



Possible effects of the sub-prime financial crisis on financial markets in African countries

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Declaration

I, Seitebaleng Millicent Shabangu, declare that the research work reported in this dissertation is my own, except where otherwise indicated and acknowledged. It is submitted for the degree of Master of Management in Finance and Investment in the University of the Witwatersrand, Johannesburg. This thesis has not, either in whole or in part, been submitted for a degree or diploma to any other universities.

Signature

Date:

Dedication

In the name of the Father, the Son and the Holy Spirit, all glory and honour be to
God Almighty!

To my brother& hero Itumeleng Shabangu, my mother& rock Tina Tlhoale, and my
sister in Christ Bontle Bunny Mabuya

To my late father Jeffrey Shabangu

To my friends, Mma Molefe, Neo, Donald and Pule who made this journey so much
fun

To my supervisor, Prof Ojah, who supported me with incredible patience

I could not have done it without you all

Thank you ever so much!

Abstract

The aim of this paper is to investigate financial contagion in African financial markets from the global financial crisis. Interest in this subject has grown exponentially in the recent past in light of expanding globalization. The empirical analysis is based on daily stock price indices of a sample of African countries in order to compute the stock returns and find the impact of correlations between them and the US market. The empirical evidence is based on correlation tests by Forbes & Rigobon (2002). The analysis suggests that the larger markets by market capitalization and number of traded stocks exhibit co-movement, whereas the smaller markets experience financial contagion.

The results have implications for financial investment process and risk management in terms of globalization and the unfolding of financial liberalization in Africa.

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Chapter1: Introduction

1.1 Problem statement

When the music stops (in terms of liquidity), things will get complicated. But as long as the music is playing, you've got to get up and dance. We're still dancing. - Chuck Prince, Citigroup

The music came to a halt in 2008 and the United States of America ("USA") economy entered a financial crisis. And as the saying goes, when the USA sneezes, we all catch a cold. The world economy soon followed, plunging into one of the most devastating financial crises in recorded history since the Great Depression. It later became known as the Global Financial Crisis. A prominent feature of the USA sub-prime financial crisis is that the crisis began in the USA financial sector and spread rapidly, spilling over not only to other sectors of the economy, but also other countries.

Emerging market economies were "hit hard", eliciting pessimistic economic growth forecasts (Boorman, 2009). The IMF World Economic Outlook statistics released in April 2009 (IMF, 2009) reflected a 1.3% expected contraction in World GDP, the first such contraction since the Second World War. Emerging market economies, excluding China and India, were expected to slowdown in growth, relative to advanced economies, which were expected to contract by 3.8%. Africa's emerging economic growth, on the other hand, was expected to slow down to 1.5% in 2008.

The financial crisis had a real impact on South Africa ("SA"), despite assertions by National Treasury authorities that SA had been sheltered from the devastating effects observed in other emerging economies (National Treasury, 2011). Drawing from personal observation, I witnessed a few family members and a handful of neighbours losing their jobs. Two of my local stores were closed down in the period between 2008 and 2009. Almost anywhere one went, one was sure to hear of someone's friend or family member having lost his or her job. Losing a job is particularly distressing in African households since one often finds that there is only

one breadwinner in the household and/ or external family structure (de Witte, Rothmann, & Jackson, 2012).

The impact was observed in areas such as healthcare, with healthcare financing in Sub-Saharan African (“SSA”) becoming constrained. Donor funding for healthcare programs relating to the fight against the AIDS pandemic, where overseas funding is the primary source of funding, was reduced. The United States Agency for International Development (“USAID”) reported a regional cut in the Department of International Development (“DFID”) HIV/AIDS annual budget for 2010 by approximately £10 million in favor of investments into the South African bi-lateral agreement (Masau, 2010).

The sub-prime global financial crisis also had an adverse effect on growth prospects for the African continent. Key growth drivers mainly trade flows, capital inflows, natural resource sectors (oil and minerals) and agricultural exports, declined. SSA growth dropped by 1.4% to 5.5% in 2008 from 6.9% in 2007; in January 2009, the International Monetary Fund (“IMF”) once more cut its forecast for growth by 1.6 percentage points to 3.5%. In April 2009, the IMF revised its forecast again to a new projection for SSA growth in 2009 of 1.7% (Brambila-Macias and Massa, 2010). These reduced growth forecasts present an unfavourable set of circumstances, since, given a simplified macroeconomic model, increased economic growth (output) implies that the economy can absorb more people into the labour force and hence reduce unemployment in the country. Reduced unemployment, in turn, is conducive for the reduction of other social ills, such as crime, homelessness, and susceptibility to malnutrition, illness, mental stress, and loss of self-esteem, to name but a few.

Clearly, the effect of a financial crisis spreading to African economies had far reaching consequences for the economies in question. It is also worth noting that economies are made up of individuals with families. They are not just an abstract concept or terminology. It is thus important for Africa’s leaders and economic experts to have a clear understanding of the linkages between Africa and the developed economies, so as to minimize the impact of such financial crisis contagion

in the future. There is a need to examine and understand the impact the financial crisis had on African financial markets, and its consequences on the “real” economy in Africa.

1.2 Purpose of Study

The purpose of this study is to examine the presence and effect of financial contagion on the financial markets of African emerging economies. The study aims to determine the degree of negative financial effects that the sub-prime crisis had on financial markets in select African countries, as well as ascertain and the severity of the crisis on these economies.

1.3 Research questions

The following are questions emanating from the above purpose of study, which engage inquiry into this topic:

- Were African countries affected by the USA sub-prime financial crisis?
 - If there is evidence of contagion, can the degree of financial contagion be measured?
 - If there is no evidence of contagion, what possible reasons could be offered as to the lack of evidence (in particular economies relative to others)?
- Which of these transmission channels reflect the most significant measure of contagion?
- What were the transmission channels through which each country was affected, either directly or indirectly?
- How severely did the crisis impact the countries under investigation?
- Is it possible to utilize these transmission channels as indicators, and perhaps classify them as leading and / or lagging indicators of financial contagion for future reference?

1.4 Significance of study

The objective of this study is to investigate the effects the global financial crisis of 2007-2009 had on African financial markets. A vast majority of studies conducted in this regard have focused mainly on the economic and social effects of the financial crisis on African economies (Congressional Research Paper 2009, Overseas Development Institute 2009, African Development Bank, IMF 2009, et.al). One of these studies took the form of a study on the effect of the financial crisis on income distribution in Mexico (Lopez-Acevedo and Salinas, 1998). According to the World Economic Outlook report for April 2009 (IMF, 2009), "...however, financial stress attributed primarily to securities markets has been examined less comprehensively, especially those episodes that involved multiple emerging economies".

This study aims to extend the understanding and study of the effects of the sub-prime global financial crisis to include African financial markets. In doing so, this study seeks to understand the transmission channels through which financial contagion occurred. Given an understanding of these transmission channels, the hope is that countries can then monitor these transmission channels and employ adequate control measures to limit the degree of financial contagion in the future and significantly reduce the impact thereof.

George Santayana (1863-1952) once said, "Those that fail to learn from history, are doomed to repeat it". The hope of this study is to avoid such a failure, heed the lessons from history and critically observe financial markets for future management.

1.5 Limitations of the study

The study investigates the effects of financial contagion as a result of the global financial crisis on the financial markets of select African countries. However, no scientific selection criterion has been employed in selecting the countries in question. This is due to the fact that there are only twenty odd active financial equity

markets in Africa at present and only a few of these have useable data available for statistical analysis.

These markets are:

- Bolsa de Valores de Cabo Verde (Cape Verde);
- Botswana SE (Botswana);
- Bourse de Tunis (Tunisia);
- BRVM (Ivory Coast, Benin, Burkina Faso, Mali, Niger, Senegal, Togo and Guinee-Bissau);
- Casablanca SE (Morocco);
- Dar Es Salaam SE (Tanzania);
- Douala Stock Exchange (Cameroon);
- EGX (Egypt);
- Ghana SE (Ghana);
- JSE Ltd. (South Africa);
- Khartoum SE (Sudan);
- Libyan Stock Market (Libya);
- Lusaka SE (Zambia);
- Malawi SE (Malawi);
- Mozambique SE (Mozambique);
- Nairobi SE (Kenya);
- Namibian SE (Namibia);
- Nigerian SE (Nigeria);
- Rwanda Stock Exchange (Rwanda);
- SE of Mauritius (Mauritius);
- Uganda SE (Uganda) and
- Zimbabwe SE (Zimbabwe)

Therefore, the study will be limited to the financial markets of these countries. Data on these exchanges is limited, as some stock exchanges in Africa are still in their developing stages, with some having as little as two listed stocks.

The study will also focus primarily on the effect on financial markets, with only an overview reference to the social effects of the sub-prime global financial crisis. These other topics have been discussed at length in the literature.

1.6 Overview of research design and methodology

The study will deploy both qualitative and quantitative methodology approaches, and as such, both primary and secondary sources of data will be used.

In reviewing the economic and financial implications of the financial crisis as well as the financial transmission channels applicable to each country, relevant journal papers, conference papers, presentations, articles and other types of academic reports on the topic will be reviewed. These will be sourced from electronic databases as well as academic and financial publication websites.

In investigating the financial contagion effect on financial markets in select African countries, the market based data will be sourced from the relevant stock exchange websites and a financial database. The proposed method of analysis is regression analysis, using fitting econometric techniques. A battery of tests will be used in order to test for contagion, including correlation tests, and regression tests which will be used specifically to determine which transmission mechanisms are more significant in these markets.

Taking into consideration the view of Negayasu (Armada et al, 2008), who stated that, in the short term, daily data allows for the detection of contagion effects that could not be detected in an analysis that uses less frequent data, daily data will be used in this study. Contagion studies usually use monthly or weekly data (Armada et al, 2008), which are relevant for this study because many of Africa's national equity markets have stocks that trade infrequently in either weeks or months.

1.7 Outline of the study

The remainder of this paper will be structured in the following way: The remainder of Chapter One will provide some background as to the apparent root causes of the USA sub-prime financial crisis, now known as the Global Financial Crisis (“GFC”). Chapter Two will include a full review of the related literature, with particular focus on identifying and measuring financial contagion and its potential impact on African financial markets. Chapter Three will present a full exposition of the methodology employed in the study in order to arrive at a satisfactory response to the research questions. Chapter Four will recall the research questions posed earlier in Chapter One and discuss the corresponding research results. Chapter Five will conclude the study and offer preliminary recommendations as to the early detection of financial contagion in African financial markets and possible appropriate policy responses thereto.

1.8 The Global Financial Crisis (“GFC”)

The financial crisis started in the summer of 2007 in the USA and intensified in September 2008. Financial giants such as Bear Stearns, Lehman Brothers, Merrill Lynch, AIG, Fannie Mae, Freddie Mac, and Citigroup either disappeared or were rescued through large government bailouts. Goldman Sachs and Morgan Stanley converted to bank holding companies in late September, marking the end of an era for investment banking in the United States.

The crisis of 2007–2008 unfolded in several stages (Roubini & Mihm 2010). It began with the bursting of a housing bubble and the growth of mortgage defaults, particularly those involving subprime mortgages that had been extended in growing numbers to less creditworthy borrowers. These defaults increasingly affected the stability of financial institutions with exposure to these mortgages as well as financial products tied to these mortgages. Several hedge funds were the first to collapse in May and June 2007, and by August, serious concerns broke out in money markets

about the exposure of a wide range of financial institutions in the US and Europe that had invested heavily in mortgage-related financial products. By mid-September, panic even broke out at the retail level, with Britain experiencing its first bank run (Northern Rock) since the nineteenth century.

Despite official efforts to calm the markets with large doses of liquidity, the crisis only deepened in March 2008, when the major US investment bank Bear Sterns had to be rescued by US authorities. Three developments in September 2008 then triggered a total collapse of market confidence. Early in the month, the US government placed the two giant government-sponsored mortgage lending agencies, Fannie Mae and Freddie Mac, under a form of public “conservatorship” because of the enormous losses they were experiencing. By the middle of the month, the US investment bank Lehman Brothers was forced into bankruptcy. Shortly thereafter, the world’s largest insurance company, American International Group (AIG), was rescued and nationalized by the US government. It was at this point that the severity of the crisis began to be felt much more strongly beyond the North Atlantic region. Because of their difficulties, US and European banks pulled back their international loans, triggering severe financial problems and debt crises in countries that had been borrowing heavily from abroad. International trade credits also dried up, bringing exports and imports to a standstill in many sectors and countries.

Adverse spillover effects were felt strongly in countries whose financial systems were already vulnerable because of home-grown housing bubbles, financial excesses, and/or large current account deficits. Iceland was a particularly dramatic example, but there were many others, such as Britain, Germany, Ireland, Spain, the Baltic countries, Dubai, Singapore, Australia, and New Zealand. The impact of the financial crisis also spread globally through various spillovers operating through the “real economy,” such as collapsing exports, commodity prices, and remittance payments. Although economists largely failed to predict this global economic seismic shock, they have since made up for their oversight by generating a large and growing literature explaining the crisis. Many economists point to market failures that

generated excessive risk taking and a financial bubble during the years leading up to the crisis. Although some of the specific failures were unique to this era, those with a historical perspective have usefully highlighted broad parallels with past crises. Drawing on Kindleberger's (1978) classic work, they note that financial manias are usually set off by a change in expectations or "displacement," often caused by some kind of innovation. This innovation then generates overtrading and the emergence of a bubble driven by a kind of excessive optimism and herd behavior. When the bubble eventually bursts, panic ensues.

Chapter 2: Literature review

2.1 Introduction

Contagion is a fairly new concept in realm of economics. The term was scarcely mentioned in economic literature prior to 1997, where the term “contagion” usually referred to the spread of a medical disease (Edwards, 2000). A Lexis-Nexis search for contagion before 1997 finds a number of examples in major newspaper publications, yet relatively few examples refer to turmoil in international financial markets. Interest in this concept stemmed from the Asian crisis of 1997 (Hunter, Kaufman& Krueger, 1999). A currency crisis in Thailand quickly spread throughout East Asia and then on to Russia and Brazil. Developed markets in North America and Europe were also affected, as the relative prices of financial instruments shifted and caused the collapse of Long-Term Capital Management (LTCM), a large U.S. hedge fund. These global repercussions from what began in the relatively small Thai economy sparked the widespread use of a new meaning for the term contagion. Subsequently, the idea of the transmission of financial turmoil across regional and internal borders became prominent.

Comparing the spread of a financial crisis as likened to a disease is advantageous in this context and is displayed through two levels. First, contagion is a disease in as far as the devastating effects the sub-prime mortgage crisis had: giving rise to a contraction in income-levels, employment and standards of living in many emerging markets (K. Forbes & Claessens, 2000). Contagion also refers to the propagation of a disease. The speed with which the Thai crisis spread through to Indonesia, the Philippines, Malaysia, Hong Kong, and Korea highlighted the need to understand the initial events, which prompted the crisis as much as understanding why the crisis spread in the first place.

Since the Asian crisis, contagion has been an important feature in past financial crisis episodes. The timing and severity of financial crises often seem unrelated to the fundamental problems facing the countries and markets concerned. Soon after the

Asian crisis, came the Russian crisis in 1998 and the Brazilian crisis in 1999. The striking feature of these crisis episodes was how an initial country-specific shock rapidly transmitted to markets of very different sizes and structures around the globe. As such, the negative consequences associated with the episodes of instability were not limited to the countries of origin. Leitão, Lobao, & Armada (2008) state that these crises quickly transmitted all over the world to several international markets.

Events that took place in the global economy in the period 2007 to 2010 serve as a reminder that we are living in an increasingly inter-connected world, where the effect of events occurring in one part of the world can be felt on the other side of the ocean. The turbulence in financial systems charted a significant reduction in real economic activity in a large number of countries (Cali, Massa, & Velde, 2008). Although country experiences have varied with regard to the source of difficulty in each episode, the profiles of crises display similar traits. A "sudden stop" of capital inflows is almost always followed by a sharp contraction in economic activity (Ozkan & Unsal, 2012). The impact, though, is not always adequately explained by fundamental economics. The linkage through which the transmission of shocks takes place can be explained at times, while at other times there seems to be an absence of apparent links. This transmission of shock effect has been covered extensively in theoretical and empirical literature since the Asian crisis (Lau & Li 2000, Tuluca & Zwick 2001, Cheng & Glascock 2006, Forbes & Rigobon 2002, Arestis et al 2005, and Wang & Thi 2006). However, the literature is yet to reach consensus as to what it entails.

The literature has thus far not been able to formulate a unified definition of what contagion is, although much has been written about the channels and mechanisms thereof. There currently exists no theoretical or empirical identification technique upon which academics agree, although there seems to be an informal understanding of what it is. Earlier studies on this topic focused on the channels through which the negative financial shocks were propagated, and as such, did not distinguish between contagion and interdependence, the two opposing views on this topic (K. J. Forbes &

Rigobon, 2002). Recent studies distinguish interdependence as a crisis that propagates as a result of fundamental real and cross-country linkages, while contagion is referred to as “shocks that produce a discontinuity in the data generating process of asset prices” (Pericoli & Sbracia, 2003). In an attempt to identify and define contagion for the purposes of this review, it is worthwhile to explore the definition of what a financial crisis is and what it entails.

2.2 What Is a Financial Crisis?

Pericoli & Sbracia (2003) suggest that definitions and measures of contagion work well when an unambiguous definition of a financial crisis is identified. The literature has distinguished these definitions based on the object of analysis. As such, the literature has identified (i) a currency crisis as a devaluation from its peg figure or an extreme value of an exchange rate stress indicator; (ii) a stock market crisis as a sharp fall in the stock market index or an upsurge in asset price volatility; (iii) a banking crisis as a fall in the ratio of non-performing assets to total assets, closure or failure of major banking institutions or the nationalisation of banks.

While financial crises have common elements, they do come in many forms. A financial crisis is often associated with one or more of the following phenomena: substantial changes in credit volume and asset prices; severe disruptions in financial intermediation and the supply of external financing to various actors in the economy; large scale balance sheet problems (of firms, households, financial intermediaries and sovereigns); and large scale government support (in the form of liquidity support and recapitalization (Claessens & Kose, 2013). As such, financial crises are typically multidimensional events and can be hard to characterize using a single indicator. The literature has clarified some of the factors driving crises, but it remains a challenge to definitively identify their deeper causes. Many theories have been developed over the years regarding the underlying causes of crises. While fundamental factors—macroeconomic imbalances, internal or external shocks—are often observed; many questions remain on the exact causes of crises (Claessens & Kose, 2013).

Financial crises sometimes appear to be driven by “irrational” factors (Claessens & Kose, 2013). These include sudden runs on banks, contagion and spillovers among financial markets, limits to arbitrage during times of stress, emergence of asset busts, credit crunches, and firesales, and other aspects related to financial turmoil. The idea of “animal spirits” (as a source of financial market movements) has long occupied a significant space in the literature attempting to explain crises (Minsky, 1975; Kindleberger, 1978). Financial crises are often preceded by asset and credit booms that eventually turn into busts. Many theories focusing on the sources of crises have recognized the importance of booms in asset and credit markets. However, explaining why asset price bubbles or credit booms are allowed to continue and eventually become unsustainable and turn into crunches has been challenging.

The dynamics of macroeconomic and financial variables around crises have been extensively studied. Empirical studies have documented the various phases of financial crises, from initial, small-scale financial disruptions to large-scale national, regional, or even global crises. They have also described how, in the aftermath of financial crises, asset prices and credit growth can remain depressed for a long time and how crises can have long-lasting consequences for the real economy (Claessens & Kose, 2013).

It is to be noted that the object of analysis in this paper is the stock market¹, and hence a financial crisis in this context is defined as *an event of a sharp fall in the stock market index or an upsurge in asset price volatility* (Pericoli & Sbracia, 2003). Having defined the financial crisis event, contagion can now be defined and investigated.

¹ Although this paper only focuses on stock markets, the methodology can be tailored to test for contagion based on correlation coefficients in other markets such as the bond and currency markets.

2.3 Financial Contagion: Theories and Concepts

Contagion incorporates many different ideas and concepts. Even though there is no current consensus on what is contagion, there are a few definitions that have been commonly used in the literature. The term “contagion” suggests the spread of a disease from one infected host to others. The term also implies that there is a mechanism of transmission from one infected victim to other potential victims. In the context of finance, contagion refers to the spread of financial stress from one firm, market, asset class, nation or geographical region to others. Over the years, the definition of contagion has taken on different forms or versions of the description above.

One of the earlier descriptions of contagion comes from Masson (1999), who, in the context of developing his macroeconomic model, simply defined it as an event where a country jumps to a “bad” equilibrium as a result of a crisis in another country. Pritsker (2003) took this definition a step forward, and went on to define the phenomenon as “a shock to one or a group of markets, countries, or institutions, spread to other markets, or countries, or institutions”. Dornbusch, Park, & Claessens (2000) follow with their proposition that contagion is best defined as “a significant increase in cross-market linkages after a shock to an individual country or group of countries, as measured by the degree to which asset prices or financial flows move together across markets relative to this co-movement in tranquil times”. Kodres & Pritsker (2002) simply define contagion as a shock in one market that affects asset prices in other markets. Kaminsky et al (2003), in their article, refer to contagion as an episode in which there are significant immediate effects in a number of countries following an event. They further qualify the effects as “fast and furious”, evolving over a matter of hours or days. Dungey & Tambakis (2003) speak of “true” contagion, which they define as an unanticipated transmission of shocks.

Pericoli & Sbracia (2003) attempt to summarise the definition debate by presenting five definitions commonly used in the literature.² Hwang et al (2010) offer an alternative definition by referring to contagion as the co-movement of exchange rates, stock prices, sovereign spreads and capital flows in one market as a result of a financial crisis in another market.

The common theme amongst these definitions is that they all allude to a link amongst the economies through which adverse market conditions propagate from one market to another. Some of the definitions are narrow while others are wide and inclusive.

On the other hand, K. J. Forbes & Rigobon (2002) contend that, rather, there exists interdependence amongst markets, instead of contagion. They argue their point by employing different definitions of contagion, testing these and yielding different test results depending on the definition used. They conclude by presenting the definition of a contagion event as a significant increase in cross-market linkages after a shock, such as a financial crisis. According to their definition, contagion only occurs if cross-market co-movement increases significantly after a shock. If the co-movement does not increase significantly, then any continued level of market correlation is indicative of strong linkages between the two economies that exist in all states of the world. Based on this definition, Forbes and Rigobon (2002) argue that there was hardly any contagion during the Asian crisis of 1997, the Mexican Peso crisis of 1994 and the 1987 USA stock crash, all episodes that other researchers identified as contagious episodes. The authors refer to these incidents as interdependence. The authors do

² **Definition 1.** Contagion is a significant increase in the probability of a crisis in one country, conditional on a crisis occurring in another country. **Definition 2.** Contagion occurs when volatility of asset prices spills over from the crisis country to other countries. **Definition 3.** Contagion occurs when cross-country comovements of asset prices cannot be explained by fundamentals. **Definition 4.** Contagion is a significant increase in comovements of prices and quantities across markets, conditional on a crisis occurring in one market or group of markets. **Definition 5.** (Shift-) contagion occurs when the transmission channel intensifies or, more generally, changes after a shock in one market.

not discuss what “significant” is in this context. This is because, at times, markets reflect high degrees of co-movement during stable periods, and it would not be regarded as a case of contagion, even if the markets continue to be highly correlated after a shock to one market.

The working definition of contagion in this paper seeks to incorporate the definitions referred to above by characterising contagion as *an event of a sharp fall or upsurge in asset price volatility in the stock market index occurring as a result of the volatility of asset prices spilling over from the crisis country to other countries.*

To truly identify a financial crisis as a contagious episode depends on being able to specify the mechanism through which financial distress is transmitted. An understanding of the transmission mechanism clarifies the concept of contagion.

2.4 Transmission Channels of Contagion

There is extensive theoretical literature on the international proliferation of financial shocks. Theories exist that assume investors behave differently post a crisis; while some argue that most shocks are propagated through stable real linkages between countries, such as trade (K. J. Forbes & Rigobon, 2002).

Kodres & Pritsker (2002) propose that there are four separate channels of financial market contagion, the first being the correlated information channel. This channel speaks to the notion that if there are common macroeconomic influences that determine asset prices in more than one country because of real linkages, then the real linkage causes the financial markets to be linked. A key feature of this channel is the existence of information asymmetry. Calvo (1999) discusses this channel in detail where he examines capital markets populated by informed and uninformed investors. The second channel, referred to as the correlated liquidity shock, involves a financial market participant responding to a shock that affects him by rebalancing and liquidating his portfolios across markets, thus transmitting the shock. The third channel is cross-market hedging or rebalancing, which occurs when investors respond to shocks to macroeconomic risks by readjusting their hedges. Lastly,

contagion occurs where a shock to the wealth of the investor induces him to adjust his portfolio holdings, hence the obvious term wealth shock. It is worth noting that investors responding to a wealth shock choose to liquidate, whereas investors responding to a correlated liquidity shock are forced to liquidate.

The channels discussed above can be classified into two broad categories: real and financial linkages. An economy is deemed more vulnerable if it has weak macroeconomic fundamentals or financial system. The degree of vulnerability is also believed to increase with the number and size of linkages with the real economy and financial systems of other economies. Thus, the transmission channels can be economic (real) or financial.

2.4.1 *Real linkages*

One of the most commonly studied real channels of contagion involves trade linkages. If the export market of an economy experiences a shock such that its demand for imports declines, the exporting economy's trade account will be adversely affected. The deterioration in the trade account will undermine economic growth, and if the deterioration is large relative to the availability of external financing, investors may reassess the investment risks involved (Cheung, Tam, & Szeto, 2009).

In another scenario, an economy can lose competitiveness when the currency of a major trading partner depreciates substantially. The authorities may attempt to safeguard the economy's competitiveness by devaluing its currency. If investors foresee this decision as likely, they would cut their demand for the country's assets, bringing about a decline in the currency, a fall in asset prices, and perhaps capital outflows, which may trigger a crisis in the end (Cheung et al., 2009). Glick and Rose (1998) show that trade linkages help explain cross-country correlations in exchange market pressure during crisis episodes, after controlling for other macroeconomic factors. Kaminsky & Reinhart (2000) found that sharing a common trade bloc would make an economy particularly susceptible to contagion from a member economy.

2.4.2 Financial linkages

While trade linkages may help explain contagion between economies that are closely related, they leave some cases of contagion unanswered, such as the one between Russia and Brazil in late 1990s. These two countries did not have substantial trade links at the time (Cheung et al., 2009). On occasion, financial linkages might be the more appropriate in explaining shock transmission.

There are many ways that financial linkages help propagate contagion, and the extent is partly determined by the degree of financial market integration between the economies concerned. Collins & Biekpe (2003) explored this idea and argued that the spread of a crisis depends on the degree of financial market integration, and that the more integrated the markets are, the higher the contagious effect of a shock to another country. There are four common financial linkages:

- a) Common creditor: In this instance, a shock could begin with an international bank which then spills over to the real sectors of other economies through decreased lending by the bank. An example of this occurred in the Asian crisis where many banks in industrial countries pulled back from lending to emerging market economies after sustaining losses in their securities investment (Kaminsky & Reinhart, 2000).
- b) Interconnected lenders: Under this domino model of financial contagion, for example, if an international bank, Bank A, has borrowed from Bank B in another country, and Bank B has borrowed from Bank C, then the default of A impacts B, which then impacts C. Similarly, a shock in Country A can cause Bank A to incur loss in its lending business in this country. If Bank A has deposits with another bank, say Bank B, that has loans in Country B, then the problems with Bank A can cause it to withdraw its deposits from Bank B, causing problems to Bank B as well. Bank B may in turn alter its loan portfolio

in Country B. Both scenarios result in the shock being transmitted from Country A to Country B through a chain of interconnected lenders (Cheung et al., 2009).

- c) Interactions under a market-based financial system: The linkages described above view financial contagion traditionally through the lens of defaults. However, in a modern market-based financial system, contagion can be transmitted through price changes and the marked-to-market capital of financial institutions. When balance sheets are marked to market, asset-price changes will be reflected immediately on balance sheets and will trigger a response from financial market participants. Even if exposures are dispersed widely throughout the financial system, the potential impact of a shock can be amplified through market price changes (Cheung et al., 2009).
- d) Portfolio rebalancing: Similar to the interconnected lender channel referred to by Kodres & Pritsker (2002), correlated liquidity shocks can lead to financial market contagion (Kaminsky & Reinhart, 2000). For example, investment funds that foresee future redemptions after a shock in one economy may need to raise funds by selling assets in other economies.

The need for liquidation also occurs when a negative shock in one economy diminishes the value of leveraged investors' collateral, leading them to sell part of their holdings in unaffected economies to meet margin calls. For example, hedge funds may be highly leveraged, so that losses in one market lead to a write down of capital that requires shrinking the portfolio size and this leads to liquidation of their holdings in a number of markets. Furthermore, according to Shin and Adrian (2008), there is evidence pointing to pro-cyclical leverage where financial intermediaries actively adjust their balance sheets i.e. having high leverage during booms and low leverage during busts. This makes financial intermediaries' net worth even more sensitive to price changes and shifts in measured risks.

Another motivation for portfolio rebalancing is cross-market hedging. Contagion occurs through the cross-market hedging channel because investors respond to shocks by readjusting their hedges to macroeconomic risks (Kodres & Pritsker, 2002).

Given the varied and dynamic nature of these real and financial channels, an effective policy assessment is required to correctly identify the channels of contagion and formulate the appropriate policy response. Having explored the different channels through which risks can spread, the next step is to identify the way contagion emerges.

2.5 Contagion Models/ Causes

The causes of contagion have long been the subject of interest by economists and politicians alike. It is a curious topic because of the distressing impact it can have on economies and political careers. In an effort to understand the cause of contagion, (Dornbusch et al., 2000) suggest that the causes can be separated into two categories. Masson (1999), Wolf (1999), K. J. Forbes & Rigobon (2002) and Pritsker (2003) also allude to these. Naoui, Khemiri, & Liouane (2010) also mention these two categories, referring to them as two separate contagion models.

The first category highlights the spillover effect that occurs due to globalization and increased financial integration resulting in adverse shocks being transmitted across countries. S. Calvo & Reinhart (1996) call this type of propagation of contagion “fundamental-based contagion”. Fundamental-based contagion refers to co-movements in financial asset prices that result from the normal interdependence among market economies due to real and financial linkages. Fundamental causes of contagion include macroeconomic shocks that have consequences internationally and local shocks transmitted through trade links, competitive devaluations, and financial links.

There are several types of fundamental factors that drive spillovers. One of the most obvious is a common global factor, such as a major economic shift in industrial countries or a shock to commodity prices, which can trigger crises through large capital inflows or outflows. Another fundamental factor is a local economic shock that is transmitted across borders through trade links. Any major trading partner of a country in which a financial crisis has caused currency depreciation could experience declining asset prices and large capital outflows (Dornbusch et al., 2000). The trading partner country could become the target of a speculative attack as investors anticipate a decline in exports to the crisis country, and hence a deterioration in the crisis country's trade account as a result of the crisis country not having enough foreign exchange.

Competitive devaluations can be another cause for contagion. Devaluation in a country hit by a crisis reduces the export competitiveness of the countries with which it competes in third markets, putting pressure on the currencies of other countries. Lastly, a financial crisis in one country can lead to direct financial effects, which may include reductions in trade credits, foreign direct investment, and other capital flows abroad (Dornbusch et al., 2000).

Contagion can also be caused by other fundamentals. In situations where there are no global shocks, contagion is said to be caused by investor behavior. Contagion in this instance arises when co-movement occurs even when global shocks are not existent, and interdependence and fundamentals are not elements of concern. Investor behavior, whether rational or irrational, allows shocks to spill over from one country to another (Dornbusch et al., 2000).

The first example of contagion caused by investor behavior is information asymmetries and differences in investor expectations (Dornbusch et al., 2000). A crisis in country A may induce an attack on the currencies of other countries if investors believe that a financial crisis in country A could lead to similar crises in other countries. This theory presumes that investors are imperfectly informed about each country's true characteristics and thus make decisions on the basis of some

known indicators. The information that investors use in their decisions may be 'secondary' and include the actions of other investors.

The second example is one where contagion is induced by a lack of confidence in healthy economies when a financial crisis sparks in similar seemingly healthy economy elsewhere, resulting in a shift in market expectations and confidence (Dornbusch et al., 2000).

The final investor behavior example stems from investors changing their perception of the rules under which international financial transactions occur. An example of a change in the rules would be a change in the treatment of foreign private creditors or that there might not be a bailout of such creditors as expected. The supply of funds from international lenders of last resort could also be of concern. In late 1998, for example, the International Monetary Fund (IMF) found itself called upon to rescue so many countries, raising concern as to whether it would be able to deal with many more liquidity crises (Dornbusch et al., 2000).

Many studies are conducted to determine the origin of contagion. Despite the controversy regarding the search for a universal definition of contagion, these studies, at the very least, agree on the two approaches discussed above: the approach relating the channels of contagion to interdependence between countries (Eichengreen et al, 1996; Glick and Rose 1999; Rijckeghem & Weder, 1999) and the second approach considering the main cause of contagion as the rational or irrational attitude of investors whether individually and/or collectively, specifying then the notion of 'pure contagion' (K. Forbes & Rigobon, 2001; Masson, 1999; Pritsker, 2003).

2.6 Testing Contagion

There is a range of various quantitative methodologies in the related literature, which can be categorised by the different definitions of contagion. According to the World Bank, these can be conceptually divided into three categories, based on how

specific the contagion definition is. The empirical methodology for testing differs accordingly. The definitions discussed in Section 2.2 fall into three broad categories, based on how inclusive or exclusive the definition is deemed to be. The definition categories, together with a description of the empirical methodology for testing, are set out below.

The first is referred to as the *broad definition*. This is where contagion refers to the cross-country transmission of shocks or general cross-country spillover effects (Dornbusch et al., 2000). Under this definition, contagion can be transmitted through real or financial linkages, i.e. fundamentals-based contagion (S. Calvo & Reinhart, 1996). These forms of co-movements may reflect normal interdependence, and do not need to be related to crises.

The second, referred to as the *restrictive definition of contagion*, refers to the transmission of shocks to other economies, beyond any fundamental link among the economies and beyond common shocks. It is sometimes known as excess co-movement (Dornbusch et al., 2000).

In the third definition, termed the *very restrictive definition*, contagion occurs when cross-country correlations increase during “crisis times” as compared with correlations during “tranquil times”. This is used mostly in empirical analyses to establish the contagion incidence and measurements (Dornbusch et al., 2000).

Much of the empirical literature uses the broad definition of contagion as specified above. Several different approaches are utilised to measure the transmission of shocks and test for contagion: analysis of cross-market correlation coefficients, GARCH frameworks, co-integration and probit models.

Tests based on cross-market correlation coefficients are the most straightforward (K. Forbes & Claessens, 2000). These tests measure the correlation in returns between two markets during a stable period and then test for a significant increase in this correlation coefficient after a shock. If the correlation coefficient increases

significantly, this suggests that the transmission mechanism between the two markets increased after the shock and contagion occurred. In the first major article on this subject, King & Wadhvani (1990) test for an increase in cross-market correlations between the U.S., U.K. and Japan and find that correlations increase significantly after the U.S. crash. Lee and Kim (1993) extend this analysis to twelve major markets and find further evidence of contagion: that average weekly cross-market correlation increased from 0.23 before the 1987 crash to 0.39 afterward. (S. Calvo & Reinhart, 1996) use this approach to test for contagion after the 1994 Mexican peso crisis and find that the correlation in stock prices and Brady bonds between Asian and Latin American emerging markets increased significantly.

Baig and Goldfajn (1998) present a thorough analysis using this framework and test for contagion in stock indices, currency prices, interest rates, and sovereign spreads in emerging markets during the 1997-98 East Asian crisis. They find that cross-market correlations increased during the crisis for many of the countries. In summary, each of these tests based on cross-market correlation coefficients reaches the same general conclusion: correlations usually increase significantly after the relevant crisis and therefore, contagion occurred during the period under investigation.

A second approach to test for contagion is to use an ARCH or GARCH framework to estimate the variance-covariance transmission mechanism across countries. Chou et al. (1994) and Hamao et al. (1990) use this procedure and find evidence of significant spillovers across markets after the 1987 USA stock market crash. They also conclude that contagion does not occur evenly across countries and is fairly stable through time. (Edwards, 2000) examines the propagation across bond markets after the Mexican peso crisis by focusing on how capital controls affect the transmission of shocks. He estimates an augmented GARCH model and shows that there were significant spillovers from Mexico to Argentina, but not from Mexico to Chile.

A third series of tests for contagion focus on changes in the long-run relationship between markets, instead of any short-run changes after a shock, as the two

methods above do (K. J. Forbes, 2012a). These tests use the same basic procedures as above, except test for changes in the co-integrating vector between stock markets instead of in the variance-covariance matrix. The final approach uses simplifying assumptions and exogenous events to identify a model and directly measure changes in the propagation mechanism.

