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CAN A PROXY FOR INTERNATIONAL INVESTOR SENTIMENT TOWARDS EMERGING MARKETS BE IDENTIFIED?

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This Dissertation has been prepared in fulfilment of the requirements for the degree of Masters in Business Science Degree at the University of Cape Town.

DECLARATION

This work has not been previously submitted in whole, or in part, for the award of any degree. It is my own work. Each significant contribution to, and quotation in, this dissertation from this work, or works, of other people has been attributed and has been cited and referenced.

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ABSTRACT

International portfolio diversification is an area of popular academic interest. Most of the research is based on linkages between developed markets or between developed markets and emerging markets. Emerging markets have only been a feature of research for periods of crisis and contagion such as the emerging market crisis of 1997 and 1998.

The common argument used to explain the cause of the stock market linkages is based on economic slowdowns (or deep-recession), large balance of payment problems or other macro-economic problems in the emerging markets. Contagion or herding behaviour is an alternative explanation to the cause of the co-movement of emerging markets.

Contagion or Herding behaviour is based on the assumption that it is too costly to acquire information. Investors thus remain uninformed in the countries in which they invest. Investors try to infer future movements in one market based on how the rest of the market is reacting. The uniformed investors follow the supposedly informed investor. These information frictions can make investors follow the market, rather than take the time and expense to make their own assessments about the market fundamentals.

This research aims to identify countries that are regarded as similar by international investors. Countries that are regarded as similar can be grouped together to form separate clusters. This research attempts to ascertain as whether there has been any change of perceptions since the emerging market crisis of 1997 and 1998, hence any change in the composition of above-mentioned clusters.

The sovereign bond spreads or sovereign bond indices can be interpreted as an indicator of international investors' sentiment towards the various emerging markets. As sovereign risk of a country decreases (increases) the sovereign bond return index increases (decreases) and investment in that country's equity would increase (decrease) thus giving us a positive relationship between the sovereign index and equity index.

Sovereign risk is an important determinant of stock market movements during the crisis period and exerts a greater influence on stock markets than it did prior to the crisis. Equity returns are more sensitive to sovereign risk after the crisis than before. The geographical location of a country plays an important role in the composition of the clusters of emerging markets.

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The events that had the greatest impact on the integrity of the equity index clusters (during the crisis period) were related to concerns over a country's currency and the greatest impact on sovereign bond clusters (during the crisis period) were largely related to macro-economic problems or downgrading of sovereign bonds. It is thus apparent that sovereign risk is not a complete and therefore an inadequate measure of international investor sentiment towards emerging market equity. There has been a shift in the way investors view equity risk relative to sovereign risk.

Currency risk is less of an explanatory variable than sovereign risk is, for equity market returns. However, currency movements provide a better indication of how international investors view emerging markets. The day-to day currency movements that take place are largely due to capital inflows and outflows. This research identifies groupings of emerging markets based on large capital inflows and outflows by performing cluster analysis on equity returns less currency returns (as well as currency moving volatilities). This identifies linkages that are partly caused by international investor sentiment. The problem with using currency movements is the potential interference of Reserve Banks as well as the fact that countries that have pegged currencies cannot be included in any form of testing. No measure that solely and accurately captures international investor sentiment for all the emerging markets could be found.

The impact of local investor sentiment on equity markets can be assessed by examining the relationship between equity and bonds. There are indications that the local investors of SA behave similarly to the local investors in the emerging markets of Europe.

The area of linkages amongst emerging markets continues to be an area that requires further research. In the context of international portfolio diversification, it is not advisable to invest in countries that are in close geographical proximity to each other.

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INTRODUCTION

International portfolio diversification is an area of popular academic interest. Much of the research in this field has been prompted by the search for an adequately well-diversified international portfolio. A low correlation (or insignificant results from co-integration tests) between stock markets has often been presented as evidence supporting potential gains from international diversification. For example, Barr & Sharp (1997) use correlation based tests while Arshanapalli & Doukas (1993) co-integration tests.

Most of the research is based on linkages between developed markets or between developed markets and emerging markets. Emerging markets have only been a feature of research for periods of crisis and contagion[1] such as the emerging market crisis of 1997 and 1998 and the Mexican crisis of 1994/5.

Linkages between developed markets have often been justified by rational reasons such as:

1. There is generally a significant amount of trade between developed markets that has a significant impact on a country economy and thus stock market.
2. There are few capital controls that excessively restrict cross-border investments.
3. There may be a large number of multi-listed firms across various developed markets, thus directly and indirectly causing the markets to follow each other more closely.

Arshanapalli & Doukas (1993) and Schollhammer & Sand (1985) provide the reasons for linkages amongst developed markets in greater detail. The above, however, cannot justify linkages between emerging markets. There generally is minimal trade between any two randomly chosen emerging markets. Emerging markets are usually subjected to capital controls that would disallow the outflow of capital and there are not a significant number of multi-listed companies between emerging markets. The traditional forms of testing for market linkages are thus not applicable to emerging markets, as there are different reasons as to why emerging markets would be linked.

[1] Contagion has taken on various meanings in research but is generally referred to the increase in cross-country correlations during crisis periods.

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Correlation tests can also be an indicator of linkages between emerging markets, however Cheung & Ho (1991) and Longin & Solnik (1995) could not conclude with certainty that their correlation matrices was stable over time[2]. Furthermore, the dynamic nature of emerging markets and the globalisation that has been taking place, limits the period of data available to perform such tests. Interestingly, Calvo & Mendoza (2000) identify globalisation as a possible cause for contagion.

The events of 1997 and 1998 indicate a strong amount of linkage between emerging markets, as there was a significant amount of co-movement in emerging market indices. There have been two approaches at answering why emerging markets were linked, particularly during that time period.

According to Schmukler & Laminsky (1999), the first, more commonly used argument, the 'fundamental' approach, argues that the crisis occurred because of economic slowdown (or deep-recession), large balance of payment problems or other macro-economic problems.

The second, less commonly, explanation offered to explain emerging market linkages is contagion and/ or herding behaviour. Herding behaviour, as defined by the literature in the field[3], starts with the assumption that it is too costly to acquire information. Investors thus remain uninformed in the countries in which they invest. Therefore, investors try to infer future movements in one market based on how the rest of the market is reacting[4]. The uniformed investors follow the supposedly informed investor. These information frictions can make investors follow the market, rather than take the time and expense to make their own assessments about the market fundamentals.

Calvo & Mendoza (2000) argue that if a portfolio manager faces a scenario where the gain from gathering information does not exceed the costs, there exists a range of multiple equilibria inside of which investors rationally choose to mimic market portfolios. When a rumour favours another portfolio in that range, all the investors "follow the herd." Globalisation exacerbates contagion because the indeterminacy range widens as the market of invest able securities grows.

In Kodres & Pritsker (1998), the informed investors will sell their assets in one country (as a result of some shock) and buy assets in another country. The new position can be hedged by selling assets in a third country.

[2] Appendix A gives the correlation table for several emerging markets. No significant relationships can be identified over the different time periods.
[3] Schmukler & Laminsky (1999) quote Banerjee (1992).
[4] Calvo and Mendoza (2000) define Contagion in a similar manner

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Uninformed investors will follow informed investors on the notion that the informed investors are trading on inside information as opposed to attempting to hedge out macro-economic factors. The linkage between the three countries thus becomes self-fulfilling.

Herding behaviour theories also make several suggestions about the incentives to gather information; Investors have less of an incentive to gather good news in a bull market, and the incentives increase in a bear market. However when costly information is expected to produce good news, and short-selling constraints limit the gains from learning bad news, incentives for buying news are weak (Calvo & Mendoza, 2000).

In terms of the definitions of herding behaviour above, investors also infer future price movements in one stock market based on movements in other stock markets (a non-expensive source of valuable information). Thus, an important and underplayed factor that links emerging markets would be international investors' perception. This research attempts to identify countries that are regarded as similar by international investors (and, thus, by the argument above, closely linked) and attempts to ascertain whether there has been any change of perceptions since the emerging market crises of 1997 and 1998. To establish this it first becomes necessary to identify a proxy for international investor perceptions/ sentiment.

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CHAPTER 2: DATA AND METHODOLOGY

All the data from the sample was collected from Bloombergs and all tests were either done on Microsoft Excel or the 'Statistica' (statistics package). This research will focus on those countries that have sovereign bonds and easily accessible local bond indices in issue.

Given that the fear of default was a prominent feature of many emerging markets during the crisis of 1997 and 1998, some measure of sovereign risk is the obvious choice to use as a proxy for international investor perception. Indices that reflect the price of all the sovereign bonds in issue are used in this research.

This research is based on the following countries[5]: Argentina, Brazil, Czechoslovakia, China, Ecuador, Mexico, Panama, Peru, Philippines, Poland, Russia, South Africa, South Korea, Thailand and Venezuela. Various tests either include or exclude certain countries based on data availability or for the sake of comparability.

Two indices were used for China, namely Shanghai A and Shanghai B. Shanghai A (hereafter called China A) is based on equity listed on the Shanghai stock exchange that only local investors are allowed to invest in while Shanghai B (hereafter called China B) is based on equity that foreigners can invest in.

A possible limitation of this research is the quality of data used. Effort was made to ensure that the equity indices used were liquid and representative of the equity[6] in the specific country. The indices produced by the Industrial Finance Corporation (IFC) would be better in this respect; however, this data was not available to the researcher.

The time period the data is based on ranges from the beginning of 1995 to the end of October 2001. Weekly data was preferred over daily data given the problems that may arise by the fact that these sample members are in various time zones. Thus, there were a total of 356 data points per time series.

All regression tests were done using returns as opposed to actual data. Indices are generally non-stationary in nature and thus do not comply with the fundamental assumptions of regression. For cluster analysis the

[5] See Appendix B for further details on the indices used.

[6] See Appendix B for further details on the indices used.

researcher preferred to utilise actual indices wherever possible as cluster analysis is a distance analysis technique. This would thus reduce the possibility of incorrect conclusions based on spurious relationships. Cluster analysis that included currency data, however, was based on returns as emerging market currencies continuously establish new market equilibriums after minor currency crisis. 'If the correction is seen as triggering a very distortionary policy response that will cripple the economy, the market collapse can become part of a self-fulfilling crisis. Another reason would be the performance-based incentives. The sharp fall of the Peso on 11 November 1995 is evidence of this. The fall was triggered by unfounded rumours and only recovered marginally after the rumours were discredited' (Calvo & Mendoza, 2000).

CHAPTER OVERVIEW

Chapter 3 provides a 'Brief Overview of the Emerging Market Crisis' to put the research into context. It is assumed that the reader is aware of the details of the crisis. This chapter is thus kept short. Chapter 4, The Role of Sovereign Risk explains the importance of sovereign risk for the purposes of this research. Chapter 4 also details the adjusted methodology that used to compensate for the lack of availability of crucial data.

In the chapter on the Significance of Sovereign Risk (Chapter 5), the returns on sovereign bond indices were regressed onto the returns on equity indices to establish the significance of sovereign risk in explaining equity returns. The results and summary statistics are tabulated thereafter. For comparative purposes all tests were done on both equity returns in the local currency as well as local index converted into US Dollars.

In the following chapter on Cluster Analysis (Chapter 6), all the data was re-indexed so that they have the same starting point. The K-means cluster analysis used in this research relies on the Euclidean distances between sample members, which can be misstated if the indices are not re-indexed. All the results from the cluster tests are reported in the same manner. The distances of the cluster members from the cluster centre are in the line below the list of members for the respective cluster. The inter-cluster distances are also reported in this format.

In the latter part of Chapter 6, certain dates were isolated on the basis of the integrity of the cluster groups (on those dates). Press reports and analyses performed by reputable market commentators were reviewed to identify potential causes for the loss of integrity of the clusters. These comments are

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included in Appendix F. This was done to give us insight into the potential differences between sovereign risk clusters and the index clusters.

The currency risk analysis in Chapter 7, The Role of Currency Risk, is done in a similar manner as the sovereign risk analysis. Thereafter in Chapter 8, Volatility of Exchange Rates, the researcher focuses on the relationship between currency movements (both returns as well as volatility), bond returns and equity movements.

Chapter 9 focuses on Equity risk for all the emerging markets in the sample. The chapter also reviews the relationship between sovereign risk and equity risk.

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CHAPTER 3: A BRIEF OVERVIEW OF THE EMERGING MARKET CRISIS

The equity indices and exchange rate data used in this research covers an unstable period of the global economy. The emerging stock market crises of 1997 and 1998 saw almost all the emerging markets suffer large declines in their asset prices, collapses in their corporate environment and extreme financial fragility, as well as drastic economic slowdowns. In over a year some markets saw their market capitalisation decrease by 80% in US Dollar terms. Currencies had depreciated by more than is needed to maintain competitiveness[7]. Governments countered the weakness in their currency by raising interest rates and selling foreign currencies, which in turn, slowed economic growth.

In May, the Russian financial system had come under severe pressure as the bond and equity markets slumped, forcing the central bank to triple interest rates to 150%[8]. In August 1998 Russia defaulted after failing to pay its debt on their treasury bills. This had a severe impact on the Latin American stock and bond markets. At this point, yields on US Treasury bills reached record lows as investors bought into, what is regarded as the safest investment, given the surrounding turmoil.

The cause of the crises has broadly been attributed to two major factors, namely fragile economies based on inappropriate macro-economic policies (this more appropriately attributed to the Asian emerging markets which occurred in the latter part of 1997 through to mid 1998) and fear of default on government debt, more appropriately attributed to Russia, and (to a lesser extent) Brazil and other Latin American markets, which occurred in early 1998 and climaxing in August 1998). This fear of default had even affected countries (i.e. the contagion had spread) that had been following sound macro-economic policies and had the ability to pay their debts.

For the purposes of this research the two crises are treated as one. The starting date of the crisis period is widely accepted as 2 July 1997 (Kaminsky & Schmukler, 1999) with the devaluation of the Thai Bhat. A lenient date is chosen for the end of the crisis, namely, 27 January 1999 after the Brazilian government allows the Real to float freely[9], which led to an increase in investment in Latin American equity.

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[7] Source: http: newriskifer.ch 145900.htm The causes of the Asian Financial and Economic Crisis, accessed 02 11 2000.

[8] Source: http:www.pbs.org wgbh pages frontline shows crash etc cron html. Frontline: the crash.timeline of the crash, accessed 06 12 2000.

