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Integration, Growth and Contagion in African Equity Markets

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I certify that this dissertation is my own work and has not been submitted for degree purposes at any other university.

Signed by candidate

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August 2003

SYNOPSIS

During the 1990s, many African policymakers liberalised their capital accounts and opened equity markets to foreign investment. The motivation behind these liberalisations was to obtain the promised benefits of increased liquidity and market participation. In the same decade, however, African markets witnessed their more mature emerging market counterparts suffering the consequences of crisis and contagion. In light of this, policymakers are now concerned about how best to approach future capital account policy. Should they actively proceed to encourage foreign investment, for instance by listing a country fund? Alternatively, should liberalisations be revoked and foreign investment prohibited? Or is the best option to wait and see? In response to these questions, this thesis presents an investigation into integration, growth and contagion in African equity markets.

Integration is defined as a process whereby the financial markets of different countries become interlinked through a more fluid flow of capital. The first task in this thesis must therefore be to establish a reasonable estimate of integration for each market. A commonly used method of quantifying integration is used, but rather than measuring integration on a market level basis, the analysis is performed on a sector-by-sector basis. Given the disproportionate weightings of certain sectors in African markets, an integration measure based on a market-to-market comparison with global markets would be biased. Moreover, by measuring integration on a sector-by-sector basis, an internal analysis is achieved, providing more insight into the diversity within each equity market.

On this basis, technology-related sectors are found to exhibit higher levels of integration. If integration estimates at the market level are measured on a sector-by-sector weighted basis, South Africa reports the highest level of integration, whilst integration levels for other markets suggest that, on the whole, African markets remain largely segmented. Measuring integration over two adjacent panel data sets reveals that markets are moving steadily towards higher levels of integration.

Establishing integration levels for African markets allows for the investigation of other questions concerning the process of integration, the relationship between growth and integration and the connection between contagion and integration. Because most African markets are small, relatively young and mostly segmented, there is a unique opportunity to examine markets as they are emerging, in comparison to analysing other markets that are approaching maturity.

The intuitive notion of financial market globalisation suggests that markets first develop regionally before becoming globally connected. An examination of recently liberalised markets in Europe during the late 1970s upholds this notion by reporting a greater connection between neighbouring European countries than with the non-neighbouring United States. However, given advances in communication and technology, it is proposed that countries that have liberalised more recently, as several African markets have done, may now develop globally before they even establish regional links. Although a comparison between regional and global integration in Africa provides some evidence in support of this hypothesis, it appears that the process of integration has not changed radically over time.

The theoretical benefits of capital account openness include the promise of increased growth. This notion, advanced by Stulz (1999), states that increased integration leads to a lower cost of capital, thus reducing the hurdle rate for the acceptance of capital projects, which is ultimately manifested in increased growth. This hypothesis is tested by calculating overall and sector-by-sector cost of equity measures for African markets in two adjacent panel datasets, and comparing these measures with the integration results. Larger sectors (Non-cyclical Goods, Financials and Basic Industries) all report lower cost of equity levels, suggesting the presence of a liquidity premium. More importantly, cost of equity is found to decline in almost all sectors of each African market, suggesting that these markets have become more stable over time. This effect is robust even if the risk-free component in the cost of equity is held constant over the two periods, suggesting that the result is driven by decreases in the equity risk premium.

Consistent with theory, almost all integration increases are accompanied by decreases in the cost of equity. However, cost of equity also declines in several instances where integration decreases. This indicates that whilst increases in integration may plausibly contribute to a lower cost of equity, there are factors other than integration influencing cost of equity in African markets. Consequently, to the extent that decreases in cost of equity are a first step towards growth, it appears that integration and growth are not strongly related in African markets.

If integration fails to deliver its promised benefit of growth, then what of its potential cost – contagion? To assess whether contagion is linked to higher levels of integration, the contagion of African markets is measured on a sector basis using two different methodologies during the 1997 East Asian and 1998 Russian crises. In both crises, there is relatively little evidence of contagion, consistent with findings of previous market level contagion studies in African markets. Moreover, sectors showing susceptibility to contagion in the Asian crisis are different to those sectors affected in the Russian crisis. The hypothesis that high levels of integration are associated with the presence of contagion is then tested on a sector basis. However, a comparison between levels of integration and instances of contagion reveals no relationship.

On the one hand, these results suggest that policymakers in African markets do not need to be concerned with contagion, the alleged downside of integration. On the other hand, the substantial growth effect reported at the sector level cannot be entirely attributed to increases in integration. Nevertheless, considering the widespread decline in cost of equity and the minimal effect of contagion, integration appears to give markets the opportunity to share in the possibility of growth whilst remaining largely insulated from the risk of contagion.

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1 INTRODUCTION

For centuries, economic literature has questioned why some nations are rich whilst others remain poor. The fact that the answer to this question has eluded economists to this day bears testimony to the complexity of the problem. Some authors have attempted to provide clarity on the issue; for instance, Landes (1998) has suggested that favourable climate, vigorous work ethic, freedom from religious dogma, democracy and capitalism all contribute to successful and economically superior countries.

Economists now refer to “developing economies”, a descriptive term that implies that countries can shed their “third world” status to become developed, or rich. Yet some countries have been more successful than others at precipitating this transition. Why some nations are poor and others rich is perhaps a less important question today than why some poor nations have recently managed to *become* rich whilst others have *remained* poor. In the early 1990s, for instance, a topic of much discussion concerned Asian countries, which had developed far quicker than African countries, despite facing similar levels of poverty in the earlier twentieth century. Are there material differences between these regions that may have contributed to this discrepancy?

It may be that a market’s openness to foreign investment is associated with economic success and prosperity. Although evidence is mixed, integration is alleged to have positive effects on economic growth. Moreover, empirical tests suggest that education, banking and stock market development, law and order and government integrity are all more advanced in integrated markets (Edison et al., 2002). Therefore, perhaps the key factor separating the success of Asian markets from their African counterparts is their degree of international financial integration.

The relevance of integration in the process of economic development is a debate that extends far beyond the bounds of academia. Policymakers in developing countries are acutely aware of the need to improve the economic welfare of their citizens and therefore have a heightened sensitivity to measures that may advance such an

improvement. The media has also maintained an active interest; writing in a recent article for *The Economist*, Crook (2003) presents a survey of global finance that assesses most of the issues associated with global financial integration.

But integration is not without risk. An economy will not be able to attract wealth from foreign investors if there are rigid capital and exchange controls in place. Foreigners will resist investment in the absence of a guarantee that they can retrieve their monies with relative ease. However, if there are no barriers in place, the market will be vulnerable to excessive volatility in short-term capital flows – a circumstance that is exacerbated in times of crisis. The contagious crises of the 1990s bear witness to the risk of openness and overenthusiastic integration policies.

This thesis tackles the relevance of integration within the context of African markets. Firstly, the extent of integration in African markets is measured on both a regional and global basis. The possible growth effects of integration are then evaluated, and the simultaneous risk of contagion is assessed. Considered together, these studies provide a quantitative and empirical basis for discussion on whether integrationist policies should be pursued in African markets. This discussion is indeed relevant to academics and the media, but most importantly, it is primarily relevant to policymakers in developing countries.

1.1 A definition of integration

The definition of integration is given a relatively liberal treatment in integration literature. On the one hand, the literature offers several different interpretations for the meaning of integration. On the other hand, integration is sometimes used interchangeably with other terms. However, considered more closely, these concepts can often be shown to be rather different from the essence of integration. This section attempts to address these issues so that unnecessary ambiguity is avoided in the later chapters.

Integration, for the purposes of this thesis, is defined as the process whereby the financial markets of different countries become interlinked through a more fluid flow of capital. Critical to this definition is the notion of capital flows as opposed to, say,

trade flows. In other words, it is *financial* integration, not economic integration (as defined by Phylaktis and Ravazzolo, 2002) that is of interest. Whilst there is a well-established body of literature considering the benefits of increased trade between countries and regions, the benefits of increased capital flows have only been discussed more recently and remain controversial. In addition to the emphasis on capital flows, the definition also acknowledges that integration is a *process*, rather than a once-off event. Although Bekaert, Harvey and Lundblad (2003a) refer to the integration of equity markets as a “structural change”, they do not suggest that this change happens overnight. The length of the integration process is a matter for debate, but most academics agree that the process takes some time. The nuances of the integration process are discussed in section 1.2 below.

Capital account liberalisation is an event that is connected to integration, but is perhaps credited in certain studies with demonstrating a disproportionate relevance to the integration process. The problem arises because many studies, purporting to measure the effects of integration on a particular variable (usually growth), use liberalisation dates as their integration basis. However, as Bekaert and Harvey (2003) argue, liberalisation and integration – although plausibly related – are not one and the same, even though they are sometimes used synonymously (see, for instance, Errunza and Miller, 1998).

The distinction is clearly made in Levine and Zervos (1998a) where the effects of capital account liberalisation are measured on several variables, including international integration. Using a well-established measure of integration, Levine and Zervos (1998a) find that markets become more internationally integrated following liberalisation. In other words, liberalisation may be a factor that contributes to the process of integration, but it alone does not wholly constitute the process of integration. However, because it is unlikely that markets will ever achieve full integration if they refuse to liberalise, it may be claimed that liberalisation is a necessary, but not sufficient, condition to bring about world capital market integration. Nonetheless, even this claim is debatable – Bekaert, Harvey and Lundblad (2003a) point out that integration may bypass liberalisation if foreign

investors can access the domestic market adequately through country funds or depository receipts.

Some researchers use the terms “globalisation” and “integration” interchangeably (see, for example, Stulz, 1999), but globalisation is more commonly used within a broader context. Typically, globalisation refers not only to the financial integration of markets, but also to economic integration and, in particular, the creation and spread of “global” businesses and brands. On the other hand, financial integration, as defined in this study, is only concerned with the globalisation of capital flows.

In the contagion literature, yet another term bearing similarity to integration is introduced. Forbes and Rigobon (2002) refer to “interdependence” in their study of financial contagion during the 1997 Asian crisis. Interdependence is defined as a high level of inter-market correlation in all states of the world, and is therefore similar in spirit to the notion of financial integration. However, it should be acknowledged that integrated markets will not necessarily exhibit high levels of correlation with one another, even if integrated inter-market correlation is higher than correlation between segmented markets. Perhaps characterising interdependence as a sub-category of integration best describes the relationship between the two concepts.

Despite these attempts to avert ambiguity, it should be acknowledged that the study of integration is nevertheless a rather imprecise science. Even today, there is considerable difficulty in determining when a country reaches the “tipping point” that renders it integrated rather than segmented. This may, in part, be due to the general opaqueness of the integration process, discussed below.

1.2 The process of integration

Most integration literature has focused on measuring the global, rather than regional, integration of markets and the particular consequences that arise from increased integration. However, there is a potentially valuable research opportunity that arises from measuring the regional integration of markets. The central issue is one of *process*: how does the process of integration develop?

As suggested above, it is widely acknowledged that the process is gradual and takes time (Bekaert and Harvey, 2000), but there has been relatively little endeavour to consider the integration process from a holistic perspective. Where it has been discussed, the literature has concentrated almost exclusively on instruments and micro-processes that facilitate it. For example, several researchers (see Miller, 1999; Foerster and Karolyi, 1999; Bekaert, Harvey and Lumsdaine, 2002) have found conclusive evidence to suggest that the introduction of depository receipts in foreign markets has a profound impact on the integration profile of the local market. Other literature suggests that the listing of country funds (Bekaert and Urias, 1996) and financial liberalisations (see, for example, Henry, 2000a,b, 2003; Levine and Zervos, 1998a) are important.

However, when listed, these depository receipts and country funds, representing the assets of a particular emerging market, are typically located in developed markets rather than, say, other emerging markets. Consequently, there is an implied suggestion that integration occurs globally rather than regionally; that in this virtual world it is not only possible, but also more likely for countries to become globally integrated before they are even regionally integrated. This is perhaps not surprising when one considers the significant advances in communication and the dramatic improvements in the proliferation of financial information that have occurred in the recent past. In addition, it may be that investment capital is not readily available within certain regions. What makes this claim controversial, however, is that it denies the traditional and intuitive notion of how countries develop: first internally, then regionally, *then* globally. According to this model, regional integration is, in a sense, bypassed in order to satiate the appetite for capital flows from developed markets. Furthermore, the suggestion is that these capital flows (from international investors) are more important than trade links (with regional partners) in the process of economic development.

This question of regional versus global integration is addressed in chapter 3 of this thesis. Apart from measuring the extent of integration in African markets using a dataset that expands on Collins and Abrahamson (2003), this chapter explores how the process of integration may develop in African markets. Specifically, the hypothesis

suggested above is tested, i.e. that the process moves from internal to global integration, thereby bypassing regional integration.

Moreover, it would be interesting to gauge whether the process of integration has fundamentally changed over the last two decades. If the suggestion is that markets are more easily able to integrate globally because of advances in technology and communication, then markets may have followed an entirely different process of integration in previous years. For instance, it may be that traditionally trade links were first established, which led to a familiarity of certain foreign products. This exposure may have encouraged local investors to invest in those particular foreign companies, thus increasing capital flows. Today, however, local investors have easy and comprehensive access to information on companies in a plethora of foreign markets. Familiarity is therefore established virtually – not necessarily because products are locally available – and so an investor based in the United Kingdom can make an informed decision to invest in a South African company even though that company's products or services are unavailable in the U.K. Therefore, capital flows today may even precede trade links, whereas in the past, trade links may have been a necessary precursor to capital flows.

In order to shed light on this argument, the regional and global integration of a sample of European markets during the 1970s is measured using the same methodology. If, indeed, there does appear to be a difference in the integration process of the early European and recent African datasets, it will not be possible to test whether the discrepancy is due to the differences between 1970s Europe and 1990s Africa or simply a difference between the 1970s and 1990s. Nonetheless, the investigation will provide some additional insight into the complex and hitherto opaque process of post-liberalisation integration.

1.3 Integration, growth and contagion

Measuring the global integration of markets may be interesting, but it serves little useful function beyond academic endeavour if considered in isolation. However, when the effect of integration on other variables is jointly assessed, the study becomes applicable and highly relevant. It is no wonder, then, that most literature concerned

with integration has concentrated on the advantages and disadvantages of increased integration. A survey of this literature is reviewed in chapters 4 and 5, but the absence of consensus among academics is apparent. At best, some researchers will agree that increased integration carries both advantages and disadvantages, but that the one generally outweighs the other. This lack of consensus has been attributed not only to poor analytical techniques and flawed methodology, but also to the very complexity of the integration process. For instance, Obstfeld (1998, p. 9) writes that the “duality of benefits and risks is inescapable in the real world of asymmetric information and imperfect contract enforcement.”

Agénor (2003) details a multitude of benefits and costs associated with international financial integration. Benefits include consumption smoothing, increased domestic investment and growth, macroeconomic discipline and increased financial stability. Among others, Agénor (2003) suggests that domestic misallocation of capital flows, loss of macroeconomic stability and contagion are all potential costs of integration. In this thesis, economic growth is isolated as one potential benefit and contagion as a potential cost. Integration is thus presented as having a potentially dichotomous effect, although the relative strength of the growth versus contagion effects is only qualitatively discussed.

Of all the potential benefits associated with financial integration, economic growth has received the most attention. However, due to the temporary nature of short-term capital flows, there remains a debate as to whether capital market integration necessarily leads to increased growth. On the other hand, the difficulties associated with this “hot money” from speculative and volatile portfolio flows should not be confused with foreign direct investment (FDI). FDI is perceived to have clear benefits, something that is acknowledged by even the most fervent critics of recent liberalisations in the developing world (Stiglitz, 2000).

Chapter 4 examines the relationship between increased integration and economic growth in African equity markets. All African markets are classified as either emerging or frontier markets and thus expected to be either largely segmented or in the early stages of integration. Whilst it would be incorrect to suggest that the

integration process is ever irreversible (Malaysia, a previously open economy, imposed stringent capital controls following the 1997 Asian crisis), the integration process in most African markets is nonetheless in its early stages. Many African countries liberalised their capital markets in the 1990s, and some (e.g. Tanzania) are still considering whether to open their markets. Consequently, revoking the liberalisation decision would be less disruptive than in more developed countries. Policymakers in African countries (whether liberalised or not) are still considering the wisdom of liberalisation. If, therefore, it appears that no relationship between integration and growth in African markets exists, it may be worth reviewing liberalisation policies in these countries. On the other hand, if a strong relationship between integration and growth appears to be present, then perhaps other markets should follow similar strategies. The recent announcement of plans to establish a pan-African bourse based at the JSE Securities Exchange will give African markets the opportunity to gain added liquidity and greater access to foreign investors. Participation in this initiative may well lead to increased integration in these markets. However, in the context of this discussion, policymakers should carefully consider whether the promised benefits of such integration outweigh the possible risks.

In an important departure from previous studies that have considered integration, growth and contagion, all analyses in this thesis are performed at the sector level rather than market level. There are several benefits associated with this approach, and these are detailed in section 2.2.1. However, the most obvious benefit is that sector level results allow for insight into the factors driving otherwise potentially confounding market level results. For instance, it will therefore be possible to isolate in chapter 4 whether certain sectors (within and across markets) exhibit a stronger relationship between integration and growth than others.

If growth is considered to be the benefit of integration, then the risk of contagion, examined in chapter 5, is the associated cost. Theory suggests that as markets open to foreign investors and exchange controls are relaxed, their vulnerability to large and sudden capital withdrawals is increased. History provides many crises as evidence of the dangers inherent in liquid capital markets. Of most direct significance is that

recent history has witnessed several contagious crises including the Mexican crisis of 1994, the East Asian crisis of 1997/1998 and the Russian crisis of 1998.

This issue is particularly relevant in the context of African markets. The destabilisation of imposing capital controls may well outweigh the costs of contagion in those developed markets that exhibit very high levels of global integration. African markets are not in this position, but are likely to be in the earlier stages of integration because of their more recent liberalisations. However, as mentioned above, having made the decision to liberalise, policymakers in these markets are witnessing more mature emerging markets experiencing increased integration and are evaluating whether the effects are, on average, positive. If, for instance, increased integration generates an excessive vulnerability to financial contagion, then increased integration is probably undesirable for African markets. Consequently, chapter 5 investigates whether the East Asian crisis of 1997 and the Russian crisis of 1998 had contagious effects on African markets. Once again, the methodology is performed on a sector-by-sector basis, allowing for a deeper analysis than in previous studies.

When the analyses of chapters 4 and 5 are considered jointly, the results have profound policy implications. If a significant integration-growth relationship is found within African markets, but a significant integration-contagion relationship is also present, then policymakers in African countries need to consider whether the benefits outweigh the costs. However, if no integration-growth relationship exists but vulnerability to contagion is shown to be a danger, then imposing controls may be appropriate. On the other hand, if African markets show little evidence of contagion but growth and integration are positively related, then pursuing policies that promote integration (e.g. continued relaxation of foreign exchange and capital controls, encouraging dual-listing of stocks) is highly desirable.

1.4 A brief outline of this thesis

This thesis contains three separate but interrelated studies, united by a common theme: integration. The three studies are examined respectively in chapters 3, 4 and 5 and each of these chapters contains a review of literature relevant to that area of

research. In addition, the methodology and results for each study are presented separately in their respective chapters.

Chapter 2 considers the various issues surrounding the data used in this thesis. Items of particular importance include the construction of the African indices and an explanation of the sector-by-sector approach.

The process of integration is studied in chapter 3. The relationship between regional and global integration in African markets is examined at the sector level and the process is compared with an earlier time period using a European dataset. This chapter also establishes the integration baseline measure that is used in the subsequent two chapters.

Chapters 4 and 5 study the integration-growth and integration-contagion relationships in African markets respectively. The relationship between integration and growth is measured indirectly using several cost of equity measures. Tests for contagion between Hong Kong and the African markets during the 1997 East Asian crisis are performed and then compared to each country's level of integration (from chapter 3).

Finally, chapter 6 presents the conclusions and implications arising from the research findings. In particular, policy suggestions are considered. The contribution of this thesis to African equity market research is reiterated and recommendations for further research are discussed.

2 DATA

The most common challenge facing researchers in African financial markets is the difficulty surrounding data. Whilst data availability is the most common problem, the quality of data is often also in question. Nonetheless, the situation is improving and there is already enough quality equity-related data available for an in-depth analysis.

2.1 Data sources and availability

The primary data source used for this study was Thomson Financial Datastream. In addition, the I-Net Bridge database was used to collect most of the South African and Namibian data. The IFC International Finance Statistics (IFS) database was used for all data on interest rates.

A sector-by-sector approach was employed in this thesis, but because most African markets do not provide sector indices in accordance with an internationally recognised and standardised classification system, it was necessary to construct sectors from firm-level data. The scope of the research was therefore confined to the number of African markets where firm-level data was available. In addition, the markets have different periods of data availability; Kenya, for instance, has firm-level data from as early as 1991 whereas firm-level data for Mauritius only begins in 1998.

Bearing these limitations in mind, sufficient data are available for analysis on 7 African markets: Egypt, Kenya, Mauritius, Morocco, Namibia, South Africa and Zimbabwe. There is a considerable discrepancy in the size of these markets. In particular, South Africa is much larger than the other markets¹. Nonetheless, it would be incorrect to assume that South Africa's size necessarily implies dominance in market maturity. In fact, Egypt's Alexandria Stock Exchange is the oldest in Africa and was established in 1883, predating South Africa's JSE Securities Exchange by 4 years. Morocco's Casablanca Stock Exchange was founded in 1929, whereas the

¹ According to the S&P Emerging Stock Markets Factbook 2001, South Africa's market capitalisation exceeds that of Morocco (the second largest African market) by some 14 times.

Mauritian and Namibian Stock Exchanges were established only in 1988 and 1992 respectively.

2.2 Sector index approach

As indicated previously, this thesis adopts a sector-by-sector approach for analysis. There are several benefits associated with using this approach instead of a market level approach.

2.2.1 Principal benefits of sector index approach

On the one hand, an obvious benefit of sector analysis over market analysis is the added insight that one gains from having results for each sector *within* each market. Market level studies effectively report the aggregation of what is occurring on a sector and firm basis; by directly applying the analysis at a sector level one is able to understand whether a particular result is driven by one or two large sectors or whether it is truly the result of a market-wide phenomenon.

In addition, the results – where possible – are cross-sectionally aggregated *across* the markets. This allows for a “ranking” of sectors across all African markets for each study. For instance, as well as ranking, say, the contagion of each sector within each market, this approach allows for aggregation across markets so that one can see which sector is on average the most vulnerable to contagion in African markets. Where possible, sectors have been ranked according to this method in the studies included in this thesis.

But apart from the benefit of insight, the sector index approach offers what is arguably a far more important benefit. Without dwelling on the specifics, which are discussed in the respective methodology sections in the forthcoming chapters, the methodologies used in this thesis all involve estimating a relationship, usually between a world market proxy and an African market. In this context, using market-level data could be misleading. This issue is emphasised in Bekaert and Harvey (1995, p. 436), who point out that a country may be perfectly integrated with the world market but may nonetheless generate a “low or negative correlation [with the

world market] because its industry mix is much different from the average world mix”.

Collins and Abrahamson (2003) illustrate the problem in the following way. Suppose that countries comprise only two sectors, Financials and Resources. These two sectors tend to exhibit counter-cyclical behaviour (i.e. when Financials perform poorly, Resources rally) and may thus be expected to have a negative correlation². Now assume that country A is heavily weighted in favour of Resources, and country B is dominated by Financials stocks. Finally, assume that country A and country B are perfectly integrated. If this is so, then if Financials rise by 10% in country A, Financials in country B will do the same; thus it would be expected that their correlation would be exactly 1. Table 1 shows that even though country A and B both exhibit the same return in each sector over a single period, the aggregated market index return is positive for country A but negative for country B. Over time, this will

Table 1: Illustration of the market index approach weakness

	<i>Country A</i>		<i>Country B</i>	
	<i>Return (%)</i>	<i>Weight (%)</i>	<i>Return (%)</i>	<i>Weight (%)</i>
Financials	-5	10	-5	90
Resources	15	90	15	10
Index return	13%	100	-3%	100

clearly result in a negative relationship. But since the countries are perfectly integrated, their market returns should be perfectly correlated. Hence a correlation-based methodology may generate highly spurious results if applied at the market level. However, if applied at the sector level, this problem is removed because the tests directly compare like sectors with one another: differing industry mix is no longer an inhibiting factor.

² There are many examples of such behaviour on the JSE between the Resources and Financials sectors. See, for instance, daily return data in July 1998, August 1999, November 1999, May 2000 or Feb 2001 where the correlation has been negative.

2.2.2 Construction of sector indices

Once a sector-based approach is chosen, a number of decisions need to be taken. The most important of these is choice of classification system. Not only does this choice determine how one classifies the shares, it also implicitly determines which country will be used to proxy the world market and according to what method the indices will be constructed.

After some consideration, the FTSE Global Classification System was adopted. This system specifies 10 “Economic Groups”³ that are loosely referred to as “sectors” in this thesis. The choice of the FTSE system was motivated by several factors. Firstly, both the Johannesburg Stock Exchange and the Namibian Stock Exchange use the FTSE system to classify their shares. Consequently, the risk of classification error would be eliminated in these two markets. In addition, the London Stock Exchange has its shares classified according to the FTSE system making it a good proxy for the world market. The United Kingdom is considered a superior alternative to the United States as a representative of developed markets in the African market context because of its geographical proximity to Africa, its historical ties to Africa (through colonialism) and its comparable time zone. Finally, Datastream has created FTSE sector indices for several European countries, as well as Hong Kong and Russia. As sector indices are required for these countries in various studies included in this thesis, this availability once again eliminated potential classification error.

The process of classification was simplified for South Africa and Namibia as shares in these markets have already been classified according to the FTSE system. Moreover, although the system was only adopted in 2002, I-Net Bridge has made South African backdated sector indices available starting in July 1995. No such backdated series are available for Namibia but the FTSE classification of shares currently in existence is available. Consequently, sector indices needed to be generated for Egypt, Kenya, Mauritius, Morocco, Namibia and Zimbabwe.

³ Basic Industries, Cyclical Consumer Goods, Cyclical Services, Financials, General Industrials, Information Technology, Non-cyclical Consumer Goods, Non-cyclical Services, Resources and Utilities.

The process of sector index creation proceeds as follows. The first task is to obtain all share price and dividend yield data available in each market (dividend yields are required in the measurement of integration). The shares are then classified according to the FTSE system into one of the 10 sectors mentioned above. Each share is individually investigated and the nature of the company is determined. Reports from brokerage houses, websites, information from stock exchanges and company publications are all considered in this process. When sources conflict, information based on reports compiled by local (rather than foreign) sources prevails, as locals are assumed to have a richer understanding of the firms in their market than foreigners. The risk of classification error remains, but great care has been taken to ensure that this risk has been reduced as far as possible. A list of shares in each African market, classified according to the FTSE system, is included in Appendix A.

Once the shares have been individually classified, sector indices are constructed on an arithmetic basis, weighted by market capitalisation. This is in accordance with the construction of the FTSE sector indices. Price indices and dividend yield indices are constructed separately. All indices are then converted from local currency to U.K. pound sterling using a time series of exchange rates.

Importantly, one significant departure in this process of index creation in comparison to the process used in Collins and Abrahamson (2003) is the use of “chain-linking”. Whereas in that study only shares that had data stretching back to the beginning of the period were included in the indices, indices in this study include all available shares, irrespective of when they were introduced. This is achieved by chain-linking the index just prior to the introduction of a new share to the index just after the introduction, so that continuity is maintained and the resultant index that is used for calculation purposes is unaffected by the introduction. The process therefore ensures that the addition of a new share does not, for instance, induce a sudden upward jump in the index level, which would (incorrectly) suggest that prices in the sector had suddenly risen. The chain-linking of indices in this study has allowed for a dramatic increase in the number of shares that constitute each sector (for instance, Collins and Abrahamson, 2003, used only 24 shares to create sectors in Egypt; this study uses 116

shares in Egypt for a similar period) and has therefore improved the accuracy of findings.

There is, nevertheless, one remaining caveat. Datastream restricts its database to those shares that are currently available. Therefore companies that may have been present at the start of the period but subsequently ceased to exist during the period are not included in the sector indices. Due to the difficulty surrounding data availability, the possible introduction of this survivorship bias is unavoidable. However, the risk is likely to be minimal because the FTSE sector indices for South Africa, the largest market in the sample with probably the greatest number of de-listings, are available from I-Net Bridge and therefore do not need to be constructed. Importantly, these series are not subject to survivorship bias.

Table 2 provides a summary of the sector indices and details the number of shares used to create each sector index and the weight of that sector for the period 1999 to 2002, measured at a monthly frequency. The final column reports the weights of the sectors in the U.K. Notice that the weights in the U.K. are relatively evenly spread across the sectors in comparison to the spread in the African markets. The highest weighting in any U.K. sector is 25% (Financials); compare that to 81% for Zimbabwe or 61% in Namibia. Even in South Africa, Financials and Resources considered together constitute 70% of market capitalisation. The considerable discrepancy between the spread of weights between the U.K. and African markets makes the argument about the inappropriateness of market level analysis even more relevant.