In summary, a variety of different econometric techniques have been used to test whether contagion has occurred during a number of financial crises. The transmission of shocks has been measured by simple cross-market correlation coefficients; GARCH models; co-integration techniques; and probit models. The co-integration analysis is not an accurate test for contagion due to the long time periods under consideration. Results based on the other techniques, however, all arrive at the same general conclusion that some contagion occurred. Although different definitions of contagion are used, the consistency of findings is remarkable given the range of techniques utilized and periods investigated.

As alluded to in section 2.4.2, the propagation of contagion is partly determined by the degree of financial market integration between the economies concerned. The connection between contagion and financial market integration is explored in the next section.

2.7 Financial Integration

The spread and impact of a crisis depends on the degree of financial market integration. The higher the degree of integration, the more extensive the contagious effects of the shock. Equally, countries that are not financially integrated, either because of capital controls or lack of access to international financing, are deemed to be less vulnerable to the contagious effects of financial crises (Collins & Biekpe, 2003). African economies were believed to have escaped the economic catastrophe of the crisis due to their underdeveloped financial systems and relatively limited links to the global economy. Dr. Donald Kaberuka, President of the African

Development Group stated that: “The limited financial integration of Africa in the global system was seen as providing relative safety”.

Financial integration is the process through which financial markets in an economy become more closely integrated with those in other economies or with those in the rest of the world (www.iadb.org). Some advantages to this integration are the exploitation of economies of scale that can allow firms to have better access to broader capital markets and enhancing portfolio diversification.

A standard measure of financial integration is difficult to develop because integration can take place without any formal agreements. It can be in the form of financial information sharing, foreign participation in domestic banking, insurance and pension fund businesses and direct borrowing of domestic firms in international financial markets, to name a few (Eichengreen 2001).

Emerging stock markets are said to have lower exposure to world factors, hence lower levels of integration. They may offer greater opportunities for risk diversification across countries. Errunza (1994) suggests that emerging markets offer international money managers opportunities to diversify risk and seek higher returns. Part of the reason why emerging markets were a viable asset class in the early 1990s was due to their low correlation with developed markets, thus serving as a hedge in a global portfolio (Harvey, 1995). However, Harvey’s study (1995) pointed out changing correlations between emerging markets and developed markets, as emerging markets become more and more integrated into the global financial system.

2.7.1 Africa’s financial integration with the developed world market

The integration of Africa’s emerging and frontier stock markets have received little attention in the literature, compared to other emerging markets. Few African markets have been included in extensive research (see Harvey 1995, Mobarek, Muradoglu and Mollah 2014), especially in the 1990s and early 2000s. The degree of

integration of some African markets into global financial markets tends to change over time as a result of increased liberalisation and efforts to promote integration of these markets into the global economy. However, Hatemi-J and Morgan (2007) found that the liberalisation efforts of the markets towards the world market appear insignificant. The Nigerian and Zimbabwean markets, in particular, are less globally integrated. Pukthuanthong & Roll (2009) found that integration has improved in South Africa, Mauritius and Egypt but declined in Ghana, Nigeria and Zimbabwe.

Berger, Pukthuanthong, & Jimmy Yang (2011) analysed frontier market equities with respect to world market integration and diversification. They found little evidence of integration in some African countries including Kenya, Mauritius and Nigeria, whereas Botswana, Ghana, and Tunisia exhibit some level of positive world market integration.

Boamah (2014) investigates the integration of 11 African markets relative to the world and emerging markets over the period March 1997 to January 2013. The sampled countries include Botswana, Ivory Coast, Egypt, Ghana, Kenya, Mauritius, Morocco, Nigeria, South Africa, Tunisia and Zambia. The study shows a stronger relationship between South Africa and the world market compared with other African countries, which implies that South Africa is the most accessible and integrated market in Africa. The findings also support the hypothesis of partially integrated African markets relative to the world and emerging markets and that the integration of African markets has changed through time.

2.8 Emerging Markets

Since interest in financial contagion stemmed from the 1997 Asian crisis, a crisis in an emerging market, these markets are worth exploring in a little more detail.

Emerging markets are usually considered to be in a transitional phase toward developed-market (i.e., industrialized) status and in the process of building liquid

equity, debt and foreign-exchange markets (HSBC, 2015). Emerging markets are found in East and South Asia, Eastern Europe, South Africa, Latin America, and the Middle East. The most distinguishing characteristic is that these countries are experiencing an improvement in living standards and a growing middle class with rising economic aspirations and purchasing power. In the mid-2000s, the emerging markets collectively achieved an average annual GDP growth rate of nearly 7%. Their economies have been growing much faster than those of the advanced economies (Claessens & Kose, 2013).

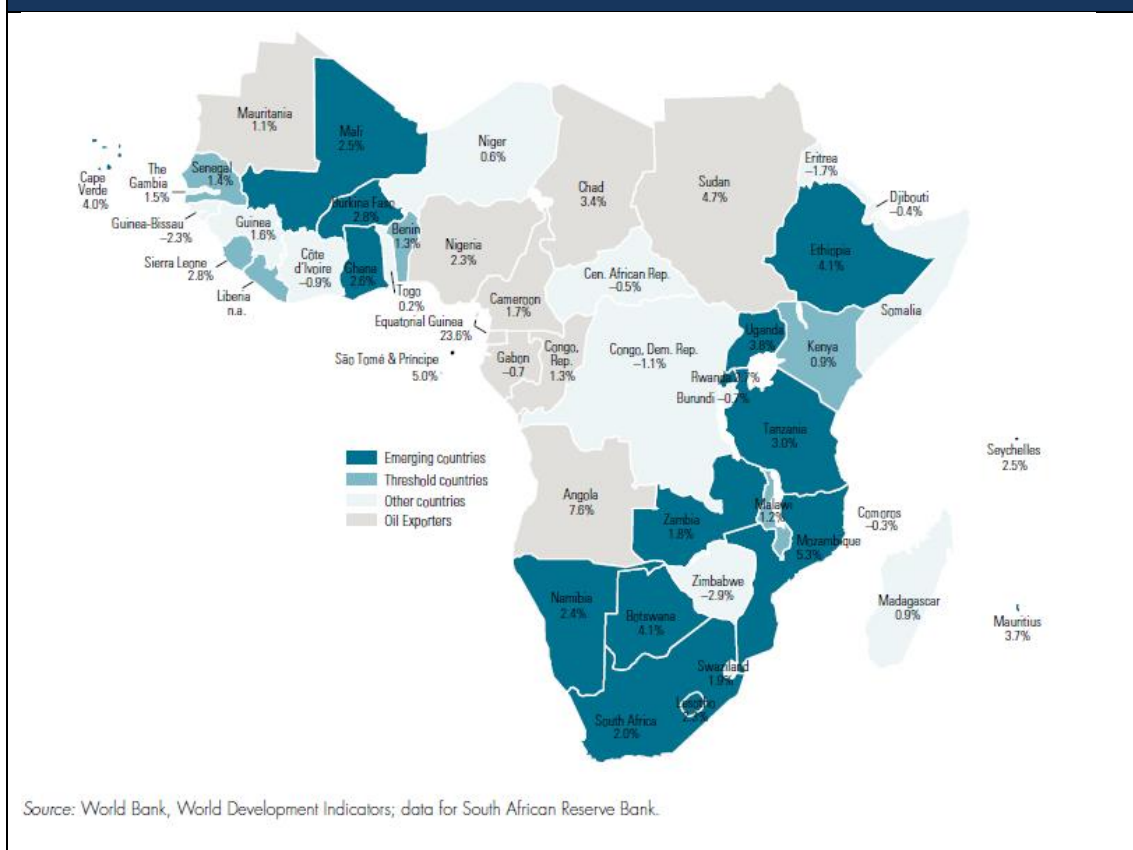
Although the term is in common usage, there is no generally agreed consensus on either the theoretical or operational definition of what constitutes an emerging market. The classification of countries as emerging markets is consequently somewhat arbitrary, and is carried out and reviewed on a regular basis by a range of international financial institutions using different categories, methodologies and degrees of granularity (Kearney, 2012).

Regardless of how broadly or narrowly they are defined, emerging markets are diverse in culture, language and politics (Kearney, 2012). They tend to have quite well-developed physical financial infrastructure including central banks, commercial banks and stock exchanges, but to have less well-developed processes and systems of accounting, governance, regulation and other financial infrastructure, and less efficient markets with less liquidity than the world's most advanced systems.

2.8 Africa as an Emerging Market

Africa is currently home to five of the world's dozen fastest-growing economies and its comparably strong performance over the last few years is more than commodity supercycle and the advantage of debt relief (Forbes, 2014). Improved macroeconomic management has played its part together with the increasing rise of the African consumer. A growing middle class concentrated in urban areas, coupled with a youth bulge across the continent bolster the case for Africa.

Figure 1: Emerging Africa average growth rates per capita, 1996-2008



Seventeen emerging African countries, home to more than 300 million people, have undergone changes in economic growth, poverty reduction, and political accountability since the mid-1990s. Another six “threshold” countries have shown promising yet less dramatic change (Radelat, 2010).

Between 1975 and 1995, the economic growth per capita among the 17 emerging African countries was close to zero. Things changed between 1996 and 2008, in which they achieved overall GDP growth exceeding 5% a year. As a result, that growth drove a 50% increase in average incomes in just 13 years. Trade and investment also doubled, school enrollments rose, and health indicators improved. The share of people living in poverty declined from 59% to 48%. Democracy, while still flawed, has become the norm rather than the exception. Governance has slowly but steadily improved. It should be noted that these countries are far from perfect. They still face many challenges, and their continued success is far from certain. But changes are taking place in these countries, and their future prospects look bright.

Together with the changes taking place in these emerging markets, there has been a considerable development in the African capital markets since the early 1990's (Yartey & Komla, 2007). Prior to 1989, there were only five stock exchanges in sub-Saharan Africa and three in North Africa. Today there are 19 stock exchanges across the continent (Yartey & Komla, 2007).

2.9 Overview of African Stock Markets

African stock markets have rapidly evolved over the last decade resulting in considerable development of the African capital markets (Piesse and Hearn, 2005). The number of stock exchanges grew from eight to 19 in about two decades. Total market capitalization for African stock markets increased from US\$113,423million to US\$244,672million between 1992 and 2002 (Odera, 2012). In most of these markets, trading only occurs in only a few stocks, which account for a considerable part of the total market capitalization. There also exist serious informational and disclosure deficiencies for other stocks. Supervision and monitoring by regulatory authorities is often far from adequate (Odera, 2012). According to Mlambo and Biekpe (2007), some of the African stock markets were established on the background of poor regulatory and legislative frameworks. Legislations to prevent insider trading are either inadequate or non-existent, and where they exist, enforcement is often poor. The inadequacy of insider trading laws on African stock markets has enhanced the perception that these markets are not efficient. However, IMF (2003) found that in a number of African countries, significant progress has been made through strengthening the regulatory and institutional framework governing private investment and fiscal capacity building. Much still remains to be done; domestic ownership is important and required to ensure that reforms are tailored to meet specific regional conditions and circumstances (Odera, 2012).

Yartey & Komla (2007) observed that African stock markets are small and characterized by a few listed companies and low market capitalization. These markets suffer from the problem of low liquidity, with implications that it is harder to support a local market with typical administrative features such as its own trading system, market analysis and brokers, since the business volume will be too low.

According to Piesse & Hearn (2005), African stock markets have historically offered a limited, narrow range of products. Common factors still inhibiting stock market development include the lack of legal protection for investors and creditors. Other constraints include limited trading hours and closely aligned trading times with other regional markets. As such, there is little domestic stock market culture and awareness. Trading in the majority of markets is overwhelmingly dominated by a few stocks, even if more securities are actually listed (Odera, 2012). Mlambo and Biekpe (2005) noted that due to the thin trading, investors might be forced to hold stocks even at a time when they want to close their positions or get out of the market. Their findings suggest that the contradictory evidence in the random walk tests of certain African stock markets could be partly a methodology problem especially in a thinly traded environment. But where they used individual stock returns, the effect of thin trading on the results was relatively minimal. Lack of liquidity is also demonstrated in large gaps between buy and sell orders. During the first half of 1996, the Ghana Stock Exchange saw offers to sell outstripping bids to buy by 3.7 times (Kenny & Moss, 1998).

The African continent has one of the only regional stock exchanges in the world, linking eight French-speaking countries in West Africa (Fick, 2007). With a market capitalisation of over US\$ 180 billion in South Africa, Africa hosts one of the largest stock markets in the world. This is in contrast to the other African stock markets that have comparatively small market capitalisations (Fick, 2007). With the exception of the South African market and to a limited extent the North African markets, African stock markets are described as “frontier markets”. These markets are typically characterised by a relatively small capitalisation and liquidity levels. As a consequence, most of these markets are excluded from the main regional equity market indices and as a result attract little Global Emerging Markets (GEM) portfolio funds (Fick, 2007).

Figure 2: List of African stock exchanges

Country	Exchange	Index	# of listed company stocks
South Africa	JSE Ltd.	FTSE/JSE All Shar	394
Nigeria	Nigerian SE	NSE All-Share Ind	198
Egypt	EGX	EGX 30	171
Morocco	Casablanca SE	MASI	75
Zimbabwe	Zimbabwe SE	Industrials	69
Kenya	Nairobi SE	NSE 20 Share Inde	62
Tunisia	Bourse de Tunis	TUNINDEX	57
Mauritius	SE of Mauritius	SEMDEX	42
Ivory Coast, Benin, Burkina Faso, Mali,			
Niger, Senegal, Togo, Guinee-Bissau	BRVM	BRVM-10	38
Botswana	Botswana SE	DCI	37
Ghana	Ghana SE	GSE All Share	35
Namibia	Namibian SE	NSX Overall Index	27
Zambia	Lusaka SE	LASI	22
Tanzania	Dar Es Salaam SE	DSEI	17
Uganda	Uganda SE	USE All SHare Ind	17
Malawi	Malawi SE	MASI	14
Libya	Libyan Stock Market	LYX	10
Cape Verde	Bolsa de Valores de Cabo Verde	N/A	4
Rwanda	Rwanda Stock Exchange	Rwanda SE Index	4
Cameroon	Douala Stock Exchange	N/A	N/A
Sudan	Khartoum SE	N/A	N/A
Mozambique	Mozambique SE	N/A	N/A

Source: Wikipedia, Association of African exchanges website

2.10 The Need for the Study of Contagion in Africa

The Global Financial Crisis (“GFC”) has been referred to as one of the worst financial and economic crises since the Great Depression (Ben Bernanke, 2014). The instability this crisis has caused highlights the importance of understanding contagion. The literature indicates that previously, contagious events, such as the Asian crisis, affected countries with similar features. The literature has focused primarily on the impact of the financial crisis on developing and emerging markets outside of Africa, save for South Africa, which is often included in the emerging market samples. Based on analysis in this paper, it seems other African economies have been overlooked in this regard. From an African perspective, studies focus on a single larger African emerging market (mainly South Africa: see K. J. Forbes & Rigobon, 2002), Arestis et al. 2005). Morales and Andreosso-O’Callaghan (2010), Asongu (2011) and Collins & Biekpe (2003) do consider a number of African countries but no studies examine the broad cross-section of emerging and frontier markets considered in this paper. This paper attempts to add to the body of knowledge by testing the existence of financial contagion to a sample of both emerging and frontier African markets.

The paper also attempts to identify which of the African countries experienced the greatest contagion effect. In so doing, this paper attempts to investigate and understand the underlying factors responsible for causing a greater contagion effect on one country versus another.

The paper also identifies the channels through which contagion was transmitted to the sample countries. In so doing, the paper seeks to tease out a common channel amongst the countries, which may, through further research, be regarded as the African contagion channel of propagation.

Once this is understood, appropriate policy responses can be formulated.

Chapter 3: Data and methodology

This chapter provides information on the data used and sources of the data. The research periods are identified in Section 3.1. The primary case study of the thesis examines the relationships between the US and African stock markets during the sub-prime mortgage crisis. There are total of 18 African countries under investigation.

This chapter then discusses the developed hypotheses of the thesis in section 3.2. The section also identifies the two main methodologies employed for testing contagion effect in this thesis: the Constant Correlation Coefficient Analysis and the Dynamic Conditional Coefficient Analysis (using multivariate GARCH).

3.1 Data

3.1.1 The Financial Crisis Period

The 2007-09 crisis was unique among post-1945 financial shocks in that it developed over a relatively long period. This makes identifying the event window potentially problematic. Because the crisis continued for some time and has had a crippling worldwide impact, new approaches are needed to contend with problems that have been documented for previous, regional crises (D. G. Baur, 2013; Kenourgios et al., 2013). One such issue is to correctly identify the dates and duration of a crisis period. If the crisis dates are not specified correctly, misleading or inaccurate results may be obtained. Using timelines from Federal Reserve Bank of St. Louis (2009), BIS (2009), and Baur (2012) suggests August 2007 as a potential start of the benchmark crisis period, with the total crisis period continuing for 86 weeks from August 2007 until March 2009.

The crisis period as defined by D. G. Baur (2012) begins with the issuance of warnings from Bear Stearns and BNP and ends with a stock market increase and negative news (Taylor and Williams, 2009; Baur, 2012). This identification of the crisis period is consistent with the crisis period from Alexakis, Kenourgios, &

Dimitriou (2016) recent article in which they employ both the financial events approach and an advanced empirical method to determine the crisis period. In alignment with this strand of literature (Baur, 2012; Dimitriou et al., 2013), this thesis defines the pre-crisis period as the time prior to 17 July 2007, when Bear Stearns informed investors that there is "very little value" remaining in its two struggling hedge funds (www.reuters.com). The period in question is January 05, 2005 through to 17 July 2007. The full sample period extends from January 05, 2005 through to 31 March 2009.

The sample period is divided into two sections: the 12-month pre-crisis period (July 13, 2006 to July 16, 2007) and the 6-month post-crisis period (July 17, 2007, to January 22, 2008). The stable period is defined as the pre-crisis period, and the turmoil period is defined as the post-crisis period.

3.1.2 Countries of Investigation and Market Returns

The principle theme of this thesis is to identify any contagion between the US and African markets arising from the US Sub-prime Mortgage Crisis. While the US is a developed market, African markets are a mixture of emerging and frontier markets and non-classified "other markets". The Global Financial Crisis (GFC) was a global event with repercussions across all market types. Previous crises examined in the contagion literature have focused on the impact on countries in the same region or markets of the same economic structures and fundamentals, for instance, the US market crash of 1987, the European Exchange Rate Mechanism of 1992, the Mexican economic crisis in 1994, the Asian financial crisis of 1997, the Russian financial crisis of 1998 and the Brazilian crisis of 1999, which began as spill-over of the East Asian financial crisis of 1997 then later spread to other Latin American countries. This paper differs from the above-mentioned studies as the global and prolonged nature of the GFC allows for an examination of these different market types.

The data begins with a sample of 22 countries, and ends up with 12 countries. The reduction is due to the fact that, as alluded to in the literature review, other African

countries do not have active and/ or liquid stock markets. Some countries, such as Rwanda and Cape Verde, only have 4 listed stocks on their stock exchange. Markets have been omitted where trading is relatively illiquid and where markets are relatively small and undeveloped (by African standards) in order to maintain robustness in the analysis. Post this short edit of the countries under investigation, the study ends with 12 countries.

The study then investigates the correlations between the returns of the US daily stock index returns and the 12 African stock indexes returns. Taking the US equity markets as the base criterion, the study investigates whether co-movements among stock markets are significantly reinforced after the sub-prime mortgages crisis.

Figure 3: Sample of African exchanges

Country	Exchange	Index	#Index members	#Listed stocks	Market Cap
South Africa	JSE Ltd	FTSE/JSE All Share	169	394	10.13 trillion
Nigeria	Nigerian SE	NSE All Share	179	198	9.26 trillion
Egypt	EGX	EGX30	31	171	88.06 billion
Morocco	Casablanca SE	MASI	75	75	103.74 billion
Tunisia	Bourse de Tunis	TUNINDEX	56	57	4.42 billion
Mauritius	SE of Tunis	SEMDEX	42	42	200.98 billion
Ivory Coast, Benin, Burkina Faso, Mali, Niger, Senegal, Togo, GuineaBissau	BVRM	BVRM-10	10	38	4.08 trillion
Botswana	Botswana SE	DCI	23	37	51.94 billion
Ghana	Ghana SE	GSE All Share	35	35	55.40 billion
Namibia	Namibian SE	NSX Overall Index	28	27	1.62 trillion
Zambia	Lusaka SE	LASI	21	22	24.74 billion
Tanzania	Dar Es Salaam SE	DSEI	17	17	11.93 trillion

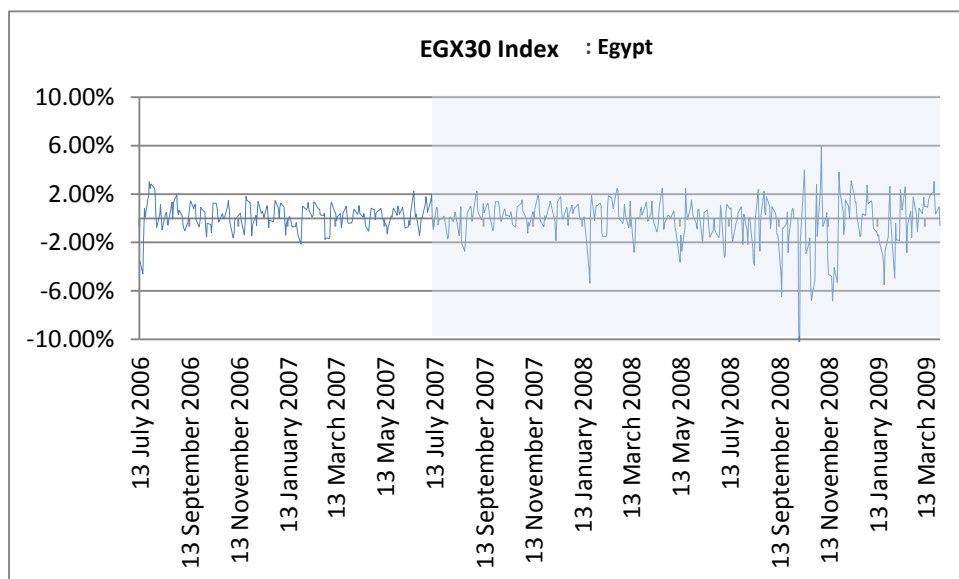
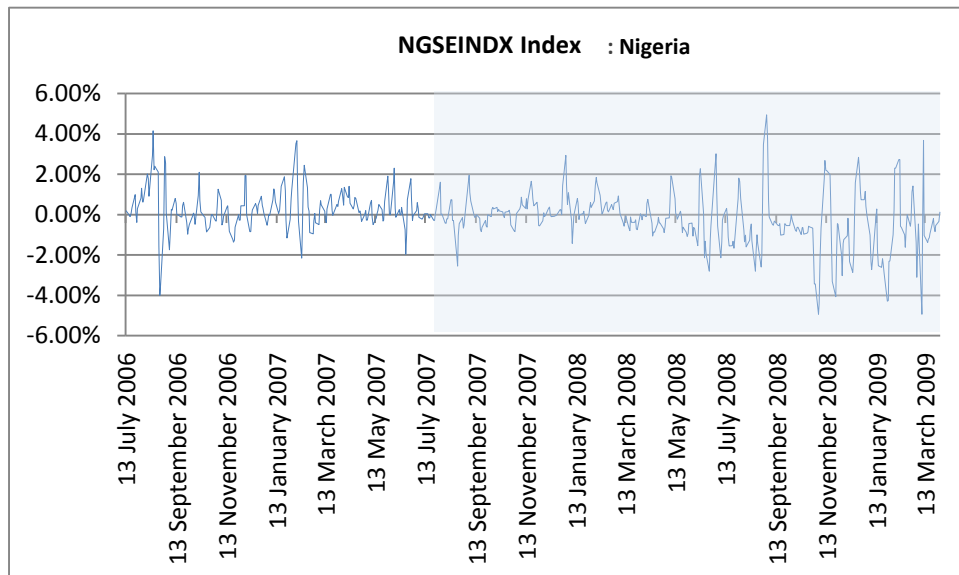
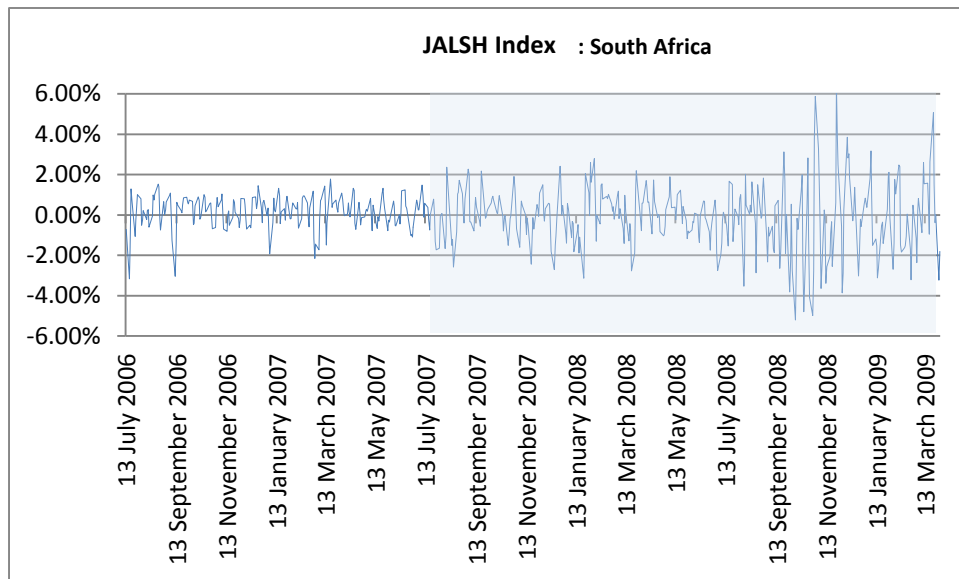
Source: Wikipedia, Association of African exchanges website

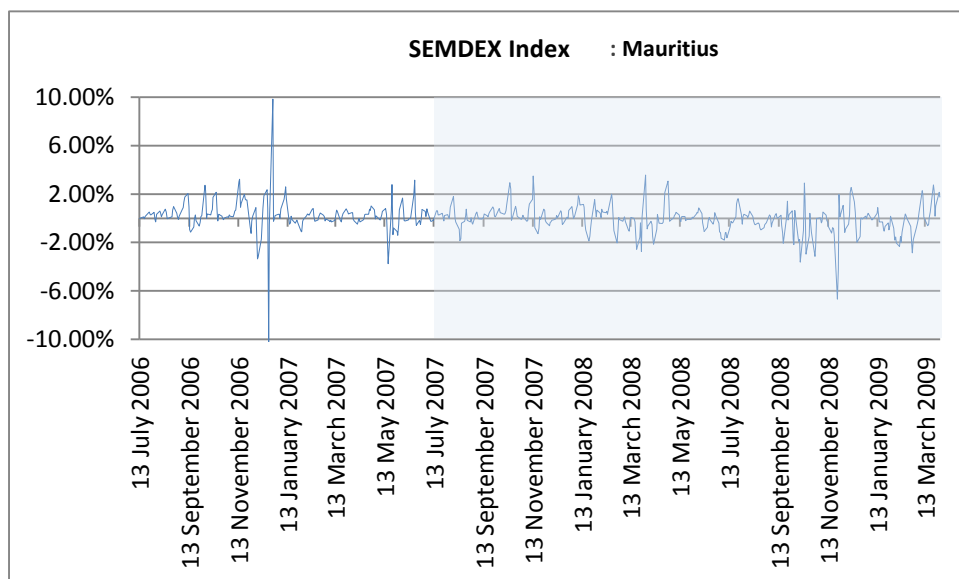
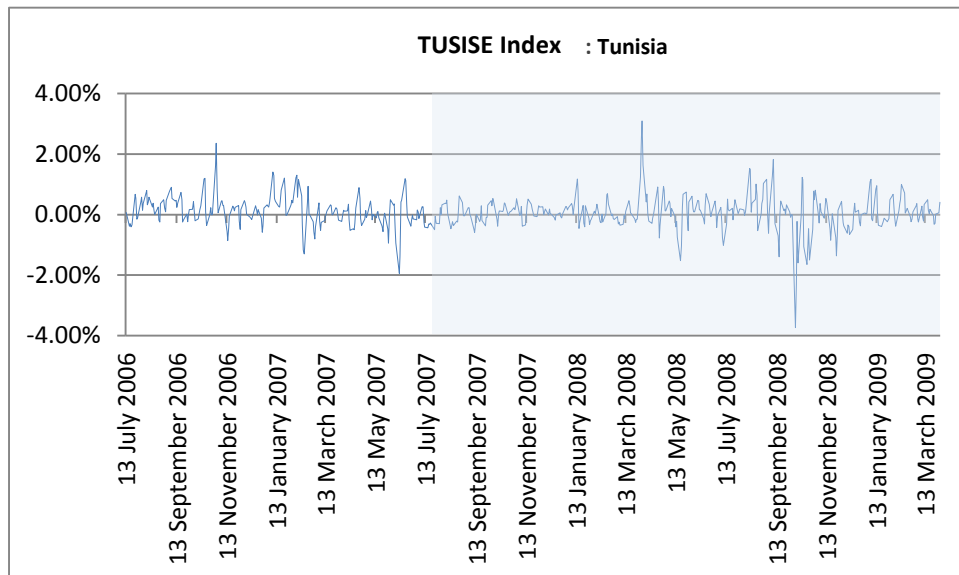
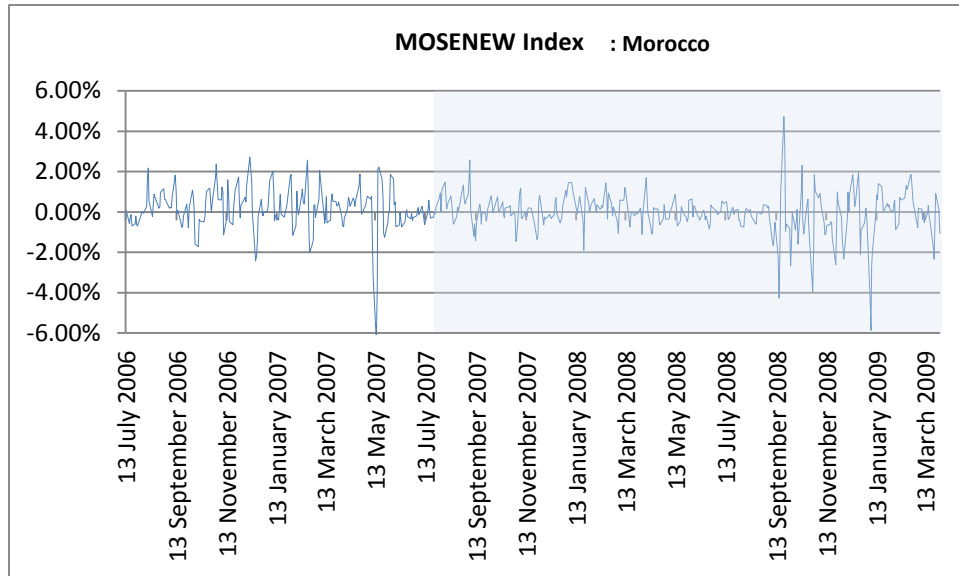
An interesting feature of the 12 remaining markets is that they are high-growth markets. This is noteworthy from a contagion perspective as previous literature suggests that financial crisis can have a disproportionate impact on high-growth markets (Ahmadu-Bello, 2014). This is partly a reflection of the tendency of large developed market investors to rapidly liquidate their emerging market investments in periods of crisis.

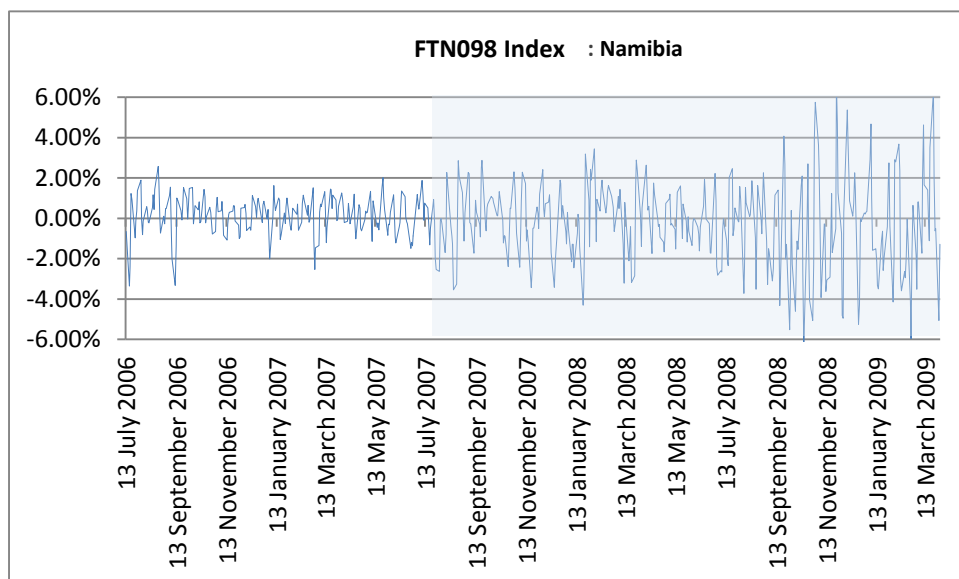
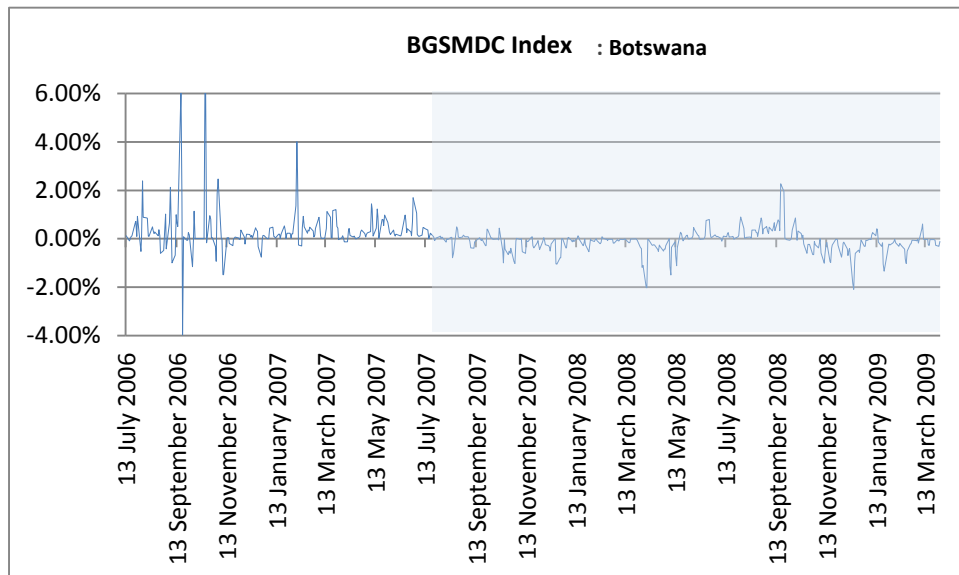
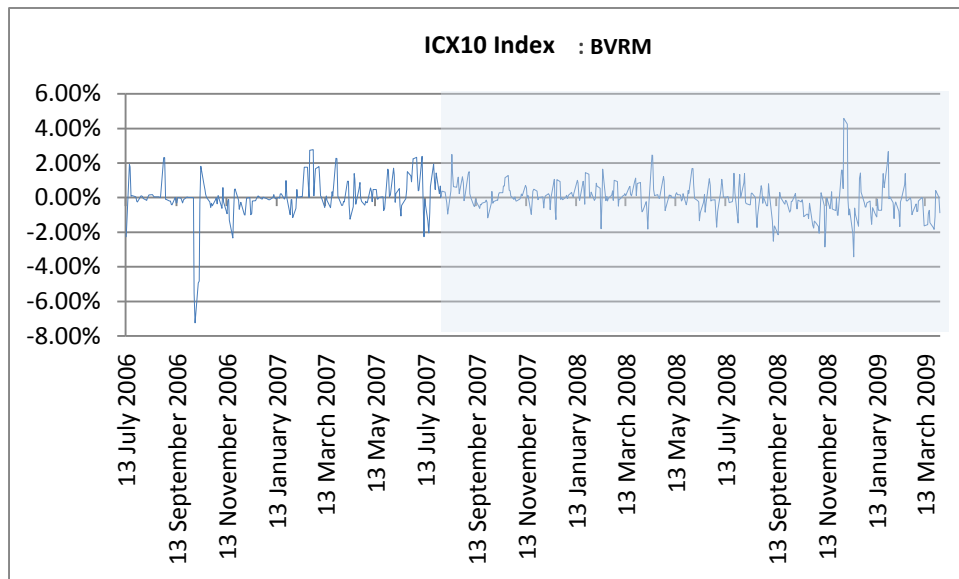
The global financial crisis took place when Africa was growing rapidly. Nisanke (2009) reported a rise in net private capital flows to Africa from US\$17.1 billion in 2002 to US\$81 billion in 2007. This offers a possible reason for the behaviour of African financial markets during the crisis and this may possibly be reflected in contagion-related events.