[9] Source: http:www.pbs.org wgbh pages frontline shows crash etc cron html. Frontline: the crash timeline of the crash, accessed 06 12 2000

Below is a graph of the average developed market index vs. the average emerging market index. [10]The wide gap that develops between the developed markets and emerging markets during the emerging market crisis indicates the minimal effect, relatively speaking, that the emerging market crisis has had on the developed markets. Even though there is a significant amount of co-movement, the developed markets recovered at a rapid pace from the 'Russian' default crisis when compared to the emerging markets. Despite the attention the crisis received in the US[11], it does not seem that the developed markets were drastically affected by the start of the 'Asian' crisis.

Graph 1: Average Stock Index (US $)
Emerging Markets vs Developed Markets

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[10] The developed market index was constructed on the basis of equally weighting the indices of the G7 countries (and Australia) and re-indexing to 100 for 6 Jan 1995. The emerging market index was constructed in a similar manner on the basis of the 17 emerging markets as defined by the Economist. The components of the two samples are included in Appendix B. Each index has 331 data points.

[11] Note the CRS report for the US Congress in February 1998 (Source: http:www.fas.org/man/crs/crs-asia2.htm, Accessed 02/11/2000)

The above graph indicates that developed markets behave differently to emerging markets and the traditional arguments, as mentioned in the introduction, that are used to justify linkages between developed markets (or linkages between emerging markets and developed markets) cannot fully justify linkages within emerging markets.

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CHAPTER 4: THE ROLE OF SOVEREIGN RISK

Sovereign risk is the risk associated with investing in that country. There exist several methods of accounting for sovereign risk in the investment decision but the most easily observable measure is the sovereign credit spread[12].

The sovereign credit spread is calculated by subtracting the yield on US Dollar bond (See Appendix C for example) from the yield on the sovereign US Dollar bonds (the bonds in question need to be of a similar term and nature for the analysis to be meaningful). It is widely assumed that the US Dollar bonds are absolutely free of risk. The US Eurodollar bond market is the largest however; sovereign bonds in other currencies such as the Yen, British Pounds as well as Euros do exist.

The resultant figure from the calculation above at any point in time is interpreted as the incremental rate of return required by investors to compensate them for taking on the additional risk of default of investing in a lower than absolutely risk free sovereign bond.

Investors' assessment of a country's sovereign risk (which is what drives the sovereign credit spread) will depend on the investors view on the country's ability to repay its debt and hence their assessment of the state of the country's economic health and governments control over it.

THE ADJUSTED METHODOLOGY

Unfortunately the yields on Eurodollar bonds needed to calculate the sovereign credit spread (for many emerging markets included in this research) were not readily available. In the event that they were available, they often reflected a lack of liquidity during critical times such as the 1997/8 crisis (This is because of the fact that there were not sufficient buyers for these bonds). In some cases the bonds were not in issue for an adequate length of period to perform meaningful analysis.

The adjusted methodology employed in this research uses Eurodollar bond indices. These indices (calculated by JP Morgan) track the cumulative returns on all the Eurodollar bonds issued by a country (commonly a

[12] The usage of this methodology is only possible for countries that have issued debt in currencies other than their own. It is mainly emerging countries that raise debt in foreign currencies.

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developing country). It is a total return index that reflects the price gains and interest income from a 'passively' portfolio of traded sovereign bonds. There is no need to take into consideration any measure of risk free 'price/ index' as we will be subtracting the same time series from all the sovereign bond indices. It must be remembered, however, that when a country is viewed as more risky than before, the sovereign credit spread would increase, whereas the returns (or cumulative returns) will decrease.

Comparing and contrasting the movement of these indicators with the stock market indices will provide us with insight as to whether there has been any change in market dynamics amongst emerging markets after the events of 1997/8.

Graph 2: Total Cumulative Returns on Sovereign Bonds

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The four continents have distinct progressions in their cumulative returns on sovereign bonds. The two major crises that occurred in the 1997/8 period are visible in the above graph of sovereign bond total returns. There are two 'dips' in the cumulative total returns for all four continents reflecting the periods when there was the greatest doubt on emerging countries to pay their debts. The European sovereign bonds suffered the most during the latter parts of 1998 largely because of Russia's default on its debt.

Another independent variable to consider is the sovereign credit ratings. It will allow for a greater coverage of countries. The sovereign credit ratings have the most impact on emerging stock markets. New information does not alter much the perception of investment conditions in industrialised (developed) or least developed countries (Calvo & Mendoza, 2000).

On the surface, it would seem that sovereign credit ratings and sovereign bond premiums are related and contain similar information. However this is not the case. Block & Vaaler (2001) regard the two separately and as being influenced by two separate 'investment groups'. In the researchers defence Reinhart (Sovereign credit ratings before and after financial crisis) finds evidence of two-way causality between sovereign credit ratings and sovereign bond spreads. They also cite Larrain, Reisen and Von Maltzan (1997) as providing strong evidence that credit ratings have a significant impact on sovereign bond yield spreads.

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CHAPTER 5: THE SIGNIFICANCE OF SOVEREIGN RISK

The Eurobond indices can be interpreted as an indicator of international investors' sentiment towards the various emerging markets[13]. By regressing the returns on the sovereign bond market onto the returns on the equity market we will be able to establish the significance of sovereign risk (or the importance international investors play in driving movements) in the emerging stock markets. **A critical assumption in this chapter and the next is that the Eurobond indices are adequate proxies for international investor sentiment.**

Weekly returns of the sovereign bonds were regressed onto index returns for the three different time periods, namely, pre-crisis, during crisis and post crisis. The sample sizes were 131, 81 and 144 (per time series) respectively. The regressions were performed on the basis of the model noted below, on both the indices in local currency and on the indices converted into US $ with sovereign returns as the independent variable and the index returns as the dependent variable. The regression also allows the co-efficient to be non-zero. The results are tabulated on page 16.

$$Y = a + bX + \xi$$

Y = the dependent variable, index returns, is assumed to have a linear relationship with the X variable

a = the intercept

b = the co-efficient or gradient of the independent variable

X = the independent variable, namely sovereign index returns, is assumed to be nonstochastic in nature whose variables are fixed

ξ = the error term. Assumptions related to the error term are:
the error term has zero expected value and has constant variance for all observations, the random variable are statistically independent of each other, and the error term is normally distributed.

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[13] AN IMF study of financial market developments in Malaysia, Indonesia, Philippines, Thailand and South support the presence of contagion effects. The study found very high correlations between sovereign spreads across the five countries. This indicated that markets felt that the probability of private debt default increased dramatically in these countries, and nervousness about one market was transmitted readily . As a consequence, global investors demanded higher risk premiums for all countries (Source: www:mas.gov.sg/resource/contagion-c.html, Economic Issues: Contagion During the Asian Currency Crisis, accessed 9/12/2000)

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The R squared column gives the R squared statistic associated with regressions. It is a measure of how well the independent variable explains the dependent variable. The closer the R squared is to one the better the movement in index returns are explained by sovereign bond returns.

The gradient (the co-efficient of the independent variable) is a measure of sensitivity of the dependent on the independent variable.

The last statistic displayed is the p-value. This is the level of significance that is associated with the gradient. The lower the p-value the more significant the independent variable.

The other terms in the regression are not disclosed (the intercept and the error term) as they are included in the model to capture other explanatory variables not included in the list of independent variables and are, thus, not important for the purposes of this research. The table does not include results from the regressions of the Argentinean and Chinas' Index in US Dollars, as they were not significantly different from the Index in local currency results. This is because the local currency of these countries was pegged to the US Dollar.

In terms of R squared, the countries that are most affected by the sovereign risk are Argentina, Brazil, Mexico and Venezuela (all South American countries). Argentina had a relatively high R squared for all the periods. Both Brazil and Venezuela demonstrated a significant increase in the R squared for the during crisis period when compared to the pre-crisis period.

A review of the results reveals that the gradient is positive for all the sample members (albeit China A and China B whose gradient is not statistically significant) and time periods. This is in line with our expectations because **as sovereign risk of a country decreases (increases) the sovereign bond return increases (decreases) and investment in that country's equity would increase (decrease) thus giving us a positive relationship between the sovereign index and equity index.**

There seems to be a significant shift from one time period to the next. The average R squared for index in local currency changes from 0.114 for the pre-crisis period to 0.245 for during the crisis period and to 0.145 after the crisis. The general trend with the sample members is similar to the trend for averages. The R squared increases from the pre-crisis levels and then decreasing after the crisis but not to its original levels. This means that **sovereign risk is an important determinant of stock market movements during the crisis period and exerts a more significant**

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influence on stock markets than it did prior to the crisis. This is also evident from reviewing the changes in the average gradient value.

The average R squared for index in US Dollars also follows a similar trend. However for most of the countries the R squared is higher than the local currency index indicating that sovereign risk is an important factor that international investors take into consideration when investing in emerging markets.

If sovereign risk increases (sovereign bond returns decrease) there should be a withdrawal of funds by international investors and this would affect the equity and currency returns negatively.

A review of the gradient indicates that **equity returns are now more sensitive to sovereign risk**. Again index returns in US Dollars are more sensitive to sovereign risk then local index returns. This implies that sovereign risk as calculated here has become a better measure of international investor sentiment than it was prior to the crisis. The average gradient increases (albeit marginally) after the crisis unlike the R squared.

The analysis above must be taken with caution, as there are equity markets where sovereign risk plays an insignificant role. This means that for these countries, international investors do not play an important role in the equity market (The alternative conclusion of sovereign risk not being an adequate measure of international investor sentiment was discarded from the outset). Despite this, in the next chapter we attempt to group equity markets and briefly compare the results with the groupings based on the sovereign bond markets.

In an interesting parallel to the results in this Chapter, Block & Vaaler (2001) concluded that sovereign spreads on emerging market debt increase after an election (A period of time that is known to bring uncertainty to investors). The change in the nature of sovereign spreads from the pre-election to post-election was also marginal and also not to the level of expectations of the researchers.

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TABLE 5.1: REGRESSION OF SOVEREIGN RETURNS ONTO EQUITY RETURNS

	PRE			DURING			POST		
	R squared	Gradient	P-value	R squared	Gradient	P-value	R squared	Gradient	P-value
ARGENTINA	0.601	1.473	1.647E-27	0.624	1.154	1.197E-18	0.421	0.633	2.015E-18
BRAZIL	0.304	1.251	9.095E-12	0.607	0.965	6.557E-18	0.380	0.739	2.441E-16
BRAZIL ($)	0.326	1.298	1.028E-12	0.634	0.999	3.640E-19	0.507	1.071	1.938E-23
MEXICO	0.276	0.964	1.187E-10	0.345	0.964	6.693E-09	0.266	1.189	4.158E-11
MEXICO ($)	0.358	1.531	4.413E-14	0.444	1.315	8.470E-12	0.307	1.415	7.169E-13
VENEZUELA	0.037	0.361	2.763E-02	0.517	0.722	2.853E-14	0.087	0.310	3.631E-04
VENEZUELA ($)	0.018	0.364	1.282E-01	0.509	0.748	5.467E-14	0.087	0.307	3.438E-04
S AFRICA	0.034	0.523	6.106E-02	0.142	0.505	4.862E-04	0.103	0.407	9.294E-05
S AFRICA ($)	0.232	0.814	1.720E-02	0.182	0.698	6.382E-05	0.118	0.492	2.747E-05
S KOREA	0.014	0.492	1.765E-01	0.178	1.119	7.943E-05	0.151	2.732	1.603E-06
S KOREA ($)	0.020	0.372	1.030E-01	0.221	0.373	8.244E-06	0.150	2.963	1.745E-06
CHINA A	0.001	-0.184	7.765E-01	0.007	0.174	4.659E-01	0.001	0.079	7.633E-01
CHINA A ($)	0.001	-0.169	7.938E-01	0.007	0.174	4.653E-01	0.001	0.079	7.652E-01
CHINA B	0.006	-0.319	4.006E-01	0.001	0.153	7.760E-01	0.005	0.498	3.916E-01
PANAMA	0.001	0.005	7.986E-01	0.000	0.005	8.537E-01	0.007	-0.021	3.129E-01
PANAMA ($)	0.001	0.005	7.986E-01	0.000	0.005	8.537E-01	0.003	-0.015	4.974E-01
PERU	0.056	0.279	6.418E-03	0.259	0.248	1.077E-06	0.119	0.135	2.468E-05
PERU ($)	0.067	0.316	2.753E-03	0.317	0.284	3.588E-08	0.171	0.175	2.834E-07
PHILLIPINES	0.071	0.626	2.020E-03	0.190	0.958	4.228E-05	0.037	0.264	2.167E-02
PHILLIPINES ($)	0.088	0.715	5.933E-04	0.179	1.243	7.307E-05	0.068	0.381	1.632E-03
RUSSIA	0.074	0.472	1.729E-03	0.154	0.466	2.656E-04	0.264	0.895	5.202E-11
RUSSIA ($)	0.088	0.510	5.699E-04	0.211	0.607	1.413E-05	0.281	0.946	1.033E-11
POLAND	0.010	0.202	2.586E-01	0.160	0.799	2.008E-04	0.043	0.509	1.277E-02
POLAND ($)	0.006	0.152	3.915E-01	0.249	1.072	1.859E-06	0.082	0.075	5.362E-04
AVERAGE VALUES									
Local index	0.114	0.473		0.245	0.633		0.145	0.644	
Index in US $	0.085	0.438		0.251	0.620		0.147	0.647	

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CHAPTER 6: CLUSTER ANALYSIS

In the previous chapters we had established the sovereign risk is an important determinant of equity returns in some emerging markets. We had also assumed that sovereign risk is a proxy for international investor sentiment towards emerging market equity. In this chapter we try and group international investor sentiment towards emerging market equity (i.e. sovereign risk) as well as the emerging stock markets (i.e. equity indices) based on similarity.

Cluster analysis has been used relatively frequently in research on stock market linkages (Cheung & Ho, 1991 and Panton, Lessig & Joy , 1976, for example) Prior research however has used Cluster analysis to graphically display a correlation table (The similarity of two markets was measured by some form of correlation statistic in the above-mentioned research). This research uses K-means clustering in identifying groupings of emerging markets. This method of clustering is different from the more commonly used, Hierarchical clustering (more specifically joining/ tree clustering).