The sectors have also been ranked by average weight across the African markets. Financials, Resources and Basic Industrials appear to form the backbone of market capitalisation in these markets, whilst Utilities and Information Technology are the smallest sectors. Interestingly, whilst the number of shares in a sector is sometimes an indication of market capitalisation (e.g. Kenya), there are many exceptions. For instance, Cyclical Services in South Africa has more than double the number of shares than Resources; nonetheless, its market capitalisation is more than 9 times smaller. Similar comments may also be made in Morocco, where Non-cyclical Goods and

Table 2: Constructed sector indices – Basic information (1999–2002)

Sector	Egypt		Kenya		Mauritius		Morocco		Namibia		South Africa		Zimbabwe		U.K. *
	Number of shares	Weight (%)	Number of shares	Weight (%)	Number of shares	Weight (%)	Number of shares	Weight (%)	Number of shares	Weight (%)	Number of shares	Weight (%)	Number of shares	Weight (%)	Weight (%)
Financials	26	26	12	32	3	45	20	46	11	61	132	23	14	81	25
Resources	–	–	2	3	–	–	2	4	3	31	53	47	8	5	14
Basic Industries	33	26	7	13	1	2	11	18	1	1	28	4	8	5	3
Non-cyclical Goods	30	17	11	36	1	3	9	12	5	<1	31	8	12	2	17
Cyclical Services	6	7	4	6	3	37	1	<1	9	3	117	5	12	3	15
General Industrials	2	<1	2	<1	2	13	3	18	1	4	25	2	13	3	3
Cyclical Goods	16	3	6	4	–	–	3	1	–	–	29	8	4	<1	1
Non-cyclical Services	2	20	1	2	–	–	–	–	1	<1	5	2	1	1	15
Utilities	1	1	1	4	–	–	1	<1	–	–	–	–	–	–	4
Information Technology	–	–	–	–	–	–	–	–	–	–	36	1	–	–	3
Total	116	100	46	100	10	100	50	100	20	100	456	100	72	100	100

– Not available.

* U.K. weights based on FTSE sector market capitalisations.

General Industrials have approximately the same weight despite Non-cyclical Goods having 3 times as many shares.

However, notwithstanding the comments above, it should be noted that Mauritius had only 10 shares available at the firm level. This is a very small sample of shares, especially when one considers the number of shares used in the other African markets. Consequently, conclusions related to Mauritius should perhaps be regarded with some circumspection.

2.2.3 Remaining data issues

A few miscellaneous data issues remain. Firstly, when considering regional integration in chapter 3, Datastream Global Equity sector indices are used for the European market sectors and when examining the contagion from the Asian and Russian crises in chapter 5, Datastream sector indices are used for the Hong Kong and Russian sectors respectively. These indices are constructed in accordance with the weighted arithmetic method as prescribed by the FTSE classification system, and correspond to the FTSE sectors. Datastream reports that these indices cover approximately 80% of market capitalisation in their respective markets.

Finally, all series used in this thesis (monthly and daily series, across all time periods) have been tested for stationarity. Log return series are used to capture the return on price indices, and first difference series are used for dividend yield and interest rate indices. Stationary series will exhibit a constant mean and variance over time. The assumptions behind the regressions used in the methodologies for this thesis require that the series used are stationary; using non-stationary series could generate spurious results. The stationarity of series used in this thesis was measured using the Augmented Dickey-Fuller (ADF) statistic, and all series were found to be stationary at the 10% level.

3 REGIONAL AND GLOBAL INTEGRATION

Initial work in the field of integration was concentrated on developing a statistically adequate and economically meaningful measure of integration. Today there are almost as many measures of integration as there are papers on the subject, and still new approaches are being developed. The inability of researchers to settle on a single accepted measure of integration may be a function of the looseness surrounding the precise definition of integration as discussed in chapter 1. Similar problems are encountered when one attempts to develop a measure of financial contagion, which is explored in chapter 5. Nonetheless, some of the more important and widely accepted integration methodologies are presented below as a basis for discussion.

3.1 Review of integration methodology

The integration literature reviewed in this section charts the development of integration methodology and thought as well as highlighting some of the most recent developments. Attention is then focused on research relating to the process of integration, specifically literature concerned with the measurement of regional integration.

3.1.1 *Early development of integration methodology*

Attempts to quantify the degree of market segmentation/integration may be traced back as early as Solnik (1974). In this paper, an international asset pricing model (IAPM) is presented and tested on a predominantly European dataset. Importantly, the model incorporates mean-variance efficiency and relative purchasing power parity. Although there is insufficient evidence to reject integration, Solnik (1974, p. 377) concludes instead that although securities were predominantly priced domestically, “an international market structure of price behavior [sic] seems to exist.”

Stehle (1977) presents another similar IAPM methodology to investigate the integration of United States stocks in comparison to the world market. Notwithstanding Solnik (1974), this paper is credited with having been the first

explicit empirical test of segmentation versus integration. However, as in Solnik (1974), this methodology only considers the polar cases of complete integration or complete segmentation. Stehle (1977) effectively examines whether assets are priced locally or globally using a cross-sectional, time series approach as a method to assess whether the market is segmented or integrated, and reports inconclusive results.

These early examples of international asset pricing models implicitly assumed that markets were perfectly integrated (though many subsequent tests of integration also make this assumption, as discussed in section 3.1.2). If all investors are assumed to hold the same world market portfolio, then it is a necessary condition that all investors should have equal and unrestricted access to all assets. However, even today this assumption is unambiguously violated.

Black (1974) and Stapleton and Subrahmanyam (1977) acknowledge this significant flaw and present early work in the investigation of market segmentation. In an important subsequent paper, Stulz (1981) extends and refines the Black (1974) model to present a model of international asset pricing that takes barriers and costs of foreign investment into account. Stulz (1981) claims that such a model is necessary in the presence of partial market segmentation, but does not attempt to establish the extent to which certain countries are more or less segmented than others.

Importantly, Stulz (1981) noted that even though most markets fell into the “grey area” between full segmentation and full integration, most studies had – until then – been solely concerned with these extreme cases. Despite this early admission, it took several years before researchers were to incorporate this finding into their models (e.g. Errunza and Losq, 1985).

3.1.2 Tests of perfect integration

Tests in this category, the most preferred integration methodology of the 1980s and early 1990s, all assume that world capital markets are perfectly integrated. The intuition behind such tests is that rejection of these models implies market segmentation.

However, these tests all suffer from the confounding problem of the joint hypothesis, a limitation that is willingly acknowledged (see, for example, Cho et al., 1986 and Wheatley, 1988) but one that casts doubt on reported results. Simply stated, the joint hypothesis problem implies that when using an asset pricing model to measure the extent of integration or segmentation, the result simultaneously incorporates the accuracy of the model, the efficiency of the market and the degree of integration. Consequently, a rejection of integration may either be the result of an incorrectly specified model, market inefficiency, or the absence of integration.

Jorion and Schwartz (1986) investigate the integration of the Canadian equity market by testing betas and cross-sectional parameters simultaneously using a maximum likelihood estimator (MLE) approach that improved on the estimation procedure employed by Stehle (1977). The world market is proxied by a portfolio of North American stocks. Jorion and Schwartz (1986) reject the joint hypothesis as described above, and conclude that the Canadian market is at least partially segmented. Wheatley (1988) presents a consumption-based asset pricing model that also uses the MLE procedure. A sample of developed markets is investigated over a 25-year period, but this time there is insufficient evidence to reject the joint hypothesis. Wheatley (1988) does nevertheless admit that the tests suffer from low power to reject the joint hypothesis, implying that the results may be better classified as inconclusive.

In a contemporaneous paper, Cho, Eun, and Senbet (1986) approach the integration question using an international arbitrage pricing theory (IAPT) model. The IAPT model, originally developed by Solnik (1983), has more explanatory potential than the single index model and its modified versions that had been used in previous integration studies. Like Wheatley (1988), Cho et al. (1986) use a dataset of developed markets and three hypotheses are tested between two different country groups: equal intercepts, equal risk premia, and both equal intercepts and risk premia. Although the equal intercepts hypothesis is not rejected, the remaining hypotheses are rejected, implying the rejection of the joint hypothesis. Cho et al. (1986) postulate that the fact that the equal intercepts hypothesis is not rejected suggests that there does exist a no-arbitrage internationally integrated capital market for risk-free assets.

Korajczyk (1996) uses a similar IAPT methodology a decade later to test the law of one price. The assumption is that if capital markets are internationally integrated, then risk will be priced internationally and thus deviations from this state are indicative of imperfect integration. Korajczyk (1996) does note, however, that markets tend to move from a segmented to an integrated state over time, and acknowledges that this time-varying integration (discussed below) is not explicitly accounted for in the IAPT model. In order to incorporate these regime shifts, Korajczyk (1996) performs the integration tests over sequential time periods. Integration measures for four developed and twenty emerging markets are generated. Not surprisingly, emerging markets report lower levels of integration than the developed markets. Nevertheless, Korajczyk (1996) finds evidence to suggest that these emerging markets are becoming increasingly integrated over time.

A study of the world CAPM is given a novel treatment in Harvey (1991). Recognising that a country's risk exposure may change over time, Harvey (1991) incorporates time-varying covariances between the country return and the world stock return. This notion of time-variation in risk exposure incorporated what was previously a glaring omission in asset pricing models, and would later be importantly extended in Bekaert and Harvey (1995), reviewed below. With respect to integration, Harvey (1991) implicitly tests for the joint hypothesis that the world CAPM with time-varying covariances holds and that markets are fully integrated. The time-varying covariances are shown to have limited predictive power, a finding that Harvey (1991, p. 111) attributes to "incomplete market integration, the existence of more than one source of risk, or some other misspecification." The approach followed by Harvey (1991) is extended in Ferson and Harvey (1993). The model used in the subsequent paper is more flexible in several ways: instead of the single index CAPM, a multiple-beta model is estimated; the assumption of perfect market integration is imposed on the model by making the risk premia depend solely on global risk factors; moreover, both the betas and the risk premia are allowed to vary over time. Ferson and Harvey (1993) find that their models are able to explain a significant proportion of the variation in asset returns, suggesting that the 18 developed markets studied are largely integrated.

A world latent factor model is the methodology employed by Campbell and Hamao (1992) in a study of long-term capital market integration between the United States and Japan. Using an unobservable benchmark portfolio, thereby removing some of the complications arising from an inappropriately specified benchmark, Campbell and Hamao (1992) find evidence of common movement in expected excess returns of the 1970s and interpret this as evidence of integration between the U.S. and Japanese markets. Bekaert and Hodrik (1992) use a similar approach but strongly reject the joint hypothesis using a single latent variable model on a dataset of four developed markets.

As is clearly evident from the studies sampled above, tests of perfect integration have provided at best inconclusive and, often, contradictory results. Nonetheless, the most problematic aspect of models in this category is their inability to deliver a graduated measure of integration. Since markets are generally accepted to be neither completely segmented nor completely integrated, the *extent* to which markets are integrated is probably the more relevant research question.

3.1.3 Towards a graduated measure of integration

Errunza and Losq (1985) provide the first useful step towards a graduated measure of integration. Acknowledging that markets were generally neither fully integrated nor segmented, they introduce a “mild segmentation” model that captured the intermediate stage in the “continuum of market structures”. Errunza and Losq (1985) test their model – a variation on Stehle (1977) – on a sample of nine emerging markets over a 4-year period and, perhaps unsurprisingly, find evidence not statistically inconsistent with the mild segmentation hypothesis. Errunza and Losq (1985) do, nevertheless, indicate some reservations about their results and strongly suggest that the study is repeated when data availability improves.

That suggestion is the subject of Errunza, Losq and Padmanabhan (1992). Using the theoretical framework of Errunza and Losq (1985), but with the more efficient maximum likelihood estimation procedure, Errunza, Losq and Padmanabhan (1992) investigate ten emerging markets over a 12-year sample period. There is strong

evidence to suggest a “non-polar” (i.e. neither completely segmented nor integrated) world market structure, consistent with the mild segmentation hypothesis.

Bekaert (1995) attempts to measure the direct effect of investment barriers on market integration and, in the process, develops a return-based integration methodology for a sample of 19 emerging markets. The correlation of expected returns in emerging markets with developed markets is used as a measure of integration; Bekaert (1995) points out that if markets are perfectly integrated then these expected returns would be perfectly correlated. Deviation from perfect correlation thus indicates partial segmentation but, importantly, the correlations offer a graduated measure of integration. A similar approach without the confounding problems of industry mix is used to measure the integration of African equity markets in Collins and Abrahamson (2003).

Arguably the most notable contribution to the literature of integration methodology is the work of Bekaert and Harvey (1995). In that paper, the importance of the mild segmentation model used in Errunza, Losq and Padmanabhan (1992) is stressed but Bekaert and Harvey (1995) point out that the methodology assumes that the degree of integration is fixed over time. Harvey (1991) found that covariances between local and world returns exhibited significant time-variation, suggesting that return-based integration methodologies should possibly also incorporate time-variation. Bekaert and Harvey (1995) therefore develop a measure of integration based on the explanatory power of a country's time-varying covariance with the world market relative to its time-varying variance (higher ratios indicate higher levels of integration). Graduated integration measures for 12 emerging markets are reported, exhibiting a wide range of integration/segmentation (Korea, for example, is almost entirely integrated whereas Colombia is largely segmented).

Several subsequent papers have followed the time-varying approach developed by Bekaert and Harvey (1995). Carrieri, Errunza and Hogan (2002), for instance, examine the extent of time variation in market integration for 8 emerging markets over a 14-year sample period. Bekaert, Harvey and Lumsdaine (2002) extend the theme of time-variation and postulate that many markets have moved from a

segmented to an integrated state over time. They therefore attempt to “date” the point of integration using a methodology to identify structural breaks.

There is an additional and voluminous body of literature (partially reviewed in chapters 4 and 5) where integration is measured in the context of either growth or contagion. In the main, methodologies used in these papers broadly reflect one of the methodologies reviewed above. There are, nonetheless, some inventive methods that are employed. For example, in a paper investigating emerging market closed-end funds, Bekaert and Urias (1996) measure integration by the extent to which an international investor would be willing to sacrifice expected return to gain exposure to emerging equity markets without any investment barriers. Willingness to forgo expected return is interpreted as indicative of at least partial market segmentation. A similar approach is followed by Domowitz, Glen and Madhavan (1997) who investigate share ownership restrictions. Their integration measure is the ratio of the prices of shares subject to restrictions to those shares that are unrestricted. Higher ratios imply lower integration.

3.1.4 Regional and global integration

There is an extensive body of literature, which is partially reviewed in this chapter and is revisited in subsequent chapters, on the subject of global integration. Separately, there is field of literature concerning regional integration. This literature is largely focused on trade and tariff reductions and their associated implications. Rather surprisingly, there does not appear to have been any concerted attempt to reconcile regional and global integration. In particular, the literature is silent on the relationship between regional and global integration or the direction of causality between these forms of integration. As indicated in section 1.2, if one is interested in exploring the process of integration, it would be useful to consider regional and global integration simultaneously and to analyse the relationship between them.

This lack of synthesis may be the result of the different approaches used to consider regional and global integration. There has been almost no attempt to “measure” regional integration directly from stock returns data, whereas global integration research is dominated by equity-related studies. In other words, regional integration

has been assessed within a framework of economic integration whereas global integration studies concentrate on financial integration. Regional and global integration have therefore been assessed using fundamentally different approaches, making comparisons difficult.

The apparent absence of literature on this subject presents a potentially new research opportunity. Nevertheless, consideration is now given to the relatively few instances where the process of integration is discussed or the relationship between global and regional integration is investigated.

Bekaert, Harvey and Ng (2003) lament that whilst global (financial) integration has been extensively investigated and measured, regional (financial) integration⁴ has been “scarcely discussed”. They therefore measure the regional integration of Europe, South-East Asia and Latin America as a pioneering contribution to the subject.

Although the claim of Bekaert, Harvey and Ng (2003) is correct, references to regional integration extend back as far as Cho, Eun and Senbet (1986). After rejecting the possibility of global integration, Cho et al. (1986) do suggest that the markets may be regionally integrated. Moreover, they cite a potential research opportunity to investigate whether different geographic areas exhibit regional, as opposed to global, integration – a suggestion that does not appear to have been pursued.

A few studies have obliquely acknowledged the notion of regional integration, either in their methodology or in the construction of their models. Engle and Susmel (1993), for instance, group international stock markets into three regions (North America, Far East and Europe) and test whether the regions share a common volatility process. They find tentative evidence to suggest volatility is generated regionally rather than globally. Cheung, He and Ng (1997) similarly investigate the predictability of returns in the Pacific, European and North American regions. They find strong evidence to suggest that there are common predictable components within these regions.

⁴ Henceforth, the term “integration” refers exclusively to financial integration.

Interestingly, North American instrumental variables are able to predict returns in the European and Pacific regions, although the authors do not find similar power in the ability of the other regions' instrumental variables to predict North American returns.

Phylaktis and Ravazzolo (2002) explore the relationship between economic and financial integration at the regional and global level. Although this thesis is primarily concerned with financial integration, the notion that economic integration should precede financial integration is probably closely related to the process of financial integration (as discussed above). Phylaktis and Ravazzolo (2002) concentrate their analysis on the Pacific Basin region and find not only a strong presence of regional integration, but also compelling evidence that financial integration is accompanied by economic integration. Although there is no explicit suggestion as to the relationship between regional and global integration, Phylaktis and Ravazzolo (2002) do find that regional integration was more pronounced than global integration in the 1990s. This could possibly imply that the process of integration begins regionally and expands globally.

The mechanics of regional integration are investigated in Dorrucchi, Firpo, Fratzscher and Mongelli (2002) where the interaction between institutional and regional integration is considered. Institutional integration (for example, the creation of a common market) is measured using a qualitative scorecard; regional integration is assessed according to seven different standards, including financial market integration. Dorrucchi et al. (2002) examine European regional integration but do not make any attempt to compare their results to global integration studies. Nevertheless, their results strongly suggest that institutional integration plays a central role in the regional integration process.

3.1.5 In response to the literature

The literature reviewed above presents an incomplete picture. It is not clear whether markets are generally segmented or integrated; there is even considerable disagreement about how to actually measure integration. Nonetheless, researchers seem to have reached consensus on a few points. Firstly, there is general agreement that most markets are neither fully integrated nor segmented, especially emerging

markets. In addition, the degree of integration appears to change over time. This is normally, but not exclusively (see Bekaert and Harvey, 1995), in the direction of segmentation to integration.

This chapter responds to the literature in the following ways. Firstly, the extent to which African equity markets are globally integrated is measured on a sector-by-sector basis. Then, in order to test the hypothesis that integration has increased over time in African markets, the methodology is repeated on two adjacent panels of data in order to capture any time-variation in this integration.

Secondly, in order to explore the process of integration, the methodology is repeated on a regional basis. Considering that most countries probably begin trading internationally by buying and selling from neighbouring countries, it may be argued that countries should be expected to integrate regionally before integrating globally. The hypothesis associated with the process of integration is therefore that integration first occurs regionally before extending globally. The test of the hypothesis will be to compare the integration measures between the regional and global tests over the same time period. If the global integration measures are consistently higher than the regional measures, the hypothesis will be rejected.

Finally, it may be argued that the advances in communication and the breakdown of international barriers over the last two decades could have altered the process of integration. Therefore, to establish whether the process of integration has changed over time, the entire methodology is repeated on a European dataset from the 1970s. The results of this test are then compared with the findings from the 1990s African dataset analysis.

3.2 Methodology

The approach used to measure integration in this thesis is similar to that cited in Bekaert (1995) and, more recently, Collins and Abrahamson (2003). There are nonetheless some minor departures from the methodologies used in those papers even though the basic tenets remain the same.

Bekaert (1995) develops an argument suggesting that if markets are perfectly integrated and share one common source of risk, then their expected returns will exhibit perfect correlation. Acknowledging the simplification and unlikelihood of a single source of risk, Bekaert (1995) claims that it would be equally improbable that returns of perfectly integrated markets would exhibit low correlations. Using a vector autoregressive (VAR) framework, Bekaert (1995) specifies a model that includes lagged local and foreign returns, dividend yields and interest rates to generate local and benchmark returns. These returns are then used to report local integration values using the correlation coefficient.

Two important caveats are emphasised. Bekaert (1995) firstly indicates that his methodology does not allow for time-variation in the integration measure and therefore implicitly assumes that integration remains constant for the sample period. In addition, the drawback associated with generating spurious results in the face of differing industry mixes between the local and benchmark market when using market level data (discussed earlier in section 2.2.1) is cited as a possible source of error.

3.2.1 Chosen estimation procedure

The methodology used to measure integration in this thesis is similarly based on the correlation coefficient between local and benchmark returns. As discussed in chapter 2, this study uses the U.K. as the benchmark and employs a sector index approach. The use of sector rather than market level data removes the problem of spurious results induced by differing industry mixes noted by Bekaert (1995).

Consistent with the approach employed in Bekaert (1995), a VAR framework comprising an equal number of local and benchmark factors is used to generate local and benchmark (fitted) returns. The fitted returns therefore represent responses to the local and international factors; the fitted returns of more integrated local markets will be predominantly derived from the international factors, and fitted returns for less integrated markets will rely primarily on the local factors. The correlation coefficient of the fitted local and benchmark returns is the integration measure.

The VAR specification is as follows:

$$X_t = \phi X_{t-1} + \theta Z_t + \varepsilon_t \quad (1)$$

$$X_t \equiv \{x_t^B, x_t^L\}' \quad (2)$$

$$Z_t \equiv \{dy_t^B, dy_t^L, i_t^B, i_t^L\}' \quad (3)$$

where x_t is the return of the benchmark (B) and local (L) markets respectively; X_t is a vector of log returns in the two stock markets; ϕ and θ are 2×2 and 2×4 matrices of coefficients respectively; and ε_t is a vector of disturbances. Z_t is a vector of exogenous variables that includes dy_t , the first difference of the dividend yield for the benchmark and local markets; and i_t , the first difference of the benchmark and local interest rate⁵.

The value of dividend yields and interest rates in predicting returns is well established and is reviewed in Campbell and Hamao (1992). Bekaert and Harvey (1995) suggest that returns in some emerging markets may be almost an entirely autoregressive process. Since the countries used in this study are all either classified as emerging or frontier markets, the importance of including lagged returns in the VAR should therefore not be underestimated.

The fitted local and benchmark return values generated from VAR equations (1) to (3) are used to formulate the integration measure, which is interpreted as the correlation coefficient between these two fitted series. Correlations closer to 1 are interpreted as higher levels of integration. Lower correlations are therefore indicative of more segmented markets. Once the integration measure has been generated, it is necessary to obtain a measure of the correlation coefficient's standard error for ranking purposes (discussed below). Consequently, rolling 12-month correlations between the local

⁵ Where possible, a Treasury bill rate was used. In cases where the Treasury bill rate was either unavailable or exhibited very little variation, the money market rate was used instead.

and U.K. fitted values are generated. The standard deviation of these rolling correlations is used as a measure of standard error for the integration measure.

3.2.2 Global versus regional integration methodology

Recall that the established aims of this chapter are: to obtain a measure of global integration for a sample of African markets; to investigate whether integration is changing over time in these markets; to gain insight into the process of integration by investigating the relationship between regional and global integration; and to establish whether this process has changed over the past two decades.

The first task is to measure the global integration of the African market sectors, which is done according to the methodology outlined in section 3.2.1. The analysis is performed over a time period extending from May 1999 to December 2002 using monthly data. The sectors are ranked according to integration, and the rank is based on the integration measure divided by its standard error. Ranks are then cross-sectionally aggregated across countries so that the most integrated sectors, on average, are placed towards the top of the results table.

As mentioned previously, Bekaert (1995) cites the inability of the methodology to capture time-variation in integration as a potential drawback. The period 1999–2002 used in this study is probably too short to expect significant integration changes within the period, particularly if one assumes that the integration process is gradual and incremental. Nonetheless, in order to address this potential shortcoming and also to investigate whether integration in African markets is changing over time, the analysis in this study is repeated on an earlier, adjacent time period (September 1995 to April 1999). The earlier integration measure is then compared to the later measure. Cases where the later measure is significantly higher than the earlier measure are interpreted as evidence of increasing integration over time. In order to evaluate significance (at the 5% level), the following *t*-statistic is used, where the integration measure (ρ) of the earlier period (subscript 1) is compared with the later period (subscript 2):

$$t = (\rho_2 - \rho_1) \sqrt{\frac{n_1 + n_2 - 4}{1 - (\rho_2 - \rho_1)^2}} \quad (4)$$

where $t_{(0.05, n_1 + n_2 - 4)}$.

Investigating the process of integration, as defined earlier in this chapter, essentially involves comparing the regional integration of a particular market to its global integration. Section 3.1.5 outlined the intuition behind the methodology: it would seem reasonable that countries should integrate regionally first and then globally. If the global integration, over a given period, is consistently higher than the regional integration, then the hypothesis predicted by theory is rejected.

The methodology for measuring the global integration of the African markets has been reviewed above. In order to measure regional integration, the same methodology is used but the choice of benchmark is changed. Ideally, this benchmark would be comprehensive African market series of sector indices. Unfortunately there is no such index available; in addition, to the extent that the local sector is present in the comprehensive sector, the integration results would be upwardly biased. Instead, South African sector indices are used as the benchmark series in the integration methodology described above. The choice of South Africa is predominantly driven by the acknowledgement that it is the largest market in Africa, and is therefore likely to have the greatest impact on regional markets. Cases where global integration is significantly greater than regional integration (evidence against the hypothesis) are highlighted, and significance is calculated using equation (4).

It should be noted that in this analysis, African markets are considered jointly to constitute one region. Although this may seem a plausible assumption, it is acknowledged that Egypt and Morocco would in certain contexts be considered to form part of the Middle-East region. The extent to which African markets should be considered to constitute a single region therefore remains a matter for debate.

Finally, in order to gauge whether the process of integration has changed over time, the analysis is repeated on a European dataset two decades earlier, i.e. May 1979 to December 1982. The European countries used in this analysis are Belgium, France,

Germany, Italy and the Netherlands. In this analysis, the United States is used as the benchmark for global integration and the United Kingdom as the regional benchmark (the U.K. was the largest market in the European region during the sample period).

3.3 Results

The results for this chapter are separated into those concerning the measurement of global integration, and those concerned with investigating the process of integration. It should be noted that the global integration results, presented in the section 3.3.1 below, are used as a basis for discussion in chapters 4 and 5 where the relationships between integration, growth and contagion are examined.

3.3.1 *The global integration of African markets*

The results of the global integration analysis, described in sections 3.2.1 and 3.2.2, are presented in Table 3 below. For each sector in each market, the integration measure is reported together with and its standard error (in parenthesis). Sectors are then ranked within each market (the most integrated sector receives a rank of 1). Ranks are then aggregated across the markets to produce an average ranking of sectors; the sectors that are on average more integrated therefore appear in the upper rows. Finally, sector integration measures within each market are combined, weighted by the sector's market capitalisation, to form a composite measure that is reported in the bottom row.

If one first considers the aggregate sector ranking, the results suggest that Information Technology, Non-cyclical Services and Cyclical Services are the most integrated sectors whilst Basic Industries, Cyclical Goods and Utilities are the least integrated. Unfortunately Information Technology is only represented in South Africa but in that country it receives the highest integration measure of any sector in any market in the analysis. This is not, however, a surprising finding. Information Technology is almost by definition a global industry, and this South African sector includes some dual listed companies (such as Dimension Data) that increase international ties. Moreover, the sample period, 1999–2002, includes the period of the “Tech Meltdown” in 2000, which saw the correction of tech-related share prices across the world.

