# A Model Framework for Stock Market Integration in Select Developed and Emerging Market Countries

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# Chapter 1

## 1.1 Background to the Study

The African markets of Botswana, Egypt, Ghana, Kenya, Mauritius, Morocco, Namibia, Nigeria, South Africa and Zimbabwe, were capitalised at over $1000bn[1] in 2011. In 2002, the market capitalisation of these markets ranged from around 10% of GDP in the case of Namibia to over 200% of GDP in the case of South Africa[2]. In 2008 the New York stock exchange Dow Jones Index lost 6.98 % in value, which amounts to over $ 1000bn[3]. Clearly a similar loss in the African markets would be devastating for African economies, considering the percentage of GDP that the markets make up. In the context of fully integrated stock markets, it is conceivable that massive losses of value in global markets, could translate to devastation of African markets.

The question of stock market integration of African markets with global markets is therefore more than a theoretical or academic question but will have ramifications on the day to day lives of Africans, should stock market integration work against them. Understanding the mechanics and extent of stock market integration is therefore crucial and is the object of this research.

There exists a vast body of literature on the integration of capital markets in general and stock markets in particular. The subject has enjoyed extensive academic focus as integration forms a critical part of portfolio theory put forward by Markowitz (1952) and extended to international portfolio management by Grubel (1968) and also the asset pricing models by Sharpe (1964) with the Capital Asset Pricing Model and Ross (1976) with the Arbitrage Pricing Model. Most notable for dealing with the issue of integration in the context of International Asset Pricing Models (IAPM) are, Solnik (1983), Stultz (1981) Adler and Dumas (1983), who developed versions of the APM and the CAPM in the context of international markets.

Market integration is at the heart of international portfolio management because if markets are fully integrated, then there is no value in the application of diversification of a portfolio as proposed by Grubel (1968). Similarly in pricing an asset, if the benchmark market against which the price of the asset is evaluated is integrated to global markets one arrives at a different valuation versus when the market is segmented from the international markets (Karolyi and Stulz, 2003; Kodongo and Ojah, 2011).

## 1.2 Contribution to the literature

The review of the literature demonstrates the extent of work that has been done on the subject of market integration. The review also shows however the disjointed nature of the work that has been done in the field.

[1] http://data.worldbank.org/indicator/CM.MKT.LCAP.CD (Accessed on 27 September 2012)
[2] http://www.imf.org/external/pubs/ft/survey/so/2007/car1012a.htm (Accessed on 27 September 2012)
[3] http://www.nytimes.com/2008/09/30/business/30markets.html?pagewanted=all&_moc.semityn.www

This study contributes to the literature in four ways:

i) It provides conceptual framework for understanding stock market integration and factors that contribute to it.

ii) It clarifies definitions and terms.

iii) It identifies the relationship between Trade, GDP, Capital Account Openness and how they contribute to Integration.

iv) It identifies the role that geographical location plays in stock market integration.

The literature review shows there are several issues that need to be addressed in order to deal with the questions of integration and these issues relate to which variables drive integration and which just measure it and how these variables interact with each other and integration; and it is in building the framework for how these variables interact to influence integration that the study makes its contribution. There are four key deficiencies that the literature review has helped to point out, all of which the study addresses. One of the key issues identified in the literature is the lack of a relatively encompassing definition for integration; and it is here that this study makes its first contribution. The others are the lack of clarity about terminology, and the lack of a framework that links how the pertinent variables relate to each other and integration.

### 1.2.1 Integration Definition

As pointed out in the review of the literature, authors such as Grubel (1968) and Lee (1969), who lay the foundations for later scholars of integration, did not provide a definition for market integration. This lack of a clear definition of what constitutes market integration has continued to the present, as articulated by authors such as Bracker et al. (1999); Billio & Pelizzon (2003); Rajan et al. (2006) and Ip-Wing et al. (2010). Rajan et al. provide a taxonomic framework of measures of integration without providing a definition of integration. It is into the vacuum for a clear definition that the current study makes its first contribution, by providing a conceptual and operational definition. The definition lays the foundation for a way of thinking about and understanding integration. The operational aspect of the definition allows us to identify how to measure integration.

Therefore in this study we shall adopt a definition of integration put forward by Fratzscher (2002), where market integration is defined as:

> "Market *i* is more integrated the stronger domestic returns$_{ri,t}$ depend on contemporaneous world market shocks".

Although the definition put forward by Fratzsher seems to be a restatement of the correlations based approach, there is a subtle but very important difference. With this definition, it is the dependent nature of the relationship between markets that is key; not just the correlation in their movements. The definition requires that we understand the structure of the relationship between the markets and not only look at their co-movements, in order to be able to say there is a dependent relationship. However in order to realise the full analytical power that is inherent in this definition, it is necessary that we alter it slightly. Fratzsher speaks of 'world market shocks', we will replace this with 'shocks to a primary market'.

Our new definition will therefore define market integration as:

> "Market *i is more integrated the stronger the domestic returns*$_{ri,t}$ *depend on the contemporaneous shocks to a different primary market*".

The word 'Primary', in this sense, is the market from which the shocks that impact the domestic market, originate. This modification will highlight the second difference of this model from pure correlation based models. With this modification we now not only consider shocks from the primary market, we will also consider the *source of shocks to* those markets. Instead of looking only at co-movement between markets as some measures of integration do, or speculating on the validity of expectation of price convergence across markets, we can look at what is causing the shocks as driving the co-movement between markets and how these shocks are being transmitted in order to result in co-movements (due to the first part of the definition). This new definition allows us to look at integration from several very important viewpoints. It allows us to look at:

i) a wide range of possible sources of the shocks on a world market
ii) the channels of transmission of the shocks between markets.

This definition is also more general, allowing us to look at two-way relationships of integration.

In looking at the sources and channels of transmission of the shocks, we can begin to look at market integration as a multifaceted phenomenon. We can begin to get insights into whether the channels through which integration happen vary with time, for example, and whether their efficacy varies with the nature of the shock; which may lead to the time varying nature of integration that has been observed in the literature by, for example, Bakeart and Harvey (1995) in their seminal paper on time-varying market integration.
This proposed definition gives us a much richer toolset with which to begin to understand market integration and its possible multifaceted nature. Therefore, the aim of this research is to explore several of these possible facets of market integration in our effort to build a holistic picture of the mechanisms through which market integration operate.

### 1.2.2 Clarification of terminology - Measures of Integration vs Contributors to Integration

The other contribution made by this study is in distinguishing between concept and measurement: this study clarifies an area that is opaque in the literature; i.e., the distinction between measures or indicators of integration and variables that contributes to or make up constituents of integration. The literature is unclear between which concepts are merely measures of integration versus which are contributors to integration. This lack of clarity may in part be due to the lack of definition. By firstly defining integration, this study makes it possible to then differentiate measures of integration, from the actual elements that form part of integration. For example, institutional and behavioural variables have sometimes been referred to as measures of integration (Rigobon 1999; Rajan et al. 2006) and other times referred to as Integration (Bekaert and Harvey, 2000).

The second possible reason for the confusion between component or elements of integration and measures of integration is the lack of a coherent framework for integration. This study tests the relationships between the components and integration, which contributes towards establishing whether a concept is a measure of or a contributor to integration. If the tested relationships show a variable contributes to integration, it will be taken as an indication that the variable is not just a measure of integration but, in fact, contributes to integration. It is in this area that the study makes the third contribution to the literature, namely the provision of a framework that will link all the key concepts that comprise integration and shows how the different elements relate to each other to influence Integration.

### 1.2.3 Conceptual Framework for Integration

As mentioned previously, Rajan et al. (2006) provide a taxonomic structure of concepts and measures of integration, but they do not provide a model or framework for integration, as their treatment does not relate the different factors to each nor does it show how they lead or contribute to integration. In fact, as stated above, they do not differentiate between drivers of and contributors to integration, components of integration and measures of integration. Other authors such as Ip Wing et al. (2010) also exhibited the same problem. This study proposes a model of integration that incorporates the factors identified by Rajan et al.(2006); Berkel (2004); Nishiotis (2004); Phylaktis and Ravazzolo (2002); Rigobon (1999); Taskin and Muradoglu (2003); etc. as either being measures of or factors driving integration, and combines them into a conceptual model of integration shown, as in Figure 2 below.

Figure 1: Market Integration Framework Investigated in this Study

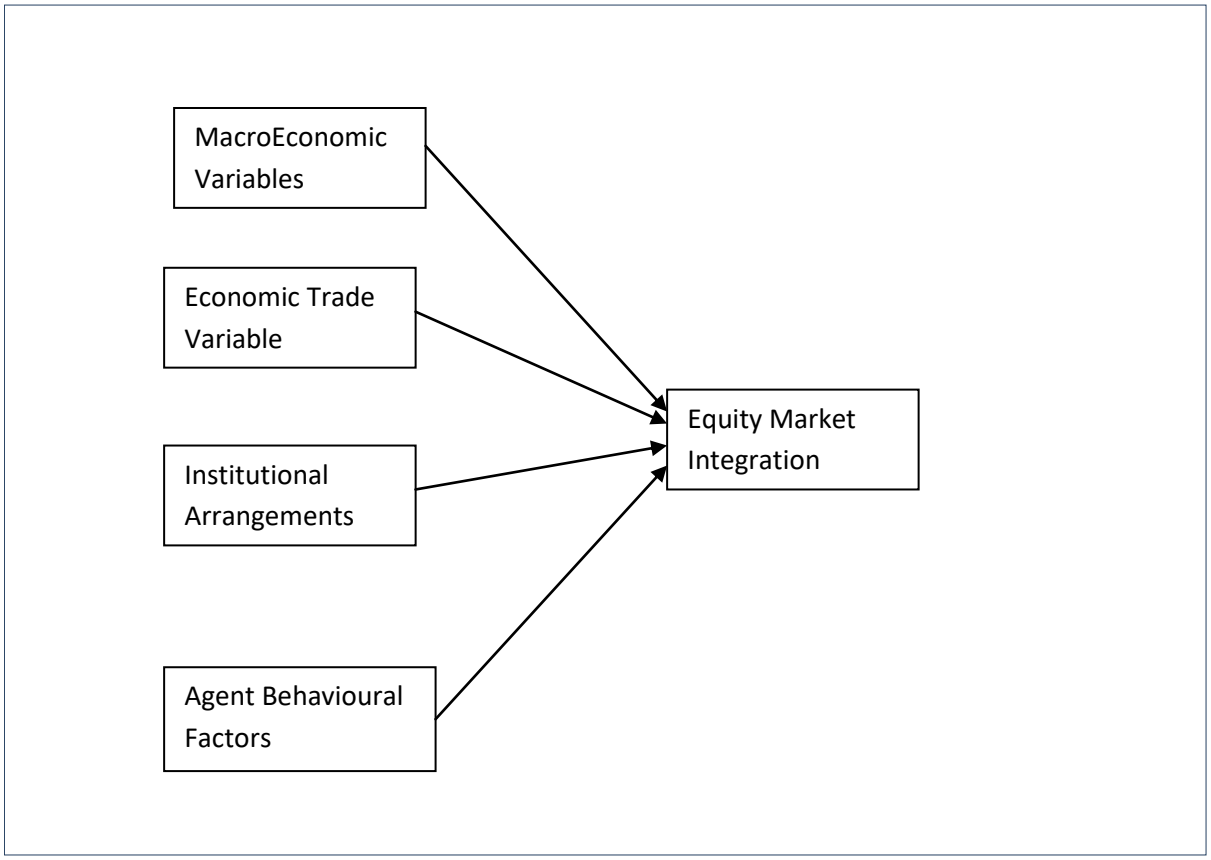



Figure 2 above illustrates the conceptual model that links the components identified in Chapter 2 into a conceptual framework that proposes how these components might contribute to integration. The framework takes the disparate ideas and combines them and their respective roles in conceptualizing integration more comprehensively than had been the case. In Figure 2, the process of how the different components contribute to integration is a direct process and there is no mediation between the factors; each of the components acts on its own to produce integration directly as opposed to its effects being mediated by another component or two components acting together to produce integration. The framework above does not postulate the extent to which each of the components contributes to integration. Figure 2 illustrates the framework that is inferred from the current body of literature. This study explores and tests this simplistic framework.. The framework will be broken down further to establish these relationships in order to understand how the components interact to drive or contribute to integration.

To uncover the dynamics of the relationship between the components, this study seeks to establish the strength of influence of each of the factors on integration, as well as how these factors evolve over time with the evolving nature of integration as illustrated by Bekeart and Harvey (1995), where they showed the time-varying nature of integration. The final model will therefore show the importance of some factors relative to others, at different times, in influencing integration.

Thus the contribution of this study to the literature is the production of an overall model of integration, which not only provides a global model of market integration but also relates the components to each other, and shows how they produce integration. The literature does not provide analysis of the relationship between factors, but rather each is considered on its own or in a taxonomic structure. This study shows how, or whether at all, the components or factors interact to create integration. It identifies which factors are necessary and which are sufficient for markets to be integrated. The study unpacks, for example, whether institutional factors are necessary for integration to exist via behavioural channels or whether economic linkages are more important.

## 1.3 Problems addressed by the Study:

According to Ip-Wing et al. (2010, p.2875), no formal definition has been agreed on in terms of what constitutes market integration. From the view point of Bracker et al. (1999, p.2), the concept is taken to cover a wide range of issues related to interrelationships between equity markets. The section on the theoretical and conceptual overview discusses these issues in more detail. It is this lack of conceptual structure around what stock market integration is, that is the first point this study seeks to address.

*Benefits of Stock Market Integration*:

There is support in the literature for the benefits of integration between markets. Bekaert and Harvey (2000) in a study of 20 emerging markets, find that integration is associated with economic growth, lower cost of capital, greater liquidity, and improved credit rating, amongst other benefits. Levine and Zervos (1996), in a study of 41 countries over a 23 year period, find a similar result. Marashdeh and Shrestha (2010, p.102) posit that integration presents several benefits: that it creates opportunities for sharing of risk between the integrated markets, "it contributes to financial stability by enhancing competition and efficiency in allocation of resources". Citing research by Tai (2007) on cost of capital in integrated markets, Marashdeh and Shrestha (2010) argue that integration "reduces the cost of capital and price volatility among integrated markets". Lastly, they argue that integration can positively affect total factor productivity and economic growth through the promotion of domestic savings and investment.

*Problems with Stock Market Integration:*

The above mentioned benefits notwithstanding, integration is noted to pose several problems as well. These problems are the secondary focal point that this study addresses.

*The First* and most fundamental problem is, as mentioned above, the lack of conceptual framework of what integration actually is and how it operates. We will go into more detail on this question in the discussion on the theoretical literature around integration in a later section of this study.

*The second problem* with integration is that integration entails faster transmission of financial instability between markets, "shocks that impact on one equity market may potentially spread to others more rapidly when the markets are more integrated" (Ip-Wing et al. 2010, p.2875). This was clearly demonstrated in the New York stock market crash of 1987, the Asian Crisis of 1997, the Russian crisis of 1999 and the latest global financial crisis of 2007/8. Integration can therefore

increase systemic instability. Other authors have also highlighted this risk of integration (Knight 1998; Raj and Dhal 2008; Agnor 2001). A sound conceptual framework of what integration is and the extent and degree of market integration are therefore important, not only to market participants who have to anticipate the impact of integration on the volatility risks of their assets but also to policy makers who are concerned with stability of the financial system.

Stock market integration has an impact on the pricing of asset risk. International versions of the CAPM (the multifactor CAPM or ICAPM which is an adaptation of the CAPM developed by Sharpe (1964) and the Arbitrage Pricing Theory developed by Ross (1976)4, and later adapted to an international version, assume that markets are integrated, without really providing a clear framework of what integration is, except to say that it is, in principle, when the "Law of One Price" applies (we will discuss this law later in this study)). Therefore, in the pricing of assets in the African markets it would be incorrect to use any version of the ICAPM or an international version of APT, if the markets are not integrated.

Whether one is looking at asset returns using domestic or international versions of the CAPM or Arbitrage Pricing Theory, integration is an important consideration. Models of the ICAPM and APT that allow for partial integration/segmentation exist, but the challenges with these models, in the context of the current discussion still remain: i.e., a lack of conceptual clarity on the mechanism for integration. Karolyi and Stulz (2003) show that pricing assets by only considering local conditions when, in fact, those assets are correlated to the world portfolio, results in under-pricing of these assets. Thus pricing of assets in the chosen markets may be affected in a negative or positive way by the integration of markets with each other and/or global markets.

Yet another problem with integration between markets lies in the impact of integration on portfolios. Grubel (1968) building on the portfolio theory developed by Markowitz (1952), shows that international diversification yields higher returns due to uncorrelated assets price movements. Portfolio managers, in particular, of unit trust funds often invest in foreign stock markets as a way of diversifying their portfolios. If however they buy assets in a market that is integrated with their own, they may have at best not reduced the risk profile of the portfolio or at worst have increased it. As there is a growing trend towards investment in emerging markets, it is important from a portfolio management point of view to understand if and how the markets in the chosen countries are integrated with each other and with the global market.

The question of the nature of stock market integration is therefore an important one because integration can lead to better developed markets which can lead to lower costs of capital, improved credit rating and ultimately, over the long term, improved economic growth for African countries. Conversely, stock market integration also carries significant risks for investors and financial stability. An understanding of the mechanism and degrees of integration can help African and global investors

4 Versions of the asset pricing models that relate to international returns have been proposed by Harris et al.(2003) based on the work of Solnik (1986), who developed an International version of the APT and Sercu (1980), amongst others. The Merton (1973) multifactor Intertemporal CAPM has also been used in an international context.

improve their returns from African assets. It can also aid African policy makers in driving the integration of their markets more effectively.

## 1.4 Purpose of the study:

The objective of this study is twofold:

i) To establish a framework that will adequately explain how stock market integration operates, and

ii) to use this framework to analyse the nature and extent of integration of the selected African, Asian and Latin American countries' stock markets with each other and with the global market.

Four African markets are included in the study: Egypt, Nigeria, Morocco and South Africa, four European markets namely, the UK, France, Germany and Spain, three South American markets of Argentina, Brazil and Mexico and two Asian markets, namely Japan and Hong Kong are considered in the study. Their integration with the key global market, represented by the North American market (New York Stock Exchange) is investigated.

Flowing from these key objectives, this study aims to answer the following pertinent questions:

i) Which factors drive or significantly influence stock market integration?

ii) How does stock market integration change over time and what drives those changes?

iii) Which factors driver integration of the selected African, Asian, European and Latin American stock markets?

## 1.5 Hypotheses to be tested

Guided by the imperatives from the foregoing, this study tests several hypotheses regarding the mechanism of stock market integration. We primarily hypothesise that market integration is a multifaceted concept and, as such, we seek to test whether in fact there is evidence of the different facets and their interaction. We operationalise market integration as instantaneous feedback between markets as outlined in Geweke (1982). As early broached, one of the other key hypotheses tested in this study is that the factors driving market integration interact with each other, thus the interactions of the variables are one of the features tested in each of the hypotheses outlined below. The hypotheses that this study tests are more specifically as follows:

1. In the first hypothesis we test whether market integration is driven directly by the variables that are hypothesised to work together or individually as part of the mechanism driving integration. To this effect therefore our first hypothesis that we test is:

   *Is market integration driven directly by the different variables, namely macro-economic variables, institutional arrangements and behavioural factors?*

2. The second hypothesis tests whether the macroeconomic variables affect integration indirectly through each other or through institutional arrangements:
    a. Does GDP[5] affect integration indirectly through institutional arrangements?
    b. Does GDP affect integration indirectly through another macro-economic variable?
    c. *Does Trade as a macro-economic variable affect integration indirectly through GDP and institutional arrangements?*
    d. *Do GDP and institutional arrangements affect integration indirectly through Trade?*
3. The third hypothesis tests whether institutional arrangements (capital account openness) are the primary driver of market integration, meaning that the macro-economic variables act on integration indirectly through the institutional arrangements.

4. Lastly we test whether the behaviour of economic agents in the markets is a facet of integration. In other words,

    *Do behavioural biases drive integration?*

Having established the applicable facets of market integration, integration of the African markets in the sample with global markets, is evaluated, based on the construct of market integration that emerges.

## 1.6 Contribution of the Study to the Literature

To recall briefly, this study investigates two issues. The first is the mechanism for stock market integration, in order to be able to build a coherent framework for analysing integration. The second is based on the emergent framework, the type and extent of integration of the selected countries' markets.

It is clear from the theoretical literature that the concept of stock market integration is currently very loosely conceptualised and incorporates many aspects and, in some aspects, appears as two diametrically opposed concepts; for example, consider Rigobbon's (1999) work regarding the crisis versus non-crisis driven models of contagion. I am not aware of a framework in the literature that integrates the perspectives around stock market integration into one cohesive model that enables one to undertake an analysis of integration both in space and over time. This is the intended purpose of the study.

I investigate a conceptual framework of stock market integration that looks at integration as a multidimensional continuum. The one end consists of informational integration as envisaged by the EMH or behavioural finance theories (e.g., Shiller, 1995); and the other end consists of institutional integration as envisaged by Taskin and Muradoglu (2003), and all other forms in-between, as postulated by Riggon (1991, 2001) and others. The framework also takes into account the time-varying nature of integration, recognizing that the stock market integration is more complex than simple spatial models would suggest.

The addition of the temporal component makes the concept of integration multidimensional, in which case the proposed multidimensional framework for conceptualising integration is able to

[5] From this point onward, the term GDP in the study refers to the GDP growth rate

provide a better understanding of the phenomenon. I investigate whether in fact the integration mechanism does not change over time across markets depending on macroeconomic conditions. For example, highly formally integrated markets have been shown to deviate in price at certain times and behave as though they are segmented (Lamont and Thaler, 2003). Whereas markets that have no formal linkage have, at other times, displayed co-movement as though they were formally linked as is the case with market contagion.

I therefore investigate whether stock market integration is a time-dependent, multidimensional construct, such that markets that may not seem to be integrated on one dimension may in fact be integrated on another, or at a different time and vice versa. Most studies that have looked at time-dependence of integration have looked at regime switching only once, I propose to see if regime switches occur more than once, implying that markets may be integrated at one point and not at another only to become integrated again at some later point in time.

The study makes the following contributions to the literature:

i) Provides a holistic framework for analysing stock market integration that makes it possible to understand the type and degree of integration of markets, with a special focus on emerging markets
ii) Provides insights into the time-dependent nature of integration based on the emergent framework
iii) Adds to the risk pricing literature for emerging market securities by allowing for the effects of integration to be appropriately taken into account in pricing of emerging market securities, particularly securities from the selected countries.
iv) Adds to the empirical literature on market integration by locating the selected emerging markets clearly within a financial integration context, by extent and mechanism of integration.

