2008	-20.01%	-35.77%	-14.31%	-37.73%	-34.04%	-52.06%	-65.85%	-62.89%
2009	-10.76%	-5.37%	-9.40%	-3.87%	21.37%	99.73%	90.46%	107.55%
2010	6.27%	-4.12%	-0.93%	3.40%	12.58%	-8.32%	16.13%	17.60%
2011	14.32%	-10.10%	-4.26%	-1.74%	1.59%	-24.41%	-13.20%	-30.26%
2012	16.95%	22.48%	15.53%	20.12%	13.04%	-5.26%	11.29%	17.09%

Table 2G: Single Year Returns From the International Perspective

	USA	Eurozone	Japan	U.K.	RSA	Brazil	Russia	India
1999	6.62%	10.61%	43.23%	2.60%	36.32%	87.55%	205.90%	97.43%
2000	-5.29%	-7.33%	-36.94%	-12.41%	-19.03%	-16.30%	-2.63%	-33.83%
2001	-19.57%	-29.27%	-38.97%	-22.90%	-25.95%	-21.02%	61.07%	-29.13%
2002	-25.48%	-23.37%	-8.42%	-20.94%	2.99%	-46.18%	18.30%	6.27%
2003	29.22%	36.31%	43.22%	33.23%	43.50%	126.48%	72.87%	100.54%
2004	1.68%	6.82%	5.20%	11.48%	33.86%	33.76%	1.52%	13.26%
2005	4.76%	10.08%	24.91%	8.16%	46.78%	48.91%	99.64%	30.49%
2006	8.78%	13.07%	-2.17%	14.82%	4.20%	27.01%	35.59%	37.93%
2007	-6.84%	-4.58%	-13.54%	-6.42%	2.93%	79.09%	0.57%	75.02%
2008	-42.35%	-49.02%	-32.99%	-50.75%	-47.85%	-59.54%	-73.00%	-64.75%
2009	30.47%	35.99%	26.81%	39.42%	76.13%	144.20%	176.39%	90.20%
2010	17.81%	3.92%	9.27%	11.13%	21.02%	11.48%	24.83%	14.85%
2011	-1.12%	-15.57%	-10.48%	-7.48%	-4.36%	-22.88%	-18.28%	-33.31%
2012	11.81%	10.75%	3.56%	8.73%	2.31%	-13.34%	0.73%	20.03%

H. Appendix H: Regression Coefficients

Table 1H: Real Return Correlation Regression Coefficients from the Domestic perspective

		Linear Regression		Prais-Winsten Regression	
		Intercept	Time Coefficient	Intercept	Time Coefficient
Final Returns	RSA/Developed	0.59015	-0.00030	-0.00120	0.64015
	RSA/Developing	0.00232	0.00763	0.08975	0.00143
	RSA/Globe	0.53398	0.00016	0.58396	-0.00054
	Devi/Devd	-0.01616	0.00010	0.06895	0.00041
Equity Returns	JSE/Developed	0.00130	0.00000	0.00170	-0.00003
	JSE/Developing	-0.00002	0.00111	0.00137	-0.00050
	JSE/Globe	0.00131	-0.00001	0.00160	-0.00005
	Devi/Devd	0.00082	0.00000	0.00118	-0.00002
Currency Returns	ZAR/Developed	-0.00010	0.00000	-0.00085	0.00004
	ZAR/Developing	0.00108	-0.00003	0.00091	-0.00003
	ZAR/Globe	-0.00001	-0.00011	-0.00001	-0.00011
	Devi/Devd	-0.00133	0.00000	0.00002	-0.00106

Table 2H: Real Return Correlation Regression Coefficients from the International perspective

		Linear Regression		Prais-Winsten Regression	
		Intercept	Time	Intercept	Time
Final Returns	USA/Developed	0.77000	0.00060	0.77391	0.00058
	USA/Developing	0.46271	0.00212	0.50940	0.00171
	USA/Globe	0.56810	0.00149	0.60423	0.00119
	Devi/Devd	0.38211	0.00030	0.08310	0.00304
Equity Returns	SPX/Developed	0.78443	0.00032	0.79826	0.00189
	SPX/Developing	0.21588	0.00248	0.33119	0.00131
	SPX/Globe	0.52670	0.00159	0.57660	0.00104
	Devi/Devd	0.26779	0.00236	0.31543	0.00192
Currency Returns	USD/Developed	-0.57239	-0.00077	-0.56107	-0.00071
	USD/Developing	0.18542	0.00064	0.26485	-0.00589
	USD/Globe	0.04555	-0.00309	-0.13656	-0.00362
	Devi/Devd	0.06483	0.00418	0.06998	0.00419