Panton, Lessig & Joy (1976) explain Hierarchical clustering as follows:

Assume there are n entities, each of which is described in terms of p variables. In order to specify the similarity structure of the entities, it is necessary to compare these entities on the basis of all p variables simultaneously. Hierarchical clustering begins by treating each of the n entities as a separate cluster. Using a defined method of similarity (such as correlation in Panton, Lessig and Joy (1976) or Euclidean distance as in the case of this research), a search is made to find two clusters (individual entities at this stage) which are most similar. When found, these two clusters are merged and treated as one large cluster. Thus there are now n-1 clusters or groups. Again a search is made to find which two of the n-1 clusters are the most similar. These two clusters merge producing a total of n-2 clusters. This iterative process is continually repeated either until a desired number of clusters have been discovered or until all entities have been merged into one group. Appendix D illustrates how this process works.

K-means cluster analysis requires the pre-specification of the number of cluster groups. The exercise then progresses with finding elements for each cluster such that there is minimum within cluster distances as well as maximum between cluster distances. The aim of the algorithm is to maximise variability between clusters and minimise variability within clusters. In terms of traditional research, this exercise can be related to manipulating the members of each cluster such that the ANOVA lends itself

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as much as possible to rejecting the formulated Null Hypothesis (i.e. All the stock markets are similar and/ or no clustering of emerging markets occurs).

The K-means cluster analysis is preferred to the Joining clustering method since it allows for greater and easier comparability between Index results and Sovereign bonds results. The continent cumulative returns earlier indicate that it would be appropriate to assume that four different clusters exist, one for each continent.

The K-means cluster analysis was executed on three different pre-specified time periods, namely, pre-crisis, during crisis and post crisis. The sample sizes for these tests are the same as that in the previous Chapter, namely 131, 81 and 144 (per time series) respectively. The tests were done on both the sovereign risk data as well as on the index in US $ data. All indices were converted to US $ for ease of comparability and to theoretically remove any differences caused by inflation. The results are shown below.

The tables show the members of each cluster for both the tests on the index data as well as on the sovereign index data. The numbers below each country is the distance of that country from the centre of that cluster. With each period there is another table that gives the distances between the respective cluster groups. The numbers below the diagonal are the distances for the equity index clusters whereas the numbers above the diagonal are the distances for the clusters from the sovereign index tests.

PRE-CRISIS

TABLE 6.1.1: CLUSTER MEMBERS AND WITHIN GROUP DISTANCES

CLUSTER	INDEX IN US $	SOVEREIGN INDEX
1	Russia	Russia, Panama
	0	11.372, 11.372
2	Argentina, Brazil, China A, Venezuela	Peru, Venezuela
	15.092, 22.148, 19.824, 17.509	4.024, 4.024
3	China B, Mexico, Panama, Poland	Argentina, Brazil, Ecuador, Mexico, Poland
	15.274, 6.969,5.857, 12.867	3.523,4.720, 10.448, 10.398, 13.873
4	Peru, Philippines, S.A., S Korea	China, Philippines, S.A , S Korea
	12.079, 13.608, 10.538, 19.855	2.260, 7.670, 1.787, 4.103

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TABLE 6.1.2: CLUSTER DISTANCES

CLUSTER	1	2	3	4
1	0	33.767	62.913	86.533
2	74.336	0	30.737	54.169
3	103.082	35.908	0	24.166
4	129.423	64.143	28.912	0

Average distance for equity index clusters: 72.634
Average distance for sovereign index clusters: 48.714

The equity index clusters do not match the sovereign index clusters exactly. This is because there are a far greater variety of factors that would influence a stock market when compared to the sovereign bond market. Sovereign risk is one of the factors that can influence the stock market but it is not the only one. This is reiterated by the fact that, on average, the sovereign index clusters were closer to each other when compared to the equity index clusters for all the time periods. There is nonetheless a visible degree of similarity between the equity index clusters and the sovereign index clusters.

It is evident from the cluster groupings above that **the geographical location of a country plays an important role in the composition of the clusters**. 75% of the members of Cluster 2 (in equity index clusters) are from South America, whereas 80% and 75% of the members of sovereign index cluster groups 3 and 4 respectively are from the same continent as well.

Cluster 1, composed solely of Russia, in equity index clusters is the most distant group from the others. Russia has been experiencing its unique growth and development prior to the crisis. South Africa (S.A.) seems to have strong Asian influence as it is similar to China, Philippines and South Korea for the purposes of sovereign risk ratings; however, the S.A. stock market was similar to Peru, Philippines and South Korea.

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DURING CRISIS

TABLE 6.2.1: CLUSTER MEMBERS AND WITHIN GROUP DISTANCES

CLUSTER	INDEX IN US $	SOVEREIGN INDEX
1	Argentina, Brazil, China A, Mexico, Peru, Poland, S.A.	Argentina, Panama, Peru, Philippines, S.A. S Korea
	10.563, 14.937, 29.417, 9.615, 13.192, 12.571, 8.836	3.264, 2.522, 3.901, 2.004, 2.707, 5.869
2	Panama	China, Mexico, Poland
	0	2.076, 3.573, 2.766
3	China B, Russia, Venezuela	Brazil, Ecuador, Venezuela
	10.119, 13.9, 5.974	3.127, 3.035, 3.624
4	Philippines, S Korea	Russia
	6.021, 6.021	0

TABLE 6.2.2: CLUSTER DISTANCES

CLUSTER	1	2	3	4
1	0	7.430	10.818	42.515
2	80.955	0	16.886	48.884
3	23.934	102.906	0	32.411
4	35.341	111.558	29.105	0

Average distance for equity index clusters: 63.966
Average distance for sovereign index clusters: 26.491

The average distances between clusters (hereafter called average inter-cluster distance, AICD) has reduced for both equity index clusters as well as sovereign index clusters, indicating that the emerging markets followed each other more closely during the crisis period. The average sovereign cluster distances are less than half of the average equity cluster distances.

Russia forms a cluster of its own in the sovereign index analysis because of its default on debt. The closest cluster to Russia is the South American cluster of Brazil, Ecuador and Venezuela. All these countries also suffered from the fears of government bond default during the crisis[14]. Barr & Sharp (2000) quote the Economist as estimating the probability of default on the Venezuelan bonds on close to 90%. There is a similar pattern for equity index clusters. Russia and Venezuela are part of the same cluster whereas Brazil forms part of the closest neighbouring cluster.

[14] The IMF also makes reference to the Latin American countries as high probability default countries in the World Economic Outlook 2000.

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POST CRISIS

TABLE 6.3.1: CLUSTER MEMBERS AND WITHIN GROUP DISTANCES

CLUSTER	INDEX IN US $	SOVEREIGN INDEX
1	China B, Russia	Russia
	95.165, 95.165	0
2	Brazil, China A, Mexico	Brazil, Venezuela
	21.852, 21.908, 12.704	3.891, 3.891
3	Argentina, Peru, Poland, S.A. S Korea, Venezuela	Argentina, China, Ecuador, Philippines, Poland, S Korea, Panama
	10.411, 16.923, 18.766, 10.162, 29.867, 24.684	13.018, 3.076, 17.546, 7.232, 8.662, 4.146, 3.385, 7.232
4	Panama, Philippines	Mexico, Peru, S.A.
	6.747, 6.747	4.512, 5.005, 3.746

TABLE 6.3.2: CLUSTER DISTANCES

CLUSTER	1	2	3	4
1	0	212.945	249.368	233.527
2	233.564	0	38.211	22.343
3	273.392	45.184	0	16.754
4	313.505	90.397	45.733	0

Average distance for equity index clusters: 167.022
Average distance for sovereign index clusters: 128.858

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S.A. is now is more aligned to the emerging markets of South America for both the sovereign bond as well as the equity markets. Through out the periods under analysis Russia has not been consistently aligned to any of the other emerging markets. Judging by the AICD it seems that the emerging markets are more dispersed after the crisis than before the crisis. A closer analysis will reveal that the most distant of all the clusters are consistently the ones that have Russia. The average distances from re-performing the test, after excluding Russia, is tabulated below.

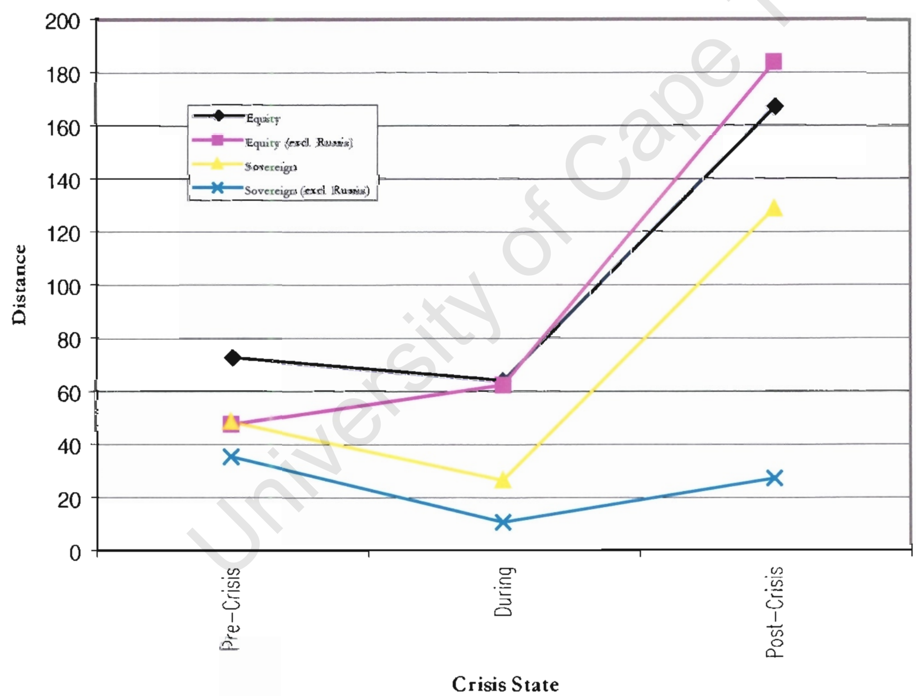
TABLE 6.3.3: AICD (EXCLUDING RUSSIA)

	PRE	DURING	POST
Equity Index	47.691	62.590	183.964
Sovereign Bond Index	35.497	10.826	27.335

The graph below shows the impact of excluding Russia from testing. It graphs **the AICD for all the cluster tests over the various crisis states.**

Excluding Russia has a significant impact on all the clusters. It seems that Russia is the most unique of all the emerging markets in the sample as the AICDs are consistently higher for the tests that include Russia (The post crisis AICD (excluding Russia) is likely to be overstated as foreign investors bought into Chinese equity after the crisis causing a high growth in the China B index). The difference in the sovereign index cluster distances indicates the uniqueness of Russia's circumstances during and after the crisis.

Graph 3: Average Inter-Cluster Distances



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The low sovereign AICD indicates the extent to which emerging markets were treated as similar. The results are in part, consistent with the results from the previous chapter. The relationship between sovereign risk and equity strengthened after the crisis. This is also evident in the movement of the sovereign and equity cluster AICDs after the crisis. The equity AICD increased greatly when compared to the increase in the sovereign AICD. Interestingly, the equity AICD is similar for the during crisis period, irrespective of whether Russia is included or excluded in the testing. The results from the cluster analysis for the during crisis period excluding Russia is included in Appendix E.

There, nonetheless, seems to be no consistent relationship between sovereign risk clusters and equity clusters. If one assumes that sovereign risk is a competent proxy for international investor sentiment, then the sovereign risk clusters are an indication of the groupings for international investor sentiment. The differences that exist between equity clusters and sovereign clusters are a result of the impact of other fundamental factors.

The alternative conclusion (taking into account the assumptions and results from the previous chapter) is that international investor sentiment is an irrelevant factor in explaining linkages amongst emerging stock markets. This cannot hold true as evidenced by the contagion that took place in 1997 and 1998 amongst various emerging markets.

The researcher is thus left with no other choice but to question the initial assumption of sovereign risk being an adequate measure towards emerging market equity. In the following section we analyse the crisis period in greater detail to provide further insight into the relationship between sovereign risk and equity returns.

THE CRISIS PERIOD ANALYSIS

It is evident that there has been a structural shift in the relationship between sovereign risk and equity returns during the crisis. Here and in Appendix F, we isolate the events that caused the equity and sovereign bond index clusters to 'drift away' from their 'equilibrium' classification for the crisis period. If the 'groupings' of sovereign risk plays a significant role in the 'groupings' of the equity markets then the events isolated as being responsible should be similar for both equity index and sovereign bond index clusters, however, if they are different then an analysis of the events could lead to an appreciation of why this is the case.

The F statistic from the analysis of variance performed on each dimension (i.e. sample point, in this case, a date) is an indication of how well the respective dimension discriminates between clusters. Cluster analysis can be interpreted an 'ANOVA in reverse.' A significantly high p-value associated with the F statistic on a dimension indicates around that time period, the current clusters are likely to be an unreliable indicator of the groupings that existed at that point in time. The analysis of variance table was searched for

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the 10 highest p-values[15]. The relevant dates arrived at, from this exercise are noted below. From these dates, press reports and analysis performed by reputable market commentators were searched to identify what events could have possibly have lead to the groupings being considered as unreliable.

TABLE 6.4: DATES ON WHICH CLUSTERS ARE UNRELIABLE

EQUITY INDEX	SOVEREIGN BOND INDEX
1 August 1997	24 October 1997
8 August 1997	19 December 1997
15 August 1997	26 December 1997
22 August 1997	13 March 1998
29 August 1997	20 March 1998
5 September 1997	3 April 1998
19 September 1997	10 April 1998
3 October 1997	17 April 1998
10 October 1997	24 April 1998
17 October 1997	1 May 1998

The equity index clusters presented in the previous section are most likely to be inaccurate for the period of August 1997 through to October 1997, whereas the sovereign index clusters are most likely to be inaccurate for the period late October 1997 through to May 1998. Interestingly there is no overlapping period for the sovereign index dates and equity index dates.

A summary (based directly from the market commentators) of the events surrounding these specific is noted in the Appendix. The default of Russia on its debt does not feature in this analysis even though it had a severe impact on the global economy. Russia forms a cluster of its own for the during crisis period. This implies that the other emerging markets were not as severely affected by the default as Russia was.