## 1.7 Outline of the Study

The preceding sections of this chapter have provided an introduction to the concept of stock market integration as well as some background to its contextual relevance, both academically and for investment practitioners and policy makers. Chapter 2 provides a review of the literature in the field of stock market integration. Chapter 3 outlines the methodology used in the study to address the relationships that are hypothesised in the preceding chapter. In chapter 4 we discuss the results of the analysis of the various relationships between integration and the variables in question for the different sample countries. The final chapter, chapter 5, provides the conclusion of the study as well as provides possible opportunities for further research that arise from this study. Appendixes A provide the detailed discussion of the analysis of each of the postulated hypotheses.

# Chapter 2: Literature Review

## 2.1 Theoretical Overview of Stock Market Integration

Integration has been approached from two perspectives in the literature. The dominant focus has been on the empirical assessment of integration. The theoretical underpinnings of integration has however not enjoyed as much focus in the literature; some authors have for example argued that if the premise that assumptions of APT hold, then the existence of integration can then be assessed from there (Korajczyk, 1995). This study aims to fill this gap in the literature by analysing the mechanism that underpins stock market integration and thus a coherent framework for understanding integration based on this mechanism.

Ip-Wing et al. (2010), derive two theoretical approaches from the literature in the conceptualisation of stock market integration. The one set of approaches they refer to as "price based approaches" built on the concept of 'Law of Once Price', derived from the work of Augustine Cournot. The other set of approaches they classify as "quantity based approaches", are based on models such as Feldstein and Horioka (1980), which focus on capital mobility. The Law of One Price concept is elaborated on below, and then follows discussions on the capital mobility approach.

Emiris (2002, *p.200*) describes capital market integration based on the Law of One Price thus:

> *"…If markets are completely integrated, assets possessing the same risk characteristics will have the same price even if they are traded on different markets. In completely integrated capital markets, investors face common and country-specific or idiosyncratic risk, but price (identically in all markets) only common risk factors, because country-specific risk is fully diversifiable. When markets are partially integrated, investors face both common and idiosyncratic risks and price them both. If markets are completely segmented, investors face and price only country-specific sources of risk. In this case, the same projects in two countries can have different expected returns, since the sources of risk and their prices may differ across markets".*

Emiris's description neatly describes the so-called "Law of One Price", i.e., the same goods in different markets should sell at the same price otherwise arbitrageurs will step in and exploit the price difference, given frictionless transactions.

Raj and Dhal (2008), supporting the price based approaches, argue that the theoretical literature on financial market integration is based on the pricing of risk across markets and if the risk attracts the same price in different markets then that is what will drive integration and its associated benefits. The ICAPM is an example of one such scenario where markets are seen as integrated and therefore risks are evaluated irrespective of local conditions, but purely based on their prospective return. Kato et al. (1991) confirm the application of this Law in empirical studies. However Lamont and Thaler (2003) in their paper on violation of the Law of One Price in markets where there is cross-listing of assets, demonstrate that the Law does not hold in all markets all the time and pricing discrepancies are in fact not arbitraged away.

It is clear however that for the Law of One Price to apply, the markets would need to be institutionally integrated, meaning they would have to allow cross-listings and other formal institutional arrangements between different markets such un-hindered cross-border access. This implies that there needs to be a more underlying institutional structure to markets for the 'pricing approaches' to integration to apply. There needs to be a structure or system that enables an asset to be accessed from different markets so that it can be priced in those different markets.

Taskin and Muradoglu (2003, p529) argue that it is capital market liberalisation that "transforms segmented stock markets into integrated ones". They argue that the purpose of liberalisation is to open the local economy to the world and thereby integrate it with the world. Thus capital market liberalisation, according to them, is the process that drives integration. This process will create the institutional structure for the Law of One Price to apply, by allowing free capital mobility.

However the Home Bias puzzle highlights the complexity of market integration. In the context of Home Bias, investors seem to prefer to invest in 'home' equities, even given the benefits of diversification. The home bias phenomenon was discovered by French and Poterba(1991), where they looked at the equity ownership in 5 developed markets and found that over 90% of all equities were held domestically (French and Poterba 1991; Tesar and Werner 1995). This phenomenon is interesting from a stock market integration point of view because it implies that even when markets are liberalised, it may not yield integration with other markets, as foreigners prefer to invest in their own markets.

Yet despite the Home Bias phenomenon, markets have tended to move together showing that there is some form of underlying integration (Büttner and Hayo 2011; Erb et al. 1994; Ip-Wing et al. 2010; Bakeart and Harvey 1995). This means that markets may not move together because of high cross-border holdings of assets between countries or liberalised markets encouraging extensive cross-border investment, but rather due to other factors such as information shocks and contagion. Taskin and Muradoglu (2003) show that the information content of world stock returns influenced emerging market stock returns prior to capital market liberalisation. Thus, the role of information in integration comes to the fore. The upshot is that stock market integration is more complex than what is implied by the international asset pricing models.

Shiller (1995) suggests that the herding effect due to shared information creates a form of informational integration. Shiller highlights the fact that market participants all share access to the same information and therefore are likely to be influenced to act on the information, particularly if the information is of a market crash, for example. The Efficient Market Hypothesis (EMH), the workhorse of capital markets theories, is also based on the role of information in asset prices.
Fundamentally the EMH proposes that markets are basically driven by information to varying degrees and Hanousek and Filer (2000) show that the Czech stock market which was found in their study to be efficient was integrated with the German market, but not the American markets. The role of information therefore in market integration is supported by the EMH. A form of integration based on information flows can be said to occur in the case of contagion.

Billio and Pelizzon (2003, p. 407-408) highlight that there is no agreed definition of contagion but rather that there are definitions with varying degrees of restriction. The most general definitions conceptualise contagion as the process by which shocks are transmitted across markets in different

countries, both in tranquil and tumultuous periods. The narrower definitions see contagion as the propagation of shocks between countries in excess of what can be justified considering the countries' fundamentals and the extent and type of co-movements of markets that arise due to the shocks. The narrowest definitions consider contagion to be a change in the shock transmission mechanism during times of turmoil in the markets, with contagion being evidenced by increased correlation between assets of these different countries. Regardless of which set of definitions one subscribes to, contagion has been viewed as a form of integration of markets in other studies (King and Wadhwani, 1989).

Rigobbon (1999) argues that contagion is in fact a misinterpretation of co-movement. He therefore proposes analysing this type of integration from the perspective of propagation of shocks between markets. He highlights the two dominant thinking around this propagation, what he calls the crisis-dependent models and the non-crisis dependent models (Rigobbon, 1999). The crisis dependent models incorporate ideas such as contagion, where integration comes about due to some form of crisis in one market and which spreads to other markets, likely through the herding effects as described by Shiller (1995). In a study of contagion across twenty countries, Eichengreen et al. (1996) find, that contagion appears to spread more easily to countries which are closely tied by international trade linkages than to countries in similar macroeconomic circumstances. The non-crisis dependent models include more stable institutional arrangements, such as market liberalisation.

## 2.2 Literature Review Overview

This literature review looks primarily at the seminal articles in the area of stock market integration and looks at articles that develop central themes or ideas emerging from the seminal articles. There is a vast body of literature on the topic and therefore a decision of what to include or exclude had to be made and thus the coverage of the articles were organised based on key themes in the evolution of the study of stock market integration.

The objective of this literature review is to provide an overview of how stock market integration has been dealt with in the literature and what key conceptual themes have emerged around this concept. The review also intends to uncover whether there is a theoretical framework of stock market integration provided in the literature that. The theoretical framework would link key concepts and provide an integrated view of stock market integration, what its drivers are, how it comes about and how it operates.

This review is broken down into two sections. The first section provides an overview of stock market integration as a concept and how it has evolved over time. The section identifies key conceptual themes that are expanded upon in the second section. The second section deals with the key themes emerging from the literature over time, on a theme by theme basis. The section evaluates whether the treatment happens in the context of building a comprehensive theoretical framework for stock market integration. This is the benchmark against which all the literature on a key theme is evaluated in the final analysis.

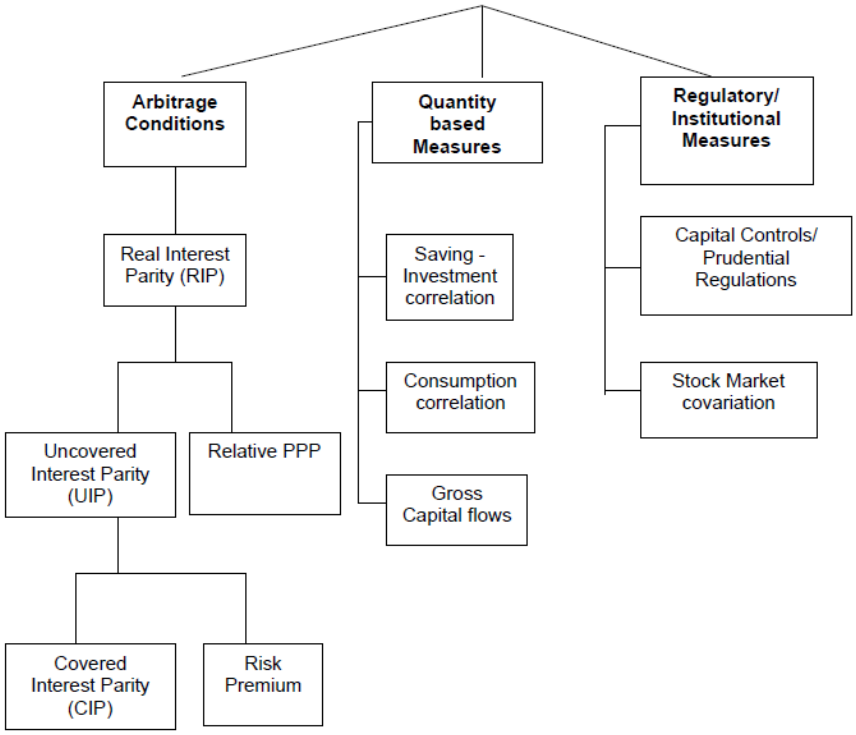
Whilst the development of some of the ideas on stock market integration does not follow a neat chronological pattern, an attempt is made to contextualise the developments in some chronology. I believe this approach is useful in clarifying how or why some ideas become important in the study of market integration.

## 2.3 Section I: Background to Stock Market Integration in the Literature

In the literature, stock market integration has been treated as a concept that covers several areas of linkages between markets (Bracker et al. 1999). Much of the literature has focused on measurement of integration, without really providing a conceptual framework for it. There has therefore been a great reliance on an empirical approach to understanding stock market integration, which points starkly to a lack of theoretical conceptualisation. This is evidenced by the fact that in the literature, the empirical approaches have only provided a shopping list of ways to measure integration, without providing an underlying theoretical framework that links the different measurement approaches.

As indicated above from Bracker et al. (1999), there is no consensus on the definition of what market integration is, a view echoed by Ip-Wing et al. (2010). There is however, some convergence on the categories of measurements of integration. Ip-Wing et al. (2010, p.2876) propose two broad categories of measures for integration, what they term i) price and ii) quantity related measures. Price related measures are focused on the pricing of risk and equating of returns for comparable assets in different markets. Quantity measures focus on the free flow of capital between countries. Other authors have proposed different or additional sets of measures. Rajan et al. (2006, p.44) for example, provide three categories of integration measurement which they classify as price based, arbitrage based and regulatory or institution based measures. These categories are illustrated and broken down in Figure 1 below.

Figure 2: Categories of Stock Market Integration Measures (Rajan et al., 2006)




The *price based* measures proposed by Ip-Wing et al. are incorporated into the arbitrage based approaches of Rajan et al. The arbitrage measures are premised on the operation of the 'Law of One Price'. The theoretical underpinning of the Law says in integrated markets, investors will arbitrage away any mispricing of goods or assets between markets (countries). When applied, the stock markets, according to the Law, risky assets should be priced the same if they carry the same risk, regardless of which country the assets are traded. If they are not priced the same, traders will buy the assets in the market where the price is low and sell them at a profit in another market where the same assets enjoy a higher price. The net effect of this process will be to arbitrage away the price differences, resulting in the one price (expressed in the same currency) applying for the same assets across markets.

*Quantity based* measures look at the flow of capital between countries. The central premise being the more freely capital flows in search of the best return, the more integrated the markets can be deemed to be. These measures therefore look at the extent to which there is a free flow of investment capital between countries. The assumption being that the greater the amount of investment capital flowing, the greater the integration between the market is assumed to be. The institutional measures to some extent mirror the quantity measures. The quantity based measures focus on the barriers to the free flow of investment capital. These measures look at the institutional arrangements that either support or restrict foreign investment in markets.

Thus the less restrictions there are, the more integrated the markets are assumed to be, the more correlated their asset prices will be. Regulatory based measures in the Rajan et al. framework have two facets, on the one hand are the institutional arrangements that control the behaviour of

investors. On the other hand are the correlations of market returns across different markets (countries).

Other authors such as Baele et al. (2004) do not agree entirely with the categorisation of integration measures as outlined by Rajan et al., in particular the last category. They propose three categories also consisting of price based measures and quantity based measures, but as a third category they propose news based measures. These measures would reflect the way that markets react to the arrival of news. This measure however, can be taken to be subsumed under the stock market co-variation measure of Rajan et al., as integrated markets would react to the arrival of news by moving together in correlation, whereas segmented markets would only respond to releases of local potentially market moving news. The focus on reaction to news however brings an additional angle into the discourse on market integration; that is the role of information in relation to the behaviour of the economic agents in the market. None of the measures discussed so far, explicitly deal with how the economic agents process information in financial markets and how as a consequence markets react. Beale et al. therefore make a crucial contribution to the discourse about market integration.

The preceding discussion serves to highlight the point made earlier about the lack of conceptual clarity about stock market integration, a situation which results in market integration sometimes being confused with contagion. This is clearly illustrated in the editorial article by Bailey and Choi (2003), where the authors refer to a need for a theoretical framework of stock market integration but then go on to refer to a framework for contagion (Bailey and Choi 2003, p.400). The authors propose that Kordes and Pritsker (2002) provide such a theoretical framework. The work by Kordes and Pritsker does indeed provide a theoretical framework for considering market linkages but only as they relate to contagion, which, using the Rajan et al. classification is one of the subsets of market integration. Contagion has been defined as a switch in the regime governing linkages of markets to each other by Rigobon (1999). What all these definitions have in common however is that they relate to the correlation in the movement of markets, a theme subsumed in Rajan et al. measurement classification under institutional measures of integration. Contagion therefore can be regarded as a measure of stock market integration according to this framework.

Rigobon (1999) provides a theoretical survey of various theoretical explanations for contagion, looking at so called crisis contingent models and non-crisis contingent models of propagation of shocks in international markets. The crisis contingent models propose that market linkages arise during crises, whereas non-crisis contingent models posit that the market linkages are more enduring and pre-date the crises and continue to exist beyond the crisis. However, the models referred to by Rigobon only address themselves to contagion, instead of a broader concept of market integration. There is still a gap therefore in the literature for a comprehensive theoretical framework of stock market integration and how it relates to market crises.

To understand how the discourse on integration may have arrived at the current state, it is useful to look at the evolution of the concept of stock market integration. The importance of market integration has its roots in the concepts of portfolio diversification. Portfolio diversification to reduce the risk of holding financial assets whilst at the same time improving returns was the central tenent of portfolio theory as proposed by Markowitz (1952) and Tobin (1958), with Markowitz

looking at diversification of stock holdings and Tobin looking at diversification of bond holdings. The two authors proposed models for diversification of investment risk by holding financial assets with different risk and return variance profiles.

Their papers, however, did not specify the scope of the application of diversification in terms of whether it applied to domestic only or also applied to international financial assets. It is in the application of their basic principles of diversification to assets on international scale, that stock market integration becomes a concern. The issue of whether returns in markets in different countries are correlated or not determines if there are any benefits to be derived from international diversification. It is the works of Grubel (1968) and Lee (1969), that more directly tackled the question of international diversification. Grubel explicitly stipulates that market integration or "*the degree of correlation of returns on domestic and foreign assets*" (Grubel, p. 1301) is a determinant of the extent of international portfolio diversification. Lee investigates the role that interest rates play in the decision to diversify internationally.

Although Grubel states the importance of market integration as a consideration in international diversification, he does not provide a model for understanding how markets may become integrated or segmented in his work, neither does Lee in his. In a later paper, Grubel and Fadner (1971) do provide the outlines of a theory of market segmentation and he attributes segmentation to "business cycles, natural and man-made catastrophes and government policies" as well as exchange rate differentials. He does not, however, flesh out his thoughts into a coherent theory of integration. Critically, implicit in both the work of Lee (1969) and Grubel (1968), is the notion that diversification is important because markets are segmented, Grubel and Fadner (1971). This justifies their views that diversification is a prudent portfolio management strategy to adopt.

That said it has to be observed that, both works, Grubel (1968) and Lee (1969), lead to schools of thought that form the basis in the literature for later thinking of what drives stock market integration. That is, the thinking that is articulated by Rajan et al., Beale et al. and Ip-Wing et al, amongst others. Grubel (1968) assumes an environment of open trade between countries and these thoughts on free trade, reflect discussions on free capital flows as a factor in integration. Black (1974) picked up on this concept in his seminal paper on the impact of capital flow restrictions on market integration. We discuss other authors who followed this line of investigation later in this report. Grubel also refers to capital flows and levels of savings and investment opportunities being key determinants of international diversification, the line of thought which arguably later becomes the quantity approach to market integration measurement.

Grubel's idea of the co-movement of markets as a determinant in diversification evolves into correlation approach to measuring market integration. Lee's thoughts on interest rates, the interest parity and market integration, become the foundation on which the arbitrage based measures of market integration are built, which measures are popularly implemented as the asset pricing model based approaches to measuring integration.

At their root, the asset pricing models of integration are based on the work by Sharpe (1964) and Lintner (1965), and later Ross (1976), who looked at asset pricing in the context of Markowitz and Tobin's portfolio theories.

In the theoretical vacuum left by Grubel and Lee's work, in terms of a comprehensive model of what leads to market integration and how integration works, several theories have been advanced as to what might lead markets to become integrated following on the different strands outlined in the preceding discussion. However, as can be seen from the discussion, a problem has emerged in the literature. There is a fragmented approach to looking at stock market integration. Various authors picked on the themes that were raised in the seminal papers by Grubel (1968) and Lee (1969) and pursued them separately, thus leading to fragmented understanding of what stock market integration is and how it occurs.

Some authors look at what may be possible causes or drivers of market integration, attributable to national savings and financial asset holdings (Feldstein and Horioka 1980), others look at requisite conditions for integration such as reduction or elimination of limitations on capital flows (Black, 1974), and other authors (Frankel and Rose 1996; Chen and Zhang 1997; Forbes and Chinn 2004; Chambert and Gibson 2008), look at measurement of integration, measuring market returns correlations and the impact of movements in economic variables.

These various approaches come about due to the absence of a holistic theoretical framework. There is no framework that identifies what the drivers of market integration are, as opposed to what are necessary conditions and what factors are simply tools for the measurement of integration. This is the contribution that this research seeks to make, to provide such a framework.

In section II of this chapter we present an overview of the literature on stock market integration along the disparate conceptual themes outlined above, namely i) the asset pricing model approaches, ii) the institutional approaches, iii) the quantity approaches, iv) the behavioural or correlation approaches and an approach not often grouped with the preceding approaches, namely iv) an approach based on economic drivers.

## 2.4 Section II: Stock Market Integration Assessment Approaches

### 2.4.1 Asset Pricing Model Based Approaches

Solnik (1974) departs from the approach to asset pricing approach used until then, of assuming fragmented markets, and proposes an asset pricing model that assumes integrated markets. He builds on the work of Merton (1973) on the Capital Asset Pricing Model first proposed by Sharpe (1964) and Lintner (1965). The Sharpe-Lintner model evaluated the expected return of an asset based on its variance from the risk-free asset return and the overall market return. This model however focused on an instrument in one market. The Merton extension of the model allows for the returns of an asset to be evaluated against several factors, Solnik extends these to include demand for assets in a world market. Solnik therefore assumes fully integrated world markets, which as indicated above, is a departure from the dominant paradigm of the time of assuming segmented markets. Solnik also makes the assumptions of: a perfect market with no frictions or restrictions as well as homogenous price expectations.

Although Solnik's extension of the CAPM to include an integrated world market, takes the thinking about the role of stock market integration in the pricing of assets in a new direction, one of its limitations is that it assumes a constantly integrated market. Sercu (1980) expands on the model and addresses some of the weaknesses of the original Solnik model. Sercu relaxes the covariance assumptions made by Solnik and as a result derives a more general international asset pricing model, thus advancing the application of asset pricing models in the study of integration. The assumption of an integrated market is also adopted by Adler and Dumas (1983), they approach their conceptualisation by using Purchasing Power Parity deviations as a means of assessing asset holding choices of different investors in different countries.

Adler and Dumas, like Solnik before them, also assume perfect markets with no frictions. In an earlier paper Stulz (1981) uses a methodology for estimating whether markets are integrated or not that is advocated by Adler and Dumas, Stulz looks at integration from the perspective of investment as a consumption choice; Adler and Dumas advocate looking at correlations in consumption as a better approach than looking at correlation in stock prices as a means of measuring integration (Adler and Dumas, 1983 p 967). Bakeart (1995) breaks with the practice of assuming integrated markets in applying the asset pricing model. He extends the CAPM as a tool for understanding market integration by doing away with the need for the markets to operate in the dichotomous position of either being completely integrated or not. He proposed a time-varying model of integration, where markets may sometime be integrated and other times not, thus making the CAPM fit data better, as per his findings. Thus Bakeart reveals an important feature of market integration, namely that it is time variant.

The Arbitrage Pricing Theory (APT) for pricing asset proposed by Ross (1976) takes into account more priceable factors than does the original CAPM and as such has also been used as a tool for measuring integration in the so-called International APT. However both models suffer from shared weaknesses in measuring integration. They rely on the Law of One Price as the theoretical architecture that justifies how they approach integration, specifically in that if assets carry the same risks in integrated markets, they should enjoy the same price in these markets. They also do not represent a theory of market integration; they merely purport to measure it.

#### *2.4.1.1 Problems with the Asset Pricing Models*

There are several problems with asset pricing model based approaches to market integration conceptualisation. We shall discuss the most problematic challenges. First of these is the equity home bias, the second is the problem of model specification and the third issue is the fundamental assumption of the validity of the Law of One Price.

*The Equity Home Bias*

The home bias puzzle was identified in studies by French and Poterba (1991) and Tesar and Werner (1995). It is the phenomenon where investors hold a greater proportion of domestic equities in their portfolio than is optimally predicted by a model of well diversified portfolios, in line with the classical

asset pricing models. In other words, the portfolio holdings predicted by the asset pricing models fail to materialise due to the home bias puzzle.