Table 3H: Regression Coefficients for Currency/Equity Return Correlations from the Domestic Perspective

Regression Results	Linear Regression		Prais-Winsten Regression	
	Intercept	Time Coefficient	Intercept	Time Coefficient
USA	0.04767	-0.00262	0.22851	-0.00242
Eurozone	-0.14201	-0.00195	-0.21121	-0.00134
Japan	0.03156	-0.00557	-0.07306	-0.00461
U.K.	-0.07216	-0.00399	-0.16296	-0.00302
RSA	0.01785	-0.00015	0.12818	-0.00126
Brazil	0.16820	0.00040	0.31310	-0.00168
Russia	-0.24363	0.00345	-0.27121	0.00375
India	-0.01842	0.00146	-0.38872	0.00106

Table 4H: Regression Coefficients for Currency/Equity Return Correlations from the International Perspective

Regression Results	Linear Regression		Prais-Winsten Regression	
	Intercept	Time Coefficient	Intercept	Time Coefficient
USA	0.07626	-0.00304	0.98888	-0.00320
Eurozone	-0.50629	0.00619	-0.49351	0.00624
Japan	0.22304	-0.00621	0.16451	-0.00581
U.K.	-0.47163	0.00584	-0.51034	0.00678
RSA	-0.15188	0.00442	0.02854	0.00263
Brazil	0.11352	-0.00087	0.16027	-0.00117
Russia	-0.34609	0.07153	-0.33634	0.00711
India	0.31440	-0.00282	-0.00237	0.26090

I. Appendix I: Graphs Representing Cash Deposit Rates Less Inflation Rates Over Time

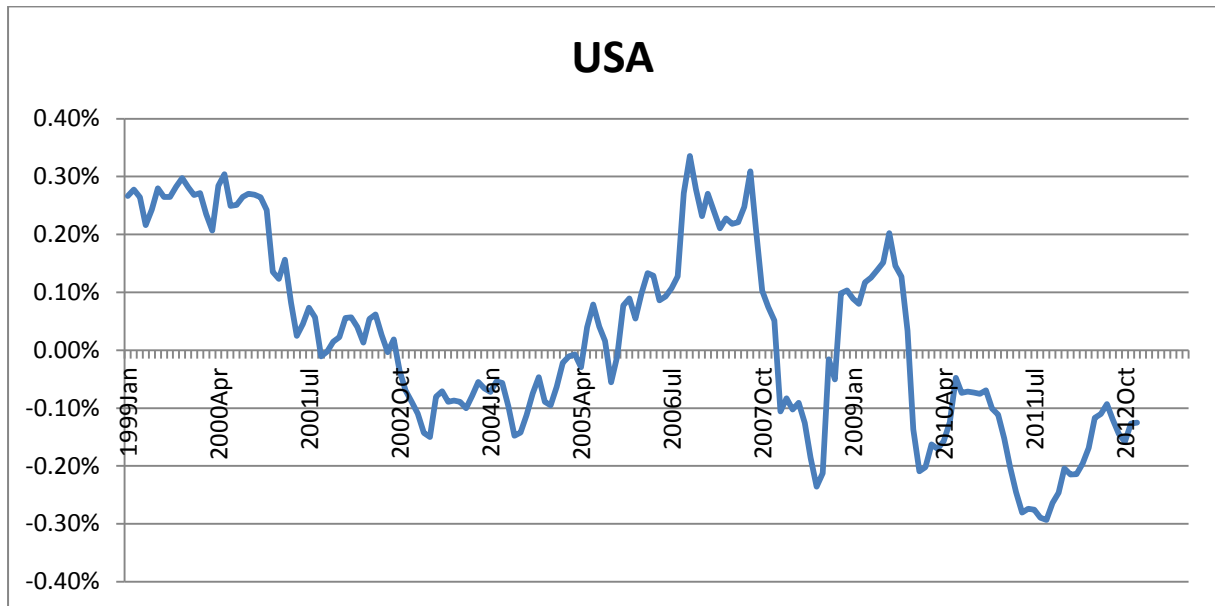


Figure 1I: Cash Deposit Rates less Inflation in the U.S.