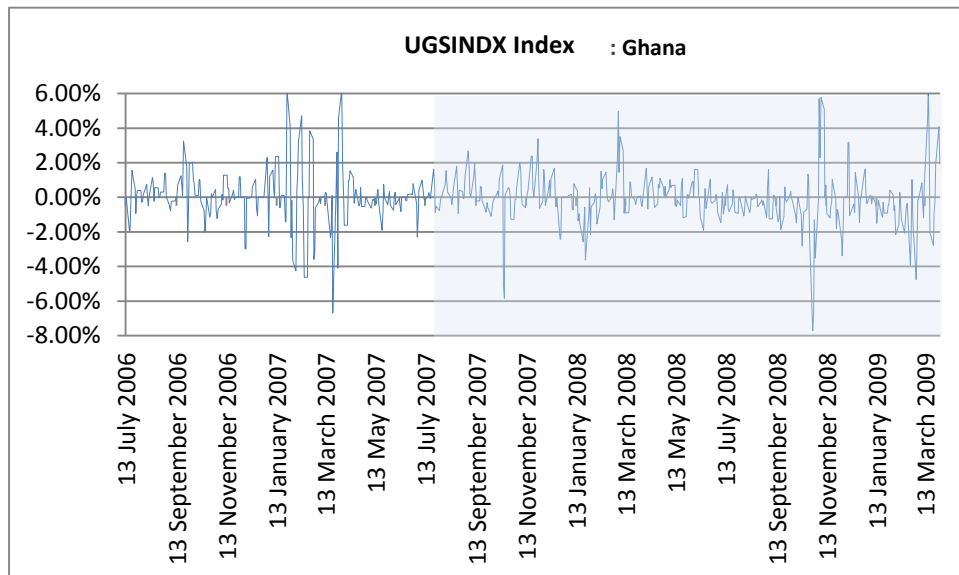
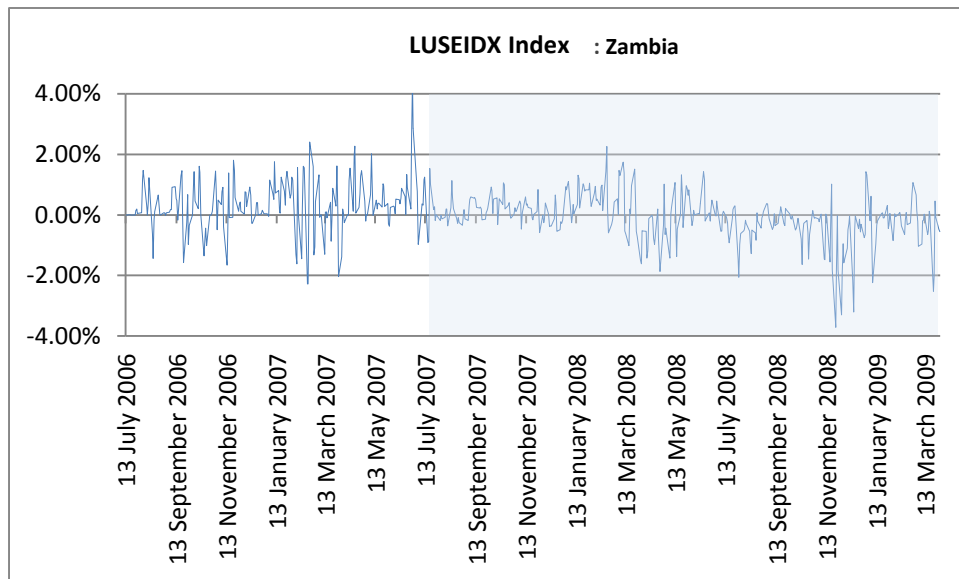
Table 1 (in Appendix) present daily returns on international stock indexes returns from July 13, 2006 through to 31 March 2009. Table 2 shows the 12 month pre-crisis data and the associated descriptive statistics. As the Table 2 shows, all of the average daily returns for the international stock markets are largely positive during the stable period. However, during the turmoil period, international stock market returns are all negative, respectively (Table 3).

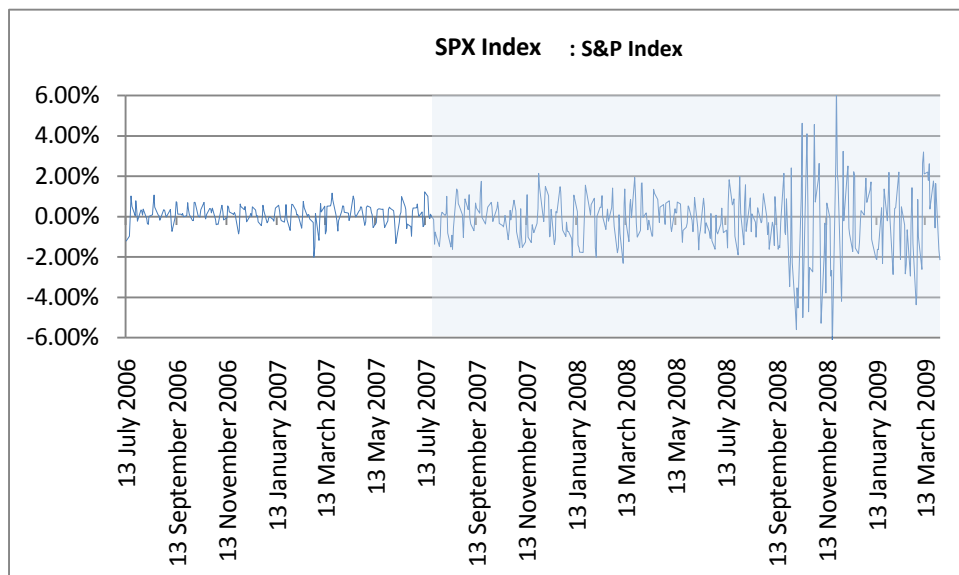
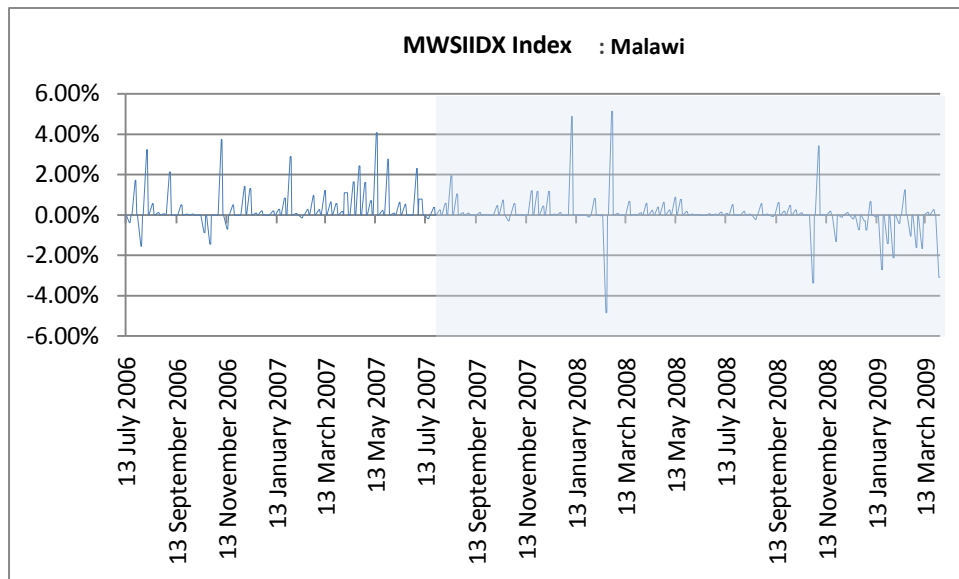
Daily return charts of all the African markets under study are provided in the figures below. The shaded elements of the charts reflect the crisis period.











It is immediately evident that several patterns exist among these markets. Morocco, Namibia, Nigeria and South Africa exhibit high volatility throughout the period with significant increases during the specified crisis period. Botswana, however, appears more volatile before the crisis period while Mauritius and Egypt show relatively low pre-crisis volatility, which increases significantly in volatility during the crisis.

3.1.3 Data Set

The data used in this paper is taken from the Bloomberg database. The data consists of market indices in local currency of the mentioned countries. The data used is the daily closing values of stock markets obtained. As per K. J. Forbes & Rigobon (2002),

this paper uses two day moving averages to compensate for differing time zones in the data.

The S&P 500 index is selected as the American index; this index is selected on the basis that it is an index that is reflective of a general cross-section of US stocks (unlike, for example, the NASDAQ and DJIA, which consist of technology stocks and the top 30 industrial stocks, respectively).

The following additional data is collected: Monthly data for CPI, to be used to calculate inflation rate, the 3-month T-Bill to be used as an interest rate proxy, and monthly country trade data are collected from Direction of Trade Statistics – IMF.

Data Cleaning Issues

Market holidays presented a challenge in the data set. National holidays differ amongst countries in the data set, resulting in a series of non-corresponding dates across the raw market data. Time was taken to go through the data sets and delete non-corresponding dates manually.

3.2 Hypothesis and Model Development

Three key models are examined in this section as follows:

- a) A model testing for the presence of contagion in the stock markets;
- b) A model testing the severity of the contagion effect in markets identified in (a); and
- c) Determining which channels of financial contagion propagation are most significant in markets identified in (a)

3.2.1 Hypotheses

The literature guides the formulation of the following hypothesis:

- H1: Contagion exists in African stock markets, i.e. there is a statistically significant increase in correlations between US and African markets over the period of investigation
- H2: Which country experienced the highest contagion effect? i.e. where was the crisis most pronounced?
- H3: What is responsible for/ explains the incidence of contagion?

3.3 Methodology

Several authors have studied contagion in its different forms using different econometric tests: e.g., linear cointegration tests, nonlinear error-correction models, and dynamic correlations (D. Baur, 2003; Chiang, Jeon, & Li, 2007; Corsetti, Pericoli, & Sbracia, 2005; K. J. Forbes & Rigobon, 2002; Kaminsky & Reinhart 2000; Yang & Bessler, 2008). However, findings to date are relatively inconclusive, and often vary per country, per sample and per period.

H1: There is a statistically significant increase in correlations between US and African markets over the period of investigation, i.e. contagion exists in African stock markets

Testing for the existence of financial contagion during a crisis has received a fair amount of attention from empirical studies, and has thus built up a reasonable body of knowledge. Although a range of methodologies has been presented, researchers have not reached consensus on a formal procedure for identifying contagion. Some of the proposed testing methodologies include, linear regression, logit-probit regressions, the latent factor model, correlation analysis, the vector autoregressive approach, probability models and the co-exceedance or extreme value approach.

Cross-market correlations: In the late 1990's, the most popular framework for analyzing contagion was to test if correlations in equity returns across different economies increased significantly after a crisis. These studies generally found evidence that market comovement increased significantly during most crises, which then was interpreted as evidence of contagion. K. J. Forbes & Rigobon (2002), however, show that the increased volatility during crises automatically generated an upward bias in correlation coefficients. They show that markets are highly "interdependent" in all states of the world, and that this usual interdependence during periods of high volatility simply becomes more apparent. Corrections for this heteroskedasticity in asset price movements lead to much less evidence of contagion. Moreover, even if this challenge of adjusting for heteroscedasticity in returns is resolved, tests for contagion based on correlation coefficients also have challenges controlling for any feedback effects (endogeneity) and common shocks (omitted variables) when estimating the effect of a crisis in one country on another.

VAR models: Closely related to using correlation coefficients to analyse contagion is to use a vector autoregression (VAR) framework. These models generally predict stock market returns or yield spreads while controlling for global factors and country-specific factors, as well as for the persistence of these factors through error-correction techniques. Contagion is then measured with an impulse-response function predicting the impact of an unanticipated shock from one country on to others. These tests are less conservative than those based on correlation coefficients as they generally do not adjust for the heteroskedasticity in returns.

Probability analysis: One of the earliest approaches for evaluating the existence and importance of contagion used probability models to assess whether a crisis occurring in a country affected the likelihood that another country would have a crisis. These papers generally find evidence that the probability of a country having a crisis increases if there is a crisis elsewhere, especially for countries in the same region. This general approach has been extended more recently to test for a role of contagion in explaining sharp movements in capital flows (K. J. Forbes & Warnock, 2012) and default probabilities derived from credit default swaps (Constâncio, 2012).

These papers generally find evidence of contagion, although they have limited success in controlling for endogeneity and omitted variables that could simultaneously cause events to occur in multiple countries (K. J. Forbes, 2012a).

Latent factor/GARCH models: The challenges of using correlation coefficients and VARs to analyze contagion prompted a series of papers using latent factor and GARCH models that allow return variances to change across regimes. Many of these papers focus on estimating spillovers in volatility. Studies using this approach generally find evidence of contagion from one country to others in certain circumstances, but not in all crises. Most of these studies also attempt to control for fundamental factors in their analysis and define contagion more strictly as the “excess correlation” after controlling for fundamentals.

Extreme Values/Co-exceedance/Jump approach: This approach builds on the initial probability approach by using multivariate extreme value theory to test whether tail observations in returns are correlated across countries. The extreme moments analysed in these papers are periods when realizations of certain variables exceed a large threshold value with different approaches used to define these “exceedances”. These approaches have a number of advantages: They do not assume the transmission of shocks is linear or focus on daily relationships between markets. Instead they only focus on the impact of large shocks, which is closer to the broader definition of contagion of concern to policymakers. These approaches are also robust to different distributional assumptions about returns. Papers using this approach generally find evidence of contagion during some crises, but not all. This approach has two disadvantages: the sample of extreme moments is often small and it is difficult to control for any global shocks that could cause an extreme value in multiple markets at once and therefore be interpreted as contagion.

Contagion methodology selected:

The estimation of correlation coefficients among stock returns is the most common method used in estimating contagion effects. This test measures the correlation

coefficient between two markets during a stable period and then tests for significant increase in this correlation coefficient after a (market related) shock. If the correlation coefficient increases significantly, this suggests that the transmission mechanism between the two economies has increased and contagion has thus occurred. The methodology's popularity is attributed to its simplicity and intuitive implications. King & Wadhvani (1990) are believed to be the first to employ this methodology. The authors used this methodology to test for an increase in stock market correlations between the US, Japan and the UK. They found that the correlations increase among these countries after the US stock market crash. S. Calvo & Reinhart (1996) also employ this approach to test for financial contagion in stock markets after the Mexican peso crisis. Their study showed an increase in correlations, and therefore evidence of contagion.

However, one problem with this approach is that crises typically increase the volatility of asset returns, which may induce a false or spurious estimated increase in correlation. K. J. Forbes & Rigobon (2002) show that there is a bias with straightforward correlation tests due to heteroskedacity in market returns. This means that an increase in market volatility biases the estimates of cross-market correlation coefficients. They then go on to show that, after adjusting the correlation coefficient, there remains little evidence of contagion between stock markets, with examples taken from the 1987 US stock market crash, the 1994 Mexican peso crisis and the 1997 Asian crisis. The markets were, however, still closely linked, but evidence of contagion, which was defined as a change in correlation, was not found.

Data often suffers from heteroscedasticity, endogeneity and omitted variable problems. Some authors have tried to solve these problems in a similar way, although they have reached different conclusions in terms of contagion. K. J. Forbes & Rigobon (2002) develop a correlation analysis that adjusted correlation coefficients only for heteroscedasticity under the assumption of no omitted variables.

The empirical test on contagion in international financial markets adopts an adjustment to the conditional coefficient, as proposed by K. J. Forbes & Rigobon (2002). K. J. Forbes & Rigobon (2002) point out that there was a bias with conditional coefficient due to heteroscedasticity in market returns. An increase in market volatility biased the estimates of cross-market correlation coefficients.

In order to measure the existence of a contagion effect, the daily data on market indices for the chosen countries are used, and rolling two-day average returns are calculated to allow for differing open market times (Collins & Biekpe, 2003). Where possible, the local benchmark index for each country is taken, that is, in South Africa; the JSE All Share Index is used. The indices are not converted into US dollar figures in this instance.³

The log difference of the variables in the data is examined for stationarity using the augmented Dickey-Fuller test (1979) test.

The stock return is defined as

$$R_t = \ln\left(\frac{P_t}{P_{t-1}}\right) * 100$$

where P_t is the closing price of the stock index on day t and P_{t-1} is the closing price on the previous day. Equity returns are a useful basis for this analysis, as they should incorporate all available information on the expected future profitability of companies in a country. Equity returns are also available at a high frequency. K. J. Forbes, (2012b) shows that this ability to better identify the effect of various shocks is critically important during crises when events have rapid effects.

Let $r_{1,t}$ and $r_{2,t}$ denote two stock returns of two different assets, and construct the following model:

$$r_{1,t} = a_0 + a_1 r_{2,t} + \varepsilon_t$$

³ Converting into US dollar using daily exchange rate data would also suffice, but Forbes and Rigobon (2002) have shown that using dollars and local indices have similar results.

The unadjusted conditional correlation coefficient is measured by the standard definition of the correlation coefficient:

$$\rho = \frac{\sigma_{xy}}{\sigma_x \sigma_y}$$

In conforming to the K. J. Forbes & Rigobon (2002) methodology⁴, the correlation coefficient is adjusted in the following way:

$$\rho = \frac{\rho}{\sqrt{1 + \sigma(1 - \rho^2)}}$$

where $\sigma = \frac{\sigma_i^y}{\sigma_i^x} - 1$

This measures the change in high period volatility (crisis period) against the low period volatility (non-crisis period). As per Collins & Biekpe (2003) study, contagion is tested using the t-test based on the differences between the correlation coefficients. Contagion in particular is measured by the significant increase in correlations during the crisis period compared to the non-crisis period. The test is defined by:

$$t = (\rho_y - \rho_x) * \sqrt{\frac{n_y + n_x - 4}{1 - (\rho_y - \rho_x)^2}}$$

where $t_{(0.01, n_y + n_x - 4)}$

The hypothesis to be tested is

$$H_0: \rho_y - \rho_x = 0 \text{ versus } H_1: \rho_y - \rho_x > 0$$

H_0 is the null hypothesis of no contagion present and H_1 is the alternative hypothesis that contagion is present and exists.

H2: Which country experienced the highest contagion effect, i.e. where the crisis was most pronounced?

⁴ The Forbes and Rigobon (2002) correlation approach assumes that no variables are omitted

According to Feldkircher (2014), most of the empirical studies use a pure cross-sectional assessment to capture the effect of the crisis on the real economy. Crisis severity is measured as the impact on GDP or private consumption, which, in turn, is referenced to growth rates in 2008 or 2009. Such an approach neglects the distinct timing of the crisis' impact on the real economy. Examining the impact of the crisis on the real economy by looking simply at growth rates of output or consumption in 2008, 2009, or the cumulative values for that period, blurs the results for a given country.

Using quarterly real GDP data for the countries identified in (a), the dates of crisis outbreak and crisis end for each country are determined. The start of the crisis period is defined as the first quarter the economy posted negative growth in the period during the crisis period. Due to lack of data availability, only seven of the countries in the sample are represented. Based on the crisis outbreak description above, three of the countries in the sample do not dip into recession. Following Cecchetti, Mohanty, & Zampolli (2011), the end of the crisis is dated as the first quarter when the economy surpassed its pre-crisis peak. In this instance, the pre-crisis peak is the peak value of real output within the four quarters preceding the previously dated outbreak of the crisis.

Next, a set of measures that captures two dimensions of the immediate impact of the crisis on the real economy are set. Following Cecchetti et al., (2011), the cumulative loss in real output during the crisis and the depth of the crisis is measured, as follows:

$$Cumulative\ loss = \frac{\sum_{t=t_{crisis.start}}^{t=t_{crisis.end}} y_t - Peak(y)}{Peak(y)} * 100$$

$$Depth = \frac{Trough(y) - Peak(y)}{Peak(y)} * 100$$

with y_t denoting real GDP at quarter t , $t_{crisis.start}$ and $t_{crisis.end}$ the country-specific dating of the crisis, $Peak(y) \frac{1}{4} \max(y_t)$, for all $t=\{t_{crisis.st4}, t_{crisis.st1}\}$ and $Trough(y) \frac{1}{4} \min(y_t)$, $c\ t \in \{t_{crisis.st}, t_{crisis.end}\}$.

H3: What is responsible for/ explains the incidence of contagion?

Based on the empirical results of the model presented in H1, the proposed model to examine the determinants of contagion based on definition suggested by K. J. Forbes & Rigobon (2002) is as follows:

$$\begin{aligned} \text{Logit} \left(P(\text{Contagion}_{i,US}) \right) \\ = \beta_0 + \beta_1 \text{TradeRatio}_{i,US} + \beta_2 \text{ExchangeRatio}_{i,US} \\ + \beta_3 \text{InflationRatio}_{i,US} + \beta_4 \text{InterestRatio}_{i,US} + \beta_5 \text{Period} + \varepsilon_t \end{aligned}$$

Where $(\text{Contagion}_{i,US})$ is a dummy variable that identifies contagion from the US to country j that has been determined in the previous model test.

$\text{TradeRatio}_{i,US}$ measures the level of dependency of country i 's bilateral trade on the US economy that may cause contagion to be transmitted from the US to the said country i . This contagion would be the result of fluctuations or shocks in the US economy. Thus $\text{TradeRatio}_{i,US}$ is defined as the ratio of country i 's bilateral trade with the US to country i 's total trade before and during the crisis. The more dependent country i 's bilateral trade is on the US economy, the stronger the contagion effect will likely be.

$\text{TradeRatio}_{i,US}$

$$\begin{aligned} & \frac{\sum_{Ty}^{t=Tx+1} ((\text{Exp}_{iUS,t}^{\text{during crisis}} + \text{Imp}_{iUS,t}^{\text{during crisis}}))}{(\text{Exp}_{i,t}^{\text{during crisis}} + \text{Imp}_{i,t}^{\text{during crisis}}))} \\ = & \frac{\sum_{Tx}^{t=1} ((\text{Exp}_{iUS,t}^{\text{pre crisis}} + \text{Imp}_{iUS,t}^{\text{pre crisis}})) / (\text{Exp}_{i,t}^{\text{pre crisis}} + \text{Imp}_{i,t}^{\text{pre crisis}}))}{\sum_{Ty}^{t=Tx+1} ((\text{Exp}_{iUS,t}^{\text{during crisis}} + \text{Imp}_{iUS,t}^{\text{during crisis}})) / (\text{Exp}_{i,t}^{\text{during crisis}} + \text{Imp}_{i,t}^{\text{during crisis}}))} \end{aligned}$$

InflationRatio is the relative inflation differential. This variable is measured by the average deviation between country i and the US's inflation rates during the crisis divided by the average deviation between the two countries' inflation rates before the crisis. Chen et al. (1986) suggest that economic variables including changes in interest rates, inflation rates, and industrial production impact the discount rate and expected cash flows thereby influencing stock prices and market returns.

$$InfRatio = \frac{\sum_{t=Tx+1}^{Ty} |Inf_{i,t}^{during\ crisis} - Inf_{US,t}^{during\ crisis}| / T_y}{\sum_{t=1}^{Tx} |Inf_{i,t}^{pre\ crisis} - Inf_{US,t}^{pre\ crisis}| / T_x}$$

InterestRatio is the relative interest rate differential which is the average deviation between country i's and the US's interest rates during the crisis divided by the average deviation between the two countries' interest rates before the crisis. It should be negatively correlated with market correlation.

$$IntRatio = \frac{\sum_{t=Tx+1}^{Ty} |Int_{i,t}^{during\ crisis} - Int_{US,t}^{during\ crisis}| / T_y}{\sum_{t=1}^{Tx} |Int_{i,t}^{pre\ crisis} - Int_{US,t}^{pre\ crisis}| / T_x}$$

ExchangeRatio is the relative exchange rate strength, which is the average rate between country i's and the US's exchange rates during the crisis divided by the average deviation between the two countries' exchange rates before the crisis. It should be negatively correlated with market correlation.

$$ExchangeRatio = \frac{\sum_{t=Tx+1}^{Ty} |Exc_{i,t}^{during\ crisis} - Exc_{US,t}^{during\ crisis}| / T_y}{\sum_{t=1}^{Tx} |Exc_{i,t}^{pre\ crisis} - Exc_{US,t}^{pre\ crisis}| / T_x}$$

Period is a dummy variable reflecting the periodic effect. It is a dummy variable taking value 1 if the period in question is the crisis period, otherwise 0.

Chapter 4: Results and discussion

In this chapter, a description of the data is given, along with a walk through of all the data preparation tests. The hypothesis presented in Section 3.2 is tested and the results are presented.

4.1 Description of Data

Table 4 reports descriptive statistics for each period separately: the pre-crisis data are reported in Panel A and during-crisis data are reported in Panel B.

Table 4: Panel A

Descriptive statistics (Quantitative data): 12 months pre-crisis period

Statistic	JALSH Index	NGSEINDX Index	EGX30 Index	MOSENEW Index	TUSISE Index	SEMDEX Index	ICX10 Index	BGSMDC Index	FTN098 Index	LUSEIDX Index	UGSINDX Index	MWSIIDX Index	SPX Index
Nbr. of observations	210	210	210	210	210	210	210	210	210	210	210	210	210
Minimum	-0.032	-0.040	-0.046	-0.064	-0.019	-0.108	-0.073	-0.040	-0.034	-0.023	-0.067	-0.016	-0.020
Maximum	0.018	0.042	0.030	0.027	0.024	0.098	0.028	0.065	0.026	0.044	0.062	0.041	0.012
1st Quartile	-0.003	-0.003	-0.003	-0.003	-0.002	-0.002	-0.002	0.000	-0.003	0.000	-0.005	0.000	-0.002
Median	0.002	0.002	0.003	0.002	0.001	0.002	0.000	0.002	0.003	0.002	0.000	0.000	0.001
3rd Quartile	0.007	0.007	0.008	0.007	0.004	0.006	0.002	0.005	0.008	0.008	0.005	0.003	0.004
Mean	0.002	0.003	0.002	0.002	0.001	0.003	0.000	0.004	0.002	0.003	0.000	0.004	0.001
Variance (n-1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Standard deviation (n-1)	0.008	0.010	0.010	0.010	0.005	0.014	0.012	0.010	0.009	0.009	0.016	0.009	0.005
Skewness (Pearson)	-1.017	0.203	-0.628	-1.387	0.185	-0.861	-2.039	3.042	-0.741	0.234	0.084	2.038	-0.830
Kurtosis (Pearson)	2.209	3.118	2.733	7.665	2.790	30.004	11.847	19.123	1.580	2.448	4.442	4.920	2.005
Standard error of the mean	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000
Standard error of the variance	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Correlation matrix (Pearson):

Variables	JALSH Index	NGSEINDX Index	EGX30 Index	MOSENEW Index	TUSISE Index	SEMDEX Index	ICX10 Index	BGSMDC Index	FTN098 Index	LUSEIDX Index	UGSINDX Index	MWSIIDX Index	SPX Index
JALSH Index	1	0.080	0.323	-0.062	0.068	0.006	-0.072	0.074	0.925	-0.100	0.074	0.045	0.440
NGSEINDX Index	0.080	1	0.021	0.041	0.073	-0.074	0.042	0.096	0.082	-0.084	-0.140	0.050	0.104
EGX30 Index	0.323	0.021	1	0.029	0.162	0.061	0.156	0.088	0.344	-0.067	-0.049	-0.099	0.252
MOSENEW Index	-0.062	0.041	0.029	1	0.168	0.006	0.096	-0.056	-0.056	-0.072	-0.065	-0.098	-0.008
TUSISE Index	0.068	0.073	0.162	0.168	1	0.111	-0.030	0.154	0.114	-0.049	0.024	0.040	0.011
SEMDEX Index	0.006	-0.074	0.061	0.006	0.111	1	-0.015	-0.087	0.015	-0.054	0.104	-0.056	0.009
ICX10 Index	-0.072	0.042	0.156	0.096	-0.030	-0.015	1	0.063	-0.086	0.067	-0.048	0.069	-0.093
BGSMDC Index	0.074	0.096	0.088	-0.056	0.154	-0.087	0.063	1	0.069	0.041	-0.107	0.022	0.035
FTN098 Index	0.925	0.082	0.344	-0.056	0.114	0.015	-0.086	0.069	1	-0.127	0.084	0.051	0.418
LUSEIDX Index	-0.100	-0.084	-0.067	-0.072	-0.049	-0.054	0.067	0.041	-0.127	1	0.037	0.045	0.057
UGSINDX Index	0.074	-0.140	-0.049	-0.065	0.024	0.104	-0.048	-0.107	0.084	0.037	1	-0.034	-0.060
MWSIIDX Index	0.045	0.050	-0.099	-0.098	0.040	-0.056	0.069	0.022	0.051	0.045	-0.034	1	0.014
SPX Index	0.440	0.104	0.252	-0.008	0.011	0.009	-0.093	0.035	0.418	0.057	-0.060	0.014	1

Values in bold are different from 0 with a significance level $\alpha=0.05$

p-values:													
Variables	JALSH Index	NGSEINDX Index	EGX30 Index	MOSENEW Index	TUSISE Index	SEMDEX Index	ICX10 Index	BGSMDC Index	FTN098 Index	LUSEIDX Index	UGSINDX Index	MWSIIDX Index	SPX Index
JALSH Index	0	0.248	0.000	0.368	0.323	0.935	0.300	0.285	0.000	0.148	0.289	0.519	0.000
NGSEINDX Index	0.248	0	0.763	0.551	0.294	0.286	0.550	0.164	0.235	0.225	0.043	0.468	0.133
EGX30 Index	< 0.0001	0.763	0	0.674	0.019	0.377	0.023	0.206	< 0.0001	0.332	0.480	0.151	0.000
MOSENEW Index	0.368	0.551	0.674	0	0.015	0.932	0.164	0.418	0.418	0.302	0.349	0.156	0.906
TUSISE Index	0.323	0.294	0.019	0.015	0	0.109	0.669	0.026	0.098	0.479	0.728	0.564	0.874
SEMDEX Index	0.935	0.286	0.377	0.932	0.109	0	0.827	0.211	0.830	0.440	0.133	0.419	0.893
ICX10 Index	0.300	0.550	0.023	0.164	0.669	0.827	0	0.362	0.213	0.334	0.492	0.321	0.181
BGSMDC Index	0.285	0.164	0.206	0.418	0.026	0.211	0.362	0	0.322	0.556	0.121	0.753	0.615
FTN098 Index	< 0.0001	0.235	< 0.0001	0.418	0.098	0.830	0.213	0.322	0	0.067	0.223	0.465	< 0.0001
LUSEIDX Index	0.148	0.225	0.332	0.302	0.479	0.440	0.334	0.556	0.067	0	0.596	0.517	0.413
UGSINDX Index	0.289	0.043	0.480	0.349	0.728	0.133	0.492	0.121	0.223	0.596	0	0.623	0.390
MWSIIDX Index	0.519	0.468	0.151	0.156	0.564	0.419	0.321	0.753	0.465	0.517	0.623	0	0.838
SPX Index	< 0.0001	0.133	0.000	0.906	0.874	0.893	0.181	0.615	< 0.0001	0.413	0.390	0.838	0
Values in bold are different from 0 with a significance level alpha=0.05													

Table 4: Panel B

Descriptive statistics (Quantitative data): 6 months post-crisis period													
Statistic	JALSH Index	NGSEINDX Index	EGX30 Index	MOSENEW Index	TUSISE Index	SEMDEX Index	ICX10 Index	BGSMDC Index	FTN098 Index	LUSEIDX Index	UGSINDX Index	MWSIIDX Index	SPX Index
Nbr. of observations	109	109	109	109	109	109	109	109	109	109	109	109	109
Minimum	-0.031	-0.026	-0.054	-0.019	-0.006	-0.019	-0.020	-0.010	-0.043	-0.009	-0.058	-0.003	-0.020
Maximum	0.024	0.029	0.022	0.026	0.012	0.035	0.025	0.005	0.029	0.015	0.034	0.049	0.021
1st Quartile	-0.008	-0.003	-0.002	-0.002	-0.002	-0.002	-0.002	-0.003	-0.011	-0.001	-0.004	0.000	-0.008
Median	-0.001	0.000	0.002	0.000	0.000	0.002	0.001	0.000	-0.002	0.002	0.000	0.000	-0.001
3rd Quartile	0.006	0.004	0.009	0.006	0.003	0.006	0.006	0.000	0.007	0.005	0.006	0.001	0.004
Mean	-0.001	0.001	0.001	0.001	0.001	0.003	0.002	-0.001	-0.002	0.002	0.001	0.003	-0.001
Variance (n-1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Standard deviation (n-1)	0.011	0.007	0.011	0.007	0.003	0.008	0.007	0.003	0.015	0.005	0.013	0.008	0.009
Skewness (Pearson)	-0.088	0.321	-1.795	0.113	0.372	0.678	0.273	-1.064	-0.235	0.552	-1.235	4.521	0.126
Kurtosis (Pearson)	0.085	3.173	6.048	1.050	0.818	2.688	1.599	1.178	-0.132	0.065	5.318	23.623	-0.489
Standard error of the mean	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.000	0.001	0.000	0.001	0.001	0.001
Standard error of the variance	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Correlation matrix (Pearson):													
Variables	JALSH Index	NGSEINDX Index	EGX30 Index	MOSENEW Index	TUSISE Index	SEMDEX Index	ICX10 Index	BGSMDC Index	FTN098 Index	LUSEIDX Index	UGSINDX Index	MWSIIDX Index	SPX Index
JALSH Index	1	-0.123	0.356	-0.002	0.201	0.118	-0.067	0.021	0.918	-0.280	0.018	-0.081	0.528
NGSEINDX Index	-0.123	1	0.147	0.193	0.168	0.001	0.073	-0.030	-0.063	0.202	0.122	-0.148	-0.294
EGX30 Index	0.356	0.147	1	0.241	0.242	0.211	-0.180	-0.030	0.349	-0.108	0.162	0.039	0.215
MOSENEW Index	-0.002	0.193	0.241	1	0.157	0.146	0.056	0.163	-0.023	-0.008	0.042	0.174	-0.085
TUSISE Index	0.201	0.168	0.242	0.157	1	0.169	0.006	0.041	0.156	-0.007	-0.062	0.036	0.189
SEMDEX Index	0.118	0.001	0.211	0.146	0.169	1	-0.023	-0.028	0.140	-0.009	-0.004	0.088	0.089
ICX10 Index	-0.067	0.073	-0.180	0.056	0.006	-0.023	1	-0.051	-0.054	0.098	-0.083	0.096	-0.125
BGSMDC Index	0.021	-0.030	-0.030	0.163	0.041	-0.028	-0.051	1	-0.007	0.040	0.282	0.058	0.017
FTN098 Index	0.918	-0.063	0.349	-0.023	0.156	0.140	-0.054	-0.007	1	-0.210	-0.029	-0.134	0.413
LUSEIDX Index	-0.280	0.202	-0.108	-0.008	-0.007	-0.009	0.098	0.040	-0.210	1	-0.216	-0.096	-0.217
UGSINDX Index	0.018	0.122	0.162	0.042	-0.062	-0.004	-0.083	0.282	-0.029	-0.216	1	0.088	0.098
MWSIIDX Index	-0.081	-0.148	0.039	0.174	0.036	0.088	0.096	0.058	-0.134	-0.096	0.088	1	-0.197
SPX Index	0.528	-0.294	0.215	-0.085	0.189	0.089	-0.125	0.017	0.413	-0.217	0.098	-0.197	1

Values in bold are different from 0 with a significance level $\alpha=0.05$

p-values:													
Variables	JALSH Index	NGSEINDX Index	EGX30 Index	MOSENEW Index	TUSISE Index	SEMDEX Index	ICX10 Index	BGSMDC Index	FTN098 Index	LUSEIDX Index	UGSINDX Index	MWSIIDX Index	SPX Index
JALSH Index	0	0.203	0.000	0.981	0.036	0.221	0.486	0.830	0.000	0.003	0.850	0.403	0.000
NGSEINDX Index	0.203	0	0.128	0.044	0.080	0.995	0.450	0.756	0.518	0.036	0.206	0.125	0.002
EGX30 Index	0.000	0.128	0	0.012	0.011	0.027	0.061	0.756	0.000	0.264	0.092	0.685	0.025
MOSENEW Index	0.981	0.044	0.012	0	0.103	0.130	0.566	0.090	0.814	0.934	0.668	0.071	0.382
TUSISE Index	0.036	0.080	0.011	0.103	0	0.080	0.954	0.670	0.104	0.942	0.522	0.710	0.050
SEMDEX Index	0.221	0.995	0.027	0.130	0.080	0	0.816	0.773	0.147	0.926	0.969	0.361	0.358
ICX10 Index	0.486	0.450	0.061	0.566	0.954	0.816	0	0.599	0.578	0.309	0.388	0.321	0.196
BGSMDC Index	0.830	0.756	0.756	0.090	0.670	0.773	0.599	0	0.945	0.676	0.003	0.548	0.860
FTN098 Index	< 0.0001	0.518	0.000	0.814	0.104	0.147	0.578	0.945	0	0.028	0.767	0.165	< 0.0001
LUSEIDX Index	0.003	0.036	0.264	0.934	0.942	0.926	0.309	0.676	0.028	0	0.024	0.320	0.024
UGSINDX Index	0.850	0.206	0.092	0.668	0.522	0.969	0.388	0.003	0.767	0.024	0	0.364	0.312
MWSIIDX Index	0.403	0.125	0.685	0.071	0.710	0.361	0.321	0.548	0.165	0.320	0.364	0	0.041
SPX Index	< 0.0001	0.002	0.025	0.382	0.050	0.358	0.196	0.860	< 0.0001	0.024	0.312	0.041	0
Values in bold are different from 0 with a significance level alpha=0.05													

Based on preliminary univariate analysis in Table 4, one observes some differences between the pre-crisis and during/post-crisis time periods. One of the observations is that the mean daily returns for most of the markets decrease during the crisis period but the volatilities increase. During the crisis period, one also finds increased standard deviations of the daily returns, which indicate an increase in market volatility. For the pre-crisis sample, Botswana (BGSMD index) and Malawi (MWSIIDX index) are the two countries that have the highest mean returns both of 0.004, respectively, with standard deviations of 0.010 and 0.009, respectively, during the period. On the other hand, BVRM (ICX10 Index) and Uganda (UGSINDX index) reflect the lowest pre-crisis mean daily return both of 0.000 and a standard deviation 0.012 and 0.016 respectively.