The reason the home bias puzzle is a problem is that it implies that internationally, investors are not making rational investment decisions even though they have similar information. Secondly, given that assets with similar risk profiles should be priced similarly and therefore portfolios should be effectively diversified to tease out priceable risk. Various explanations have been put forward as to why there might be a home bias, from information asymmetry (Bravo-Ortega 2005; Mondria and Wu 2011) to behaviour based explanations such as derivatives of Prospect Theory (Nocetti, 2006) and models based on fear of the unknown (Cao et al. 2007; Kenning et al. 2006).

Armandi (2004) however reports that the home bias phenomenon seems to be declining and provides various possible reasons why this might be the case. Mondria and Wu (2011) also report a declining equity home bias. Other authors however still report home equity bias as a factor in some markets, Daly and Vo (2012) in the Australian market, Ehrlich et al.(2011) in a study of 27 markets also find the phenomenon is still prevalent in these markets, Morse and Shive (2010) in a study of 53 countries also finds equity home bias. Thus the existence of equity home bias remains a problem in the application of asset pricing models as a means of assessing market integration.

*Model Specification*

The second key problem with using asset pricing models to measure or assess market integration is highlighted in a paper by Campbell and Hamao (1992). They pointed out that when using asset pricing models to measure integration, it is not possible to distinguish whether one is evaluating the correctness of the model specification or whether one is testing for integration. To quote Roll "A troublesome aspect of this research is the need to specify an observable benchmark portfolio a priori. The hypothesis of integration may be rejected merely because one has specified an inappropriate benchmark portfolio" (Campbell and Hamao 1992, p.44).

This critique is echoed by other authors such as Bodhura et al. (1989, p. 42) Bonser-Neal et al.(1990, p. 524), and Beale et al. (2004). This problem is key in consideration of the use of asset price based models to test for integration, it fundamentally leaves the researcher uncertain as to what the results of his test for integration are confirming or refuting. Other authors have proposed mechanisms around this problem, however it still remains a challenge. It is exacerbated by probably one of the most serious problems with an asset pricing model based approach to measuring integration, namely the fundamental assumption of the validity of the Law of One Price.

*Law of One Price*

Asset pricing models based approaches to assessing stock market integration are fundamentally based on the assumption of Law of One Price and perfect markets. The assumptions include markets where there are no frictions from transaction costs, capital barriers etc. For asset pricing model based approachs, the Law of One Price, is, however, the core assumption. However as discussed previously, the Law of One Price has been called into question by Lamont and Thaler (2003), in their

paper on violation of the Law of One Price in markets where there is cross-listing of assets, demonstrate that the Law does not hold in all markets all the time and pricing discrepancies are in fact not arbitraged away. Thus if the Law of One Price is not valid then the fundamental basis of asset pricing models for evaluating integration falls apart and the model's usefulness in this context is brought into question.

Other than the problems discussed above with the asset pricing models, the models do not propose a theory for stock market integration; as stated earlier, the purport only to measure it. If the core assumption of the Law of One Price does not hold, then these approaches model integration without an explicit theory of integration whatsoever. Asset pricing based approaches do not propose a structural theory on which we can build to find a comprehensive theoretical framework of integration. Due to these challenges to the asset pricing based approaches to market integration I do not use the asset pricing approaches in our development of a theoretical framework of stock market integration.

### 2.4.2 Institutional Arrangements Based Approaches

The next set of approaches to determining market integration that we consider is the institutional arrangements based approach. It was Black (1974) who argued that restrictions on the ownership of foreign assets could lead to segmented markets. The imposition of investment restrictions can take two forms: formal restrictions which are legally mandated by a country's government and informal restrictions which arise due to information asymmetries, transaction costs, differences in accounting standards, etc. (Claessens and Rhee, 1994). Using taxes as a proxy for a variety of international investment barriers, Black (1974) argued that the imposition of these taxes or any other form of investment barriers, would have the effect of causing investors' portfolios to be overweight on domestic assets and deviate from the optimal asset holdings predicted by asset pricing theory. Some of the papers' assumptions were criticised as leading to unrealistic outcomes such as excessive short positions being held by investors due to investment restrictions.

Stulz (1981) proposed a less extreme model of investment restriction that nevertheless leads to a greater degree of market segmentation. Although Stulz's model assumes perfect markets where the law of one price holds (the weakness of these assumptions has already been discussed), the paper does point to the significance of institutional arrangements for market integration. Although the two models, that is Black and Stulz models differ in terms of their application relative to foreign holdings, with Black's model applying to net holdings and Stulz' applying to absolute holdings, they both show that barriers to investment can lead to market segmentation.

The market segmenting effects of investment restrictions are verified by Heitala (1989) in their study of the segmentation of the Finnish market due to investment restrictions. Heitala investigates legally based investment restriction and shows that the imposition of legal investments constraints results in shares that are subject to the restrictions trading at different prices. For foreigners who are allowed to trade the shares, the shares trade at a discount whereas for domestic investors the shares trade at a premium. This is because domestic investors require compensation for not being

able to diversify their risk internationally due to the outward investment restrictions. Bonser-Neal et al. (1990) use the prices of close-ended country funds relative to the prices of the underlying assets to test for the impact of legal restrictions on market integration. They arrive at the same conclusion, that formal investment restrictions segment markets.

Bonser-Neal et al. get around the weaknesses of the asset pricing model approach by using close-ended funds to assess the impact of investment restrictions on integration. These funds can capture the effect of investment restrictions without relying on an asset price modelling. The Bonser-Neal et al. approach works on the basis that close-ended funds are funds that hold assets in foreign markets, but trade as instruments in their own right in the fund's home market. The fund's price should therefore reflect the underlying value of the overseas assets held by the fund. The effect is to capture any price differences that may arise in the valuation of the fund whose value should be the sum of the underlying assets. In cases of investment restrictions in the host market, the funds will reflect the premium or discount on the fund's price as a result of the restrictions. Bonser-Neal et al. also use changes in legal restriction regimes to test for the effectiveness of restrictions, something which is more difficult to do in asset pricing based approaches. Their research supports the view that investments restrictions have the impact of segmenting markets.

This finding by Bonser-Neal et al. (1990) is also supported by Claessens and Rhee (1994) who in a study of 20 emerging markets find that legal investment restrictions do indeed raise the domestic price of equities and lead to a segmented market. Claessens and Rhee show that reducing investment restrictions will have the effect of reducing the risk premium placed on restricted stocks by local investors and increases access to the domestic stocks for foreigners. Claessens and Rhee, like Stulz and Heitala before them, work in the tradition of using CAPM to test for integration. In their context however, because they use the CAPM to show the existence of an asset premium in restricted stocks trading in a domestic market as opposed to using the model to test for integration, they are less subjected to the specification bias challenges to which the ICAPM would be subject. Domowitz et al. (1997) focusing on the Mexican market support the findings that legal investment restrictions segment capital markets. They also find price premiums on restricted shares versus those to which foreigners have free access.

The impact of investment restriction on integration is however not as simple as the above research suggests. Chuhan (1994) surveyed various pension funds and insurance companies in the UK, the US, Germany and Japan, as institutional investors in emerging markets and found that country restrictions of the host countries were not a significant deterrent to investment. This finding would seem to contradict the preceding discussion on the impact of investment restrictions. However this finding rather highlights the fact that investors will find a way around formal investment restrictions (Kaminsky and Schmukler, 2001) and thus any consideration of the impact of investment restrictions has to take into account the effectiveness of those restrictions. Chuhan's study found other factors to be greater hindrances to investment, information asymmetry being one. The Chuhan paper therefore stands in contrast to the prevailing thought in the 1990s regarding the importance of formal financial market barriers.

Following Chuhan's work, increasingly additional research has supported the assertions of the primacy of non-formal restrictions versus formal restrictions. In fact, formal restrictions were found by various authors not to be as significant as first thought. Bekaert and Harvey (1995, p.403) have even asserted that "other markets appear segmented even though foreigners have relatively free access to their capital markets". Kaminsky and Schmukler (2001) find that formal restrictions only have a short term impact on market integration. Kaminsky and Schmukler propose a reason why legal controls may not be as significant as first thought in the literature. They argue that over time; "Legal controls on capital mobility are not always translated into actual restrictions on international capital flows. In country after country, the private sector has found ways of getting around controls." Kaminsky and Schmuckler study the impact of capital controls on market integration over long periods. Previous studies, they argue tended to focus on specific times or events and thus may have yielded a distorted picture. Kaminsky and Schmukler find that indeed over time, legal controls are not important in driving market segmentation.

Formal capital restrictions do not prevent market integration as first hypothesised by Black. Phylaktis and Ravazzolo (2002) provide additional rationale for this result. They argue that economies that share a common business cycle will also have correlated market returns without there necessarily being a flow of funds between the two countries (Phylaktis and Ravazzolo 2002, p 881). They find however that in countries with capital restrictions, markets may be integrated however, when restrictions are relaxed, as was the case with Thailand in 1987, integration increased (Phylaktis and Ravazzolo 2002, p.881). Nishiotis (2004) supports the prominence of indirect investment barriers over direct ones. Similar to Chuhan, Nishiotis cites indirect risks such as liquidity risk and adds political risk, macroeconomic instability, as important deterrents to investment. Nishiotis asserts that indirect barriers can even lead to segmentation in the absence of direct, formal barriers (Nishiotis 2004, p. 614). Adjasi and Biekpe (2006) in a study of 14 African markets found that changes in capital account openness had no effect on integration. Whereas Guesmi et al. (2013) found that capital account openness did impact the integration of the Greek market to the Southern European market.

Using close-ended funds and proxies for liquidity, political and economic stability as the indirect barriers, Nishiotis finds that these factors have a significant influence on market integration in her sample. This is an important finding for our study of segmentation because it indicates that institutional arrangements, in particular, indirect capital flow barriers can act as a channel for market integration. Berkel (2004) supports the finding of the low importance of direct barriers in favour of indirect barriers as important drivers of market segmentation. Berkel asserts that information asymmetries act as a significant barrier, however this view has been contested by other literature.

An interesting case of information asymmetries is that of joint listings. Joint listings do not directly reduce market segmentation, due to the fact that it is generally an individual company that undertakes listings on multiple exchanges, and the individual company's impact on the overall market, both domestic and foreign tends to be small. Joint listings however do play a role in reducing indirect investment barriers by reducing the perceived risk of investing in a given company from a foreign market, in keeping with Merton's (1987) assertion that investors invest in companies they know. Findings on companies that list their ADRs shows that their stocks rise in anticipation of

the listing, Bailey et al. (2006) cite various authors who find similar results in support of the effect for emerging market firms of listing in developed markets. This effects highlights the role of reducing information asymmetries in the reduction of market segmentation. This effect makes clear role of information barriers as an obstacle to investment and possibly market integration.

Bekaert and Harvey (2000) describe financial integration as relating to reduction in barriers to portfolio flows. It is evident from the recent literature that direct barriers to investments are not as prominent a driver of market integration as previously thought. The focus is therefore more on indirect barriers. Bekaert and Harvey's definition highlights the importance of, informal barriers to integration. We shall discuss later a problem with the portfolio flow view of market integration, that is, a view that implies that there can only be market integration if there is a flow of funds between markets. Correlations between markets for example, may not be the result of a flow of funds but may indicate integration. We shall extend on this idea in our discussion of the correlation based approaches to market integration.

Although the literature on indirect barriers provides insight into market integration and the role of institutional arrangements, it does so in isolation from the other factors that may contribute to market integration. Thus the weakness of the studies cited above is that they fail to take into account the role those other factors, together with or in contradiction to indirect investment barriers, may play in driving market integration. They therefore do not provide a holistic structural view of market integration. They do however add significantly towards our effort to construct a holistic theoretical model of market integration. We shall therefore consider indirect barriers such as market liquidity, transparency, political risk and portfolio flows in our framework and assess the structural relationship of these and other indirect barriers to market integration. We shall explore whether they are they causal or secondary to integration. We shall also investigate how they relate to other factors such as economic variables etc.? Answering these questions will help us in building a holistic theoretical model of stock market integration.

### 2.4.3 Quantity Based Approaches

There are two perspectives based on the quantity approach to integration measurement that we shall look at. The first is based on capital flows between countries and the second focuses on the relationship between savings and investments between countries. The preceding discussion on capital flows has already addressed this measure of integration, so we shall turn our attention to the correlation of savings and investment.

**Savings-Investment Correlation**

The theoretical concept underlying this measure of stock market integration is that in a world where capital is fully mobile, countries will not rely on their domestic savings to fund their investments, they will seek out capital from anywhere in the world and conversely investors will not only consider domestic investment opportunities but will look all over the world for the best returns. The net effect of this should be that investment rates should equalise. The relationship between savings and investment in any given country therefore could be an indication of the degree of integration of that

country to a world market, similarly therefore, stock markets would not only attract domestic investors but would attract all investors seeking a good return. Feldstein and Horoika (1980) in their seminal paper on the relationship of savings and investment to capital mobility, found that contrary to what theory would lead one to expect, there was a high retention of savings in OECD countries. The authors found that OECD markets were not integrated in that savings rates and investment rates were highly correlated for the countries under study, meaning that capital was not as mobile as theory predicted; investors were largely deploying savings domestically. Feldstein and Horoika argued that an assessment of relative capital mobility for a country, could be used to assess the integration of that country into a world market, based on the mobility of savings capital of that country. The Feldstein and Horoika approach is associated with what is termed the quantitative measure of market integration.

The Feldstein and Horoika model has been criticised on several fronts. In terms of its econometrics, it has been criticised for endogenity. It has also been criticised for the interpretation of the beta co-efficient in the Feldstein and Horoika regression, given below, as being without a structural basis.

$$(I/Y)_i = a + b(S/Y)_i \quad \text{(1)}$$

The investment and savings rates time series have also been found to be non-stationary or integrated in the first order, that is to say, I(1). This leads to two possible interpretations of the Feldstein and Horoika regression: one which implies restricted capital mobility or a segmented market, the other which can be interpreted to mean open markets with a solvency constraint on countries (Coakley et al., 1999). The model has also been criticised for misspecification bias in that it excludes certain variables which can be expected to have a significant impact on savings rates, such as the public budget deficit which would crowd out savings to varying degrees and thus affect the β coefficient for savings (Apergis and Tsoumas, 2009). The use of time-averaged data has also been criticised as it biases the β coefficient and may lead to an incorrect finding of low capital mobility (ibid). Apergis and Tsoumas cite over 50 studies that show different problems with the econometrics of the Feldstein and Horoika approach.

In terms of its applicability, it has been found not to apply in non-OECD countries and alternative models have been proposed that find high savings rates that are correlated with capital mobility. This finding contradicts Feldstein and Horoika assertion that high savings rates and high local investment are evidence of immobility of capital. As Coakley et al. (1999, p.185) state, quoting another author, ‘‘These results show that the time-series savings-investment correlation is not an informative statistic concerning the degree of international financial integration ‘‘. The Feldstein and Horoika results have been found to relate more to large countries than smaller ones, with larger countries being able to finance their investment from internal savings verus smaller countries which will be forced to seek funding outside of their borders (ibid.).

The latter point has been found to be especially applicable to low income developing countries (LCDs). The Feldstein and Horoika effects have been found by various authors not to hold in developing countries. Several studies looking at a range of developing countries have found that reasons such as foreign aid, the prevalence of the non-traded sector, the degree of openness of

economies and the degree of development of the financial sector or the financial structure of the country are more significant in influencing integration other than Feldstein and Horoika effects. (Apergis and Tsoumas 2009, p67). Bangake and Eggoh (2011) in a study of 37 African countries over a 36 year period, from 1970 to 2006, investigated the Feldstein and Horoika co-efficient and found that capital in these countries was mobile and the Feldstein and Horoika effects did not hold in these countries. Over 20 other studies cited by Apergis and Tsoumas, have found similar results for a range of developing countries.

The quantitative measures of integration have often been referred to in the literature, however the preceding discussion highlights problems with the Feldstein and Horoika based approach to these measures. Other authors have questioned the usefulness of savings and investment rates as measures of integration because they tend to be influenced by many other variables, thus making their value in determining capital mobility and therefore integration limited (Apergis and Tsoumas, 2009, p.71). This renders their use in the study of stock market integration questionable at best and dubious at worst, in particular in a study of emerging markets or developing countries. We therefore will not use the savings and investment related or Feldstein and Horoika based measures in our study nor will we incorporate them into the proposed multidimensional model of stock market integration.

### 2.4.4 Agent Behaviour Based Approaches

I have classified the correlation based approaches with what I term behavioural approaches to understanding market integration. It will become evident in the discussion that follows that looking at the market correlations from an economic agent behaviour point of view can shed some useful light on market integration.

Neurological research by Kenning et al. (2006) which investigated the existence of equity home bias at an individual behavioural level highlights the importance of taking into account the behavioural motivations of market participants or economic agents, and the role of agents' behaviour in market integration. The research looked at individuals who were asked to make a portfolio choice of risky domestic and foreign assets. The individuals were placed in an MRI scanner whilst making the choice. Researchers found that the individual's brain's consistently triggered the section of the brain responsible for processing fear, thus supporting assertions by Cao et al., (2007) and others who propose a model that explores portfolio decision making based on fear of the unknown. This line of investigation decisively puts puts on the agenda the importance of the individual market participant's behaviour in the evolution of market prices and market integration.

To help us understand behavioural approach to market integration, we shall turn to the concept of 'herd behaviour'. Rafaat et al.(2009) provide an interesting chronology of the idea of human beings exhibiting herd behaviour. The idea has a long history stretching from Adam Smith with his notion that people mimic others in certain situations, to Thorsen Veblin advanced the idea that people have an instinct for emulation. Keynes applied the idea to stock market movements and referred to it as 'animal spirits' that move markets. Scharfstein and Stein (1990) show how fund managers exhibit

herd behaviour as a means of reducing risk to their reputation, which is by following the herd they are unlikely to be perceived adversely for underperforming in turbulent markets.

Results of a survey of institutional fund managers, by Shiller and Pound (1986), support the model proposed by Scharfstein and Stein. Bikhchandani et al. (1992) show how this phenomenon can arise. They argue that individuals can in some cases disregard their own information about a given choice, in favour of what others are choosing; they refer to the process as information cascades. Engle et al. (1990), in a study of currency markets, show that information from one market can influence volatility in another market via what they call a meteor shower effect, a form of information cascade, resulting in information spill-over effects. A study by Nikkenen et al. (2006) supports the finding that news in one market has an effect on other markets. Nikkenen et al. investigated the response of developed and emerging markets to release of US economic data releases.

They found that for markets that were integrated, the economic data release had an impact on returns of developed markets and for developing Latin American markets, which had been found to be segmented from the American market, the release of the news had no impact on returns. An earlier study by Chang et al. (2000) also support the importance of economic information in encouraging herding. The authors studied South Asian markets and found herding to be very prevalent in South Korea and Taiwan, particularly around the release of economic information. Cipriani and Guarino (2009) find support for herding behaviour in a laboratory experiment with financial market professionals. A problem with studying herding behaviour has been how individuals process information in a way that may lead to herding. This information is often referred to as private information.

Cipriani and Guarino (2009) devised the experiment to overcome the problem of observing private information in market participants. By controlling which participants had access to which information, they could demonstrate the information cascade effects in the behaviour of their subjects who were acting participants in a simulated market. They found support for the theory of information cascades in their experiment. Importantly, they did not use university students in their study, as other similar studies had done, their subjects were actual financial market professionals such as traders, managers etc. In a previous paper, Cipriani and Guarino (2008) propose a model that shows how herding can lead contagion effects. Their model shows how information cascades in one market can result in spill-overs to other markets, exhibiting the familiar pattern of market contagion. Through this model, Cipriani and Guarino provide an alternative theoretical model for contagion and what might drive it and demonstrate the behavioural dimension of market correlations. There is a substantial body of literature regarding contagion and market integration. From Cipriani and Guarino's 2008 paper that links contagion and herding behaviour, an explicit link between herding behaviour and market integration is created.

Market contagion has been extensively studied in the literature. Most of the literature is based on an assessment of correlations between markets, however this approach has been criticised for containing heteroskadacity in the data, endogeneity and common factor influence, all of which serves to bias models that attempt to estimate contagion. King and Wadhwani (1990) in their seminal paper on contagion, propose a mechanism for contagion where participants in one market attempt to infer information from prices occurring in another market; this fits in very neatly with the

description of herding behaviour and information cascades, where individuals attempt to make decisions based on the actions of others. King and Wadhwani assume that prices contain information that can be gleaned by other market participants, based on the assumptions of rational expectations.

Kahneman and Tversky (1979) have shown however, that individuals do not behave as predicted by Rational Expectations formulations, that is individuals do not factor in only available information in their decisions, instead they exhibit behavioural biases, where some relevant information is disregarded and irrelevant information is used as the basis for decisions, similar to what occurs with information cascades. Thus prices may in fact not contain rational information but may be based on biases, thus any mimicking of the pricing behaviour of one market, may in fact result in pricing distortions as King and Wadhwani observe.

Longin and Solnik (1995) in a study of return correlations of seven mature markets find that correlations between the markets have increased over a 30 year period. Importantly they find that factors such as dividend yields and interest rates, contain information about future volatility; this information however is not contained in past data of returns in these markets. They also find that correlations increase during times of crisis. Other studies have found that volatility spillovers also increase in times of crisis. This finding has an important implication when considered in terms of the Kind and Wadhwani (1990) assertion about investors looking to glean information from other markets in times of crises. The information cascades of Bikhchandani et al.(1992) can explain how these spillovers are driven by investor behaviour and how this behaviour may relate to contagion and market integration.

Forbes and Rigobbon (2002) in their seminal paper on market contagion, propose a definition of contagion that they term shift-contagion. Shift-contagion occurs when the price transmission mechanisms in financial market change as a result of crisis. According to their definition contagion occurs when there is a shift in the price transmission mechanism between markets. They propose an alternative model for contagion. They distinguish between two approaches to contagion, namely the approach that sees market linkages and thus contagion, as a response to a crises and the alternative approach that sees market linkages as a more enduring phenomenon, not driven by crises.

The two approaches are termed crisis contingent and non-crisis contingent theories of market linkages. They test which of these approaches is supported by empirical data. Once they have controlled for econometric problems (heteroscedasticity, endogeneity, and the influence of common factors) of the traditional correlation based models for estimating contagion, they find that there is no support for contagion in the data, as no shift-contagion takes place. There is no change from non-crisis contingent linkages to crisis contingent linkages. They argue that markets show enduring interdependence instead of contagion, meaning that the structure of price transmission between markets remains constant before and after a crisis.

Corsetti et al. (2005) dispute the findings of Forbes and Rigobbon and argue that the methodology adopted by Forbes and Rigobbon is too restrictive and as such rules out contagion in markets where it in fact does occur. Beirne et al. (2009) find evidence of volatility spillovers as well as contagion occurring from mature markets to emerging markets during the 2007/2008 financial crisis.