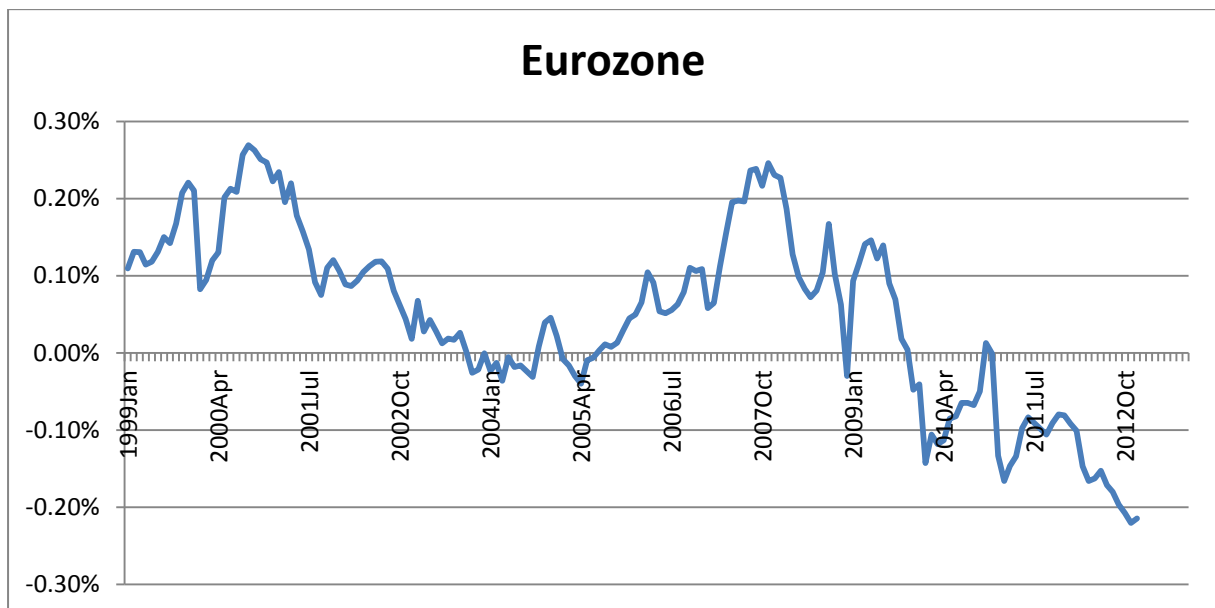


Figure 2I: Cash Deposit Rates less Inflation in the Eurozone

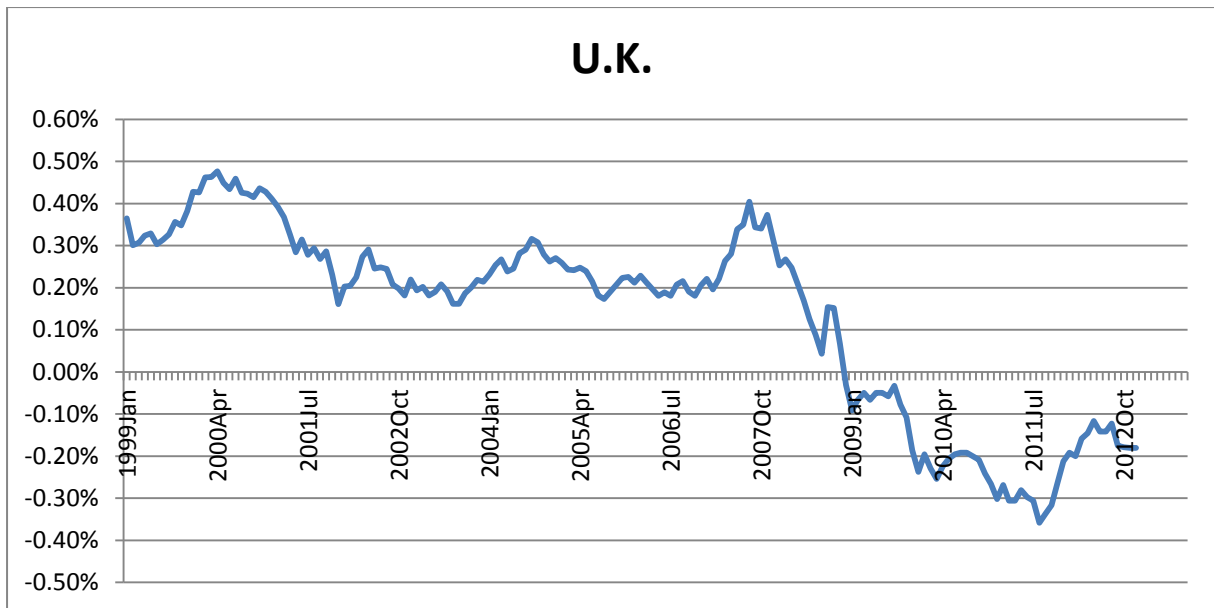


Figure 3I: Inflation less Cash Deposit Rates in the U.K.