Table 3: Ranking of integration* using sector indices (1999–2002)

Sector	Egypt		Kenya		Mauritius		Morocco		Namibia		South Africa		Zimbabwe	
	Integration (S.E.)	Sector Rank [†]	Integration (S.E.)	Sector Rank [†]	Integration (S.E.)	Sector Rank [†]	Integration (S.E.)	Sector Rank [†]	Integration (S.E.)	Sector Rank [†]	Integration (S.E.)	Sector Rank [†]	Integration (S.E.)	Sector Rank [†]
Information Technology	–	–	–	–	–	–	–	–	–	–	0.96 (0.04)	1	–	–
Non-cyclical Services	0.75 (0.14)	2	0.31 (0.27)	2	–	–	–	–	-0.10 (0.27)	6	0.73 (0.10)	3	0.16 (0.46)	2
Cyclical Services	0.20 (0.18)	4	0.72 (0.07)	1	0.37 (0.13)	1	0.42 (0.20)	2	0.50 (0.34)	3	0.61 (0.13)	5	-0.20 (0.36)	5
General Industrials	-0.05 (0.40)	6	-0.06 (0.42)	4	0.14 (0.24)	3	0.42 (0.18)	1	0.49 (0.20)	2	0.68 (0.13)	4	0.03 (0.35)	3
Financials	0.35 (0.21)	3	0.02 (0.29)	3	-0.03 (0.15)	4	0.17 (0.27)	6	0.66 (0.20)	1	0.61 (0.49)	9	0.26 (0.27)	1
Non-cyclical Goods	0.51 (0.10)	1	-0.10 (0.44)	6	0.22 (0.30)	3	0.56 (0.37)	3	-0.11 (0.26)	7	0.52 (0.23)	7	-0.11 (0.33)	4
Resources	–	–	-0.14 (0.35)	7	–	–	0.14 (0.18)	5	0.24 (0.16)	4	0.84 (0.05)	2	-0.64 (0.11)	8
Basic Industries	-0.15 (0.10)	8	-0.23 (0.24)	9	-0.26 (0.11)	5	0.22 (0.24)	4	0.40 (0.38)	5	0.76 (0.17)	6	-0.22 (0.19)	6
Cyclical Goods	0.08 (0.39)	5	-0.03 (0.17)	5	–	–	0.10 (0.25)	7	–	–	0.71 (0.32)	8	-0.33 (0.24)	7
Utilities	-0.07 (0.29)	7	-0.29 (0.33)	8	–	–	-0.18 (0.23)	8	–	–	–	–	–	–
Composite [‡]	0.30		-0.02		0.14		0.27		0.51		0.73		0.16	

– Not available.

* Integration is the correlation of fitted returns from a VAR with exogenous local and U.K. variables.

† Rank is based on the correlation of fitted returns divided by its standard error.

‡ Composite is a market capitalisation-weighted integration measure, combining all available sectors for each country.

According to the FTSE classification system, the Non-cyclical Services sector incorporates two main components: food and drug retailers, and telecommunication services (including mobile phone operators). In addition, where telecommunication shares are present, they tend to dominate the sector in African markets (e.g. MobiNil in Egypt, Econet Wireless in Zimbabwe, MTN in South Africa). On closer inspection, therefore, the Non-cyclical Services sector tends to be closely related to technology and was thus also a casualty in the “Tech Meltdown” of 2000. The synchronised crash of tech-related stocks in 2000 appears to have driven down the Non-cyclical Services sector in these African markets, resulting in a higher integration measure.

The Utilities sector, on the other hand, receives the lowest aggregate sector integration measure. Once again, this is a satisfactorily intuitive result when the profile of Utilities companies is considered. This sector, which is defined as comprising electricity, gas distribution and water companies, has a fundamentally local focus. Gas, for instance, is manufactured locally and then distributed to local companies (e.g. Egypt Gas in Egypt or Afriquia Gaz in Morocco). Theory would therefore suggest that this sector would have low levels of integration, which is consistent with these findings.

An intriguing finding is that of Financials, which appears to have a relatively average level of integration. Recall from Table 2 that Financials is the largest sector in African markets by a considerable margin. The notion, therefore, that the largest or most developed sectors are necessarily the most integrated does not appear to be substantiated by these results. In addition, although there are a few international companies in the Financials sector of various African markets, this sector is dominated by local financial institutions.

However, the importance of interest rates in this discussion should not be underestimated. The Financials sector tends to be strongly influenced by interest rate movements. As international interest rates become increasingly synchronised, it is plausible to suggest that African market interest rates are at least partially affected by international movements. Despite this international synchronisation, the effect seems

to be most dominant among developed countries, since African market interest rates continue to move relatively independently of international rates. This may suggest that African market interest rates are still in the process of integrating internationally (evidence that African market interest rates are beginning to show signs of increased synchronisation is revisited below, but it would be a spurious to suggest that they are wholly dependent on international rates).

Consequently, the general absence of foreign banks, combined with the importance of interest rates (set predominantly locally rather than internationally) in determining the fortunes of financial institutions, implies that the mediocre levels of integration in this sector appear reasonable.

With regard to the composite levels of integration for each market, the results strongly suggest that South Africa is the most integrated whilst Kenya is the least integrated. Namibia reports a remarkably high integration measure when one considers the newness of the market, but on closer inspection the result is to be expected. Namibia is totally dominated by South African shares, many of which are the larger, more international shares on the Johannesburg Stock Exchange (e.g. Barloworld is the only share representing General Industrials in Namibia). Namibia's relatively high integration results are therefore primarily driven by the presence of dual listed South African shares. In fact, in the sectors where there are very few or no South African shares (e.g. Non-cyclical Services or Non-cyclical Goods), integration levels are very low. If, for a moment, one excludes Namibia from the analysis, then South Africa, Egypt and Morocco are the three most integrated African markets in the sample. These three markets are the oldest and largest in Africa, possibly suggesting that the integration process is positively linked to the maturity and size of markets.

In addition, Egypt, Morocco and South Africa are also classified as "emerging" rather than "frontier" markets by the S&P/IFC Emerging Market Data Base (Kenya, Mauritius and Namibia all retain "frontier" status). International investors are likely to be aware of a market's classification, and a re-classification from "frontier" to "emerging" status by a prestigious rating agency sends a clear signal to investors that the market is developing positively. The extent to which African markets may attract

international capital is therefore influenced by how such rating agencies perceive market development. Increased international capital flows are likely to follow a positive re-rating, which would be a step towards increased integration. However, Zimbabwe has long been included in the S&P/IFC Emerging Markets Global Composite Index and yet remains less integrated than some “frontier” markets in the sample. This either suggests that the classification effect on international investors is relatively small, or alternatively that other factors such as political instability may be overriding the results.

Table 4 reports the comparative integration measures over two adjacent time periods, 1995–1999 and 1999–2002. Considered together, these measures provide an indication of how integration is changing over time. Instances where integration has increased significantly over time are reported in boldface. Sectors are then ranked according to the average number of significant increases in integration over time per sector. Unfortunately, some sectors represented in the 1999–2002 measurement of integration are not included in this analysis because of insufficient data availability for the earlier period (e.g. Non-cyclical Services in Egypt, Resources in Morocco). In addition, because Datastream reports no firm-level data for Mauritius before 1998, Mauritius has been entirely excluded from this analysis.

Considering the aggregate results, Information Technology and Financials experience the greatest number of increases in integration over time. As mentioned previously, the Information Technology sector in the 1999–2002 period experienced the “Tech Meltdown” of 2000, which affected tech stocks across the world with a downward revaluation. This “contagion” effect would have strengthened the integration measure over that period, so one would expect that integration would be higher in that period in comparison to the earlier period. In addition, the tech industry became increasingly global during the 1990s.

The high average ranking for Financials is particularly interesting. With the exception of Kenya, all integration measures for Financials increase over time (although the increase is not significant in South Africa). Recall from Table 3 that Financials is not especially integrated in comparison to other sectors in the later period. Nonetheless, it

Table 4: Changes in integration* over time

Sector	Egypt		Kenya		Morocco		Namibia		South Africa		Zimbabwe	
	1995–1999	1999–2002	1995–1999	1999–2002	1995–1999	1999–2002	1995–1999	1999–2002	1995–1999	1999–2002	1995–1999	1999–2002
Information Technology	–	–	–	–	–	–	–	–	0.60	0.96	–	–
Financials	0.05	0.35	0.48	0.02	-0.19	0.17	0.41	0.66	0.62	0.61	0.02	0.26
Cyclical Goods	-0.26	0.08	-0.09	-0.03	-0.22	0.10	–	–	0.35	0.71	0.29	-0.33
Non-cyclical Goods	0.02	0.51	0.30	-0.10	0.22	0.56	0.46	-0.11	0.51	0.52	0.51	-0.11
Cyclical Services	0.29	0.20	0.08	0.72	0.02	0.42	0.60	0.50	0.75	0.61	0.44	-0.20
General Industrials	-0.45	-0.05	-0.08	-0.06	0.18	0.42	0.59	0.49	0.68	0.68	0.48	0.03
Non-cyclical Services	–	–	0.31	0.31	–	–	-0.14	-0.10	0.38	0.73	–	–
Resources	–	–	-0.04	-0.14	–	–	-0.59	0.24	0.68	0.84	-0.11	-0.64
Basic Industries	0.02	-0.15	0.17	-0.23	-0.08	0.22	0.50	0.40	0.66	0.76	0.54	-0.22
Utilities	–	–	0.05	-0.29	–	–	–	–	–	–	–	–

Numbers in bold indicate integration increases significant at the 5% level.

– Not available.

* Integration is the correlation of fitted returns from a VAR with exogenous local and U.K variables.

Sectors Ranked by Average Number of Significant Increases

would appear that there is a strong movement towards increased integration in this sector; if this tendency continues, Financials may well be the most integrated African market sector in the future. The process of decomposing this phenomenon of increasing integration in Financials is complex, as there does not appear to be an obvious factor driving the increase. If one resumes the argument that the fortunes of the Financials sector are largely at the mercy of local interest rates, then it may be that local African interest rates are becoming increasingly synchronised with international (U.K.) interest rates. A few elementary calculations provide evidence suggesting that this may be the case. By simply measuring the unadjusted correlation of monthly changes in local and U.K. interest rates over the 1995–1999 and 1999–2002 periods, correlations in the later period are at least 15 percentage points higher in Morocco and Zimbabwe. It is perhaps not a coincidence that the Financials sector in these markets exhibits significant increases in integration over time.

If one examines the increases in integration on a country (as opposed to aggregate sector) basis, a few important patterns emerge. In particular, Egypt and Morocco have the most significant increases in integration over time (in fact, all Moroccan sectors exhibit significant increases). In South Africa, 7 out of 9 sectors either exhibit constant or increasing integration over time, although not all increases are significant. On the other hand, Kenya and Zimbabwe show very little evidence of increasing integration; if anything, it would seem that integration has decreased in these countries. Considering the political climate and the flight of foreign investment from Zimbabwe, the decline in integration is not surprising.

As a final comment, it would appear that there is an increasing trend of integration in African markets. Integration is either constant or increasing over time in 24 out of 44 (55%) comparative instances reported. Of those 24 increases, 17 (71%) are significant. Nonetheless, there are several instances of decreasing integration. Bekaert and Harvey (1995) find that certain markets do experience decreasing integration, although such a regression is uncommon. Given the political volatility in Zimbabwe during the later integration period, such large decreases in integration are most alarming.

3.3.2 The process of integration in African and European markets

Recall that in the context of this study, the process of integration refers to the possible relationship between regional and global integration. Two tables of results are reviewed in this section: one compares regional and global integration in African markets for the period 1999–2002, the other repeats the analysis on a European dataset for a period twenty years earlier, from 1979 to 1982. This is not to suggest that European countries were at exactly the same stage of development in the late 1970s as African countries were during the late 1990s. There are, nevertheless, some similarities. For instance, most European countries liberalised their capital markets in the 1970s following the removal of the Bretton Woods system of fixed exchange rates. Similarly, many African markets liberalised in the 1990s (e.g. Egypt, Mauritius, South Africa). To the extent that liberalisation is an important early step in the integration process, the comparison between European markets in the late 1970s and African markets in the 1990s is valid. Comparing the results from the early European analysis with the later African analysis then provides a basis for discussion on whether the process of integration has changed over time.

The results of African regional versus global integration are presented in Table 5. Instances where global integration significantly exceeds regional integration are reported in boldface. Sectors are ranked by the average number of significant exceedences, and the final row reports a composite market-capitalisation-weighted integration measure, combining all available sectors for each country. The last column reports the arithmetic mean of regional and global integration across all markets for each sector.

The first observation is that there are relatively few instances where global integration is significantly greater than regional integration. In fact, global integration only exceeds regional integration in one sixth of reported cases. But, if one considers the composite integration measures, it is evident that global integration is stronger than regional integration in Egypt, Morocco and – to a lesser extent – Mauritius. On the other hand, regional integration dominates in Kenya, Namibia and Zimbabwe. The average values for regional and global integration across all markets show that, in

Table 5: African regional vs global integration* (1999–2002)

Sector	Egypt		Kenya		Mauritius		Morocco		Namibia		Zimbabwe		Average‡	
	Regional	Global	Regional	Global	Regional	Global	Regional	Global	Regional	Global	Regional	Global	Regional	Global
Non-cyclical Services	0.42	0.75	0.10	0.31	–	–	–	–	0.43	-0.10	0.20	0.16	0.29	0.28
Cyclical Goods	-0.25	0.08	0.34	-0.03	–	–	-0.04	0.10	–	–	-0.07	-0.33	-0.01	-0.05
Financials	-0.10	0.35	0.07	0.02	-0.16	-0.03	0.05	0.17	0.96	0.66	0.36	0.26	0.20	0.24
Cyclical Services	0.09	0.20	-0.06	0.72	0.47	0.37	0.43	0.42	0.86	0.50	0.48	-0.20	0.38	0.37
General Industrials	0.32	-0.05	0.20	-0.06	0.22	0.14	0.24	0.42	0.81	0.49	0.09	0.03	0.31	0.16
Non-cyclical Goods	-0.22	0.51	0.20	-0.10	0.26	0.22	0.52	0.56	0.24	-0.11	0.01	-0.11	0.17	0.16
Basic Industries	-0.15	-0.15	-0.22	-0.23	-0.23	-0.26	0.38	0.22	0.77	0.40	0.10	-0.22	0.11	-0.04
Resources	–	–	0.03	-0.14	–	–	0.05	0.14	0.69	0.24	-0.63	-0.64	0.04	-0.10
Composite†	-0.02	0.30	0.08	-0.02	0.13	0.14	0.20	0.27	0.86	0.51	0.28	0.16	0.26	0.23

Numbers in **bold** indicate where global integration significantly exceeds regional integration. Tests are at the 5% level.

– Not available.

* Integration is the correlation of fitted returns from a VAR with exogenous local and foreign variables.

† Composite is a market capitalisation-weighted integration measure, combining all available sectors for each country.

‡ Average is the arithmetic mean of regional and global integration across all markets for each sector.

most cases, regional integration exceeds global integration, but only by a small margin (possible exceptions are General Industrials and Basic Industries). This finding is confirmed in the aggregated comparison across all markets and countries (bottom right cell), which shows that aggregated regional integration only exceeds global integration by 0.03.

When interpreting the results, it is important to recall that the issue is one of process. Intuitively, countries should first integrate regionally, and then globally. According to this hypothesis, countries (unless fully integrated) should always report higher levels of regional than global integration. If global integration is higher, then – it is supposed – there is some other factor at work. Possibly the new climate of globalisation and rapid advances in communication are breaking down barriers that allow countries in the early stages of the integration process to first integrate globally, and thus “bypass” the regional integration process. On the one hand, one could surmise that Egypt and Morocco provide evidence against the above-mentioned hypothesis. However, there are several factors that cast doubt on the conclusion that Egypt and Morocco have bypassed regional integration in favour of global integration. Central to this argument is the notion of what constitutes a region. As mentioned previously, it may be argued that Egypt and Morocco form – in the eyes of investors – part of the Middle-East region rather than the African region. Indeed, when one considers that regional integration of the African markets is measured relative to South Africa, it may even be suggested that Egypt and Morocco have more in common with the United Kingdom than South Africa. In other words, the results may be more a function of the methodology than one of the reality.

Countries that are geographically closer to South Africa seem to report stronger regional integration relative to global integration. This finding, which one might expect, is particularly prevalent in Namibia and Zimbabwe (although, as mentioned previously, Namibia contains so many South African shares that this finding is somewhat trivial). Interestingly, Kenya – perhaps an archetypal African country – reports higher regional than global integration.

A closer inspection of the average regional and global integration measures also reveals some interesting patterns. Firstly, as mentioned previously, there is little difference between the regional and global integration measures in most sectors. This suggests that in African markets, sectors are generally integrated regionally to the same extent that they are integrated globally. Consequently, for the average African market, global influences in, say, the Cyclical Services sector, are as likely to affect the local Cyclical Services sector as regional influences. Presumably the most significant influences will come from within the market, but as far as external influences are concerned, both regional and global movements appear to be relevant. Interestingly, exceptions to this pattern are in General Industrials and Basic Industries, where average regional integration exceeds global integration more significantly. Although these sectors share the commonality of being industrially driven, it is not clear why regional integration should necessarily dominate in these sectors.

A possible reason for this may stem from the choice of South Africa and the U.K. for regional and global benchmarks respectively. Whilst both choices may be the most appropriate, it cannot be ignored that characteristics peculiar to the benchmark (characteristics that are not representative of the region) could influence the results. This is perhaps especially relevant in South Africa, which has, for instance, a disproportionately large Resources sector in comparison to other African markets.

Nevertheless, these results suggest that even in this age of instant and affordable communication, African countries still largely appear to follow a traditional process of integration: first regionally, then globally. However, whilst regional integration may still outweigh global integration, it cannot be ignored that the difference is relatively minimal.

Finally, Table 6 reports the results of the European regional versus global integration results for the 1979–1982 period. As indicated in section 3.2.2, the United States was used as the benchmark for the global integration tests and the United Kingdom was used for regional integration. As in Table 5, composite regional and global integration measures are reported for each market in the bottom row, and average

Table 6: European regional vs global integration* (1979–1982)

Sector	Belgium		France		Germany		Italy		Netherlands		Average‡	
	Regional	Global	Regional	Global	Regional	Global	Regional	Global	Regional	Global	Regional	Global
Basic Industries	0.35	0.27	0.30	0.15	0.36	0.27	0.55	0.32	0.85	0.39	0.48	0.28
Cyclical Goods	–	–	0.39	0.40	0.21	0.30	-0.10	0.18	0.74	0.46	0.31	0.34
Cyclical Services	0.13	0.17	0.27	0.20	0.63	0.18	0.43	0.24	0.46	0.75	0.38	0.31
Financials	0.11	0.10	-0.09	-0.18	0.46	0.53	0.62	0.14	0.83	0.74	0.39	0.27
General Industrials	0.09	0.02	0.04	-0.06	0.32	0.20	0.46	0.33	0.26	0.29	0.23	0.16
Information Technology	–	–	-0.03	0.22	–	–	–	–	–	–	-0.03	0.22
Non-cyclical Goods	0.30	-0.07	0.42	-0.08	0.70	0.02	–	–	0.71	0.32	0.53	0.05
Non-cyclical Services	0.34	0.10	0.18	-0.37	0.46	0.21	0.79	0.19	0.32	0.37	0.42	0.10
Resources	–	–	0.59	0.61	–	–	–	–	0.95	0.86	0.77	0.74
Composite†	0.18	0.13	0.33	0.20	0.38	0.30	0.56	0.17	0.80	0.70	0.45	0.30

Numbers in **bold** indicate integration where global integration significantly exceeds regional integration. Tests are at the 5% level.

– Not available.

* Integration is the correlation of fitted returns from a VAR with exogenous local and foreign variables.

† Composite is a market capitalisation-weighted integration measure, combining all available sectors for each country.

‡ Average is the arithmetic mean of regional and global integration across all markets for each sector.

regional and global integration levels are reported for each sector in the final column. Sectors are presented in alphabetical order.

The results are unequivocal. Regional integration almost totally dominates global integration for this dataset, with only three reported instances where global integration is significantly higher than regional integration. If one considers the composite integration measures, it is clear that – in all cases – regional integration is higher than global integration. The aggregated regional and global integration measures across all markets and sectors (bottom right cell) suggest that regional integration exceeds global integration by 50%.

In some isolated sectors, global integration significantly outweighs regional integration. For instance, Information Technology in France indicates significantly higher global integration. But then, given the nature of Information Technology – already extensively discussed earlier in this chapter – it is not surprising that integration with the United States (which even in the early 1980s was undeniably the world leader in technology innovation) would be stronger than that with the United Kingdom.

The average sector results reveal that regional integration does not only exceed global integration when aggregated across all sectors, but in almost every sector as well. In most cases, average regional integration exceeds global integration by a considerable margin. The possible exceptions to this rule are Information Technology (discussed above), Cyclical Goods and Resources. Given the global nature of Resources (commodity prices are set internationally), it is probably not surprising that there should be little discrepancy between regional and global integration. Moreover, it should be highlighted that Resources reports much higher regional and global levels of integration than in any other sectors. This suggests that, whether considered regionally or globally, the Resources sector in European countries during the early 1980s was fundamentally international. Once again, it is also possible that country-specific elements inherent in the choice of regional and global benchmarks (U.K. and U.S. respectively) could be driving the results.

The composite market results show considerable disparity in the level of integration between markets. Belgium, for instance, has relatively low levels of regional and global integration, suggesting that the market was still largely influenced by local factors. On the other hand, the Netherlands reports very high levels of both regional and global integration. Consequently, it appears that while European countries in the early 1980s may have all exhibited higher average levels regional than global integration, their individual exposures to regional and global factors were considerably different.

Considering the African and European results together, one can conclude that the integration process may have changed to a degree, but it nevertheless continues to follow a predominantly traditional pattern. There may be more instances of higher global integration in Africa in the early 2000s than in Europe during the early 1980s, but in both cases regional integration dominates. If the process of integration is truly changing, it is happening at a very slow pace indeed.

4 INTEGRATION AND GROWTH

There is a vast literature related to integration and growth, which is partially due to several peripheral research questions that need to be simultaneously investigated when approaching this subject. However, the potential policy implications of this literature have ensured that the research maintains a practical focus. Policymakers in emerging economies remain particularly anxious about determining whether or not to pursue policies of liberalisation. Perhaps unsurprisingly, the literature fails to deliver an unambiguously safe course of action. Eichengreen and Leblang (2002) describe liberalisation as “neither plague nor panacea.”

Research investigating the growth effects of integration, broadly defined, can be coarsely split into those papers that support the notion that integration brings about growth, and those papers that refute this relationship. An early example may be found in Obstfeld (1994), which develops a model that links global diversification and growth. The focus remains largely theoretical although the empirical calibration supports the contention that global financial integration brings about welfare gains.

The wave of liberalisations in emerging markets in the late 1980s and early 1990s generated a new dataset and research opportunity. Consequently, there has been a proliferation of literature in this field since the late 1990s. There has also been considerable disagreement about whether the theoretical predictions are consistently borne out in practice. Furthermore, most studies concentrate on the effect of liberalisation or integration on the cost of capital, without checking whether the reduction in cost of capital ever trickles down to increases in real economic growth. Some of these concerns are addressed in section 4.1.2.

4.1 Review of integration and growth literature

As mentioned above, literature concerning integration and growth may be separated into those papers that provide evidence for and those that provide evidence against a relationship between integration and growth. This section reviews the literature using this distinction, and covers both indirect and direct methods.

4.1.1 Evidence for a relationship between integration and growth

Harvey (1995a) points out that the cost of capital in segmented markets will be higher than in integrated markets because investors will require compensation for bearing local, idiosyncratic risk. More formally, Stulz (1999) suggests that if markets are integrated internationally, then assuming a CAPM framework, their risk premia will depend on the covariances between the markets and the world market portfolio. Provided a market's variance of return is greater than its covariance with the world market portfolio, that market will experience a decline in cost of equity (and hence cost of capital) as it becomes internationally integrated. Stulz (1999) finds that this variance-covariance condition is satisfied for all 37 countries sampled over a ten-year period. In a study that explores the effects of stock market liberalisation, Henry (2000a) suggests that the decline in cost of capital cited by Stulz (1999) will lead to increased economic growth.

This indirect approach to measuring the relationship between integration and growth has several benefits. Apart from avoiding the complications of measuring the relationship between integration and growth directly, indirect procedures allow researchers to gain greater insight into the process. More importantly, this "staged" approach can potentially expose where the integration-growth relationship may break down.

Henry (2000a,b) claims that as the cost of capital falls, the hurdle rate for the acceptance of capital projects is lowered. This may transform previously unviable projects into viable ones, thus increasing investment and, ultimately, growth. However, in a recent paper, Henry (2003) points out that neoclassical theory predicts a temporary, rather than permanent, increase in investment following liberalisation. Empirical evidence of this temporary relationship is presented in Henry (2000b). Whether temporary or permanent, integration and growth are theoretically linked through the cost of capital. Specifically, a decline in the cost of capital is posited as generating growth opportunities.

Bekaert and Harvey (2000) investigate the effect of equity market liberalisation on several variables, including cost of capital, using a dataset of 20 emerging markets.

Changes in cost of capital are measured using dividend yields, an approach that had not been previously used in this literature. Bekaert and Harvey (2000) find that the cost of capital decreases significantly, although the decrease is rather small.

Henry (2000a) uses an event study approach to see the impact of equity market liberalisation on cost of equity, controlling for a number of potentially confounding factors. Henry (2000a) finds that abnormal returns of 3.3% per month are experienced in the months leading up to the initial stock market liberalisation, consistent with the claim that cost of equity falls over this period. Similarly, Errunza and Miller (1998) investigate the effect of ADR introductions on the cost of equity capital at the firm level. Two methodologies are used to investigate changes in the cost of equity: an abnormal returns-based measure (analogous to Henry, 2000a) and changes in dividend yields (as in Bekaert and Harvey, 2000). The findings of Errunza and Miller (1998) are consistent with Bekaert and Harvey (2000) and Henry (2000a), suggesting that market level analyses may yield similar results to firm level studies.

The relationship between cost of capital and growth is the subject of Henry (2000b). The effect of equity market liberalisations on growth rates in investment is found to be significant: mean growth rates of investment in the three years following liberalisation exceed their previous levels by some 22 percentage points. Henry (2003) responds to the sceptics (e.g. Stiglitz, 2000) by investigating the cost of capital and growth effects of stock market liberalisation simultaneously. Cost of equity changes are measured using the dividend yield approach similar to Bekaert and Harvey (2000). Henry (2003) finds that the aggregate dividend yield falls by 240 basis points and that both the growth rate of capital stock and the growth rate of output per worker increase. Henry (2003) concludes that capital account liberalisation clearly offers benefits.

De Gregorio (1999) investigates the role of financial development in the relationship between integration and growth. The relationship between integration and financial development is analysed first and De Gregorio (1999) finds that integration and financial development are positively associated using a range of integration and financial development indicators. The relationship between financial development

and growth is then established, a result that concurs with the findings of Rajan and Zingales (1998). Nevertheless, De Gregorio (1999) finds that there is little relationship between integration and growth other than that through financial development. De Gregorio (1999) concludes that integration can only have a positive influence on economic growth if there is a sufficient level of financial development present.

The simultaneous effects of an increase in foreign portfolio investments following financial liberalisation are investigated by Errunza (2001). Responding to the sceptics that were so vociferous following the Asian crisis, Errunza (2001) finds that liberalisation is followed by higher levels of integration, a decline in the cost of capital, an increase in financial market development and an increase in economic growth. However, Errunza (2001) does not include controlling variables in his analysis, nor is any causality inferred.

Finally, Levine (2001) also finds evidence suggesting that international financial integration spurs financial development. Liberalisations are shown to increase stock market liquidity that, in turn, raises productivity growth thus increasing economic growth. In addition, by encouraging foreign banks to participate in the local market, liberalisations promote efficiency in the local financial system. Similarly, this increases economic growth through raising productivity growth. Levine (2001) thus concludes that integration can have a positive effect on economic growth by promoting financial development.

As is evident from the literature reviewed above, many studies approach the relationship between integration and growth indirectly. Moreover, the indirect approach that appears to have been preferred by most researchers involves measuring the effect of integration on the cost of capital. Nonetheless, it is possible to measure the relationship between integration and growth directly, although there are many difficulties associated with this approach. Literature that uses this direct approach is reviewed below.

In comparison to the volume of literature concerned with measuring the relationship between integration and growth indirectly, there is relatively little empirical support for a direct relationship. Most researchers seem to have preferred to decompose the complex process of integration into sub-processes and have separately tested for relationships between these sub-processes, i.e. have used an indirect methodology. On the one hand, this approach allows for a greater understanding into the mechanics of the integration and growth relationship, as mentioned previously. On the other hand, there is considerable difficulty associated with directly measuring the relationship between integration and growth. Apart from the previously discussed complications associated with the measurement of integration, measures of economic growth are dependent on countless factors. The benefits of integration, unless overwhelming, may be difficult if not impossible to isolate in such an aggregated measure.

Bekaert, Harvey and Lundblad (2001) directly investigate the effects of financial liberalisations on economic growth for a dataset of 30 emerging markets. They find a positive relationship suggesting that liberalisations are associated with higher levels of real growth of about 1% per annum. Recognising the numerous factors that can affect GDP, Bekaert et al. (2001) perform substantial tests of robustness, controlling for the macroeconomic environment, banking development and stock market development, amongst others. The liberalisation-growth relationship remains consistently strong, although there is evidence that countries with higher levels of education benefit more from the liberalisation process.

In a subsequent and more comprehensive paper, Bekaert, Harvey and Lundblad (2003b) revisit the liberalisation-growth relationship. This paper differs from Bekaert et al. (2001) in several ways. Firstly, they employ a much larger dataset of developed and developing markets. In addition, they employ many additional tests of robustness (for example, alternative liberalisation dates, regional indicator variables and business cycle effects). Bekaert et al. (2003) find, once again, that liberalisation is associated with an increase in annual per capita GDP growth of approximately 1%. They also find evidence to suggest that countries with higher levels of financial development experience a relatively lower increase in growth following financial liberalisation.