Behaviourally based assessments of integration seem to provide insight into market dynamics that may be missed by approaches that ignore the role of the behaviour of market participants. One of the weaknesses of behavioural models of markets has been the difficulty in observing private information in order to test the theory. The experiment by Cipriani and Guarino (2008) with market professionals provided a solution to this challenge and confirmed the theory. The observed reactions of markets to releases of news and the subsequent co-movements of markets, in particular during crises, follow predictions of behavioural theories when applied to market participants; for example. Prospect Theory predicts that individuals will tend to overreact to negative news and under-react to positive information or news (Kahneman and *Tversky*, 1979). The information cascades theory shows how this reaction can then be spread to an entire market and information spill-overs show how the reaction can spread between markets. There is therefore enough ground to consider behavioural theories in the assessment of market integration.

There has been very little application in the literature of behavioural measures to the test for integration. This will be one of the contributions of this study. An interesting feature of this approach to integration is that it is not predicated on any flow of funds between markets. The focus on what could be considered behavioural measures has been the literature on contagion. As shown above the behavioural models of contagions provide a tractable approach to looking at contagion and consequently market integration. We shall therefore use these models to help us in constructing a holistic theoretical model of market integration.

Liquidity crisis and margin based models of contagions shall not be considered directly in our analysis. These types of models assume an underlying movement of funds between countries, wherein investors withdraw funds from foreign markets due to liquidity pressures in their own markets during times of crisis or because they have to meet margin calls. The effect of these factors will be imputed into the portfolio flows and these effects will be picked up in our assessment of portfolio flows on market integration.

### 2.4.4 Economic Factors Based Approaches

The last set of perspective that we consider has not often been considered in the literature that seeks to provide a taxonomy of market integration measures. This approach can be considered an economic integration based approach to market integration. The literature on the impact of economic factors on the stock market is numerous. The literature on the impact of economic factors on integration emerged from the literature on the impact of economic variables on stock returns. The relationship between economic activity and stock returns has been found to be robust over a hundred year period and so can be taken as stable feature of markets, Schwert, (1990).

The impact of economic factors on stock returns was articulated by Chen et al. (1986) in their seminal paper where they argued that that any factor that had an impact on dividends, would by implication have an effect on returns. They looked at economic variables as examples of such factors (Chen et al. 1986, p 384). Chen et al. unpack the influence of macroeconomic variables on returns and hypothesised them as resulting from the impact of the economic variables on either cash flows or discount rates. They argue that interest rates, for example, affect the discount rate thereby affecting the stock price. Inflation and output on the other hand, they argued, will affect

cash flows, with inflation affecting the value of the cash flows and output affecting cash flow levels. Although path-breaking, the Chen et al. paper was limited to one market. Chen et al. also do not provide a rationale for why they chose the economic variables that they did.

Bodhurta et al. (1989) improve on Chen et al. by providing a theoretical rationale for the selection of the economic factors. Bodhurta et al. also provided an internatlionalised version of the thinking of Chen et al. and this begins to speak to the link between economic factors and stock market integration. Bodhurta et al. identify the importance of economic factors both in segmented and integrated markets. They argue that in the case of segmented markets, economic factors impact the real variables of partner economies, and then feed through to the financial market. They therefore separate financial and real effects of economic variables (Bodhurta et al. 1989, p22). "In the segmented markets case, domestic stock returns react to international economic news due to international economic interdependence in the real sector.". Bodhurta et al. point to international reserves and trade accounts as important factors in their consideration of integration. They argue that these factors are important pointers to the degree to which an economy is open to external influences in terms of the flow of funds into and out of the economy, thereby tracking the impact of economic variables on stock returns (ibid. p. 24). Kodongo and Ojah (2012) showed how exchange rates can influence integration through the currency risk pricing mechanism, further highlighting the role that macro-economic variables play in market integration. Chen P. (2018) found that greater integration into the world economy led to greater integration of a country's equity markets with the world markets. Ahmed et al. (2017) show that economic fundamentals actually moderated the impacts of volatility spillovers from developed markets to emerging markets.

If through trade a country's firms are earning substantial revenues, this will be reflected in the trade account and will in turn be reflected in the stock market as an increase in export earnings will impact economic growth. Foreign reserves will also reflect how much trade a country is doing with the world, the reserves will also capture the impact of portfolio flows into and out of the country. Bodhurtha et al. show that economic variables can have cross-country influences but they do not elaborate on a theoretical link that may act as channel through which this impact can be driven, other than mentioning the balance of payments as one of economic drivers of asset returns. Bekaert and Harvey (2000, p.161) describe economic integration as relating to the reduction in trade barriers between countries.

*2.4.4.1 Trade Channel*

Although Bodhurtha et al. (1989) showed that economic factors can connect countries, it was Frankel and Rose (1996), who showed that countries with strong bilateral trade ties also exhibited synchronised business cycles. They thus revealed the mechanism through which two economies can be linked and the effect of that link on both economies, namely to synchronise them. Kose and Yi (2005, p.268) citing other authors assert that the literature shows that "pairs of countries that trade more with each other exhibit a higher degree of business cycle co-movement". Baxter and Kouparitsas (2005) in a study of 100 countries support the significance of trade as a channel that synchronises economic cycles of different countries.

Chen and Zhang (1997) extended the finding of connection between trade and economies by looking at the impact of trade ties on the respective countries' stock markets. They found that countries with strong trade ties have markets that are correlated. These findings have been supported by findings from Bracker et al.'s (1999) study of 22 economies and markets. The authors found that economic variables are significantly associated with stock market linkages in the countries that they studied. Importantly, they find that trade is one of the factors that plays a role in economic and stock market linkage. Their findings also support the time varying nature of stock market and economic linkages.

Choe (2001) looked at trade between 10 South Asian countries and found trade to drive economic integration amongst these countries. Following the idea that trade can be a channel for the synchronisation of business cycles, Phylaktis and Ravazzolo (2002, p.881) propose trade not only as a possible channel through which economic integration occurs, but also that it facilitates stock market integration, similar to Chen and Zhang's findings. This finding is also supported by Forbes and Chinn (2004) who, in a study of over 40 countries, find that trade is an important driver of stock market linkages. Findings of the importance of trade for market integration are supported even through the global financial crisis of 2007 by Chambet and Gibson (2008). Abdullah and Mishra (2017) support the importance of trade for integration in their study of the role of trade in the integration of the markets in the Gulf Cooperation Council states in the Gulf region.

There is therefore strong evidence in the literature for the importance of trade in linking economies and in turn linking stock markets. An understanding of integration from a point of view of the fundamental drivers of the integration is important in that it will allow us to unlock the mechanism via which integration may be occurring. We may be able to investigate the causal relationships between fundamental factors and market integration. We may also be able to test how a change in the fundamental economic drivers is likely to translate to an impact on the integration of markets.

The theory of an impact of economic factors on the stock market and of trade on the stock market is not without its detractors. Interestingly Verma and Ozuna (2005) in a study of 4 Latin American markets found no support for the impact of economic variables on the integration of the 4 markets over a ten year period, 1993 to 2003. Kizys and Pierdzioch (2009) in a study of developed markets over the period 1975 to 2004 report similar findings of no impact of economic variables on stock market integration. Early work exploring trade as a transmission channel for example by Canova and DeNicole (1995) and Schmitt-Grohe (1998) produced tentative results. Schmitt-Grohe (1998, p. 284), found that trade alone was not a significant predictor of business cycle synchronisation and that the significance of trade depends on how the data is detrended (Canova and Dellas 1993, p. 42.). Narayan et al. (2014) in a study of Asian markets found that economic variables did influence integration, however trade had a largely negative effect on integration. Chaiporn and Sriyalatha (2016) also found a negative relationship in some markets between trade and integration on a bilateral basis. They instead found that capital flows were a more significant driver of integration. We shall discuss the possible causes and implications of these findings in a later section of this chapter.

*2.4.4.2 Sectoral Channel*

Another perspective that has been proposed as to how markets may be linked by economic factors is the notion that it is not so much broader economic variables that link markets but rather specific sectors of the economy that may be linked across countries. For example, Ciner (2006) argues that linkages that were experienced in the North American Free Trade Agreement (NAFTA) markets in the late 1990s were a result of the boom of the technology sector in the economies forming part of NAFTA and was not market integration in the region as such. Baca et al. (2000) argue that sectoral effects have become more dominant in driving market integration versus country effects, basically supporting the idea that market integration may in fact not be a linkage of macro-economic factors but rather a linkage of sectors in different economies. Their findings were a break from earlier work that found no significant sector effects in stock market integration. Lessard (1976) first put forward the idea that industry sector effects may be an important factor in diversification strategies. He found however that industry factors had very little explanatory power in asset returns of a country's market index.

Roll (1992) picked up on the idea and further put forward that industrial sectoral factors played an important role in a country's market index returns, attributing over 30% to industry factors. Heston and Rouwenhorst (1994) however disputed Roll's methodology of using derived industry effects, arguing that the approach incorporates country effects and thereby overstate the importance of industry effects (Griffin and Karolyi 1998, p. 353). Based on their methodology, Heston and Rouwenhorst (1994) showed that industry effects accounted for less than 1% of returns on country indexes. The literature has been divided on the impact of country effects versus industry effects, with regards to country index returns and consequently, the impact of industry effects on market integration; for example, Eiling et al. (2012) do not find a significant difference between country and industry effects.

Bekaert et al. (2009) finds that the dominance of industry effects was a short lived phenomenon. Moor and Sercu (2010) point out that much of the disagreement about industry versus country effects is due to the different methodologies and time periods surveyed in the literature. They argue that the different authors are not measuring the same thing in their different studies. Griffin and Karolyi (1998) make an interesting distinction in industry types which may explain part of the divergences found in the literature; they find there is a difference between the impact of industries that provide what they call traded goods versus non-traded goods. Non-traded goods industries are defined as those industries whose goods are not traded in international markets due to high transport costs (Griffin and Karolyi 1998, p.358). Examples of traded goods are paper products, secondary products produced from oil, steel, textiles, automobiles and semiconductors. These are goods that are traded in international markets. Thus work that does not distinguish between the industries may produce biased results.

Although the role of industrial sectors in an economy is indisputable, the literature is divided on the impact of sectors on stock market integration. There is greater concurrence on the effect of country

effects or economic variables in a given country. The problematic nature of industry effects may account for the literature that found little impact of economic variables or trade variables.

Canova and DeNicole (1995) and Schmitt-Grohe (1998) for example looked at aggregated trade data. Looking at aggregated data may obscure relationships at a disaggregated level. It is not possible to say from their study, however if such obscuring occurred. . Kizys and Pierdzioch (2009) use a VAR framework to analyse the importance of economic factors to market returns and find no impact. Johnson and Soenen (2003) point out however that: "The VAR approach is deficient in its failure to incorporate potential long term relations and, therefore, may suffer from specification bias" (ibid, p.88). Kizys and Pierdzioch also do not take into account lagged effects of economic variables which the literature has found to have a lagged effect on index returns.

In the final analysis, it seems that the role of economic variables on market integration remains a key factor to be taken into account. However, the shortcoming in the literature that was reviewed on the impact of economic variables on integration is that the authors viewed economic variables in isolation from other factors that may contribute to integration. The literature also does not indicate whether economic factors drive integration or whether they are necessary conditions for integration. The literature that finds that economic variables or trade have no impact on integration may be pointing to a situation where integration takes place in the absence of economic linkages or in fact where economic linkages do not foster integration. It may also be that the literature measured when there truly was no integration, which is not to say no integration came about later or before these periods, as market integration has been found to be time varying.

The literature does not make this distinction clear, it merely points to these cases as indications of no integration. It remains to be explored therefore what role economic factors play in market integration: are they causal or secondary to market integration, can integration take place without economic integration? Does economic integration via trade provide a stable relationship for stock market integration? These and other questions are what this research will address itself to in the development of a theoretical framework of stock market integration that incorporates economic integration considerations.

## 2.5 Conclusion on the Literature Review

The review of the literature has shown that there is indeed no comprehensive theoretical framework for looking at and understanding market integration. The popularly used asset pricing model based approaches to market integration have been shown to be wanting in several key respects. Approaches that look at barriers to international investment have been shown to be potentially useful in understanding market integration and possibly therefore justified in the inclusion of an integrated theoretical framework of market integration. The review has also shown that there is scope for inclusion of economic integration based variables in a framework of market integration although these have often been left out in previous attempts to provide taxonomy of approaches for understanding market integration.

The potential insights that can be gained from integrating a behaviourally based approach into the study of market integration has also been demonstrated by this review. Such an approach has not been adopted previously in the literature. There is therefore opportunity for research that will help establish a comprehensive theoretical framework for stock market integration, showing the drivers of integration versus factors that are required conditions as opposed to factors that are just measures of integration.

## 2.6 Hypotheses to be tested in the Study based on the Gaps identified in the Literature

The integration relationships to be tested are based on the definition of market integration that has been proposed for this study. The individual relationships of key factors will be tested within the context of an overall framework of all the variables as outlined above. The relationships will be tested through four primary hypotheses, i) that Macro economic factors (GDP growth), Trade and Institutional Arrangements (Capital Account Openness) and Behavioiural variables (Herding) influence integration directly ii) that the key variables interact in their influence on integration iii) that Institutional Arrangements (Capital Account Openness) is the primary variable influencing integration and all the other variables act through Institutional Arrangements iv) lastly that behavioral variables is the key driver of integration.

The hypotheses to be tested were therefore as follows;

1. The first hypothesis is that market integration is driven directly by the variables that are hypothesised to work together or individually as part of the mechanism driving integration. To this effect therefore the first hypothesis that was tested was:

   *Market integration is driven directly by the macro-economic variables (GDP and Trade), institutional arrangements (Capital Account Openness) and behavioural factors (Herding).*

2. The second hypothesis is that the macroeconomic and trade variables affect integration indirectly either through each other or through institutional arrangements, the sub-hypotheses under this hypothesis were;
   a. GDP affects integration indirectly through institutional arrangements (Capital Account Openness)
   b. GDP affects integration indirectly through Trade
   c. *Trade affects integration indirectly through GDP and institutional arrangements (Capital Account Openness)*
   d. *GDP and institutional arrangements (Capital Account Openness) affect integration indirectly through Trade*
3. The third hypothesis that was that institutional arrangements (Capital Account Openness) are the primary driver of market integration, meaning that the macro-economic variables all act on Integration indirectly through the institutional arrangements?

4. The fourth hypothesis is whether the behaviour of economic agents in the markets is a facet of integration with the hypothesis being that:

   *Behavioural biases drive integration*

   However the findings of the study made it impossible to test this hypothesis as the behavioral variable's significance could not be confirmed, as the two estimation approaches produced contradictory results.

5. The last hypothesis was tested for European and Latin American countries and Asian and African countries as two distinct groupings. The hypothesis is that:

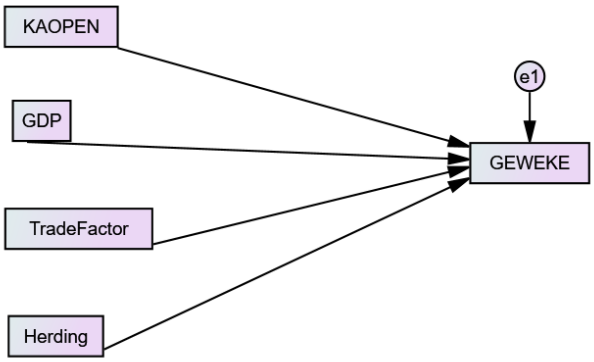
   *Trade influences Integration both directly and indirectly*

**Hypothesis 1**

This postulates a direct relationship between all of the key variables and integration is modeled as follows. The direct impact of macro-economic variables on integration is postulated by, amongst others, Bodhurta et al. (1989); Frankel and Rose (1996) and Bekaert and Harvey (2000, p.161); Pretorius (2002). The body of literature supporting this relationship adequately demonstrates its usefulness in understanding market integration. Authors such as Kose and Yi (2005); Baxter and Kouparitsas (2005); Chen and Zhang (1997); Bracker et al. (1999) Choe (2001); Phylaktis and Ravazzolo (2002) and Chambet and Gibson (2008), discuss the relationship between Trade and equity market returns in different countries. In the literature as well as in this study, economic variables such as GDP are treated as separate from Trade.

Though the literature shows support for the existence of a channel by which trade between countries seems to result in changes in returns in the equity markets. The direct relationship between Institutional Arrangements and Integration, is also tested in the first model, Institutional Arrangements, in the context of this study, refer to the degree of financial openness of a market or country. This relationships is articulated in the literature, by Stulz (1981); Heitala (1989); Bonser-Neal et al. (1990); Claessens and Rhee (1994); Chuhan (1994); Domowitz et al. (1997); Kaminsky and Schmukler (2001); Phylaktis and Ravazzolo (2002); Nishiotis (2004) and Berkel (2004), amongst others. The last direct relationship that is explored in the first model is the behaviour of market agents its influence on market integration. This relationship is contemplated in the works of authors such as Engle et al. (1990), Nikkenen et al. (2006); Chang et al. (2000) and Cipriani and Guarino (2009).

Figure 3: Direct Relationship between GDP, Trade, Capital Account Openness and Integration




This model consists of a set of simultaneous equations that capture the direct effect of the independent variables namely, Capital Account Openness, GDP rate, Trade and Herding (Agent Behaviour ) on market integration (as operationalised through the Geweke measure).

$$\text{Geweke} = \propto_1 + \beta_1 KAOPEN + u_1$$
$$\text{Geweke} = \propto_2 + \beta_2 GDP + u_2$$
$$\text{Geweke} = \propto_3 + \beta_3 TradeFactor + u_3$$
$$\text{Geweke} = \propto_4 + \beta_4 Herding + u_4$$

**Hypothesis 2**

The second hypothesis postulates an indirect relationship between the key variables (GDP, Trade and Capital Account Openness) and Integration. For example GDP may have an indirect effect on Integration, mediated though Capital Account Openness (with Trade, Herding and Capital Account Openness having a direct effect on Integration). Various authors discuss the interactions between the key variables in this study and the impacts of these interactions on Integration. Hypothesis 2, tests these interactions. In the models in hypothesis 2, Herding is left as a direct variable as none of the authors reviewed reflected on its indirect impact.

**Hypothesis 2(a)**

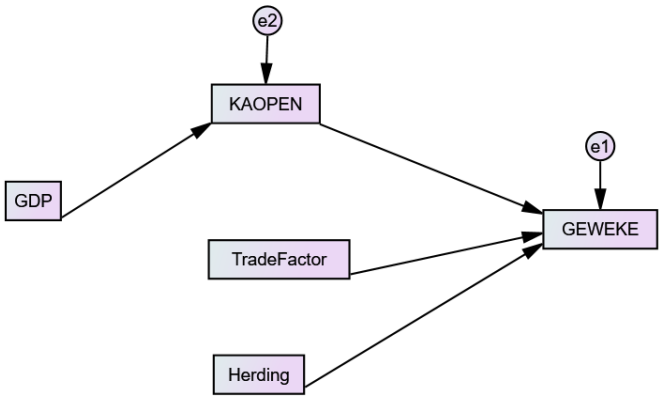
The first sub-hypotheses under hypothesis 2 is that;

*a.* GDP affects integration indirectly through institutional arrangements (Capital Account Openness-KAOPEN)

This hypothesis explores a relationship postulated by authors such as Bodhurta et al. (1989), who state that ”In the segmented markets case, domestic stock returns react to international economic news due to international economic interdependence in the real sector.”. They argue that international reserves and trade accounts are important pointers to the degree to which an

economy is open to external influences in terms of the flow of funds into and out of the economy, thereby tracking the impact of economic variables on stock returns (ibid. p. 24).

Figure 4: Indirect Relationship between GDP and Integration through Capital Account Openness




Empirically this sub-hypothesis is modeled through three simultaneous equations as;

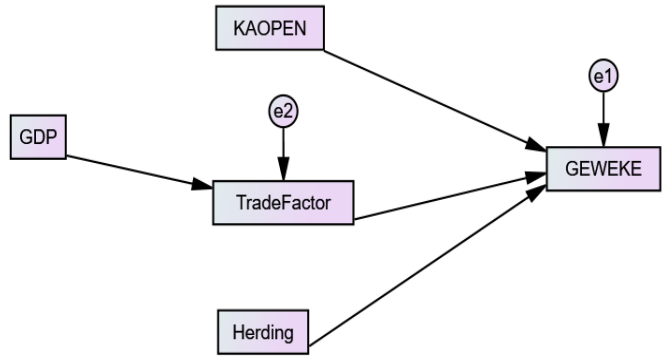
$$\text{KAOPEN} = \propto_5 + \beta_5 GDP + u_5$$
$$\text{Geweke} = \propto_6 + \beta_6 KAOPEN + u_6$$
$$\text{Geweke} = \propto_7 + \beta_7 TradeFactor + u_7$$
$$\text{Geweke} = \propto_7 + \beta_7 Herding + u_7$$

**Hypothesis 2 (b)**

The second sub-hypothesis under hypothesis 2, is that GDP affects Integration indirectly through Trade, while KAOPEN (Capital Account Openness) and Herding act directly on Integration. The possibility of an indirect link between GDP Trade and Integration is postulated in the literature, albeit not directly by any one author. Authors such as Frankel and Rose (1996), Baxter and Kouparitsas (2005), showed the linkage between trade and business cycles in that countries with strong bilateral trade ties also exhibited synchronised business cycles. Others such as Kose and Yi (2005, p.268) show that "pairs of countries that trade more with each other exhibit a higher degree of business cycle co-movement". Chen and Zhang (1997) show the impact of trade ties on the respective countries' stock markets. Phylaktis and Ravazzolo (2002) proposed that trade facilitates stock market integration, Forbes and Chinn (2004) find that trade is an important driver of stock market linkages. Chambet and Gibson (2008) supported the importance of trade for market integration, even through the global financial crisis of 2007.

Hypothesis 2 tests whether the direction of influence between Trade and GDP on Integration, is from GDP through Trade to Integration. The direction of Trade through GDP is tested later in hypothesis 2(d).