The analysis of dates in the Appendix shows that the events that had the greatest impact on the integrity of the equity index clusters were related to concerns over a **country's currency** and the greatest impact on sovereign bond clusters were largely related to macro-economic problems or downgrading of sovereign bonds. It is thus apparent that **sovereign risk is not an adequate measure of international investor sentiment towards**

[15] The first two dates were not include in the exercise. Since all indices were re-indexed to the same base, they are the most likely to have high p-values.

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emerging market equity. The type of events that drive the co-movement in emerging market equity are distinct from the type of events that drive the co-movement in sovereign risk, furthermore, it was earlier noted that sovereign risk had a low explanatory power in explaining equity returns.

The dynamics of a country's exchange rate, however, could provide us with greater insight in identifying linkages between emerging markets. In the next chapter we explore the role of currency in explaining international investor sentiment.

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CHAPTER 7: THE ROLE OF CURRENCY RISK

So far, we have discussed the role of sovereign risk as a measure of international investor sentiment. However, another risk that has a significant role in international investors decision is currency risk.

Currency risk, for the purposes of this research, is measured by returns taking place on the local bond market that can be attributed to expectations in currency movements. Using the adjusted methodology[16] noted earlier, this is the difference between the returns on the local bond market and the returns on the sovereign bond market. There were only four countries where both the local bond index and sovereign bond index was available.

The results from the regression of currency risk returns and index returns for the pre-crisis (sample size: 131 per time series) and the post crisis (sample size: 144 per time series) period are tabulated below. These results are reported in a similar manner to the sovereign returns regressions. The 'during crisis' period is analysed separately.

TABLE 7.1: REGRESSION OF CURRENCY RISK RETURNS ONTO INDEX RETURNS

	PRE			POST		
	R squared	Gradient	P-value	R squared	Gradient	P-value
MEXICO	0.168	-1.147	1.165E-06	0.226	-1.133	1.950E-09
MEXICO ($)	0.268	-1.509	2.377E-10	0.252	-1.326	1.668E-10
S AFRICA	0.006	0.058	0.445	0.103	-0.407	9.253E-05
S AFRICA ($)	0.013	-3.774	0.252	0.116	-0.489	3.139E-05
PHILIPPINES	0.065	-0.595	0.003	0.018	-0.164	0.106
PHILIPPINES ($)	0.079	-0.678	0.001	0.031	-0.227	3.445E-02
POLAND	0.008	-0.091	0.324	0.049	-0.511	0.008
POLAND ($)	0.001	-0.040	0.664	0.082	-0.804	5.195E-04

The test in this section was done in a similar manner to the sovereign risk section. The R squared for each of the sample members for the currency risk is less than the respective R squared from the sovereign risk regressions. This means that **currency risk is less of an explanatory variable than sovereign risk is, for equity market returns**.

[16] Appendix C includes an example on how the currency risk can be calculated using the conventional method.

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The R squared is consistently higher for equity index returns converted into US Dollars than it is for index returns in the local currency. There are two potential interpretations of this result, namely:

1. This is expected as changes in the expectations of currency risk is likely to affect international investors more than local investors, or

2. The reward for currency risk as calculated here is undoubtedly related to actual currency movements. The currency movements are already included in the calculations of equity returns in US Dollars. This is likely to improve the explanatory power of the independent variable.

The researcher takes the second view for the purposes of this research.

Given the low R squared statistics and the small sample size, it is not possible to draw any further conclusions. There is, thus, no point pursuing cluster analysis for currency risk. Once again we focus on the crisis period to provide us with further insight into the role of currency risk in international investor sentiment.

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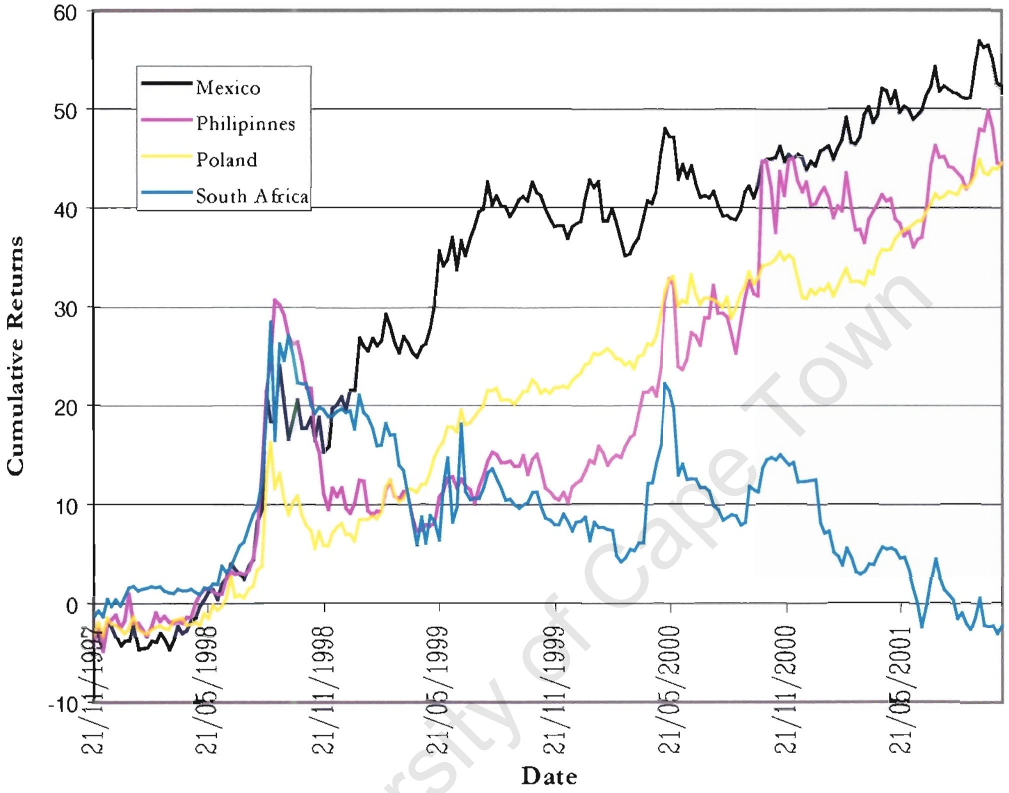
THE CRISIS PERIOD

Graph 4: Cumulative Returns
Rewarded for Currency Risk



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The graph above shows the difference between total cumulative returns for the local currency bonds and the sovereign currency bonds from 21 November 1997 onwards. This result is the total cumulative returns rewarded to investors for exclusively bearing currency risk.

The cumulative returns for all the countries except South Africa display an upward trend. This is an indication that they expect the currency to continue to depreciate over that time period. For South Africa, on the other hand, the currency was expected to remain at some constant level or appreciate after the crisis.

There is a sudden 'spike' around mid-August 1998 onwards. This is because of the default by the Russian government on its debt. The impact of this default had a severe impact on the S.A. economy given the Central Banks' reaction to the crisis[17].

[17] The Reserve Bank had raised the Repo rate to 22% to protect the South African currency.

Using the expectations theory, it would seem that investors are being rewarded for a relatively large amount of currency risk. However this is not the case. It is not prudent to conclude that an increase in sovereign risk in one country has increased the currency risk of another country without, initially, considering the impact on the country's sovereign risk.

An alternative explanation is that the cumulative returns on both sovereign bonds and local currency bonds decreased. The decrease in local bonds was not as substantial as the sovereign bonds thus giving an upward spike in the graph.

As equity markets had also become risky around that time, there had been a 'flight to quality', i.e. assets that offered a better risk/ return profile. There would have been an oversupply of sovereign bonds as there were enough sellers but not enough buyers (Barr & Sharp, 2000). However, as international investors attempted to sell off local currency bonds there would have been relatively more buyers (as local investors experiencing their own flight to quality) of local currency bonds. There are two reasons for this.

1. Foreign exchange controls' not permitting a true flight to quality assets, and/ or
2. 'homeward bias' whereby local investors choose to invest in their own domicile.

Many emerging markets including S.A. have foreign exchange controls that restrict the outflow of capital. Calvo & Mendoza (2000) note that the key distinctive features of global markets from domestic markets are the more important roles that information frictions play in the investment decision. "The issues of concern to the international investors are thus radically different from those that worry domestic investors, and the costs incurred in gaining the same level of expertise at the same level of that typically acquired for domestic investment are much higher.[18]"

A combination of the above factors contributed to the 'upward spikes' in the graph above. **If one assumes that the Russian default had an equally cataclysmic impact on all the emerging markets in the sample, then the height of the spikes can be interpreted as a measure of the impact of 'homeward bias' and restrictive foreign exchange controls. Alternatively, it is a measure of local investor sentiment to the crisis.**

[18] Frankel & Schmukler (1996) as quoted by Calvo & Mendoza (1999)

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The table below gives the increase in cumulative returns from the default date, 17 August 1998, to the local maximum for each of the countries.

TABLE 7.1.1: LOCAL MAXIMUM DATES FOR CURRENCY CRISIS

	INCREASE	LOCAL MAX DATE
PHILIPPINES	16.889	28 August 1998
S.A.	16.092	28 August 1998
MEXICO	14.581	4 September 1998
POLAND	12.492	11 September 1998

This chapter highlights the difference between foreign investor behaviour and local investor behaviour, even though both may (or may not) be acting rationally. This difference is identified by focusing on currency risk as currency risk is less of a concern for local investors. However, currency risk is not adequate proxy to identify linkages between emerging markets.

Interestingly, Schmukler & Kaminsky (1999) identify that 34% the market jitters in the emerging markets in Asia during the crisis were based no sound reasons whatsoever. 'Many studies of asset pricing have rejected the view that new information is the driving force behind asset price movements.'

In the next chapter we focus on currency movement as opposed currency risk in order to ascertain an adequate measure for international investor sentiment.

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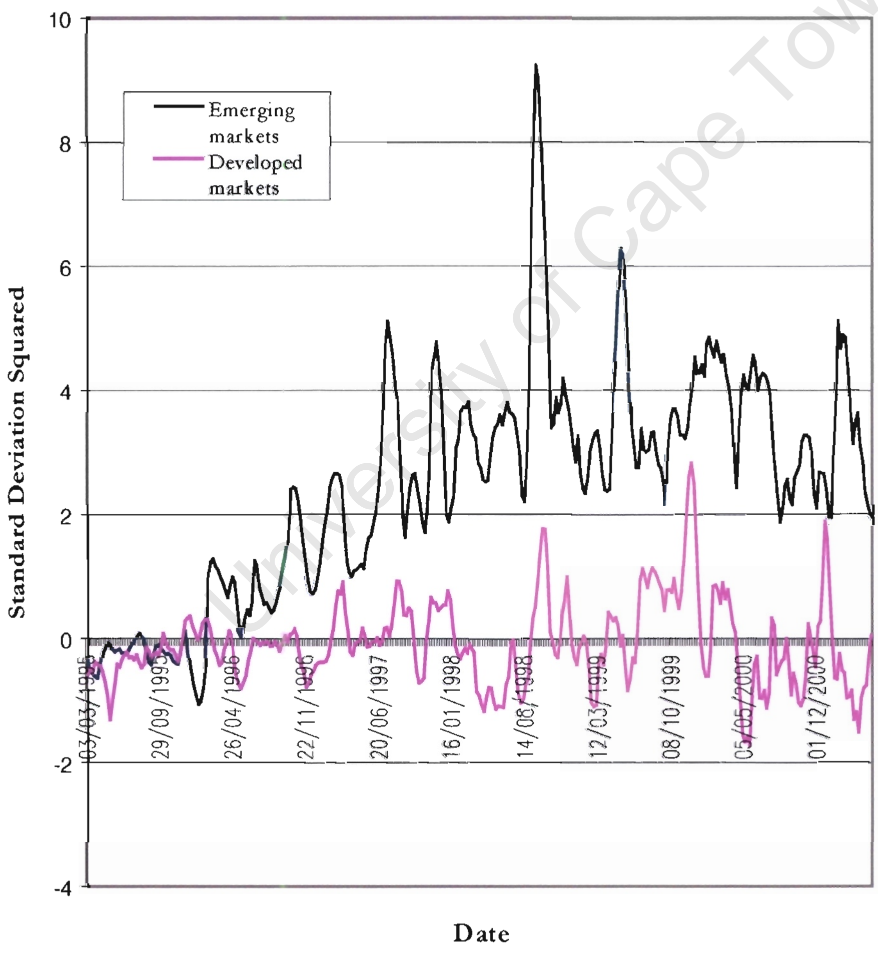
CHAPTER 8: VOLATILITY OF EXCHANGE RATES

The graph below details the difference in the moving volatility[19] of the average emerging (developed) market index and the average emerging (developed) market index translated into US Dollars. The difference is an indication of the extent of the volatility that was absorbed by the foreign exchange market. It is a graphical display of the impact of capital flows in the equity markets on the foreign exchange markets[20]. Since capital flows are largely due to international investors, exchange rate data could possibly be a proxy for international investor sentiment.

Grsph 5: Difference in Moving Volatility



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[19] The moving volatility is based on overlapping window periods of 9 weeks. The sample members for the emerging market index and developed market index are detailed in Appendix B.
[20] The above statement is made with qualification as many of the emerging country's foreign exchange markets were in turmoil irrespective of conditions of the equity markets.

The developed markets seem to have relatively stable exchange rates with the difference in moving volatility varying around zero. The emerging markets however show an increase in the difference in moving volatility from 1996 onwards. The first major spike occurs with the devaluation of the Thai Bhat in July 1997 and the Russian default is the prominent spike in the graph. Both these events are associated with large capital outflows from emerging markets.

It thus seems feasible to conduct cluster analysis on the differences in moving volatility to establish groupings for the sentiment towards the various emerging stock markets.

The results from this exercise must be interpreted with caution as Central Banks have on several occasions interfered in foreign exchange markets. Currencies that are pegged cannot be included in this exercise[21]. Currencies that are forced to trade within a 'tight' bandwidth (or have a crawling peg) are likely to have their results misstated[22]. Most importantly, capital flows[23] from one emerging market to another will not be noticed by analysing the differences in moving volatility thus defeating the purpose of the exercise. For the reasons mentioned above the analysis is done for only the post crisis period and the results are included in the following section.

ASSESSING INTERNATIONAL INVESTOR SENTIMENT

Kantor (1995, Understanding Capitalism: how economies work, p 159) notes that the day-to-day currency movements that take place are largely due to capital inflows and outflows. Furthermore, the sovereign risk is a better explanatory variable for equity returns in US Dollars as opposed to equity returns in local currency. It is possible to create emerging market groupings (subject to the limitations mentioned above) based on international investor sentiment by performing cluster analysis on the moving volatilities.