The direct relationship between integration and growth is not always shown to be unambiguously positive. Chari and Henry (2002) investigate the effects of liberalisation on the growth rate of capital stock⁶ for a typical firm. They contrast two schools of thought – “allocative efficiency” (liberalisation brings positive benefits) and “animal spirits” (liberalisation has no real effect). Although Chari and Henry (2002) find significant evidence to suggest that the growth rate of capital stock increases significantly following the liberalisation event, there is doubt as to whether this effect is distributed equally among firms. This concern is revisited below in Das and Mohapatra (2003). In a paper not related to liberalisation or integration, Rajan and Zingales (1998) consider the effects of financial development on economic growth, and find a positive relationship. Vlachos and Waldenström (2002) borrow from and extend this methodology to investigate whether countries that experience faster growth also have liberalised capital accounts, equity markets and integrated global capital markets. They find that growth in value-added is not significantly related to liberalisation, but that growth in production and the number of establishments (new firms) is significantly related to liberalisation. However, this latter effect is only true in countries that have attained a fairly high level of financial development, a finding that conflicts with Bekaert et al. (2003).

Bekaert, Harvey and Lumsdaine (2002) introduce a methodology for dating the integration of world equity markets. Apart from the complexity of their econometric contribution, the approach makes a clear distinction between the liberalisation and integration of equity markets (they find, for instance, that integration dates are usually after official liberalisation dates). Having then generated dates of integration for each of the markets, Bekaert et al. (2002) investigate the association between integration and several factors, including real economic growth. Unlike Levine and Zervos (1998b), reviewed below, Bekaert et al. (2002) find that integration is associated with increased economic growth ranging from about 2% to 8%. This result is far stronger than Bekaert et al. (2001, 2003), but there are no control variables included in this specification.

⁶ Although this is not a measure of GDP growth, it is included in this section because an increase in the growth rate of capital stock will have a direct positive effect on GDP growth.

4.1.2 Evidence against a relationship between integration and growth

Literature offering evidence against a relationship between integration and growth may be separated into those studies that are primarily concerned with policy implications, and those that are not. The latter literature is reviewed first.

In a paper predominantly concerned with measuring whether financial development and growth are associated, Levine and Zervos (1998b) also consider whether integration is associated with higher levels of economic growth. Although they do find a relationship between financial development and growth, they find no such relationship between integration and growth. Integration is measured using the ICAPM and IAPT approaches as discussed in section 3.1.2. Interestingly, Henry (2000b) later suggests that this negative result may be due to a temporary, rather than permanent, relationship between liberalisation and growth. Levine and Zervos (1998b) effectively test for a permanent relationship, which Henry (2000b) claims is not actually predicted by the theory.

A recent contribution by Edison, Levine, Ricci and Sløk (2002) provides a rare and direct test of whether international financial integration and economic growth are positively related. Integration is assessed according to a variety of measures, and several control variables are included in their regressions. Edison et al. (2002) employ three different econometric methodologies for robustness and use a dataset of 57 countries over a period of 20-25 years. They do not find evidence that international financial integration accelerates economic growth. Edison et al. (2002) are, nevertheless, quick to point out that their results do not imply that openness is mutually exclusive from economic success. On the contrary, they suggest that “successful countries are generally open economies” and provide evidence to suggest that integration is positively associated with several variables including stock market development.

Edison and Warnock (2003) and Klein (2003) suggest that openness and growth are not necessarily related; rather, their results are sensitive to the degree of openness and the income distribution of countries respectively. Edison and Warnock (2003) find that following liberalisation the cost of capital decreases substantially; in fact, their

results suggest that this decline is more significant than in previous studies. However, they also find that if the liberalisation is not complete but only “partial”, the cost of capital actually increases. One possible conclusion of this research is that the damaging effects that are attributed to liberalisations are not in fact the fault of the policymakers who choose to liberalise, but rather the practitioners who fail to provide a comprehensive liberalisation implementation. In a similar vein, Klein (2003) finds that the relationship between growth and income per capita following liberalisation exhibits an inverted-U relationship. In other words, middle-income countries experience significant positive growth following liberalisation, but low- and high-income countries show no significant relationship. Klein (2003) even finds evidence that for low-income countries, a significant negative relationship between capital account openness and growth may exist.

In a recent paper, Das and Mohapatra (2003) investigate the controversial question of whether increased economic growth necessarily implies increased economic welfare in the context of liberalisations. Although Das and Mohapatra (2003) find that the post-liberalisation level of income exceeds the pre-liberalisation level in most countries studied, they question the distribution of these additional flows. They find that the middle class⁷ suffers at the expense of the highest income quintile, a most disturbing finding. Interestingly, incomes in the lowest income quintile appear to be largely unaffected by the liberalisation process. Agénor and Aizenman (1999) also find that integration may have welfare reducing effects if the foreign interest rates facing the liberalising country are volatile. However, there is no attempt to measure these effects on income distribution.

In a paper principally concerned with the policy implications arising out of a poor relationship between integration and growth, Stiglitz (2000) presents arguments against the case for capital market liberalisation. Drawing on the evidence of destruction in the wake of the financial crises of the 1990s, Stiglitz (2000) shows why liberalisation is destined to bring about instability rather than growth. Stiglitz (2000) argues that firms are unlikely to be interested in committing long-term resources to

⁷ Das and Mohapatra (2003, p. 245) define the middle class as the “aggregate sum of the three middle quintiles”.

projects on the basis of short-term flows (although the benefits of foreign direct investment are not questioned). Instead, Stiglitz (2000) insists that interventionist policies such as capital controls are not only appropriate but also essential.

Similarly, Rodrik (1998) and Bhagwati (1998) stress the difference between current and capital account convertibility and claim that capital account liberalisation is an entirely inappropriate course of action in the current financial climate. Although Rodrik (1998) admits that capital controls are not without their faults, he asserts that capital account liberalisation “fits the bill even less”.

This claim is put to the test in Eichengreen and Leblang (2002) where the relationship between capital controls and growth is investigated over a period of 117 years. Their preliminary finding is striking: the presence of capital controls is positively related to growth. In other words, countries that had capital controls experienced superior rates of growth than those that did not. On closer examination, Eichengreen and Leblang (2002) point out that this result is primarily driven by the unstable interwar period. They consequently conclude, uncontroversially, that capital controls have a positive effect on growth during crises, but a negative effect when crises are absent.

Eichengreen (2001) provides a comprehensive summary of the liberalisation versus capital controls literature. The conclusion reached is similar to that of this literature review: empirical evidence fails to provide clear and unambiguous guidelines for countries considering the liberalisation of their capital account. On the one hand, the theoretical relationship between integration and growth is compelling and is, to an extent, supported by various direct and indirect studies. On the other hand, many developing countries that liberalised their markets in the late 1980s and early 1990s were severely damaged by the financial crises of the mid- to late-1990s. Eichengreen (2001) suggests that the dangers of premature liberalisation are now so pervasive as to be common knowledge. Nonetheless Eichengreen (2001), who describes the lack of empirical clarity as “worrisome indeed”, proposes that the problem has been the macroeconomic foundations of the literature. What is required, he asserts, is more firm-level evidence based on a microeconomic foundation.

4.1.3 In response to the literature

This chapter is partially motivated by the challenge of Eichengreen (2001). Rather than providing a market level analysis, the relationship between integration and growth is investigated at a sector level in a sample of African markets. The hypothesis is that certain sectors are more receptive to the benefits of integration than others. Such a finding may expose interesting trends and may lead to important conclusions, particularly when considering the capital raising possibilities of certain sectors.

Establishing which sectors exhibit a stronger relationship between integration and growth will provide valuable insight, especially if this finding is robust across markets. However, a weak or inconsistent relationship could be equally revealing if, for instance, sectors report increases in either integration or growth, but not both simultaneously.

For instance, sectors that experience increases in integration but fail to produce increases in growth are unlikely to derive considerable benefit from the integration process. In particular, such a finding could possibly indicate that the sector is dominated by a few large firms, making it almost impossible for potential newcomers to raise the necessary capital to be competitive. On the other hand, if growth effects are found to be present in sectors that have not reported ostensible increases in integration, then either there are factors other than integration at work or a reverse causality (i.e. increased growth leads to increased integration) may be present.

Given that the indirect approach to measuring the relationship between integration and growth has been more comprehensively explored and established in the literature, this study adopts an indirect methodology that compares changes in integration with changes in cost of equity. The details of this methodology, as well as literature relevant to cost of equity, are presented below.

4.2 Methodology

The methodology used in this chapter follows an indirect approach to measuring the relationship between integration and growth. Integration measures from the previous

chapter are used in the analysis, and cost of equity measures are developed below. As before, the analysis is performed at the sector level.

It should be emphasised that causality cannot be firmly established using the methodology developed in this section. Whilst *a priori* knowledge and theoretical relationships may lead one to suspect a causal relationship (for instance, that increased integration leads to increased growth) the approach used in this section can only prove association.

The principal difficulties associated with this indirect approach are that it (i) requires a number of assumptions, and that it (ii) requires that integration and cost of equity are measured accurately. The main assumptions (these are discussed in more detail in section 4.2.3) rest on the theoretical relationship suggesting that an increase in integration leads to a decline in the cost of equity (because the opportunity sets of firms increases as markets are opened to international competition). This leads to a decline in firms' cost of capital, which, it is assumed, lowers the hurdle rate for accepting capital projects. Such increased investment stimulates the economy and reduces unemployment, which ultimately leads to increased growth.

The accuracy of the integration measure has already been addressed in chapter 3 and is not revisited here except to draw attention to the fact that it, too, is an indirect measure⁸. But perhaps the most significant challenge is the measurement of cost of equity. Estrada (2000) points out that the commonly used international version of the Capital Asset Pricing Model (CAPM), which uses beta as its source of risk, implicitly assumes that markets are fully integrated. Collins (2003) draws attention to the fact that most African markets are either developing or frontier markets, and are thus unlikely to meet the requirement of full integration. Evidence from chapter 3 confirms this contention. For these reasons, a brief review of the literature concerned with measuring the cost of equity is presented below.

⁸ A more direct integration measure would incorporate capital flow data, which is perhaps the clearest indicator of integration. However, it is difficult to decompose this data into its constituents and practically impossible to decompose the data into sectors.

4.2.1 Measuring the cost of equity

Traditionally, the cost of equity has been measured using a CAPM-based required return measure, according to the following equation:

$$RR_i = R_f + \beta_i(R_w - R_f) \quad (5)$$

where RR_i is the required return (cost of equity) for country i , R_f is the risk-free rate, β_i is the measure of systematic risk for country i and R_w is the return on the world market portfolio.

However, there are a number of shortcomings with this approach, most of which are associated with the use of systematic risk (measured by beta) as the measure of risk. Harvey (1995a) finds that these problems are particularly exacerbated in a sample of 20 emerging markets. Over a substantial sample period (1979–1992) only seven of the emerging markets have betas significantly different from zero and only one market has a beta greater than 1. Consequently, required returns are unacceptably low. This represents a departure from the developed market findings where all betas are significant and generate acceptable required returns. In a related study, Harvey (1995b) finds that betas of emerging markets fail to explain any cross-sectional variation in expected returns in a single-factor model framework.

Various alternative approaches have been suggested to measure the cost of equity (see Estrada, 2000 for a review of this literature). Bekaert, Harvey and Lundblad (2003b) argue that because the level of integration is changing over time, and because integration represents a structural break, asset-pricing approaches to measuring cost of equity will generate spurious results. One solution, proposed by Bekaert and Harvey (1995), is to use a time-varying approach whereby the cost of equity changes over time. However, the complexity of this approach makes it rather unattractive, particularly for practitioners. Another possibility is to use country credit ratings as a predictor of costs of equity, but these measures are subjective and are only applicable at the market level. It is also not possible to use this approach to measure firm-specific, or even sector-specific, costs of equity.

A recent approach (see Bekaert and Harvey, 2000; Bekaert, Harvey and Lundblad, 2003b; Errunza and Miller, 1998; Henry, 2003) uses dividend yields as a basis for measuring cost of equity. The standard Gordon model implies:

$$\frac{D}{P} = RR_i - g \quad (6)$$

where the left-hand side of the equation represents the prospective dividend yield, RR_i is as defined previously, and g is the expected growth rate of dividends.

If the growth rate of dividends is assumed constant, then changes in dividend yields measure the change in the cost of equity. This is a non-trivial assumption, especially when one considers that liberalisations are often accompanied by macroeconomic reforms that may well affect growth rates (Henry, 2003). Companies may also revise their payout ratios, which would also change the growth rate of dividends. However, proponents of this approach argue that this change is relatively small in comparison to the adjustment in cost of equity.

Finally, Estrada (2000) and Harvey (2000) consider several different risk factors to investigate which command the most explanatory power. An important component of these papers is the inclusion of measures that capture “downside” risk. Estrada (2000) uses a CAPM-based model to measure cost of equity, and the methodology is thus subject to the criticism of Bekaert, Harvey and Lundblad (2003b), mentioned above. However, Estrada (2000) argues that a simple model that measures cost of equity in emerging markets with acceptable levels of accuracy is most desirable, despite any theoretical shortcomings. Estrada (2000) finds that semistandard deviation of returns is the most appropriate measure of risk to calculate the cost of equity in a sample of 28 emerging markets. Collins (2003) performs a similar analysis at the market level on a dataset that includes 11 African markets but reports inconclusive results.

There are several other methodologies that have been omitted in this brief review; those that have been profiled each have their own advantages and disadvantages.

When measuring changes in the cost of equity, perhaps the most sensible (and robust) approach is to use a number of techniques. Consequently, several different cost of equity measures are employed in this section, based on the measures adopted by Estrada (2000) and Collins (2003). These measures are reviewed below.

4.2.2 Cost of equity measures used for analysis

Most cost of equity measures used in this chapter are based on a CAPM-type structure. Specifically, the cost of equity is decomposed into two components: a risk-free rate and an equity risk premium. In each case, the equity risk premium comprises the world market risk premium multiplied by a risk measure, calculated in different ways (outlined below). The cost of equity measure may thus be summarised as follows:

$$CE_i = R_f + RM_i(RP_w) \quad (7)$$

where CE represents the cost of equity, R_f is the international risk-free rate, RM_i is the risk measure, RP_w is the world market risk premium and i indexes market sectors.

This study adopts the perspective of an international investor based in the United Kingdom when calculating the cost of equity in a specified African market sector. Consequently, the risk-free rate is taken to be the rate prevailing on U.K. Treasury bills at the end of the sample period. The world market risk premium is taken to be 6%, as used in Karolyi and Stulz (2002).

Five different risk measures are used to generate costs of equity. The choice of risk measures was motivated by recommendations made in Estrada (2000) and Collins (2003). Estrada (2000) emphasises the importance of downside risk measures, and Collins (2003) finds that a size risk measure produces the most intuitive results in a market-level analysis of African markets. Specifically, the risk measures used in this study are standard deviation (total risk), beta (systematic risk), semi-standard deviation with respect to mean (downside risk), downside beta (downside risk) and

log of average market capitalisation (size). These measures are each briefly explained below.

Standard deviation (total risk)

Standard deviation is regarded as a measure of total risk as it incorporates both systematic risk (market-related risk that is undiversifiable) and non-systematic risk (company- or industry-specific risk that is diversifiable). Moreover, as it is a symmetrical measure, upside and downside risk are given equal attention. Consequently, cost of equity based on standard deviation provides what may be considered to be an upper bound measure. The relevant equation is therefore:

$$CE_{TR,i} = R_f + \left(\frac{\sigma_i}{\sigma_w} \right) (RP_w) \quad (8)$$

where σ_i is the standard deviation of the African market sector and σ_w is the standard deviation of the world market, represented by the MSCI World Index.

Beta (systematic risk)

The CAPM, first published by Sharpe (1964), uses beta – a measure of systematic risk – as its risk measure. This has since become the most commonly used model for asset pricing and, despite its many shortcomings, retains prominence on most trading floors today. Beta is estimated from historical data according to the following equation:

$$R_{i,t} = \gamma_i + \beta_i (R_{m,t}) + v_{i,t} \quad (9)$$

where $R_{i,t}$ is the return on asset (or, in this study, sector) i at time t , $R_{m,t}$ is the return on the world market at t , γ_i and β_i are the unknown constant and coefficient, respectively, and $v_{i,t}$ is the residual.

Once the beta coefficient has been determined, the cost of equity equation using systematic risk as its risk measure is:

$$CE_{SR,i} = R_f + \left(\frac{\beta_i}{\beta_w} \right) (RP_w) \quad (10)$$

Note that since $\beta_w = 1$ (the sensitivity of the market to itself is 1), equation (10) reduces to the CAPM of Sharpe (1964) as reported in equation (5).

Semi-standard deviation with respect to the mean (downside risk)

The notion of downside risk indicates a recognition that investors are not necessarily averse to risk, but rather to the more specific risk of loss. In fact, upside risk may, under certain circumstances, be considered desirable. Consequently, it is argued, risk measures should aim exclusively to capture downside risk – the risk of loss, however defined – in cost of equity calculations.

Semi-standard deviation with respect to the mean (henceforth “semi-deviation”) measures the standard deviation of returns falling below the arithmetic mean of all returns in the sample period. Semi-deviation is therefore calculated as follows:

$$\Sigma_{\mu} = \sqrt{\frac{1}{T} \sum_{t=1}^T (R_t - \mu)^2} \quad \text{for all } R_t < \mu \quad (11)$$

where T is the sample size, R_t is the return, μ is the arithmetic mean of returns in the sample period, and t indexes time.

The cost of equity equation using semi-deviation as a measure for downside risk is:

$$CE_{DR,i} = R_f + \left(\frac{\Sigma_{\mu,i}}{\Sigma_{\mu,w}} \right) (RP_w) \quad (12)$$

where $\Sigma_{\mu,i}$ is the semi-deviation with respect to the mean for each market sector, indexed by i , and $\Sigma_{\mu,w}$ is the semi-deviation with respect to the mean for the world market (MSCI World index).

Downside beta (downside risk)

Semi-deviation is effectively a downside risk version of standard deviation. Downside beta is, similarly, a downside risk version of beta. Its method of calculation involves isolating instances when both the local and the world index simultaneously decline. These instances are then used to generate two new “downside” series, and beta is calculated for these series, as according to equation (9). That beta is given the title “downside beta”. In accordance with Collins (2003), the cost of equity equation using downside beta is thus:

$$CE_{\beta^D, i} = R_f + \left(|\beta_i^D| \right) (RP_w) \quad (13)$$

where β_i^D represents the downside beta measure for the African market sector i .

Log of average market capitalisation (size)

The intuition behind this risk measure is that larger markets are typically older and hence more mature. In particular, larger markets are assumed to be less volatile and thus less risky. This measure captures this “size effect” by using the log of each sector’s average market capitalisation over the sample period. Since larger sectors are deemed to be less risky, the inverse of the log is used:

$$CE_{SZ, i} = R_f + \left(\frac{1}{\ln(\overline{mktcap}_i)} \right) (RP_w) \quad (14)$$

where \overline{mktcap}_i is the average market capitalisation for African market sector i .

4.2.3 Test design

The aim of this chapter is to cast light on the potential relationship between integration and growth, where changes in cost of equity are used to provide an indication of the first stage for changes in sector growth. Importantly, therefore, it is not the level but rather the change in costs of equity that is of interest. Whereas

previous papers (Estrada, 2000; Harvey, 2000; Collins, 2002) are concerned with measuring the cost of equity, the focus of this section is rather measuring the change in cost of equity. Nonetheless, cost of equity levels calculated over 1999–2002 are presented in section 4.3.1 for brief analysis.

In order to measure the change in cost of equity, it is necessary to measure its level on two adjacent, non-overlapping time periods. Since the ultimate goal is to compare the cost of equity changes with changes in integration, the time periods used in chapter 3 are also appropriate for this analysis. Consequently, the “early” time period is 1995–1999 and the “late” period is 1999–2002; in both cases, a monthly frequency is used. The risk-free rate for the early period (taken as the rate prevailing on U.K. Treasury bills at the end of the period) is 4.90% and, for the late period, 3.84%.

The presentation of findings requires some explanation. Recall that, for each sector within each market, five costs of equity are generated for each period. Given that six markets are considered and that there are on average 7 sectors per market, there are thus over 200 different costs of equity measured and over 100 calculated changes in cost of equity. In order to distil the findings into a more manageable format, some aggregation is necessary.

Changes in cost of equity are calculated by taking the percentage change over the two periods, rather than, for instance, the difference. This is because some risk measures (e.g. total risk) generate much larger costs of equity than others (e.g. size). This is relevant because the arithmetic mean of changes across the five costs of equity is then calculated for each sector within each market. Consequently, costs of equity that are larger by virtue of their risk measure alone (and which, therefore, may report relatively large differences across time periods) do not dominate smaller costs of equity if their *percentage* change is the same over time. For each mean percentage change in cost of equity, the standard error (measured by standard deviation) across the different cost of equity measures is also reported.

The percentage change in cost of equity within each sector is then compared to the change in integration over time. Recall that the theoretical relationship between

integration and cost of equity suggests that a decrease in cost of equity (i.e. negative percentage change) is consistent with an increase in integration (i.e. positive change).

As a test of robustness, the analysis is repeated using a methodology based on changes in dividend yields. Recall from equation (6) that if one assumes the growth rate of dividends remains constant, then a change in dividend yield represents a change in cost of equity. Changes in integration are once again compared to changes in costs of equity using this methodology.

Finally, changes in costs of equity are compared to levels of integration prevailing in the later period. The hypothesis behind this test is that more integrated sectors may be in a better position to take advantage of the benefits associated with integration and may, thus, report larger cost of equity declines.

4.3 Results

The stated aim of this chapter is to measure the relationship between integration and growth indirectly by observing changes in integration and changes in cost of equity over time. However, before that relationship is investigated, the cost of equity results are first reviewed separately.

4.3.1 Cost of equity levels

Whilst changes, not levels, in cost of equity are required in the indirect measurement of the integration and growth relationship, it is nevertheless instructive to consider cost of equity levels before proceeding. Collins (2003) investigates cost of equity levels for 59 developed and emerging markets, including a sample of 11 African markets. Two aspects of that paper are particularly relevant to this thesis: firstly, Collins (2003) measures cost of equity at the market level and, secondly, South Africa does not report the lowest cost of equity as one might expect. On the other hand, cost of equity levels in Morocco and Kenya are relatively low.

Cost of equity levels for this study are presented in Table 7. Each cost of equity measure is the average of the five measures outlined in section 4.2.2. Sectors are ranked within each market, so that the lowest cost of equity receives a rank of 1.

Sectors are ranked across markets by average cost of equity levels and the final row presents a composite market capitalisation-weighted cost of equity measure for each country. Recall that the measures are calculated from the perspective of an international U.K.-based investor. Consequently, the risk-free rate used in the calculations is 3.84%, the rate prevailing on U.K. Treasury bills at the end of the period (1999–2002). As mentioned in section 4.2.2, the world market risk premium is estimated to be 6% for calculation purposes.

The cost of equity levels range from 5.69% (Financials in Morocco) to 16.46% (Basic Industries in Zimbabwe), with most levels averaging about 10%. This is a rather low average, although consistent with the findings of Collins (2003). It is possible, therefore, that this methodology (or the use of particular risk measures in the average⁹) underestimates the true cost of equity level. The composite measures reveal that Egypt, Kenya and Morocco have the lowest average cost of equity levels. Once again, this finding corroborates market level evidence presented in Collins (2003). However, the main contribution of this analysis is the insight gained at the sector level.

Returning to the results of Egypt, Kenya and Morocco, the sector insight suggests that the low composite cost of equity levels in these markets are predominantly driven by the Non-cyclical Goods, Financials and Basic Industries sectors. In fact, across all markets, these three sectors report the lowest average levels for cost of equity. Considering the average market capitalisation of these sectors, reviewed in Table 2, it is perhaps not a coincidence that these three sectors are among the top four largest sectors in African markets. This suggests that a size effect may be responsible for these findings. It may be that larger sectors carry the benefit of increased liquidity and thus command a premium in price. This liquidity premium may be responsible for driving down the cost of equity in these sectors.

The possible presence of a liquidity premium driving down cost of equity levels raises the question of whether such an effect is robust over time. In particular, do the same

⁹ Cost of equity measures using systematic risk, downside beta and size are consistently lower than measures based on total risk or downside risk using semi-deviation.

Table 7: Cost of equity* in African markets (1999–2002)

Sector	Egypt		Kenya		Morocco		Namibia		South Africa		Zimbabwe	
	Cost of Equity	Sector Rank [†]	Cost of Equity	Sector Rank [†]	Cost of Equity	Sector Rank [†]	Cost of Equity	Sector Rank [†]	Cost of Equity	Sector Rank [†]	Cost of Equity	Sector Rank [†]
Non-cyclical Goods	7.46	2	7.19	1	7.44	4	8.47	1	8.92	2	9.18	1
Financials	8.48	4	8.44	4	5.69	1	12.44	6	8.70	1	12.06	3
Basic Industries	6.48	1	7.83	3	7.00	3	8.69	2	9.71	5	16.46	7
Cyclical Services	10.67	5	10.62	8	7.52	5	11.32	5	9.36	3	10.90	2
Cyclical Goods	7.72	3	7.47	2	13.94	6	–	–	11.75	7	12.78	5
Non-cyclical Services	–	–	8.67	6	–	–	11.28	4	12.53	8	–	–
General Industrials	16.37	6	9.49	7	6.97	2	10.13	3	9.63	4	13.46	6
Resources	–	–	8.44	5	–	–	12.55	7	10.91	6	12.38	4
Utilities	–	–	11.45	9	–	–	–	–	–	–	–	–
Information Technology	–	–	–	–	–	–	–	–	14.93	9	–	–
Composite [‡]	6.41		8.18		6.46		12.41		10.23		12.31	

– Not available.

* Cost of equity is the average of five cost of equity measures.

† Lower costs of equity receive lower ranks (i.e. closer to 1).

‡ Composite is a market capitalisation-weighted cost of equity measure, combing all available sectors for each country.

sectors that report low cost of equity levels also exhibit the largest percentage declines in cost of equity over time? Section 4.3.2 addresses this issue directly and lays the foundation for the comparison between changes in cost of equity and changes in integration over time.

4.3.2 Changes in cost of equity

The results of the analysis concerning the changes in cost of equity over time are presented in Table 8. Cost of equity changes are presented as percentage changes. As before, five different measures of the percentage change in cost of equity are aggregated into a single reported measure for each sector. In the case of South Africa, however, the aggregated measure does not include percentage changes in cost of equity using size as its risk measure. This is because backdated market capitalisation data for the FTSE South African sectors over the 1995–1999 period has not yet been calculated by the JSE Securities Exchange, and is therefore currently unavailable.

In addition to the “mean percentage change in cost of equity” measure, the standard error of the measure is also reported. Sectors are then individually ranked within each market. Ranks are based on the cost of equity measure divided by its standard error. Finally, ranks are aggregated across markets to produce an overall sector ranking; the sectors experiencing the greatest declines in costs of equity are presented in the upper rows.

Certainly the most noticeable feature of Table 8 is the number of declines in cost of equity. In all markets, the majority of sectors experience decreases in cost of equity. Although the standard error is rather large in some markets (e.g. Morocco), others seem to have reasonably small standard errors (e.g. South Africa). The aggregate sector ranking suggests that Utilities, Non-cyclical Goods and Cyclical Goods are the sectors that experience the greatest declines in cost of equity over time. On the other hand, Resources receives the lowest ranking. To the extent that a decline in cost of equity is the first step in generating growth opportunities, this finding suggests that Resources experienced the fewest growth opportunities in the late 1990s. This may be due to the gradual decline in the resources industry in African markets, which has

Table 8: Changes in cost of equity over time (1995–1999 vs 1999–2002)

Sector	Egypt		Kenya		Morocco		Namibia		South Africa		Zimbabwe	
	Mean % Δ C.E.* (S.E.)	Sector Rank†	Mean % Δ C.E.* (S.E.)	Sector Rank†	Mean % Δ C.E.* (S.E.)	Sector Rank†	Mean % Δ C.E.* (S.E.)	Sector Rank†	Mean % Δ C.E.* (S.E.)	Sector Rank†	Mean % Δ C.E.* (S.E.)	Sector Rank†
Utilities	–	–	-35.8 (17.2)	4	–	–	–	–	–	–	–	–
Non-cyclical Goods	-30.7 (35.8)	4	-37.5 (11.8)	1	-14.6 (26.9)	2	-21.0 (20.5)	5	-34.8 (3.5)	1	-45.4 (20.8)	1
Cyclical Goods	-43.1 (17.4)	2	-42.6 (18.6)	3	-12.5 (36.7)	4	–	–	-5.1 (10.2)	8	-43.4 (26.6)	3
Cyclical Services	-21.0 (8.2)	1	-10.5 (47.8)	9	-13.4 (25.9)	3	-38.1 (19.2)	2	-38.7 (18.4)	6	-41.6 (25.3)	2
Basic Industries	-45.4 (37.8)	3	-18.8 (19.8)	7	-2.6 (29.5)	6	-29.2 (16.8)	4	-26.5 (3.8)	2	-36.2 (37.2)	5
Non-cyclical Services	–	–	-14.9 (12.0)	5	–	–	-27.7 (27.6)	6	-26.5 (15.1)	7	–	–
Financials	-8.0 (59.9)	5	-20.6 (21.0)	6	-14.7 (17.6)	1	-24.0 (13.7)	3	-50.5 (12.1)	4	-12.8 (43.9)	6
General Industrials	18.4 (73.7)	6	-20.7 (37.1)	8	-3.6 (25.0)	5	-31.4 (12.4)	1	-32.4 (7.1)	3	-30.9 (29.3)	4
Information Technology	–	–	–	–	–	–	–	–	-3.7 (32.1)	9	–	–
Resources	–	–	-28.1 (10.2)	2	–	–	175.6 (432.4)	7	-13.5 (4.7)	5	39.2 (176.5)	7

– Not available.