Figure 5: Indirect Relationship between GDP and Integration through Trade




Empirically this relationship is modeled as

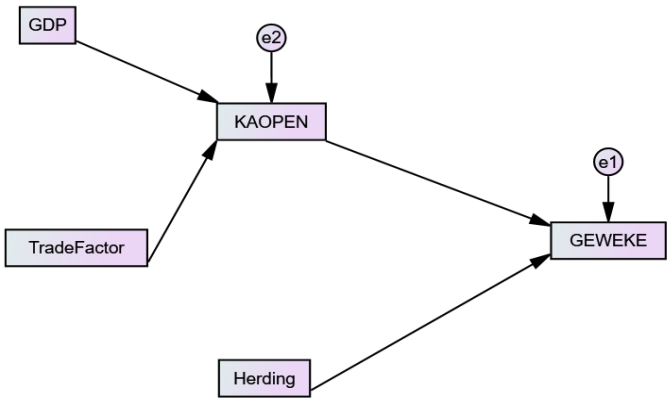
$$\text{Geweke} = \propto_8 + \beta_8 KAOPEN + u_8$$
$$\text{Trade} = \propto_9 + \beta_9 GDP + u_9$$
$$\text{Geweke} = \propto_{10} + \beta_{10} TradeFactor + u_{10}$$
$$\text{Geweke} = \propto_{11} + \beta_{11} Herding + u_{11}$$

**Hypothesis 2 (c)**

The third sub-hypothesis under hypothesis 2 is that GDP and Trade act indirectly on Integration through Capital Account Openness, while the influence of Herding on Integration remains direct.

This hypothesis combines the views of such authors as Bodhurta et al. (1989), who postulate an indirect the link between GDP and Capital Account Openess and Frankel and Rose (1996), Baxter and Kouparitsas (2005) and others who argue for a link between economic output and Trade.

Figure 6: Indirect Effect of GDP and Trade on Integration throgh Capital Account Openness



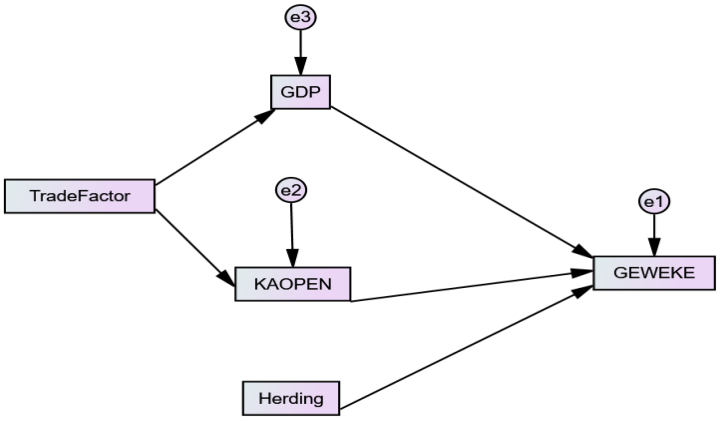

Empirically this model is specified as;

$$\text{KAOPEN} = \propto_{12} + \beta_{12} GDP + \beta_{13} TradeFactor + u_{12}$$
$$\text{Geweke} = \propto_{13} + \beta_{14} KAOPEN + u_{13}$$
$$\text{Geweke} = \propto_{14} + \beta_{15} Herding + u_{14}$$

**Hypothesis 2(d)**

The fourth sub-hypothesis under hypothesis 2 is that Trade influences Integration indirectly thorough GDP and Capital Account Openness (KAOPEN). As indicated in hypothesis 2(b) the relationship between Trade and GDP growth is tested by authors such as Frankel and Rose (1996), Baxter and Kouparitsas (2005) Kose and Yi (2005, p.268). Chen and Zhang (1997) then showed the link between Trade and asset returns. Narayan et al. (2014) argued that trade was an important driver of GDP growth, thus providing a direction of the relationship between trade and GDP growth. This direction is what hypothesis 2(d) test. The hypothesis also tests the direction of a relationship between capital account openness and Trade put forward by Bodhurta et al. (1989) amongst others.

Figure 7: Indirect Relationship between Trade and Integration through GDP and Capital Account Openness




Empirically this relationship is specified as

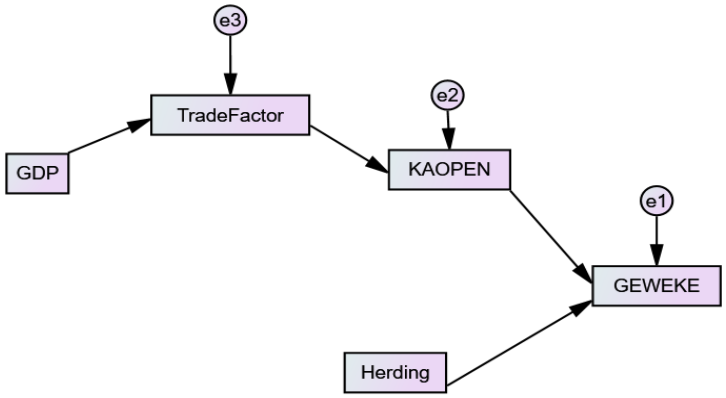
$$\text{GDP} = \propto_{15} + \beta_{16} TradeFactor + u_{15}$$
$$\text{KAOPEN} = \propto_{16} + \beta_{17} TradeFactor + u_{16}$$
$$\text{Geweke} = \propto_{17} + \beta_{18} GDP + u_{17}$$
$$\text{Geweke} = \propto_{18} + \beta_{19} KAOPEN + u_{18}$$
$$\text{Geweke} = \propto_{19} + \beta_{20} Herding + u_{19}$$

**Hypothesis 3**

Given that hypothesis 2 tests various combinations of indirect effects of indirect effects of Trade, GDP and Capital Account Openness on Integration, hypothesis 3 tests whether in fact Trade and GDP both act through Capital Account Openness to impact Integration. Meaning that Capital Account Openness is the most dominant effect on Integration and the other variables are subsumed under it. Herding continues to be tested for its direct effects as in the literature is presented as being separate from the effects of fundamental effects. The link between GDP and Trade was established in hypothesis 2(b), (Phylaktis and Ravazzolo 2002, p 881) argue that economies with correlated business cycle will also have correlated market returns without there necessarily being a flow of funds between the two countries, however a reduction in capital barriers increases the integration, they thus establishing a link between GDP, Trade and Capital Account Openness. This is the link that is explored in hypothesis 3.

Hypothesis 3 postulates that the macroeconomic variable and Trade impact Integration through Capital Account Openness, and agent behavior (Herding) impacts Integration directly.

Figure 8: Indirect Relationship between GDP and Integration through Trade and Capital Account Openness



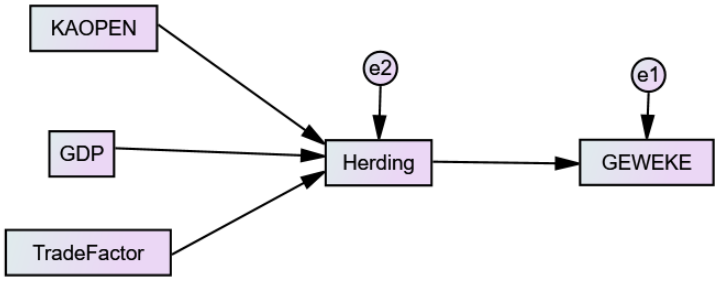

Empirically this relationship is modeled as

$$\text{TradeFactor} = \propto_{20} + \beta_{21} GDP + u_{20}$$
$$\text{KAOPEN} = \propto_{21} + \beta_{22} TradeFactor + u_{21}$$
$$\text{Geweke} = \propto_{22} + \beta_{23} KAOPEN + u_{22}$$
$$\text{Geweke} = \propto_{23} + \beta_{24} Herding + u_{23}$$

**Hypothesis 4**

Hypothesis 4 postulates that all of the key variables in the study, namely GDP, Trade and Capital Account Openness impact Integration indirectly through agent behavior, operationalised in the study through the Herding variable. This relationship between fundamental information and agent behaviour is explored by several authors in the literature. The indirect impact of macroeconomic variables on integration through behavioural factors is supported by authors such as Chang et al. (2000) who's findings support the importance of economic information in encouraging herding. Others such as Scharfstein and Stein (1990), Shiller and Pound (1986), Bikhchandani et al. (1992) show how economic information is subjugated to agent behavioural biases through information cascades, where agents ignore their own information in favour of the information of others. Kind and Wadhwani (1990) similarly assert that investors looking to glean information from other markets in times of crises, thus subjugating fundamental information.

Figure 9: Indirect Relationship of GDP, Trade, Capital Account Openness through Herding




Empirically this model is specified as

$$\text{Herding} = \propto_{24} + \beta_{25} KAOPEN + u_{24}$$
$$\text{Herding} = \propto_{25} + \beta_{26} GDP + u_{25}$$
$$\text{Herding} = \propto_{25} + \beta_{26} TradeFactor + u_{25}$$
$$\text{Geweke} = \propto_{26} + \beta_{27} Herding + u_{27}$$

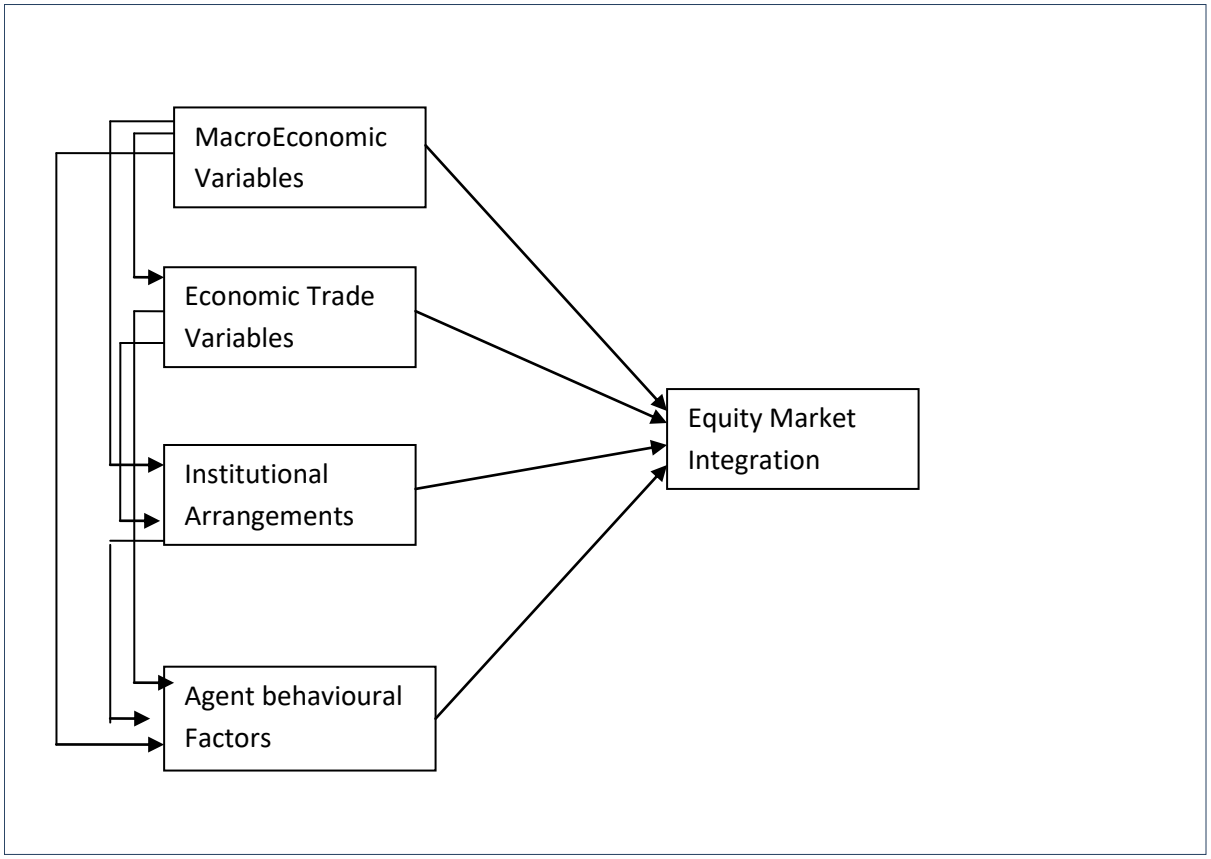
**Significance testing of the variable parameters and the models**

The models will be estimated using Path Analysis. The statistical significance of the variable parameters will be used, in conjunction with the performance of a given model against other models, to select the model that best captures how the key variables influence Integration. This approach is discussed further in the Methodology section.

All of the relationships discussed above are brought together in one framework, wherein the full interactions between the variables each other and with integration will be established. Figure 9 below illustrates the relationships between the variables and integration that will be tested as well as their interaction with market integration through each other.

The relationships are also modeled at different points in time before and after a crisis to capture the impact of a crisis on integration. Authors such as Forbes and Rigobbon (2002), Rigobbon (1999), have indicated that crises play an important role in integration and this study tests this impact empirically, within a framework of other variables that have been asserted to be important for integration.

Figure 10: Market Integration Framework




This framework will be the overarching contribution of this study to the literature. It will show the factors that contribute to integration, how they interaction with each other and how through this interaction or lack of interaction at various points in time, they influence market integration. The study will also look at the role that geographical location plays and how it interacts with the key variables to influence integration.

# Chapter 3: Methodology

## 3.1 Overview

Recall that this study aims to build a conceptual and empirical framework of stock market integration; it therefore will consist of testing of relationships that might underlie the conceptual framework of variables driving Integration. The relationship testing part of the study will be quantitative analysis of data obtained for each of the key markets considered in this study. The study is positivist in orientation, in that it assumes that there is an objective reality that exists and is verifiable by careful observation and analysis. The quantitative approach will meet the objectives of the study more effectively than a qualitative approach as the study aims to uncover empirical relationships between correlations of stock markets and constructs such as institutional arrangements, trade and market agent behaviour.

The study is inductive in nature in that it will seek to infer versions of reality based on existing data, a conceptual framework will be built and the data will be used to test the inferences about the nature of relationships between the variables. The framework will seek to show relationships that explain how market integration comes about both in space and over time. The variables that the study investigates are market returns, trade between countries expressed in dollars, institutional arrangements between countries, that is to say, openness of countries to capital flows, Gross Domestic Product (GDP) and market agent behaviour expressed in market returns of selected stocks and market index returns and encapsulated in the concept of herding.

## 3.2 Data

The study uses daily and weekly data from key North and South American, African, European and Asian markets, i.e. for the North American market data on New York Stock Exchange Index (The Dow Jones Index) is used. The countries were selected based on the size of their economies in their regions. Counties with the highest GDP in constant 2013 US Dollars were selected for South America, Europe and Africa6. For Asian countries Japan and Hong Kong were selected due to availability of macro-economic data for other countries in the region. For the South American markets, index data from Brazilian Sao Palo Stock Exchange Index (BOVESPA), the Mexican Stock Exchange Index (Mexican Bolsa IPC) are used. For the European markets, the study uses data on the London Stock Exchange Index (The FTSE), the German DAX, the French CAC and the IBEX 35 for the Spanish market. For the Asian markets, data on the Japanese Nikkei Index, the Hong Kong Hang Seng, are used. For African stock market index data from Moroccan, Egyptian, Nigerian and South African

6 For African countries, Morocco, which was half the size of the Algerian economy, according to the IMF World Economic Outlook 2013, was selected instead of Algeria due to the availability of stock market data for Morocco. For European countries Spain was chosen instead of Italy in order to capture the impact of the Global Financial Crisis on the Portugal, Ireland, Greece, Spain (PIGS) group of countries more clearly in European data. This is in order to capture the effects of crises referred to in the literature more clearly.

stock markets are used. The US market, represented by the New York Stock Exchange, is used as a proxy for the world market as, according to the World Federation of Exchanges Monthly Report it is the largest market in the world, with a market capitalization of USD 14bn in 2013, which was 25% of the global market capitalization of all the stock markets in the world. The study is broken down into two periods, the one period starts in 2003, the period shortly after the Dot Com Collapse of 2000 and runs until 2007, the beginning of the Global Financial Crisis, both events started in the US and reverberated throughout the world. The second starts from 2008, after the events leading to the Global Financial Crisis, to 2012. By which stage most markets in the world had recovered from the Global Financial Crisis (Foo and Witkowska, 2016). The period of the Global Financial Crisis represents a natural break in the data of many markets in the world, which were characterised by severe correlations in world equity markets as the Global Financial Crisis unfolded.

The market data are sourced from Bloomberg. For the economic variables data, Bloomberg is used as the source of key economic information that has an impact on the stock markets. The macroeconomic variables the study looks at are GDP data, and trade data of the different countries. The institutional arrangement variables are proxied by data on capital controls in various countries. Data on the capital controls in place in the various countries are sourced from the Ito-Chinn Index (KAOPEN) which uses data from the IMF Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER), which provides a comprehensive listing of exchange and trade systems of various countries and the. The Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER) has been published since 1950 and covers over 190 countries both developing and developed countries. The Ito-Chinn Index (KAOPEN) which is as stated earlier is based on the AREAER, extends the AREAER as it provides a way of measuring indirect controls as well as direct controls (Chinn and Ito, 2007). The Ito-Chinn index (KAOPEN) consolidates the AREAER data and provides an index number on country openness, which measures the existence and extent of capital controls, for over 180 countries, from 1970 to 2011.

The behavioural aspect of market integration is operationalized through the concept of herding as a way of also capturing information cascades. Data sources for herding are the daily trades carried out by institutional investors in individual stocks, which are accessed from Bloomberg. We use daily trades because, as Christoffersen and Tang (2010) argue, information cascades may take place over short period; and prices may re-adjust to their fundamental values over longer periods such as weeks or months. Therefore data collected at the quarterly or monthly level may miss cascades that occur over a few days or weeks and then correct away. This focus on short term stock trading movements to detect information cascades is supported extensively in the literature, for example: Nofsinger and Sias (1999); Kremer and Nautz (2011); Patterson and Sharma (2010) and Shyu and Sun (2010).

## 3.3 Data Summary: Stock Market Index Statistics

The stock market index and macro-economic data are all sourced from the Bloomberg database, for all the countries in the study. Daily market index closing levels from each of the stock markets were used in the study. There was a challenge in the data, which was that it covered markets in almost all of the timezones of the globe. This meant that markets in the West would be closing while markets in the East were about to open and this may have an effect on how integration between the markets

takes place. We have not isolated the effects of integration across these different time zones in this study. This is a limitation of the study. The second challenge was in cleaning the data and catering for the fact that while some markets were open, markets in other coutnries may have been closed due holiday in those countries or due to the fact that for example in Arab countires, such as Egypt, the work week ends on Thursday and starts on Sunday. There were few incidents such as these in the data and the resulting missing data that occurred as a consequence of these timing differences, means that these were eliminated from the final data analysed in the study.

Stock market index data was obtained for the Americas, north and south made up of the US market, the Mexican market, the Argentinian and the Brazilian markets. The second region in the study are the European markets, data for the UK market, the French market, the German market and the Spanish market was obtained. The Spanish market was selected specifically to capture the impact of the Euro debt crisis on integration. Spain is one of the countries that faced a debt crisis, as fall out from the global financial crisis. We also looked at markets in the Asian region. Data was obtained for the Japanese market and the Hong Kong market. Hong Kong is part of what Ip-Wing Yu et al. (2010) refer to as the greater China region. For the African market we selected countries for which there was the greatest depth of makret and macro-ecomomic data. Availability of data was the biggest challenge with African markets and African economies. From the African countries in the Bloomberg database the following stock market data was selected, Egyptian market, the Moroccan market, the Nigerian market and the South African market.

For analysis we use the log of returns on the stock market indexes. The log returns have certain desirable properties for statistical analysis (Brooks, 2008) . Log returns are normally distributed whereas the raw returns may not be. We test all the returns from all the markets for normality. All the market series are normally, distribution in the long term. The market index data was used to construct a Geweke (1982) measure, which measures instantenous feedback between markets. The Geweke measure is discussed in more detail below. The study uses the Geweke measure to operationalise the measurement of integration between countries.

#### 3.2.2.1 Data Summary Statistics:

##### Data Summary: Geweke Measure (Instantaneous Market Feedback Measures)

To capture the feedback between markets in the different countries in the study, the study uses an approach recommended by Geweke (1982). The approach is based on a VAR framework, but does not suffer from the weaknesses of the basic VAR approach. As pointed out by Johnson and Soenen (2003, p88) “The VAR approach is deficient in its failure to incorporate potential long term relations and, therefore, may suffer from specification bias”. Other implementations of the VAR approach such as the Vector Error Correction (VEC) method, which is able to capture long term relationships between variables, however for the purpose of this study we also need to capture instantaneous feedbacks between variables. VEC focuses on long term relationships between variables instead of instantaneous ones, as illustrated in the study by Bundoo (2017), where he used at VEC to estimate long term cointegration between markets in the SADC (Southern African Development Community) region. VEC was also used by Hearn and Piesse (2002) to test for long term integration between the

markets of Namibia, Botswana and South Africa. These studies were looking at integration over the long term. Geweke in his 1982 proposed a modification to the standard VAR formulation for estimating the relationship between two variables, x and y.

$$x_t = \sum_{s=1}^{p} E_{1s} x_{t-s} + u_{1t} \qquad Var(u_{1t}) = \sum_1 \qquad (2)$$

$$y_t = \sum_{s=1}^{p} G_{1s} y_{t-s} + v_{1t} \qquad Var(v_{1t}) = T_1 \qquad (3)$$

$$x_t = \sum_{s=1}^{p} E_{2s} x_{t-s} + \sum_{s=1}^{p} F_{2s} y_{t-s} + u_{1t} \qquad Var(u_{2t}) = \sum_2 \qquad (4)$$

$$y_t = \sum_{s=1}^{p} G_{2s} y_{t-s} + \sum_{s=1}^{p} H_{2s} x_{t-s} + v_{2t} \qquad Var(v_{2t}) = T_2 \qquad (5)$$

$$x_t = \sum_{s=1}^{p} E_{3s} x_{t-s} + \sum_{s=0}^{p} F_{3s} y_{t-s} + u_{3t} \qquad Var(u_{3t}) = \sum_3 \qquad (6)$$

$$y_t = \sum_{s=1}^{p} G_{3s} y_{t-s} + \sum_{s=0}^{p} H_{3s} x_{t-s} + v_{3t} \qquad Var(v_{3t}) = T_3 \qquad (7)$$

Geweke proposed that the variance-covariance matrix of the residuals from the VAR estimation be used estimate the instantaneous linear feedback between x and y. (Dicle and Levendis, 2013).