Another method that is used is by performing cluster analysis on equity returns less currency returns. If there is a large amount of capital inflow (outflow) into a stock market, there should be a positive (negative) impact on returns on the equity markets as well as returns on the foreign exchange

[21] It is common knowledge that the SARB openly announced that would defend the currency during the crisis. Other countries also admitted to defending the currency, but at later stage.
[22] Appendix G gives details of the sample members exchange rate/ monetary policy for year ended 1997 onwards.
[23] Appendix H gives the results from correlation tests based on macro-economic data such as the financial account and the current account. The limitations of using macro-economic data is discussed in the appendix itself.

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markets. This will allow identification of any form of herding behaviour (rational or irrational) by international investors. The pitfall with such an analysis is that the groupings will also include the impact of fundamental factors (e.g. external events such as economic shocks to a common trading partner) and local investor sentiment on equity. The results from the test and the moving volatility test for the post crisis period are tabulated below.

TABLE 8.1.1: CLUSTER MEMBERS FOR MOVING VOLATILITY AND EQUITY LESS CURRENCY

CLUSTER	MOVING VOLATILITY	EQUITY LESS CURRENCY
1	Venezuela	S Korea
	0	0
2	Russia	Czech, Poland
	0	1.869, 1.869
3	Brazil, Mexico	Russia
	2.824, 2.824	0
4	Peru, Czech, Philippines, Thailand, S.A., Poland , S Korea	Brazil, Mexico, Peru, Philippines, S.A., Thailand, Venezuela
	2.313, 0.738, 0.618, 1.095, 1.289, 3.780, 0.805	3.420, 3.112, 2.183, 3.133, 2.759, 3.180, 3.680

TABLE 8.1.2: CLUSTER DISTANCES

CLUSTER	1	2	3	4
1	0	5.586	7.777	4.731
2	172.260	0	6.965	3.199
3	179.954	11.355	0	6.772
4	186.203	17.447	7.421	0

The first column in Table 8.1.1 gives the results from the cluster analysis on the difference in moving volatility data whereas the second column gives the results from the Index returns less the currency returns. The distances below the diagonal in Table 8.1.2 relate to the moving volatility clusters and those above the diagonal relate to the index less currency returns clusters.

Once again, geographical location plays an important role in the country groupings. The results are not alike because of the moving volatility's inability to distinguish between capital inflows and outflows and the impact of the behaviour of local investors.

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ASSESSING LOCAL INVESTOR SENTIMENT

As noted in the previous chapter, bonds become a safe haven for local investors during periods of uncertainty in emerging markets. By comparing the differences in returns for equity markets and the bond markets for the various emerging markets, it will be possible to assess the sentiment of local and international investors. For comparative purposes the cluster results for equity returns has also been included.

TABLE 8.2.1: CLUSTER MEMBERS FOR EQUITY LESS BOND RETURNS

CLUSTER	EQUITY LESS BOND RETURNS	EQUITY RETURNS
1	Mexico	Mexico, S.A.
	0	2.059, 2.059
2	Czech, Poland, S.A.	Czech, Poland
	2.251, 2.237, 2.416	1.815, 1.815
3	Philippines, Thailand	Philippines, Thailand
	2.324, 2.324	2.185, 2.185

TABLE 8.2.2: CLUSTER DISTANCES

CLUSTER	1	2	3
1	0	3.479	3.969
2	4.026	0	4.070
3	4.961	3.614	0

In this test we have restricted the cluster number to three given the small sample size. The 'equity less currency' results focus on the behaviour of international investors. International investors are likely to take their funds in or out of the country depending on how their assessments of the riskiness of that country. The 'equity less bonds' results focus on local investors, as they are more likely to move funds in or out of the bond market depending on their outlook of the economy. As can be seen, the geographical location plays a distinct role in the composition of the clusters.

Interestingly, in previous tests SA has not been associated to the European emerging markets. Previous tests indicate that SA was regarded as similar to the emerging markets of Asia or South America (based on both fundamental and/ or by international investors). The results indicate that local investors of SA behave similarly to their European counterparts.

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In this Chapter we used currency data in identifying how international investors group emerging markets. While the results were positive, it does not solely capture international investor sentiment. In the following chapter we consider equity risk for all the emerging markets in the sample.

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CHAPTER 9: VAR AND EQUITY RISK

In this chapter we focus on equity risk. This is the risk that investors in the stock market assess it to be after taking into consideration all the relevant factors. Value at Risk (VaR) measures, in a single number, the total market risk a portfolio is exposed to. It is aimed at establishing, with a given amount of certainty, the maximum loss a portfolio will suffer over a specified period of time.

If one assumes (as has been in this research) that the equity index of a country is an adequate representation of all the equity listed on that stock exchange then, performing VaR tests on that index will give an indication of the equity risk of that country at a specific point in time.

In this chapter, the researcher calculated the 95% weekly VaR based on the annual volatility[24] of each of the stock exchanges. The calculation is done on the basis of an initial investment of US $ 100. To illustrate, if Argentina had a VaR of 9.46% on 24 March 1995, this means that there is a 95% certainty that the maximum loss over the course of the following week will be no more than US $ 9.46. The research only uses index in US $ so as to make the equity risk comparable amongst the different sample members.

The 'moving' VaR is calculated as follows:

The earliest data point is dropped and the latest data point joins the 'sample'. This algorithm starts once there is sufficient data to calculate a VaR and ends with the last data point.

The above process results in a time series that indicates how the equity risk of a country changes over time.

Graph 9.1 shows the 'moving' VaR for all the Asian emerging markets within the sample. Graph 9.2 shows the 'moving' VaR for all the other (Latin, European and South Africa) emerging markets within the sample. The graphs indicate that the impact of the two distinct crisis. The equity risk for the Asian emerging markets starts increasing from around May 1997, close to the start of the crisis as defined in this research. The equity risk for the non-Asian markets increases (taking into account the contagion from the Asian crisis) from around July 1998, close to the date of default of the Russian government on its debt.

[24] The annual volatility is calculated by using the standard deviation of 52 consecutive data points. The index data used in this research is of weekly frequency.

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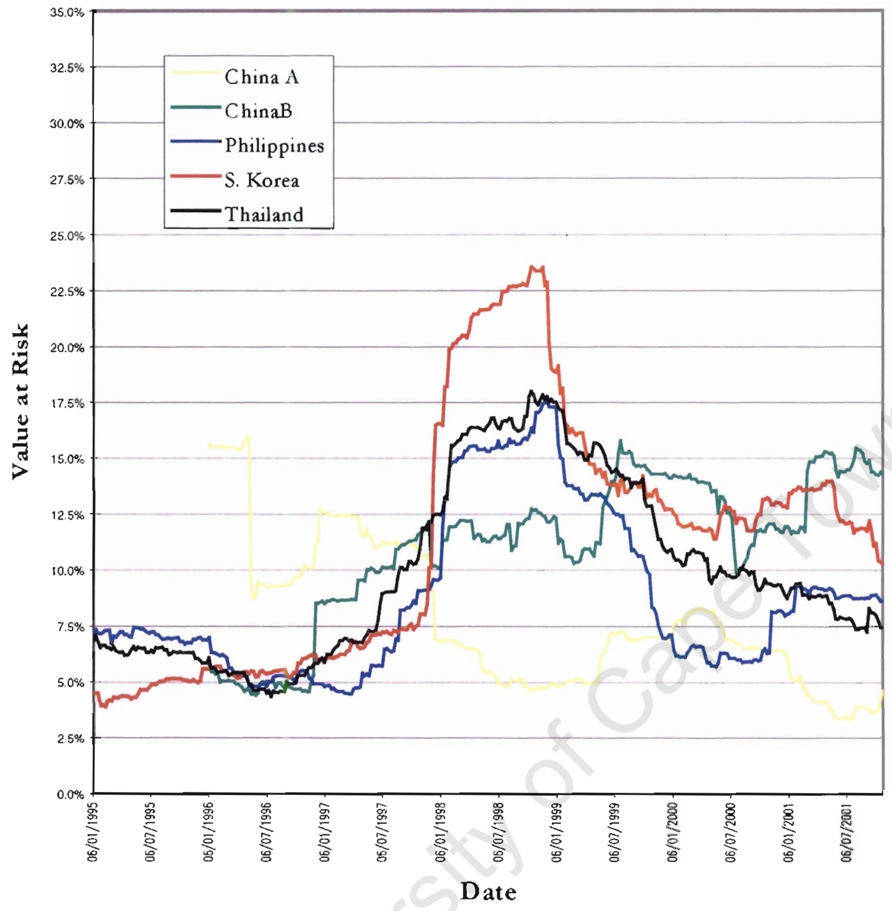
Graph 6: VaR for Asian Markets



The VaR for the Asian markets do not return to the lows that they had experienced before the crisis indicating that they have not yet fully recovered from the crisis or there has been a change in the risk profile of the Asian markets. The VaR for the non-Asian markets, however, in most cases, are close (and in most cases below) to their pre-crisis levels. This is largely because of the higher than expected VaR during the start of the time series. The non-Asian markets consist mainly of Latin American markets, which had suffered from a banking crisis and contagion in 1994/5. As can be seen South Africa was more affected by the Russian default crisis than it was by the Asian crisis.

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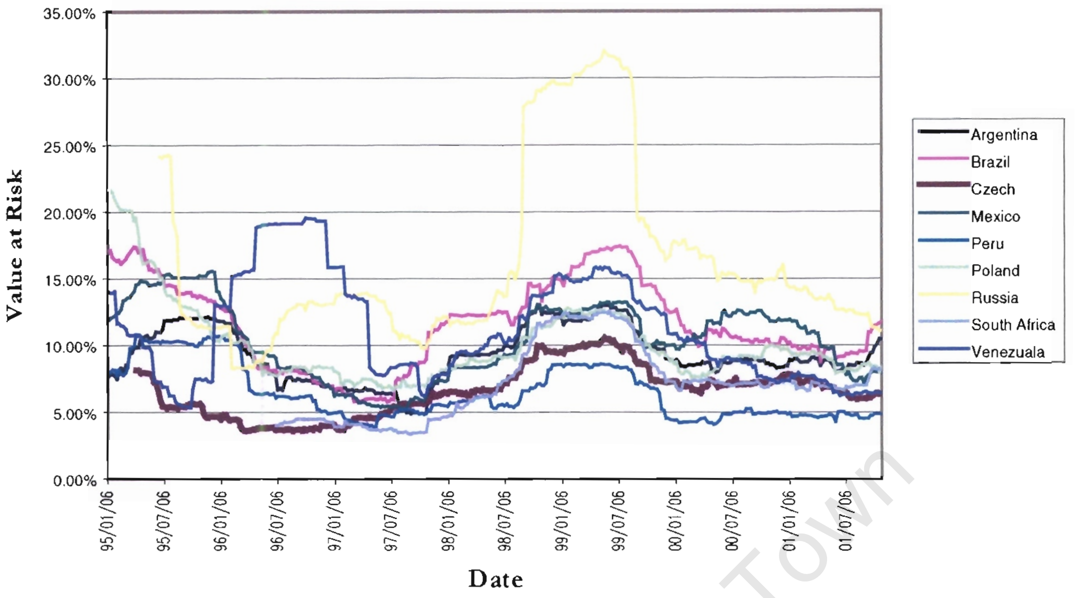
Graph 7: VaR for non-Asian markets



SOVEREIGN RISK VS. EQUITY RISK

If the risk of investing in a country increases then one would expect the sovereign risk (assuming sovereign risk is an adequate indicator of equity risk) to increase as well as the equity risk (VaR). This implies one would expect to see a negative relationship (correlation) between the sovereign bond indices and the VaR of a country. The table below gives the correlation for the sovereign risk index and the VaR for all the sample member countries over the major time periods as well as over the entire sample period. A graph based on the table has been included below the table for ease of reference.

The movement in correlation over the various time periods is significant and often against what we had initially expected. If we assume that the crisis period is associated with an increase in sovereign risk as well as equity risk then one possible explanation for these drastic movements in the correlation is the structural shifts in investors' assessment of equity risk relative to sovereign risk[25].

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[25] This conclusion is based on the fact that the methodology used to calculate VaR has not changed to take into account the crisis period.

TABLE 9.1: CORRELATION OF SOVEREIGN RISK AND EQUITY RISK

	Pre-crisis	During	Post crisis	Overall
Argentina	-0.67	-0.09	-0.55	-0.16
Brazil	-0.97	-0.60	-0.93	-0.38
China A	-0.11	-0.75	-0.72	-0.74
China B	0.84	0.51	0.29	0.77
Mexico	-0.88	-0.11	-0.63	-0.24
Peru	-0.87	-0.18	-0.76	-0.72
Philippines	-0.89	-0.06	-0.10	0.18
Poland	-0.95	0.79	-0.51	-0.55
Russia	0.07	-0.98	-0.87	-0.61
S. Africa	-0.60	-0.45	-0.71	0.18
S. Korea	0.90	-0.49	-0.52	0.25
Venezuela	0.42	-0.75	-0.92	-0.37

Only Russia, Venezuela, South Korea and China had a decrease in correlation from pre-crisis to during crisis[26]. This implies that the nature of the crisis in these countries did not cause a drastic shift in the manner in which investors view equity risk. For all the other countries, there has been a change in the nature of equity risk from pre-crisis to during crisis periods. However all post crisis correlations (except China B) are negative, which is in line with our expectations. This reflects a return to normality.

The correlation between sovereign risk and equity risk indicates the significance of sovereign risk in a country's' equity. A large negative correlation implies that the risk is an important determinant of equity risk in that country. Since sovereign risk is calculated from instruments traded by international investors, it follows that a large negative correlation between equity risk and sovereign risk implies that sovereign risk is a good proxy for international investor sentiment for those countries.

[26] The Latin American countries had experienced their own crisis in the earlier part of the pre-crisis period. The pre-crisis correlation is likely to be lower than the 'ordinary' levels.