The data reflects some negative daily mean returns such as South Africa (JALSH index), Botswana (BGSMD index), Namibia (FTN098 index) and the US (SPX index). The standard deviations in these markets have also increased significantly during the crisis, reflecting the tumultuous nature of the period.

In the pre-crisis period, there is a significant amount of kurtosis, suggesting the existence of a distribution with fat tails. For the pre-crisis period, returns for six of the countries in the sample are skewed left or negatively skewed; that is to say, the left tail is much longer than the right. For the during-crisis period, only four countries skewed left or negatively skewed. The Pearson correlation coefficients and p-values for South Africa (JALSH), Egypt (EGX30 index) and Namibia (FTN098 index) stock returns in the sample data are highly correlated to each other not only in the pre-crisis period but also in the crisis period.

4.2 Stationarity tests

To check the stationarity of the series, Augmented Dickey–Fuller test (ADF) is utilised. For the pre-crisis data, the results indicate that all stock market returns are level stationary at the 5% significance level. However, for the post-crisis data, one cannot reject the hypothesis that a unit root exists in SA (JALSH), Egypt (EGX30),

BVRM (ICX10), Botswana (BGSMD) and Uganda (UGSINDX). After having determined that the series are stationary, following Sheng and Tu (2000) and Kenourgios& Padhi (2012), the cointegration test is applied.

Cointegration amongst the 12 countries in the pre-crisis and post-crisis periods is examined. This data set excluded the US since the paper seeks to examine the US as the source of contagion.

Table 5: Cointegration amongst 12 country indices using MA2 returns – Pre-crisis period

Lambda max test:				
H0 (Nbr. of cointegrating equations)	Eigenvalue	Statistic	Critical value	p-value
None	0.492	134.080	73.095	< 0.0001
At most 1	0.422	108.582	67.080	< 0.0001
At most 2	0.327	78.293	61.041	0.001
At most 3	0.233	52.603	54.964	0.085
At most 4	0.208	46.152	48.879	0.094
At most 5	0.124	26.228	42.771	0.829
At most 6	0.114	24.005	36.629	0.637
At most 7	0.080	16.604	30.439	0.802
At most 8	0.057	11.658	24.161	0.808
At most 9	0.040	8.066	17.797	0.699
At most 10	0.023	4.515	11.225	0.548
At most 11	0.000	0.001	4.130	0.961
Lambda max test indicates 3 cointegrating relation(s) at the 0.05 level.				
Trace test:				
H0 (Nbr. of cointegrating equations)	Eigenvalue	Statistic	Critical value	p-value
None	0.492	510.787	311.127	< 0.0001
At most 1	0.422	376.707	263.261	< 0.0001
At most 2	0.327	268.125	219.399	< 0.0001
At most 3	0.233	189.832	179.508	0.013
At most 4	0.208	137.230	143.671	0.109
At most 5	0.124	91.078	111.781	0.477
At most 6	0.114	64.850	83.940	0.522
At most 7	0.080	40.844	60.062	0.669
At most 8	0.057	24.240	40.175	0.692
At most 9	0.040	12.582	24.275	0.657
At most 10	0.023	4.516	12.321	0.636
At most 11	0.000	0.001	4.130	0.961
Trace test indicates 4 cointegrating relation(s) at the 0.05 level.				

The results presented in Table 6 indicate that there are seven cointegrating vectors during the crisis period at a 95% confidence interval. This figure includes both the lambda max and trace tests. In the post crisis period, the data shows 20 (ten lambda max test and ten trace test) cointegrating vectors at a 95% confidence interval.

Table 6: Cointegration amongst 12 country indices using MA2 returns – Post-crisis period

Lambda max test:				
H0 (Nbr. of cointegrating equations)	Eigenvalue	Statistic	Critical value	p-value
None	1.000	1248.636	73.095	< 0.0001
At most 1	0.999	645.370	67.080	< 0.0001
At most 2	0.988	432.713	61.041	< 0.0001
At most 3	0.982	391.087	54.964	< 0.0001
At most 4	0.875	201.865	48.879	< 0.0001
At most 5	0.814	163.232	42.771	< 0.0001
At most 6	0.616	92.814	36.629	< 0.0001
At most 7	0.451	58.126	30.439	< 0.0001
At most 8	0.279	31.748	24.161	0.004
At most 9	0.184	19.703	17.797	0.026
At most 10	0.038	3.765	11.225	0.666
At most 11	0.027	2.620	4.130	0.125
Lambda max test indicates 10 cointegrating relation(s) at the 0.05 level.				
Trace test:				
H0 (Nbr. of cointegrating equations)	Eigenvalue	Statistic	Critical value	p-value
None	1.000	3291.681	311.127	< 0.0001
At most 1	0.999	2043.045	263.261	< 0.0001
At most 2	0.988	1397.674	219.399	< 0.0001
At most 3	0.982	964.962	179.508	< 0.0001
At most 4	0.875	573.874	143.671	< 0.0001
At most 5	0.814	372.009	111.781	< 0.0001
At most 6	0.616	208.777	83.940	< 0.0001
At most 7	0.451	115.963	60.062	< 0.0001
At most 8	0.279	57.837	40.175	0.000
At most 9	0.184	26.089	24.275	0.029
At most 10	0.038	6.385	12.321	0.391
At most 11	0.027	2.620	4.130	0.125
Trace test indicates 10 cointegrating relation(s) at the 0.05 level.				

4.3 Contagion identification

To investigate the incidence of contagion during the 2008 GFC, the K. J. Forbes & Rigobon (2002) definition of contagion is employed and models specified in section 3.3 are evaluated. Table 7 shows the contagion effect from the US to the countries in the data sample during the GFC. The results show that Tunisia is the biggest recipients of the contagion effect. South Africa reflects the highest post crisis adjusted correlation; however this is evidence of a co-movement effect instead of contagion. These results indicate that financial contagion affected some African equity markets during the GFC. This contagion may reduce the effectiveness investors' attempts to reduce risk during a crisis by employing an African emerging market diversification strategy.

Table 7: Contagion to African markets from the 2007/08 GFC – correlation coefficients, adjusted and unadjusted (using method described in Section 3.3)

Variable	Corr with US during entire sample	Corr with US during pre-crisis period	Corr with US during crisis period	Std Dev in pre-crisis period	Std Dev in pre-crisis period	Std Dev in crisis period	Std Dev in crisis period squared	Pre crisis Adjusted Corr	Post crisis Adjusted Corr	Sample size pre-crisis	Sample size crisis period	t-statistic	Critical value	Reject/ Cannot reject H0	Evidence of Contagion/ Co-movement
JALSH Index	0.565	0.440	0.528	0.008	0.00006	0.011	0.00013	0.374	0.388	210	109	1.566	1.960	Cannot reject H0	Co-movement
NGSEINDX Index	-0.001	0.104	-0.294	0.010	0.00011	0.007	0.00005	0.124	(0.400)	210	109	(7.061)	1.960	Reject H0	Contagion
EGX30 Index	0.353	0.252	0.215	0.010	0.00010	0.011	0.00012	0.240	0.194	210	109	(0.655)	1.960	Cannot reject H0	Co-movement
MOSENEW Index	0.071	-0.008	-0.085	0.010	0.00011	0.007	0.00005	(0.010)	(0.124)	210	109	(1.356)	1.960	Cannot reject H0	Co-movement
TUSISE Index	0.116	0.011	0.189	0.005	0.00003	0.003	0.00001	0.015	0.315	210	109	3.151	1.960	Reject H0	Contagion
SEMDEX Index	0.037	0.009	0.089	0.014	0.00019	0.008	0.00007	0.012	0.145	210	109	1.411	1.960	Cannot reject H0	Co-movement
ICX10 Index	-0.026	-0.093	-0.125	0.012	0.00013	0.007	0.00004	(0.122)	(0.213)	210	109	(0.572)	1.960	Cannot reject H0	Co-movement
BGSMDC Index	0.028	0.035	0.017	0.010	0.00010	0.003	0.00001	0.062	0.054	210	109	(0.316)	1.960	Cannot reject H0	Co-movement
FTN098 Index	0.517	0.418	0.413	0.009	0.00008	0.015	0.00023	0.336	0.263	210	109	(0.090)	1.960	Cannot reject H0	Co-movement
LUSEIDX Index	0.007	0.057	-0.217	0.009	0.00008	0.005	0.00002	0.079	(0.394)	210	109	(4.854)	1.960	Reject H0	Contagion
UGSINDX Index	0.018	-0.060	0.098	0.016	0.00025	0.013	0.00016	(0.066)	0.119	210	109	2.793	1.960	Reject H0	Contagion
MWSIIDX Index	0.076	0.014	-0.197	0.009	0.00008	0.008	0.00006	0.016	(0.233)	210	109	(3.740)	1.960	Reject H0	Contagion
SPX Index	1	1	1	0.005	0.00002	0.009	0.00008	1.000	1.000	210	109	0	1.960		

If the absolute value of the t-statistic is greater than this critical value, then you can reject the null hypothesis, H0, at the 0.05 level of significance.

Notes: Pre-crisis period is 12 month period from 13 July 2006 to 16 July 2007

Post-crisis period is 6 month period from 17 July 2007 to 22 January 2008

4.4 Degree of crisis severity

Crisis periods and the two measures for crisis severity are provided in Table 8a. Countries are ordered by cumulative output loss measure. The country most affected by the crisis in terms of output loss is Botswana. One observes that some countries fail to fully recover from the crisis during the observation period. Of the seven countries investigated, four of them did not recover to their pre-crisis peak. The majority of the countries felt the real downturn during late 2009.

Country	Cumulative loss	Depth	Crisis start	Crisis end
Botswana	595%	-105%	Q106	Q410
Mauritius	-136%	-91%	Q309	Q410
Morocco	-123%	-70%	Q309	Q410
Nigeria	-173%	-99%	Q109	Q410
South Africa	No recession evident in the data			
Egypt	No recession evident in the data			
Tunisia	No recession evident in the data			

To test the robustness of the findings, a means difference test is applied to the countries identified in 8a.

Table 9: Means difference test												
t-Test: Two-sample test assuming unequal variances: T-stat results												
Country	SA	Nigeria	Egypt	Morocco	Tunisia	Mauritius	BVRM	Botswana	Namibia	Zambia	Uganda	Malawi
JALSH Index	1.0000											
NGSEINDX Index	-1.7210	1.0000										
EGX30 Index	-1.8159	-0.4206	1.0000									
MOSENEW Index	-2.1556	-0.5596	-0.0089	1.0000								
TUSISE Index	-1.6038	0.5565	0.8678	1.3080	1.0000							
SEMDEX Index	-2.8285	-1.5106	-0.8043	-1.0075	-2.3823	1.0000						
ICX10 Index	-2.5263	-1.0241	-0.3499	-0.4528	-1.9882	0.6222	1.0000					
BGSMDC Index	0.1383	3.1580	2.6582	3.9604	4.7899	4.6864	4.7858	1.0000				
FTN098 Index	0.5418	2.0013	2.0897	2.3506	1.8952	2.9117	2.6434	0.5592	1.0000			
LUSEIDX Index	-2.8799	-1.4143	-0.5490	-0.7656	-3.0350	0.4814	-0.2555	-6.7309	-2.8935	1.0000		
UGSINDX Index	-1.3811	-0.0244	0.3081	0.3643	-0.3606	1.0714	0.6750	-1.9260	-1.7147	0.8679	1.0000	
MWSIIDX Index	-3.0708	-1.7890	-0.9830	-1.2609	-2.8548	-0.1790	-0.8612	-5.3689	-3.0954	-0.7485	-1.2378	1.0000
Max	4.7899											
Min	-6.7309											

Based on this methodology, Botswana appears to have experienced a heightened impact of financial contagion, compared to the other countries in the sample.

4.5 Contagion determinants

In this section, the determinants of contagion are identified. The logistic regression results prove to be non-conclusive, due to missing data points. The thesis hereby attempts to answer this question through inference from other similar studies.

Luchtenberg and Vu (2015) investigated contagion and its determinants using an international sample of returns. Their empirical results on contagion determinants, presented in Table 10, revealed that the main predictors of contagion are changes in relative trade structure ratio, relative inflation, industrial production and interest rate ratios and relative volatility. The study finds that an increase in relative export from one country to another before and during the 2008GFC is positively related to contagion. Similarly, a decrease in the relative deviation of interest rate between two countries before and during the crisis is significantly and positively correlated with contagion as expected.

Figure 4: Contagion determinants results as per Luchtenburg & Vu (2015)

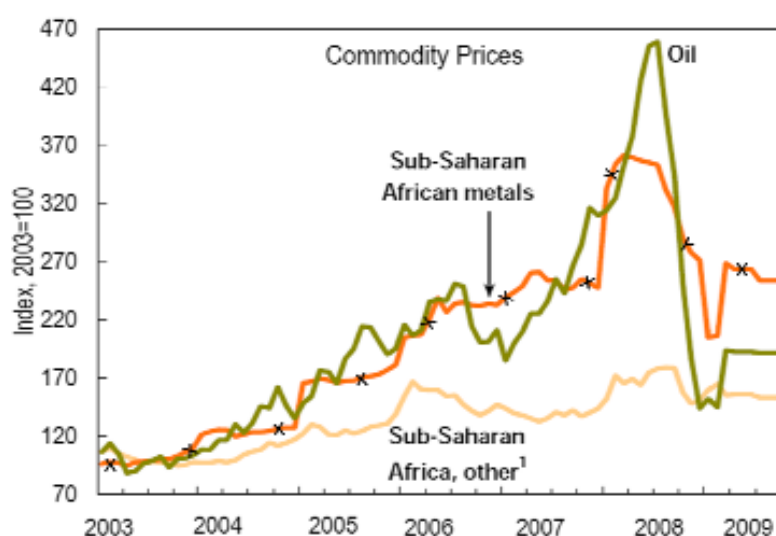
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
<i>TradeRatio</i>	-3.593**	-5.011***	-7.616***	-5.420**	-6.659**	-5.571**	-8.867***	-7.297***
S.E.	1.544	1.754	2.292	2.521	2.835	2.458	2.553	2.210
ChiSq	5.417	8.159	11.04	4.622	5.516	5.138	12.06	10.90
Pr > ChiSq	0.020	0.004	0.001	0.032	0.019	0.023	0.001	0.001
<i>InfRatio</i>	-1.592*	-2.409**	-3.571***	-3.418***	-3.419**	-2.244*	-3.792***	-2.253**
S.E.	0.943	1.090	1.239	1.292	1.454	1.375	1.402	1.315
ChiSq	2.848	4.882	8.303	6.997	5.529	2.665	7.315	2.938
Pr > ChiSq	0.092	0.027	0.004	0.008	0.019	0.100	0.007	0.087
<i>IpRatio</i>		-2.244***	-2.492***	-3.015***	3.130***	-2.973***	-2.830***	-2.580***
S.E.		0.816	0.890	1.016	1.027	1.082	0.981	0.968
ChiSq		7.564	7.836	8.811	9.283	7.558	8.318	7.105
Pr > ChiSq		0.006	0.005	0.003	0.002	0.006	0.004	0.008
<i>ExpRatio</i>			2.294**	1.905**	3.499***		3.919***	
S.E.			0.925	0.938	1.303		1.276	
ChiSq			6.154	4.126	7.212		9.434	
Pr > ChiSq			0.013	0.042	0.007		0.002	
<i>SizeRatio</i>				13.71*	13.58	12.46		
S.E.				8.241	8.960	9.201		
ChiSq				2.768	2.298	1.834		
Pr > ChiSq				0.096	0.130	0.176		
<i>IntRatio</i>					-2.541**	-2.583**	-2.475**	-2.540**
S.E.					1.038	1.028	0.967	0.964
ChiSq					5.990	6.306	6.546	6.947
Pr > ChiSq					0.014	0.012	0.011	0.008
<i>ImpRatio</i>						3.481***		3.831***
S.E.						1.191		1.150
ChiSq						8.532		11.102
Pr > ChiSq						0.004		0.001
<i>VolRatio</i>	5.798***	6.445***	7.309***	7.468***	8.337***	8.902***	8.272***	8.808***
S.E.	1.481	1.609	1.793	1.833	2.110	2.196	2.088	2.167
ChiSq	15.32	16.05	16.62	16.61	15.62	16.43	15.70	16.53
Pr > ChiSq	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
<i>dRegion</i>	-1.554***	-1.779***	-2.705***	-2.677***	-3.705***	-3.803***	-3.746***	-3.833***
S.E.	0.583	0.628	0.796	0.804	1.038	1.016	1.037	1.014
ChiSq	7.099	8.029	11.548	11.077	12.736	14.019	13.038	14.299
Pr > ChiSq	0.008	0.005	0.001	0.001	0.000	0.000	0.000	0.000

According to experts and analysts, African economies could have weathered the initial effects of the financial crisis in developed markets because of the weak integration of their financial markets into the global financial systems. However, it was argued that their export demand and access to international finance could be adversely affected (Owoye, 2009). The transformation of the global economic and financial crisis into a global recession meant that there were other transmission channels through which African economies was affected even though it was not directly through their financial sectors (Owoye, 2009).

In a panel discussion by the Export-Import Bank of the United States, three expert panelists discussed the impact of the global financial on Sub-Saharan Africa. One of the panelists identified “three channels through which the economic impact of the crisis affecting advanced countries reaches sub-Saharan Africa” namely (a) through a shift in demand for African products since almost 60 percent of African exports go to the United States and the European countries – the major economies that had been severely affected by the crisis, (b) global decline in commodity prices because oil and copper prices declined by about 15 percent over the period, and (c) reallocation of financing flows to Africa due to the cutback in portfolio or foreign investment (Owuye, 2009). In another related study, Moss (2009) also identified three major channels of transmission: global trade, capital flows, and policy responses.

- I. **Trade:** In the ten year period up to 2007, international trade became an important source of economic growth in African countries. In this period, over 60% of African exports went to the United States and the European Union. Before the outbreak of the financial crisis, SSA countries benefited from increases in commodities prices, especially from oil and primary grains (Massa and te Velde, 2008). The continuous demand for natural resources (e.g. by China and India) played in favour of oil rich countries and agriculture net exporters. As a result, terms of trade improved throughout the region since 2003.

Figure 5: Sub-Saharan Africa commodity prices



Source: IMF Regional Economic Outlook: Sub-Saharan Africa, April 2009

The table below shows some of the country-specific primary commodities and real GDP growth rates for 2008-2010 for the five countries identified in H1.

Table 10: Real GDP growth rates, 2008-2011

Country	Exports	Real GDP Growth Rate			
		2008	2009	2010	2011
Nigeria	Cocoa,peanuts, petroleum, rubber	6.0	7.0	8.4	6.9
Tunisia	Agricultural products, oil, textiles	4.5	3.1	3.7	1.3
Zambia	Copper, minerals, tobacco	5.7	6.4	7.6	6.8
Uganda	Beans, coffee, corn, cotton, fish, tea, sesame	8.7	7.2	5.2	6.0
Malawi	Cotton, tea, tobacco, sugar	8.6	7.6	6.6	6.1

Source: IMF World Economic Outlook April 2011

The global financial crisis and lower global growth, however, started to dampen demand for SSA's exports with the consequent slump in prices.

Table 11: Difference in real GDP growth rates, 2008-2011

Country	Exports	Impact on Real GDP Growth Rate			
		2008	2009	2010	2011
Nigeria	Cocoa,peanuts, petroleum, rubber	(1.0)	1.0	1.4	(2.4)
Tunisia	Agricultural products, oil, textiles	(1.8)	(1.4)	0.6	(2.4)
Zambia	Copper, minerals, tobacco	(0.5)	0.7	1.2	(0.8)
Uganda	Beans, coffee, corn, cotton, fish, tea, sesame	0.3	(1.5)	(2.0)	0.8
Malawi	Cotton, tea, tobacco, sugar	2.8	(1.0)	(1.0)	(0.5)

Source: IMF World Economic Outlook April 2011

The data above reveals that the countries hardest hit were Tunisia in 2008 and Uganda in 2009 and 2010.

Nigeria: The key trade impact in Nigeria was the reduction in the demand for crude oil, which alone generates more than 80% of Nigeria's foreign earnings. This impact is evident in volume sales, which went from 1.69 million barrels a day to 1.49 on a half-year basis between 2007 and 2008 (Ajakaiye and Fakiyesi, 2009).

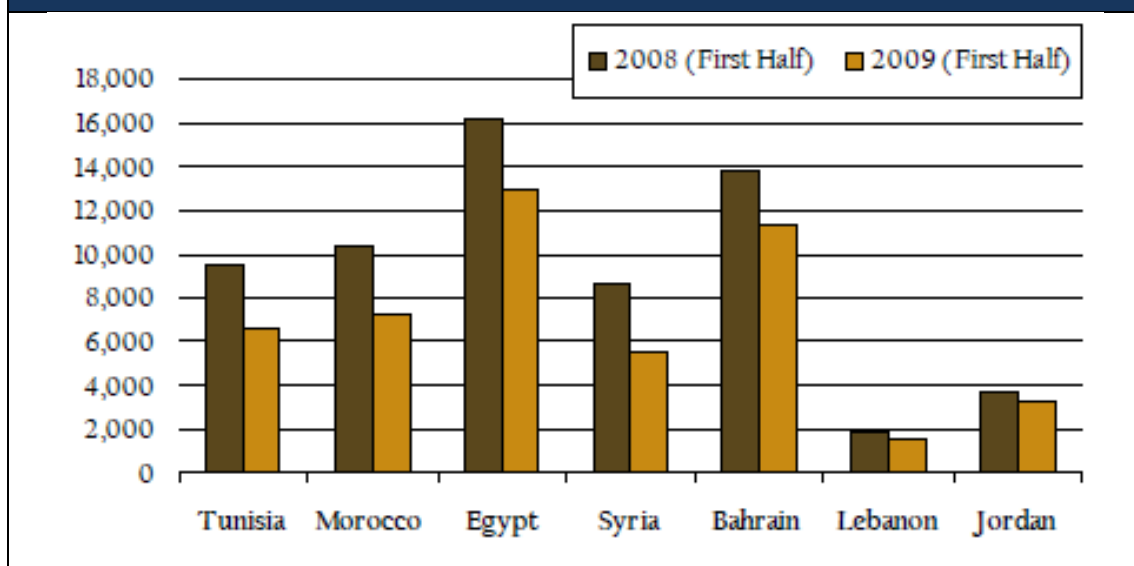
Table 12: % Sectoral contribution to growth rates of GDP in Nigeria, 2003-2007

	2003	2004	2005	2006	2007
Agriculture	2.58	2.65	2.85	2.93	2.65
Crop production	2.42	2.36	2.56	2.64	2.67
Industry	6.12	1.22	0.47	-0.62	-0.78
Crude petroleum	6.02	0.84	0.12	-0.93	-1.08
Building and construction	0.12	0.14	0.18	0.2	0.21
Wholesale and retail	0.69	1.24	1.82	2.16	2.34
Services	0.06	1.32	1.19	1.36	1.49
Communications	0.36	0.36	0.43	0.59	0.74
Total GDP	9.57	6.58	6.51	6.03	6.22
Non-oil GDP	3.44	5.36	6.04	6.65	6.99

Source: CBN 2008a

Tunisia: Tunisia reported sharp declines in exports of agricultural and manufactured products in 2009, 80% of which are destined for Europe (Habibi, 2009). The growth of exports decreased from 12% in 2007 to 1% in 2008 and -22% in the first semester of 2009. The slowdown of exports is focused primarily in the textile and clothing sectors (-16.6%) and the mechanical and electrical industries (-12.6%) (Habibi, 2009).

Figure 6: Merchandise exports of MENA countries, 2008 vs. 2009

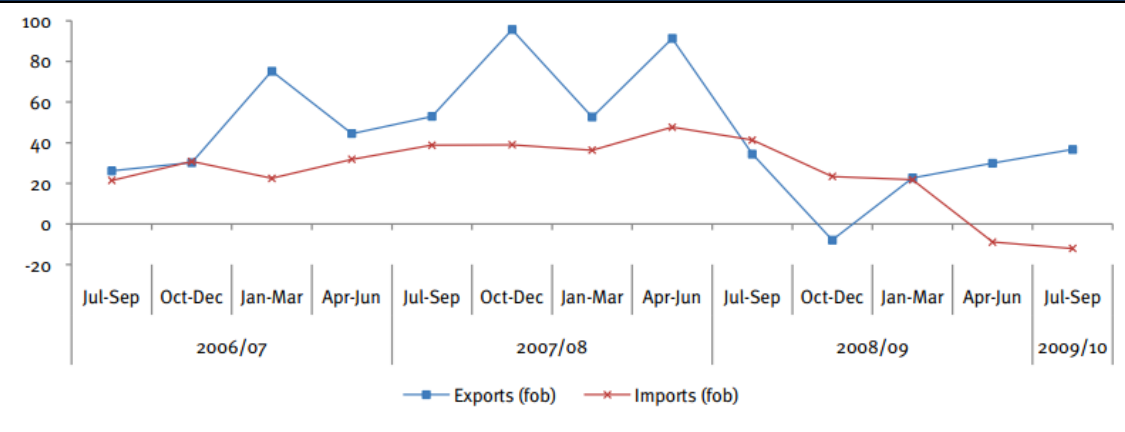


Source: Direction of trade statistics, IMF

Zambia: The export sector has been the most dynamic segment in terms of generating foreign exchange earnings (Ndulo, 2009). Total exports in 2008 represented 31% of GDP. Imports grew from US\$978 million in 2000 to \$4007 million in 2007, estimated at 34% of GDP in 2007 (Ndulo, 2009). The impact of the crisis through trade was felt during the third and fourth quarters of 2008. In August 2008, the price of copper fell by 9%, from US\$8407 per tonne in July. This trend continued until it hit a price of \$3105 per tonne in December 2008.

Uganda: In the case of Uganda, coffee export earnings dropped, with earnings reaching \$336.39 million in 2008/09, down from \$48.63 million in 2007/08 (3.5%) (Ssewanyana and Bategeka, 2010). Coffee exports in value terms dropped by 24.3% in the first quarter of 2009 compared with the same period in 2008. The slowdown continued in the second quarter of 2009, with a marked reduction of 35.4% compared with the corresponding period in 2008. Figure 7 shows that Uganda's year-on-year total export value growth in the fourth quarter of 2008 dropped by 7.9%.

Figure 7: Zambian imports and exports trend



Source: BoU balance of payments data

Malawi:

Growth in 2009 remained robust at an estimated 7%, although slower than the 9.8% achieved in 2008. Strong maize and tobacco harvests, and the start of the uranium production helped anchor the economy's resilience ([www. afdb.org](http://www.afdb.org)).

- II. Exchange rate strength:** In African countries, the impact of the financial crisis manifested itself through currency fluctuations, especially against the US dollar or the Euro. The depreciation of currencies in these economies is attributable to the impact of the financial crisis on commodity prices and the decline in foreign exchange reserves.

Table 13: African exchange rates against the dollar

<u>Country</u>	<u>Currency</u>	<u>Benchmark July 2007</u>	<u>Value at February 2009</u>	<u>Rate of depreciation</u>
Nigeria	Naira	118.9	149.1	-20.3%
Tunisia	Tunisian Dinar	1.2	1.4	-14.3%
Zambia	Zambian Kwacha	3,558.9	5,398.6	-34.1%
Uganda	Ugandan Shilling	1,671.0	1,978.5	-15.5%
Malawi	Kwacha	144.0	143.8	0.1%

Source: IMF World Economic Outlook April 2011

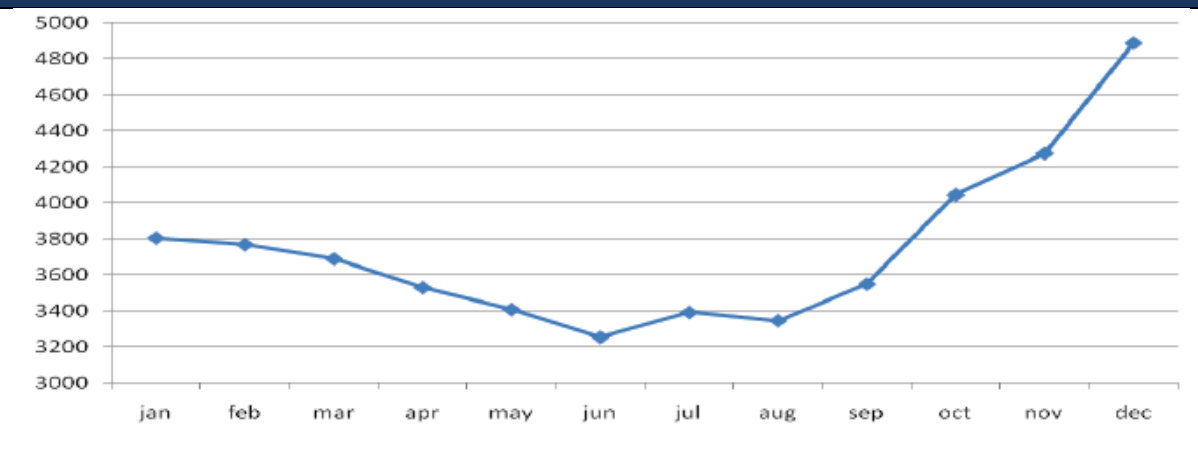
The Zambian Kwacha exchange rate to the US dollar depreciated sharply in 2008 by as much as 50%, although the exchange rate slightly improved at the end of the year.

Nigeria: Nigeria's high dependence on crude oil exports as a source of foreign exchange receipts had an impact on the country's foreign exchange strength (Njiforti, 2015). Nigeria experienced low demand for its oil export due to recession in the economies of her major trading partners. Bonny Light Crude Oil Spot Price FOB which was \$95.16 per barrel in January 2008 rose to \$146.15 in July 2008 and then declined to \$76.24 per barrel by October 17, 2008. Thus, within four months, it had lost 50% of its peak price. This, coupled with the collapse in the international price of oil, led to a decline in foreign exchange receipts (Njiforti, 2015). The low accretion to foreign exchange reserves and demand pressure in the foreign exchange market led to volatility and substantial depreciation of the naira exchange rate (Njiforti, 2015).

Zambia: There was an immediate impact on the exchange rate with the fall in copper prices in the fourth quarter of 2008, with the kwacha depreciating rapidly from

October (Ndulo et al). From January 2008, the kwacha had been appreciating slowly, until about June 2008, when it started depreciating.

Figure 8: Zambian monthly exchange rate (K/USD), 2008

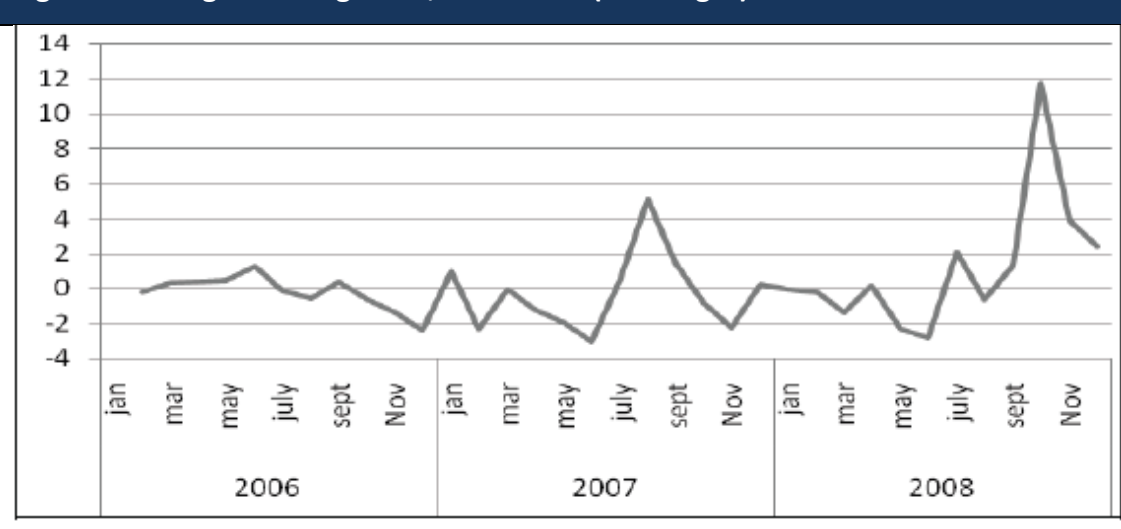


Source: BoZ database

In Zambia, there exists a direct relationship between the exchange rate and copper prices (Ndulo et al, 2009). The fall in the price of copper affects investor's confidence, who then move their funds to safe havens. According to Ndulo et al (2009), there was reduced supply of foreign exchange from the copper mines as a result of the fall in the copper price.

Uganda: In Uganda, the depreciation of the shilling against the dollar and the increase in domestic interest rates was a direct result of weakened capital inflows (Ssewanyana et al, 2009). The exchange rate depreciated by nearly 12% in October 2008; it stood at Shs2020 to US\$1 by mid-march 2009 (Ssewanyana et al, 2009).

Figure 9: Foreign exchange rate, 2006-2008 (% changes)

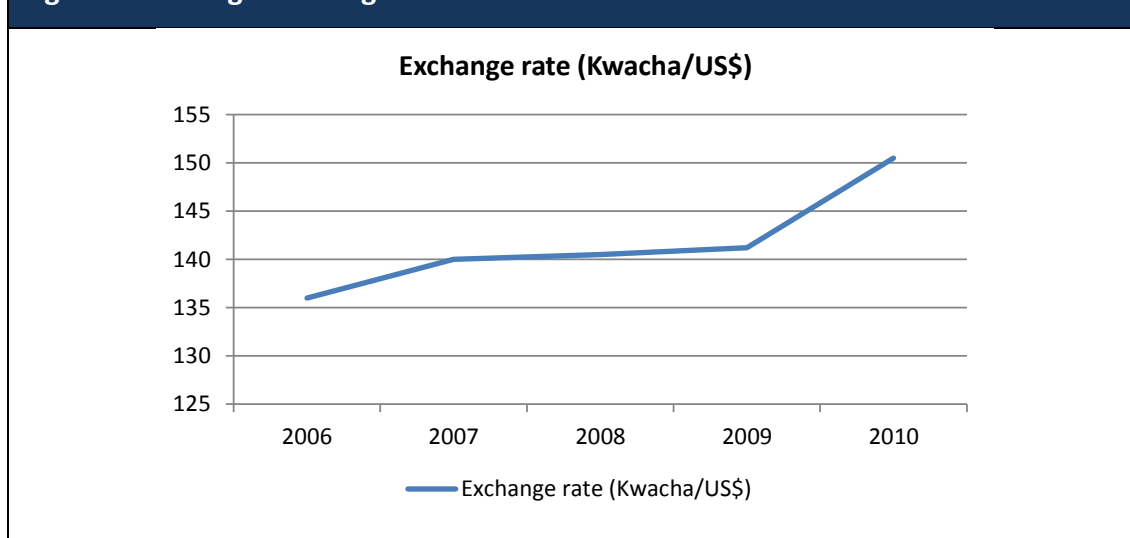


Source: BoU 2006-2008

Malawi:

The Malawi kwacha remained fairly stable against the United States Dollar, closing the year at MK140.5 per dollar as compared to 2007.