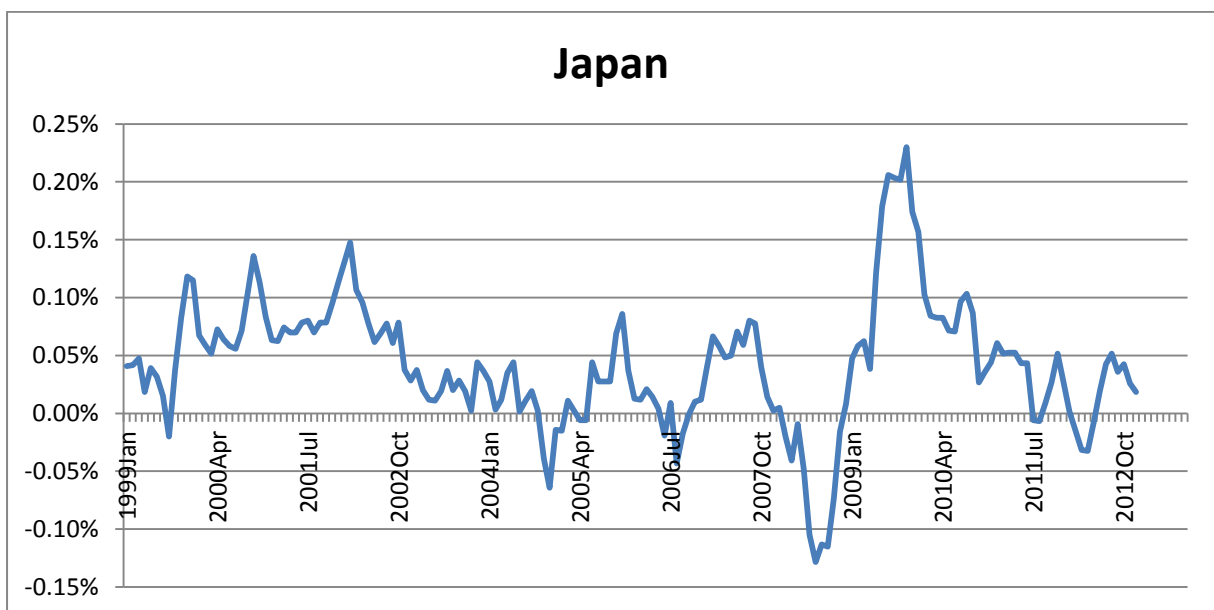


Figure 4I: Cash Deposit Rates less Inflation in Japan

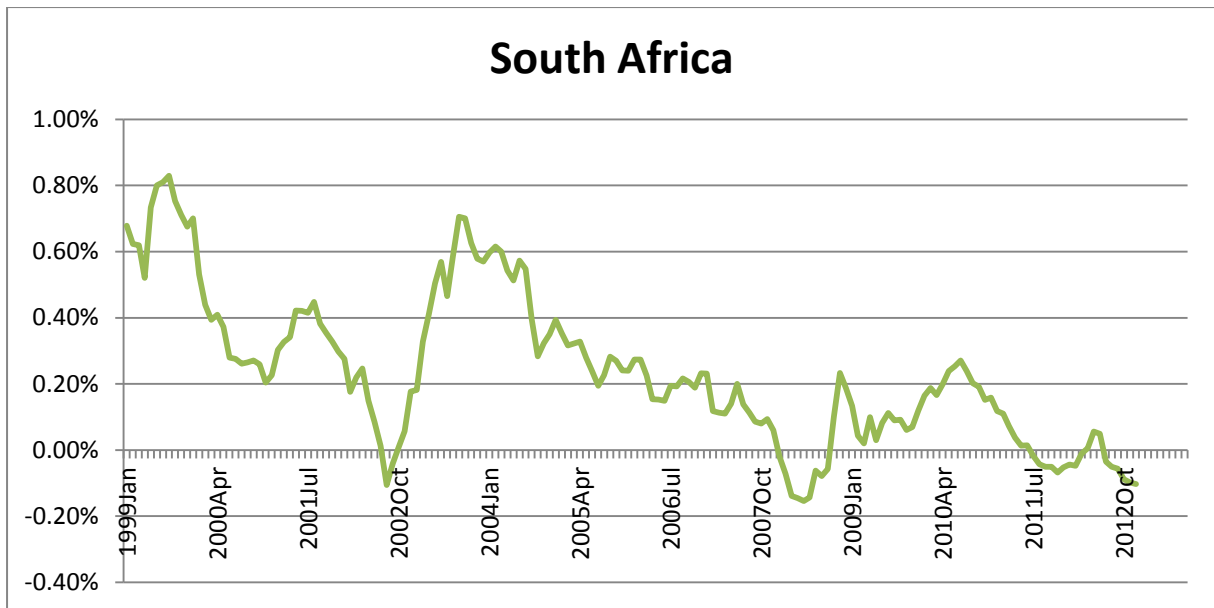