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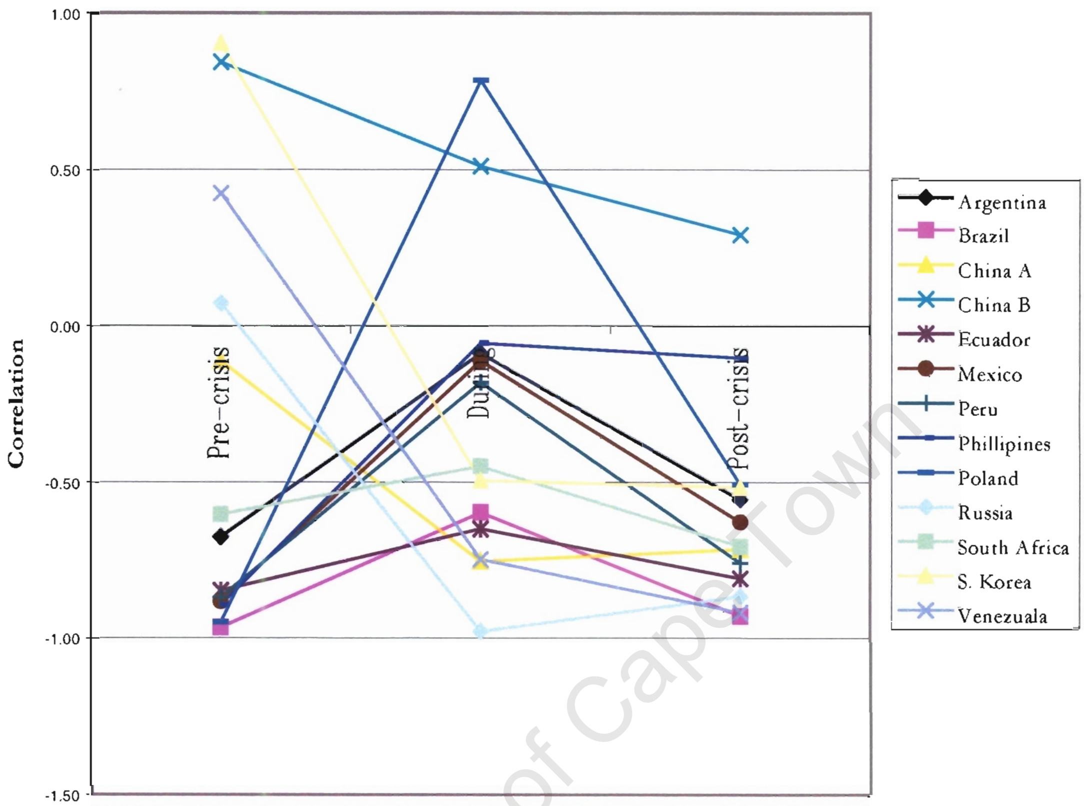
Graph 8: Correlation between sovereign risk and equity risk



Judging by the correlations over the entire period, Peru, Poland, Russia, Brazil, Mexico, Venezuela and Argentina[27] are countries whereby one can assess international investor sentiment by following sovereign risk. In Chapter 5 we had concluded that equity is more sensitive to sovereign risk after the crisis than before the crisis. It would thus not be appropriate to re-perform cluster tests on the smaller sample over the current sample period used in this research but rather to focus on updating the sovereign risk data and thereafter performing cluster tests.

[27] China A has been ignored despite having a negative correlation as China A is restricted to local investors.

CHAPTER 10: CONCLUSION

This research is based on the assumption that investor sentiment is the dominant factor in explaining linkages that may exist between emerging markets. Thus finding a proxy for international investors sentiment towards emerging market equity is a key concern that this research attempts to address.

The obvious choice for such a proxy, sovereign risk, cannot satisfactorily explain the co-movement of emerging market indices caused by contagion or herding behaviour. It was established that sovereign risk has a negative relationship with equity as expected. Sovereign risk has more of an influence on equity than it did before the crisis.

The sovereign bond clusters were largely affected by macro-economic news or sovereign bond downgrades. Equity index clusters were largely affected by concerns over the currency. However if sovereign risk and equity risk have a strong relationship then sovereign risk can be an adequate proxy for international investor sentiment.

Currency risk has less explanatory power than sovereign risk in explaining linkages between emerging markets. Using the concept of currency risk, however, the research does provide some insight into the extent of adversity experienced by some emerging markets during the emerging market crisis of 1997/8.

Currency movements provide a better indication of how international investors view emerging markets. The problem with using currency movements is the potential interference of Central Banks as well as the fact that countries that have pegged currencies cannot be included in any form of testing. The impact of local investor sentiment on equity markets can be assessed by examining the relationship between equity and bonds.

The day-to day currency movements that take place are largely due to capital inflows and outflows. This research identifies groupings of emerging markets based on large capital inflows and outflows by performing cluster analysis on equity returns less currency returns (as well as currency moving volatilities). This identifies linkages that are partly caused by international investor sentiment.

There are indications that the local investors of SA behave similarly to the local investors in the emerging markets of Europe. This is an area of further research as the relationship between the equity markets and the foreign

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exchange markets can be interpreted as the impact of international investor sentiment.

There are also indications that there has been a shift in the way investors view equity risk relative to sovereign risk. Another area of research is the relationship between sovereign credit ratings and equity returns. Sovereign credit ratings may be a better proxy for international investor sentiment when compared to sovereign bond indices. The relationship between sovereign risk and equity risk deserves further attention. Other pitfalls that can be addressed in future research is the pre-definition of the crisis states in this research or the quality of data used can be improved on.

No measure that solely and accurately captures international investor sentiment for all the emerging markets could be found. It was nonetheless established that markets that are in close geographical proximity to each other, are likely to be more linked due to both, fundamental factors as well as investor sentiment. In the context of international portfolio diversification, it is not advisable to invest in countries that are in close geographical proximity to each other.

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BIBLIOGRAPHY

Articles:

- Abdalla I., Murinde V., 1997, Exchange rate and stock price interaction in emerging markets: evidence on India, Korea, Pakistan and Philippines, Applied Financial Economics, 7, pp25-35.
- Ammer J., Mei J., 1996, Measuring International Economic Linkages with stock market data, Journal of Finance, Vol. U, No. 5, December, pp1-21.
- Arshanapalli B., Doukas J., 1993, International stock market linkages: Evidence from the pre- and post-October 1987 period, Journal of Banking and Finance, 17, pp193-208.
- Barr G., Sharp L., Unpublished paper first draft, Measuring Contagion – the Profile of South African Emerging Market Risk Over the 1998 Crisis
- Barr G., Sharp L., 1997, The realignment of international stock markets after the 1987 crash, with special reference to the Johannesburg Stock Exchange, South African Journal of Accounting Research, 11, pp1-13.
- Bennett P., Kelleher J., 1988, The international transmission of stock price disruption in October 1987, Federal Reserve Bank Quarterly Review, Summer, pp 17-33.
- Block S., Vaaler P., 2001, The Price of Democracy: Sovereign Credit Ratings, Bond Spreads and Political Business Cycles in Developing Countries, CID Working paper no. 82, Working papers, Centre for International Development at Harvard University. www.cid.harvard.edu/cidwp/082/htm, accessed 20/07/2002.
- Bodart V., Reding P., 1999, Exchange rate regime, volatility and international correlations on bond and stock markets, Journal of International Money and Finance, 18, pp133-151.
- Calvo G., 1999, Contagion in emerging markets: when Wall Street is a carrier, Unpublished paper, second draft, www.bsos.umd.edu/econ/ciecalvo.htm, accessed 20/07/2002.
- Calvo G., Mendoza E., 2000, Rational contagion and the globalisation of securities markets, Journal of International Economics, 51(1), pp79-113.
- Cantor R., Packer F., June 1995. Sovereign Credit Ratings. Current Issues in Economics and Finance, Federal Reserve Bank of New York, Vol. 1 No. 3, June, pp1-6.
- Cheung Y., Ho Y., January 1991. The Intertemporal Stability of the Relationships between the Asian Emerging Equity Markets and the Developed Equity Markets, 18 (2), 235-254.
- Dickinson D., 2000, Stock market integration and macro-economic fundamentals: an empirical analysis, 1980-95, Applied Financial Economics, 10, pp261-276.

University of Cape Town

- Drazen A., 2001, Interest Rate Defense Against Speculative Attack as a Signal: A Premier, unpublished paper, www.tau.acil/~drazen/dooley22501.pdf, accessed 20/07/2002.
- Errunza V., Hogan K., Hung M., 1999, Can the gains from international diversification be achieved without trading abroad?, Journal of Finance, Vol. LIV No. 6, December , pp2075-2107.
- Eun C., Shim S., 1989, International transmission of stock market movements, Journal of Financial and Quantitative Analysis, June, 24 (2), pp241-256.
- Fernald J., Edison H., Loungani P., 1999, Was China the first domino? Assessing links between China and other Asian economies, Journal of International Money and Finance, 18, pp515-535.
- Fleming J., Kirby C., Ostdiek B., 1998, Information and volatility linkages in the stock, bond, and money markets, Journal of Financial Economics , 49, 111-137.
- Fraser P., 1995, UK stock and government bond markets: predictability and term structure, Applied Financial Economics, 5, pp61-67.
- Glick R., Rose A., 1999, Contagion and trade. Why are currency crisis regional, Journal of International Money and Finance, 18, pp603-617.
- Griffin J., Karolyi A., 1998. Another look at the role of the industrial structure of markets for international diversification strategies, Journal of Financial Economics, 50, 351-373.
- Hartmann P., Straetmans S., De Vries C., Asset market linkages in crisis periods, European Central Bank, Working paper series, Working paper 71, July 2001, pp34.
- Hilliard J., 1979, the relationship between equity indices on world exchanges, Journal of Finance, March, pp103-114.
- Jefferis K., Okeahalam C., 1999, International stock market linkages in Southern Africa, South African Journal of Accounting Research, 13(2), pp27-51.
- Jiang C., Chiang T., 2000, Do foreign exchange risk premiums relate to the volatility in the foreign exchange and equity markets?, Applied Financial Economics, 10, pp95-104.
- Kamin S., 1999, The current international financial crisis: how much is new? , Journal of International Money and Finance, 18, pp501-514.
- Kaminsky G., Schmukler S., 1999. What triggers market jitters? A chronicle of the Asian crisis, Journal of International Money and Finance, 18, 537-560.
- King M., Sentana E., Wadhwani S., 1994, Volatility and links between national stock markets, Econometrica, Vol. 62, No. 4, July, pp901-933
- Ko K., Lee S., 1991. A comparative analysis of the daily returns: Japan, the US and the Asian NICs, Journal of Business Finance & Accounting, January , 18(2), 219-237.

University of Cape Town

- Kohers T., Kohers G., Pandey V., 1998 The contribution of emerging markets in diversification strategies, Applied Financial Economics, 8, pp445-454.
- Korajczyk R., 1995, A measure of Stock Market Integration for Developed and Emerging markets, Policy Research Working Paper 1482, June, the World Bank, Policy research department, pp41.
- Loflund A., Nummelin K., 1997, Stocks, bonds and business conditions, Applied Financial Economics, 7, pp137-146.
- Longin F., Solnik B., 1995, Is the correlation in international equity returns constant: 1960-1990?, Journal of International Money and Finance, 14, pp3-26.
- Masson P., 1999, Contagion: macroeconomic models with multiple equilibria Journal of International Money and Finance, 18, 587-602.
- Meric I., Meric G., 1989, Potential gains from International Portfolio Diversification and Inter-temporal stability and seasonality in International Stock Market Relationships, Journal of Banking and Finance, 13, pp627-640.
- Ong L., Izan H., 1999, Stocks and currencies: are they related?, Applied Financial Economics, 9, pp523-532.
- Panton D., Lessig V., Joy O., September 1976, Co-movement of international equity markets: A taxonomic approach, Journal of Financial and Quantitative Analysis, September, pp 415-432.
- Patel S., Sarkar A., 1998,Stock market crisis in developed and emerging markets, April: 28 pp. Online. Available: http://www.ny.frb.org/rmaghome/rsch_pap/9809.pdf, accessed 21/06/1999.
- Phylaktis K., 1999, Capital market integration in the Pacific Basin region: an impulse response analysis, Journal of International Money and Finance, 18, pp267-287.
- Reinhart C., 2001, Sovereign Credit Ratings Before and After Financial Crisis, unpublished paper second draft, www.faculty/papers/reinhart/ratpap.pdf, accessed 20/07/2002.
- Schollhammer H., Sand O., 1985, The interdependence among the stock markets of major European Countries and the United States: An empirical investigation of interrelationships among national stock price movements, Management International Review, 25, pp17-27.
- Shachmurove Y., 1998, Portfolio analysis of South American stock markets, Applied Financial Economics, 8, pp315-327.
- Shiller R., Beltratti A., 1992, Stock prices and bond yields: Can their co-movements be explained in terms of present value models?, Journal of Monetary Economics, 30, pp25-46.
- Sinclair, C. et al, 1997, A note on the stability of relationships between returns from emerging stock markets Applied Financial Economics, 7, pp273-280.