Figure 10: Foreign exchange rate

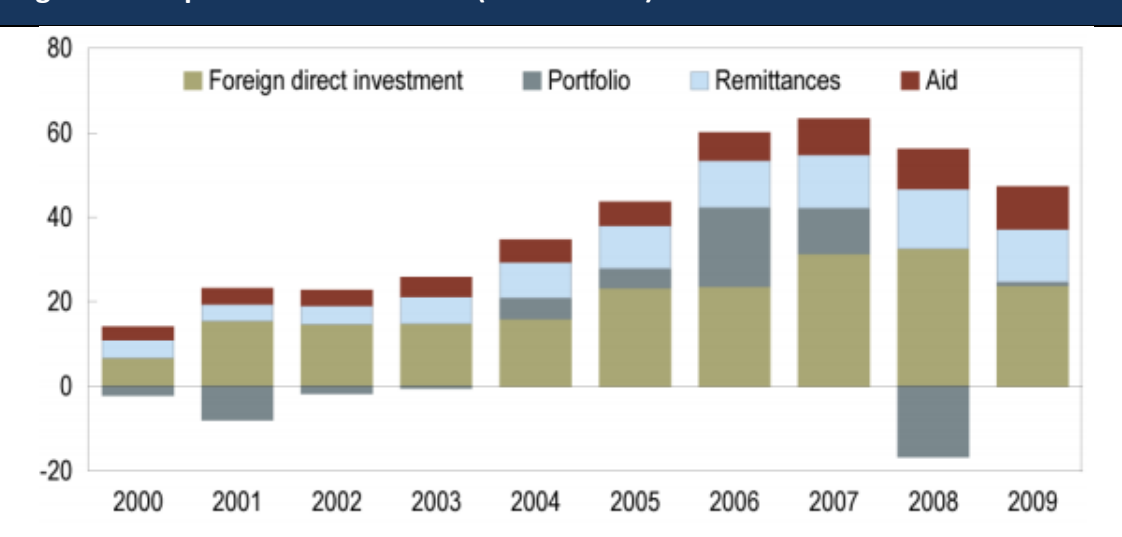


Source: Bloomberg

- III. Capital flows (FDI, Remittances and ODA):** Capital flows, which include Foreign Direct Investment (“FDI”), portfolio investment flows, worker remittances, private charity, and foreign aid, helped drive Africa’s economic growth between 2000 and 2007. Private capital inflows were the most important source of external finance for the region, growing from an estimated \$8.9 billion in 2000 to \$54.8 billion in 2007.

This is 6.5 times global foreign aid of \$8.5 billion. According to IMF estimates, FDI in Africa dropped by c.26.7% in 2009, compared to 2008, as per the chart below.

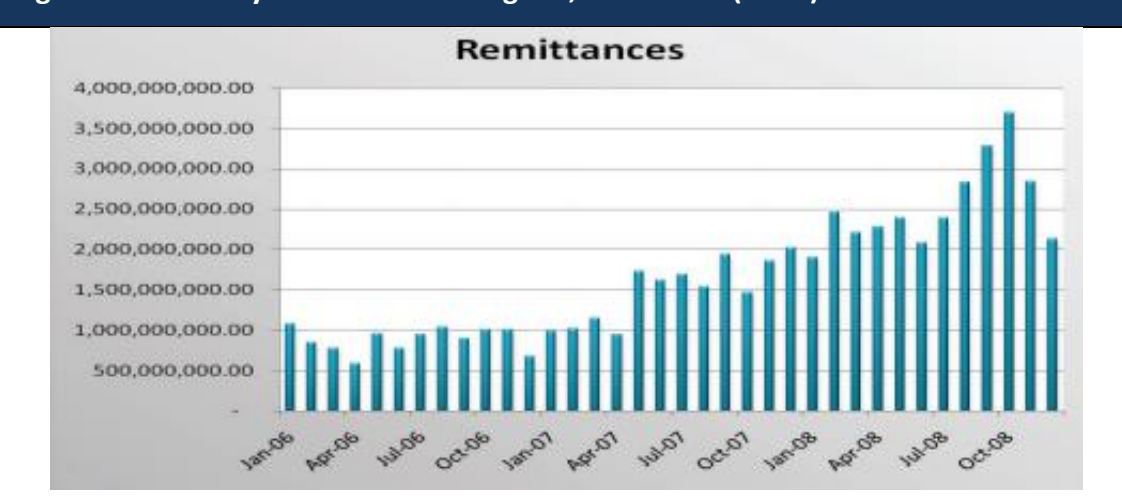
Figure 11: Capital inflows to Africa (USD billions)



Source: IMF Regional Economic Outlook: Sub-Saharan Africa, April 2009

Nigeria: Remittances from Nigeria show a relatively stable trend in 2006 and an increasingly progressive trend afterwards until late 2008, when we expect the unemployment rate in source countries to increase. Remittances, especially from the latter part of the last quarter of 2008, are shown in the figure below.

Figure 12: Monthly remittances to Nigeria, 2006-2008 (naira)



Source: Central Bank of Nigeria, 2009

Tunisia: Remittances are an important source of income to Tunisia. Worker remittances in Tunisia accounted for 5% of GDP in 2007. Although the experience of

most MENA countries is decreased remittances, Tunisia reported an 8% increase in its remittance revenue between June 2008 and June 2009, owing mainly to the higher skill level of Tunisian migrant workers as compared with workers from other Arab countries.

Zambia: Overseas development assistance (“ODA”) is the most important resource inflow into the country, estimated at 13.2% of GDP in 2006. This is followed by FDI, estimated at 5.7% of GDP in 2006.

Table 14: Resource flows, 2000-2007 (US\$m)				
Year	FDI	Private Inflows	ODA	Remittances
2000	121.7	5.6	-	-
2001	71.7	7.5	349.0	-
2002	298.4	0.3	639.0	-
2003	347.0	2.3	589.0	36.3
2004	363.0	0.1	1125.0	48.4
2005	356.0	122.4	935.0	52.9
2006	615.8	50.4	1425.0	57.7
2007	835.9	41.8	1045.0	59.3

Source: BoZ et al. (2008); IMF (2008)

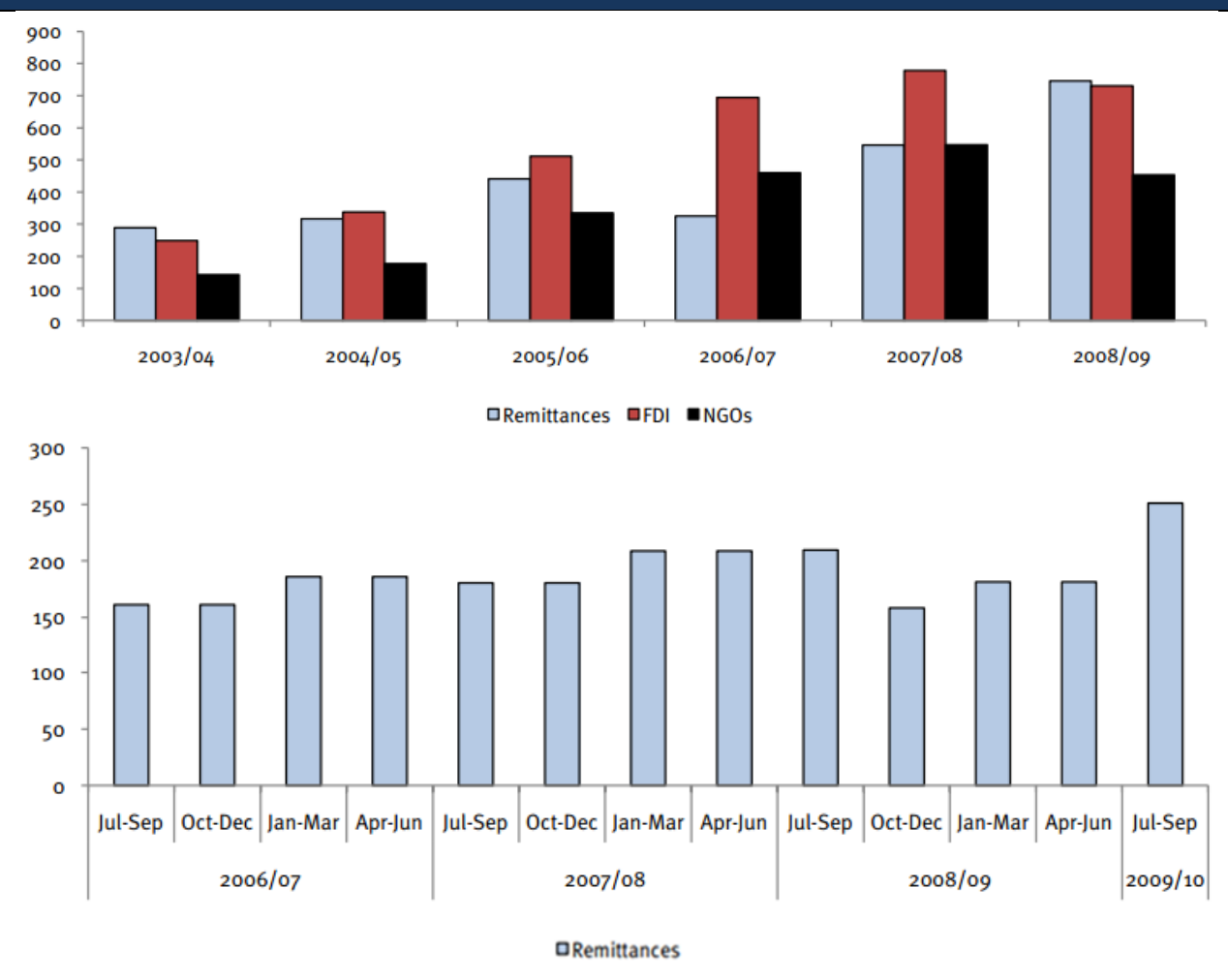
There is very few data available on remittance flows in Zambia (Hougaard et al., 2008). The limited data that are available indicate that the flow of remittances increased steadily between 2003 and 2007. It is difficult to discern the impact on remittances of the global financial crisis for the country because there are no high-frequency data available.

However, remittances in 2003 were estimated at US\$36.3 million. These increased to \$59.3 million in 2007. This is 7.1% of FDI and 0.5% of GDP. Remittances are therefore less important than FDI and ODA as external resource transfers into the economy.

ODA has been an important external resource flow for the Zambian economy. The level of ODA support increased from a low of US\$349 million in 2001 to a high of \$1425 million in 2006. This is more than twice the level of FDI and 13.2% of GDP. The key donors are the UK, US, Denmark, Netherlands, Sweden and Norway.

Uganda: FDI in Uganda has been directed mainly towards natural resources, including oil and electricity generation. Other areas of FDI attraction include telecommunications. Uganda's FDI declined from \$778.43 million in 2007/08 to \$730.45 in 2008/09 (Figure 13). There was a reversal in portfolio capital inflows, from a net inflow of \$66.30 million in 2007/08 to a net outflow of \$108.95 million in 2008/09.

Figure 13: FDI, remittances and non-governmental organisations, 2003/04-2008/09 (USD millions)



Source: BoU balance of payments data

Remittances to Uganda are mainly from the US, the UK, Iraq and the United Arab Emirates. Remittances increased from \$546.36 in 2007/08 to \$745.85 million in 2008/09, representing an increase of 36.5% (Figure 13). Remittances were almost at

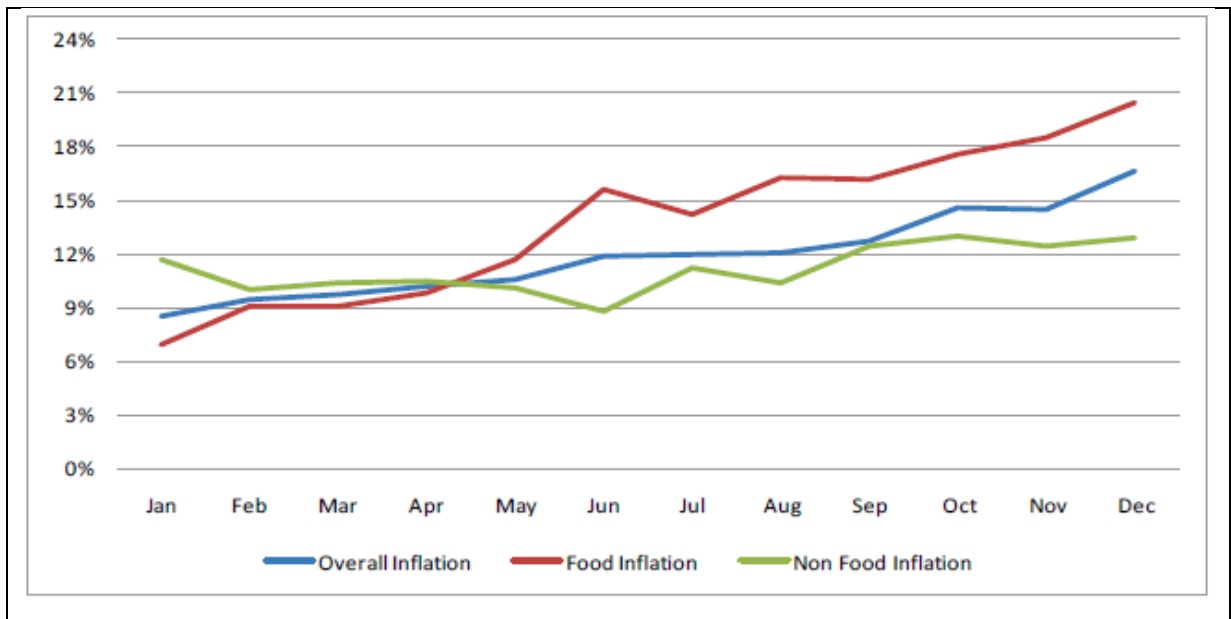
a par with FDI in 2008/09. Remittances to Uganda during the second quarter of 2009 were down by 11.4% compared with same period in 2008.

- IV. Inflation:** The impact on inflation depends on the degree of changes of commodity prices and the accompanying changes in the terms of trade. Owing to the commodity price boom, inflation rates rose strongly.

Nigeria: Nigeria started experiencing a two-digit inflation rate from the third quarter of 2008 (Ajakaiye and Fakiyesi, 2009).

Zambia: The global financial crisis adversely affected the inflation rate during the third quarter of 2008. The rate had, however, already started rising during the second quarter. Figure 14 shows the trends in overall, food and non-food inflation during 2008. Overall inflation rose from 8.5% in January to 16.6% in December. This rise is attributed to the increase in food prices driven by low food supply and increased production and transportation costs (BoZ, 2009b). During the first quarter, food inflation was below the overall inflation rate, whereas non-food inflation was above. The trend changed during the second quarter of the year, when food inflation increased sharply, from 12% in June to 20% in December, whereas non-food inflation increased from 9% to 13%.

Figure 14: Monthly inflation rate percentage, 2008



Source: CSO database

The increase in non-food inflation can be attributed to the pass-through effect of the depreciation of the kwacha against the major currencies during the second half of the year. This was further exacerbated by the depreciation of the kwacha during the third and fourth quarters. During these two quarters, the non-food inflation rate increased by 15%, partially as a result of the impact of the global financial crisis, which led to the depreciation of the kwacha by 44% against the US dollar.

Chapter 5: Conclusion

The key objective of this research has been to assess the impact of the 2007-09 financial crisis on financial contagion in African markets. Contagion in this thesis is defined as *“an event of a sharp fall or upsurge in asset price volatility in the stock market index occurring as a result of the volatility of asset prices spilling over from the crisis country to other countries”*.

The GFC crisis was unique from a contagion perspective given that it was a truly global event that had a significant impact on most of the world’s financial markets. This has presented researchers with a unique opportunity to examine the impact of a single event on different types of markets (developed and emerging/frontier) and different geographical regions. In comparing different African emerging and frontier markets with each other, the paper examines the relevance of differences in financial integration on the contagion process.

5.1 Summary of findings

Theories of financial contagion and financial integration were discussed in the literature review section (Chapter 2) as part of the process of identifying the gaps in the literature that research undertaken in this paper could add to. Within this chapter, the potential contribution is applying contagion testing to both emerging and frontier African markets, an area of limited research in the literature and examining the degree of crisis severity amongst the different countries.

Chapter 3 discussed the dataset and developed two statistical hypotheses. The dataset consisted of a sample of 12 African markets. The hypotheses set out in this chapter and subsequently tested in Chapters 4. The results indicate that contagion occurred in some of the sampled African markets, while others exhibited co-movement with the US market. Chapters 3 also detailed the econometric analysis undertaken in the thesis following K. J. Forbes & Rigobon (2002)’s correlation approach.

5.2 Review of key findings

The analysis indicates that the level of correlations between the US and African markets, save for Egypt, were low before the crisis. This allows for a classification of the sample into low and highly (correlation of 30% or more) integrated markets. The highly integrated markets were Egypt, Namibia and South Africa.

The cumulative loss analysis on the complete list of sample countries indicates that Botswana exhibited the highest cumulative loss compared to the sampled markets, and also proved to have experienced the crisis more severely than the other countries in the sample, based on a means variance test.

Botswana, similar to other African countries, depends on developed countries' demand. With the ensuing global recession resulting from the GFC, Botswana experienced a fall in trade, foreign direct investment and remittances (Ntsosa, 2011). The country imports most of its intermediate and consumption goods. The Pula was expected to depreciate against the US dollar due to a fall in trade and foreign exchange reserves (Ntsosa, 2011).

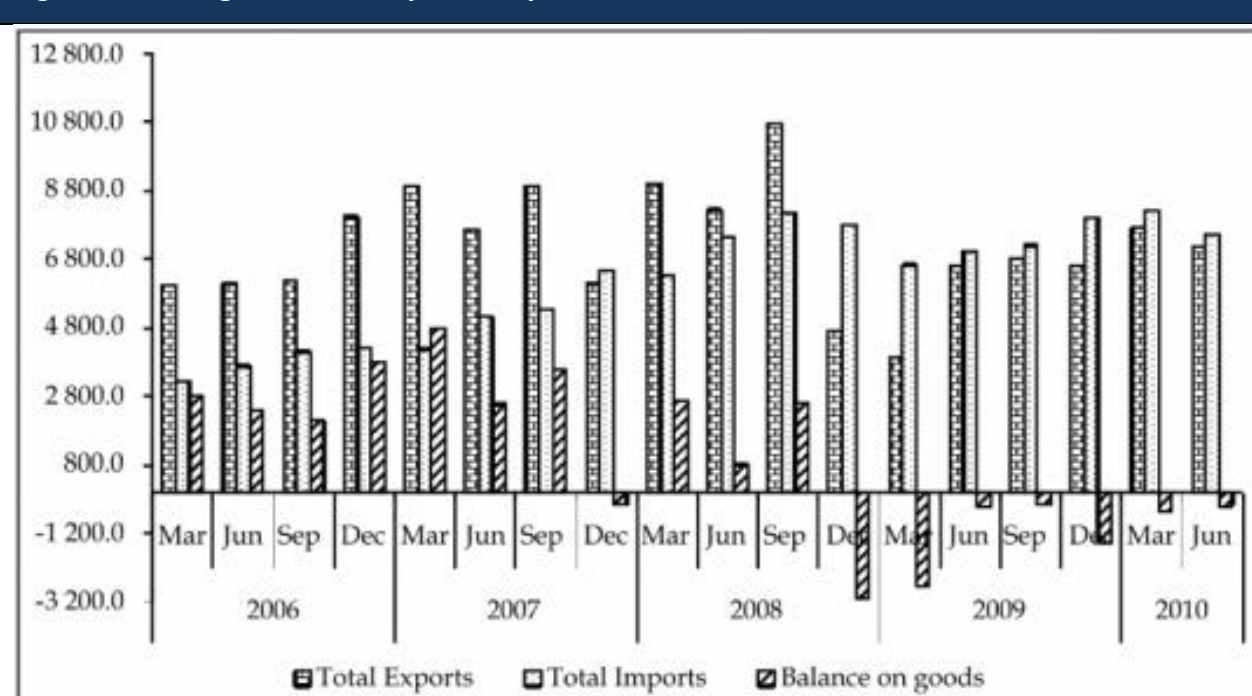
Trade: The overall balance of payments declined in 2008 and 2009. From a surplus of P10.6 billion in 2007, it fell to P7.4 billion and a deficit of P4.5 billion in 2008 and 2009 respectively. The largest contributor to the worsening was the balance on goods. Imports increased from P21.1 billion in 2007 to P29.7 billion and P28.9 billion in 2008 and 2009 respectively. However, this was not matched by a parallel increase in exports, which rose by only P1 billion from 2007 to 2008 and fell by P8.8 billion in 2009. This was mainly due to a rise in fuel prices and imports of construction equipment (Ntsosa, 2011).

Table 15: Overall balance of payments

	2006	2007	2008	2009
A. Current account	11317.2	11710.1	6314.29	-4856
Balance on goods	11114.8	10560.8	2982.1	-4948.7
Exports	26386.3	31694.9	32767.5	23950.3
Of which minerals	23998.1	26478.3	27222	19380.1
Beef	363.2	592.322	530.254	480.051
Textiles	916.714	2787.51	1819.29	1414.75
Imports	15271.4	21134.2	29785.4	28899
Balance on services	-372.28	-1103.9	544.085	-4507.4
Balance on income	-4511.5	-4531.2	-4314.7	286.674
Balance on current transfers	5086.08	6784.48	7102.79	4313.42
B. Capital and Financial account	-887.35	-904.18	9367.28	5971.67
Total A+B	10429.8	10805.9	15681.6	1115.62
C. Net errors and omissions	-173.9	-112.2	-8229.8	-5678.1
Overall Balance (A+B+C)	10255.9	10693.7	7451.79	-4562.5
Reconciliation/Financing	-10256	-10694	-7451.8	4562.51
Change in the level of reserves	-13365	-10543	-10093.3	10703
Valuation Adjustments	3109.33	-150.92	2641.52	-6140.8

Source: IMF database

Figure 16: Changes in Total Exports, Imports and Balance on Good

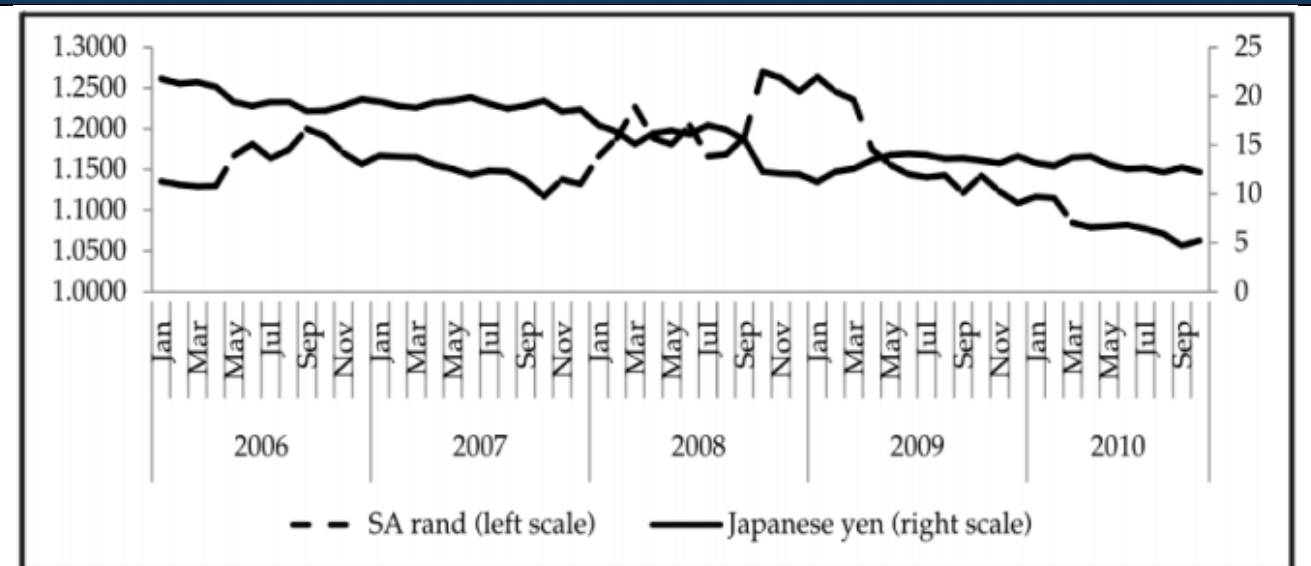


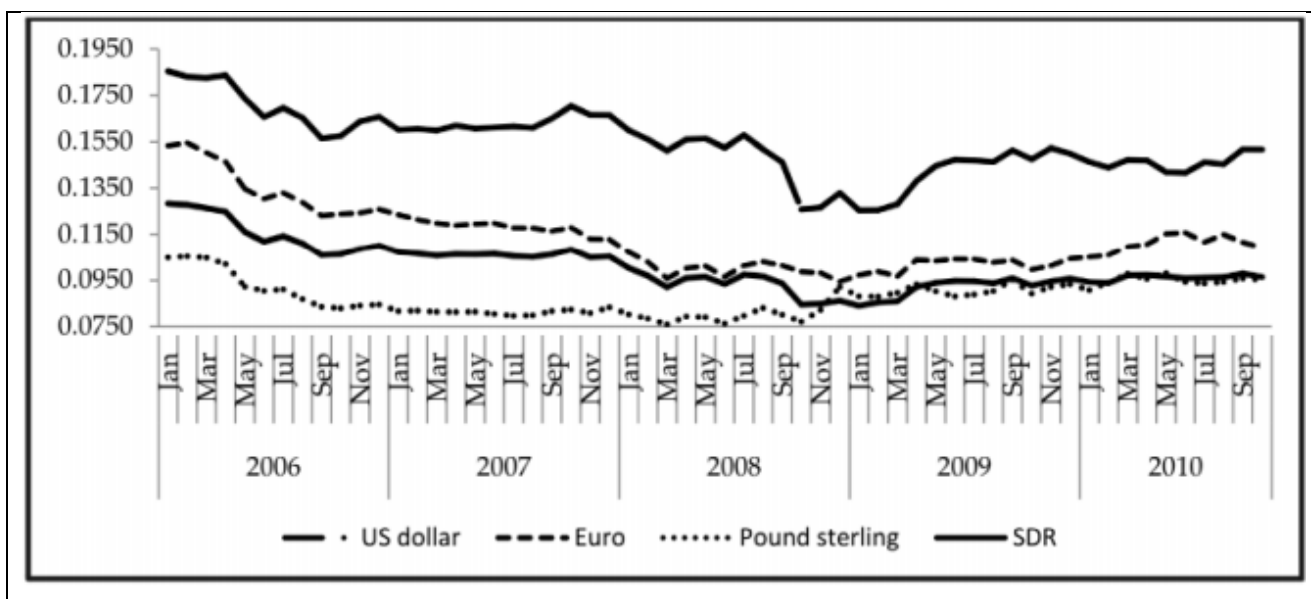
Source: IMF database

Exchange Rate: The Pula depreciated against the Japanese Yen and the US dollar from October 2007. This continued until January 2009 when it began to recover. It fell from ¥19.53 per Pula to ¥11.22 per Pula before it appreciated to around ¥13 per Pula. Against the US dollar, it fell from \$0.1704 per Pula to around \$0.1255 per Pula. Beyond January 2009 the Pula appreciated against the dollar up to \$0.1523 in November 2009 before it settled around \$0.1446 (Ntsosa, 2011).

The Pula depreciated since the beginning of 2006 against the Euro and the British pound, until March 2008. Initially the Pula could buy Euros for 0.1545 in February 2006 but could only buy 0.0958 Euros in March 2008. The exchange rate settled at around €0.0967 per Pula until March 2009 when the Pula began to appreciate. Similarly, the depreciation of the Pula against the British Pound was from £0.1053 per Pula in February 2006 to a low of £0.076 per Pula in March 2008. The Pula began to appreciate until it settled around £0.095 per Pula in October 2010 (Ntsosa, 2011).

Figure 17: Foreign currencies Per Pula

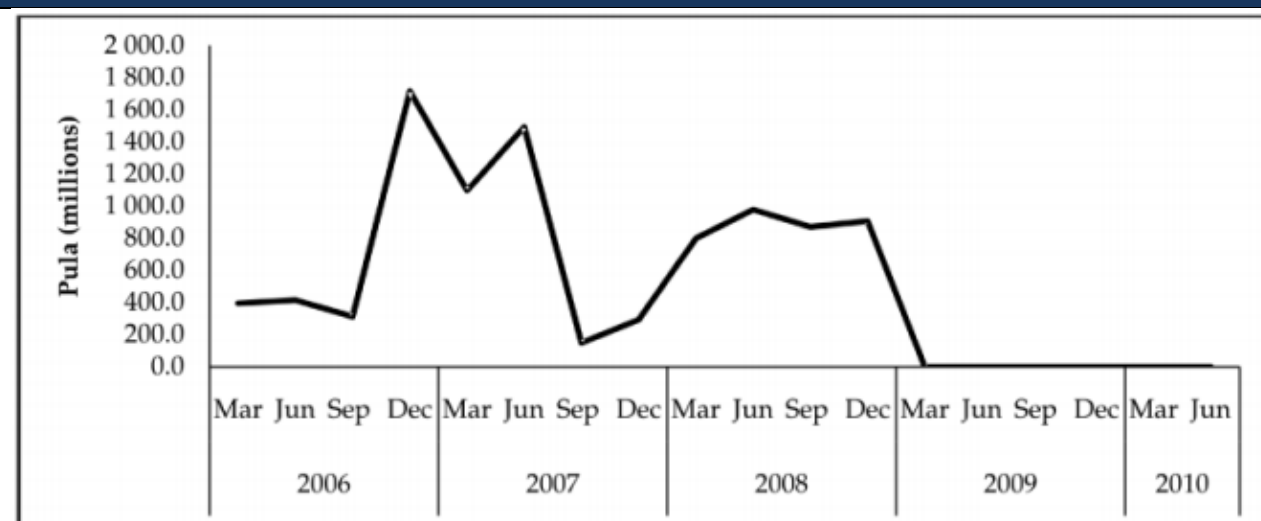




Source: IMF database

FDI: From a high of P107.8 million in mid-2006, FDI fell to a low of -P237.5 million in mid-2008. It reached a peak of P123.3 million at the end of 2009 before it started deteriorating. For the available data from March 2006 to March 2008 direct investment showed a declining trend. From a peak of P1716.2 million at the end of 2006 it declined P150 million at the third quarter of 2007. It then rose and settled around to P900 million from June 2008.

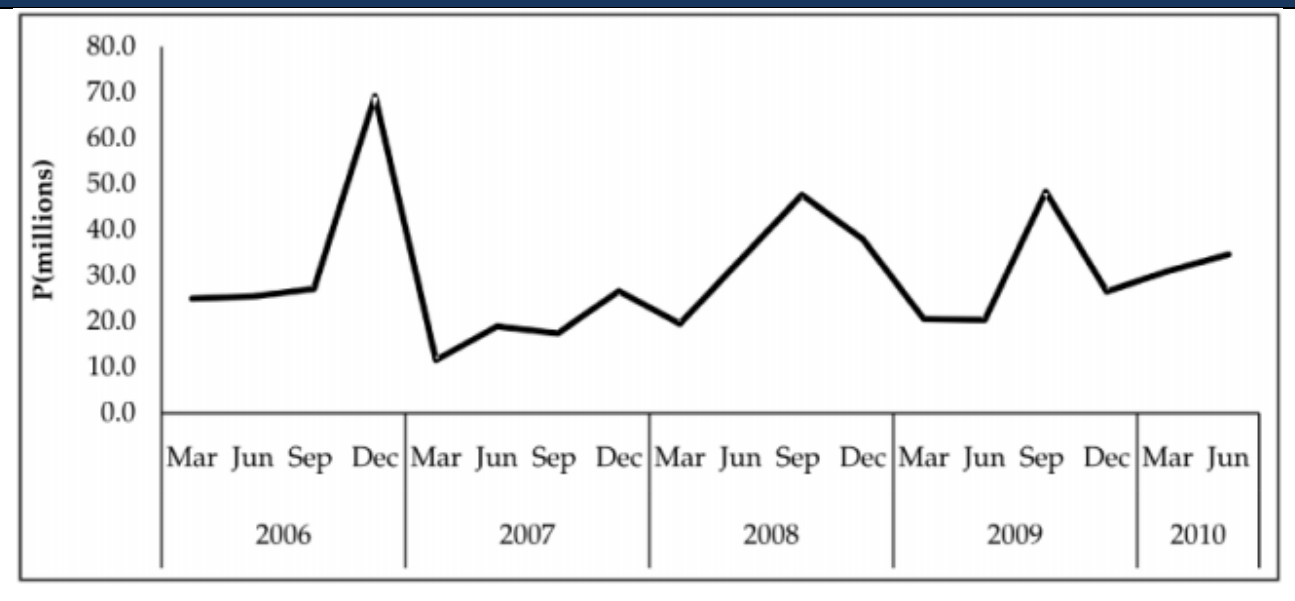
Figure 18: Foreign Direct Investment in Botswana



Source: IMF database

Remittances: As a share of GDP remittances were around 1.1% in 2008 (World Bank, 2009). Remittances are vital because they go directly to the rural poor where there are many uses that include school fees, food, construction of homes and small businesses (Ntsosa, 2011). Earnings by Botswana residents abroad fell from P69.2 million in December 2006 to P11.6 million in March 2007. Then the earnings recovered and then followed a generally upward trend.

Figure 19: Income Earned by Botswana Residents Abroad



Source: IMF database

5.3 Limitations of the research

A number of important markets are missing in the study, such as Ghana and Kenya, because of limitations in respect to data sources. A lack of access to a full set of data on country GDP for African markets limited the investigation on crisis severity in the sampled markets.

There were also challenges in respect to stock exchange data. Given that national holidays differ across the globe, there were a number of non-corresponding days that had to be eliminated from the sample.

5.4 Potential areas for future research

It is worth investigating the significant channels of transmission amongst the sampled African markets with the aim of developing indicative leading indicators of contagion from these, post a crisis event in Africa. This could be a first step in formulating African market resilience against adverse financial impact from global financial events.