Figure 5I: Cash Deposit Rates less Inflation in South Africa

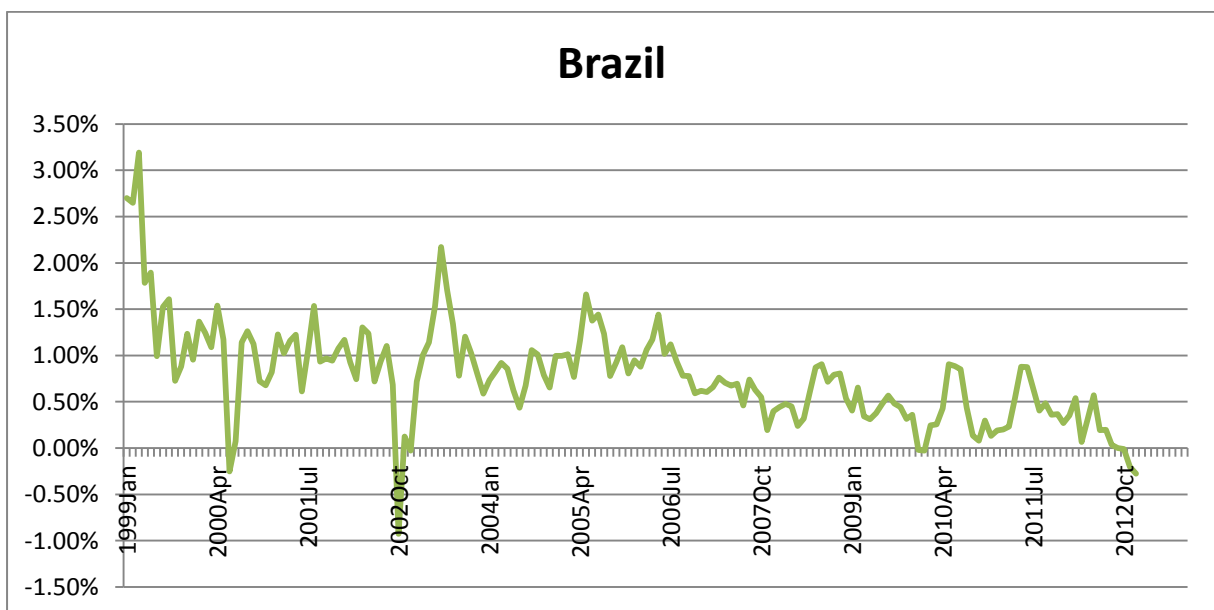


Figure 6I: Cash Deposit Rates less Inflation in Brazil

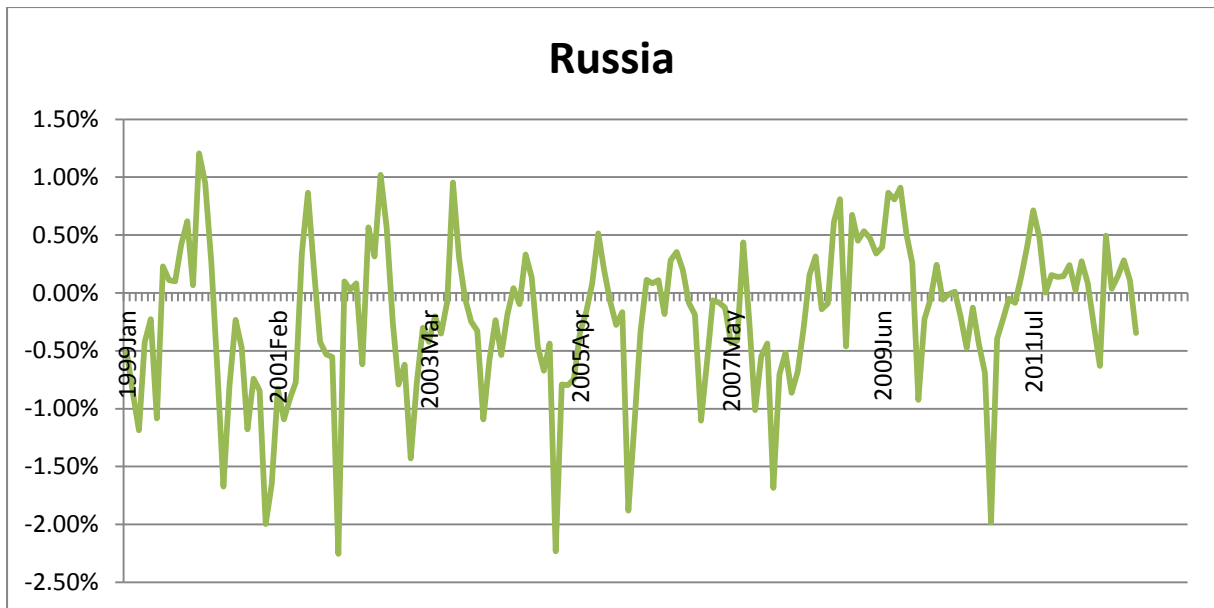