* Mean % Δ C.E. is the mean percentage change across five (four for South Africa) cost of equity measures over two adjacent time periods.

† Rank is based on the mean % Δ C.E. divided by its standard error.

been especially evident in South Africa.

These results are, nonetheless, quite remarkable. There is a wholesale decline in cost of equity in all markets and in most sectors. Even though standard errors are relatively substantial, there is still convincing evidence that cost of equity has declined in most instances. Furthermore, the decline in some instances is considerable. In the late period, the cost of equity for Financials in South Africa, for instance, is effectively half its early period value. It is certainly plausible, if not likely, that the cost of equity in South African Financials has declined. Indeed, interest rates at the end of 2002 (end of late period) are significantly lower (almost half) those reported at the end of 1998 (end of early period). However, the dramatic reported decline in cost of equity does suggest a closer review of the assumptions used in the analysis.

Recall, for instance, that the cost of equity comprises a risk-free rate and an equity risk premium. In turn, the equity risk premium comprises a risk measure multiplied by the world market risk premium. Since the world market risk premium is considered to be constant over time at 6%, the only sources of variation over time are the risk-free rate and the risk measures. As outlined above, the risk-free rate is taken to be the rate prevailing at the end of each period on U.K. Treasury bills. However, the rate at the end of the second period (3.84%) is significantly lower than that for the first period (4.90%). In order to check whether this change in risk-free rate is responsible for the widespread decline in costs of equity, the analysis was repeated using a constant risk-free rate of 3.84% for both periods.

The effect of fixing the risk-free rate at 3.84% is that changes in cost of equity then represent pure equity risk premium changes, or more specifically, changes in the risk measures. In other words, it is only changes in the risk profile of African market sectors, rather than changes in the total cost of equity to the international investor, that are evaluated. A comparison between the results in Table 8 and the results using a constant risk-free rate is presented in Table 9. Instances where the two approaches yield changes in cost of equity that have opposite signs are reported in boldface, and sectors are presented in alphabetical order.

Generally the changes in cost of equity using the constant risk-free rate are, predictably, somewhat less pronounced than when the risk-free rate varies across the two time periods. With the exception of Morocco, the two approaches provide relatively consistent results with an unambiguous conclusion: the cost of equity in African market sectors declined between 1995 and 2002. This concordance between the two approaches provides a test of robustness that the widespread decline in cost of equity reported in Table 8 is predominantly driven by the decrease in equity risk premium rather than risk-free rate.

This effect can be investigated more closely by considering the extent to which changes in cost of equity differ between the two approaches, assuming cost of equity declines in both cases. Because the change in risk-free rate (from 4.90% to 3.84%) is the same for all sectors in all countries, the reduction in the percentage change due to this component should be relatively similar in all instances. If the difference between the two approaches in a particular market's sector is relatively small, then there is a strong likelihood that the decline in cost of equity in that sector is dominated by a reduction in the equity risk premium.

For example, if a difference of 10 percentage points is considered relatively small, then for all sectors in South Africa where cost of equity declined in both approaches, it would seem that the equity risk premium was largely responsible. On the other hand, the evidence for Egypt is relatively mixed, with different sectors suggesting different outcomes. Considering average sector results, Basic Industries, Cyclical Goods, Cyclical Services and General Industrials seem to be the sectors where, using the previous argument and parameters, declines in cost of equity are mostly driven by the changes in equity risk premium. Whilst evidence in other sectors is less convincing, there are instances in nearly every sector that point to the dominance of changes in the equity risk premium relative to the risk-free rate.

Notwithstanding this general conclusion, all sectors in Morocco report decreases in cost of equity when calculated with a variable risk-free rate, but when calculated using a constant risk-free rate, costs of equity all increase. Results pertaining to Morocco are thus particularly sensitive to the choice of a variable or constant risk-free

Table 9: Comparison of percentage changes in cost of equity over time using variable and constant risk-free rates

Sector	Egypt		Kenya		Morocco		Namibia		South Africa		Zimbabwe	
	% Δ C.E. (var. R_f)*	% Δ C.E. (cnst R_f)†	% Δ C.E. (var. R_f)*	% Δ C.E. (cnst R_f)†	% Δ C.E. (var. R_f)*	% Δ C.E. (cnst R_f)†	% Δ C.E. (var. R_f)*	% Δ C.E. (cnst R_f)†	% Δ C.E. (var. R_f)*	% Δ C.E. (cnst R_f)†	% Δ C.E. (var. R_f)*	% Δ C.E. (cnst R_f)†
Basic Industries	-45.4	-34.7	-18.8	-5.2	-2.6	21.6	-29.2	-19.9	-26.5	-20.2	-36.2	-31.2
Cyclical Goods	-43.1	-36.6	-42.6	-36.0	-12.5	1.1	–	–	-5.1	2.7	-43.4	-39.1
Cyclical Services	-21.0	-11.4	-10.5	6.4	-13.4	3.4	-38.1	-32.3	-38.7	-34.5	-41.6	-35.7
Financials	-8.0	27.2	-20.6	-10.0	-14.7	6.4	-24.0	-16.5	-50.5	-47.7	-12.8	4.2
General Industrials	18.4	31.3	-20.7	-10.5	-3.6	17.2	-31.4	-23.2	-32.4	-27.2	-30.9	-24.5
Information Technology	–	–	–	–	–	–	–	–	-3.7	2.5	–	–
Non-cyclical Goods	-30.7	-18.8	-37.5	-28.8	-14.6	1.4	-21.0	-8.5	-34.8	-29.7	-45.4	-39.7
Non-cyclical Services	–	–	-14.9	-2.6	–	–	-27.7	-19.0	-26.5	-22.2	–	–
Resources	–	–	-28.1	-19.1	–	–	175.6	-270.7	-13.5	-6.1	39.2	12.8
Utilities	–	–	-35.8	-29.7	–	–	–	–	–	–	–	–

Numbers in **bold** indicate that the different methodologies produce changes that have opposite signs.

– Not available.

* % Δ C.E. (var R_f) is the percentage change in cost of equity over time (using 4.90% risk-free rate for early period and 3.84% for late period).

† % Δ C.E. (cnst R_f) is the percentage change in cost of equity over time (using 3.84% risk-free rate for both periods).

rate, suggesting that the true change in cost of equity (positive or negative) may be relatively marginal. Considering the results on a sector basis, the Financials sector exhibits the greatest number of sign changes across the two approaches. Once again, this may suggest that, for this sector, the change in cost of equity effect may be relatively weak.

Although the discussion on cost of equity results using a constant risk-free rate is valuable insofar as revealing the sensitivity of otherwise unchallenged conclusions, cost of equity results using a variable risk-free rate are used in the analyses for the remainder of this chapter. This is because it is more theoretically correct to use different risk-free rates for different periods, and other than in Morocco, there is very little material difference in the results. Moreover, if the analysis was adopted from an international U.S. (as opposed to U.K.) investor point of view, the risk-free rate would change by more than 2 percentage points (whereas the U.K. difference is less than 1 percentage point) over the two periods, which empirically challenges the foundation of assuming a constant risk-free rate.

4.3.3 Relationship between integration and cost of equity

Having established a measure for changes in cost of equity over time, the attention is turned to the main concern of this chapter, investigating the relationship between integration and cost of equity.

The first set of results is presented in Table 10, which reports changes in integration and changes in cost of equity, as defined in section 4.3.2. Recall the theoretical mechanism operating between integration and cost of equity: increases in integration are ultimately manifested in increased growth, which is at least partially effected by a decline in cost of equity (Stulz, 1999; Henry, 2000a). Thus, if the relationship is upheld, integration and cost of equity will move in opposite directions over time. In such cases, changes in integration and cost of equity over time will have opposite signs; these “theoretical movements” are printed in boldface in Table 10. Finally, sectors are ranked by the average number of theoretical movements, aggregated across markets.

Table 10: Relationship between differences in integration* and percentage changes in cost of equity over time (1995–1999 vs 1999–2002)

Sector	Egypt		Kenya		Morocco		Namibia		South Africa		Zimbabwe	
	Δ in Integration	% Δ in Cost of Equity [†]	Δ in Integration	% Δ in Cost of Equity [†]	Δ in Integration	% Δ in Cost of Equity [†]	Δ in Integration	% Δ in Cost of Equity [†]	Δ in Integration	% Δ in Cost of Equity [†]	Δ in Integration	% Δ in Cost of Equity [†]
Information Technology	–	–	–	–	–	–	–	–	0.36	-3.7	–	–
Cyclical Goods	0.34	-43.1	0.06	-42.6	0.32	-12.5	–	–	0.36	-5.1	-0.62	-43.4
Financials	0.30	-8.0	-0.46	-20.6	0.36	-14.7	0.25	-24.0	-0.01	-50.5	0.24	-12.8
Non-cyclical Services	–	–	0.00	-14.9	–	–	0.04	-27.7	0.35	-26.5	–	–
Non-cyclical Goods	0.49	-30.7	-0.40	-37.5	0.34	-14.6	-0.57	-21.0	0.01	-34.8	-0.62	-45.4
Resources	–	–	-0.10	-28.1	–	–	0.83	175.6	0.16	-13.5	-0.53	39.2
Basic Industries	-0.17	-45.4	-0.40	-18.8	0.30	-2.6	-0.10	-29.2	0.10	-26.5	-0.76	-36.2
Cyclical Services	-0.09	-21.0	0.64	-10.5	0.40	-13.4	-0.10	-38.1	-0.14	-38.7	-0.64	-41.6
General Industrials	0.50	18.4	0.02	-20.7	0.24	-3.6	-0.10	-31.4	0.00	-32.4	-0.45	-30.9
Utilities	–	–	-0.34	-35.8	–	–	–	–	–	–	–	–

Numbers in **bold** indicate that the theoretical relationship between the changes in integration and cost of equity is upheld, i.e. changes have opposite sign.

– Not available.

* Integration is the correlation of fitted returns from a VAR with exogenous local and U.K variables.

† % Δ Cost of Equity is the mean percentage change across five (four for South Africa) cost of equity measures over two adjacent time periods.

A cursory glance at the results in Table 10 provides an initial basis for discussion. Firstly, in approximately half of the reported cases, the integration-cost of equity theoretical mechanism is upheld. There is thus some evidence to suggest that such a relationship exists, but it would be inaccurate to claim that the relationship is manifested in a clear majority of cases. Furthermore, considering the results by market, it would appear that Egypt, Morocco and South Africa have the highest average number of theoretical movements (as defined above).

The aggregated sector results suggest that the increases in integration are most likely to result in cost of equity reductions in the Information Technology, Cyclical Goods and Financials sectors. These sectors share little commonality in terms of size; on average, Financials is the largest sector in African markets, Cyclical Goods is relatively small and Information Technology is very small. Therefore it cannot be a size effect that is driving the results, as appeared to be the case in Table 7 where cost of equity levels were measured. However, these are all fairly global and cyclical sectors – Cyclical Goods includes white goods and luxury items, evidence from chapter 3 suggests that Financials is becoming increasingly global and Information Technology is at the forefront of global industry. Perhaps increased integration is predominantly valuable in reducing cost of equity when it occurs in sectors that have international operations or connections.

However, bearing the results of the previous section in mind, Table 10 appears to represent a different reality. Recall that the principal finding of the cost of equity results was the general decline in cost of equity over time across most sectors in all featured markets. The consequence of this widespread effect is that the potential to isolate a clear relationship between integration and cost of equity is weakened. In other words, the “relationship” characterised in Table 10 is effectively a depiction of changes in integration only. This is evident if one compares Table 10 with Table 4, which reports changes in integration over time. Notice, for instance, that the aggregate ranking of sectors (by “number of significant increases” in Table 4 and by “average number of theoretical movements” in Table 10) is very similar. As a result, it may be inaccurate to suggest that the theoretical relationship between integration and cost of equity is particularly strong in, say, Financials (as a light reading of Table

10 might suggest). Instead, it may be argued, the perceived relationship is merely a function of the sector's increased integration over time, effectively rendering the changes in cost of equity irrelevant.

For this reason (i.e. lack of power) and for purposes of robustness, the relationship between changes in integration and cost of equity is reinvestigated using a different cost of equity methodology. Specifically, the change in dividend yield (under the assumption of constant dividend growth) provides a measure of the change in cost of equity as explained in section 4.2.3. These results are summarised in Table B1 in Appendix B.

An immediately apparent and significant difference between the approaches to measuring changes in cost of equity is that the dividend yield approach reports far fewer cost of equity declines. Interestingly, there is a similar proportion (between 50% and 60%) of theoretical movements in Table B1 compared to Table 10. On the other hand, there seems to be almost no consistency across the two approaches in the ranking of sectors by average number of theoretical movements. Another significant difference concerns the number of theoretical movements per market. Whereas South Africa has several instances in both approaches (although the sectors involved are not all the same), Kenya, Namibia and Zimbabwe all report numerous theoretical movements in Table B1, a feature that is absent in Table 10. Moreover, Egypt and Morocco show relatively few theoretical movements, casting doubt on the earlier suggestion that market maturity and development may be necessary for the integration-cost of equity theoretical mechanism to operate.

There are, nonetheless, a number of difficulties associated with the dividend yield approach. Firstly, the quality of data (particularly for the 1995–1999 period) is relatively poor and often includes far fewer companies than the price indices that are used in the previous cost of equity methodology. More problematic, however, is the constant dividend growth assumption central to the latter cost of equity methodology. The problem is that in an environment of increasing integration, which represents a structural change (albeit gradual), the likelihood that dividend policy will remain unchanged is minimal. If, for instance, integration brings about a growth in profits of

a particular firm, it may be inclined to reduce its payout ratio and so reinvest a greater proportion of profits for new capital projects to meet investors' expectations. Such a decision would reduce the growth rate of dividends, and thus distort the results. Clearly, results generated using this approach must be interpreted with caution.

Having investigated the relationship between changes in integration and cost of equity, the results remain inconclusive. Rather than add further tests of robustness that may cause further confusion, a slightly different approach is adopted in the final analysis that follows. Whereas previously changes in integration have been compared with changes in cost of equity, this approach suggests comparing levels of integration with changes in cost of equity. The intuition behind this approach is that sectors or markets that currently exhibit relatively high levels of integration are likely to have experienced declines in cost of equity in the past. In other words, the emphasis has shifted: previously, it was where integration had come from that was important; in this approach, it is the extent of current integration that is of interest.

Table 11 summarises the results according to the approach explained directly above. Changes in cost of equity are calculated according to the original methodology, and sectors are ranked as in Table 7. However, instead of reporting changes in integration, the levels of integration (corresponding to the levels presented in Table 2 for 1999–2002) are compared to changes in cost of equity. Recall that this approach is only concerned with sectors that exhibit relatively high levels of integration. Consequently, the attention is drawn to sectors where integration is greater than 0.30, and these instances are reported in boldface.

A number of patterns emerge from the analysis. Firstly, in all cases where integration is greater than 0.30, cost of equity is shown to have declined over time. Secondly, all sectors in South Africa exhibit integration greater than 0.30, and following from the first point, cost of equity is shown to decline in all cases. Furthermore, although not present in all cases, several Namibian sectors also experience cost of equity declines when integration is greater than 0.30. Finally, considering the sector results, Cyclical Services reports a number of cases where integration is greater than 0.30 and cost of equity declines.

Table 11: Relationship between levels of integration* and percentage changes in cost of equity

Sector	Egypt		Kenya		Morocco		Namibia		South Africa		Zimbabwe	
	Integration	% Δ in Cost of Equity [†]	Integration	% Δ in Cost of Equity [†]	Integration	% Δ in Cost of Equity [†]	Integration	% Δ in Cost of Equity [†]	Integration	% Δ in Cost of Equity [†]	Integration	% Δ in Cost of Equity [†]
Utilities	–	–	-0.29	-35.8	–	–	–	–	–	–	–	–
Non-cyclical Goods	0.51	-30.7	-0.10	-37.5	0.56	-14.6	-0.11	-21.0	0.52	-34.8	-0.11	-45.4
Cyclical Goods	0.08	-43.1	-0.03	-42.6	0.10	-12.5	–	–	0.71	-5.1	-0.33	-43.4
Cyclical Services	0.20	-21.0	0.72	-10.5	0.42	-13.4	0.50	-38.1	0.61	-38.7	-0.20	-41.6
Basic Industries	-0.15	-45.4	-0.23	-18.8	0.22	-2.6	0.40	-29.2	0.76	-26.5	-0.22	-36.2
Non-cyclical Services	–	–	0.31	-14.9	–	–	-0.10	-27.7	0.73	-26.5	–	–
Financials	0.35	-8.0	0.02	-20.6	0.17	-14.7	0.66	-24.0	0.61	-50.5	0.26	-12.8
General Industrials	-0.05	18.4	-0.06	-20.7	0.42	-3.6	0.49	-31.4	0.68	-32.4	0.03	-30.9
Information Technology	–	–	–	–	–	–	–	–	0.96	-3.7	–	–
Resources	–	–	-0.14	-28.1	–	–	0.24	175.6	0.84	-13.5	-0.64	39.2

Numbers in **bold** indicate instances where integration is greater than 0.30.

– Not available.

* Integration is the correlation of fitted returns from a VAR with exogenous local and U.K variables for the period 1999–2002.

† % Δ Cost of Equity is the mean percentage change across five (four for South Africa) cost of equity measures over two adjacent time periods.

Whilst the Namibia and Cyclical Services patterns do not seem to be robust across the other two approaches, the findings in connection with South Africa are more reliable. Nonetheless, it is worth reiterating that the main finding of this approach – high levels of integration are associated with declines in cost of equity – is predominantly driven by the cost of equity methodology which reports declines in most instances.

On the surface, the results may appear to be somewhat inconclusive. Whilst the cost of equity levels seem reasonable, the sheer number of declines in cost of equity over time is unexpected. And although the dividend yield methodology reports fewer declines, this approach relies on several unrealistic assumptions. However, the fact that cost of equity may have declined in nearly all sectors is not, in itself, a necessarily contradictory finding. On the other hand, when changes in integration are compared with changes in cost of equity, the theoretical relationship, as suggested by Stulz (1999), does not appear to be generally observed.

The observation that changes in integration and cost of equity are not closely related may be indicative of an insufficiently sensitive methodology. The approach used in this chapter has been to measure integration and cost of equity over two adjacent periods, and then to compare the changes in integration with changes in cost of equity. This static two-period model is thus unable to capture any dynamic changes or time-variation within the periods. Moreover, since the periods do not overlap and are identical for the integration and cost of equity measures, it is not possible to capture any lagged relationships, should they exist. It may be that dynamic, time-varying measures of integration and cost of equity will reveal a stronger relationship between integration and cost of equity.

Notwithstanding this suggestion, there may be an alternative explanation for the perceived absence of a relationship between changes in integration and cost of equity. It is worth reiterating that the cost of equity is found to decline in almost all reported cases, suggesting that there has been a wholesale reduction in risk (as calculated according to five different risk measures) in African markets over time. Although it is beyond the scope of this research to investigate why this may have happened (other than to examine its potential relationship with integration), it is nonetheless possible –

if not likely – that the decline may have been driven by factors other than increased integration.

Indeed, given that cost of equity is found to decline in most cases, the difficulty effectively only surrounds the cases where integration decreases and cost of equity also reduces over time. Whilst at face value this simultaneous decline may appear to be a contradiction of theory, it may also simply indicate that the market is developing locally, but in the absence of foreign investors. Even if global integration reduces over time, this does not preclude the possibility that the market may develop locally. Such development may drive down the cost of equity in a particular sector even if the market is distancing itself from global forces. It may be that once markets have gone beyond a certain threshold of integration, the benefits of foreign involvement are profound and continue to operate even if integration should decrease. This may be the case in Zimbabwe or Kenya where integration was relatively high in the early period despite decreasing over time.

On the other hand, in almost all cases where integration increased, cost of equity declined. As suggested above, it may be inaccurate to imply that this decline was driven entirely by the increase in integration, but it is probably equally incorrect to suggest that increases in integration have no effect on cost of equity. In other words, the results imply that whilst decreases in integration do not have an ostensibly negative impact on cost of equity, increases in integration may have a positive influence.

Therefore, the conclusion is that whilst increases in integration should perhaps always lead to decreases in cost of equity, the converse (that decreases in integration lead to increases in cost of equity) is not necessarily true. To the extent that a decline in cost of equity is the first step towards increased growth, these findings suggest that increases in integration may lead to increases in growth, but that this growth effect persists even when integration decreases. Consequently, it would appear that there are factors other than, or in addition to, integration influencing growth in African markets.

5 INTEGRATION AND CONTAGION

History has provided researchers with a comprehensive sample of financial crises. Indeed, the study of financial crises also has its own history. Although the approach to handling contagious crises may have changed over the years and although the models used to predict crises might have become more sophisticated, researchers seem to agree that some things have not changed. Firstly, contagious crises continue to happen. Moreover, the subject remains as contentious as ever. Burton (1902, p. 1) writes:

“No subject of economic discussion has provoked a greater variety of conflicting opinions than that of financial crises...”

Nearly one hundred years later, Kindleberger (2000, p. 1) opens his book with these words:

“There is hardly a more controversial subject in economic literature than financial crises.”

Given the ostensible controversy surrounding financial crises, it is no wonder that researchers greeted the financial crises of the mid- to late-1990s with open arms. A new set of crises had happened, and a new term was born: contagion. Claessens and Forbes (2001) show that before 1997, the word “contagion” had been almost exclusively used in the medical context. However, following the “Asian Flu” and “Russian Virus” crises, almost all references to contagion indicated the spread of financial market turmoil.

5.1 Review of integration and contagion literature

In this review, literature concerning contagion and its relationship to integration is discussed. However, probably because the field is still relatively underdeveloped, there remains some considerable debate as to what constitutes contagion. Since a clear definition of contagion is critical to a discussion comparing contagion and integration, literature concerning the definition and measurement of contagion is

reviewed first. Attention is then focused on the potential causes of contagion. Particular emphasis is given to assessing the credibility of the claim that increased integration necessitates an increased likelihood of contagion risk. Of course an investigation into the causes of contagion cannot always be neatly separated from the question of how to measure contagion; there is considerable overlap in the literature in this respect. Nonetheless, it is helpful to categorise the literature in this way for the purposes of this review. The approach used in this chapter concludes the review.

5.1.1 Defining and measuring contagion

Researchers seem to agree that contagion is somehow associated with the movement of shocks from one country or region to another. Claessens, Dornbusch and Park (2001) suggest that this transmission is mostly “on the downside”. In other words, contagion represents an unwelcome transmission of shocks between countries.

However, there is little agreement among researchers on the specifics. Apart from the numerous methodologies that are proposed, many of which are reviewed below, the basic premise for what constitutes contagion remains open for debate. For instance, Kaminsky and Reinhart (2000) contrast what they call “fundamentals-based” contagion with “true” contagion. The former refers to contagion between countries that have established links in trade and finance, the latter to investor herding behaviour. That may seem reasonable, but there seems to be little difference between the fundamentals-based contagion of Kaminsky and Reinhart (2000) and “interdependence” as defined by Forbes and Rigobon (2002). Interdependence, according to Forbes and Rigobon (2002), refers to the state where countries share a “continued high level of market correlation” and is quite different from their definition of contagion. De Gregorio and Valdés (2001) prefer a more general definition and thus “use indistinctly the expressions contagion, interdependence, and co-movements.” Connolly and Wang (2003) simply define contagion as the mechanism by which trading in one market affects stock prices in other markets; this definition does not even imply that contagion has necessarily negative effects.

It may be argued that the absence of a universally accepted definition of contagion is not a matter for concern. Provided that the multitude of definitions¹⁰ and methodologies are acknowledged, and therefore spurious comparisons are avoided, the fact that definitions vary from paper to paper should not be considered an insurmountable difficulty. It is important, however, that contagion should be clearly defined and appropriately linked to the chosen methodology. A sample of contagion methodologies is reviewed immediately below.

One of the earliest tests for contagion, so described, appears in King and Wadhvani (1990). The paper was motivated by the simultaneous crash of markets throughout the world following the October 1987 stock market crash in the United States. King and Wadhvani (1990) report increases in correlation coefficients between markets in the period before the crash and even higher correlations during the week of the crash. This is interpreted as evidence of contagion.

This correlation-based approach to measuring contagion (i.e. contagion defined as increased cross-market correlation during periods of crisis) was used by several researchers during the 1990s but was critically revisited in Forbes and Rigobon (2002). In that paper it is shown that the correlation coefficient will necessarily increase during periods of increased volatility, and therefore using correlations to measure contagion is likely to inaccurately indicate the presence of contagion. Forbes and Rigobon (2002) consequently propose an adjustment to the correlation coefficient to produce contagion measures that are unconditional on market volatility. Their adjustment relies, however, on two important assumptions: (1) no variables have been omitted and (2) there is no endogeneity between markets. When applying this methodology to the 1987 U.S. market crash, 1994 Mexican “Tequila” crisis and the 1997 “Asian Flu” crisis, Forbes and Rigobon (2002) find no evidence of contagion.

Nonetheless, the debate remains open. Longin and Solnik (2001) show that it is incorrect to assume that market correlations necessarily increase as volatility increases. Instead, they claim that correlations only increase in bear markets; no

¹⁰ See Pericoli and Sbracia (2003) for a comprehensive analysis of contagion definitions.

significant increase is present in bull markets, despite the added volatility. It could be argued that this finding of Longin and Solnik (2001) does not materially affect the Forbes and Rigobon (2002) claim since contagion is generally associated with bear, rather than bull, markets. Although Baig and Goldfajn (2001) use the Forbes and Rigobon (2002) adjustment, they remain sceptical about whether adjusting for volatility is appropriate because “volatility is an integral part of any crisis scenario”. Baig and Goldfajn (2001) warn that contagion tests may lack power when the adjustment is used. On the other hand, Corsetti, Pericoli and Sbracia (2003) openly challenge the methodology of Forbes and Rigobon (2002). Corsetti et al. (2003) are suspicious of the “no-contagion” conclusion that inevitably results from almost any crisis sample when using the Forbes and Rigobon (2002) adjustment. They suggest that the results are based on “arbitrary and overly restrictive” assumptions, particularly pertaining to the variance of country-specific shocks. Using a related but less restrictive methodology, Corsetti et al (2003) find evidence of contagion following the 1997 Hong Kong crash to several Asian and European countries. In a subsequent paper, Rigobon (2003) admits that the correlation adjustment proposed by Forbes and Rigobon (2002) should “not be used” since, in the presence of common shocks, the adjustment will be excessive.

In addition to correlation-based measures of contagion, Pericoli and Sbracia (2003) identify four other strands of contagion methodology. Some of these techniques, as well as others not mentioned in Pericoli and Sbracia (2003), are reviewed below.

Several papers consider the mechanism by which contagion is transferred from one country to another. Most of these papers, some of which are reviewed in section 5.1.2, avoid the direct measurement of contagion. For instance, Eichengreen, Rose and Wyplosz (1997) construct a probit model using macroeconomic and political factors among the explanatory variables. Their results suggest that contagion occurred over a 30-year sample period. Moreover, Eichengreen et al (1997) find that trade linkages between international markets are a more important determinant of contagion risk than similarity in macroeconomic fundamentals. Forbes (2003) uses firm-level data to construct cumulative abnormal returns over the Asian and Russian

crises. Forbes (2003) then investigates which of five different transmission mechanisms are most likely to exacerbate contagion effects.

Other papers consider volatility spillover effects. These papers mostly employ ARCH or GARCH frameworks to test for the transfer of volatility. This approach was first applied by Hamao, Masulis and Ng (1990) to test for volatility spillover effects following the October 1987 U.S. market crash. More recent examples include Edwards (1998), who investigates Latin American bond markets following the Mexican crisis of 1995, and Park and Song (2001) who investigate the 1997 Asian crisis. Forbes and Rigobon (2002) criticise this approach for not delivering a clear measure of contagion.