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Appendix

Table 1: Daily Stock Exchange return data, full sample period

Date	JALSH Index	NGSEINDX Index	EGX30 Index	MOSENEW Index	TUSISE Index	SEMDEX Index	ICK10 Index	BGSMDX Index	FTN098 Index	LUSEIDX Index	UGSINDX Index	MWSIIDX Index	SPX Index
13 July 2006	-0.72%	0.18%	-3.46%	0.07%	0.07%	-0.01%	-2.26%	0.12%	-0.65%	0.00%	0.00%	0.00%	-1.20%
17 July 2006	-3.16%	-0.04%	-4.58%	-0.57%	-0.38%	0.09%	1.92%	-0.08%	-3.36%	0.00%	-1.93%	-0.38%	-0.97%
18 July 2006	-1.75%	-0.10%	-1.91%	-0.34%	-0.30%	0.12%	1.78%	-0.02%	-2.42%	0.00%	-1.92%	-0.38%	-0.22%
19 July 2006	1.28%	0.04%	0.81%	-0.13%	-0.41%	-0.03%	0.09%	0.08%	1.23%	0.00%	0.02%	0.00%	1.02%
20 July 2006	0.68%	0.35%	0.10%	-0.68%	-0.34%	0.16%	0.13%	0.12%	0.91%	0.00%	1.56%	0.00%	0.49%
24 July 2006	-1.06%	0.99%	1.93%	-0.60%	0.67%	0.47%	0.07%	0.65%	-0.97%	-0.01%	0.47%	1.72%	0.04%
25 July 2006	-0.26%	0.12%	3.02%	-0.22%	0.54%	0.53%	0.05%	0.72%	-0.14%	0.14%	-0.93%	1.72%	0.78%
26 July 2006	0.48%	-0.39%	2.48%	-0.65%	-0.15%	0.32%	-0.21%	0.10%	0.38%	0.20%	0.15%	0.00%	0.30%
27 July 2006	1.00%	0.29%	2.85%	-0.71%	-0.13%	0.28%	-0.24%	0.93%	1.37%	0.05%	0.39%	0.00%	-0.22%
31 July 2006	0.80%	0.82%	2.54%	-0.18%	0.44%	0.49%	0.10%	-0.52%	1.90%	0.07%	0.39%	-1.55%	0.32%
01 August 2006	-0.51%	1.31%	2.26%	-0.02%	0.58%	-0.11%	0.10%	0.14%	-0.06%	0.07%	-0.27%	-1.55%	0.30%
02 August 2006	-0.26%	0.63%	0.51%	0.01%	0.14%	-0.30%	0.07%	2.40%	-0.81%	1.17%	-0.27%	0.00%	0.07%
03 August 2006	0.21%	0.63%	-0.74%	-0.07%	0.37%	0.33%	-0.05%	0.88%	-0.13%	1.47%	0.13%	0.00%	0.37%
07 August 2006	-0.23%	1.79%	0.33%	0.26%	0.79%	0.59%	-0.15%	0.86%	0.58%	0.30%	0.74%	3.24%	-0.11%
08 August 2006	0.22%	2.02%	1.11%	1.58%	0.33%	0.46%	-0.03%	0.85%	0.39%	0.00%	0.13%	3.24%	-0.34%
09 August 2006	0.27%	1.77%	-0.08%	2.17%	0.41%	0.12%	0.09%	0.11%	-0.20%	0.43%	-0.48%	0.00%	-0.39%
10 August 2006	-0.61%	0.92%	-0.95%	0.56%	0.58%	0.28%	0.15%	0.09%	-0.23%	1.22%	0.00%	0.00%	0.01%
14 August 2006	-0.06%	2.94%	0.30%	-0.23%	0.25%	0.76%	0.18%	0.49%	0.54%	-0.64%	1.12%	0.57%	0.09%
15 August 2006	0.99%	4.16%	0.50%	0.23%	0.38%	0.50%	0.11%	0.35%	1.16%	-1.44%	0.90%	0.57%	0.54%
16 August 2006	0.74%	2.22%	0.00%	0.89%	0.12%	-0.03%	0.04%	0.22%	0.43%	-0.16%	-0.23%	0.00%	1.06%
17 August 2006	1.03%	2.40%	-0.57%	0.77%	0.01%	-0.02%	0.04%	0.28%	1.44%	0.12%	0.56%	0.00%	0.46%
21 August 2006	1.53%	2.11%	0.87%	0.28%	0.25%	0.11%	0.04%	0.13%	2.58%	0.66%	0.53%	0.12%	0.08%
22 August 2006	1.39%	-1.55%	1.34%	0.19%	-0.18%	0.11%	0.05%	0.37%	1.82%	0.40%	-0.02%	0.12%	0.05%
23 August 2006	-0.18%	-4.00%	-0.06%	0.24%	-0.24%	0.68%	0.02%	0.12%	0.03%	0.00%	0.00%	0.00%	-0.17%
24 August 2006	-0.75%	-3.59%	1.37%	0.98%	0.36%	0.97%	0.02%	-0.60%	-0.73%	0.00%	0.30%	0.00%	-0.11%
28 August 2006	0.66%	-0.71%	1.97%	1.14%	0.49%	0.42%	2.31%	-0.48%	0.10%	0.07%	0.30%	0.06%	0.34%
29 August 2006	0.01%	2.88%	0.73%	0.63%	0.21%	0.12%	2.31%	0.29%	-0.27%	0.07%	1.39%	0.06%	0.32%
30 August 2006	0.24%	2.54%	0.30%	0.62%	0.09%	-0.09%	-0.10%	1.03%	0.49%	-0.02%	1.39%	0.00%	0.10%
31 August 2006	0.65%	0.08%	0.67%	0.52%	0.47%	0.14%	-0.10%	-0.41%	0.49%	0.06%	0.05%	0.00%	-0.02%
04 September 2006	0.96%	-1.74%	0.18%	0.18%	0.76%	0.72%	-0.20%	0.65%	1.12%	0.09%	-0.46%	2.14%	0.26%
05 September 2006	1.09%	-0.76%	-0.65%	0.24%	0.84%	0.90%	-0.19%	2.13%	1.55%	0.17%	-0.76%	2.14%	0.36%
06 September 2006	-0.23%	0.26%	-0.82%	0.20%	0.90%	1.33%	-0.40%	0.30%	-0.76%	0.18%	-0.25%	0.00%	-0.41%
07 September 2006	-1.25%	0.22%	-1.03%	0.68%	0.54%	1.76%	-0.41%	-0.99%	-2.02%	0.92%	-0.21%	0.00%	-0.74%
11 September 2006	-3.04%	0.80%	-0.31%	1.82%	0.45%	2.05%	0.00%	-0.68%	-3.33%	0.93%	-0.21%	0.00%	-0.03%
12 September 2006	-1.44%	0.56%	0.39%	1.02%	0.47%	0.94%	-0.31%	1.00%	-1.41%	0.53%	0.01%	0.00%	0.73%
13 September 2006	0.62%	-0.01%	0.85%	-0.09%	0.24%	-0.93%	-0.31%	0.69%	1.01%	0.48%	0.01%	0.00%	0.71%
14 September 2006	0.49%	0.00%	1.43%	0.08%	0.39%	-1.14%	0.00%	0.51%	0.90%	-0.18%	0.72%	0.00%	0.12%
18 September 2006	0.23%	-0.11%	0.81%	-0.55%	0.74%	-0.73%	-0.02%	6.23%	0.37%	1.29%	1.24%	0.51%	0.12%
19 September 2006	0.11%	-0.11%	1.07%	-0.77%	0.49%	-0.05%	-0.20%	1.74%	-0.08%	1.46%	0.61%	0.51%	0.08%
20 September 2006	0.49%	0.44%	1.18%	-0.72%	-0.25%	0.28%	-0.30%	-3.98%	0.45%	0.00%	0.09%	0.00%	0.15%
21 September 2006	0.85%	0.61%	-0.15%	-0.20%	-0.18%	-0.20%	-0.12%	0.08%	1.53%	-1.58%	3.26%	0.00%	-0.01%
25 September 2006	0.87%	-0.38%	-0.70%	0.39%	0.02%	-0.63%	0.02%	-0.06%	0.97%	-0.26%	1.77%	0.03%	0.04%
26 September 2006	0.63%	-0.97%	-0.13%	-0.23%	-0.24%	-0.33%	0.02%	-0.06%	-0.03%	0.67%	-2.58%	0.03%	0.69%
27 September 2006	0.54%	-0.72%	0.91%	-0.78%	-0.03%	0.12%	0.00%	0.25%	0.55%	-0.97%	-1.09%	0.00%	0.38%
28 September 2006	0.74%	-0.49%	0.75%	0.23%	0.17%	0.23%	0.00%	0.17%	1.48%	-0.34%	1.94%	0.00%	0.11%
02 October 2006	0.68%	-0.09%	0.49%	1.08%	0.17%	2.74%	0.00%	-1.15%	1.52%	-0.01%	2.04%	0.04%	-0.20%
03 October 2006	-0.49%	0.07%	-0.79%	0.69%	0.43%	2.26%	-0.01%	-0.01%	-0.28%	0.96%	0.96%	0.04%	-0.19%
04 October 2006	-0.41%	0.02%	-1.55%	0.12%	0.18%	0.00%	-5.53%	1.15%	0.06%	1.43%	0.86%	0.00%	0.70%
05 October 2006	0.45%	-0.49%	-0.41%	-1.59%	-0.20%	0.37%	-7.25%	0.00%	0.63%	0.46%	0.09%	0.00%	0.71%
09 October 2006	0.90%	0.94%	-0.50%	-1.71%	-0.14%	0.27%	-4.93%	0.00%	0.41%	0.20%	0.09%	0.00%	0.02%
10 October 2006	0.72%	2.09%	-1.18%	-0.37%	0.04%	0.51%	-4.82%	0.00%	0.82%	1.61%	1.03%	0.00%	0.01%
11 October 2006	-0.21%	0.70%	-0.21%	-0.44%	0.16%	0.72%	-0.30%	0.00%	-0.23%	1.40%	1.03%	0.00%	-0.03%
12 October 2006	-0.11%	0.14%	1.26%	-0.47%	0.29%	1.73%	1.81%	0.00%	-0.16%	0.00%	-0.24%	0.00%	0.35%
16 October 2006	1.01%	-0.09%	1.26%	-0.50%	1.18%	1.55%	0.74%	0.00%	-1.35%	-0.76%	-0.87%	0.70%	0.70%
17 October 2006	0.88%	-0.14%	0.84%	-0.20%	1.20%	0.49%	0.45%	6.49%	1.07%	-0.76%	-2.01%	-0.87%	0.04%
18 October 2006	0.15%	-0.47%	0.13%	0.46%	0.09%	-0.23%	0.19%	6.17%	-0.23%	-0.43%	-1.49%	0.00%	-0.11%
19 October 2006	0.22%	-0.86%	-0.32%	1.03%	-0.36%	0.34%	0.00%	-0.17%	0.10%	-1.02%	0.00%	0.00%	0.11%
23 October 2006	0.56%	-0.64%	0.30%	1.18%	0.00%	0.17%	-0.25%	0.96%	0.54%	0.00%	-1.13%	-1.44%	0.40%
24 October 2006	0.59%	-0.25%	0.38%	0.41%	0.23%	0.00%	-0.57%	0.81%	0.29%	0.00%	-0.92%	-1.44%	0.38%
25 October 2006	0.04%	0.00%	0.00%	0.00%	0.00%	-0.12%	-0.33%	0.05%	-0.13%	0.00%	0.21%	0.00%	0.19%
26 October 2006	-0.68%	0.00%	0.00%	0.50%	0.00%	0.03%	-0.48%	0.05%	-0.79%	0.12%	0.00%	0.00%	0.42%
30 October 2006	-0.62%	-0.31%	0.92%	1.72%	1.62%	0.12%	-0.12%	-0.34%	-0.65%	1.45%	0.44%	0.00%	-0.16%
31 October 2006	0.27%	-0.32%	1.48%	2.37%	2.36%	0.07%	-0.01%	-0.93%	0.48%	0.83%	-0.78%	0.00%	-0.40%
01 November 2006	0.86%	0.37%	0.67%	1.46%	0.82%	0.27%	-0.37%	1.88%	1.04%	-0.49%	-1.23%	0.00%	-0.37%
02 November 2006	0.40%	1.25%	-0.37%	0.61%	0.06%	0.17%	0.12%	2.47%	0.33%	0.49%	-0.69%	0.00%	-0.39%
06 November 2006	0.74%	0.71%	-1.61%	0.59%	0.44%	0.13%	-0.48%	0.01%	0.37%	0.34%	-0.39%	3.75%	0.44%
07 November 2006	1.04%	-0.52%	-1.24%	1.23%	0.46%	0.36%	-0.61%	0.01%	0.84%	0.77%	0.15%	3.75%	0.56%
08 November 2006	0.00%	-0.36%	-0.17%	0.98%	0.30%	0.59%	0.57%	-1.48%	0.02%	0.92%	-0.15%	0.00%	0.21%
09 November 2006	-0.71%	-0.08%	-0.02%	-1.15%	0.30%	0.69%	-0.25%	-1.48%	-0.84%	-0.39%	1.27%	0.00%	-0.16%
13 November 2006	-0.81%	0.38%	0.27%	-0.25%	-0.56%	3.02%	-0.93%	0.04%	-1.07%	-1.66%	1.27%	-0.71%	-0.05%
14 November 2006	-0.02%	0.44%	0.35%	1.58%	-0.86%	3.24%	-0.20%	0.02%	-0.30%	-0.66%	0.53%	-0.71%	0.54%
15 November 2006	0.20%	-0.34%	0.40%	0.74%	-0.44%	0.92%	-0.10%	0.05%	0.18%	1.39%	-0.53%	0.00%	0.44%
16 November 2006	-0.51%	-0.83%	-0.17%	-0.47%	-0.05%	1.22%	-1.30%	-0.19%	0.29%	-0.09%	-0.33%	0.00%	0.23%
20 November 2006	-0.12%	-1.24%	-1.39%	-0.63%	0.28%	1.98%	-2.34%	-0.29%	0.36%	-0.07%	0.23%	0.50%	0.14%
21 November 2006	0.75%	-1.36%	-0.04%	0.12%	0.23%	1.57%	-1.04%	-0.02%	0.62%	1.81%	0.42%	0.50%	0.11%
22 November 2006	0.62%	-1.27%	1.80%	0.68%	0.12%	1.52%	0.45%	0.04%	0.62%	1.47%	-0.14%	0.00%	0.20%
23 November 2006	0.14%	-0.63%	1.49%	1.06%	0.24%	1.52%	0.51%	0.07%	-0.14%	0.57%	0.00%	0.00%	0.12%
27 November 2006	-0.19%	0.00%	1.29%	1.73%	0.30%	-0.69%	-0.16%	0.03%	-0.34%	0.12%	0.00%	-0.02%	-0.87%
28 November 2006	-0.62%	-0.27%	0.12%	0.63%	-0.21%	-1.25%	-0.67%	-0.02%	-1.00%	0.31%	1.18%	-0.02%	-0.69%
29 November 2006	-0.25%	-0.27%	-1.47%	-0.29%	-0.48%	-0.25%	-0.41%	-0.02%	-0.92%	0.42%	1.18%	0.00%	0.63%
30 November 2006	0.81%	0.43%	-0.49%	0.32%	0.16%	0.19%	-0.27%	0.36%	0.50%	0.12%	0.00%	0.00%	0.50%
04 December 2006	0.80%	0.43%	0.22%	0.64%	0.46%	0.88%	-0.99%	0.08%	0.53%	0.03%	0.00%	1.41%	0.34%
05 December 2006	0.50%	1.94%	-0.60%	0.72%	0.41%	-0.99%	-1.00%	-0.22%	0.69%	0.76%	-2.99%	1.41%	0.50%
06 December 2006	-0.26%	1.94%	0.76%	0.49%	0.25%	-3.35%	-0.42%	0.05%	0.25%	0.74%	-2.99%	0.00%	0.13%
07 December 2006	-0.70%	0.00%	1.37%	1.29%	0.00%	-3.21%	-0.03%	0.19%	-0.61%	0.28%	-0.05%	0.00%	-0.26%
11 December 2006	-0.51%	-0.84%	0.41%	2.71%	-0.08%	-1.72%	0.00%	0.18%	-0.44%	0.92%	-0.05%	1.31%	0.00%
12 December 2006	-0.64%	-0.84%	0.56%	2.14%	-0.12%	-0.16%	-0.99%	0.08%	-0.59%	0.64%	0.00%	1.31%	0.15%
13 December 2006	0.02%	0.00%	0.42%	1.48%	-0.16%	0.83%	-0.92%	0.14%	0.14%	-0.28%	0.00%	0.00%	0.01%
14 December 2006	0.86%	0.23%	0.06%	-0.03%	-0.08%	1.85%	-0.19%	0.01%	1.14%	-0.28%	0.60%	0.00%	0.49%
18 December 2006	0.89%	0.55%	1.04%	-2.42%	0.29%	2.36%	-0.18%	0.45%	0.58%	0.00%	1.04%	0.09%	0.33%
19 December 2006	0.32%	0.37%	0.60%	-2.18%	0.17%	0.83%	-0.05%						

Date	JALSH Index	NGSEINDX Index	EGX30 Index	MOSENEW Index	TUSISE Index	SEMDEX Index	ICX10 Index	BGSMDX Index	FTN098 Index	LUSEIDX Index	UGSINDX Index	MWSIDX Index	SPX Index
01 January 2007	-0.03%	-0.53%	0.85%	-0.01%	0.32%	0.32%	-0.06%	0.00%	-0.03%	0.03%	2.29%	0.00%	-0.30%
02 January 2007	0.34%	-0.25%	0.00%	0.25%	0.27%	0.32%	-0.10%	0.00%	0.43%	0.00%	0.00%	0.00%	-0.23%
03 January 2007	-0.63%	0.00%	0.93%	0.76%	0.25%	0.00%	-0.12%	0.01%	-0.55%	-0.04%	-2.29%	0.00%	-0.06%
04 January 2007	-1.94%	-0.04%	1.27%	1.55%	0.43%	0.77%	-0.11%	0.44%	-2.01%	1.15%	1.21%	0.00%	0.00%
08 January 2007	-0.38%	0.72%	0.94%	2.02%	1.40%	1.58%	0.02%	0.48%	0.06%	0.70%	1.58%	0.19%	-0.13%
09 January 2007	0.82%	1.28%	-0.06%	0.97%	1.29%	1.94%	0.17%	0.10%	1.63%	0.51%	0.36%	0.19%	-0.22%
10 January 2007	0.25%	1.15%	-1.38%	-0.43%	0.54%	2.60%	0.00%	0.08%	0.86%	1.75%	0.00%	0.00%	0.07%
11 January 2007	0.15%	0.62%	-0.49%	-0.17%	0.44%	1.62%	-0.06%	0.03%	0.39%	0.73%	2.36%	0.00%	0.41%
15 January 2007	1.33%	0.06%	0.18%	-0.41%	0.27%	-0.48%	0.00%	0.19%	1.01%	0.80%	2.36%	0.28%	0.56%
16 January 2007	0.96%	0.21%	-0.12%	0.35%	0.25%	-0.37%	-0.03%	0.19%	0.89%	0.09%	-0.60%	0.28%	0.28%
17 January 2007	-0.43%	0.65%	-0.29%	0.86%	0.43%	0.17%	0.20%	0.01%	-1.05%	0.06%	-0.60%	0.00%	0.00%
18 January 2007	0.15%	1.40%	-0.68%	-0.11%	0.81%	-0.11%	0.24%	0.21%	-0.81%	1.25%	0.10%	0.00%	-0.19%
22 January 2007	0.32%	1.88%	-0.70%	-0.26%	1.21%	-0.41%	-0.08%	0.53%	0.27%	0.78%	0.10%	0.83%	-0.27%
23 January 2007	-0.25%	1.17%	-0.35%	0.04%	0.68%	-0.25%	0.07%	0.33%	-0.26%	0.33%	-1.42%	0.83%	0.06%
24 January 2007	0.60%	-0.28%	-0.71%	0.10%	-0.03%	-0.15%	0.98%	0.00%	0.57%	1.17%	-1.42%	0.00%	0.60%
25 January 2007	0.92%	-1.16%	-1.33%	0.37%	-0.01%	-0.38%	-0.06%	0.23%	1.00%	1.44%	6.25%	0.00%	-0.14%
29 January 2007	-0.20%	-0.25%	-2.15%	1.72%	0.25%	-1.05%	-0.99%	0.23%	-0.36%	0.55%	4.09%	2.88%	-0.68%
30 January 2007	-0.18%	0.78%	-0.68%	1.85%	0.33%	-1.12%	-0.12%	0.02%	-0.59%	0.69%	-2.33%	2.88%	0.17%
31 January 2007	0.21%	1.22%	0.99%	0.53%	0.47%	-0.26%	-0.10%	0.20%	-0.21%	1.25%	-0.17%	0.00%	0.62%
01 February 2007	0.59%	1.77%	0.97%	-1.16%	0.39%	-0.11%	-1.15%	0.20%	0.51%	1.15%	-3.65%	0.00%	0.60%
05 February 2007	0.31%	3.52%	0.70%	-0.69%	1.21%	0.19%	-0.63%	1.37%	0.26%	-1.30%	0.08%	0.00%	0.30%
06 February 2007	0.29%	3.66%	0.90%	1.03%	1.30%	0.35%	0.47%	4.02%	0.19%	-1.62%	0.46%	0.08%	0.07%
07 February 2007	0.60%	1.55%	1.30%	0.24%	0.58%	0.33%	0.03%	2.72%	0.71%	1.57%	1.07%	0.00%	1.00%
08 February 2007	-0.65%	-0.33%	0.65%	-0.14%	1.16%	0.26%	0.03%	-0.26%	-0.59%	-0.02%	3.23%	0.00%	0.01%
12 February 2007	-0.18%	-2.16%	0.09%	0.83%	0.62%	0.77%	0.07%	-0.30%	-0.19%	-1.44%	4.72%	-0.14%	-0.58%
13 February 2007	0.83%	-0.86%	0.28%	1.13%	-0.34%	0.81%	0.05%	0.47%	0.73%	0.20%	0.93%	-0.14%	-0.14%
14 February 2007	0.94%	1.59%	1.37%	0.49%	-1.17%	0.21%	0.97%	0.93%	1.15%	1.61%	-0.56%	0.00%	0.76%
15 February 2007	0.95%	2.44%	1.28%	0.39%	-1.31%	-0.25%	1.76%	0.50%	0.88%	1.56%	-4.62%	0.00%	0.43%
19 February 2007	0.59%	1.34%	0.84%	2.58%	0.41%	-0.13%	1.76%	0.23%	0.16%	-2.28%	-4.62%	0.27%	0.01%
20 February 2007	-0.01%	0.37%	0.75%	1.41%	0.94%	0.12%	0.97%	0.36%	0.64%	-2.28%	0.00%	0.27%	0.10%
21 February 2007	-0.60%	0.16%	0.75%	-1.12%	0.01%	0.31%	0.00%	0.32%	-0.20%	0.89%	0.00%	0.00%	0.07%
22 February 2007	0.34%	-0.89%	0.27%	-2.01%	-0.01%	0.45%	2.73%	0.48%	-0.11%	2.41%	3.84%	0.00%	-0.11%
26 February 2007	1.18%	-0.96%	0.23%	-1.45%	-0.23%	0.25%	2.78%	0.32%	1.51%	1.60%	3.36%	0.95%	-0.28%
27 February 2007	-1.17%	-0.31%	0.43%	0.30%	-0.56%	0.13%	0.11%	0.08%	-1.12%	-1.32%	-3.59%	0.95%	-2.01%
28 February 2007	-2.16%	0.05%	-1.74%	0.35%	-0.81%	-0.22%	1.10%	0.15%	-2.54%	-1.06%	-3.11%	0.00%	-1.49%
01 March 2007	-1.44%	-0.40%	-1.61%	-0.27%	-0.41%	-0.07%	1.68%	0.43%	-1.47%	0.44%	-0.60%	0.00%	0.15%
05 March 2007	-1.73%	-0.49%	-1.68%	0.66%	0.39%	-0.19%	1.80%	0.89%	-1.35%	1.32%	-0.25%	0.27%	-1.18%
06 March 2007	-0.21%	0.22%	-1.47%	2.07%	-0.21%	-0.28%	1.17%	0.63%	0.31%	-0.08%	0.00%	0.27%	-0.28%
07 March 2007	0.72%	0.69%	1.13%	1.55%	-0.52%	-0.16%	0.11%	0.12%	0.70%	-0.01%	-0.36%	0.00%	0.65%
08 March 2007	0.76%	0.49%	1.32%	1.22%	-0.26%	-0.31%	0.04%	0.02%	0.57%	0.01%	0.00%	0.00%	0.23%
12 March 2007	1.43%	0.17%	0.45%	-0.56%	-0.20%	-0.18%	-0.57%	0.02%	1.32%	-1.30%	0.04%	1.21%	0.52%
13 March 2007	0.46%	-0.28%	0.45%	-0.18%	-0.06%	0.21%	-0.24%	0.18%	0.43%	0.09%	0.28%	1.21%	-0.86%
14 March 2007	-1.49%	-0.40%	-0.20%	0.75%	0.05%	0.68%	0.11%	0.43%	-1.21%	0.10%	0.24%	0.00%	-0.70%
15 March 2007	-0.37%	0.28%	0.13%	-0.54%	0.13%	0.59%	-0.15%	1.13%	-0.46%	-0.10%	-0.26%	0.00%	0.52%
19 March 2007	1.77%	1.00%	0.38%	-0.40%	0.33%	-0.19%	-0.57%	0.89%	1.44%	0.42%	-2.34%	0.64%	0.53%
20 March 2007	1.34%	1.01%	-0.81%	0.47%	0.30%	-0.31%	-0.21%	0.04%	1.42%	-0.87%	-1.98%	0.64%	0.67%
21 March 2007	0.38%	0.20%	-0.33%	0.89%	0.00%	0.12%	0.35%	0.03%	0.49%	0.05%	0.10%	0.00%	1.16%
22 March 2007	0.55%	-0.03%	0.42%	0.54%	0.00%	0.39%	0.07%	1.16%	1.14%	0.88%	-6.70%	0.00%	0.83%
26 March 2007	0.74%	0.38%	0.99%	0.51%	0.23%	0.78%	2.28%	1.21%	0.92%	0.29%	0.00%	0.56%	0.09%
27 March 2007	0.35%	0.49%	0.44%	0.30%	0.18%	0.67%	2.26%	0.51%	-0.12%	1.62%	2.60%	0.56%	-0.21%
28 March 2007	0.14%	0.40%	-0.32%	0.34%	-0.03%	0.53%	0.07%	0.44%	-0.01%	0.04%	-4.09%	0.00%	-0.71%
29 March 2007	0.58%	0.66%	-0.41%	0.50%	-0.19%	0.36%	0.01%	-0.03%	0.60%	-2.04%	4.58%	0.00%	-0.21%
02 April 2007	1.09%	1.29%	-0.39%	-0.22%	-0.22%	0.47%	-0.45%	0.03%	1.26%	-1.38%	6.21%	0.17%	0.26%
03 April 2007	0.76%	0.91%	-0.13%	-0.69%	-0.02%	0.47%	-0.43%	0.12%	0.91%	0.20%	1.70%	0.17%	0.53%
04 April 2007	0.19%	0.47%	0.43%	-0.73%	0.15%	-0.08%	-0.22%	0.01%	0.30%	0.01%	0.07%	0.00%	0.52%
05 April 2007	-0.04%	1.35%	0.75%	-0.33%	0.11%	-0.22%	-0.26%	-0.12%	-0.21%	-0.26%	-1.61%	1.10%	0.21%
09 April 2007	0.04%	0.87%	0.34%	0.17%	0.13%	-0.49%	0.94%	-0.12%	-0.14%	0.00%	-1.61%	1.10%	0.18%
10 April 2007	0.59%	0.84%	0.53%	0.72%	0.34%	-0.19%	0.94%	0.32%	0.73%	0.00%	0.94%	0.00%	0.16%
11 April 2007	0.16%	1.40%	1.04%	0.64%	-0.16%	-0.02%	-0.39%	0.43%	0.40%	1.14%	0.94%	0.00%	-0.20%
12 April 2007	-0.10%	0.56%	0.35%	0.27%	-0.53%	-0.30%	-1.25%	0.14%	-0.28%	1.55%	1.54%	0.00%	-0.02%
16 April 2007	1.32%	0.28%	0.09%	0.69%	-0.47%	-0.13%	-0.52%	0.08%	0.56%	0.12%	1.17%	1.63%	1.02%
17 April 2007	1.22%	0.47%	0.38%	0.54%	-0.50%	-0.06%	1.40%	0.11%	1.20%	1.97%	-0.34%	1.63%	0.81%
18 April 2007	-0.41%	0.85%	0.07%	0.28%	-0.29%	0.30%	1.05%	0.06%	-0.15%	2.28%	0.02%	0.00%	0.14%
19 April 2007	-0.72%	0.81%	-0.62%	0.61%	0.22%	0.33%	-0.37%	-0.01%	-1.01%	0.06%	0.46%	0.00%	-0.03%
23 April 2007	0.62%	0.11%	-1.07%	1.27%	0.89%	0.34%	0.51%	0.06%	0.67%	0.25%	-0.48%	2.44%	0.29%
24 April 2007	0.09%	0.18%	-0.36%	1.87%	0.55%	0.76%	0.88%	0.12%	0.52%	0.70%	-0.36%	2.44%	0.33%
25 April 2007	-0.49%	0.04%	0.16%	0.95%	-0.13%	0.64%	0.00%	0.28%	-0.49%	1.29%	0.58%	0.00%	0.49%
26 April 2007	-0.13%	-0.34%	0.83%	-0.11%	-0.36%	1.01%	-0.21%	0.36%	-0.62%	1.46%	-0.53%	0.00%	0.47%
30 April 2007	-0.09%	0.02%	0.71%	0.23%	-0.15%	0.71%	-0.43%	0.21%	-0.09%	0.46%	-0.52%	1.61%	-0.44%
01 May 2007	0.17%	0.19%	-0.12%	0.35%	0.13%	-0.06%	-0.21%	0.07%	0.36%	-0.20%	0.01%	1.61%	-0.27%
02 May 2007	0.28%	-0.27%	0.40%	0.54%	-0.10%	0.19%	-0.28%	0.18%	0.26%	-0.01%	0.00%	0.00%	0.45%
03 May 2007	0.19%	-0.27%	0.53%	0.79%	-0.01%	0.13%	-0.28%	0.25%	0.29%	-0.01%	-0.19%	0.00%	0.54%
07 May 2007	0.82%	0.59%	0.76%	0.64%	0.45%	-0.15%	0.57%	0.29%	1.34%	0.67%	-0.56%	0.70%	0.45%
08 May 2007	-0.21%	0.70%	0.83%	0.78%	0.16%	0.01%	0.34%	1.45%	-0.38%	2.02%	-0.62%	0.70%	0.18%
09 May 2007	-0.78%	-0.14%	0.51%	-0.63%	-0.18%	0.28%	-0.23%	1.23%	-1.14%	1.05%	-0.25%	0.00%	1.00%
10 May 2007	0.49%	-0.50%	-0.03%	-3.15%	0.01%	0.57%	0.47%	0.11%	0.86%	-0.01%	-0.10%	0.00%	-0.54%
14 May 2007	-0.46%	-0.16%	-0.48%	-6.37%	-0.11%	0.82%	0.47%	0.44%	-0.22%	0.49%	-0.37%	4.07%	-0.31%
15 May 2007	-0.67%	0.09%	-0.60%	-3.78%	0.07%	0.31%	-0.09%	1.23%	-0.45%	0.19%	0.17%	4.07%	0.32%
16 May 2007	-0.09%	0.20%	-1.31%	2.11%	0.10%	-1.15%	-0.09%	0.91%	-0.23%	0.39%	0.44%	0.00%	0.36%
17 May 2007	-0.31%	0.50%	-0.76%	2.22%	-0.11%	-3.76%	0.00%	0.02%	-0.58%	0.39%	-0.40%	0.00%	0.38%
21 May 2007	1.05%	0.25%	0.20%	1.60%	-0.38%	0.61%	0.04%	0.80%	1.55%	0.26%	-1.91%	0.21%	0.36%
22 May 2007	1.32%	-0.32%	0.08%	0.72%	-0.56%	2.79%	0.04%	0.80%	2.01%	1.03%	-0.78%	0.21%	0.37%
23 May 2007	0.77%	-0.27%	0.64%	-1.06%	-0.16%	-1.35%	-0.75%	0.54%	1.04%	0.97%	0.74%	0.00%	-0.09%
24 May 2007	0.32%	0.65%	0.84%	-1.26%	0.05%	-0.80%	-0.62%	0.98%	0.42%	0.28%	-0.04%	0.00%	-0.55%
28 May 2007	-0.78%	1.92%	0.26%	-0.55%	-0.48%	-1.10%	1.65%	0.68%	-0.84%	0.37%	-0.42%	2.76%	-0.22%
29 May 2007	-0.26%	1.27%	1.02%	-0.11%	-0.94%	-1.41%	1.53%	0.53%	-0.29%	-0.30%	-0.04%	2.76%	0.35%
30 May 2007	-0.35%	0.00%	0.77%	0.03%	-0.05%	-0.52%	0.04%	0.28%	-0.32%	-0.37%	0.34%	0.00%	0.48%
31 May 2007	-0.07%	0.00%	0.32%	1.86%	0.49%	0.71%	0.15%	0.18%	0.29%	0.25%	-0.47%	0.00%	0.41%
04 June 2007	0.70%	1.62%	0.89%	1.62%	0.31%	1.67%	1.70%	0.36%	1.17%	0.29%	-0.75%	0.09%	0.29%
05 June 2007	0.41%	2.30%	0.38%	0.34%	0.35%	0.66%	1.33%	0.20%	0.38%	0.27%	0.01%	0.09%	0.01%
06 June 2007	-0.52%	0.30%	-0.17%	0.48%	-0.46%	-0.21%	-0.26%						