Geweke proposed the following formulation to measure instaneus linear feedback between the variables;

$$n \times F_{X \to Y} = n \times \ln\left(\frac{T_1}{T_2}\right) \qquad \sim X_p^2$$

$$n \times F_{Y \to Z} = n \times \ln\left(\frac{\sum_1}{\sum_2}\right) \qquad \sim X_p^2$$

$$n \times F_{X \times Y} = n \times \ln\left(\frac{T_1 \times \sum_2}{|Y|}\right) \qquad (8)$$

$$= n \times \ln\left(\frac{\sum_2}{\sum_3}\right) \qquad (9)$$

$$= n \times \ln\left(\frac{T_2}{T_3}\right) \qquad \sim X_1^2 \qquad (10)$$

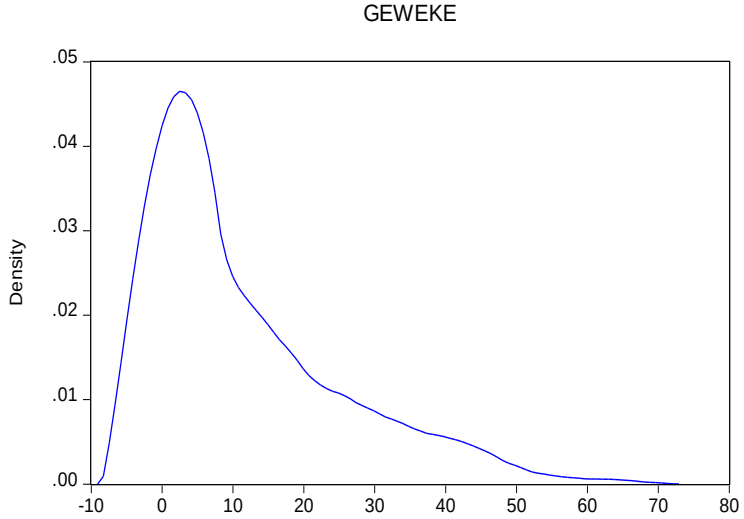
$$n \times F_{X,Y} = n \times \ln\left(\frac{T_1 \times \sum_1}{|Y|}\right) \qquad \sim X_{(2p+1)}^2$$

where |Y|= $\begin{bmatrix} \Sigma_2 & C \\ C & T_2 \end{bmatrix}$ and C = $cov(u_{2t}, v_{2t})$. $F_{X\to Y}$ and $F_{Y\to X}$ and the Granger-type causation *F* statistics, *n* is the number of observations for the unrestricted estimations. $F_{X\times Y}$ is the measure of instantneous causation (instantaneous feedback). $F_{X,Y}$ is the measure of total feedback between x and y. $F_{X,Y}$ also equals to $F_{X\to Y}$ + $F_{Y\to X}$ + $F_{X\times Y}$ Geweke showed that the measures are asymptotically distributed as F distributions.

For purposes of the study, we use the implementation of the Geweke procedure by Dicle and Levendis (2013). Dicle and Levendis' implementation of the Geweke procedure is carried out in STATA and provides a Chi-square score and a measure of the p-value of the statistic to determine whether or not there is significant instantaneous feedback between two markets. Instantaneous feedback tests were carried out between the US market and the other markets, as an important part of the study. The country pairs analysed were the US and markets in Latin America, the US and Western European countries, the US and African countries and the US and Asian countries. The data from the tests yielded Geweke measures for each of country pair. All of Geweke scores for all the countries pairs were then analysed together to ascertain the distribution of the data. The results of the analysis are provided in Figure 10 below.

Figure 10 shows that the Geweke measure is not normally distributed. The measure has a kurtosis of 4.19 which is above the normal kurtosis of 3. The skewness also shows that the data is not normally distributed.

Figure 10: Geweke Measure Data Distribution

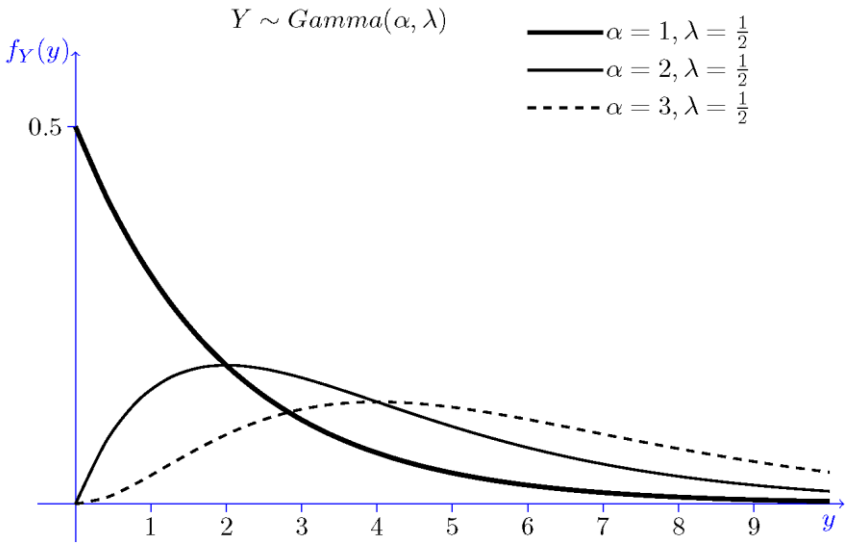



| | GEWEKE |
|---|---|
| Mean | 11.58734 |
| Median | 6.135100 |
| Maximum | 64.03150 |
| Minimum | 0.000000 |
| Std. Dev. | 13.55276 |
| Skewness | 1.341224 |
| Kurtosis | 4.197860 |
| | |
| Jarque-Bera | 100.3284 |
| | |
| Observations | 279 |

Figure 11 shows the gamma distribution and it can be seen that the Geweke data distribution in figure 10, more closely resembles a gamma distribution than the normal distribution. The gamma distribution is described by two parameters, a shape parameter $\alpha$, and a scale parameter $\theta$. Figure 2 shows the Probability Distribution Function (PDF) for the gamma function. The Geweke data clearly follows the gamma distribution with a shape parameter of 1. It is noteworthy that the gamma

distribution is related to the normal distribution in that it comes close to looking like normal distribution when the shape parameter α, is 100.

Figure 11: Gamma Distribution




Estimation of the Geweke measure in any model cannot be done using OLS, as OLS assumes normality of the data and the Geweke measure is clearly not normally distributed. The study will make use of Bayesian and Maximum Likelihood estimation to model the Geweke measure and the other data in the study.

### Data Summary: KAOPEN- *Capital Controls/Capital Account Openess*

To capture the degree of captial controls in the country, the KAOPEN index was used for each of the countries in the study. The index was created by Chinn and Ito (2008) and it is based on the Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER), published by the International Monetary Fund on the various types of capital controls in place in over 182 countries. Chinn and Ito created the index from data starting from 1970 to 2013. They have constructed a data series stretching over 43 years, the most comprehensive capital controls index of its type. They consider the extent and intensity of capital controls in each of the countries in the AREAER database. They acknowledge that measurement of de-facto capital controls is made difficult by the fact that the private sector may undertake certain actions in order to circumvent capital controls (Chinn and Ito, 2008). The authors look at four variables and construct dummy variables to represent the presence or otherwise of the variable in question. The variables they look at are (ibid):

- variable indicating the presence of multiple exchange rates (k1);
- variable indicating restrictions on current account transactions (k2);

- variable indicating restrictions on capital account transactions (k3); and
- variable indicating the requirement of the surrender of export proceeds (k4).

The authors indicate that "In order to focus on the effect of financial openness – rather than controls" they transform the variable k3, reversing it, making the dummy variable 1, represent an absence of capital controls. The KAOPEN index that they then construct, reflects greater capital flow openness as a higher KAOPEN score.

The authors argue that measuring k1, k2 and k4, they capture effects that other measures or indexes of capital account openness that only focus on capital account controls may miss, thus enabling KAOPEN to act as a measure of capturing those controls that may be imposed over and above controls on the capital account. Thus KAOPEN also captures capital contorls when no restrictions on the capital account are in place, but other types of controls are in place, such as the requirement to surrender export proceeds or the operation of a multiple exchange rate regimes.

Although the KAOPEN measure does not capture variables that reflect informal capital controls such as information asymmetry, for example, between the host country and potential investors, for the purposes of our study, we are satisfied that the measure can capture the impact of capital contorls on market integration. Informal controls, such as information asymmetry will in general be overcome by investors as part of their due diligence process before investing in a country. Other controls such as taxation of portfolio investment beyond certain prescribed limits, we will not be captured in this study. The study will deal with the more general cases as captured in the IMF AREAER document and reflected in the KAOPEN index score.

Table 1 below provides the measure of the countries in the study's capital account openness as per the KAOPEN measure of Chinn and Ito (2008) for the period 2008 to 2013 The stability of the KAOPEN score for the developed versus the developing countries (excluding Mexico) is stark. Figure 13 below shows how the KAOPEN measure varies over the countries in the study. The higher scores in the data are attributable to the developed countries and the lower and more variable scores are attributable to the developing countries.

Table 1: KAOPEN 2008-2013

| | **2008** | **2009** | **2010** | **2011** | **2012** | **2013** |
|---|---|---|---|---|---|---|
| United States | 2.389668 | 2.389668 | 2.389668 | 2.389668 | 2.389668 | 2.389668 |
| United Kingdom | 2.389668 | 2.389668 | 2.389668 | 2.389668 | 2.389668 | 2.389668 |
| France | 2.389668 | 2.389668 | 2.389668 | 2.389668 | 2.389668 | 2.389668 |
| Germany | 2.389668 | 2.389668 | 2.389668 | 2.389668 | 2.389668 | 2.389668 |
| Argentina | -0.83125 | -0.83125 | -0.83125 | -0.83125 | -1.8889 | -1.8889 |
| Brazil | 0.647755 | 0.388501 | 0.129246 | -0.13001 | -0.13001 | -0.13001 |
| Mexico | 1.093394 | 1.093394 | 1.093394 | 1.093394 | 1.093394 | 1.093394 |

Table 1 illustrates the difference between emerging market countries and developed economies in terms of the stability or otherwise of the KAOPEN variable. As can be seen from the table, the more developed countries tend to have less capital controls and their economies are open over the period

under review. However it is also important to note that some countries' openness varies over time, countries such as Brazil and Argentina. Brazil for example moved from an open framework to one with more stringent capital controls in 2011.

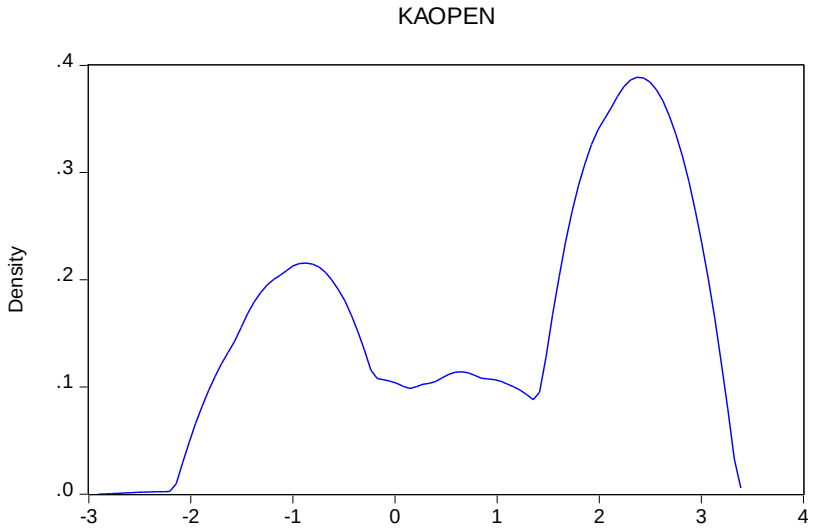
Similarly, a country such as Egypt has become progressively less open over time with an initially open capital flow regime to one which was significantly more restrictive by the end of 2013, post the Arab Spring uprisings in that country and a change in the political order.

The KAOPEN data is only provided at an annual level for each country. For purposes of our study it was therefore necessary to interpolate the data into quartely series. The linear interpolation function in Microsoft Excel was used to carry out the interpolation for our analysis.

Figure 12 shows the data distribution for the KAOPEN variable for the countries in the study over the period 2008 to 2012. As the figure shows, the KAOPEN data does not follow a normal distribution. The data seems to be more like categorical data, with several categories.

The fact that the KAOPEN variable is not normally distributed means that it cannot be analysed using statistical methods that rely on the variable in question being normally distributed. As indicated previously, Bayesian and ML estimation will be used for modeling this variable.

Figure 12: KAOPEN Distribution




| | KAOPEN |
|---|---|
| Mean | 1.034301 |
| Median | 2.389668 |
| Maximum | 2.389668 |
| Minimum | -1.888895 |
| Std. Dev. | 1.512729 |
| Skewness | -0.455631 |
| Kurtosis | 1.485481 |
| | |
| Jarque-Bera | 36.31841 |
| | |
| Observations | 279 |

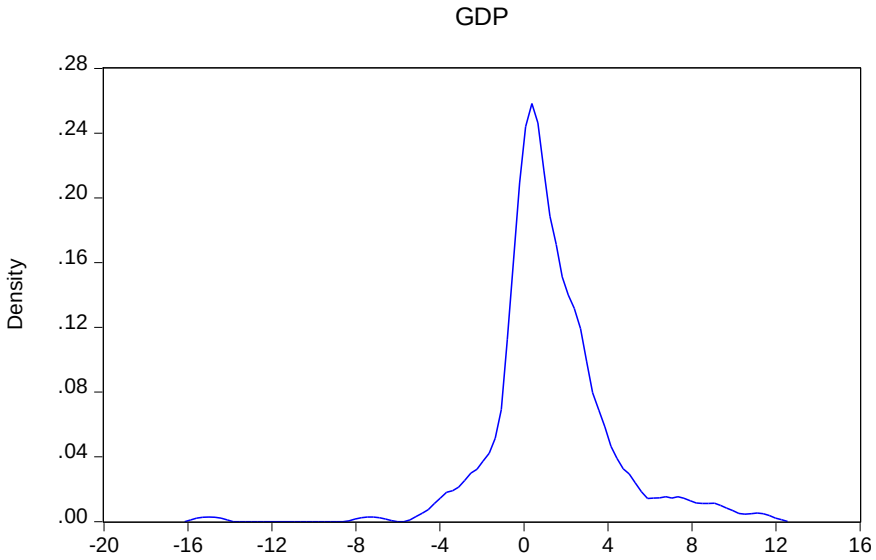
## Data Summary: Macro-Economic Data - *GDP and Trade Data*

Following the study of Bracker et al. (1999) where the authors found that macro-economic variables have an impact on market integration, we have included GDP as a macro-econonic variable of interest for the pursposes of our study. Pretorius (2002) also found growth to be a significant determinant of market integration, although inflation was found not to be significant. The linkage between growth and integration was also highlighted by authors such as Dumas et al. (2003). The impact of output growth impacts the returns that companies earn and through the dividend growth

model, influence asset prices. Thus an economy that is growing should also have equity markets that grow in tandem and thus with counties that have integrated economic activity, the results should also come through in the countries' equity markets. We will also, in a similar vein as Pretorius, look at growth and trade as an important contributors to equity market integration. Pretorius makes the point that it is the differentials of the variables as opposed to their absolute levels that are important in influencing integration. We will, therefore, look at the cross country differentials of growth and trade. For purposes of our study, the macro-economic data was taken from the Bloomberg financial database. The GDP data is provided on a quarterly year on year basis. Data on trade was extracted from the '2014 International Trade Statistics Yearbook, Vol I - Trade by Country' report for trade between all counties, as well as from United States Census Bereau website, for trade data for the United States of America with the rest of the world.

The GDP growth data for all the countries in the study is normally distributed, with a very high peak, as is shown in figure 13. The figure captures the distribution of GDP growth rates for all the countries in the study over the period under review. The Jacque-Berra test for normality shows that that the data is normally distributed with a Jarque Bera score of 384. The distribution is skewed to the right and the kurtosis of over 9.2 indicates that this distribution is very peaked around its center.

Figure 13: GDP Distribution




| | GDP |
|---|---|
| Mean | 1.282427 |
| Median | 0.800000 |
| Maximum | 11.40000 |
| Minimum | -15.00000 |
| Std. Dev. | 2.776497 |
| Skewness | -0.038945 |
| Kurtosis | 9.210228 |
| | |
| Jarque-Bera | 384.1228 |
| Probability | 0.000000 |
| | |
| Observations | 239 |

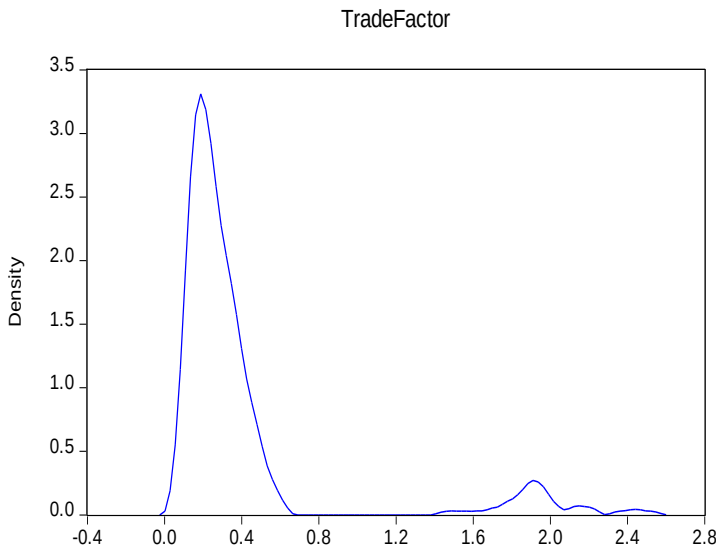
**Trade Data – Trade Factor**

The Trade data has been transformed into a variable we have termed the Trade Factor. The Trade Factor variable captures the relative proportions of the trading relationships between a country and its trading partners, in the case of the study, it captures the relative proportions of trade between a given country and the United States. The trade factor is the ratio of trade between countries, which is defined by Pretorius (2002) as:

$$\text{Trade}_{ij} = \frac{x_{ij}+z_{ij}}{X_i+Z_i} + (x_{ji}+z_{ji})/(X_j + Z_j) \quad (11)$$

Where $z_{ij}$ and $x_{ij}$ are imports and exports from country *i* to country *j*. $X_i$ and $Z_i$ are the total exports and imports of country *i*. (Petorius, 2002). The country that all countries are benchmarked against is the United States of America. Thus the data reflects trade between the US and other countries.
The distribution of the trade factor variable for all the countries in the study is not normally distributed as is shown in figure 14.

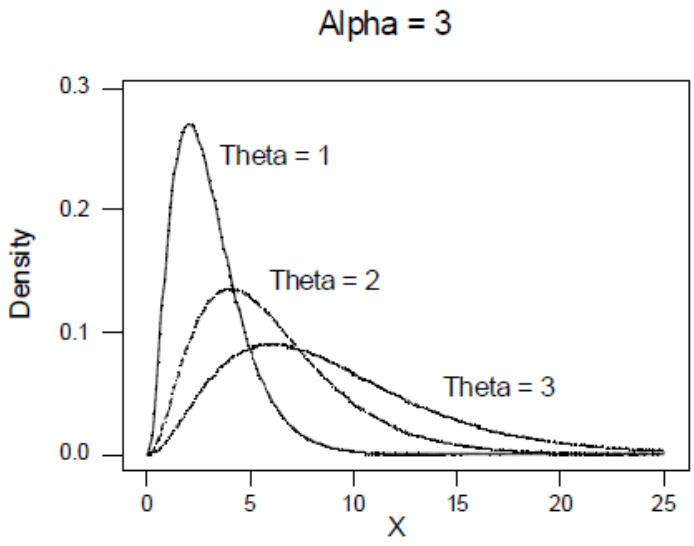
Figure 14: Trade Factor Distribution




| | TRADEFACTOR |
|---|---|
| Mean | 0.399559 |
| Median | 0.250452 |
| Maximum | 2.495428 |
| Minimum | 0.081234 |
| Std. Dev. | 0.485922 |
| Skewness | 2.854051 |
| Kurtosis | 9.957101 |
| | |
| Jarque-Bera | 806.4624 |
| | |
| Observations | 239 |

The Trade Factor data follows a gamma distribution instead of a normal distribution. The gamma distribution is shown in Figure 15, with the distribution described by two parameters, a shape parameter $\alpha$, and a scale parameter $\theta$. It is clear from the data that the trade factor distribution follows a gamma distribution with a theta, i.e, scale parameter of 1.

Figure 15: Gamma Distribution



## Data Summary: Herding

One of the phenomena of interest in this study is herding. Herding occurs when market participants ignore their own private information about asset prices and emulate the behaviour of other market participants. Herding as a phenomenon in this study would therefore capture a behavioural element of integration. It would capture the occurrence of information spill-overs where information about what is occurring in one market influences what market participants in anther market do. We had expected that herding would be a feature that accompanies the correlations of returns in the markets under study, in particular herding with the US market. For purposes of this study, herding is operationalised using the Cross-sectional Absolute Deviation (CSAD) measure of Christie and Huang (1995) and Chang et al. (2000).

CSAD measures the degree to which returns in a given stock deviates from the market returns, given that in times of market stress, there will be less deviation from the market return than during times when there is no stress in the market. The underlying principle is that when there is greater market uncertainty, participants will tend to 'go with the crowd' thus resulting in there being less deviation from the returns of individual stocks, from the market return. In this study, we follow the approach of Chiang and Zheng (2010) where they used CSAD to assess herding of markets in different countries, in particular herding of East Asian and South American markets with the US market. Whereas equation 12 below measures CSAD in one market, Chang and Zheng (ibid.) used equation 13 to measure herding across markets

$$CSAD_t = \frac{1}{N}\sum_{i=1}^{N}\left|R_{i,t} - R_{m,t}\right| \quad \text{.....(12)}$$

Empirically CSAD is operationalised as

$$CSDA_t = \gamma_0 + \gamma_1 R_{m,t} + \gamma_2\left|R_{m,t}\right| + \gamma_3 R_{m,t}^2 + \epsilon_t \quad \text{.....(13)}$$

which measures herding in one market. $R_m$ measures the returns in the market, $|R_m|$ measures absolute returns in the market. The co-efficient, $\gamma_3$, in equation 13, measures herding in a given market, with a negative value indicating herding and positive value of $\gamma_3$ indicating no herding.