There are a number of other approaches that have been used to model contagion¹¹, but rather than providing an exhaustive list, a sample of the most recent contributions follows below.

Bekaert, Harvey and Ng (2003) and Wongswan (2002) specify asset-pricing models to control for economic fundamentals and systematic risk. Bekaert et al. (2003) uses a two-factor model whilst Wongswan (2002) employs a world-CAPM. In both papers, contagion is defined as the correlation that remains after controlling economic fundamentals or systematic risks, i.e. correlation of the model residuals. Bekaert et al. (2003) find evidence of contagion during the Asian crisis, but not for the Mexican crisis. Wongswan (2002) investigates three geographical regions (Asia, Latin America, Western Hemisphere) and finds evidence of both regional integration and regional contagion. This somewhat conflicts with Bekaert et al. (2003) who find limited evidence of a regional integration phenomenon.

Finally, in what must surely be a development long overdue, Bae, Karolyi and Stulz (2003) propose a methodology that draws on the literature of epidemiology research on contagious diseases. Bae et al. (2003) use multinomial logistic regressions to model “exceedances”, defined as a return that lies “either below (above) the 5th (95th)

¹¹ See, for instance, Fratzscher (1999) and Masson (1999) for contagion models that use a regime-switching framework.

quantile of the marginal return distribution". Monte Carlo simulations are used to model the distribution of the exceedances. Bae et al. (2003) find that contagion is more pronounced in Latin America than in Asia, and that the United States is largely insulated from contagion that originates in Asia.

5.1.2 Causes of contagion

Following the dramatic Asian and Russian crises, the World Bank and World Institute for Development Economics Research commissioned a research project in 1999 that explored the spread of contagion and suggestions for how it can be stopped. The emphasis was to obtain a greater understanding of the causes and transmission mechanisms of contagion as well as potential treatments. This section reviews literature that investigates these areas of contagion research.

Crises, whether they be contagious or not, are commonly associated with irrational behaviour. Overenthusiastic investors, or so the caricature goes, panic when faced with inexplicable losses and resort to herd behaviour that ultimately results in a market crash. Calvo (1999) investigates the role of Wall Street investor behaviour in the Russian crisis of 1998. Perhaps surprisingly, Calvo (1999) does not suggest that irrationality (in its common interpretation) was to blame. Instead, rational but uninformed investors are shown to respond very enthusiastically to signals from informed investors. However, Calvo (1999) points out that informed individuals may be reacting to a number of factors that are unrelated to the state of the emerging market. Uninformed investors may, for instance, interpret sales by informed investors as a negative signal when the sales are in fact in response to margin calls. Such erroneous interpretation, however excusable, can nevertheless quickly degenerate into herd behaviour. Kaminsky and Schmukler (1999) examine the contagion arising from the Asian crisis and scrutinise the suggestion that investors' herding behaviour was to blame. Their findings suggest herd behaviour was entirely responsible for the largest daily swings during the crisis. Moreover, Kaminsky and Schmukler (1999) find that as the crisis deepened, such behaviour was accentuated. And when news does matter, they find evidence indicating that investors over-react to bad news, exacerbating contagion effects. It would therefore seem that whatever other factors contribute to the cause of contagion, investor behaviour remains a relevant concern.

Nonetheless, it may be argued that investor behaviour can only be a factor if the market is actually open for investment. Claessens, Dornbusch and Park (2001) argue that if a country exhibits little or no integration with world markets, it will be “relatively immune” to contagion. However, Claessens et al. (2001) are careful to point out that while international capital market integration may be a necessary condition for contagion to occur, it is by no means a sufficient condition. Open and liquid financial markets, they claim, therefore play a facilitating rather than causal role in contagion.

This qualitative and theoretical conclusion is tested empirically in Calvo and Mendoza (2000). They develop a model that suggests globalisation may promote contagion. Calvo and Mendoza (2000) argue that as markets become increasingly integrated, the incentives for gathering expensive information are reduced; simultaneously, portfolio managers are encouraged to imitate the market portfolios against which they are measured. One can easily see how such imitation could degenerate into herd behaviour, and ultimately contagion. Given the apparent welfare costs of integration in the face of contagion, Calvo and Mendoza (2000) speculate that capital controls may be an attractive option worth considering. Martin and Rey (2002) report similar results using a sample of developed and emerging markets. They show that in closed markets, the frequency of crashes and the log of GDP per capita are unrelated, whilst in open markets the two variables are negatively related. Following liberalisation, Martin and Rey (2002) find that almost all emerging markets suffer from an increase in the number of market crashes. Moreover, the findings suggest that the vulnerability of emerging markets to crashes is not necessarily a result of poor fundamentals or inefficient financial markets, but simply because they have a lower income level than developed markets.

Another branch of related literature investigates the channels by which contagion is transmitted. In assessing vulnerability to contagion, Eichengreen, Rose and Wyplosz (1997) compare countries that share strong trade links with those that have similar macroeconomic characteristics. Their factor analysis suggests that contagious currency crises (the subject of their paper) are spread mainly via international trade links. They find no evidence to suggest that contagion occurs between countries

sharing similar macroeconomic characteristics. Glick and Rose (1999) reach a similar conclusion. Noting that currency crises tend to be regional, they test for whether trade links are the most important determinant in assessing the vulnerability of countries to contagion effects. Using a dataset comprising five currency crises between 1971 and 1997, Glick and Rose (1999) find that crises predominate in groups of countries that trade with one another. As in Eichengreen et al. (1997), they find that macroeconomic similarity is a poor determinant of contagion vulnerability. Using firm-level data over the Asian and Russian crises, Forbes (2003) similarly finds that contagion is primarily transmitted via trade channels. Forbes (2003) claims that the geographical location of a firm may also be relevant, but that trade linkages are more important in assessing the firm's vulnerability to contagion.

Kaminsky and Reinhart (2000) admit that it may be difficult to separate trade and financial links in the regional contagion context. They employ an extensive dataset extending over 28 years and including 80 currency crises and consider several possible channels of transmission. Despite the difficulties of separating trade and financial links mentioned above, they conclude that financial linkages (especially the role played by banks) are probably more likely to have been the most important mechanism of transmission. Hernández and Valdés (2001) do not exclusively investigate currency crises but instead concentrate on the recent Thai, Russian and Brazilian crises. The transmission of contagion is found to differ depending on the nature of the crisis. Nevertheless, Hernández and Valdés (2001) suggest that while neighbourhood and trade links are important, financial links are very important.

It could be argued that if the transmission mechanisms of contagion are well understood, then the solution to preventing contagion altogether should be relatively apparent. Grabel (2003) claims that the Asian crisis could have been prevented and suggests several guidelines for dealing with contagion risk. Among these suggestions, Grabel (2003) includes currency convertibility restrictions and the careful monitoring of measures that would indicate a country was facing potential contagion risk. Grabel (2003) argues that such controls would not necessarily increase the hurdle rate required to attract private capital flows because investors would be encouraged by the promise of greater stability. De Gregorio and Valdés (2001) consider the 1982 debt

crisis, 1994 Mexican crisis and the 1997 Asian crisis and, in addition to finding a strong neighbourhood effect, investigate what actions (if any) mitigate the effects of contagion. Contrary to popular wisdom (see Bhagwati, 1998; Rodrik, 1998; Stiglitz, 2000), De Gregorio and Valdés (2001) do not find that capital controls provide any significant insulation against contagion. However, they do find that exchange rate flexibility and a debt maturity structure that is tilted towards the long run can reduce (albeit marginally) the contagion risk.

5.1.3 *In response to the literature*

The following conclusions can be drawn from the review of contagion literature above: firstly, no universally accepted definition of contagion has yet been established. Secondly, there are several different approaches to measuring contagion and none has been shown to be consistently superior to the others. Thirdly, contagion is probably caused by investor herding behaviour in the presence of an (at least partially) integrated market. Moreover, trade and financial linkages are important in determining contagion vulnerability whilst macroeconomic fundamentals appear to be largely irrelevant. Finally, while it may be possible to limit contagion effects, there is no obvious panacea.

In this chapter the relationship between contagion and integration in African equity markets is investigated. Collins and Biekpe (2003) investigate contagion in African equity markets at the market level during the Asian crisis and find that most markets did not experience contagion. In this chapter, contagion in African equity markets is measured on a sector basis during the Asian and Russian crises. It will therefore be possible to assess whether contagion is more prevalent in particular sectors.

Once the contagion of the African market sectors has been measured, it will then be possible to investigate whether the particular sectors experiencing contagion are, on average, more or less integrated than those that do not experience contagion effects (using the findings of chapter 3).

5.2 Methodology

This chapter employs two different methodologies to measure contagion in African markets. In addition, each methodology is repeated for a period corresponding to the Asian crisis and another corresponding to the Russian crisis. Different methodologies are used in order to provide a check of robustness and the different periods of crisis add a further basis for discussion in African markets. In this chapter, unlike chapters 3 and 4, daily data are used for analysis. Measuring contagion requires high frequency data because crises are often short-lived (although their effects may be long lasting) and therefore the use of low frequency data is unlikely to adequately capture any contagion effects.

5.2.1 *Choice of tranquil and crisis periods*

Before the methodologies are explained, issues concerning the two crisis periods must be addressed. Most importantly, it is necessary to specify the beginning and end of tranquil and crisis periods. Both methodologies involve comparing the behaviour of each sector during a normal, or “tranquil”, period with the behaviour during the crisis period. It is therefore critical that the periods are carefully chosen.

For the Asian crisis, tranquil and crisis periods were taken from Corsetti et al. (2003). They specify the tranquil period from 2 January 1997–17 October 1997. The crisis period, approximately one month, then extends from 20 October 1997–28 November 1997. The choice of crisis period is motivated primarily by the Hong Kong crash that took place on 17 October 1997. The tranquil period is sufficiently long to capture the normal behaviour of sectors without including too much data that could encapsulate structural changes in, say, integration. Hong Kong is used as the source of crisis in the contagion methodologies, and as mentioned in section 2.2.3, Datastream Global Equity sector indices for Hong Kong are used in the analyses for the Asian crisis.

The dates for the Russian crisis are somewhat less obvious. In particular the choice of a tranquil period needs to be made carefully. Baig and Goldfajn (2001) investigate contagion effects during the Russian crisis between Russia and Brazil, and note that from October 1997 until at least the end of December 1998, emerging markets were experiencing a time of crisis. Consequently, Baig and Goldfajn (2001) suggest using

a tranquil period pre-October 1997. This study therefore uses the same tranquil period, 2 January 1997–17 October 1997, for both contagion studies. The crisis period for the Russian crisis needs to be carefully chosen, and should ideally be of a similar length to the Asian crisis period if results from the two crises are to be considered together. The period used is 13 August 1998–30 September 1998. Russia was already showing signs of difficulty in December 1997 when Standard & Poor's rating agency downgraded Russian debt. In July 1998 yields on short-term bonds rose to 120% of the annual interest rate, but the problem was thought to be contained. However, on 13 August 1998 the government imposed controls on the ruble and on 17 August 1998, Russia declared a debt moratorium. The 13th of August is therefore something of a turning point and is hence used as the start of the period. Datastream Global Equity sector indices for Russia (the source of crisis) are used in the analyses for the Russian crisis.

5.2.2 Forbes-Rigobon methodology

The first methodology adopted in this chapter is based on the work of Forbes and Rigobon (2002). Forbes and Rigobon (2002) adopt a traditional correlation-based framework, which suggests the presence of contagion if the correlation between market returns of a crisis country and another country are higher during times of crisis than during tranquil times.

However, Forbes and Rigobon (2002) propose an adjustment, as mentioned in section 5.1.1, to remove the upward bias that otherwise overstates the level of contagion. Their argument is as follows: during periods of volatility, the variance of returns will be higher than during periods of calm. However, the correlation coefficient between two markets – the basis of contagion measurement – incorporates not only the covariance of returns but also the standard deviation of returns. Consequently, the correlation coefficient during times of crisis will, by definition, be larger than during tranquil times *even if* the markets are not more synchronised (i.e. contagion is not present). A mathematical exposition may be helpful. Suppose markets x and y observe the following relationships¹²:

¹² These equations are taken from Forbes and Rigobon (2002).

$$y_t = \alpha + \beta x_t + \varepsilon_t \quad (15)$$

$$\text{where } E[\varepsilon_t] = 0 \quad (16)$$

$$E[\varepsilon_t^2] = c < \infty \quad (17)$$

$$E[x_t \varepsilon_t] = 0 \quad (18)$$

Divide time period t of x_t into two periods: l represents a period of low volatility, and h represents a period of high volatility. Consequently define:

$$\delta = \frac{\sigma_{xx}^h}{\sigma_{xx}^l} - 1, \quad \delta > 0 \quad (19)$$

where σ_{xx}^h and σ_{xx}^l represent the variances of x_t for the periods of high volatility and low volatility respectively.

Then,

$$\begin{aligned} \sigma_{yy}^h &= \beta^2 \sigma_{xx}^h + \sigma_{ee} \\ &= \sigma_{yy}^l \left(1 + \delta \beta^2 \frac{\sigma_{xx}^l}{\sigma_{yy}^l} \right). \end{aligned} \quad (20)$$

Combining equation (20) with

$$\rho = \frac{\sigma_{xy}}{\sigma_x \sigma_y} = \beta \frac{\sigma_x}{\sigma_y} \quad (\text{according to definition of } \beta), \quad (21)$$

then

$$\sigma_{yy}^h = \sigma_{yy}^l \left(1 + \delta [\rho^l]^2 \right). \quad (22)$$

Finally,

$$\begin{aligned} \rho^h &= \frac{\sigma_{xy}^h}{\sigma_x^h \sigma_y^h} \\ &= \rho^l \sqrt{\frac{1 + \delta}{1 + \delta [\rho^l]^2}}. \end{aligned} \quad (23)$$

This shows that the correlation coefficient is an increasing function of δ , which, from equation (19), is a function of the ratio of volatility between crisis and tranquil periods. Consequently, Forbes and Rigobon (2002) propose that the unadjusted correlation coefficient for the crisis period should be adjusted according to the following equation:

$$\rho^a = \frac{\rho^u}{\sqrt{1 + \delta[1 - (\rho^u)^2]}} \quad (24)$$

where ρ^a and ρ^u represent the adjusted and unadjusted correlation coefficients respectively.

Forbes and Rigobon (2002) use a VAR framework with multiple lags and various exogenous variables to generate fitted stock market returns, but note that using actual returns “actually strengthens” their central results. Consequently, actual (rather than fitted) log returns are used in this analysis to calculate the adjusted correlation coefficients. In order to ensure that differences in time zones are not responsible for confounding the results, rolling two-day average returns are used. In addition, all indices from which returns are calculated are converted into a common currency (pound sterling) before the analysis is performed.

In order to test for contagion, the following hypotheses are used:

$$\begin{aligned} H_0: & \rho_c - \rho_t = 0 \\ H_1: & \rho_c - \rho_t > 0 \end{aligned} \quad (25)$$

where H_0 is the null hypothesis of no contagion, H_1 is the hypothesis indicating the presence of contagion, ρ_c represents the adjusted correlation coefficient during the crisis period and ρ_t is the correlation coefficient during the tranquil period.

The hypotheses are tested using a t -test as in equation (4):

$$t = (\rho_c - \rho_t) \sqrt{\frac{n_c + n_t - 4}{1 - (\rho_c - \rho_t)^2}} \quad (26)$$

where $t_{(0.05, n_c + n_t - 4)}$ and subscripts c and t refer to crisis and tranquil periods respectively.

For reference purposes, this approach is termed the “Forbes-Rigobon methodology”.

5.2.3 Corsetti et al. methodology

As highlighted in section 5.1.1, the Forbes-Rigobon methodology relies on some restrictive assumptions. Corsetti, Pericoli and Sbracia (2003) provide evidence to suggest that the assumptions inherent in the Forbes-Rigobon methodology are likely to have the effect of underestimating the effect of contagion. Corsetti et al. (2003) note that Forbes-Rigobon results typically fail to find contagion and propose that “arbitrary and unrealistic” restrictions on the variance of country-specific shocks are largely responsible for “no-contagion” results.

Consequently, Corsetti et al. (2003) suggest a methodology that demands less restrictive assumptions and accordingly produces more intuitive results. The methodology used in this section is based on the work of Corsetti et al. (2003) and is outlined below.

A return-generating framework for each sector is adopted according to a single-factor model¹³:

$$\begin{aligned} R_i &= \alpha_i + \gamma_i \cdot f + \varepsilon_i \\ R_j &= \alpha_j + \gamma_j \cdot f + \varepsilon_j \end{aligned} \quad (27)$$

¹³ These equations are taken from Corsetti et al. (2003).

where R_i is the return on a particular African market sector, R_j is the return on the crisis market sector, α_i and α_j are constants, γ_i and γ_j are factor loadings, f is a common factor, and ε_i and ε_j are sector-specific shocks.

The common factors used are the FTSE All-World sector indices. This allows for greater explanatory power than, say, the MSCI World index, which is effectively an aggregation of all sectors. As indicated previously, the “crisis markets” are Hong Kong and Russia for the Asian and Russian crises respectively.

Using the model stipulated in equations (27), and a set of assumptions that are omitted for brevity, Corsetti et al. (2003) propose that the correlation coefficient between R_i and R_j should be:

$$\rho^T = \frac{1}{\left[1 + \frac{\text{Var}(\varepsilon_i)}{\gamma_i^2 \text{Var}(f|T)}\right]^{\frac{1}{2}} \cdot \left[1 + \frac{\text{Var}(\varepsilon_j|T)}{\gamma_j^2 \text{Var}(f|T)}\right]^{\frac{1}{2}}} \quad (28)$$

for the tranquil (T) period and

$$\rho^C = \frac{1}{\left[1 + \frac{\text{Var}(\varepsilon_i)}{\gamma_i^2 \text{Var}(f|C)}\right]^{\frac{1}{2}} \cdot \left[1 + \frac{\text{Var}(\varepsilon_j|C)}{\gamma_j^2 \text{Var}(f|C)}\right]^{\frac{1}{2}}} \quad (29)$$

for the crisis (C) period.

Observing equations (28) and (29), Corsetti et al. (2003) point out that ρ^C will be greater than ρ^T if the variance of the common factor increases relative to that of idiosyncratic noise and/or if coefficients γ_i and γ_j increase during the crisis period. Corsetti et al. (2003) consequently define contagion as an increase in correlation

coefficient that is inconsistent with equation (27) and its assumptions. Therefore, a theoretical measure of interdependence is proposed:

$$\phi(\lambda_j^T, \lambda_j^C, \delta, \rho^T) \equiv \rho^T \left[\frac{\left(\frac{1 + \lambda_j^T}{1 + \lambda_j^C} \right)^2}{1 + (\rho^T)^2 \left[(1 + \delta)^{\frac{1 + \lambda_j^T}{1 + \lambda_j^C}} - 1 \right]} \frac{1 + \delta}{(1 + \lambda_j^T)} \right]^{\frac{1}{2}} \quad (30)$$

where $\delta = \frac{\text{Var}(R_j | C)}{\text{Var}(R_j | T)} - 1$, $\delta > 0$ and the variance ratios λ_j^T and λ_j^C are

defined according to the following identities: $\lambda_j^T = \frac{\text{Var}(\varepsilon_j | T)}{\gamma_j^2 \cdot \text{Var}(f | T)}$ and

$$\lambda_j^C = \frac{\text{Var}(\varepsilon_j | C)}{\gamma_j^2 \cdot \text{Var}(f | C)}.$$

Corsetti et al. (2003) then specify the contagion and interdependence hypotheses as follows:

$$\begin{aligned} H_0: \rho^C &\leq \phi \\ H_1: \rho^C &> \phi \end{aligned} \quad (31)$$

where H_0 is the null hypothesis of interdependence and H_1 is the hypothesis indicating the presence of contagion.

Evaluating equations (28), (29) and (30) by inspection, it is apparent that ρ^C and ϕ will be equal if the factor loadings remain stable across periods. However, if the factor loadings increase during the crisis period – suggesting a stronger than normal relationship between the African sector return and the FTSE factor return – then ρ^C will exceed ϕ , suggesting contagion.

The approach used in Corsetti et al. (2003) to evaluate the hypotheses is to find the critical levels of the variance ratios at which the hypothesis of interdependence is rejected. Conditional on λ_j^T , $\hat{\delta}$, $\hat{\rho}$ and $\hat{\omega}$, the threshold value of λ_j^C , $\bar{\lambda}^C$, is implicitly defined as follows:

$$\left[1 + (\hat{\rho}^T)^2 \frac{\hat{\delta}(1 + \lambda_j^T) + (\lambda_j^T - \bar{\lambda}^C)}{(1 + \bar{\lambda}^C)} (1 + \lambda_j^T) \right] \left[\frac{1 + \bar{\lambda}^C}{1 + \lambda_j^T} \right] - \left(\hat{\rho}^T \cdot \frac{\hat{\omega} + 1}{\hat{\omega} - 1} \right)^2 (1 + \hat{\delta}) = 0 \quad (32)$$

Finally,

$$\bar{\lambda}^C = \begin{cases} \bar{\lambda}^C(\lambda_j^T, \hat{\delta}, \hat{\rho}, \hat{\omega}) & \text{if } \hat{\omega} > 1 \\ +\infty & \text{if } \hat{\omega} \leq 1 \end{cases} \quad (33)$$

where $\hat{\omega} = \exp \left[2 \left(z(\hat{\rho}^C) - 1.64 \left(\frac{1}{n^T - 3} + \frac{1}{n^C - 3} \right)^{\frac{1}{2}} \right) \right]$ and n^T , n^C denote the size of the tranquil and crisis periods respectively.

In addition to this approach of finding threshold variance ratios, Corsetti et al. (2003) use a Fisher z -transformation to perform a test of equality between ρ^C and ϕ . However, they note that the results of this approach are not affected by using alternative testing frameworks. In particular, the t -test for equality of coefficients (used in Forbes and Rigobon, 2002) is cited as a viable alternative. Consequently, this section uses the t -test, as cited in equation (26), as a basis for comparing ρ^C and ϕ according to the hypotheses set out in equation (31).

5.3 Results

The primary objective of this chapter is to investigate the relationship between integration and contagion. Recall that theory (Claessens et al., 2001; Calvo and Mendoza, 2000; Martin and Rey, 2002) suggests that more integrated markets are more vulnerable to contagion effects. Therefore a comparison between the contagion results and integration levels of African markets is required. Nonetheless, the

contagion results (reported at the sector level) warrant separate consideration, and represent an important component of this study's contribution. Consequently, the contagion results of the Asian and Russian crises are reviewed separately before the empirical evidence pertaining to the relationship between integration and contagion is discussed.

Section 5.2 indicates that two methodologies, the Forbes-Rigobon and the Corsetti et al. methodology, are used in this chapter to evaluate contagion. Section 5.2.3, however, proposes two approaches to evaluate contagion using the Corsetti et al. methodology. Specifically, the one approach involves evaluating the threshold value of the crisis period variance ratio whilst the other uses a *t*-test to compare the crisis correlation coefficient with a theoretical measure of interdependence.

The test results reveal that, in nearly all cases, the threshold value for the crisis variance ratio is positive infinity. In the few remaining cases, the threshold value far exceeds the calculated crisis variance ratio value. Consequently, this approach reports a "no-contagion" conclusion for all sectors in all markets. These results are therefore omitted from presentation, although the conclusion is noted. Accordingly, only the *t*-test results are reported for the Corsetti et al. methodology.

5.3.1 Evidence of contagion from the Asian crisis

In order to reduce the number of tables included in the main text, only the contagion conclusions (yes/no contagion) are presented here. For evidence of contagion in African markets from the Asian crisis, the detailed results for the Forbes-Rigobon and Corsetti et al. methodologies are therefore reported in Appendix B in Tables B2 and B3 respectively.

Table 12 reports the contagion results for the Asian crisis, separately indicating the results according to the two methodologies. As before, results are presented on a sector and country basis, and the sectors are ranked by the average number of contagion occurrences.

Table 12: Contagion to African markets during Asian crisis (Forbes-Rigobon vs Corsetti et al. methodology)

Sector	Egypt		Kenya		Morocco		Namibia		South Africa		Zimbabwe	
	Forbes Contagion	Corsetti Contagion	Forbes Contagion	Corsetti Contagion	Forbes Contagion	Corsetti Contagion	Forbes Contagion	Corsetti Contagion	Forbes Contagion	Corsetti Contagion	Forbes Contagion	Corsetti Contagion
Utilities	–	–	Y	N	–	–	–	–	–	–	–	–
Non-cyclical Services	–	–	N	N	–	–	Y	N	Y	N	–	–
Cyclical Goods	N	N	Y	N	Y	N	–	–	Y	N	N	N
General Industrials	Y	N	N	N	Y	Y	N	N	N	N	N	N
Resources	–	–	N	N	–	–	N	N	Y	N	Y	N
Basic Industries	Y	N	N	N	N	N	N	N	N	N	–	–
Cyclical Services	N	N	N	N	N	N	Y	N	N	N	N	N
Non-cyclical Goods	N	N	N	N	Y	N	N	N	N	N	N	N
Financials	N	N	N	N	N	N	N	N	N	N	N	N
Information Technology	–	–	–	–	–	–	–	–	N	N	–	–

– Not available.

Y indicates contagion; N indicates no contagion. Tests performed at the 5% level.

Forbes Contagion is the correlation measure according to the adjusted Forbes-Rigobon methodology.

Corsetti Contagion is the correlation measure according to the Corsetti et al. methodology.

Considering first the difference in results according to the two methodologies, it is immediately apparent that the Corsetti et al. methodology reports only one instance of contagion whereas the Forbes-Rigobon methodology reports 13 instances. Although this may lead one to the conclusion that the Forbes-Rigobon methodology is significantly more sensitive than the Corsetti et al. methodology, it shall become apparent in the analysis of the Russian crisis that this is not the case. Nonetheless, given the criticisms concerned with the lack of sensitivity in the Forbes-Rigobon methodology levelled by Corsetti et al. (2003), this finding is intriguing and raises the question of whether there are inherently unusual characteristics of African markets driving the disparity in results between the two methodologies.

It is interesting, in addition, that the single instance where the Corsetti et al. methodology reports contagion (General Industrials in Morocco) is in agreement with the Forbes-Rigobon methodology, which also finds contagion. This particular sector in Morocco is noteworthy in that it is dominated by a single company, ONA, which is also the largest share on the Casablanca Stock Exchange. This may suggest the possible presence of a “size effect” in contagion, i.e. larger shares are more vulnerable to contagion because of enhanced liquidity (investors can sell the shares more quickly in times of crisis). Such a finding would be consistent with Forbes (2003).

Combining the results across the two methodologies, it is also apparent that each market experienced contagion in at least one of their sectors during the Asian crisis. Morocco and South Africa each experienced contagion in three sectors, but it would be misleading to imply that the analysis suggests contagion effects were rampant in these African markets. It appears, therefore, that contagion should not be considered as a fear for African markets.

However, this does not necessarily imply that the destabilising effects of increased volatility are never present during contagious crises. Indeed, volatility does increase in several sectors during the crisis period, but these methodologies control for the confounding effects of volatility on the correlation coefficient by making an adjustment (in the Forbes-Rigobon case) or specifying a theoretical measure of interdependence (Corsetti et al. methodology). In fact, the unadjusted correlation

coefficients (not reported), which do not control for the effects of volatility on the correlation coefficient, show several instances where the crisis correlation significantly exceeds the tranquil correlation. However, contagion – as defined for the purposes of this study – is not merely concerned with volatility spillover but rather the strength of the relationship between the crisis country and the African market.

Considering the aggregated sector results, it would seem that the sectors most vulnerable to contagion are Utilities, Non-cyclical Services, Cyclical Goods and General Industrials. The Utilities finding is most puzzling as one would not expect to see contagion effects in a sector that is fundamentally local in nature. In addition, as with Information Technology, there is only one market that reports results. Consequently, the results of this sector are impossible to compare across markets and are highly sensitive to average ranking (if contagion is present, then it receives the highest average rank, if contagion is absent, it receives the lowest average rank). Since Utilities in Kenya comprises only one firm, the Kenya Power and Lighting Company (KPLC), it may be appropriate to give further consideration to firm-specific events that were taking place in 1997. KPLC has a history beginning in 1875, and has since then been a supplier of electricity to Kenya and various other African countries. Until 1997, it also managed the Kenya Power Company (KPC), which was primarily concerned with the generation (as opposed to distribution) of power. However, as a result of new reforms in the energy sector and economy, the two companies separated from one another in 1997 and KPC was re-launched in October 1998 as the Kenya Electricity Generating Company. Consequently, the identity of the firm changed considerably during 1997 (particularly towards the end of 1997) and it may well be these firm-specific changes, as opposed to a genuine contagion effect, that is driving the results.