Figure 7I: Cash Deposit Rates less Inflation in Russia

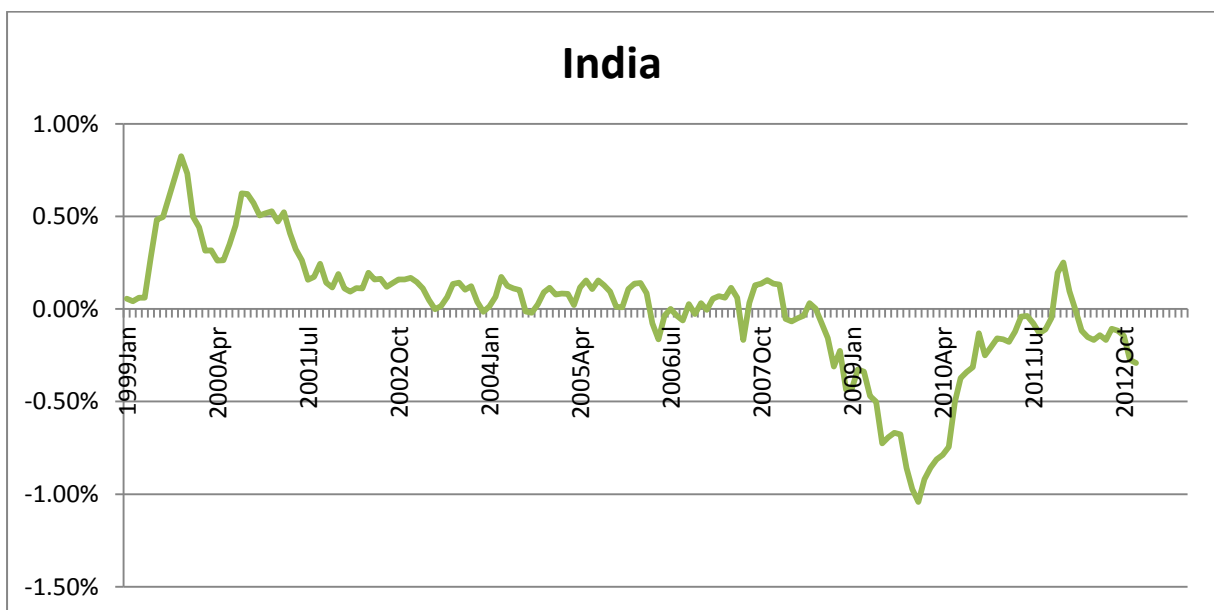


Figure 8I: Cash Deposit Rates less Inflation in India