17 July 2007	-0.31%	-0.16%	0.84%	0.57%	-0.31%	0.63%	-2.03%	0.01%	-0.35%	-0.88%	0.26%	-0.18%	0.05%
18 July 2007	-0.75%	-0.16%	-0.56%	-0.02%	-0.32%	0.27%	-0.86%	0.14%	-1.32%	1.54%	0.07%	0.00%	-0.11%
19 July 2007	0.03%	0.01%	-0.10%	-0.31%	-0.27%	0.27%	0.63%	0.23%	-0.51%	1.04%	-0.06%	0.00%	0.12%
23 July 2007	0.78%	-0.27%	-0.03%	-0.26%	-0.45%	0.42%	1.95%	0.09%	0.93%	0.17%	1.63%	0.37%	-0.15%
24 July 2007	-0.05%	-0.29%	0.00%	0.00%	-0.49%	0.17%	0.89%	-0.07%	-0.15%	0.27%	0.82%	0.37%	-1.37%
25 July 2007	-1.32%	0.00%	0.18%	-0.11%	-0.05%	-0.22%	0.46%	-0.05%	-1.93%	-0.19%	-0.88%	0.00%	-0.77%
26 July 2007	-1.73%	0.27%	0.05%	0.28%	-0.29%	0.24%	1.43%	0.03%	-2.53%	0.01%	-0.50%	0.00%	-0.95%
30 July 2007	-1.66%	1.27%	-1.74%	0.68%	-0.29%	0.30%	0.23%	0.09%	-2.62%	-0.14%	-0.77%	0.25%	-1.48%
31 July 2007	-0.04%	1.61%	-1.39%	0.94%	0.22%	0.06%	0.68%	0.11%	-0.12%	-0.18%	-0.26%	0.25%	-0.93%
01 August 2007	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
02 August 2007	0.07%	0.02%	0.12%	1.09%	0.33%	0.91%	0.38%	0.07%	-0.28%	-0.13%	0.09%	0.00%	0.22%
06 August 2007	-1.67%	-0.41%	-0.28%	1.48%	0.37%	1.80%	0.31%	-0.08%	-1.70%	-0.08%	0.73%	0.58%	0.06%
07 August 2007	-0.99%	-0.44%	0.05%	0.55%	0.36%	1.05%	-0.07%	-0.13%	-0.80%	0.20%	1.53%	0.58%	0.15%
08 August 2007	2.37%	-0.21%	0.51%	0.15%	0.48%	-0.02%	-0.30%	0.00%	2.27%	0.20%	0.89%	0.00%	1.01%
09 August 2007	1.62%	-0.21%	0.25%	0.40%	0.03%	-0.31%	-0.94%	-0.04%	1.65%	-0.37%	0.28%	0.00%	-0.81%
13 August 2007	-0.82%	0.74%	-1.43%	0.78%	-0.47%	-0.91%	0.40%	0.05%	-0.39%	0.24%	0.00%	1.94%	-1.51%
14 August 2007	-1.51%	0.74%	-0.39%	0.37%	-0.34%	-1.85%	2.50%	0.06%	-0.86%	1.13%	-0.41%	1.94%	-0.92%
15 August 2007	-1.21%	-0.29%	0.97%	-0.14%	-0.23%	-1.69%	1.46%	-0.78%	-1.27%	0.58%	-0.13%	0.00%	-1.62%
16 August 2007	-2.58%	-0.29%	-1.99%	-0.61%	-0.36%	-0.41%	0.63%	-0.61%	-3.54%	0.21%	0.54%	0.00%	-0.54%
20 August 2007	-0.84%	-1.98%	-2.73%	-0.25%	-0.21%	-0.24%	0.60%	0.49%	-3.26%	-0.12%	1.81%	1.05%	1.36%
21 August 2007	1.04%	-2.55%	-1.83%	0.23%	-0.25%	0.20%	1.01%	0.39%	0.66%	-0.28%	0.34%	1.05%	1.25%
22 August 2007	1.12%	-1.03%	-0.55%	0.02%	0.05%	0.74%	1.19%	0.08%	2.85%	-0.09%	-0.93%	0.00%	0.64%
23 August 2007	1.72%	-0.46%	0.44%	0.24%	0.62%	-0.17%	0.23%	0.04%	-0.25%	0.41%	0.00%	0.53%	
27 August 2007	1.05%	-0.14%	0.96%	1.12%	0.40%	-0.30%	1.20%	0.07%	1.28%	-0.34%	0.34%	0.11%	0.09%
28 August 2007	0.02%	-0.67%	0.97%	1.34%	-0.01%	0.03%	0.83%	0.15%	-0.16%	0.01%	-0.09%	0.11%	-1.04%
29 August 2007	-0.40%	-0.53%	-0.25%	0.72%	-0.04%	-0.38%	-0.18%	0.12%	-1.12%	0.17%	-0.02%	0.00%	-0.10%
30 August 2007	0.78%	0.00%	0.11%	0.40%	-0.02%	-0.49%	0.10%	0.09%	0.28%	-0.13%	1.21%	0.00%	0.87%
03 September 2007	2.28%	1.53%	1.91%	0.88%	0.22%	0.39%	1.37%	0.09%	2.26%	-0.18%	2.69%	0.09%	0.35%
04 September 2007	2.01%	1.95%	2.22%	1.76%	0.23%	0.51%	1.51%	-0.01%	2.21%	0.30%	1.70%	0.09%	1.08%
05 September 2007	-0.33%	1.11%	0.89%	2.57%	0.02%	0.27%	0.22%	-0.10%	-0.21%	0.51%	0.23%	0.00%	-0.06%
06 September 2007	-0.35%	0.68%	0.41%	0.02%	-0.07%	-0.02%	0.00%	-0.37%	-0.27%	0.60%	0.02%	0.00%	-0.37%
10 September 2007	-0.80%	0.00%	-0.12%	-1.21%	-0.49%	-0.07%	-0.49%	-0.39%	-1.73%	0.55%	1.30%	0.00%	-0.70%
11 September 2007	0.01%	-0.14%	0.25%	-0.59%	-0.60%	0.02%	-0.51%	-0.13%	-0.70%	0.58%	1.98%	0.00%	-0.24%
12 September 2007	0.86%	-0.14%	1.20%	-1.43%	-0.30%	0.00%	-0.06%	-0.11%	0.89%	0.52%	0.70%	0.00%	0.68%
13 September 2007	0.39%	0.00%	0.45%	-0.51%	0.35%	-0.25%	-0.06%	0.29%	0.25%	-0.21%	0.00%	0.42%	
17 September 2007	-0.34%	-0.18%	1.23%	0.39%	-0.22%	0.21%	-0.62%	0.05%	-0.30%	0.23%	-0.21%	0.13%	0.17%
18 September 2007	-0.55%	-0.73%	1.24%	0.22%	-0.16%	0.12%	-0.40%	-0.02%	-0.93%	0.26%	0.61%	0.13%	1.19%
19 September 2007	2.18%	-0.85%	0.67%	-0.60%	0.30%	0.40%	-0.42%	-0.07%	2.50%	0.19%	0.61%	0.00%	1.74%
20 September 2007	1.82%	-0.64%	0.24%	-0.05%	-0.19%	0.52%	-0.32%	-0.01%	2.87%	-0.16%	-0.17%	0.00%	-0.03%
24 September 2007	-0.17%	-0.29%	-1.01%	-0.05%	-0.37%	0.95%	-0.25%	-0.29%	-0.29%	-0.15%	-0.73%	0.02%	-0.37%
25 September 2007	-0.09%	-0.55%	-0.67%	-0.45%	-0.10%	0.76%	-0.15%	-0.29%	-0.63%	0.06%	-0.87%	0.02%	-0.05%
26 September 2007	0.17%	-0.62%	0.55%	-0.24%	-0.09%	0.18%	-0.26%	0.40%	0.53%	0.14%	-0.31%	0.00%	0.25%
27 September 2007	0.28%	0.00%	1.35%	0.13%	0.32%	0.12%	-1.16%	0.37%	0.70%	0.21%	-0.58%	0.00%	0.46%
01 October 2007	0.59%	-0.10%	1.37%	0.81%	0.46%	0.71%	-0.35%	0.01%	1.09%	0.92%	-1.10%	0.00%	0.70%
02 October 2007	0.81%	0.26%	0.95%	0.57%	0.29%	0.82%	0.36%	0.03%	1.04%	0.80%	-0.78%	0.00%	0.50%
03 October 2007	0.92%	0.36%	-0.05%	-0.05%	0.53%	0.47%	-0.33%	-0.02%	0.99%	0.05%	-0.26%	0.00%	-0.24%
04 October 2007	0.75%	0.28%	-0.24%	0.06%	0.45%	0.44%	-0.23%	-0.02%	0.80%	0.52%	-0.15%	0.00%	-0.12%
08 October 2007	0.10%	0.35%	0.76%	0.65%	-0.16%	0.32%	-0.14%	0.00%	0.13%	0.57%	0.21%	0.47%	0.42%
09 October 2007	0.07%	0.15%	0.76%	0.76%	-0.38%	0.39%	-0.16%	0.00%	0.12%	-0.32%	0.36%	0.47%	0.72%
10 October 2007	0.66%	0.26%	0.21%	0.00%	0.02%	0.63%	0.19%	-0.05%	0.73%	0.14%	0.00%	0.00%	0.32%
11 October 2007	0.96%	0.18%	0.29%	0.03%	0.13%	1.07%	0.29%	0.45%	1.31%	0.54%	1.05%	0.00%	-0.34%
15 October 2007	-0.06%	0.14%	0.15%	0.50%	0.10%	2.93%	0.29%	-0.50%	-0.10%	0.35%	1.86%	0.74%	-0.44%
16 October 2007	-0.80%	-0.04%	0.54%	-0.12%	0.15%	2.42%	0.67%	-1.00%	-1.22%	1.06%	-5.02%	0.74%	-0.51%
17 October 2007	-0.15%	-0.15%	0.35%	-0.28%	0.39%	-0.17%	0.66%	-0.04%	-0.86%	1.00%	-5.83%	0.00%	-0.24%
18 October 2007	-0.03%	0.12%	-0.50%	0.19%	0.36%	0.04%	1.16%	-0.42%	-0.89%	0.20%	0.13%	0.00%	0.05%
22 October 2007	-1.51%	0.15%	-0.73%	0.25%	-0.03%	0.98%	1.27%	-0.66%	-2.39%	0.31%	0.57%	-0.29%	-1.15%
23 October 2007	-0.92%	0.21%	0.04%	0.25%	0.04%	0.76%	0.43%	-0.51%	-0.99%	0.41%	0.52%	-0.29%	-0.67%
24 October 2007	-0.18%	-0.01%	0.95%	0.31%	0.10%	0.17%	0.40%	-0.60%	0.50%	-0.01%	0.07%	0.00%	0.32%
25 October 2007	-0.05%	-0.51%	0.99%	-0.18%	0.10%	0.12%	0.11%	-0.38%	0.48%	-0.11%	-1.27%	0.00%	-0.17%
29 October 2007	1.91%	-0.80%	1.23%	-0.06%	0.23%	-0.10%	-0.11%	-0.94%	2.30%	0.02%	-1.28%	0.57%	0.82%
30 October 2007	1.34%	-0.84%	1.51%	-0.09%	0.17%	0.01%	0.05%	-1.02%	1.51%	0.24%	-0.14%	0.57%	0.55%
31 October 2007	0.20%	-0.32%	0.56%	-1.46%	0.32%	0.26%	-0.20%	-0.08%	0.25%	0.11%	-0.12%	0.00%	0.27%
01 November 2007	-0.69%	0.06%	0.50%	-1.35%	0.52%	0.10%	-0.19%	0.01%	-0.73%	0.15%	0.53%	0.00%	-0.74%
05 November 2007	-1.60%	0.28%	-0.15%	0.96%	-0.02%	-0.25%	-0.09%	-0.02%	-2.43%	0.46%	2.01%	0.00%	-1.55%
06 November 2007	-0.08%	0.45%	-1.23%	1.17%	0.02%	-0.18%	0.00%	-0.03%	-0.64%	0.36%	1.63%	0.00%	0.39%
07 November 2007	0.69%	0.86%	-0.32%	-0.31%	0.27%	0.63%	0.22%	0.00%	0.93%	-0.46%	0.15%	0.00%	-0.89%
08 November 2007	0.47%	0.49%	-0.64%	-0.32%	-0.38%	1.18%	0.12%	-0.54%	2.28%	0.07%	-0.41%	0.00%	-1.52%
12 November 2007	0.01%	0.30%	0.47%	0.02%	-0.34%	1.58%	0.71%	-0.60%	1.72%	0.60%	-0.60%	0.00%	-1.25%
13 November 2007	-0.98%	0.79%	0.53%	-0.23%	0.04%	3.50%	0.57%	-0.06%	-1.14%	0.32%	-0.04%	0.00%	0.21%
14 November 2007	-0.15%	0.28%	-0.05%	-0.21%	0.31%	2.03%	-0.02%	-0.11%	-0.58%	0.36%	0.14%	0.00%	1.08%
15 November 2007	-0.51%	0.77%	0.74%	0.20%	0.51%	-0.78%	0.13%	-0.11%	-1.07%	0.25%	0.45%	0.00%	-1.02%
19 November 2007	-2.44%	1.66%	1.91%	0.18%	0.34%	-1.27%	-0.96%	0.06%	-3.43%	0.22%	2.37%	1.20%	-1.28%
20 November 2007	-1.01%	1.21%	1.54%	-0.02%	0.17%	-0.82%	-0.18%	0.09%	-2.49%	-0.11%	2.38%	1.20%	-0.40%
21 November 2007	-0.13%	0.77%	0.31%	-0.21%	0.09%	0.13%	0.37%	-0.28%	-0.49%	-0.16%	0.46%	0.00%	-0.58%
22 November 2007	-0.71%	0.44%	-0.24%	-0.40%	-0.05%	-0.09%	0.49%	-0.38%	-0.48%	0.02%	0.00%	0.00%	-0.80%
26 November 2007	0.52%	0.61%	-0.68%	-1.37%	-0.07%	0.75%	0.37%	-0.18%	0.57%	0.11%	2.13%	1.17%	-0.34%
27 November 2007	0.27%	0.17%	0.19%	-1.17%	0.15%	0.66%	-0.13%	-0.08%	0.25%	0.84%	3.38%	1.17%	0.40%
28 November 2007	-0.07%	-0.55%	-0.15%	0.45%	0.29%	-0.20%	0.00%	-0.25%	-0.51%	0.22%	1.26%	0.00%	2.15%
29 November 2007	1.08%	-0.55%	0.11%	0.81%	0.25%	-0.35%	0.00%	-0.44%	1.19%	-0.58%	-0.64%	0.00%	1.43%
03 December 2007	1.50%	-0.30%	1.14%	-0.27%	0.25%	-0.63%	0.04%	-0.10%	2.42%	0.00%	-0.23%	0.44%	0.12%
04 December 2007	0.04%	0.09%	1.40%	-0.64%	-0.01%	-0.36%	-0.59%	0.05%	0.45%	-0.26%	1.61%	0.44%	-0.24%
05 December 2007	-0.31%	-0.10%	1.09%	-0.25%	0.08%	-0.26%	-0.13%	-0.04%	0.07%	-0.16%	1.21%	0.00%	0.43%
06 December 2007	0.31%	-0.05%	0.86%	-0.35%	0.19%	-0.18%	0.09%	-0.25%	0.72%	0.40%	-0.49%	0.00%	1.50%
10 December 2007	0.57%	0.31%	-0.26%	-0.20%	-0.01%	-0.09%	0.23%	-0.28%	0.80%	0.02%	0.46%	1.17%	1.03%
11 December 2007	0.55%	0.37%	-1.83%	-0.11%	0.18%	-0.03%	0.12%	-0.34%	1.16%	-0.38%	1.00%	1.17%	-0.99%
12 December 2007	-0.26%	0.04%	-0.67%	-0.20%	0.03%	0.22%	-0.69%	-0.51%	0.29%	-0.36%	0.05%	0.00%	-0.98%
13 December 2007	-1.80%	-0.11%	1.41%	-0.33%	0.02%	0.05%	0.05%	-0.22%	-1.70%	-0.38%	1.10%	0.00%	0.36%
17 December 2007	-2.71%	-0.09%	1.77%	-0.13%	-0.10%	0.62%	1.06%	-0.03%	-3.43%	-0.13%	1.68%	0.04%	-1.39%
18 December 2007	-1.49%	-0.05%	0.82%	0.57%	-0.18%	0.52%	-0.83%	-0.02%	-2.17%	0.66%	0.04%	0.04%	-1.14%
19 December 2007	-1.05%	-0.05%	0.00%	0.70%	0.00%	-0.51%	-1.26%	-1.04%	-1.63%	0.38%	-0.55%	0.00%	0.24%
20 December 2007	-0.11%	0.00%	0.00%	-0.10%	0.00%	-0.43%	1.03%	-1.04%	-0.96%	-0.55%	-0.02%	0.00%	0.18%
24 December 2007	2.42%	0.25%	0.92%	-0.55%	0.06%	0.02%	0.93%	-					

Table 2: Pre-crisis return data, 13 July 2006 – 13 February 2007

Date	JALSH Index	NGSEINDX Index	EGX30 Index	MOSENEW Index	TUSISE Index	SEMDEX Index	ICX10 Index	BGSMDX Index	FTN098 Index	LUSEIDX Index	UGSINDX Index	MWSIIDX Index	SPX Index
13 July 2006	-0.72%	0.18%	-3.46%	0.07%	0.07%	-0.01%	-2.26%	0.12%	-0.65%	0.00%	0.00%	0.00%	-1.20%
17 July 2006	-3.16%	-0.04%	-4.58%	-0.57%	-0.38%	0.09%	1.92%	-0.08%	-3.36%	0.00%	-1.93%	-0.38%	-0.97%
18 July 2006	-1.75%	-0.10%	-1.91%	-0.34%	-0.30%	0.12%	1.78%	-0.02%	-2.42%	0.00%	-1.92%	-0.38%	-0.22%
19 July 2006	1.28%	0.04%	0.81%	-0.13%	-0.41%	-0.03%	0.09%	0.08%	1.23%	0.00%	0.02%	0.00%	1.02%
20 July 2006	0.68%	0.35%	0.10%	-0.68%	-0.34%	0.16%	0.13%	0.12%	0.91%	0.00%	1.56%	0.00%	0.49%
24 July 2006	-1.06%	0.99%	1.93%	-0.60%	0.67%	0.47%	0.07%	0.65%	-0.97%	-0.01%	0.47%	1.72%	0.04%
25 July 2006	-0.26%	0.12%	3.02%	-0.22%	0.54%	0.53%	0.05%	0.72%	-0.14%	0.14%	-0.93%	1.72%	0.78%
26 July 2006	0.48%	-0.39%	2.48%	-0.65%	-0.15%	0.32%	-0.21%	0.10%	0.38%	0.20%	0.15%	0.00%	0.30%
27 July 2006	1.00%	0.29%	2.85%	-0.71%	-0.13%	0.28%	-0.24%	0.93%	1.37%	0.05%	0.39%	0.00%	-0.22%
31 July 2006	0.80%	0.82%	2.54%	-0.18%	0.44%	0.49%	0.10%	-0.52%	1.90%	0.07%	0.39%	-1.55%	0.32%
01 August 2006	-0.51%	1.31%	2.26%	-0.02%	0.58%	-0.11%	0.10%	0.14%	-0.06%	0.07%	-0.27%	-1.55%	0.30%
02 August 2006	-0.26%	0.63%	0.51%	0.01%	0.14%	-0.30%	0.07%	2.40%	-0.81%	1.17%	-0.27%	0.00%	0.07%
03 August 2006	0.21%	0.63%	-0.74%	-0.07%	0.37%	0.33%	-0.05%	0.88%	-0.13%	1.47%	0.13%	0.00%	0.37%
07 August 2006	-0.23%	1.79%	0.33%	0.26%	0.79%	0.59%	-0.15%	0.86%	0.58%	0.30%	0.74%	3.24%	-0.11%
08 August 2006	0.22%	2.02%	1.11%	1.58%	0.33%	0.46%	-0.03%	0.85%	0.39%	0.00%	0.13%	3.24%	-0.34%
09 August 2006	0.27%	1.77%	-0.08%	2.17%	0.41%	0.12%	0.09%	0.11%	-0.20%	0.43%	-0.48%	0.00%	-0.39%
10 August 2006	-0.61%	0.92%	-0.95%	0.56%	0.58%	0.28%	0.15%	0.09%	-0.23%	1.22%	0.00%	0.00%	0.01%
14 August 2006	-0.06%	2.94%	0.30%	-0.23%	0.25%	0.76%	0.18%	0.49%	0.54%	1.12%	0.57%	0.76%	0.09%
15 August 2006	0.99%	4.16%	0.50%	0.23%	0.38%	0.50%	0.11%	0.35%	1.16%	-1.44%	0.90%	0.57%	0.54%
16 August 2006	0.74%	2.22%	0.00%	0.89%	0.12%	-0.03%	0.04%	0.22%	0.43%	-0.16%	-0.23%	0.00%	1.06%
17 August 2006	1.03%	2.40%	-0.57%	0.77%	0.01%	-0.02%	0.04%	0.28%	1.44%	0.12%	0.56%	0.00%	0.46%
21 August 2006	1.53%	2.11%	0.87%	0.28%	0.25%	0.11%	0.04%	0.13%	2.58%	0.66%	0.53%	0.12%	0.08%
22 August 2006	1.39%	-1.55%	1.34%	0.19%	-0.18%	0.11%	0.05%	0.37%	1.82%	0.40%	-0.02%	0.12%	0.05%
23 August 2006	-0.18%	-4.00%	-0.06%	0.24%	-0.24%	0.68%	0.02%	0.12%	0.03%	0.00%	0.00%	0.00%	-0.17%
24 August 2006	-0.75%	-3.59%	1.37%	0.98%	0.36%	0.97%	0.02%	-0.60%	-0.73%	0.00%	0.30%	0.00%	-0.11%
28 August 2006	0.66%	-0.71%	1.97%	1.14%	0.49%	0.42%	2.31%	-0.48%	0.10%	0.07%	0.30%	0.06%	0.34%
29 August 2006	0.01%	2.88%	0.73%	0.63%	0.21%	0.12%	2.31%	0.29%	-0.27%	0.07%	1.39%	0.06%	0.32%
30 August 2006	0.24%	2.54%	0.30%	0.62%	0.09%	-0.09%	-0.10%	1.03%	0.49%	-0.02%	1.39%	0.00%	0.10%
31 August 2006	0.65%	0.08%	0.67%	0.52%	0.47%	0.14%	-0.10%	-0.41%	0.49%	0.06%	0.05%	0.00%	-0.02%
04 September 2006	0.96%	-1.74%	0.18%	0.18%	0.76%	0.72%	-0.20%	0.65%	1.12%	0.09%	-0.46%	2.14%	0.26%
05 September 2006	1.09%	-0.76%	-0.65%	0.24%	0.84%	0.90%	-0.19%	2.13%	1.55%	0.17%	-0.76%	2.14%	0.36%
06 September 2006	-0.23%	0.26%	-0.82%	0.20%	0.90%	1.33%	-0.40%	0.30%	-0.76%	0.18%	-0.25%	0.00%	-0.41%
07 September 2006	-1.25%	0.22%	-1.03%	0.68%	0.54%	1.76%	-0.41%	-0.99%	-2.02%	0.92%	-0.21%	0.00%	-0.74%
11 September 2006	-3.04%	0.80%	-0.31%	1.82%	0.45%	2.05%	0.00%	-0.68%	-3.33%	0.93%	-0.21%	0.00%	-0.03%
12 September 2006	-1.44%	0.56%	0.39%	1.02%	0.47%	0.94%	-0.31%	1.00%	-1.41%	0.53%	0.01%	0.00%	0.73%
13 September 2006	0.62%	-0.01%	0.85%	-0.09%	0.24%	-0.93%	-0.31%	0.69%	1.01%	0.48%	0.01%	0.00%	0.71%
14 September 2006	0.49%	0.00%	1.43%	0.08%	0.39%	-1.14%	0.00%	0.51%	0.90%	-0.18%	0.72%	0.00%	0.12%
18 September 2006	0.23%	-0.11%	0.81%	-0.55%	0.74%	-0.73%	-0.02%	6.23%	0.37%	1.29%	1.24%	0.51%	0.12%
19 September 2006	0.11%	-0.11%	1.07%	-0.77%	0.49%	-0.05%	-0.20%	1.74%	-0.08%	1.46%	0.61%	0.51%	0.08%
20 September 2006	0.49%	0.44%	1.18%	-0.72%	-0.25%	0.28%	-0.30%	-3.98%	0.45%	0.00%	0.09%	0.00%	0.15%
21 September 2006	0.85%	0.61%	-0.15%	-0.20%	-0.18%	-0.20%	-0.12%	0.08%	1.53%	-1.58%	3.26%	0.00%	-0.01%
25 September 2006	0.87%	-0.38%	-0.70%	0.39%	0.02%	-0.63%	0.02%	-0.06%	0.97%	-0.26%	1.77%	0.03%	0.04%
26 September 2006	0.63%	-0.97%	-0.13%	-0.23%	-0.24%	-0.33%	0.02%	-0.06%	-0.03%	0.67%	-2.58%	0.03%	0.69%
27 September 2006	0.54%	-0.72%	0.91%	-0.78%	-0.03%	0.12%	0.00%	0.25%	0.55%	-0.97%	-1.09%	0.00%	0.38%
28 September 2006	0.74%	-0.49%	0.75%	0.23%	0.17%	0.23%	0.00%	0.17%	1.48%	-0.34%	1.94%	0.00%	0.11%
02 October 2006	0.68%	-0.09%	0.49%	1.08%	0.17%	2.74%	0.00%	-1.15%	1.52%	-0.01%	2.04%	0.04%	-0.20%
03 October 2006	-0.49%	0.07%	-0.79%	0.69%	0.43%	2.26%	-0.01%	-0.01%	-0.28%	0.96%	0.96%	0.04%	-0.19%
04 October 2006	-0.41%	0.02%	-1.55%	0.12%	0.18%	0.00%	-5.53%	1.15%	0.06%	1.43%	0.86%	0.00%	0.70%
05 October 2006	0.45%	-0.49%	-0.41%	-1.59%	-0.20%	0.37%	-7.25%	0.00%	0.63%	0.46%	0.09%	0.00%	0.71%
09 October 2006	0.90%	0.94%	-0.50%	-1.71%	-0.14%	0.27%	-4.93%	0.00%	0.41%	0.20%	0.09%	0.00%	0.02%
10 October 2006	0.72%	2.09%	-1.18%	0.04%	0.04%	0.51%	-4.82%	0.00%	0.82%	1.61%	1.03%	0.00%	0.01%
11 October 2006	-0.21%	0.70%	-0.21%	-0.44%	0.16%	0.72%	-0.30%	0.00%	-0.23%	1.40%	1.03%	0.00%	-0.03%
12 October 2006	-0.11%	0.14%	1.26%	-0.47%	0.29%	1.73%	1.81%	0.00%	-0.16%	0.00%	-0.24%	0.00%	0.35%
16 October 2006	1.01%	-0.09%	1.26%	-0.50%	1.18%	2.15%	0.74%	0.00%	1.43%	-1.35%	-0.76%	-0.87%	0.70%
17 October 2006	0.88%	-0.14%	0.84%	-0.20%	1.20%	0.49%	0.45%	6.49%	1.07%	-0.76%	-2.01%	-0.87%	0.04%
18 October 2006	0.15%	-0.47%	0.13%	0.46%	0.09%	-0.23%	0.19%	6.17%	-0.23%	-0.43%	-1.49%	0.00%	-0.11%
19 October 2006	0.22%	-0.86%	-0.32%	1.03%	-0.36%	0.34%	0.00%	-0.17%	0.10%	-1.02%	0.00%	0.00%	0.11%
23 October 2006	0.56%	-0.64%	0.30%	1.18%	0.00%	0.17%	-0.25%	0.96%	0.54%	0.00%	-1.13%	-1.44%	0.40%
24 October 2006	0.59%	-0.25%	0.38%	0.41%	0.23%	0.00%	-0.57%	0.81%	0.29%	0.00%	-0.92%	-1.44%	0.38%
25 October 2006	0.04%	0.00%	0.00%	0.00%	0.00%	-0.12%	-0.33%	0.05%	-0.13%	0.00%	0.21%	0.00%	0.19%
26 October 2006	-0.68%	0.00%	0.00%	0.50%	0.00%	0.03%	-0.48%	0.05%	-0.79%	0.12%	0.00%	0.00%	0.42%
30 October 2006	-0.62%	-0.31%	0.92%	1.72%	1.62%	0.12%	-0.12%	-0.34%	-0.65%	1.45%	0.44%	0.00%	-0.16%
31 October 2006	0.27%	-0.32%	1.48%	2.37%	2.36%	0.07%	-0.01%	-0.93%	0.48%	0.83%	-0.78%	0.00%	-0.40%
01 November 2006	0.86%	0.37%	0.67%	1.46%	0.82%	0.27%	-0.37%	1.88%	1.04%	-0.49%	-1.23%	0.00%	-0.37%
02 November 2006	0.40%	1.25%	-0.37%	0.61%	0.06%	0.17%	0.12%	2.47%	0.33%	0.49%	-0.69%	0.00%	-0.39%
06 November 2006	0.74%	0.71%	-1.61%	0.59%	0.44%	0.13%	-0.48%	0.01%	0.37%	0.34%	-0.39%	3.75%	0.44%
07 November 2006	1.04%	-0.52%	-1.24%	1.23%	0.46%	0.36%	-0.61%	0.01%	0.84%	0.77%	0.15%	3.75%	0.56%
08 November 2006	0.00%	-0.36%	-0.17%	0.98%	0.30%	0.59%	0.57%	-1.48%	0.02%	0.92%	-0.15%	0.00%	0.21%
09 November 2006	-0.71%	-0.08%	-0.02%	-1.15%	0.30%	0.69%	-0.25%	-1.48%	-0.84%	1.27%	0.00%	-0.16%	0.00%
13 November 2006	-0.81%	0.38%	0.27%	-0.25%	-0.56%	3.02%	-0.93%	0.04%	-1.07%	-1.66%	1.27%	-0.71%	-0.05%
14 November 2006	-0.02%	0.44%	0.35%	1.58%	-0.86%	3.24%	-0.20%	0.02%	-0.30%	-0.66%	0.53%	-0.71%	0.54%
15 November 2006	0.20%	-0.34%	0.40%	0.74%	-0.44%	0.92%	-0.10%	0.05%	0.18%	1.39%	0.53%	0.00%	0.44%
16 November 2006	-0.51%	-0.83%	-0.17%	-0.47%	-0.05%	1.22%	-1.30%	-0.19%	-0.09%	-0.33%	0.00%	0.00%	0.23%
20 November 2006	-0.12%	-1.24%	-1.39%	-0.63%	0.28%	1.98%	-2.34%	-0.29%	0.36%	-0.07%	0.23%	0.50%	0.14%
21 November 2006	0.75%	-1.36%	-0.04%	0.12%	0.23%	1.57%	-1.04%	-0.02%	0.62%	1.81%	0.42%	0.50%	0.11%
22 November 2006	0.62%	-1.27%	1.80%	0.68%	0.12%	1.52%	0.45%	0.04%	0.62%	1.47%	-0.14%	0.00%	0.20%
23 November 2006	0.14%	-0.63%	1.49%	1.06%	0.24%	1.52%	0.51%	0.07%	-0.14%	0.57%	0.00%	0.00%	0.12%
27 November 2006	-0.19%	0.00%	1.29%	1.73%	0.30%	-0.69%	-0.16%	0.03%	-0.34%	0.12%	0.00%	-0.02%	-0.87%
28 November 2006	-0.62%	-0.27%	0.12%	0.63%	-0.21%	-1.25%	-0.67%	-0.02%	-1.00%	0.31%	1.18%	-0.02%	-0.69%
29 November 2006	-0.25%	-0.27%	-1.47%	-0.29%	-0.48%	-0.25%	-0.41%	-0.02%	-0.92%	0.42%	1.18%	0.00%	0.63%
30 November 2006	0.81%	0.43%	-0.49%	0.32%	0.16%	0.19%	-0.27%	0.36%	0.50%	0.12%	0.00%	0.00%	0.50%
04 December 2006	0.80%	0.43%	0.22%	0.64%	0.46%	0.88%	-0.99%	0.08%	0.53%	0.03%	0.00%	1.41%	0.34%
05 December 2006	0.50%	1.94%	-0.60%	0.72%	0.41%	-0.99%	-1.00%	-0.22%	0.69%	0.76%	-2.99%	1.41%	0.50%
06 December 2006	-0.26%	1.94%	0.76%	0.49%	0.25%	-3.35%	-0.42%	0.05%	0.25%	0.74%	-2.99%	0.00%	0.13%
07 December 2006	-0.70%	0.00%	1.37%	1.29%	0.00%	-3.21%	-0.03%	0.19%	-0.61%	0.28%	-0.05%	0.00%	-0.26%
11 December 2006	-0.51%	-0.84%	0.41%	2.71%	-0.08%	-1.72%	0.00%	0.18%	-0.44%	0.92%	-0.05%	1.31%	0.00%
12 December 2006	-0.64%	-0.84%	0.56%	2.14%	-0.12%	-0.16%	-0.99%	0.08%	-0.59%	0.64%	0.00%	1.31%	0.15%
13 December 2006	0.02%	0.00%	0.42%	1.48%	-0.16%	0.83%	-0.92%	0.14%	0.14%	-0.28%	0.00%	0.00%	0.01%
14 December 2006	0.86%	0.23%	0.06%	-0.03%	-0.08%	1.85%	-0.19%	0.01%	1.14%	-0.28%	0.60%	0.00%	0.49%
18 December 2006	0.89%	0.55%	1.04%	-2.42%	0.29%	2.36%	-0.18%	0.45%	0.58%	0.00%	1.04%	0.09%	0.33%

15 January 2007	1.33%	0.06%	0.18%	-0.41%	0.27%	-0.48%	0.00%	0.19%	1.01%	0.80%	2.36%	0.28%	0.56%
16 January 2007	0.96%	0.21%	-0.12%	0.35%	0.25%	-0.37%	-0.03%	0.19%	0.89%	0.09%	-0.60%	0.28%	0.28%
17 January 2007	-0.43%	0.65%	-0.29%	0.86%	0.43%	0.17%	0.20%	0.01%	-1.05%	0.06%	-0.60%	0.00%	0.00%
18 January 2007	0.15%	1.40%	-0.68%	-0.11%	0.81%	-0.11%	0.24%	0.21%	-0.81%	1.25%	0.10%	0.00%	-0.19%
22 January 2007	0.32%	1.88%	-0.70%	-0.26%	1.21%	-0.41%	-0.08%	0.53%	0.27%	0.78%	0.10%	0.83%	-0.27%
23 January 2007	-0.25%	1.17%	-0.35%	0.04%	0.68%	-0.25%	0.07%	0.33%	-0.26%	0.33%	-1.42%	0.83%	0.06%
24 January 2007	0.60%	-0.28%	-0.71%	0.10%	-0.03%	-0.15%	0.98%	0.00%	0.57%	1.17%	-1.42%	0.00%	0.60%
25 January 2007	0.92%	-1.16%	-1.33%	0.37%	-0.01%	-0.38%	-0.06%	0.23%	1.00%	1.44%	6.25%	0.00%	-0.14%
29 January 2007	-0.20%	-0.25%	-2.15%	1.72%	0.25%	-1.05%	-0.99%	0.23%	-0.36%	0.55%	4.09%	2.88%	-0.68%
30 January 2007	-0.18%	0.78%	-0.68%	1.85%	0.33%	-1.12%	-0.12%	0.02%	-0.59%	0.69%	-2.33%	2.88%	0.17%
31 January 2007	0.21%	1.22%	0.99%	0.53%	0.47%	-0.26%	-0.10%	0.20%	-0.21%	1.25%	-0.17%	0.00%	0.62%
01 February 2007	0.59%	1.77%	0.97%	-1.16%	0.39%	-0.11%	-1.15%	0.20%	0.51%	1.15%	-3.65%	0.00%	0.60%
05 February 2007	0.31%	3.52%	0.70%	-0.69%	1.21%	0.19%	-0.63%	1.37%	0.26%	-1.30%	-4.25%	0.08%	0.30%
06 February 2007	0.29%	3.66%	0.90%	1.03%	1.30%	0.35%	0.47%	4.02%	0.19%	-1.62%	0.46%	0.08%	0.07%
07 February 2007	0.60%	1.55%	1.30%	0.24%	0.58%	0.33%	0.03%	2.72%	0.71%	1.57%	1.07%	0.00%	0.10%
08 February 2007	-0.65%	-0.33%	0.65%	-0.14%	1.16%	0.26%	0.03%	-0.26%	-0.59%	-0.02%	3.23%	0.00%	0.01%
12 February 2007	-0.18%	-2.16%	0.09%	0.83%	0.62%	0.77%	0.07%	-0.30%	-0.19%	-1.44%	4.72%	-0.14%	-0.58%
13 February 2007	0.83%	-0.86%	0.28%	1.13%	-0.34%	0.81%	0.05%	0.47%	0.73%	0.20%	0.93%	-0.14%	-0.14%
14 February 2007	0.94%	1.59%	1.37%	0.49%	-1.17%	0.21%	0.97%	0.93%	1.15%	1.61%	-0.56%	0.00%	0.76%
15 February 2007	0.95%	2.44%	1.28%	0.39%	-1.31%	-0.25%	1.76%	0.50%	0.88%	1.56%	-4.62%	0.00%	0.43%
19 February 2007	0.59%	1.34%	0.84%	2.58%	0.41%	-0.13%	1.76%	0.23%	0.16%	-2.28%	-4.62%	0.27%	0.01%
20 February 2007	-0.01%	0.37%	0.75%	1.41%	0.94%	0.12%	0.97%	0.36%	0.64%	-2.28%	0.00%	0.27%	0.10%
21 February 2007	-0.60%	0.16%	0.75%	-1.12%	0.01%	0.31%	0.00%	0.32%	-0.20%	0.89%	0.00%	0.00%	-0.07%
22 February 2007	0.34%	-0.89%	0.27%	-2.01%	-0.01%	0.45%	2.73%	0.48%	-0.11%	2.41%	3.84%	0.00%	-0.11%
26 February 2007	1.18%	-0.96%	0.23%	-1.45%	-0.23%	0.25%	2.78%	0.32%	1.51%	1.60%	3.36%	0.95%	-0.28%
27 February 2007	-1.17%	-0.31%	0.43%	0.30%	-0.56%	0.13%	0.11%	0.08%	-1.12%	-1.32%	-3.59%	0.95%	-2.01%
28 February 2007	-2.16%	0.05%	-1.74%	0.35%	-0.81%	-0.22%	1.10%	0.15%	-2.54%	-1.06%	-3.11%	0.00%	-1.49%
01 March 2007	-1.44%	-0.40%	-1.61%	-0.27%	-0.41%	-0.07%	1.68%	0.43%	-1.47%	0.44%	-0.60%	0.00%	0.15%
05 March 2007	-1.73%	-0.49%	-1.68%	0.66%	0.39%	-0.19%	1.80%	0.89%	-1.35%	1.32%	-0.25%	0.27%	-1.18%
06 March 2007	-0.21%	0.22%	-1.47%	2.07%	-0.21%	-0.28%	1.17%	0.63%	0.31%	-0.08%	0.00%	0.27%	-0.28%
07 March 2007	0.72%	0.69%	1.13%	1.55%	-0.52%	-0.16%	0.11%	0.12%	0.70%	-0.01%	-0.36%	0.00%	0.65%
08 March 2007	0.76%	0.49%	1.32%	1.22%	-0.26%	-0.31%	0.04%	0.02%	0.57%	0.01%	0.00%	0.00%	0.23%
12 March 2007	1.43%	0.17%	0.45%	-0.56%	-0.20%	-0.18%	-0.57%	0.02%	1.32%	-1.30%	0.04%	1.21%	0.52%
13 March 2007	0.46%	-0.28%	0.45%	-0.18%	-0.06%	0.21%	-0.24%	0.18%	0.43%	0.09%	0.28%	1.21%	-0.86%
14 March 2007	-1.49%	-0.40%	-0.20%	0.75%	0.05%	0.68%	0.11%	0.43%	-1.21%	0.10%	0.24%	0.00%	-0.70%
15 March 2007	-0.37%	0.28%	0.13%	-0.54%	0.13%	0.59%	-0.15%	1.13%	-0.46%	-0.10%	-0.26%	0.00%	0.52%
19 March 2007	1.77%	1.00%	0.38%	-0.40%	0.33%	-0.19%	-0.57%	0.89%	1.44%	0.42%	-2.34%	0.64%	0.53%
20 March 2007	1.34%	1.01%	-0.81%	0.47%	0.30%	-0.31%	-0.21%	0.04%	1.42%	-0.87%	-1.98%	0.64%	0.67%
21 March 2007	0.38%	0.20%	-0.33%	0.89%	0.00%	0.12%	0.35%	0.03%	0.49%	0.05%	0.10%	0.00%	1.16%
22 March 2007	0.55%	-0.03%	0.42%	0.54%	0.00%	0.39%	0.07%	1.16%	1.14%	0.88%	-6.70%	0.00%	0.83%
26 March 2007	0.74%	0.38%	0.99%	0.51%	0.23%	0.78%	2.28%	1.21%	0.92%	0.29%	0.00%	0.56%	0.09%
27 March 2007	0.35%	0.49%	0.44%	0.30%	0.18%	0.67%	2.26%	0.51%	-0.12%	1.62%	2.60%	0.56%	-0.21%
28 March 2007	0.14%	0.40%	-0.32%	0.34%	-0.03%	0.53%	0.07%	0.44%	-0.01%	0.04%	-4.09%	0.00%	-0.71%
29 March 2007	0.58%	0.66%	-0.41%	0.50%	-0.19%	0.36%	0.01%	-0.03%	0.60%	-2.04%	4.58%	0.00%	-0.21%
02 April 2007	1.09%	1.29%	-0.39%	-0.22%	-0.22%	0.47%	-0.45%	0.03%	1.26%	-1.38%	6.21%	0.17%	0.45%
03 April 2007	0.76%	0.91%	-0.13%	-0.69%	-0.02%	0.47%	-0.43%	0.12%	0.91%	0.20%	1.70%	0.17%	0.53%
04 April 2007	0.19%	0.47%	0.43%	-0.73%	0.15%	-0.08%	-0.22%	0.01%	0.30%	0.01%	0.07%	0.00%	0.52%
05 April 2007	-0.04%	1.35%	0.75%	-0.33%	0.11%	-0.22%	-0.26%	-0.12%	-0.21%	-0.26%	-1.61%	1.10%	0.21%
09 April 2007	0.04%	0.87%	0.34%	0.17%	0.13%	-0.49%	0.94%	-0.12%	-0.14%	0.00%	-1.61%	1.10%	0.18%
10 April 2007	0.59%	0.84%	0.53%	0.72%	0.34%	-0.19%	0.94%	0.32%	0.73%	0.00%	0.94%	0.00%	0.16%
11 April 2007	0.16%	1.40%	1.04%	0.64%	-0.16%	-0.02%	-0.39%	0.43%	0.40%	1.14%	0.94%	0.00%	-0.20%
12 April 2007	-0.10%	0.56%	0.35%	0.27%	-0.53%	-0.30%	-1.25%	0.14%	-0.28%	1.55%	1.54%	0.00%	-0.02%
16 April 2007	1.32%	0.28%	0.09%	0.69%	-0.47%	-0.13%	-0.52%	0.08%	0.56%	0.12%	1.17%	1.63%	1.02%
17 April 2007	1.22%	0.47%	0.38%	0.54%	-0.50%	-0.06%	1.40%	0.11%	1.20%	1.97%	-0.34%	1.63%	0.81%
18 April 2007	-0.41%	0.85%	0.07%	0.28%	-0.29%	0.30%	1.05%	0.06%	-0.15%	2.28%	0.02%	0.00%	0.14%
19 April 2007	-0.72%	0.81%	-0.62%	0.61%	0.22%	0.33%	-0.37%	-0.01%	-1.01%	0.06%	0.46%	0.00%	-0.03%
23 April 2007	0.62%	0.11%	-1.07%	1.27%	0.89%	0.34%	0.51%	0.06%	0.67%	0.25%	-0.48%	2.44%	0.29%
24 April 2007	0.09%	0.18%	-0.36%	1.87%	0.55%	0.76%	0.88%	0.12%	0.52%	0.70%	-0.36%	2.44%	0.33%
25 April 2007	-0.49%	0.04%	0.16%	0.95%	-0.13%	0.64%	0.00%	0.28%	-0.49%	1.29%	0.58%	0.00%	0.49%
26 April 2007	-0.13%	-0.34%	0.83%	-0.11%	-0.36%	1.01%	-0.21%	0.36%	-0.62%	1.46%	-0.53%	0.00%	0.47%
30 April 2007	-0.09%	0.02%	0.71%	0.23%	-0.15%	0.71%	-0.43%	0.21%	-0.09%	0.46%	-0.52%	1.61%	-0.44%
01 May 2007	0.17%	0.19%	-0.12%	0.35%	0.13%	-0.06%	-0.21%	0.07%	0.36%	-0.20%	0.01%	1.61%	-0.27%
02 May 2007	0.28%	-0.27%	0.40%	0.54%	-0.10%	0.19%	-0.28%	0.18%	0.26%	-0.01%	0.00%	0.00%	0.45%
03 May 2007	0.19%	-0.27%	0.53%	0.79%	-0.01%	0.13%	-0.28%	0.25%	0.29%	-0.01%	-0.19%	0.00%	0.54%
07 May 2007	0.82%	0.59%	0.76%	0.64%	0.45%	-0.15%	0.57%	0.29%	1.34%	0.67%	-0.56%	0.70%	0.45%
08 May 2007	-0.21%	0.70%	0.83%	0.78%	0.16%	0.01%	0.34%	1.45%	-0.38%	2.02%	-0.62%	0.70%	0.18%
09 May 2007	-0.78%	-0.14%	0.51%	-0.63%	-0.18%	0.28%	-0.23%	1.23%	-1.14%	1.05%	-0.25%	0.00%	0.10%
10 May 2007	0.49%	-0.50%	-0.03%	-3.15%	0.01%	0.57%	0.47%	0.11%	0.86%	-0.01%	-0.10%	0.00%	-0.54%
14 May 2007	-0.46%	-0.16%	-0.48%	-6.37%	-0.11%	0.82%	0.47%	0.44%	-0.22%	0.49%	-0.37%	4.07%	-0.31%
15 May 2007	-0.67%	0.09%	-0.60%	-3.78%	0.07%	0.31%	-0.09%	1.23%	-0.45%	0.19%	0.17%	4.07%	0.32%
16 May 2007	-0.09%	0.20%	-1.31%	2.11%	0.10%	-1.15%	-0.09%	0.91%	-0.23%	0.39%	0.44%	0.00%	0.36%
17 May 2007	-0.31%	0.50%	-0.76%	2.22%	-0.11%	-3.76%	0.00%	0.02%	-0.58%	0.39%	-0.40%	0.00%	0.38%
21 May 2007	1.05%	0.25%	0.20%	1.60%	-0.38%	0.61%	0.04%	0.80%	1.55%	0.26%	-1.91%	0.21%	0.36%
22 May 2007	1.32%	-0.32%	0.08%	0.72%	-0.56%	2.79%	0.04%	0.80%	2.01%	1.03%	-0.78%	0.21%	0.37%
23 May 2007	0.77%	-0.27%	0.64%	-1.06%	-0.16%	-1.35%	-0.75%	0.54%	1.04%	0.97%	0.74%	0.00%	-0.09%
24 May 2007	0.32%	0.65%	0.84%	-1.26%	0.05%	-0.80%	-0.62%	0.98%	0.42%	0.28%	-0.04%	0.00%	-0.55%
28 May 2007	-0.78%	1.92%	0.26%	-0.55%	-0.48%	-1.10%	1.65%	0.68%	-0.84%	0.37%	-0.42%	2.76%	-0.22%
29 May 2007	-0.26%	1.27%	1.02%	-0.11%	-0.94%	-1.41%	1.53%	0.53%	-0.29%	-0.30%	-0.04%	2.76%	0.35%
30 May 2007	-0.35%	0.00%	0.77%	0.03%	-0.05%	-0.52%	0.04%	0.28%	-0.32%	-0.37%	0.34%	0.00%	0.48%
31 May 2007	-0.07%	0.00%	0.32%	1.86%	0.49%	0.71%	0.15%	0.18%	0.29%	0.25%	-0.47%	0.00%	0.41%
04 June 2007	0.70%	1.62%	0.89%	1.62%	0.31%	1.67%	1.70%	0.36%	1.17%	0.29%	-0.75%	0.09%	0.29%
05 June 2007	0.41%	2.30%	0.38%	0.34%	0.35%	0.66%	1.33%	0.20%	0.38%	0.27%	0.01%	0.09%	0.01%
06 June 2007	-0.52%	0.30%	-0.17%	0.48%	-0.49%	-0.21%	-0.26%	0.11%	-0.92%	0.04%	0.29%	0.00%	-0.71%
07 June 2007	-0.54%	-0.13%	-0.81%	-0.73%	-0.94%	-0.21%	0.23%	0.19%	-1.23%	0.52%	-0.42%	0.00%	-1.33%
11 June 2007	0.01%	0.25%	-0.70%	-0.66%	-1.94%	-0.14%	0.53%	0.14%	-0.40%	0.50%	-0.06%	0.62%	-0.27%
12 June 2007	-0.45%	0.00%	-0.19%	-0.03%	-1.38%	-0.04%	-0.46%	0.13%	-0.21%	0.37%	-0.47%	0.62%	0.08%
13 June 2007	0.10%	0.00%	-0.57%	-0.45%	0.41%	0.00%	-1.06%	0.12%	0.78%	0.55%	-0.83%	0.00%	0.22%
14 June 2007	1.20%	0.35%	0.40%	-0.75%	0.47%	-0.01%	-0.45%	0.23%	1.36%	0.88%	0.01%	0.00%	0.99%
18 June 2007	1.24%	-0.75%	2.27%	-0.49%	1.18%	1.89%	-0.12%	0.98%	1.07%	0.61%	0.01%	0.54%	0.50%
19 June 2007	0.44%	-1.97%	0.80%	-0.06%	1.13%	3.15%	-0.07%	0.78%	0.05%	0.02%	-0.19%	0.54%	0.35%
20 June 2007	0.33%	-0.88%	0.11%	0.11%	0.34%	0.50%	0.47%	0.25%	-0.19%	1.33%	-0.19%	0.00%	-0.60%
21 June 2007	0.11%	0.74%	0.34%	-0.22%	-0.07%	-0.58%							