Given the uncertainty that prevails in times of crisis, it is not surprising that there is strong evidence of contagion in the Cyclical Goods sector. Cyclical Goods in South Africa is dominated by Richemont, one of the world's leading luxury goods groups. Richemont's primary listing is on the London Stock Exchange and it is thus a truly international company. Furthermore, as is the nature of the Cyclical Goods sector, the company is sensitive to economic fluctuations (people are less likely to purchase

luxury goods in times of hardship). In Kenya and Morocco, the Cyclical Goods sector primarily comprises automobile-related firms (especially tyre manufacturers). For many households, cars are the ultimate luxury item (whether it be the purchase of a new car or the maintenance of a current model); one could therefore expect that demand would reduce in times of crisis.

Despite the presence of contagion in these sectors, certain sectors (Financials and Information Technology) report no contagion whatsoever. The absence of contagion in Financials is particularly remarkable. For instance, the possible “size effect”, cited above, would surely prevail in at least one of the Financials sectors, as it is the largest sector in several African countries (see Table 2). In Zimbabwe, for example, the Financials sector commands 81% of market capitalisation, and in Namibia, 61%. In fact, according to the Forbes-Rigobon methodology, the adjusted correlation coefficient actually declined in all markets except Morocco between the tranquil and crisis periods (see Table B2). In other words, not only was there no *significant* increase indicating contagion, but the correlation instead decreased in most reported cases, suggesting a decline in interdependence. This finding is corroborated by the Corsetti et al. methodology, where the theoretical measures of interdependence in Financials across all the markets are all in excess of their respective crisis correlation coefficients.

Importantly, the sector level findings of this section, when aggregated to market level, are broadly consistent with the findings of Collins and Biekpe (2003). Investigating contagion during the Asian crisis, Collins and Biekpe (2003) find evidence of contagion in Egypt and South Africa (using the Forbes-Rigobon methodology) and in Egypt, Morocco, South Africa and Namibia (using an approach related to the Corsetti et al. methodology used in this study).

One of the contributions of this study is that it provides insight at the sector level whereas previous studies only reported market level findings. Now that evidence of contagion is presented at the sector level, the question is whether the market level results of Collins and Biekpe (2003) are influenced by one or two large sectors or whether the effect is spread across several sectors.

Contagion in South Africa, for instance, appears to have occurred in the Non-cyclical Services, Cyclical Goods and Resources sectors. Sector market capitalisations from Table 2 reveal that Non-cyclical Goods commands 2% of South African market capitalisation whilst Cyclical Goods forms 8%. On the other hand, Resources alone represents 47% of South African market capitalisation. This finding suggests that Resources probably was the driving force behind the South Africa contagion finding in Collins and Biekpe (2003). In Egypt, Table 12 shows that General Industrials (the smallest sector) and Basic Industries (the largest sector) report contagion, suggesting that the Collins and Biekpe (2003) market level finding of contagion in Egypt was likely to have come entirely through Basic Industries. Similarly, Morocco reports contagion in Cyclical Goods (1% of market capitalisation), General Industrials (18%) and Non-cyclical Goods (12%). Since General Industrials and Non-cyclical Goods together command 30% of market capitalisation, the market level contagion finding in Collins and Biekpe (2003) was, in all probability, generated by these sectors.

Collins and Biekpe (2003) find no contagion in Namibia according to the Forbes-Rigobon methodology, which is not surprising when the two sectors (Non-cyclical Services and Cyclical Services) that show contagion in Table 12 together constitute less than 4% of Namibian market capitalisation. The same comments can be made for Kenya (Utilities and Cyclical Goods together represent only 8% of market capitalisation) and Zimbabwe (Resources constitutes only 5% of market capitalisation).

The comparison between the market level and sector contagion results for the Asian crisis is particularly revealing. Firstly, where market level results have found evidence of contagion, sector level results have been able to confirm that sectors comprising a non-trivial component of total market capitalisation also experience contagion. More importantly, however, the sector analysis has revealed that contagion seems to generally only come through one or two large sectors. In other words, market level contagion results may generate disproportionate concern, suggesting that the entire market is vulnerable to contagion when – in fact – contagion is operating through one sector only. Consequently, these results further confirm the conclusion of Collins and Biekpe (2003) that Africa has little to fear from contagion.

5.3.2 Evidence of contagion from the Russian crisis

Although the Russian crisis has been considered as a crisis separate from the Asian crisis, with its own independent effects and consequences, it is nevertheless worth reiterating that the period extending from late 1997 to the end of 1998 was a time of general uncertainty and crisis in emerging markets. As a result, it is perhaps not without justification to consider contagion effects from the Asian and Russian crises simultaneously, as is done in section 5.3.3 where integration and contagion are jointly assessed. It was, indeed, the length and persistence of market instability and irrationality that had such damaging effects even in developed markets; for example, the hedge fund, Long-Term Capital Management, ultimately suffered losses in the order of \$1 trillion because markets remained irrational longer than it could remain solvent.

Therefore, the way in which contagion was manifested in the Russian crisis is probably quite different to the situation surrounding the Asian crisis. The Asian crisis took investors by surprise and caused widespread panic in emerging markets throughout the world. The Russian crisis, though unexpected (in his book, “When Genius Failed”, Lowenstein, 2002 p. 139, recalls how investors blindly asserted that “Nuclear powers don’t default”), came after a time of general market instability. One might expect that most investors would have liquidated their risky emerging market portfolios in 1997 (and would have been unlikely to have reinstated those positions so quickly as to pre-date the Russian crisis). This expectation is particularly relevant to African markets, many of which remain classified as “frontier” markets by the IFC, and are therefore perceived to be especially illiquid and risky.

The contagion results for the Russian crisis are presented in Table 13. Once again, detailed results are catalogued in Appendix B in Tables B4 and B5. Because Datastream has only provided data for the General Industrials and Information Technology sectors from 2000 onwards, these sectors have been omitted from this analysis.

The most apparent feature of the results is, as in Table 12, the general absence of contagion. Most sectors report no contagion according to either the Forbes-Rigobon

Table 13: Contagion to African markets during Russian crisis (Forbes-Rigobon vs Corsetti et al. methodology)

Sector	Egypt		Kenya		Morocco		Namibia		South Africa		Zimbabwe	
	Forbes Contagion	Corsetti Contagion	Forbes Contagion	Corsetti Contagion	Forbes Contagion	Corsetti Contagion	Forbes Contagion	Corsetti Contagion	Forbes Contagion	Corsetti Contagion	Forbes Contagion	Corsetti Contagion
Basic Industries	N	Y	N	N	N	N	Y	Y	N	Y	N	N
Non-cyclical Goods	N	Y	N	Y	Y	N	N	N	N	N	Y	N
Resources	-	-	N	N	-	-	Y	N	N	N	N	N
Financials	N	N	N	N	N	N	N	N	N	N	Y	N
Cyclical Goods	-	-	N	N	N	N	-	-	N	N	N	N
Cyclical Services	N	N	N	N	N	N	N	N	N	N	N	N
Non-cyclical Services	-	-	N	N	-	-	N	N	N	N	-	-
Utilities	-	-	N	N	-	-	-	-	-	-	-	-

- Not available.

Y indicates contagion; N indicates no contagion. Tests performed at the 5% level.

Forbes Contagion is the correlation measure according to the adjusted Forbes-Rigobon methodology.

Corsetti Contagion is the correlation measure according to the Corsetti et al. methodology.

or Corsetti et al. methodologies. Although there are fewer instances of reported contagion in the Russian crisis than in the Asian crisis, the difference is not very significant, especially when one considers that two sectors have been omitted from the analysis. What is strikingly different, however, is the even spread of contagion across the two methodologies. Recall that in section 5.3.1, Corsetti et al. results only reported one instance of contagion, as opposed to 13 instances according to the Forbes-Rigobon methodology. In Table 13, however, each methodology reports 5 instances of contagion. The notion that the Corsetti et al. methodology necessarily underestimates contagion relative to the Forbes-Rigobon methodology (a conclusion that could have been plausibly drawn from the results in the previous section) appears to be without foundation.

As in the Asian crisis results, each country seems to experience contagion in at least one of its sectors, but there is no country that clearly seems to be especially vulnerable to contagion. At the sector level, Basic Industries and Non-cyclical Goods report many more instances of contagion than any other sector (Cyclical Goods, Cyclical Services, Non-cyclical Services and Utilities do not even have a single instance of contagion). Moreover, an inspection of the detailed Corsetti et al. results reveals that in Basic Industries, the crisis correlation coefficient exceeds the theoretical measure of interdependence in 5 out of 6 markets (albeit not significantly in all cases). Similarly, in Non-cyclical Goods, the crisis coefficient exceeds the theoretical measure of interdependence in all 6 markets. Such a strong pattern warrants further scrutiny.

The Basic Industries sector in African markets comprises mainly cement (particularly in Egypt) and construction companies, whilst food and beverage companies predominate in Non-cyclical Goods. It is not immediately apparent why these industries should be vulnerable to contagion, and it is worth noting that Basic Industries and Non-cyclical Goods each only reported one instance of contagion during the Asian crisis. One possible explanation, although contentious, is that a size effect may be at work. Although, once again, Financials (the sector with the largest average market capitalisation) reports very few instances of contagion, Basic Industries and Non-cyclical Goods are the third and fourth largest sectors on average

(see Table 2). In particular, they together command nearly half of market capitalisation in Egypt, and Non-cyclical Goods alone represents 36% of market capitalisation in Kenya. Although size did not seem to be particularly relevant in the contagion results from the Asian crisis, it may be that size played an important role in contagion from the Russian crisis to African markets.

5.3.3 *The relationship between integration and contagion*

No matter what factors were responsible for contagion during the Asian or Russian crises, the results are clear on one issue: there is relatively little evidence of contagion in African markets. This study has highlighted that certain sectors are more vulnerable to contagion than others; in particular, Cyclical Services, Financials and Information Technology appear to be almost immune to contagion. Nonetheless, no particular sector or country demonstrates particularly high contagion risk.

Remembering that the aim is to evaluate the relationship between integration and contagion, it is useful to recall from chapter 3 that sectors in most African markets exhibited relatively unremarkable levels of integration (with the possible exception of South Africa). Theory would therefore predict that there would be relatively little risk of contagion, since the transmission of contagion requires – by definition – that markets are reasonably open (Claessens, Dornbusch and Park, 2001). A perfectly closed market will be immune to factors and events that exist outside market parameters. Given the low levels of integration in African markets, an attempt to quantify the relationship between integration and contagion may suffer from a lack of power. Nevertheless, having acknowledged these potential difficulties, the relationship between integration and contagion is discussed below.

Table 14 presents integration and contagion results for comparative purposes. Integration values are taken from the levels calculated over the 1995–1999 period, as recorded in Table 4. This period was used as it overlapped with the 1997–1998 period that was used for the contagion tests. The contagion results represent a combination of both the Forbes-Rigobon and Corsetti et al. methodologies over the Asian and Russian crises. The results are weighted in favour of a “yes-contagion” conclusion. In other words, if a particular sector reported a yes-contagion conclusion

Table 14: Relationship between integration* and contagion†

Sector	Egypt		Kenya		Morocco		Namibia		South Africa		Zimbabwe	
	Contagion	Integration	Contagion	Integration	Contagion	Integration	Contagion	Integration	Contagion	Integration	Contagion	Integration
Utilities	-	-	Y	0.05	-	-	-	-	-	-	-	-
Resources	-	-	N	-0.04	-	-	Y	-0.59	Y	0.68	Y	-0.11
Non-cyclical Goods	Y	0.02	Y	0.30	Y	0.22	N	0.46	N	0.51	Y	0.51
Non-cyclical Services	-	-	N	0.31	-	-	Y	-0.14	Y	0.38	-	-
Cyclical Goods	N	-0.26	Y	-0.09	Y	-0.22	-	-	Y	0.35	N	0.29
Basic Industries	Y	0.02	N	0.17	N	-0.08	Y	0.50	Y	0.66	N	0.54
General Industrials	Y	-0.45	N	-0.08	Y	0.18	N	0.59	N	0.68	N	0.48
Cyclical Services	N	0.29	N	0.08	N	0.02	Y	0.60	N	0.75	N	0.44
Financials	N	0.05	N	0.48	N	-0.19	N	0.41	N	0.62	Y	0.02
Information Technology	-	-	-	-	-	-	-	-	N	0.60	-	-

- Contagion data not available.

* Integration is the correlation of fitted returns from a VAR with exogenous local and U.K. variables over a period from 1995 to 1999.

† Contagion in Asian and/or Russian crisis, according to Forbes-Rigobon and/or Corsetti et al. methodology.

Y indicates contagion; N indicates no contagion. Tests performed at the 5% level.

in either methodology during either crisis, a yes-contagion conclusion is reported in Table 14. Finally, the sectors are ranked by the average number of contagion instances in each sector.

The principal question is whether there is a level of integration at which contagion becomes a problem. Despite the upward bias and the aggregation across crises, contagion still occurs in a minority of cases (20 out of 44 reported instances). Utilities, Resources, Non-cyclical Goods and Non-cyclical Services appear to experience the most instances of contagion. However, a brief inspection of the comparable integration levels does not suggest an obvious relationship between integration and contagion. If one sets Utilities aside (for the reasons cited in section 5.3.1), then one notices that in Namibia and Zimbabwe contagion is present despite negative integration values. Non-cyclical Goods, on the other hand, reports higher integration values in markets where contagion is present. Still, Non-cyclical Goods in Egypt reports contagion although the integration value is almost zero.

On closer inspection, it is evident that in only 10 out of the 20 reported instances of contagion are the integration values greater than 0.10. It may be suggested that in South Africa the relationship is stronger because contagion is only present in sectors that have integration levels of at least 0.35. However, the suggestion is spurious as the remaining sectors that do not show evidence of contagion also report substantial integration levels; in fact, Cyclical Services, which reports the highest level of integration in South Africa, does not report any contagion.

Therefore, it would seem that at these levels of integration, sector on sector, higher integration does not necessarily result in contagion. However, had the comparison between integration and contagion been evaluated at the market level, the results may have erroneously suggested that the relationship is much stronger. This is because contagion often occurs in one or two large sectors that may dominate no-contagion findings in smaller sectors when aggregated to the market level.

There are several possible explanations to suggest why there is not any ostensible relationship between integration and contagion in African markets. Perhaps most of

these markets are still in the process of integration and, in the main, are still largely segmented. On the other hand, it may be that the theoretical relationship between integration and contagion requires a minimum level of integration that these markets do not achieve. This conclusion, which is consistent with that of Collins and Biekpe (2003), suggests that African markets should not be concerned with the potentially negative contagion-related ramifications that are cited in integration literature. For the meanwhile, at least, it appears that contagion – when it does affect African markets – is probably more related to size and sector characteristics than levels of integration.

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6 CONCLUSIONS AND IMPLICATIONS

The main objectives of this thesis have been to measure global versus regional integration in African markets, to investigate the possible relationship between integration and growth in these markets, and to evaluate the association between integration and contagion. In addition to these broadly defined objectives, several other related issues have also been explored. This chapter reviews the important conclusions arising from these studies and, where relevant, their implications for policymakers in African markets. Finally, recommendations for further research are offered.

6.1 Conclusions

Perhaps the most general conclusion is one related to the methodology used in this thesis. Specifically, the use of a sector level (rather than market level) approach has been a particularly useful tool. Firstly, the construction of a comparable set of sector indices for African markets has allowed for insight into the profile of these markets. One can confidently conclude, for instance, that the Financials, Resources and Basic Industries sectors are the largest sectors in African markets. On the other hand, Utilities and Information Technology are relatively small sectors. In addition, whilst the spread of market capitalisation among U.K. sectors is fairly even, market capitalisation in African markets tends to be clustered in one or two large sectors. In addition, sector level results often provide insight into results that had previously been generated at the market level, an issue that is revisited several times below. Indeed, a main finding and conclusion of this thesis must be that a sector level approach adds a valuable layer of analysis to market level findings.

Sector level results reveal that technology-related sectors Information Technology and Non-cyclical Services (which is often dominated by mobile telecommunications companies) are the most globally integrated sectors in African markets, with Cyclical Goods and Utilities the least integrated. However, the integration of Cyclical Goods shows evidence of increasing over time, as do the Financials and Information

Technology sectors. The increasing integration of Financials suggests the possible movement towards a closer synchronisation of African and international interest rates.

Aggregating results to the market level, South Africa, Namibia, Egypt and Morocco report the highest levels of integration, and Kenya the lowest level. South Africa is significantly more integrated than other African markets, suggesting that size and scale of operation are important determinants of integration in African markets. However, many sectors in Kenya and Zimbabwe actually report declines in integration over time. In the case of Kenya, this may be because of a premature liberalisation and privatisation programme in the early 1990s that led to instability and corruption; the Zimbabwe results suggest that the recent political instability has had a negative impact on the foreign investment in the local market. More generally, with the exception of South African sectors, integration levels reported in the majority of African market sectors are relatively low. It may therefore be concluded that most African markets remain largely segmented and are still probably in the early stages of the integration process.

Nonetheless, integration is shown to have increased over time in a majority of cases. This trend towards increasing integration is likely to be given a significant boost in the near future. Russell Loubser, chief executive of the JSE, announced in August 2003 that plans were afoot to establish a pan-African bourse, using the JSE Securities Exchange as the main hub. This will generate much needed liquidity in African markets and will allow foreigners to invest more easily in these markets. Undoubtedly, this development will have the effect of increasing the global integration of African markets.

Further investigation into the integration process reveals that regional integration is marginally stronger than global integration in African markets. Consequently, there is no convincing evidence to suggest that recent advances in communication and technology have resulted in African markets integrating globally before achieving regional integration. Nonetheless, Egypt and Morocco report higher levels of global integration than regional integration, but this result may be driven by the possibility that these countries more accurately form part of a Middle-East (rather than African)

region. When the analysis is repeated on a European dataset twenty years earlier, regional integration is found to exceed global integration by 50% on average. To the extent that 1970s Europe can be compared with 1990s Africa (for instance, many European countries liberalised in the 1970s and several African countries liberalised their markets in the 1990s), it would appear that the process of integration has not radically changed over the last two decades. Although levels of global integration were relatively higher in the later analysis, regional integration still dominates. Even today, regional links therefore form a relevant component in the process of integration.

The primary benefit of integration is postulated to be increased growth, and this claim is indirectly tested in chapter 4 using changes in cost of equity as an indication of the first step towards growth. Having measured cost of equity levels in African markets, it appears that larger sectors (Non-cyclical Goods, Financials and Basic Industries) exhibit lower levels. This size effect suggests the presence of a liquidity premium in large sectors that drives down the cost of equity.

Comparing the cost of equity over two adjacent time periods indicates that in almost all sectors of all markets, the cost of equity declined over time. Although certain sectors exhibited greater declines than others, all show evidence of decreases in cost of equity. Even if the risk-free component in the cost of equity is held constant over the two periods, the wholesale decline effect remains robust. This suggests that the decline is predominantly motivated by decreases in the equity risk premium or, more accurately, decreases in risk. Such a finding is consistent with the notion that African markets are becoming more stable over time.

However, the widespread decline in cost of equity over time has the result that changes in integration are not strongly related. On the one hand, high levels of integration and increases in integration over time are both found to be positively associated with decreases in cost of equity, as predicted by theory. This effect is particularly strong in Morocco and South Africa. However, integration is found to decrease in several sectors where cost of equity also decreases, especially in Kenya,

Namibia and Zimbabwe. Instead, one might have expected cost of equity to increase in these sectors.

Notwithstanding this expectation, it is not necessarily inconsistent to suggest that integration and cost of equity should simultaneously decrease. Rather, this finding suggests that share prices in these sectors are appreciating (hence cost of equity falls) and that this rally is driven by local rather than international investors (hence integration falls). This is likely to be the dynamic operating in Zimbabwe where the local market has performed relatively well in recent years despite the political instability. In fact, local investors have turned to equities for investment as other asset classes (e.g. property) have become less attractive. This has resulted in the establishment of several new companies and development at the local level. International investors, on the other hand, have reduced their exposure to Zimbabwe during this time due to its increasingly unconvertible exchange rate. In this scenario, one would expect to find integration declining in most sectors but cost of equity also decreasing in several cases. The results confirm this expectation.

The relevance of these findings for policymakers in African markets may be summarised as follows. Whilst integration and growth (to the extent that declines in cost of equity are the first step towards growth) are linked in certain instances, the effect is not robust in all cases. Instead, all markets seem to be experiencing increased stability at the sector level regardless of integration, suggesting that the development may be locally driven. Consequently, although there is no evidence suggesting that integration inhibits growth, and although the results do not exclude the possibility that integration may promote growth, integration nevertheless does not seem to be the most important determinant of growth in African markets.

If integration is not robustly linked to growth, its alleged benefit, then is it robustly linked to contagion, its associated cost? This question is addressed in chapter 5 using two methodologies to measure possible contagion effects in African markets during the 1997 Asian and 1998 Russian crises. Although evidence of contagion is present in both the Asian and Russian crises, it would be spurious to claim that contagion is widespread in African markets.

In the Asian crisis, for instance, South Africa and Morocco experience the highest number of contagion instances. However, even in these countries, contagion occurs in a minority of sectors. Aggregating results across markets, the Non-cyclical Services and Cyclical Goods sectors seem to be the most vulnerable to contagion, whilst Financials shows no evidence of contagion. Comparing these sector level results with the market level analysis of Collins and Biekpe (2003) not only shows consistency between the two sets of results, but also provides insight into the sectors that influenced the market level findings. For example, Collins and Biekpe (2003) find contagion in Egypt, and this study shows that this result is predominantly driven by contagion in Egypt's Basic Industries sector. Similarly, Resources is almost certainly the sector behind the Collins and Biekpe (2003) contagion finding in South Africa.

Results for the Russian crisis show even fewer instances of contagion, and where contagion is present, it occurs in different sectors to the Asian crisis (Basic Industries and Non-cyclical Goods are the most vulnerable, suggesting a possible size effect). Considered together, the Asian and Russian crises indicate that there are relatively few instances of contagion, and when it does occur, it happens in different sectors for different crises.

Even so, there is still scope for a relationship between integration and contagion if the few instances of contagion all occur in highly integrated sectors. However, the results do not show evidence of such a relationship. Although contagion does occur in some sectors that exhibit high levels of integration (e.g. Resources in South Africa), it also often arises in sectors that report very low integration levels (e.g. General Industrials in Egypt). In African markets, there does not seem to be a consistent relationship between integration and contagion.

For policymakers in African markets, this result is particularly important. Developing countries around the world are strongly encouraged to liberalise their markets, and are sometimes forced to do so as part of an IMF intervention programme. However, whereas the risk of contagion remains a major concern in most liberalised markets, this risk appears to be minimal in liberalised African markets. In addition, because African market sectors that exhibit higher levels of integration do not consistently

experience contagion, it appears that attempts to control or limit the level of integration are unnecessary. Nevertheless, it may be that contagion is only associated with integration after integration reaches a certain minimum level that has not yet been attained in African markets. Should integration continue to increase in the future, contagion risk may become more relevant.

Considering the integration, growth and contagion results simultaneously, what can be concluded? Firstly, most African markets remain largely segmented, with the possible exception of South Africa. Secondly, although regional integration is proportionally lower relative to global integration than it may have been in the 1970s, regional links appear to remain relevant. Cost of equity seems to have declined over time in most African market sectors, suggesting that increases in integration may be linked to growth but that evidence of a growth effect persists even when integration decreases. On the other hand, there appears to be relatively little evidence of contagion in African markets, and where present, this contagion appears unrelated to levels of integration. Stated differently, the findings of this thesis suggest that opening markets in Africa carries uncertain growth benefits but no ostensible contagion risk.

6.2 Recommendations for further research

There are several recommendations arising from this thesis. Some of these recommendations involve refinements to the methodologies used in this thesis, whilst others suggest new opportunities for further research.

One of the most interesting and unexpected findings of this thesis has been the widespread decline in cost of equity over time, reported in chapter 4. Whilst the scope of the thesis was restricted to evaluating the relationship between cost of equity and integration, it appears that there are factors other than, or in addition to, integration that are influencing this result. Consequently, an investigation into the factors that could be responsible for this effect would be an appropriate extension to this initial finding. In particular, it is strongly recommended that factors such as value traded, stock market development and number of new listings are considered when attempting to investigate the causes of the decline.

It was acknowledged in chapter 4 that the static, two-period methodology may have been partially responsible for the apparent lack of relationship between changes in integration and cost of equity. It is therefore recommended that for future research considering the relationship between changes in integration and cost of equity, a dynamic methodology be used instead. This would possibly incorporate time-varying integration and cost of equity levels within each period, and a system of lags.

Another important recommendation concerns access to data. Seven African markets were included in this research, but this only represents a small sample of all African equity markets. As data access improves, and more African countries with firm-level data are added to commercial databases, it is vital that the studies reported in this thesis are repeated on larger datasets.

A related recommendation is that the studies in this thesis are repeated on other non-African developing and developed markets. It would be instructive to see whether the main conclusions (e.g. absence of relationship between integration and contagion) are robust across international regions and levels of country development. That research would also give African policymakers an insight into the experiences of other regions.

Several findings in this thesis (e.g. cost of equity levels, contagion during the Russian crisis) seem to have exhibited a “size effect”. In other words, it was the relative size of the sectors that was driving a particular result rather than, say, the particular characteristics (e.g. cyclical) of the sectors involved. To the extent that this size effect is relevant in African markets, it would be valuable to measure this more directly. Specifically, instead of performing an analysis on a sector basis, it could be measured on a size basis in each market. For instance, the analysis could be performed on “large cap” shares that constitute the top 20% of market capitalisation and compare the results with “small cap” shares that constitute the bottom 20%.

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APPENDIX A: AFRICAN SECTOR INDEX CONSTITUENTS

Constituent companies used to generate the chain-linked constructed sector indices for Egypt, Kenya, Mauritius, Morocco, Namibia, South Africa and Zimbabwe are presented below. In accordance with the method outlined in section 2.2.2, the constituent companies have been classified in accordance with the FTSE Global Classification system. Company names are presented in alphabetical order and are reported according to Datastream and I-Net titles. Constituents for sector indices of other countries used in this thesis can be provided upon request.

EGYPT

Basic Industries

Acrow Misr, Alexandria Cement, Alexandria Nat. Iron & Steel, Amriayh Cement, Arabian Intn. Contractor, Development & Engr., Egyptian Chemical Ind, Egyptian Fin. & Ind., Egyptians Housing Dev., El Kahera Housing & Dev., Ezz Steel Rebars, Giza General Contracting, Helwan Portland Cement, Ind. Engr. Con. & Dev., Kafr El – Zaitv, Mahmoudia Contracting, Middle East Paper (Simo), Misr Aluminium, Misr Cement (Qena), Misr Chemical Industries, Nasr Comp.Civil Works, National Cement, Nile Match Co., Orascom Construction Ind, Paint & Chemical (Pacin), Rakta, Sinai Cement, South Valley Cement, Suez Cement, Tora Portland Cement, Unipack, United Housing & Dev., Upper Egypt General Contracting

Cyclical Goods

Alexandria Spinning & Weaving, Arab Ceramic, Arab Cotton Ginning, Arab Polivara Spng.&Wvg., Dakahila Spinning, Damietta Filature, Delta Industries (Ideal), El Nasr For Garments (Kabo), EZZ CMC and Porcelain, Filature Nationale, Intl. Electronics, Miraco, Nile Cotton Ginning, Orient Linen & Cotton, Oriental Weavers, Telemisr

Cyclical Services

General Silos Storage, Media Production City, Misr Duty Free Shops, Misr For Hotels (Hilton), Orascom Hotel Holding, Orascom Proj. & Tourist

Financials

Alex Real Estate, Commercial Int.Bank, Credit Int. D'Eypte, Delta Insurance, Delta International Bank, EFG Holding Company, Egypt American Bank, Egyptian British Bank, Egyptian Gulf Bank, Egyptian Workers Bank, El Watany Bk. of Egypt, Export Dev. Bk. Egypt, Heliopolis Housing Con., Housing & Dev. Bank, Mibank, Misr Exterior Bank, Mohandes Insurance, Mohands Bank, Nasr City Housing, Nat. Bank For Dev., Nat. Societe General

Bk., Olympic Group, Saudi Egypt Inv.Finance, Six October Dev. & Inv. (SODIC), Suez Canal Bank, United Bank Of Egypt

General Industrials

Egyptian Electric Cable, IEEC

Non-cyclical Goods

Al – Ahram Beverages, Alexandria For Pharmacy, Alexandria Mills, Ameriyah Pharmacy, Cairo Pharma, Cairo Poultry, Chipsy For Food Ind, Delta Sugar, East Delta Flour Mills, Eastern Tobacco, Egypt For Starch, El Nasr Dehydrated, Epico, Extracted Oils Derivatre, Hoechst Orient, Ibn Sina Treatment And Medical Services, Memphis Pharmaceuticals, Middle & West Delta, Middle Egypt For Mills, Misr Gulf Oil Processing, Misr Oil, Nile Pharmaceuticals, North Cairo Mills, Noubareyah Agricultural, Pfizer Egypt, Savola Sime, South Cairo Mills, Swiss Pharma, Upper Egypt Flour Mills, Wadi Agr.Crop Exports

Non-cyclical Services

MobiNil, Orascom Telecom

Utilities

Egypt Gas

KENYA

Basic Industries

Athi Rvr.Mng., Bamburi Port.Cmt., Boc Kenya, Carbacid Invs., Cwn.Berger Kenya, East African Port.Cmt., Et.Af.Pack.