University of Cape Town

Websites:

- http://pages.stern.nyu.edu/~nroubini/asia/Asiachronology.html, Chronology of the Asian Currency Crisis and its global Contagion, accessed 07/11/2000.
- http:www.pbs.org/wgbh/pages/frontline/shows/crash/etc/cron.html, Frontline: the crash:timeline of the crash, accessed 06/12/2000.
- http:www.washingtonpost.com/wp-srv/business/longterm/asiaecon/timeline.html, Timeline of the Asian crisis, accessed 13/11/2001.
- http://newriskifci.ch/145900.htm. The causes of the Asian Financial and Economic Crisis, accessed 02/11/2000.
- www:mas.gov.sg/resource/contagion-c.html, Economic Issues: Contagion During the Asian Currency Crisis, accessed 9/12/2000

Books:

- IMF, 2000, World Economic Outlook
- IMF 1997, International Financial Statistics Yearbook 1997
- IMF 1998, International Financial Statistics Yearbook 1998
- IMF 1999, International Financial Statistics Yearbook 1999
- IMF 2000, International Financial Statistics Yearbook 2000
- IMF 2001, International Financial Statistics Yearbook 2001
- IMF 2002, International Financial Statistics Yearbook 2002
- Kantor B., 1995, Understanding Capitalism: How economies work, Bowerdean publishing Co, London

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Appendix A: CORRELATION TABLE FOR EMERGING MARKET INDICES IN US DOLLARS

	China A	China B	Indonesia	Malaysia	Philippines	N. Zealand	Thailand	Argentina	Brazil	Chile	Colombia	Mexico	Venezuela	S Africa	Hungary	Poland	Russia	S.Korea
China A	1.00	0.33	-0.70	-0.63	-0.80	0.91	-0.84	0.00	0.55	-0.73	-0.69	0.77	0.05	-0.65	0.56	0.11	0.56	-0.56
China B	0.33	1.00	0.12	0.13	-0.02	0.29	-0.04	0.19	0.24	0.11	-0.02	0.22	0.39	0.14	0.02	0.07	0.40	-0.05
Indonesia	-0.70	0.12	1.00	0.96	0.95	-0.78	0.82	0.34	-0.21	0.88	0.63	-0.46	0.26	0.82	-0.40	0.26	-0.25	0.68
Malaysia	-0.63	0.13	0.96	1.00	0.94	-0.73	0.84	0.22	-0.25	0.86	0.49	-0.42	0.15	0.79	-0.47	0.28	-0.30	0.74
Philippines	-0.80	-0.02	0.95	0.94	1.00	-0.85	0.87	0.23	-0.35	0.86	0.63	-0.58	0.11	0.79	-0.48	0.23	-0.42	0.67
New Zealand	0.91	0.29	-0.78	-0.73	-0.85	1.00	-0.83	-0.04	0.50	-0.73	-0.65	0.77	0.08	-0.63	0.55	-0.02	0.57	-0.57
Thailand	-0.84	-0.04	0.82	0.84	0.87	-0.83	1.00	-0.13	-0.60	0.87	0.46	-0.67	-0.16	0.74	-0.76	-0.09	-0.58	0.84
Argentina	0.00	0.19	0.34	0.22	0.23	-0.04	-0.13	1.00	0.74	0.27	0.54	0.38	0.83	0.46	0.66	0.72	0.64	-0.18
Brazil	0.55	0.24	-0.21	-0.25	-0.35	0.50	-0.60	0.74	1.00	-0.21	0.05	0.77	0.65	-0.02	0.87	0.64	0.87	-0.49
Chile	-0.73	0.11	0.88	0.86	0.86	-0.73	0.87	0.27	-0.21	1.00	0.67	-0.41	0.22	0.87	-0.44	0.15	-0.18	0.75
Colombia	-0.69	-0.02	0.63	0.49	0.63	-0.65	0.46	0.54	0.05	0.67	1.00	-0.39	0.52	0.65	0.01	0.21	0.09	0.18
Mexico	0.77	0.22	-0.46	-0.42	-0.58	0.77	-0.67	0.38	0.77	-0.41	-0.39	1.00	0.32	-0.27	0.71	0.38	0.76	-0.32
Venezuela	0.05	0.39	0.26	0.15	0.11	0.08	-0.16	0.83	0.65	0.22	0.52	0.32	1.00	0.36	0.55	0.51	0.75	-0.23
S Africa	-0.65	0.14	0.82	0.79	0.79	-0.63	0.74	0.46	-0.02	0.87	0.65	-0.27	0.36	1.00	-0.24	0.34	-0.05	0.61
Hungary	0.56	0.02	-0.40	-0.47	-0.48	0.55	-0.76	0.66	0.87	-0.44	0.01	0.71	0.55	-0.24	1.00	0.58	0.79	-0.66
Poland	0.11	0.07	0.26	0.28	0.23	-0.02	-0.09	0.72	0.64	0.15	0.21	0.38	0.51	0.34	0.58	1.00	0.45	-0.13
Russia	0.56	0.40	-0.25	-0.30	-0.42	0.57	-0.58	0.64	0.87	-0.18	0.09	0.76	0.75	-0.05	0.79	0.45	1.00	-0.47
S. Korea	-0.56	-0.05	0.68	0.74	0.67	-0.57	0.84	-0.18	-0.49	0.75	0.18	-0.32	-0.23	0.61	-0.66	-0.13	-0.47	1.00

The above correlations are based on weekly data from January 1995 to April 2001. A comparison of the correlations for pre-crisis, during crisis and post crisis (not included in this research) do not reflect any definite relationships, and thus tests using correlations on index data was not pursued.

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Appendix B: SAMPLE MEMBER COUNTRIES AND INDICES USED

COUNTRY	INDEX	STOCK SELECTION	STOCK EXCHANGE
EMERGING MARKET INDICES			
Argentina	Merval	Stock selected on the basis of number of transactions and volume	Buenos Aires
Brazil	Bovespa	Weighting by trade volume.	Sao Paulo
Chile	IPSA	40of the highest average annual trading volume over the past year.	Santiago
China A	Shanghai A	Capitalization-weighted, restricted to local investors.	Shanghai
China B	Shanghai B	Capitalization-weighted, available for investment by foreign investors. Priced in US $	Shanghai
Indonesia	Jakarta Composite	Modified capitalization-weighted index off all listed stock	Jakarta
Malaysia	Kuala Lumpur Composite	Broad-based capitalization-weighted index of 100 stocks.	Kuala Lumpur
Philippines	PSE-Composite	Capitalization-weighted	Philippine SE.
New Zealand	NZSE40	Modified market cap. weighted of 40 largest & most liquid stock.	New Zealand
Thailand	Bangkok SET	Capitalization-weighted index off all listed stock	SE of Thailand
Colombia	Bog-Bolsa	20 of the volume based companies selected.	Bogota
Mexico	Mexican Bolsa	Capitalization-weighted	Mexican
Venezuela	General Index	Capitalization-weighted of 15 most liquid stock	Caracas
South Africa	Johannesburg All Share	Capitalization-weighted of all listed stock	Johannesburg
Hungary	Budapest stock exchange index	Capitalization-weighted	Budapest
Poland	WIG 20	Capitalization-weighted index of 20 stock	Warsaw
Russia	ASP General	Composite index of all Russian stock	Russian
South Korea	KOSPI2	Capitalization-weighted index of 200 stock.	Korea
Czechoslovakia	PX-50	Capitalization-weighted index of 50 stock.	Prague
Ecuador	BVG Index	Total return index, revised bi-annually	Bolsa deValores de Guayaquil
Panama	Panama Stock Exchange General	No further info available.	Panama
Peru	Peru Lima General Index	Value weighted index. Based on largest and actively traded stock.	Lima

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DEVELOPED MARKET INDICES			
USA	NYSE Composite	Capitalization-weighted of all listed stock	New York
United Kingdom	FTSE 100	Capitalization-weighted of the 100 highest capitalized stock	London
France	CAC-40	Capitalization-weighted of 40 stock	Paris bourse
Germany	HDAX 100	Total return index of 100 highest capitalized stock	Frankfurt
Japan	Nikkei 225 Average	Price-weighted index of 225 top-rated Japanese stock	Tokyo
Canada	TSE 100	Capitalization-weighted of 100 highest capitalized stock	Toronto
Italy	MIB 30	Capitalization-weighted of 30 stock	Milan
Australia	Australian All Ordinaries	Capitalization-weighted of the 500 largest companies	Australian

The underlined countries were used in the construction of the emerging market or developed market index, those in bold form part of the core sample that the tests in this research are based on.

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Appendix C: EXAMPLE OF CALCULATION OF SOVEREIGN RISK: S.A.

To calculate the sovereign credit spread for South Africa, a simple contrast between the yield on a rand-denominated bond issued by the Republic of South Africa and a US dollar-denominated bond issued by the US Treasury will not be helpful. In particular, part of the higher yield that investors receive on rand-denominated bonds relative to US Treasury bonds is related to expectations of currency performance over the lifetime of the bonds in question. That is, an investor who prefers a rand-based US Treasury bond will only do so if he is compensated, firstly, for relatively higher credit risk of the South African government relative to the US government, and secondly, for the likelihood that the rand will lose ground against the dollar over the term of the bond.

The spread between a rand-based RSA bond and a dollar-based USA bond can be split into two (admittedly related) components: the currency risk and the credit risk. The currency risk is merely the level of compensation that investors demand for holding rand- rather than dollar-denominated bonds of the same tenure, that is, investor expectations of rand depreciation against the dollar over the period in question.

Spread = Currency (or Exchange Rate) Risk + Sovereign (or Credit) Risk

Thus, by way of example, consider the following 3 instruments:

1. 10 year RSA government bond in Johannesburg, yielding 15% in Rand.
2. 10 year RSA government bond trading in New York (paying a dollar coupon) redeemable in dollars, yielding 8%.
3. 10 year US government bond in New York, yielding 6%.

a) We may first calculate the Currency or Exchange Rate Risk. This is the premium paid for a Rand denominated rather than a dollar denominated bond (same default (or sovereign) risk).

It is the Risk adjusted assessment of the depreciation of the Rand/ $ exchange rate for the tenure of the bond (in this case 10 years).

Exchange Rate Risk = 1.- 2.

In this example, Exchange Rate Risk = 15% - 8% = 7%, that is, the Rand is expected to depreciate by 7% (annually) over the next 10 years.

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b) We may then calculate the Sovereign Risk. This is the Risk premium the RSA government must pay above the US government for borrowing money (in dollars). Assuming the US Government has no default risk this is a measure of the RSA government default risk.

(SA) Sovereign Risk = 2. – 3.

In this example, (SA) Sovereign Risk = 8% - 6% = 2%.

Also, the total Spread which equals

(1. – 3.) = 15% - 6% = 9%

and this must equal the sum of currency risk and sovereign risk (2% + 7%).

Source: Barr & Sharp (2000), unpublished paper, first draft, Measuring Contagion – The profile of South African Emerging Market Risk over the 1998 crisis.

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Appendix D: ILLUSTRATION ON HOW HIERARCHICAL ANALYSIS WORKS

Assume that the similarity structure of five objects, A, B, C, D and E is to be examined using hierarchical cluster analysis. Let a cluster (or similarity grouping) be identified by parentheses that enclose the identification of the entities within the cluster. The aggregation of the five entities into clusters could proceed in the following fashion:

Iteration 1: (A) (B) (C) (D) (E)

Iteration 2: (A, D) (B) (C) (E)

Iteration 3: (A, D) (B, E) (C)

Iteration 4: (A, D) (B, E, C)

Iteration 5: (A, D, B, E, C)

It can be seen that A and D are the most similar pair of objects followed by B and E. C is the most similar to the cluster (B, E) than it is to the (A, D) cluster. Finally, the aggregation process forces (A, D) and (B, E, C) to merge. By observing the pattern of mergers, the level of association at which groups merge, and the identity of the resulting clusters, the investigator gains insight into the similarity structure of his data.

Source: Panton, Lessig & Joy (1976), Co-movement of international equity markets: A taxonomic approach, Journal of Financial and Quantitative Analysis. September, pp415-432.

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Appendix E: CLUSTER ANALYSIS RESULTS

The results are based on cluster analysis tests done on the during crisis period after excluding Russia.

TABLE: CLUSTER MEMBERS AND WITHIN GROUP DISTANCES

CLUSTER	INDEX IN US $	SOVEREIGN INDEX
1	Argentina, Brazil, China B, Peru, S.A. , Venezuela	Argentina, Panama, Peru, Philippines, S.A.
	4.740, 7.115, 8.535, 5.570, 8.307, 11.393	2.549, 2.058, 3.592, 2.461, 2.468
2	China A, Mexico, Poland	China, Mexico, Poland
	15.832, 12.859, 6.392	2.087, 3.533, 2.720
3	Philippines, S Korea	Brazil, Venezuela
	6.021, 6.021	3.044, 3.044
4	Panama	S Korea
	0	0

TABLE: CLUSTER DISTANCES

CLUSTER	1	2	3	4
1	0	6.884	9.879	7.036
2	28.806	0	16.011	11.654
3	24.053	49.167	0	11.681
4	94.981	66.977	111.558	0

Average distance for equity index clusters: 62.590
Average distance for sovereign index clusters: 10.541

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Appendix F: CRISIS DATE ANALYSIS

EQUITY INDEX DATES

The events in **August** had a severe impact on most emerging markets. The Singapore dollar starts declining and the Malaysian Ringgit hits a 38-month low in the last week of July. This starts a currency meltdown over Asia.

On the **5 August**, Thailand adopts tough economic measures proposed by the IMF in return for a $17 billion loan from international and Asian nations. The Thai government suspends 48 financing firms. The Indonesian Rupiah comes under severe pressure and the system of managing the exchange rate through the use of a band is abolished, thus allowing the currency to trade freely. The Indonesian central bank raises interest rates in response to the drastic drop in the Rupiah.

The Hong Kong Dollar comes under speculative attack on **15 August** and overnight interest rates are up 150 basis points to 8%. The stock markets are sharply lower. The IMF approves a further $3.9 billion credit for Thailand on 20 August.

The Philippine Peso comes under severe pressure on **4 September** and drops to a record low against the US Dollar. The reserve bank intervenes and helps the Peso recover.

Malaysia threatens to ban (or implement tighter controls on) foreign exchange trading on **1 October** and the currency falls more than four percent in the space of two hours. The Indonesian currency is also affected negatively.

On **14 October**, Vietnam doubles the trading range for their Dong currency to 10% either side of the official trading rate. The Taiwan Dollar is devalued as well. On **17 October**, Malaysia presents a belt-tightening budget to try to stop the economy from sliding into recession.

All the events noted above relate to the Asian (currency) crisis while only four of the thirteen sample members (two relate to China which had a pegged currency during the crisis) used in the cluster analysis relate to Asia. Given the geographical mixture of results from the previous chapter for the during crisis state one can conclude that there was a significant amount of cross-continental contagion, especially during the weeks mentioned in this chapter.

SOVEREIGN INDEX DATES

By **24 October** the Hong Kong stock market had shed a quarter of its value in the space of four days. The fall was more severe than the 1987 crash. This was based on concerns of interest rate hikes and pressure on the Hong Kong Dollar. These concerns were founded on the recent devaluation of the Taiwanese Dollar, which could not keep up with the link with the US Dollar.

In the week preceding **19 December**, the IMF announced the restarting $10 billion loan to Russia to provide much-needed financial assistance for the government amid persistent market tension. The South Korean currency recovers by 10% on the prospects of further funding from the IMF. All other South East Asian currencies were sharply lower.

On **16 December** the US announces that it will keep interest rates unchanged due to lower inflation figures and the worsening of the crisis in Asia. Japan, on the other hand, announces large cuts in personal income taxes to rescue the economy. The dollar was sharply lower the following day. South Korea elects a new president, Kim Dae-jung, raising concerns by some investors that the economy would suffer further.