To measure herding across markets, in particular to measure herding with the US market, CSAD was operationalised by Chiang and Zheng (ibid.) as,

$$CSAD_t = \gamma_0 + \gamma_1 R_{m,t} + \gamma_3\left|R_{m,t}\right| + \gamma_3 R_{m,t}^2 + \gamma_4 CSAD_{US,t} + \gamma_5 R_{US,t}^2 + \varepsilon_t \text{ ,.....(14)}$$

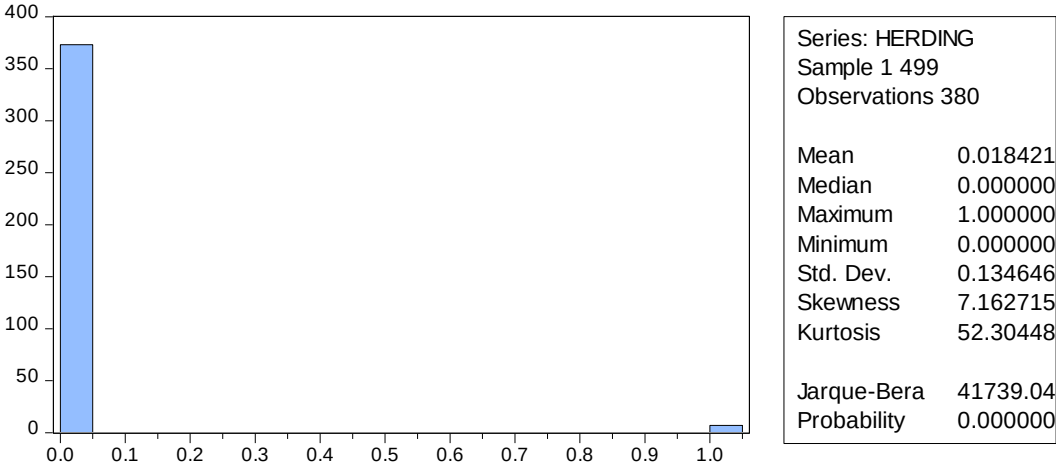
which measures the absolute correlation of returns in one market with returns in another market, with the logic being that if the returns are significantly correlated, herding may be present in the markets. The coefficient $\gamma_5$, in equation 14, measures herding, in the same way as $\gamma_3$, in equation 13; however, in this case, $\gamma_5$ measures herding of a country's market towards the US market. The returns in a market are the log returns as discussed earlier in this section, which are normally distributed and have desirable statistical characteristics.

The Herding variable in the data is a dichotomous variable, taking values of 0 or 1 as shown in figure 16. This operationalisation of the Herding variable was as a result of the results of the estimation of model 14. In periods where the estimation found statistically significant herding the variable was at

1, in periods where no significant herding was found, the variable was set at 0. The Herding data was also difficult to obtain for this study as Mexican and South African data was not available for the construction of the Herding variable.

Herding

Figure 16: Herding Data Distribution




## 3.4 Path Analysis

The method used to estimate the empirical models to be investigated in this study will be the Path Analysis approach. Path Analysis is one of the two aspects of a Structural Equation Model (SEM). SEM is made of two elements or models, a structural model and a measurement model. *The structural model is a Path Model (Hair et al., 2010, p.19)*. SEM models are dealt with in more detail in the Appendix to the Methodology section.

Path analysis has been selected because it lends itself more readily to testing the types of relationships postulated in this study, than does basic multiple regression modeling. Path analysis' power lies not only in its ability to model two way relationships between dependent and independent variables, but also to model situations where the relationships are reversed; that is to say, situations where the dependent variables become the independent variable (Raykov and Marcoulides, 2006). SEM, and in particular path analysis, also allows for the measurement of direct and indirect effects of variables (mediator and moderator variables). This allows us to test for a theoretical action of a variable through another variable or construct, something which is more complex to implement in standard multiple linear regressions. As discussed in the literature review, the empirical specifications of the models to be estimated are a series of simultaneous equations, which are more amenable to estimation using Path Analysis rather than standard multiple linear regression.

Path analysis can also take measurement errors into account and models these explicitly, which traditional regression does not do (Blunch, 2013). The one critique made against path analysis, is that it assumes no measurement error, which in the case of the data that this study is dealing with is a reasonable assumption as the data is made of market prices, GDP and trade data, all of which are variables that are measured in monetary terms, thus reducing the likelihood of measurement errors.

Path Analysis and SEM utilize simultaneous equations and so the question of identification is important for the implementation of Path Analysis. Identification basically means that there are enough equations, in the system of equations, to find the value of the parameters in the entire system of equations. There is a rule of thumb which is a necessary but not sufficient condition for model identification in Path Analysis and SEM: the so called t-rule (Raykov and Marcoulides, 2006), that is to say "the number of pieces of information shall be as large as the number of parameters to be estimated …" (Blunch, 2013, p.78). In other words, that number of equations or relationships being investigated should be equal to the parameters to be solved for from the equations and this is the case with the models in this study.

Each of the hypotheses postulated in the Literature Review section are tested via models that aim to capture the empirical relationships between the variables. Because there may be other variables that may affect Integration that are not considered in this study, as this study focused on the variables that were reported in most of the literature, the $R^2$ for the models may be found to be very low. Due to this challenge, $R^2$ could not be used to determine which model was the best at capturing the relationship between the variables; instead we use the AIC7 scores of the models. The AIC scores of the different models measure the degree to which a given model captures the information about relationships between variables in a model. The objective of modeling the relationships is captured as much information as possible, about the relationship, in the model. The AIC score reflects the degree to which a model succeeds in doing this. Models with lower AIC scores are deemed to carry more information than ones with a higher score. Therefore the model with the lowest AIC score is preferred over ones with a higher score. Burnham and Anderson (2002), compare the selection of the best model to a car race where the key question is which car won and in the case of competing models, the answer is "the model with the minimum AIC value."(ibid. p. 74)8.

7 AIC=-2(log-likelihood) + 2K, where K is the number of parameters in the model (i.e. variables plus the intercept). This AIC estimation equation is consistent with MLE method used to estimate models in this study. The alternative equation is for estimating AIC for models estimated using Least Squares estimation.

8 Burnham and Anderson also propose a scale for evaluating what the size of the difference between models' AIC scores and the minimum information model. They recommend that models with a delta greater than 2 should be considered significant.

### 3.4.1 Model Estimation in Path Analysis

As indicated earlier, there are several approaches to estimating Path Analysis models, the most common being Maximum Likelihood, Generalised Least Squares (GLS) and Bayesian analysis (Blunch, 2013). This study uses Maximum Likelihood as well as the Bayesian estimation approach. Due to specific features of the Bayesian estimation approach which will be discussed in more detail later in this section, the Bayesian estimation will be used to test for the robustness of the models developed using MLE. As indicated previously, GLS is one of the ways in which Path Analysis models can be estimated, GLS is the easiest to implement conceptually, however it is has limitation due to its requirements for large samples sizes (Lee, 2007). The asymptotic sample size requirement is a feature of frequentist based estimation methods, where, for assumptions underlying the estimation approach to be valid, the sample has to reasonably fit the assumption of being infinitely large.

Another limitation of GLS is the assumption about the nature of the distribution of the data. GLS does not allow one to readily and easily change the distribution that the data is assumed to follow. The default distribution for GLS methods generally tends to be the normal distribution. There are specialised approaches that can be used to deal with non-normal data. The negative challenge of these specialised approaches is that they complicate the analysis process. There is also a requirement that the error terms not be serially correlated. ML estimation is more flexible than GLS estimation; however it has limitations in dealing with small samples. To address this shortcoming, models estimated using MLE will also be estimated using Bayesian Estimation to the robustness of the MLE estimates.

### 3.4.2 Bayesian Estimation Overview

Bayesian Estimation is ideally suited for dealing with small samples. As this study will largely be dealing with small samples when looking at country capital restrictions and some macroeconomic data, Bayesian Estimation can be used to test the robustness of MLE estimates. Bayesian Estimation does not require the assumption of asymptotically large data, which MLE does.

The Bayesian approach is different from MLE in that it does not rely on frequency of occurrence of data. Bayesian statistics use known information about specific events to draw inference about the probability of the occurrence of an event (Iversen, 1984), instead of assuming that the event occurs an infinite number of times, which is the standard asymptotically large sample assumption of frequentist analysis, of which MLE is an example. Thus using Bayesian analysis, it is possible to make estimates for events that occur infrequently or where sample sizes are small. To achieve this, Bayesian inference treats a variable not as a fixed outcome of an event but as representing a range of possible outcomes represented by a distribution, whereas frequentist approaches treat each data point as a fixed outcome.

In a frequentist approach, in order to draw any meaningful inferences, one would require a large number of fixed outcomes. Instead by using the distribution from which the data is drawn, Bayesian inference does not require a large sample of fixed individual occurrences from which inferences can

be drawn. Because it treats variables as occurrences of a distribution, inferences can be drawn from the distribution even if the number of events is low. New information or data is used to update the expectations about the nature of the distribution, thus updating the inferences that can be drawn from the data at hand, through incorporating the new data. Therefore, as more information becomes known about an event, current probability estimates are updated and the probability estimates improve.

Bayesian estimation in Path Analysis therefore does not require that samples be large, which is a significant benefit over the ML estimation approach, which is robust only for large samples (Dunson et al., 2005; Lee, 2007).

Another feature of the Bayesian estimation approach to Path Analysis and SEM, which is different from OLS, GLS and ML estimations in that it uses the raw data under study as opposed to OLS, GLS and ML which use the variance/covariance matrix derived from the sample data (Lee, 2007) in order to do parameter estimation. In OLS, GLS and MLE, the variance/covariance matrix derived from the raw data is then used to calculate the parameter values implied by the proposed Path model. In OLS, GLS and MLE the model is therefore reliant on the variance/covariance matrix for the estimation of parameter values. In this context the raw data is only useful for deriving the variance/covariance matrix; in fact after the matrix has been derived the raw data can be discarded and not used again.

Bayesian estimation instead uses the raw data to derive parameter values. To do this the Bayesian estimation used in this study uses the Markov Chain Monte Carlo (MCMC) algorithm. To implement the MCMC, Bayesian analysis software uses a Gibbs sampler which provides better convergence properties than the Manhattan Hastings algorithm in which the solution may fail to converge on a set of parameter values (Kruschke, 2011). MCMC is important because "MCMC methods can be applied without knowledge of the normalizing constant of the target density, which is very important in the Bayesian context where the normalizing constant of the target (posterior) density is almost never known" (Chib and Greenberg, 2002, p.410). The Bayesian estimation approach is based on Bayes' Rule. For continuous variables, the rule is generally given as

$$P(y|x) = p(x|y)(p(y)/\int dy\, p(x|y)p(y) \quad \text{.....(15)}$$

where p(y|x) is the conditional probability of y occurring given that x has occurred. The term p(x|y)p(y) represents the information that is known at the time of estimation, known as the prior of the model. The prior can also be represented by a distribution that captures the distribution that the data in question is known or assumed to follow. The denominator represents a posterior joint conditional probability also called the normalising constant. Similar to the prior, the normalising constant can be represented by a distribution function, such as the binomial distribution that models a given set of raw data. If one is estimating many parameters, this would imply several distributions in the normalising constant, which would have to be computed together. In these types of applications, such as is required in this study, the normalising constant may be intractable to calculate directly.

This is where the Gibbs Sampler becomes very useful. The purpose behind the normalising constant is to estimate the posterior distribution function, which will allow the calculation of parameter

estimates of the model. The Gibbs sampler enables the estimation of this posterior distribution through an algorithm that derives a sample which can be used to estimate the normalising constant, instead of trying to calculate the normalising constant directly. The raw data is used in the derivation of the parameters drawn from the sample created by the Gibbs Sampler. One of the benefits of the Gibbs Sampler over the Manhattan Hastings (MH) algorithm for estimating the normalising constant is that the Gibbs Sampler requires a lower burn-in rate. This means that its search time for the possible parameter values is shorter than the MH approach. The Gibbs Sampler also converges on a solution more frequently than the MH algorithm (Kruschke, 2011).

MCMC is also able to deal with missing data through data augmentation utilising the Gibbs Sampler algorithm initially developed by Geman and Geman (1984). The Path models developed using Bayesian estimation based on MCMC will allow for the modelling of financial time series data and our proposed model. Tsiakas (2006) also show that the MCMC algorithm used in Bayesian estimation is suitable for dealing with heteroscadacity and the fat tailed nature of financial return time series data.

The final benefit of adopting a Bayesian estimation approach is that Bayesian identifiability implies Bayesian learning. Bayesian learning occurs when the posterior distributions can differ from the prior distributions, reflecting that we have updated our beliefs based on the current data, that is to say, we have learnt. "Potentially, one can choose informative prior distributions for the parameters in a model that is under-identified from a frequentist perspective, and still obtain Bayesian identifiability for unknowns of interest" (Dunson et al, 2005). In frequentist SEM or Path Analysis which relies on the variance/covariance matrix to be able to determine the value of a parameter, identifiability of the model is essential. The number of equations versus the number of parameters in the model determines whether the model can be estimated. However, because Bayesian SEM does not use correlation or covariance matrixes, the question of identifiability of the model based on number of parameters relative to the number of equations in the model, is not a limiting factor (Hair et al., 2010, p.698).

#### 3.4.2.1 Bayesian Data Analysis Applied to the Data in the Study

As mentioned previously, Bayesian analysis, as a statistical approach, does not assume that a data distribution follows one or other distribution, for example the frequentist approach often assumes that data is asymptotically normally distributed. Bayesian analysis attempts to establish the kind of distribution that the data may have been drawn from, by creating a random sample that matches the data on hand and then establishing the kind of distribution that sample follows. By repeatedly referencing the data on hand as it tries to draw a random sample of data points, using the MCMC algorithm, the Bayesian approach is therefore able to infer the distribution from which the original data was drawn.

This inferred distribution is then what is used to estimate the model parameters from, instead of simply assuming that data follow a normal or any other kind of distribution. It is possible to assess how well the MCMC algorithm has done in drawing a sample that approximates the original data, by looking at the trace sketch of the sample as well as the correlation co-efficient of the sample. The more the trace sketch of the sample resembles white noise, in other words, the more the trace is

random with no apparent trend, as shown in Figure 20 for the Trade Factor, the better the sample approximates the original data.

With respect to the correlations, the faster the correlations die out, as shown in Figure 19 for the Trade Factor, the better the sample distribution approximates the original data. According to the Bayesian Estimation, the mean of the Trade Factor variable was estimated at 0.391, with a standard deviation of 0.032 and as can be seen in the table below, the estimation of the mean derived of the Trade Factor variable based on analysis, approximates the mean of the original data.

Table 2: Actual Data Mean and Bayesian Estimated Mean Comparison

| Actual Data Mean | Bayesian Estimated Mean |
|---|---|
| 0.399559 | 0.391 |

Figure 17 shows the distribution that the MCMC algorithm extrapolated from the original data, on which the estimated mean is based. The proximity of the Bayesian Estimated mean and the mean from the original data, as well the randomness of the trace sketch and the declining pattern of the correlations, show that the estimated distribution, matches the original data very well.

Figure 17: Bayesian Estimation of the Trade Factor Mean

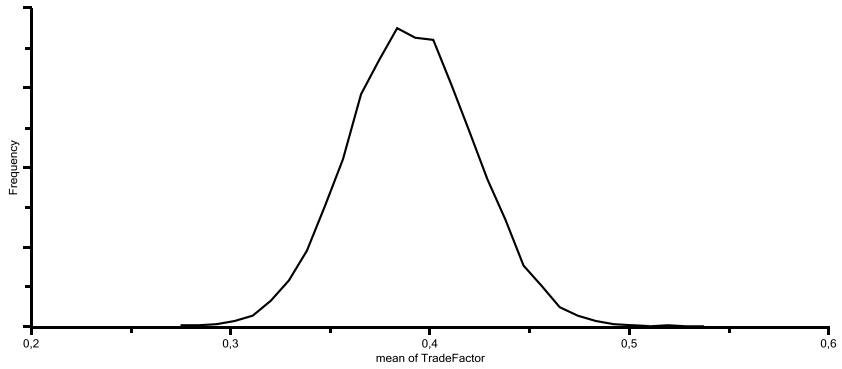



Figure 18: Correlogram of Trade Factor Bayesian Sample Estimates

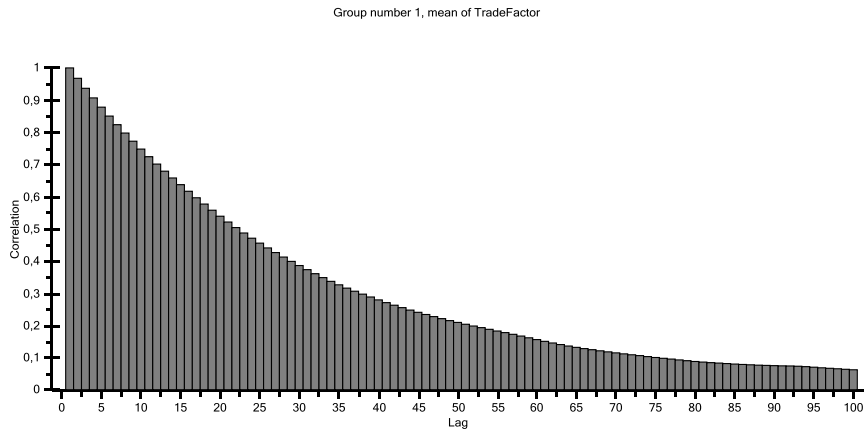
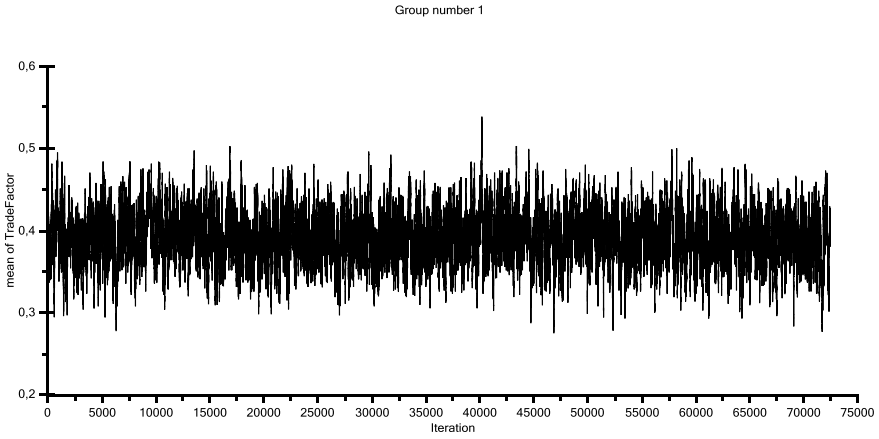


Figure 19: Trace of Trade Factor Bayesian Mean Estimation Iterations




GDP and KAOPEN were also modelled using Bayesian analysis and the results of the derived distributions are reported in Table 3 below. The reported means are compared to the means of the original data.

Table 3: Mean Estimates

| Variable | Bayesian Mean | Original Mean |
|---|---|---|
| GDP | 1.292 | 1.2824 |
| KAOPEN | 1.035 | 1.034 |

As can be seen, the values of the estimated and original means are very similar, the diagnostic analysis of the variables is provided in Appendix D. The diagnostic analysis for both variables shows that they both have highly random trace sketches and correlations that die out over time, meaning that the estimated distributions are good approximations of the original distributions and thus can be used for inference and for deriving parameters.

Bayesian estimation techniques therefore make it ideal for ensuring that the findings of ML estimation are robust and not biased by sample size or the distribution of the data. As such all models in the study are estimated using both MLE and Bayesian estimation.

Other methodological issues are covered in the results section of this study and for the sake of parsimony have not been repeated in this section.

## 3.5 Limitations of the study in the context of methodology

*Ontological Limitation*

The positivist approach of this study leaves the subjective experience of market integration by the market agents unexplored. The study is rooted in the 'physical nature of reality' perspective and therefore does not deal with the possible meta-physical dimensions of integration. It may be that the meta-physical aspects of market integration play a critical part in its manifestation, this aspect is not dealt with in this study.

The study adopts an empirical approach to building theory. Some would argue that this approach is akin to data mining and risks providing theories or policy guides that only apply in special situations. Testing the resulting model against data different from that which was used to develop the model will provide a meaningful answer to this challenge. If the model is able to successfully work in African markets it will have fulfilled the objectives of this study, which are to establish whether the selected African markets are integrated using a more comprehensive integration analysis framework.

*Analytical Limitation*

A possible shortcoming with employing the MCMC algorithm is that the methodology has challenges converging to a solution (Jackman, 2000). Various implementations of the Gibbs sampler have been proposed which have varying degrees of success in overcoming the convergence problem. Most of these solutions have been implemented in the SAS and MPlus statistical modelling software, which are used in this study. We anticipate however that it may be necessary to make subjective decisions about the appropriate duration to give an attempt at convergence (Jackman, 2000).

# Chapter 4: Results Discussion

## 4.1 Background

In this section we discuss the results of tests conducted to test three hypotheses that seek to establish the how the variables postulated in the literature, namely trade, economic growth, Capital Account Openness and Herding, drive integration and interact with each other.

1 The first hypothesis that was tested is that market integration is driven directly by the variables that are hypothesised to work together or individually as part of the mechanism driving integration. To this effect therefore the first hypothesis that was tested was:

> *Market integration is driven directly by the macro-economic variables (GDP and Trade), institutional arrangements (Capital Account Openness) and behavioural factors (Herding).*

*2.* The second hypothesis is that the macroeconomic variables affect integration indirectly either through each other or through institutional arrangements, the sub-hypotheses under this hypothesis were;

- *a.* GDP affects integration indirectly through institutional arrangements (Capital Account Openness)
- *b.* GDP affects integration indirectly through Trade
- *c. Trade affects integration indirectly through GDP and institutional arrangements (Capital Account Openness)*
- *d. GDP and institutional arrangements (Capital Account Openness) affect integration indirectly through Trade*

3. The third hypothesis that was that institutional arrangements (Capital Account Openness) are the primary driver of market integration, meaning that the macro-economic variables all act on Integration indirectly through the institutional arrangements?

4. The fourth hypothesis is whether the behaviour of economic agents in the markets is a facet of integration with the hypothesis being that:

> *Behavioural biases drive integration*

However the findings of the study made it impossible to test this hypothesis as the behavioral variable's significance could not be confirmed, as the two estimation approaches produced contradictory results.

5. The last hypothesis was tested for European and Latin American countries and Asian and African countries as two distinct groupings. The hypothesis is that:

> *Trade influences Integration both directly and indirectly*

These hypotheses were tested before and after the 2007/8 Global Financial Crisis, in two different sections, for the European and Latin American countries. In section A we consider all the countries in the study together as one group, before and after the Crisis. In the section B we find that the countries break out into two distinct groups depending on how they responded to the Global Financial Crises. The groupings are European and Latin American Countries on the one hand and African and Asian Countries on the other. So in section B test the hypothesis for these two distinct groups of countries, again the hypotheses are tested before and after the Crisis.

The results discussion is broken down into the following sections. Section A discusses the results of all the countries when analysed together as one group. Section B looks at only the results of the European and Latin American (LATAM) countries together. Section C discusses the result of only the African and Asian countries together.

## 4.2 Section A: Analysis of All the Countries Together

The results discussed in this section are for all the countries in the study, namely, the UK, France, Germany, Spain, Japan, Hong Kong, Mexico, Argentina, Brazil, Morocco, Egypt, Nigeria and South Africa, which were analysed as one group with each of these hypotheses, were tested against the entire group of countries. The hypotheses were tested in various models that sought to capture the postulated relationships between the variables. Table 4 below shows the models and the respective hypothesis that the models were testing, for all the countries considered as one group.