Table 3: During/ post crisis return data, 17 July 2007 – 31 December 2007

Date	JALSH Index	NGSEINDX Index	EGX30 Index	MOSENEW Index	TUSISE Index	SEMDEX Index	ICX10 Index	BGSMDC Index	FTN098 Index	LUSEIDX Index	UGSINDX Index	MWSIIDX Index	SPX Index
17 July 2007	-0.31%	-0.16%	0.84%	0.57%	-0.31%	0.63%	-2.03%	0.01%	-0.35%	-0.88%	0.26%	-0.18%	0.05%
18 July 2007	-0.75%	-0.16%	-0.56%	-0.02%	-0.32%	0.27%	-0.86%	0.14%	-1.32%	1.54%	0.07%	0.00%	-0.11%
19 July 2007	0.03%	0.01%	-0.10%	-0.31%	-0.27%	0.27%	0.63%	0.23%	-0.51%	1.04%	-0.06%	0.00%	0.12%
23 July 2007	0.78%	-0.27%	-0.03%	-0.26%	-0.45%	0.27%	1.95%	0.09%	0.93%	1.17%	1.63%	0.37%	-0.15%
24 July 2007	-0.05%	-0.29%	0.00%	0.00%	-0.49%	0.17%	0.89%	-0.07%	-0.15%	0.27%	0.82%	0.37%	-1.37%
25 July 2007	-1.32%	0.00%	0.18%	-0.11%	-0.05%	-0.22%	0.46%	-0.05%	-1.93%	-0.19%	-0.88%	0.00%	-0.77%
26 July 2007	-1.73%	0.27%	0.05%	0.28%	-0.29%	0.24%	1.43%	0.03%	-2.53%	0.01%	-0.50%	0.00%	-0.95%
30 July 2007	-1.66%	1.27%	-1.74%	0.68%	-0.29%	0.30%	0.23%	0.09%	-2.62%	-0.14%	-0.77%	0.25%	-1.48%
31 July 2007	-0.04%	1.61%	-1.39%	0.94%	0.22%	0.06%	0.68%	0.11%	-0.12%	-0.18%	-0.26%	0.25%	-0.93%
01 August 2007	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
02 August 2007	0.07%	0.02%	0.12%	1.09%	0.33%	0.91%	0.38%	0.07%	-0.28%	-0.13%	0.09%	0.00%	0.22%
06 August 2007	-1.67%	-0.41%	-0.28%	1.48%	0.37%	1.80%	0.31%	-0.08%	-1.70%	-0.08%	0.73%	0.58%	0.06%
07 August 2007	-0.99%	-0.44%	0.05%	0.55%	0.36%	1.05%	-0.07%	-0.13%	-0.80%	0.20%	1.53%	0.58%	0.15%
08 August 2007	2.37%	-0.21%	0.51%	0.15%	0.48%	-0.02%	-0.30%	0.00%	2.27%	0.20%	0.89%	0.00%	1.01%
09 August 2007	1.62%	-0.21%	0.25%	0.40%	0.03%	-0.31%	-0.94%	-0.04%	1.65%	-0.37%	0.28%	0.00%	-0.81%
13 August 2007	-0.82%	0.74%	-1.43%	0.78%	-0.47%	0.91%	0.40%	0.05%	-0.39%	0.24%	0.00%	1.94%	-1.51%
14 August 2007	-1.51%	0.74%	-0.39%	0.37%	-0.34%	-1.85%	2.50%	0.06%	-0.86%	1.13%	-0.41%	1.94%	-0.92%
15 August 2007	-1.21%	-0.29%	0.97%	-0.14%	-0.23%	-1.69%	1.46%	-0.78%	-1.27%	0.58%	-0.13%	0.00%	-0.62%
16 August 2007	-2.58%	-0.29%	-1.99%	-0.61%	-0.36%	-0.41%	0.63%	-0.61%	-3.54%	0.21%	0.54%	0.00%	-0.54%
20 August 2007	-0.84%	-1.98%	-2.73%	-0.25%	-0.21%	-0.24%	0.60%	0.49%	-3.26%	-0.12%	1.81%	1.05%	1.36%
21 August 2007	1.04%	-2.55%	-1.83%	0.23%	-0.25%	0.20%	1.01%	0.39%	0.66%	-0.28%	0.34%	1.05%	1.25%
22 August 2007	1.12%	-1.03%	-0.55%	0.02%	0.05%	0.74%	1.19%	0.08%	2.85%	-0.09%	-0.93%	0.00%	0.64%
23 August 2007	1.72%	-0.46%	0.44%	0.24%	0.62%	-0.17%	0.23%	0.04%	2.06%	-0.25%	0.41%	0.00%	0.53%
27 August 2007	1.05%	-0.14%	0.96%	1.12%	0.40%	-0.30%	1.20%	0.07%	1.28%	-0.34%	0.34%	0.11%	0.09%
28 August 2007	0.02%	-0.67%	0.97%	1.34%	-0.01%	0.03%	0.83%	0.15%	-0.16%	0.01%	-0.09%	0.11%	-1.04%
29 August 2007	-0.40%	-0.53%	-0.25%	0.72%	-0.04%	-0.38%	-0.18%	0.12%	-1.12%	0.17%	-0.02%	0.00%	-0.10%
30 August 2007	0.78%	0.00%	0.11%	0.40%	-0.02%	-0.49%	0.10%	0.09%	0.28%	-0.13%	1.21%	0.00%	0.87%
03 September 2007	2.28%	1.53%	1.91%	0.88%	0.22%	0.39%	1.37%	0.09%	2.26%	-0.18%	2.69%	0.09%	0.35%
04 September 2007	2.01%	1.95%	2.22%	1.76%	0.23%	0.51%	1.51%	-0.01%	2.21%	0.30%	1.70%	0.09%	1.08%
05 September 2007	-0.33%	1.11%	0.89%	2.57%	0.02%	0.27%	0.22%	-0.10%	-0.21%	0.51%	0.23%	0.00%	-0.06%
06 September 2007	-0.35%	0.68%	0.41%	0.02%	-0.07%	-0.02%	0.00%	-0.37%	-0.27%	0.60%	0.02%	0.00%	-0.37%
10 September 2007	-0.80%	0.00%	-0.12%	-1.21%	-0.49%	-0.07%	-0.49%	-0.39%	-1.73%	0.55%	1.30%	0.00%	-0.70%
11 September 2007	0.01%	-0.14%	0.25%	-0.59%	-0.60%	0.02%	-0.51%	-0.13%	-0.70%	0.58%	1.98%	0.00%	-0.24%
12 September 2007	0.86%	-0.14%	1.20%	-1.43%	-0.30%	0.00%	-0.06%	-0.11%	0.89%	0.52%	0.70%	0.00%	0.68%
13 September 2007	0.39%	0.00%	0.45%	-0.51%	0.01%	0.35%	-0.25%	-0.06%	0.29%	0.25%	-0.21%	0.00%	0.42%
17 September 2007	-0.34%	-0.18%	1.23%	0.39%	-0.22%	0.21%	-0.62%	0.05%	-0.30%	0.23%	-0.21%	0.13%	0.17%
18 September 2007	-0.55%	-0.73%	1.24%	0.22%	-0.16%	0.12%	-0.40%	-0.02%	-0.93%	0.26%	0.61%	0.13%	1.19%
19 September 2007	2.18%	-0.85%	0.67%	-0.60%	0.30%	0.40%	-0.42%	-0.07%	2.50%	0.19%	0.61%	0.00%	1.74%
20 September 2007	1.82%	-0.64%	0.24%	-0.05%	-0.19%	0.52%	-0.32%	-0.01%	2.87%	-0.16%	-0.17%	0.00%	-0.03%
24 September 2007	-0.17%	-0.29%	-1.01%	-0.05%	-0.37%	0.95%	-0.25%	-0.29%	-0.29%	-0.15%	-0.73%	0.02%	-0.37%
25 September 2007	-0.09%	-0.55%	-0.67%	-0.45%	-0.10%	0.76%	-0.15%	-0.29%	-0.63%	0.06%	-0.87%	0.02%	-0.05%
26 September 2007	0.17%	-0.62%	0.55%	-0.24%	-0.09%	0.18%	-0.26%	0.40%	0.53%	0.14%	-0.31%	0.00%	0.25%
27 September 2007	0.28%	0.00%	1.35%	0.13%	0.32%	0.12%	-1.16%	0.37%	0.70%	0.21%	-0.58%	0.00%	0.46%
01 October 2007	0.59%	-0.10%	1.37%	0.81%	0.46%	0.71%	-0.35%	0.01%	1.09%	0.92%	-1.10%	0.00%	0.70%
02 October 2007	0.81%	0.26%	0.95%	0.57%	0.29%	0.82%	0.36%	0.03%	1.04%	0.80%	-0.78%	0.00%	0.50%
03 October 2007	0.92%	0.36%	-0.05%	-0.05%	0.53%	0.47%	-0.33%	-0.02%	0.99%	0.05%	-0.26%	0.00%	-0.24%
04 October 2007	0.75%	0.28%	-0.24%	0.06%	0.45%	0.44%	-0.23%	-0.02%	0.80%	0.52%	-0.15%	0.00%	-0.12%
08 October 2007	0.10%	0.35%	0.76%	0.65%	-0.16%	0.32%	-0.14%	0.00%	0.13%	0.57%	0.21%	0.47%	0.42%
09 October 2007	0.07%	0.15%	0.76%	0.76%	-0.38%	0.39%	-0.16%	0.00%	0.12%	-0.32%	0.36%	0.47%	0.72%
10 October 2007	0.66%	0.26%	0.21%	0.00%	0.02%	0.63%	0.19%	-0.05%	0.73%	0.14%	0.00%	0.00%	0.32%
11 October 2007	0.96%	0.18%	0.29%	0.03%	0.13%	1.07%	0.29%	0.45%	1.31%	0.54%	1.05%	0.00%	-0.34%
15 October 2007	-0.06%	0.14%	0.15%	0.50%	0.10%	2.93%	0.29%	-0.50%	-0.10%	0.35%	1.86%	0.74%	-0.44%
16 October 2007	-0.80%	-0.04%	0.54%	-0.12%	0.15%	2.42%	0.67%	-1.00%	-1.22%	1.06%	-5.02%	0.74%	-0.51%
17 October 2007	-0.15%	-0.15%	0.35%	-0.28%	0.39%	-0.17%	0.66%	-0.04%	-0.86%	1.00%	-5.83%	0.00%	-0.24%
18 October 2007	-0.03%	0.12%	-0.50%	0.19%	0.36%	0.04%	1.16%	-0.42%	-0.89%	0.20%	0.13%	0.00%	0.05%
22 October 2007	-1.51%	0.15%	-0.73%	0.25%	-0.03%	0.98%	1.27%	-0.66%	-2.39%	0.31%	0.57%	-0.29%	-1.15%
23 October 2007	-0.92%	0.21%	0.04%	0.25%	0.04%	0.76%	0.43%	-0.51%	-0.99%	0.41%	0.52%	-0.29%	-0.67%
24 October 2007	-0.18%	-0.01%	0.95%	0.31%	0.10%	0.17%	0.40%	-0.60%	0.50%	-0.01%	0.07%	0.00%	0.32%
25 October 2007	-0.05%	-0.51%	0.99%	-0.18%	0.10%	0.12%	0.11%	-0.38%	0.48%	-0.11%	-1.27%	0.00%	-0.17%
29 October 2007	1.91%	-0.80%	1.23%	-0.06%	0.23%	-0.10%	-0.11%	-0.94%	2.30%	0.02%	-1.28%	0.57%	0.82%
30 October 2007	1.34%	-0.84%	1.51%	-0.09%	0.17%	0.01%	0.05%	-1.02%	1.51%	0.24%	-0.14%	0.57%	0.55%
31 October 2007	0.20%	-0.32%	0.56%	-1.46%	0.32%	0.26%	-0.20%	-0.08%	0.25%	0.11%	-0.12%	0.00%	0.27%
01 November 2007	-0.69%	0.06%	0.50%	-1.35%	0.52%	0.10%	-0.19%	0.01%	-0.73%	0.15%	0.53%	0.00%	-0.74%
05 November 2007	-1.60%	0.28%	-0.15%	0.96%	-0.02%	-0.25%	-0.09%	-0.02%	-2.43%	0.46%	2.01%	0.00%	-1.55%
06 November 2007	-0.08%	0.45%	-1.23%	1.17%	0.02%	-0.18%	0.00%	-0.03%	-0.64%	0.36%	1.63%	0.00%	0.39%
07 November 2007	0.69%	0.86%	-0.32%	-0.31%	0.27%	0.63%	0.22%	0.00%	0.93%	-0.46%	0.15%	0.00%	-0.89%
08 November 2007	0.47%	0.49%	-0.64%	-0.32%	-0.38%	1.18%	0.12%	-0.54%	2.28%	0.07%	-0.41%	0.00%	-1.52%
12 November 2007	0.01%	0.30%	0.47%	0.02%	-0.34%	1.58%	0.71%	-0.60%	1.72%	0.60%	-0.60%	0.00%	-1.25%
13 November 2007	-0.98%	0.79%	0.53%	-0.23%	0.04%	3.50%	0.57%	-0.06%	-1.14%	0.32%	-0.04%	0.00%	0.21%
14 November 2007	-0.15%	0.28%	-0.05%	-0.21%	0.31%	2.03%	-0.02%	-0.11%	-0.58%	0.36%	0.14%	0.00%	1.08%
15 November 2007	-0.51%	0.77%	0.74%	0.20%	0.51%	-0.78%	0.13%	-0.11%	-1.07%	0.25%	0.45%	0.00%	-1.02%
19 November 2007	-2.44%	1.66%	1.91%	0.18%	0.34%	-1.27%	-0.96%	0.06%	-3.43%	0.22%	2.37%	1.20%	-1.28%
20 November 2007	-1.01%	1.21%	1.54%	-0.02%	0.17%	-0.82%	-0.18%	0.09%	-2.49%	-0.11%	2.38%	1.20%	-0.40%
21 November 2007	-0.13%	0.77%	0.31%	-0.21%	0.09%	0.13%	0.37%	-0.28%	-0.49%	-0.16%	0.46%	0.00%	-0.58%
22 November 2007	-0.71%	0.44%	-0.24%	-0.40%	-0.05%	-0.09%	0.49%	-0.38%	-0.48%	0.02%	0.00%	0.00%	-0.80%
26 November 2007	0.52%	0.61%	-0.68%	-1.37%	-0.07%	0.75%	0.37%	-0.18%	0.57%	0.11%	2.13%	1.17%	-0.34%
27 November 2007	0.27%	0.17%	0.19%	-1.17%	0.15%	0.66%	-0.13%	-0.08%	0.25%	0.84%	3.38%	1.17%	0.40%
28 November 2007	-0.07%	-0.55%	-0.15%	0.45%	0.29%	-0.20%	0.00%	-0.25%	-0.51%	0.22%	1.26%	0.00%	2.15%
29 November 2007	1.08%	-0.55%	0.11%	0.81%	0.25%	-0.35%	0.00%	-0.44%	1.19%	-0.58%	-0.64%	0.00%	1.43%
03 December 2007	1.50%	-0.30%	1.14%	-0.27%	0.25%	-0.63%	0.04%	-0.10%	2.42%	0.00%	-0.23%	0.44%	0.12%
04 December 2007	0.04%	0.09%	1.40%	-0.64%	-0.01%	-0.36%	-0.59%	0.05%	0.45%	-0.26%	1.61%	0.44%	-0.24%
05 December 2007	-0.31%	-0.10%	1.09%	-0.25%	0.08%	-0.26%	-0.13%	-0.04%	0.07%	-0.16%	1.21%	0.00%	0.43%
06 December 2007	0.31%	-0.05%	0.86%	-0.35%	0.19%	-0.18%	0.09%	-0.25%	0.72%	0.40%	-0.49%	0.00%	1.50%
10 December 2007	0.57%	0.31%	-0.26%	-0.20%	-0.01%	-0.09%	0.23%	-0.28%	0.80%	0.02%	0.46%	1.17%	1.03%
11 December 2007	0.55%	0.37%	-1.83%	-0.11%	0.18%	-0.03%	0.12%	-0.34%	1.16%	-0.38%	1.00%	1.17%	-0.99%
12 December 2007	-0.26%	0.04%	-0.67%	-0.20%	0.03%	0.22%	-0.69%	-0.51%	0.29%	-0.36%	0.05%	0.00%	-0.98%
13 December 2007	-1.80%	-0.11%	1.41%	-0.33%	0.02%	0.05%	0.05%	-0.22%	-1.70%	-0.38%	1.10%	0.00%	0.36%
17 December 2007	-2.71%	-0.09%	1.77%	-0.13%	-0.10%	0.62%	1.06%	-0.03%	-3.43%	-0.13%	1.68%	0.04%	-1.39%
18 December 2007	-1.49%	-0.05%	0.82%	0.57%	-0.18%	0.52%	-0.83%	-0.02%	-2.17%	0.66%	0.04%	0.04%	-1.14%
19 December 2007	-1.05%	-0.05%	0.00%	0.70%	0.00%	-0.51%	-1.26%	-1.04%	-1.63%	0.38%	-0.55%	0.00%	0.24%
2													

Table 7: Contagion to African markets from the 2007/08 GFC – correlation coefficients, adjusted and unadjusted (using method described in Section 3.3)

Variable	Corr with US during entire sample	Corr with US during pre-crisis period	Corr with US during crisis period	Std Dev in pre-crisis period	Std Dev in pre-crisis period	Std Dev in crisis period	Std Dev in crisis period squared	Pre crisis Adjusted Corr	Post crisis Adjusted Corr	Sample size pre-crisis	Sample size crisis period	t-statistic	Critical value	Reject/ Cannot reject H0	Evidence of Contagion/ Co-movement
JALSH Index	0.565	0.440	0.528	0.008	0.00006	0.011	0.00013	0.374	0.388	210	109	1.566	1.960	Cannot reject H0	Co-movement
NGSEINDX Index	-0.001	0.104	-0.294	0.010	0.00011	0.007	0.00005	0.124	(0.400)	210	109	(7.061)	1.960	Reject H0	Contagion
EGX30 Index	0.353	0.252	0.215	0.010	0.00010	0.011	0.00012	0.240	0.194	210	109	(0.655)	1.960	Cannot reject H0	Co-movement
MOSENEW Index	0.071	-0.008	-0.085	0.010	0.00011	0.007	0.00005	(0.010)	(0.124)	210	109	(1.356)	1.960	Cannot reject H0	Co-movement
TUSISE Index	0.116	0.011	0.189	0.005	0.00003	0.003	0.00001	0.015	0.315	210	109	3.151	1.960	Reject H0	Contagion
SEMDEX Index	0.037	0.009	0.089	0.014	0.00019	0.008	0.00007	0.012	0.145	210	109	1.411	1.960	Cannot reject H0	Co-movement
ICX10 Index	-0.026	-0.093	-0.125	0.012	0.00013	0.007	0.00004	(0.122)	(0.213)	210	109	(0.572)	1.960	Cannot reject H0	Co-movement
BGSMDX Index	0.028	0.035	0.017	0.010	0.00010	0.003	0.00001	0.062	0.054	210	109	(0.316)	1.960	Cannot reject H0	Co-movement
FTN098 Index	0.517	0.418	0.413	0.009	0.00008	0.015	0.00023	0.336	0.263	210	109	(0.090)	1.960	Cannot reject H0	Co-movement
LUSEIDX Index	0.007	0.057	-0.217	0.009	0.00008	0.005	0.00002	0.079	(0.394)	210	109	(4.854)	1.960	Reject H0	Contagion
UGSINDX Index	0.018	-0.060	0.098	0.016	0.00025	0.013	0.00016	(0.066)	0.119	210	109	2.793	1.960	Reject H0	Contagion
MWSIIDX Index	0.076	0.014	-0.197	0.009	0.00008	0.008	0.00006	0.016	(0.233)	210	109	(3.740)	1.960	Reject H0	Contagion
SPX Index	1	1	1	0.005	0.00002	0.009	0.00008	1.000	1.000	210	109	0	1.960		

If the absolute value of the t-statistic is greater than this critical value, then you can reject the null hypothesis, H0, at the 0.05 level of significance.

Table 8b: Calculations for measure of crisis severity analysis

	Botswana				Egypt				Mauritius				Morocco				South Africa		Tunisia		Nigeria		Max	Min
	Recession test	Max	Min		Recession test	Max	Min		Recession test	Max	Min		Recession test	Max	Min									
	9.04				8.96	5.79							1.03				4.47							
	-1.16 Dip				8.29 Increase	5.05 Increase							1.65 Increase				4.37 Increase							
	5.20 Increase				4.42 Increase	3.75 Increase							1.37 Increase				5.29 Increase							
	23.57 Increase				3.34 Increase	1.54 Increase							1.82 Increase				7.68 Increase							
Q106	-7.41 Dip	Recession	23.57	(1.16)	4.92 Increase	6.00 Increase							0.73 Increase				7.43 Increase			-	-	Increase		
Q206	13.69 Increase	Recession			5.48 Increase	4.75 Increase							0.14 Increase				7.46 Increase	1.80% Increase	-	-	Increase			
Q306	10.78 Increase	Recession			7.51 Increase	6.07 Increase							1.36 Increase				10.32 Increase	2.65% Increase	-	-	Increase			
Q406	1.38 Increase	Recession			11.39 Increase	8.33 Increase							3.84 Increase				6.78 Increase	1.72% Increase	-	-	Increase			
Q107	4.98 Increase	Recession			18.24 Increase	11.64 Increase							3.19 Increase				9.13 Increase	2.54% Increase	4,809.0	-	Dip			
Q207	6.19 Increase	Recession			16.58 Increase	10.03 Increase							3.78 Increase				9.16 Increase	2.48% Increase	4,921.4	2.34	Increase			
Q307	7.02 Increase	Recession			11.20 Increase	6.94 Increase							4.12 Increase				5.77 Increase	0.81% Increase	5,594.6	13.68	Increase			
Q407	0.21 Increase	Recession			5.20 Increase	4.17 Increase							4.59 Increase				8.43 Increase	3.20% Increase	5,615.9	0.38	Increase			
Q108	9.32 Increase	Recession			13.51 Increase	4.98 Increase							5.66 Increase				7.87 Increase	2.33% Increase	5,624.8	0.16	Increase	12.79	0.16	
Q208	8.26 Increase	Recession			11.90 Increase	7.08 Increase							5.72 Increase				8.99 Increase	3.03% Increase	5,809.5	3.28	Increase			
Q308	4.97 Increase	Recession			30.50 Increase	9.30 Increase							7.69 Increase				9.18 Increase	3.68% Increase	6,552.8	12.79	Increase			
Q408	14.54 Increase	Recession			21.65 Increase	5.24 Increase							4.44 Increase				7.28 Increase	1.42% Increase	6,678.2	1.91	Increase			
Q109	1.54 Increase	Recession			7.96 Increase	2.27 Increase							4.90 Increase				8.12 Increase	0.00% Increase	5,571.4	(16.57)	Dip	Recession		
Q209	12.91 Increase	Recession			11.02 Increase	0.88 Increase							2.33 Increase				7.68 Increase	1.40% Increase	5,977.3	7.29	Increase	Recession		
Q309	0.15 Increase	Recession			8.75 Increase	-2.17 Dip	Recession	9.30	0.88				-1.07 Dip	Recession	7.69	2.33	6.87 Increase	2.76% Increase	6,718.2	12.40	Increase	Recession		
Q409	0.09 Increase	Recession			12.02 Increase	-1.17 Dip	Recession	5.24	(2.17)				0.11 Increase	Recession			7.95 Increase	2.01% Increase	6,969.1	3.73	Increase	Recession		
Q110	14.28 Increase	Recession			10.01 Increase	1.38 Increase	Recession						-0.79 Dip	Recession	4.90	(1.07)	10.02 Increase	1.97% Increase	12,790.4	83.53	Increase	Growth		
Q210	15.57 Increase	Recession			9.82 Increase	1.66 Increase	Recession						1.59 Increase	Recession			12.88 Increase	2.58% Increase	13,141.5	2.75	Increase	Recession		
Q310	23.17 Increase	Recession			11.02 Increase	1.10 Increase	Recession						1.38 Increase	Recession			11.17 Increase	0.63% Increase	14,516.6	10.46	Increase	Recession		
Q410	22.16 Increase	Recession			10.07 Increase	2.87 Increase	Recession						0.38 Increase	Recession			10.24 Increase	0.63% Increase	15,020.9	3.47	Increase	Recession		
CumLoss			595%																					
Depth			-105%																					

Table 4: Panel A

XLSTAT 2015.6.01.25106 - Descriptive statistics - on 1/30/2016 at 9:50:43 PM

Quantitative data: Workbook = Data v13.xlsx / Sheet = 12 month precrisis / Range = '12 month precrisis'!\$C\$2:\$O\$212 / 210 rows and 13 columns

Descriptive statistics (Quantitative data): 12 months pre-crisis period

Statistic	JALSH Index	NGSEINDX Index	EGX30 Index	MOSENEW Index	TUSISE Index	SEMDEX Index	ICX10 Index	BGSMDC Index	FTN098 Index	LUSEIDX Index	UGSINDX Index	MWSIIDX Index	SPX Index
Nbr. of observations	210	210	210	210	210	210	210	210	210	210	210	210	210
Minimum	-0.032	-0.040	-0.046	-0.064	-0.019	-0.108	-0.073	-0.040	-0.034	-0.023	-0.067	-0.016	-0.020
Maximum	0.018	0.042	0.030	0.027	0.024	0.098	0.028	0.065	0.026	0.044	0.062	0.041	0.012
1st Quartile	-0.003	-0.003	-0.003	-0.003	-0.002	-0.002	-0.002	0.000	-0.003	0.000	-0.005	0.000	-0.002
Median	0.002	0.002	0.003	0.002	0.001	0.002	0.000	0.002	0.003	0.002	0.000	0.000	0.001
3rd Quartile	0.007	0.007	0.008	0.007	0.004	0.006	0.002	0.005	0.008	0.008	0.005	0.003	0.004
Mean	0.002	0.003	0.002	0.002	0.001	0.003	0.000	0.004	0.002	0.003	0.000	0.004	0.001
Variance (n-1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Standard deviation (n-1)	0.008	0.010	0.010	0.010	0.005	0.014	0.012	0.010	0.009	0.009	0.016	0.009	0.005
Skewness (Pearson)	-1.017	0.203	-0.628	-1.387	0.185	-0.861	-2.039	3.042	-0.741	0.234	0.084	2.038	-0.830
Kurtosis (Pearson)	2.209	3.118	2.733	7.665	2.790	30.004	11.847	19.123	1.580	2.448	4.442	4.920	2.005
Standard error of the mean	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000
Standard error of the variance	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 4: Panel B

Descriptive statistics (Quantitative data): 6 months post-crisis period

Statistic	JALSH Index	NGSEINDX Index	EGX30 Index	MOSENEW Index	TUSISE Index	SEMDEX Index	ICX10 Index	BGSMDC Index	FTN098 Index	LUSEIDX Index	UGSINDX Index	MWSIIDX Index	SPX Index
Nbr. of observations	109	109	109	109	109	109	109	109	109	109	109	109	109
Minimum	-0.031	-0.026	-0.054	-0.019	-0.006	-0.019	-0.020	-0.010	-0.043	-0.009	-0.058	-0.003	-0.020
Maximum	0.024	0.029	0.022	0.026	0.012	0.035	0.025	0.005	0.029	0.015	0.034	0.049	0.021
1st Quartile	-0.008	-0.003	-0.002	-0.002	-0.002	-0.002	-0.002	-0.003	-0.011	-0.001	-0.004	0.000	-0.008
Median	-0.001	0.000	0.002	0.000	0.000	0.002	0.001	0.000	-0.002	0.002	0.000	0.000	-0.001
3rd Quartile	0.006	0.004	0.009	0.006	0.003	0.006	0.006	0.000	0.007	0.005	0.006	0.001	0.004
Mean	-0.001	0.001	0.001	0.001	0.001	0.003	0.002	-0.001	-0.002	0.002	0.001	0.003	-0.001
Variance (n-1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Standard deviation (n-1)	0.011	0.007	0.011	0.007	0.003	0.008	0.007	0.003	0.015	0.005	0.013	0.008	0.009
Skewness (Pearson)	-0.088	0.321	-1.795	0.113	0.372	0.678	0.273	-1.064	-0.235	0.552	-1.235	4.521	0.126
Kurtosis (Pearson)	0.085	3.173	6.048	1.050	0.818	2.688	1.599	1.178	-0.132	0.065	5.318	23.623	-0.489
Standard error of the mean	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.000	0.001	0.000	0.001	0.001	0.001
Standard error of the variance	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000