A triple-digit figure loss in the US market the day before and a 5% drop in Tokyo shares on **19 December** affect other Pacific Rim markets negatively. Concerns about the state of reform for the South Korean economy resurface, one day after the presidential elections. Investors comment that the recent collapse of foodstuffs trader Toshoku Ltd, the fourth largest bankruptcy in post-war Japan, provides more evidence that debt-ridden Japanese banks have tightened lending so severely that the economy is in the grip of a credit crunch.

On **22 December**, Moody's Investor Service downgrades the sovereign debt of four Asian countries (Indonesia, Malaysia, South Korea and Thailand), lowering three of them to junk bond status. The rating agency attributes this move to concerns about South Korea's short-term foreign currency needs and the ability of Indonesia's corporate sector to meet foreign debt obligation.

Key markets are sharply lower on **23 December** based on the news of downgrading of sovereign debt to junk bond status. South Korea suffers the worst. Of the 861 stocks that dropped, 772 hit their daily lower limit. Brokers and dealers say the markets slid as confidence in South Korea was shaken by comments from Kim Dae-jung and the downgrades by S & P as well as Moody's Investor Services. Kim told local media, "We don't know whether we could go bankrupt tomorrow or day after tomorrow. I can't sleep since I was briefed about the financial situation." The Finance Ministry has estimated short-term debt due to be $30 billion over the next two months.

"The Won's nose-dive was a major factor to ruin the debt market," commented a dealer at Daishin Securities. Dealers say the won's volatility reminded the debt market of the possibility of debt defaults by South Korea.

"The exchange rate is saying how dire the markets feel the circumstances are," an international broker commented.

South Korean stock market falls 6% on **24 December** based on concerns of the present crisis in Korea leading to a debt moratorium. Bankers in Tokyo believe that South Korean financial institutions could default on its debt if Korea maintains IMF conditions on restricting liquidity. The IMF, USA and 12 other nations pledged to speed up $10 billion in bailout money to South Korea. U.S. Treasury Secretary Robert Rubin commented, "This is a major world event and it seemed appropriate for the G7 industrial countries and other nations involved to move their aid forward."

A dispute on **9 March** between Indonesia and the IMF about the country's commitment to economic reform and delay in disbursement of funds affects most Pacific Rim markets. The IMF is concerned about the credibility and effectiveness of a currency board, should Indonesia apply one.

The events of **April** affected sovereign bonds globally. Pacific Rim equity was lower on **30 March** as investors lose faith in the Japanese government ability to float the market. Economic indicators released on the 31 March indicate Korea is heading towards a recession. On **2 April** Pacific Rim markets suffer as a recently released survey indicate the corporate confidence in the Japanese economy is at an all time low. On **3 April** Moody lowers its rating on Japanese sovereign debt. The US withholds funds designated to replenish IMF resources.

On **7 April** South Korea decides to delay the issue of its $4 billion sovereign bonds. The bonds are later sold successfully and South Korea considers raising a further $1 billion through further bonds issues. Moody's Investor Service lowers the outlook for Japan's sovereign debt rating from stable to negative.

The rest of the month was filled with concerns over the Japanese economy.

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Sources:

- http://pages.stern.nyu.edu/~nroubini/asia/Asiachronology.html, Chronology of the Asian Currency Crisis and its global Contagion, accessed 07/11/2000.
- http:www.pbs.org/wgbh/pages/frontline/shows/crash/etc/cron.html, Frontline: the crash:timeline of the crash, accessed 06/12/2000.
- http:www.washingtonpost.com/wp-srv/business/longterm/asiaecon/timeline.html, Timeline of the Asian crisis, accessed 13/11/2001.
- Kaminsky G., Schmukler S., 1999. What triggers market jitters? A chronicle of the Asian crisis, Journal of International Money and Finance, 18, 537-560.

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Appendix G: EXCHANGE RATE ARRANGEMENTS OF SAMPLE MEMBERS

	31 March 1997	31 March 1998	31 March 1999	31 March 2000	31 March 2001	31 Dec 2001
ARGENTINA	Pegged to US $	Pegged to US $	Currency board arrangement.	Currency board arrangement	Currency board arrangement	Currency board arrangement
BRAZIL	Managed Floating	Managed Floating	Independently floating	Independently floating	Independently floating	Independently floating
CHINA	Managed Floating	Managed Floating	Fixed peg arrangement	Fixed peg arrangement	Fixed peg arrangement	Fixed peg arrangement
CZECHOSLOVAKIA	Pegged to composite of currencies	Managed Floating	Managed floating with no preannounced path for exchange rate	Managed floating with no preannounced path for exchange rate	Managed floating with no preannounced path for exchange rate	Independently floating
PANAMA	Pegged to US $	Pegged to US $	Exchange rate with no separate legal tender	Exchange rate with no separate legal tender	Exchange rate with no separate legal tender	Exchange rate with no separate legal tender
PERU	Independently floating	Independently floating	Independently floating	Independently floating	Independently floating	Managed floating with no preannounced path for exchange rate
PHILIPPINES	Independently floating	Independently floating	Independently floating	Independently floating	Independently floating	Independently floating
POLAND	Managed floating	Managed floating	Exchange rates within crawling band arrangement	Exchange rates within crawling band arrangement	Independently floating	Independently floating
RUSSIA	Managed floating	Managed floating	Managed floating with no preannounced path for exchange rate	Independently floating	Managed floating with no preannounced path for exchange rate	Managed floating with no preannounced path for exchange rate
SOUTH AFRICA	Independently floating	Independently floating	Independently floating	Independently floating	Independently floating	Independently floating
SOUTH KOREA	Managed floating	Independently floating	Independently floating	Independently floating	Independently floating	Independently floating
THAILAND	Pegged to a composite of currencies	Managed floating	Independently floating	Independently floating	Independently floating	Managed floating with no preannounced path for exchange rate
VENEZUELA	Managed floating	Managed floating	Exchange rates within crawling band arrangement	Exchange rates within crawling band arrangement	Exchange rates within crawling band arrangement	Exchange rates within crawling band arrangement

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Source: IMF (1997), International Financial Statistics Yearbook 1997
IMF (1998), International Financial Statistics Yearbook 1998
IMF (1999), International Financial Statistics Yearbook 1999
IMF (2000), International Financial Statistics Yearbook 2000
IMF (2001), International Financial Statistics Yearbook 2001
IMF (2002), International Financial Statistics Yearbook 2002

Appendix H: MACRO-ECONOMIC DATA CORRELATION TESTS

Correlation table for current account statistics

	ARGENTINA	BRAZIL	CZECH	CHINA	MEXICO	PHILIPPINES	POLAND	RUSSIA	S AFRICA	S KOREA	VENEZUELA
ARGENTINA		-0.42	-0.12	n/a	-0.05	0.13	n/a	0.20	0.10	-0.27	0.21
BRAZIL	0.72		0.71	n/a	0.43	-0.13	n/a	-0.27	-0.44	-0.26	-0.13
CZECH	-0.07	0.06		n/a	0.88	-0.33	n/a	-0.62	-0.34	0.15	-0.38
CHINA	-0.61	-0.92	-0.07		n/a	n/a	n/a	n/a	n/a	n/a	n/a
MEXICO	0.10	0.54	-0.42	-0.59		-0.31	n/a	-0.72	-0.39	0.49	-0.56
PHILIPPINES	0.24	-0.01	0.55	0.11	-0.83		n/a	0.26	-0.43	0.21	0.36
POLAND	0.19	0.44	-0.17	-0.55	0.86	-0.80		n/a	n/a	n/a	n/a
RUSSIA	0.69	0.36	0.13	-0.15	-0.54	0.82	-0.58		0.14	-0.43	0.90
S AFRICA	0.38	0.17	0.24	-0.02	-0.65	0.91	-0.79	0.92		0.04	-0.02
S KOREA	-0.43	-0.56	0.72	0.51	-0.84	0.66	-0.63	0.14	0.34		-0.47
VENEZUELA	0.81	0.44	-0.46	-0.29	-0.06	0.30	-0.19	0.79	0.58	-0.46	

The above table gives the correlation between the sample country's current accounts. The current account is the sum of the balances on goods, services, income and current transfers. This is in effect a correlation of the trade taking place between the home country and the rest of the world. The correlation statistics below the diagonal are based on annual data ranging from 1995 to 2001 (or the latest data available), whereas the correlation statistics above the diagonal are based on quarterly data ranging from the beginning of 1999 to 2001 (or the latest data available). N/A indicates that data was not available.

Correlation table for financial account statistics

	ARGENTINA	BRAZIL	CZECH	CHINA	MEXICO	PHILIPPINES	POLAND	RUSSIA	S AFRICA	S KOREA	VENEZUELA
ARGENTINA		-0.39	0.59	n/a	0.43	-0.13	n/a	0.01	0.05	0.65	0.00
BRAZIL	-0.48		0.09	n/a	0.53	-0.38	n/a	-0.22	-0.03	-0.18	-0.21
CZECH	-0.13	0.35		n/a	0.42	-0.56	n/a	-0.06	-0.43	0.10	-0.26
CHINA	-0.54	0.59	0.56		n/a	n/a	n/a	n/a	n/a	n/a	n/a
MEXICO	0.28	-0.41	-0.92	-0.79		-0.27	n/a	-0.44	0.09	0.27	-0.45
PHILIPPINES	-0.24	0.39	0.18	0.81	-0.54		n/a	0.33	0.23	0.33	0.07
POLAND	0.67	-0.52	-0.03	-0.81	0.30	-0.68		n/a	n/a	n/a	n/a
RUSSIA	-0.32	-0.20	0.05	0.26	-0.33	0.50	-0.08		0.19	0.09	0.18
S AFRICA	-0.20	-0.23	-0.25	0.20	-0.09	0.59	-0.18	0.92		0.05	0.30
S KOREA	-0.02	0.33	0.63	0.56	-0.53	0.16	-0.40	-0.56	-0.59		-0.13
VENEZUELA	0.31	-0.40	-0.69	-0.46	0.51	0.11	0.32	0.52	0.70	-0.88	

The above table gives the correlation between the sample country's financial accounts. This is the sum of the direct investment, portfolio investment, financial investment and other investments moving in and out of the country. If international investors regard two countries as similar, then the capital accounts should have a high correlation. The correlation statistics

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below the diagonal are based on annual data ranging from 1995 to 2001 (or the latest data available), whereas the correlation statistics above the diagonal are based on quarterly data ranging from the beginning of 1999 to 2001 (or the latest data available). N/A indicates that data was not available.

Unfortunately given the low frequency and short time period at hand, it is not possible to draw any conclusions from the above tests. The frequency of data does not cover the crisis in sufficient detail. The dynamic nature of emerging markets as well as globalisation would make results based on a longer stream of historical data useless for the purposes of this research.

Nonetheless, similar correlations tests were performed on other components of the capital accounts such as Direct Investment in the home country by foreigners as well as Equity Securities Liabilities, which reflect instruments, held by foreigners that usually reflect ownership. The correlation tables are included below.

Correlation table for Direct Investment account statistics

	ARGENTINA	BRAZIL	CZECH	CHINA	MEXICO	PHILIPPINES	POLAND	RUSSIA	S AFRICA	S KOREA	VENEZUELA
RGENTINA		-0.10	-0.27	n/a	-0.45	-0.40	n/a	-0.06	-0.17	-0.18	-0.26
BRAZIL	0.19		0.38	n/a	-0.31	0.25	n/a	0.17	-0.37	0.41	0.08
CZECH	0.55	0.67		n/a	-0.21	-0.59	n/a	0.25	0.08	0.70	0.04
CHINA	-0.23	-0.54	-0.83		n/a	n/a	n/a	n/a	n/a	n/a	n/a
MEXICO	0.08	0.77	0.40	-0.33		0.28	n/a	0.12	-0.25	0.42	0.83
ILIPPINES	-0.85	0.30	-0.22	0.26	-0.01		n/a	-0.34	-0.01	-0.26	0.06
POLAND	0.06	0.88	0.74	-0.87	0.74	0.21		n/a	n/a	n/a	n/a
RUSSIA	0.30	0.22	-0.19	0.53	0.61	-0.46	0.01		-0.15	0.49	0.25
S AFRICA	0.18	-0.13	-0.37	0.44	0.43	-0.47	-0.25	0.90		-0.20	-0.15
S KOREA	0.37	0.81	0.91	-0.96	0.66	-0.11	0.94	0.05	-0.24		0.58
ENEZUELA	-0.01	0.73	0.07	0.72	0.86	0.24	0.51	0.75	0.48	0.38	

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Correlation table for Equity Investment Liability account statistics

	ARGEN TINA	BRAZIL	CZECH	CHINA	MEXICO	PHILIPPIN ES	POLAND	RUSSIA	S AFRICA	S KOREA	VENEZUE LA
RGENTINA		-0.69	-0.60	n/a	0.00	-0.53	n/a	-0.48	-0.20	-0.12	-0.01
BRAZIL	0.04		0.51	n/a	0.04	0.31	n/a	0.19	-0.12	0.07	-0.35
CZECH	-0.58	-0.49		n/a	-0.17	0.15	n/a	0.81	-0.20	0.04	-0.65
CHINA	-0.45	0.23	-0.32		n/a	n/a	n/a	n/a	n/a	n/a	n/a
MEXICO	0.68	0.70	-0.85	-0.01		-0.41	n/a	-0.07	0.77	-0.07	0.12
HII IPPINES	0.16	0.31	-0.10	-0.60	0.29		n/a	-0.04	-0.18	-0.20	0.03
POLAND	-0.32	-0.06	-0.05	0.74	-0.30	-0.68		n/a	n/a	n/a	n/a
RUSSIA	-0.33	0.48	-0.03	-0.06	0.22	0.61	-0.62		-0.22	-0.05	-0.47
S AFRICA	0.54	-0.66	-0.29	-0.08	0.04	-0.28	-0.06	-0.44		-0.09	0.38
S KOREA	0.25	0.08	-0.51	0.27	0.19	0.02	0.60	-0.52	0.11		0.29
ENEZUELA	0.22	0.60	-0.33	-0.18	0.67	0.40	-0.72	0.75	-0.20	-0.55	

Data sourced from:

IMF (1997), International Financial Statistics Yearbook 1997
IMF (1998), International Financial Statistics Yearbook 1998
IMF (1999), International Financial Statistics Yearbook 1999
IMF (2000), International Financial Statistics Yearbook 2000
IMF (2001), International Financial Statistics Yearbook 2001
IMF (2002), International Financial Statistics Yearbook 2002

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