Cyclical Goods

Car & Gen.Kenya, CMC Hdg., Dun.Kenya, Firestone East Africa, Marshalls Et.Af., Rea Vipingo Plantations

Cyclical Services

Expr.Kenya, Kenya Airways, Nat.Mda.Gp., Std.Nwsp., Tourism Promotion Svs.

Financials

Barclays Bank, CFC Bk., Cty.Tst., Diamond Trust (Kenya), Hsg.Fin., ICDC Investment, Jubilee In., Kenya Commercial Bank, Nat.Bk.Of Kenya, National Indl.Credit, Pan Afn.Ins., Std.Cht.Bk.

General Industrials

A Baumann & Co., Et.Afn.Cbls.

Non-cyclical Goods

Bat Kenya, Brooke Bd.Kenya, EAAGADS, East African Breweries, Kakuzi, Kapchorua Tea, Limuru Tea, Mumias Sug.Co., Sasini Tea & Coffee, UNGA Gp., Williamson Tea Kenya

Non-cyclical Services

Uchumi Supermarkets

Resources

Kenya Oil Co., Ttl.Kenya

Utilities

Kenya Power & Lighting

MAURITIUS

Basic Industries

United Basalt Products

Cyclical Services

Air Mauritius, New Mauritius Hotel, Sun Resorts

Financials

British American In., MCB, State Bank Of Mauritius

General Industrials

Ireland Blythe, Rogers

Non-cyclical Goods

Happy World Foods

MOROCCO

Basic Industrials

Aluminium Du Maroc, Cimentsm, Cior, Engrais, Fertima, Lafarge, Lecarton, Longometal, Magoxygene, Papelera, Sonasid

Cyclical Goods

Auto Nedjma, Auto – Hall, General – Tire

Cyclical Services

CTM – Ln

Financials

Acred, Agma – Lahlou Tazi, Balima, BCM, BMCE, BMCI, BNDE, CDM Credit Du Maroc, CIH Cdt.Immob.Hotelier, Credor, Diac – Salaf, Eqdom, Magbail, Rebabcie, SNI, Sofac, Taslif, Wafabank, Wafassur, Zellidja

General Industrials

Carnaud, Nexans Maroc, ONA

Non-cyclical Goods

Berliet – M, Branoma, Brasserie Du Maroc, Centrale Laitiere, Cosumar, Lesieur, LGMC, Oulmes, Unimer

Resources

Managem, SMI

Utilities

Afriquia Gaz

NAMIBIA

Basic Industries

African Oxygen Limited – Namibia

Cyclical Services

Afr Portland Ind, Avis Holdings – Namibia, Ellerine Holdings Limited – Namibia, JD Group – Namibia, Nictus – Namibia, Pep Namibia Holdings, Truworths International Limited – Namibia, Wooltru - N – Namibia, Wooltru Limited – Namibia

Financials

Alexander Forbes Group Ltd – Namibia, Firststrand Limited – Namibia, FNB – Namibia, Investec Limited – Namibia, Mutual & Federal – Namibia, Namibian Harvest, New Africa Capital Ltd – Namibia, Old Mutual Plc – Namibia, Sanlam Limited – Namibia, Santam Limited – Namibia, Standard Bank Group – Namibia

General Industrials

Barloworld Limited – Namibia

Non-cyclical Goods

Gendor Holdings, Kolosus Holdings – Namibia, Namibia Sea Products – Namibia, Namibian Breweries, Namibian Fishing Ind – Namibia

Non-cyclical Services

CIC Holdings Limited

Resources

Anglo American Plc – Namibia, Namibian Minerals Corporation, Trans Hex Group Limited – Namibia

SOUTH AFRICA¹⁴

Basic Industries

African Oxygen Limited, Aveng Limited, AECI Limited, Masonite (Africa) Limited, Cementation Company (Africa) Limited, AG Industries Limited, Buildmax Limited, Basil Read Holdings Limited, Canadian Overseas Packaging Industries Limited, Chemical Services Limited, Concor Limited, Ceramic Industries Limited, Cashbuild Limited, Distribution & Warehousing Network Ltd, Dorbyl Limited, ELB Group Ltd, Group Five Limited, Highveld Steel & Vanadium Corporation Limited, Iliad Africa Limited, Iscor Limited, Italtile Limited, Murray & Roberts Holdings Limited, Omnia Holdings Limited, Pretoria Portland Cement Company Limited, Sappi Limited, Spanjaard Limited, Wilson Bayly Holmes - Ovcon Limited, York Timber Organisation Limited

Cyclical Goods

Adonis Knitwear Holdings Limited, Amalgamated Appliance Holdings Limited, Amlac Limited, Anbeeco Investment Holdings Limited, Bridgestone Firestone Maxiprest Limited, Burlington Industries Limited, Busby Limited, Combined Motor Holdings Limited, Glodina Holdings Limited, Gubb & Inggs Limited, McCarthy Limited, McCarthy Limited CCP, McCCarthy Limited Senior Debentures, Metair Investments Limited, Nu-World Holdings Limited, Pals Holdings Limited, Richemont Securities AG, Sear del Investment Corporation Limited, Sear del Investment Corporation -N-, Steinhoff International Holdings Limited, Tiger Wheels Limited, Universal Growth Holdings Limited, Vaalauto Limited, Vaaltrucar Limited, Venter Leisure & Commercial Trailers Ltd, Wesco Investments Limited

Cyclical Services

Acuity Group Holdings Limited, Adcorp Holdings Limited, Admiral Leisure World, Advanced Technical Systems Limited, Advanced Technical Systems Limited -N-, Advtech Limited, African & Overseas Enterprises 6.0% Part Prefs, African & Overseas Enterprises -N-, African And Overseas Enterprise, African Media Entertainment Ltd, Alex White Holdings Limited, Astrapak Limited, Avis Southern Africa Limited, Bearing Man Limited, Bidvest Group, Bowler Metcalf Limited, Brandcorp Holdings Limited, Cargo Carriers Limited, Caxton & CTP Publishers & Printers Limited, Caxton 6% Part Prefs, CCN Holdings Limited, City Lodge Hotels Limited, Comair Limited, Command Holdings Limited, Connection Group Holdings Limited, Cullinan Holdings Limited, DNA Supply Chain Investments Limited, Dynamo Retail Limited, Edgars Consolidated Stores Limited, Electronic Media Network & Supersport, Ellerrine Holdings Limited, Enviro serv Holdings Limited, Excellerate Holdings Conv Debs, Excellerate Holdings Limited, Fashion Africa Limited, Foschini Limited, Global Village Holdings Limited, Gold Reef Casino Resorts Limited, Grindrod Limited, Grindrod Limited -N-, Heritage Collection Holdings Limited, Inmins Limited, JD Group Limited, Johnnic Communications Limited, Johnnic Holdings Limited, Kagiso Media

¹⁴ As of August 2003.

Limited, Kersaf Investments Limited, King Consolidated Holdings 14.0% CD, King Consolidated Holdings Limited, LA Group Limited, LA Group Limited –N, Leisurennet Limited, Massmart Holdings Limited, Mathomo Group Limited, Metro Cash & Carry, Millionair Charter Limited, Mobile Industries 6.0% Unsec Auto Conv Debs, Mobile Industries Limited, Mobile Industries Ltd –N, Money Web Holdings Limited, Moribo Leisure Limited, Mr Price Group Limited, Nampak Limited, Naspers Limited –N, New Africa Investment Limited, New Africa Investments –N, New Clicks Holdings Limited, Nictus Beperk, Oakfields Throughbreds & Leisure Industries, Onelogix Group Limited, Pepkor Limited, Phumelela Gaming And Leisure Limited, Primedia Limited, Primedia Ltd –N, Primeserv Group Ltd, Putco Limited, Quyn Holdings Limited, Reberve Holdings Limited, Relyant Retail Limited, Retail Apparel Group Limited, Rex Trueform Clothing Co Ltd – N, Rex Trueform Clothing Company Limited, Sail Group Limited, Sasani Limited, Spur Corporation Limited, Steers Holdings Limited, Stocks Hotels & Resorts Limited, Sun International (South Africa), Super Group Limited, Terexko Limited, Terrafin Holdings Limited, The Don Group Limited, Tourism Investment Corporation, Tradehold Limited, Transpaco Limited, Trencor 6.0% Unsec Auto Conv Debs, Trencor Limited, Truworths International Limited, United Services Technologies Limited, Unitrans Limited, Value Group Limited, Wetherlys Investment Holdings Limited, Winhold 9.0% Convertible Prefs, Winhold Limited, Wooltru – N, Wooltru Limited, Woolworths Holdings Limited

Financials

ABSA Group Limited, Acucap Properties Limited, African Bank Investments Limited, African Life Assurance Company Limited, Alacrity Financial Services Limited, Alexander Forbes Limited, Allan Gray Property Trust, AMB Holdings Limited, Apexhi Properties – A, Apexhi Properties – B, Aquila Growth Limited, Arnold Property Fund, Atlas Properties Limited, Barnard Jacobs Mellett Holdings Limited, Bonatla Property Holdings Limited, Brait S.A., Brimstone Investment Corporation, Brimstone Investment Corporation –N, Cadiz Holdings Limited, Cape Empowerment Trust Limited, Capital Alliance Holdings, Capital Property Fund, Capitec Bank Holdings Limited, Centrecity Property Fund, Chariot Land Limited, Clientle Life Assurance Company Limited, Commercial Finance Company Limited, Congella Federation Limited, Consolidated Property & Finance Limited, Coronation Fund Managers, Coronation Holdings Limited, Coronation Holdings -N-, Corpcapital Limited, Corwil Investments Limited, Cycad Financial Holdings Limited, Decillion Limited, Decillion Ltd - C Debentures, Discovery Holdings Limited, Enterprise Risk Management Limited, Eureka Industrial Limited, Fairvest Property Holdings, Firstrand Limited, Firstrand Limited (FAS Only), Gencor Limited, Glenrand M.I.B. Limited, Gold Edge Holdings Limited, Good Cape Limited, Growthpoint Properties Limited, Hosken Consolidated Investments Limited, Hyprop Investments Limited, Ifour Properties Limited, IMR Investments Limited, Incentive Holdings Limited, Insurance Outsource Holdings Ltd, Investec Limited, Investec PLC, Liberty Group Limited, Liberty Holdings Limited, Liberty International PLC, London Finance & Investment Group PLC, London Finance & Investment Options

PLC, Lyons Financial Solutions Holdings Limited, M.Cubed Holdings Limited, Marshalls Limited, Marshalls -N Limited, Martprop Property Fund, Mercantile Lisbon Holdings Limited, Metboard Properties Limited, Micromega Holdings Ltd, Mutual And Federal Insurance Company Limited, Nedcor Limited, New Africa Capital, Octodec Investments Limited, Old Mutual PLC, Pangbourne Properties Limited, Paramount Property Fund, Peregrine Holdings Limited, Petra Mining Limited, Premier Group Limited, Premium Properties Limited, Prima Property Trust, Primegro Properties Limited, Proper Group Limited, PSG Group Limited, Putco Properties Limited, Rand Leases Properties Limited, Real Africa Holdings Limited, Redefine Income Fund Limited, Remgro Limited, Rentsure Holdings Limited, Resilient Property Income Group, Richway Retail Properties Limited, RMB Holdings Limited, SA Retail Properties Limited, Saambou Holdings Limited, Sable Holdings Limited, Sabvest Limited, Sabvest Limited –N, Sage Group Limited, Samrand Development Holdings Ltd, Sanlam Limited, Santam Limited, Sasfin Holdings Limited, Shops For Africa Ltd, South African Eagle Insurance Company Limited, Spearhead Property Holdings Limited, Standard Bank Group Ltd, Sycom Property Fund Units, Tigon Limited, Tisec Limited, Trematon Capital Investments Limited, Venfin Limited, Zarara Energy Limited, Zeltis Limited.

General Industrials

Allied Electronics Corporation Limited, Allied Electronics Part Prefs, Allied Technologies Limited, Argent Industrial Limited, Barloworld Limited, Bell Equipment Limited, BICC CAFCA Limited, Control Instruments Group Limited, Delta Electrical Industries Limited, Digicore Holdings Limited, Grintek Limited, Howden Africa Holdings, Hudaco Industries Limited, Imperial Holdings Limited, Invicta Holdings, IST Group Limited, Jasco Electronics Holdings Limited, Kairos Industrial Holdings Ltd, Monteagle SA, Northern Engineering Industries Africa Limited, Pasdec Resources SA Limited, Reunert Limited, Sekunjalo Investments Limited, Setpoint Technology Holdings Ltd.

Information Technology

AST Group Limited, Bytes Technology Group Limited, Comparex Holdings Limited, Compu Clearing Outsourcing Limited, Crux Technologies Limited, CS Computer Services Holdings Limited, Datacentrix Holdings Limited, Datatec Limited, Dimension Data Holdings PLC, Elexir Technology Holdings Limited, Enterprise Outsourcing Holding Ltd, Erp.Com Holdings Limited, Faritec Holdings Limited, Frontrange Limited, Global Technology Limited, Idion Technology Holdings Limited, Intervid Limited, Maxtec Limited, MGX Holdings Limited, Mustek Limited, Net 1 Applied Technology Holdings Ltd, Netactive Limited, Omega Alpha International Information Technology, OSI Holdings Limited, Paracon Holdings Limited, Pinnacle Technology Holdings Limited, Prism Holdings Limited, Siltek Limited, Softline Limited, Spescom Limited, Spicer Holdings Limited, Square One Solutions Group Limited, Top Info Technology Holdings Limited, UCS Group Limited, Vesta Technology Holdings Limited, Y3K Group Limited.

Non-cyclical Goods

Afgri Limited, Afrox Healthcare Limited, Alliance Pharmaceutical Ltd, Alliance Pharmaceuticals –N, Amalgamated Beverage Industries Limited, Anglovaal Industries Limited, Aspen Pharmacare Holdings Limited, Astral Foods Limited, Awethu Breweries Limited, Choice Holdings 10.0% Convert Prefs, Choice Holdings Limited, Conafex Holdings Societe Annoyme, Crookes Brothers Limited, Distell Group Limited, Forim Holdings Limited, Illovo Sugar Limited, Intertrading Limited, Kolosus Holdings Limited, KWV Beleggings Beperk, Medi-Clinic Corporation Limited, Namibian Fishing Industries, Namibian Sea Products Limited, Network Healthcare Holdings Limited, Oceana Group Limited, Rainbow Chicken Limited, SABMiller PLC, Sovereign Food Investments, Tiger Brands Limited, Tongaat-Hulett Group Limited, W B Holdings Limited.

Non-cyclical Services

MTN Group Limited, Pick 'n Pay Holdings Limited, Pick 'n Pay Stores Limited, Shawcell Telecommunications Limited, Shoprite Holdings Limited, Telkom SA Limited.

Resources

African Gem Resources Limited, African Rainbow Minerals Limited, Afrikander Lease Limited, Anglo American Platinum Corporation, Anglo American PLC, Anglogold Limited, Anglovaal Mining Limited, Assmang Limited, Assore Limited, Avgold Limited, Barnato Exploration Limited, Barplats Investments Limited, BHP Billiton PLC, Diamond Core Resources Limited, Durban Roodepoort Deep Limited, Eersteling Gold Mine, Energy Africa Limited, Falcon Investment Holdings Societe Anonyme, Free State Development & Investment Corp Ltd, Goldfields Limited, Harmony Gold Mine Opt Warrant, Harmony Gold Mining Company Limited, Impala Platinum Holdings Limited, JCI Limited, Kelgran Africa, Kumba Resources Limited, Lonmin PLC, Matodzi Resources Limited, Messina Limited, Metorex Limited, Mvelaphanda Resources Limited, Northam Platinum Limited, OTR Mining Limited, OTR Mining Limited Options, Palabora Mining Company Limited, Randgold and Exploration Company, Sallies Limited, Sasol Limited, Scharrig Mining Limited, Simmer and Jack Mines Limited, South African Chrome and Alloys Limited, Southern Mining Corporation Limited, Stilfontein Gold Mining Company Limited, Sub Nigel Gold Mining Company Limited, Thabex Exploration Limited, Trans Hex Group Limited, Village Main Reef Gold Mining Company (1934) Ltd, Wankie Colliery Company Limited, Western Areas Limited, Zambia Copper Investments Limited

ZIMBABWE

Basic Industries

Astra Inds., Border Timbers, Chemco Hdg., Cir.Cmt., Hunyani Hdg., PG Industries Zimbabwe, Pretoria Port.Cmt. (Zim), Zimplot

Cyclical Goods

Cotton Zimbabwe, Dvd.Whitehead Text., National Tyre Svs., Phnx.Cons.Inds.

Cyclical Services

Clan Hdg., Edgars Strs.(Zim), Haddon & Sly, Innscor, Meikles Africa, OK Zimbabwe, Pelhams, Rainbow Tourism Gp., Tedco, Truworths, Zimbabwe Newspapers, Zimbabwe Sun

Financials

Africa Banking, Barclays Bk.of Zimbabwe, Century Hdg., Commercial Bank Zimbabwe, First Bkg., Kingdom Financial Hdg., Nicoz Diamond, Nmbz Holdings, Old Mutual (Zim), South Africa Rein., Tst.Hdg., Zimbabwe Finl.Hdg., Zimbabwe Rein., Zimnat Lion Ins.

General Industrials

Apex Corp. Of Zimbabwe, Ariston Holdings, BICC CAFCA, CFI Holdings, DELT., Gulliver Cons, Murray & Roberts, Powerspeed Electrical, Radar Holdings, Ta Holdings, Tractive Pwr.Hdg., Trans Zambesi Inds., TSL

Non-cyclical Goods

Brit.Amer.Tob.Zimbabwe, Cairns, Caps Hdg., Colcom Holdings, Dairibord Zimbabwe, Hippo Vly.Ests., Interfresh Ltd., Medtech Holdings, National Foods Hdg., Seed Co.of Zimbabwe, Tanganda Tea, ZSR

Non-cyclical Services

Econet Wireless

Resources

Ashanti Goldfields (Zim), Ashanti Goldfields Zdr, Bindura Nickel, Falcon Gd.Zimbabwe, Falcon Invs.(Zim), Rio Tinto Zimbabwe, Wankie Colliery, Zimbabwe Alloys Pref.

Table B1: Relationship between changes in integration* and percentage changes in cost of equity

Sector	Egypt		Kenya		Morocco		Namibia		South Africa		Zimbabwe	
	Δ in Integration	% Δ in Cost of Equity [†]	Δ in Integration	% Δ in Cost of Equity [†]	Δ in Integration	% Δ in Cost of Equity [†]	Δ in Integration	% Δ in Cost of Equity [†]	Δ in Integration	% Δ in Cost of Equity [†]	Δ in Integration	% Δ in Cost of Equity [†]
Resources	–	–	-0.10	63.5	–	–	0.83	–	0.16	-3.8	-0.53	86.0
Information Technology	–	–	–	–	–	–	–	–	0.36	-76.6	–	–
Utilities	–	–	-0.34	63.0	–	–	–	–	–	–	–	–
Basic Industries	-0.17	34.3	-0.40	48.5	0.30	20.4	-0.10	58.4	0.10	-9.0	-0.76	70.5
Cyclical Services	-0.09	273.3	0.64	-9.5	0.40	13.2	-0.10	91.7	-0.14	22.1	-0.64	-31.7
Financials	0.30	114.4	-0.46	24.3	0.36	32.3	0.25	124.7	-0.01	31.5	0.24	-10.5
General Industrials	0.50	386.1	0.02	200.1	0.24	-43.8	-0.10	72.3	0.00	8.7	-0.45	101.8
Non-cyclical Services	–	–	0.00	-33.7	–	–	0.04	–	0.35	-2.9	–	–
Non-cyclical Goods	0.49	198.2	-0.40	28.3	0.34	56.8	-0.57	-36.0	0.01	36.4	-0.62	17.0
Cyclical Goods	0.34	757.9	0.06	182.4	0.32	126.9	–	–	0.36	-15.2	-0.62	-17.1

Numbers in **bold** indicate that the theoretical relationship between the changes in integration and cost of equity is upheld.

– Not available.

* Integration is the correlation of fitted returns from a VAR with exogenous local and U.K variables.

† % Δ Cost of Equity is the percentage change in cost of equity over two adjacent time periods using a change in dividend yield methodology with constant growth assumptions.

Table B2: Contagion to African markets during Asian crisis (Forbes-Rigobon methodology)

Sector	Egypt			Kenya			Morocco			Namibia			South Africa			Zimbabwe		
	ρ^T	ρ^C	Ctgn*	ρ^T	ρ^C	Ctgn*	ρ^T	ρ^C	Ctgn*	ρ^T	ρ^C	Ctgn*	ρ^T	ρ^C	Ctgn*	ρ^T	ρ^C	Ctgn*
Utilities	-	-	-	0.01	0.18	Y	-	-	-	-	-	-	-	-	-	-	-	-
Non-cyclical Services	-	-	-	0.04	0.11	N	-	-	-	0.15	0.26	Y	0.25	0.40	Y	-	-	-
Cyclical Goods	0.21	0.21	N	-0.04	0.16	Y	0.05	0.17	Y	-	-	-	0.13	0.34	Y	-0.06	-0.09	N
Resources	-	-	-	-0.03	-0.33	N	-	-	-	0.31	0.03	N	0.07	0.40	Y	-0.03	0.69	Y
General Industrials	0.11	0.29	Y	-0.04	0.04	N	-0.01	0.10	Y	0.28	0.24	N	0.35	0.24	N	0.15	0.00	N
Basic Industries	-0.03	0.18	Y	0.06	0.11	N	-0.01	-0.03	N	0.09	0.09	N	0.16	0.21	N	-	-	-
Cyclical Services	0.12	-0.05	N	-0.01	-0.01	N	0.00	0.04	N	0.12	0.26	Y	0.38	0.30	N	0.06	0.00	N
Non-cyclical Goods	0.07	0.02	N	-0.11	-0.01	N	-0.14	0.05	Y	0.12	0.03	N	0.18	0.09	N	0.04	0.01	N
Financials	0.13	0.12	N	0.09	0.03	N	0.02	0.05	N	0.25	0.15	N	0.40	0.22	N	-0.02	-0.06	N
Information Technology	-	-	-	-	-	-	-	-	-	-	-	-	0.10	0.11	N	-	-	-

Numbers in **bold** indicate contagion.

- Not available.

* Ctgn indicates whether or not the difference in correlation constitutes contagion, calculated at the 5% level using a *t*-test.

ρ^T is the correlation measure during the tranquil period.

ρ^C is the correlation measure during the crisis period.

Table B3: Contagion to African markets during Asian crisis (Corsetti et al. methodology)

Sector	Egypt			Kenya			Morocco			Namibia			South Africa			Zimbabwe		
	ϕ	ρ^c	Ctgn*	ϕ	ρ^c	Ctgn*	ϕ	ρ^c	Ctgn*	ϕ	ρ^c	Ctgn*	ϕ	ρ^c	Ctgn*	ϕ	ρ^c	Ctgn*
General Industrials	0.26	0.17	N	0.21	0.09	N	0.09	0.23	Y	0.51	0.42	N	0.55	0.42	N	0.44	0.03	N
Basic Industries	0.43	0.28	N	0.21	0.05	N	0.36	0.07	N	0.43	0.24	N	0.47	0.40	N	–	–	–
Cyclical Goods	0.34	0.04	N	0.15	0.05	N	0.37	0.08	N	–	–	–	0.48	0.33	N	0.14	0.09	N
Cyclical Services	0.47	0.05	N	0.38	0.02	N	0.24	0.18	N	0.55	0.38	N	0.59	0.38	N	0.35	0.05	N
Financials	0.48	0.29	N	0.52	0.01	N	0.27	0.16	N	0.65	0.36	N	0.68	0.47	N	0.33	0.05	N
Information Technology	–	–	–	–	–	–	–	–	–	–	–	–	0.09	0.08	N	–	–	–
Non-cyclical Goods	0.13	0.05	N	0.10	0.04	N	0.12	0.02	N	0.11	0.04	N	0.13	0.08	N	0.13	0.00	N
Non-cyclical Services	–	–	–	0.27	0.13	N	–	–	–	0.34	0.22	N	0.39	0.30	N	–	–	–
Resources	–	–	–	0.03	0.02	N	–	–	–	0.10	0.07	N	0.17	0.16	N	0.05	0.09	N
Utilities	–	–	–	0.37	0.36	N	–	–	–	–	–	–	–	–	–	–	–	–

Numbers in **bold** indicate contagion.

– Not available.

* Ctgn indicates whether or not the difference between ϕ and ρ^c constitutes contagion, calculated at the 5% level using a *t*-test.

ϕ is the theoretical measure of interdependence.

ρ^c is the correlation measure during the crisis period.

Table B4: Contagion to African markets during Russian crisis (Forbes-Rigobon methodology)

Sector	Egypt			Kenya			Morocco			Namibia			South Africa			Zimbabwe		
	ρ^T	ρ^C	Ctgn*	ρ^T	ρ^C	Ctgn*	ρ^T	ρ^C	Ctgn*	ρ^T	ρ^C	Ctgn*	ρ^T	ρ^C	Ctgn*	ρ^T	ρ^C	Ctgn*
Non-cyclical Goods	0.24	0.27	N	0.12	0.17	N	0.13	0.24	Y	0.12	-0.11	N	0.39	0.20	N	0.17	0.32	Y
Resources	–	–	–	0.13	-0.03	N	–	–	–	0.04	0.18	Y	0.32	0.09	N	-0.13	-0.06	N
Financials	-0.01	0.08	N	-0.04	0.03	N	0.07	0.06	N	0.09	0.00	N	0.23	0.02	N	-0.10	0.06	Y
Basic Industries	0.15	0.23	N	0.04	0.08	N	0.05	-0.11	N	0.14	0.28	Y	0.37	0.27	N	0.08	0.13	N
Cyclical Goods	–	–	–	-0.06	-0.12	N	0.00	-0.06	N	–	–	–	0.08	-0.12	N	0.14	-0.01	N
Cyclical Services	0.20	-0.02	N	0.05	0.04	N	0.05	0.02	N	0.24	0.02	N	0.60	0.00	N	0.03	-0.01	N
Non-cyclical Services	–	–	–	0.08	-0.01	N	–	–	–	0.25	0.23	N	0.37	0.24	N	–	–	–
Utilities	–	–	–	0.15	-0.06	N	–	–	–	–	–	–	–	–	–	–	–	–

Numbers in **bold** indicate contagion.

– Not available.

* Ctgn indicates whether or not the difference in correlation constitutes contagion, calculated at the 5% level using a *t*-test.

ρ^T is the correlation measure during the tranquil period.

ρ^C is the correlation measure during the crisis period.

Table B5: Contagion to African markets during Russian crisis (Corsetti et al. methodology)

Sector	Egypt			Kenya			Morocco			Namibia			South Africa			Zimbabwe		
	ϕ	ρ^c	Ctgn*	ϕ	ρ^c	Ctgn*	ϕ	ρ^c	Ctgn*	ϕ	ρ^c	Ctgn*	ϕ	ρ^c	Ctgn*	ϕ	ρ^c	Ctgn*
Basic Industries	0.06	0.18	Y	0.02	0.10	N	0.04	0.04	N	0.06	0.22	Y	0.10	0.29	Y	0.04	0.07	N
Non-cyclical Goods	0.06	0.26	Y	0.02	0.22	Y	0.04	0.12	N	0.02	0.07	N	0.12	0.18	N	0.05	0.14	N
Cyclical Goods	–	–	–	0.11	0.11	N	0.28	0.04	N	–	–	–	0.37	0.23	N	0.11	0.03	N
Cyclical Services	0.08	0.01	N	0.05	0.00	N	0.03	0.09	N	0.13	0.10	N	0.22	0.17	N	0.05	0.10	N
Financials	0.01	0.01	N	0.01	0.04	N	0.00	0.00	N	0.03	0.05	N	0.04	0.06	N	0.01	0.01	N
Non-cyclical Services	–	–	–	0.19	0.07	N	–	–	–	0.27	0.25	N	0.33	0.24	N	–	–	–
Resources	–	–	–	0.18	0.13	N	–	–	–	0.38	0.26	N	0.46	0.35	N	0.27	0.18	N
Utilities	–	–	–	0.07	0.06	N	–	–	–	–	–	–	–	–	–	–	–	–

Numbers in **bold** indicate contagion.

– Not available.

* Ctgn indicates whether or not the difference between ϕ and ρ^c constitutes contagion, calculated at the 5% level using a *t*-test.

ϕ is the theoretical measure of interdependence.

ρ^c is the correlation measure during the crisis period.