In table 4 below, the models are estimated for the period to the Global Financial Crisis, 2003-2007 and after the Crisis 2008-2013. Thus models 1 to 6 are for prior to the Crisis and models 7 to 12 are for after the Crisis. Each of the models tests a given hypothesis as given in table 4.

Table 4: Models and Hypothesis Mapping Overview

| Model | Hypothesis | Relationship being Tested |
|---|---|---|
| **Model 1 and 7**<br>Geweke = $\propto_1 + \beta_1 KAOPEN + u_1$<br>Geweke = $\propto_2 + \beta_2 GDP + u_2$<br>Geweke = $\propto_3 + \beta_3 TradeFactor + u_3$<br>Geweke = $\propto_4 + \beta_4 Herding + u_4$ | 1 | Direct impact of all the variables on Integration |
| **Model 2 and 8**<br>KAOPEN = $\propto_5 + \beta_5 GDP + u_5$<br>Geweke = $\propto_6 + \beta_6 KAOPEN + u_6$<br>Geweke = $\propto_7 + \beta_7 TradeFactor + u_7$<br>Geweke = $\propto_7 + \beta_7 Herding + u_7$ | 2(a) | Indirect impact of GDP on Integration, acting through Capital Account Openness |

| | | |
|---|---|---|
| **Model 3 and 9**<br>Geweke = $\propto_8 + \beta_8 KAOPEN + u_8$<br>Trade = $\propto_9 + \beta_9 GDP + u_9$<br>Geweke = $\propto_{10} + \beta_{10} TradeFactor + u_{10}$<br>Geweke = $\propto_{11} + \beta_{11} Herding + u_{11}$ | 2(b) | Indirect impact of GDP on Integration, acting through Trade |
| **Model 4 and 10**<br>KAOPEN = $\propto_{12} + \beta_{12} GDP + \beta_{13} TradeFactor + u_{12}$<br>Geweke = $\propto_{13} + \beta_{14} KAOPEN + u_{13}$<br>Geweke = $\propto_{14} + \beta_{15} Herding + u_{14}$ | 2(c) | Indirect impact of Trade, acting through Capital Account Openness |
| **Model 5 and 11**<br>GDP = $\propto_{15} + \beta_{16} TradeFactor + u_{15}$<br>KAOPEN = $\propto_{16} + \beta_{17} TradeFactor + u_{16}$<br>Geweke = $\propto_{17} + \beta_{18} GDP + u_{17}$<br>Geweke = $\propto_{18} + \beta_{19} KAOPEN + u_{18}$<br>Geweke = $\propto_{19} + \beta_{20} Herding + u_{19}$ | 2(d) | Indirect impact of Trade, acting through GDP and Capital Account Openness |
| **Model 6 and 12**<br>TradeFactor = $\propto_{20} + \beta_{21} GDP + u_{20}$<br>KAOPEN = $\propto_{21} + \beta_{22} TradeFactor + u_{21}$<br>Geweke = $\propto_{22} + \beta_{23} KAOPEN + u_{22}$<br>Geweke = $\propto_{23} + \beta_{24} Herding + u_{23}$ | 3 | Direct impact of Capital Account Openness with GDP and Trade being indirect and acting through Capital Account Openness |

All of the models were estimated using Path Analysis, which is implemented using Maximum Likelihood estimation, with Bayesian estimation then used to test for robustness of the MLE parameters. The AIC scores of these models were used to determine which model was best at capturing the relationship between variables under study. The detailed results of the estimation of each model can be found in Appendix A. Hypothesis 4 is not reported in the study due to the results that emerged from the testing of the other 3 hypotheses, which showed that Herding was not significant in influencing Integration, this finding will be discussed in more detail in the section below and in further sections of this study.

## 4.2.1 Integration Hypothesis Testing 2003-2007

Table 5 shows results of the MLE analysis for all the models before the Global Financial Crisis. The table provides a comparison of the p-values of all the variables in the models (*** indicates a p-value lower than 0.01, meaning that the variable is significant) as well the AIC scores of the different models.

Table 5: Integration Models AIC Scores Comparison 2003-2007 (i.e., the Geweke meausure represents Intergration as the dependent variable, representative of Equations. in Table 4)

| 2003-2007 Models | Hypothesis | KAOPEN | Herding | GDP | Trade | Model AIC Score |
|---|---|---|---|---|---|---|
| **Model 1** | 1 | 0.657<br>*(0.066)* | 1.096<br>*(0.761)* | 0.511<br>*(0.134)* | 6.213<br>*(***)* | 68.699 |
| **Model 2** | 2(a) | 0.821<br>*(0.022)* | 1.114<br>*(0.738)* | 0.305<br>*(*** )*<br>*(Indirect- through KAOPEN)* | 6.458<br>*(***)* | 46.284 |
| **Model 3** | 2(b) | 0.821<br>*(0.022)* | 1.114<br>*(0.758)* | 0.019<br>*(0.280)*<br>*(Indirect – through Trade)* | 6.458<br>*(***)* | 69.613 |
| **Model 4** | 2(c) | 0.506<br>*(0.177)* | 1.857<br>*(0.625)* | 0.328<br>*(*** )*<br>*(Indirect – through KAOPEN)* | -0.664<br>*(***)*<br>*(Indirect- through KAOPEN)* | 60.682 |
| **Model 5** | 2(d) | 0.279<br>*(0.457)* | 1.747<br>*(0.638)* | 0.747<br>*(0.036)* | 0.318<br>*(0.252)*<br>*(Indirect- through GDP)*<br>-0.556<br>(0.008)<br>*(Indirect - through KAOPEN)* | 85.958 |
| **Model 6** | 3 | 0.506<br>*(0.179)* | 1.857<br>*(0.625)* | 0.019<br>*(0.280)*<br>*(Indirect – through Trade)* | -0.556<br>*(0.008)*<br>*(Indirect - through KAOPEN)* | 88.487 |

****Indicates a p-value that is lower than 0.001*

Table 5 above shows that Model 2, in which Capital Account Openness, Trade and Herding act directly on Integration and GDP acts indirectly on Integration through Capital Account Openness, stands out as the model with more information content than the other models over the 2003-2007 period. The results of the analysis show Hypothesis 2(a) therefore not rejected, whereas hypothesis 1 and 2(b), (c), (d) and 3 are rejected.

For ease of reference the MLE results of the model are reproduced in table 6 below.

Table 6: Model 2 MLE Estimation Results

| | | | Estimate | S.E. | C.R. | P | Label |
|---|---|---|---|---|---|---|---|
| KAOPEN | <--- | GDP | .305 | .053 | 5.698 | *** | |
| GEWEKE | <--- | KAOPEN | .821 | .359 | 2.288 | .022 | |
| GEWEKE | <--- | Herding | 1.114 | 3.616 | .308 | .758 | |
| GEWEKE | <--- | TradeFactor | 6.458 | 1.219 | 5.296 | *** | |

****Indicates a p-value that is lower than 0.001*

The results of the MLE were supported by the Bayesian analysis which was used to test the robustness of the MLE results. Details of the findings for each of models in Table 5 can be found in Appendix A.

It is clear from Model 2(a), that Capital Account Openness is a key variable in what drives Integration between the US and markets in Europe, Africa, Asia and Latin America, when all these countries are considered together. The economics underlying this model are that GDP contributes towards increasing Capital Account Openness, thus economic growth will stimulate greater capital account openness, as the GDP variable has a positive coefficient, which in turn will influence Integration of the markets to the US. The model also shows that Trade between the country concerned and the US will contribute towards greater integration of that country and the US market.

*The results of Model 2 show that, Capital Account Openness and Trade are key direct drivers of integration of the markets in countries in the study and the US market.* GDP plays a significant role in influencing Capital Account Openness, with greater economic growth driving greater Capital Account Openness, but GDP does not drive integration directly.

It is important to note that when all of these markets are considered together, Herding does not play a significant part in driving integration of the markets in all the countries with the US markets.

## 4.2.2 Integration Hypothesis Testing of 2008-2012

### Herding Analysis

In the literature Herding was shown to be important for integration. Table 7 shows the results of the herding analysis for the emerging market countries with the US for the period 2008 to 2012. In this period there were only four periods where three of the markets experienced herding with the US market. The results for the Herding variable in the Pre-Crisis period showed that Herding was not significant in any of the models discussed above. The analysis in table 5 shows that after the Crisis, Herding with the US market does indeed occur. However it occurs so infrequently as to make it difficult to undertake any definitive analysis of the phenomenon in the context of integration for this period. There were only four occurrences of herding during the period, involving only three countries, as shown in table 5. As a result herding is excluded from the post Crisis analysis. It is possible that the herding may occur more often with higher frequency data; however that would make it difficult to incorporate into the current study, as the study does not look at high frequency data.

Table 7: Emerging Market Economies Herding Towards the US Market Analysis

| | 2008 (H1) | | 2008 (H2) | | 2009 (H1) | | 2009 (H2) | | 2010 (H1) | | 2010 (H2) | | 2011 (H1) | | 2011 (H2) | | 2012 (H1) | | 2012 (H2) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\gamma_5 R^2_{US,m,t}$ | *p* | $\gamma_5 R^2_{US,m,t}$ | *p* | $\gamma_5 R^2_{US,m,t}$ | *p* | $\gamma_5 R^2_{US,m,t}$ | *p* | $\gamma_5 R^2_{US,m,t}$ | *p* | $\gamma_5 R^2_{US,m,t}$ | *p* | $\gamma_5 R^2_{US,m,t}$ | *p* | $\gamma_5 R^2_{US,m,t}$ | *p* | $\gamma_5 R^2_{US,m,t}$ | *p* | $\gamma_5 R^2_{US,m,t}$ | *p* |
| **Argentina** | 0.153 | * | -0.016 | * | 0.396 | * | -0.014 | * | -0.527 | * | -0.618 | * | -0.356 | * | -0.034 | * | -0.090 | * | 0.243 | * |
| **Mexico** | -0.585 | *** | -0.178 | * | 0.059 | * | -0.537 | * | -0.259 | * | -0.477 | * | -0.783 | * | 0.085 | * | 0.746 | * | -0.988 | * |
| **Brazil** | -0.420 | * | 0.041 | * | -0.278 | *** | 0.042 | * | 0.436 | *** | 0.067 | * | 0.724 | * | 0.241 | * | -0.127 | * | -0.894 | * |
| **Japan** | -0.316 | * | 0.093 | * | 0.243 | * | | | 0.023 | * | -0.194 | * | 0.586 | * | -0.024 | * | -0.641 | * | -0.157 | * |
| **Hong Kong** | -0.159 | * | -0.012 | * | -0.242 | * | 0.099 | * | -0.034 | * | -0.104 | * | -0.204 | * | 0.055 | * | 0.071 | * | -0.763 | * |
| **Egypt** | 0.195 | * | 0.175 | * | -0.061 | * | 0.109 | * | 1.256 | * | 0.110 | * | 0.599 | * | -0.625 | * | -.0227 | * | 0.380 | * |
| **Morocco** | 0.323 | * | -0.004 | * | -0.122 | * | -0.224 | * | -0.365 | * | -0.537 | * | -0.356 | * | 0.506 | *** | 0.378 | * | 0.938 | * |
| **Nigeria** | 0.162 | * | -0.118 | * | 0.082 | * | 0.858 | * | -0.309 | * | -0.084 | * | 0.058 | * | 0.077 | * | 0.177 | * | 0.318 | * |

*= variable is not significant , ***= variable is significant

In the following section we look at the results of the analysis of the period immediately after the Crisis, from 2008 till 2012, similar to the preceding section we look at all the countries as one group and test the three hypotheses. All of the models, Post Crisis, were estimated using Path Analysis, which was implemented using Maximum Likelihood estimation technique, with the Bayesian estimation technique used to test for robustness of the MLE parameters. The AIC scores of these models were used to determine which model was best at capturing the relationship between variables under study. The detailed results of the estimation of each model can be found in Appendix A.

Table 8 below shows results of the MLE analysis. These results are also in line with results from the Bayesian analysis. As in the preceding section, Hypothesis 2(a) (Model 8), cannot be not rejected based on the results of the MLE analysis. And all the other hypotheses are not supported by the results.

Table 8: Integration AIC Models Comparison 2008-2012 (i.e., the Geweke meausure represents Intergration as the dependent variable, representative of Equations. in Table 4)

| 2008-2012 Models | Hypothesis | KAOPEN | GDP | Trade | AIC Score |
|---|---|---|---|---|---|
| **Model 7** | 1 | 2.768<br>*(***)* | -0.250<br>*(0.400)* | 4.245<br>*(0.012)* | 28.878 |
| **Model 8** | 2(a) | 2.821<br>*(***)* | -0.080<br>*(0.022)*<br>*(Indirect through KAOPEN)* | 4.280<br>*(0.012)* | 24.893 |
| **Model 9** | 2(b) | 2.821<br>*(***)* | -0.003<br>*(0.785)* | 4.268<br>*(0.012)* | 29.524 |
| **Model 10** | 3 | -0.026<br>*(0.201)*<br>*(Indirect through Trade)* | -0.080<br>*(0.022)*<br>*(Indirect through KAOPEN)* | 3.460<br>*(0.053)* | 52.472 |
| **Model 11** | 2(c) | 2.714<br>*(***)* | -0.082<br>*(0.018)*<br>*(Indirect through KAOPEN)* | 2.714<br>*(0.161)*<br>*(Indirect through KAOPEN)* | 29.365 |
| **Model 12** | 2(d) | 2.658<br>*(***)* | -0.271<br>*(0.368)* | -0.265<br>*(0.188)*<br>*(Indirect through KAOPEN)*<br>-0.131<br>*(0.732)*<br>*(Indirect through KAOPEN)* | 35.340 |

****Indicates a p-value that is lower than 0.001*

Looking at market integration for the period 2008 to 2012, it is clear that market integration with the US during this period was driven respectively by Capital Account Openness and Trade between the countries and the US, as captured in Model 8. The importance of Capital Account Openness for Integration demonstrated in Model 8 supports the assertions by authors such as Black (1974) that free capital flows are critical for driving integrated markets. The findings on the impact of Trade on integration, are in line with the findings by Pretorius (2002) that trade, amongst other macro-economic variables, plays an important part in driving market integration. Bracker et al. (1999); Chen and Zhang (1997) also found that countries with strong trade ties have markets that are correlated. The results in table 8 show that Post Crisis, when all the countries are looked as one group, Trade affects integration directly and not indirectly through any other variable. This was not explored in other studies in the literature. We will discuss later in this study, how the role of Trade changes when crises are factored into the models and when the countries are not considered as one big group.

The importance of other macro-economic variables such as GDP was articulated by authors such as Baxter and Kouparitsas (2005); Chen and Zhang (1997); Bracker et al. (1999); Choe (2001); Phylaktis and Ravazzolo (2002) and Chambet and Gibson (2008). A finding coming out of the study of that period for all the countries analysed together, is that GDP does not act on integration directly but rather through Capital Account Openness. However, these authors did not establish the link between GDP, market integration and capital account openness, which is what this study has done. For ease of reference the MLE results of Hypothesis 2(a) (Model 8) are reproduced below.

Table 9: Hypothesis 2 (Model 8) MLE Results for All Countries for 2008-2012

| | | | Estimate | S.E. | C.R. | P | Label |
|---|---|---|---|---|---|---|---|
| KAOPEN | <--- | GDP | -.080 | .035 | -2.292 | .022 | |
| GEWEKE | <--- | KAOPEN | 2.821 | .506 | 5.571 | *** | |
| GEWEKE | <--- | TradeFactor | 4.280 | 1.695 | 2.525 | .012 | |

****Indicates a p-value that is lower than 0.001*

What is different for GDP before and after the Crisis however, as can be seen in table 9, is that after the Crisis GDP has a negative co-efficient, which means that GDP has the effect of lowering the level at which Capital Account Openness impacts market integration. After the Crisis, higher GDP reduces Capital Account Openness. This was an unexpected finding and was not anticipated in the literature. It implies that after the Crisis, growth in GDP somehow causes countries to increase their capital controls, but this effect is not observed before the Crisis. When we look at the countries in smaller groupings the reasons for this apparent phenomenon become clearer.

The impact of GDP on Capital Account Openness is the opposite of what one would expect, in that one would expect that economic growth would spur on greater openness, however it is most probably due to the action of the LATAM monetary authorities who may have been

reducing their capital account openness in effort to protect their economies during times of economic stress, by tightening controls during times of economic boom. During the period under review, the KAOPEN score for the LATAM countries varied widely as shown in Table 10 below, whereas it was very stable for European countries.

Table 10: KAOPEN Comparison for LATAM countries and Europe

| **LATAM Country** | **2003 to 2007 KAOPEN Score Range** | | | **European Country** | **2003 to 2007 KAOPEN Score Range** |
|---|---|---|---|---|---|
| Brazil | 2003 | 0,194059 | | Germany | |
| | 2007 | 0,90701 | | | |
| Mexico | 2003 | 0,035746 | | United Kingdom | 2,389668 |
| | 2007 | 1,093394 | | | |
| Argentina | 2003 | -0,92325 | | Spain | |
| | 2007 | 0,83125 | | | |
| | | | | France | |

For Argentina for example, the KAOPEN score varied between a negative 1 and a positive 1, between 2003 and 2007. Thus the negative relationship between GDP and Capital Account Openness may reflect a Latin American dynamic more than a European one. As stated before, another unexpected finding was that herding played little, to no role in market integration, during this period for all the countries in the study.

From the contagion models of integration, it was expected that herding would help account for another channel through which integration could take place other than the institutional channels of trade and the capital account. But there was very little herding witnessed during the period covered by the study, when all the countries were considered together, thus making it less compelling to assess the impact of herding on integration as a separate hypothesis. As shown in Table 7 above only three countries exhibited herding in four periods of six months, over a period of 5 years, meaning that these were only four periods of herding, out of eighty (80) periods. Herding clearly was not a feature of the behaviour of the markets in the study during this period. Thus Hypothesis 4, which postulates that integration may be a result of psychological dynamics finds no support in the data in this study, thus far, we shall discuss Herding again when we look at integration of African and Asian countries separately from the other countries as other dynamics emerge from that analysis.

The variability of Capital Account Openness in its effects was not picked up in previous studies of capital account openness (Black, 1974) and how it influences market integration are the new

findings of this study, arising from the analysis of all the countries together. It does however explain why Phylaktis and Ravazzolo (2002) found that even when there are capital flow restrictions, markets could still be integrated. The authors found that reduction of capital controls tended to increase integration. The results of the analysis of all the countries explains their finding, it shows that capital account openness influences the degree of integration and this can vary in significance in how it impacts integration. We will discuss later in this study, how the role of Capital Account Openness varies with crises.

This study has shown that when all the countries in the study are considered together, the variables of trade, capital account openness and GDP have a significant influence on market integration. The study has also however found that the relationship between these variables is not always straight forward; for example, the case of the inverse relationship between GDP and Capital Account Openness and how they interact to influence integration.

### 4.2.3 Section A Conclusion

The results of the analysis show that in the period after the financial crisis, when considering all the countries in the study together, trade and capital account openness were important in driving market integration. This finding supports the authors who have argued for the importance of macro-economic variables in the how integration takes place in world equity markets. However it is not domestic macro-economic variables, such as GDP that seem to drive integration, but rather those macro-variables that link countries, i.e. trade or the ease with which money can move in and out of a country. It is understandable that the ease with which money can flow between countries and their respective markets should have an influence on the integration of markets, since the easier it is for investors to move in and out of a country's market, the more there will be a link between returns in the investor's home market and the destination country's markets. If investors perceive that their markets are not offering attractive returns, they will choose to move money out of their markets to where they believe better returns can be earned and vice versa, thus linking the two markets. This view of integration is supported by the analysis of markets of all the countries together after the 2007 financial crisis.

Authors such as Bracker et al. (1999); Chen and Zhang (1997) have argued for the importance of trade for integration, a view supported by the results of the analysis of all the countries in the study when looked at together. Trade between countries could drive integration as goods are purchased from companies in the sending country by consumers or other businesses in the destination country. The purchases represent revenue for the sending country's companies, which should be reflected in the stock price of those companies. Thus the trade between US and other countries in the study would drive the flow of revenues from the destination country to US companies and consequently affect US markets and vice versa, depending on the relative size of the trade with the US. The results of the analysis of this section support the notion that this may indeed how trade acts to affect integration.

Looking at stock market integration, for all the countries, together, after the 2007 financial crisis, this part of the study has found that it is not a unidimensional phenomenon, but that in

fact is driven by two factors, namely trade and capital account openness. This supports the view that this study seeks to test, that is, whether integration is a multi-dimensional phenomenon, i.e. is made up various factors that interact to drive integration. Surprisingly herding, which has been postulated to possibly be another possible dimension of integration, was found not to be significant for many of the periods considered during 20003- 2012, between the US and the markets in the study. Herding was therefore not considered in this section, in terms of whether it is also an additional dimension of integration. It will however be explored in more detail in later sections of this study.

In the next section we separate the markets out and consider whether the same findings hold when one considers different countries separately instead of as one monolithic group. The markets of the different countries responded differently to the 2007/8 global financial crisis and this occasions looking them as separate groupings. The European and Latin American markets responded differently to the Global Financial Crisis, from the African and Asian markets and so in the next section these markets will be considered separately.

## 4.3 Section B: Analysis of European/Latin American (LATAM) Markets

**Structural Break Analysis**

The 2007/8 Global Financial Crisis rippled through most economies and markets and resulted in declines in economic growth for many countries as well as loss in market capitalisation for markets in the US and Europe. Due to the significance of this period, structural break analysis was done of each country's market data using the Sequential Bai-Perron technique for the period 2006/7 in this study. The analysis showed that there was a structural break in the European and Latin American markets. Table 11 shows the periods during which the breaks occurred in the different markets.

Table 11: Structural Break Test

| Country | Year of Structural Break |
|---|---|
| UK, France, Germany | 2007 |
| Spain | No break |
| Mexico, Argentina, Brazil | 2006 |
| Japan, Hong Kong, Morocco, South Africa, Nigeria | No break |

It is important to note that the structural break for LATAM countries happens in 2006 whereas for the European countries the structural break occurs in 2007, however in the preceding section where all the countries were analysed together, the data was analysed for the periods 2003-2007 and 2008-2012, because the rate of defaults on subprime loans exploded in 2007. In the analysis below of the LATAM and European countries, the models are analysed for breaks

occurring in 2006 and in 2007 respectively. The detailed analysis of the models, with the two different periods of structural breaks, are provided in Appendix A.

The results of the structural break analysis indicate that there may be a difference in the African and Asian markets that caused them not to be affected in the same way as the European and Latin American countries, by the financial crisis emanating from the US. This prompted further analysis of integration to be undertaken for the different clusters of countries i.e. Europe and Latin America and African and Asian countries. The results are reported below, starting with the European and Latin American (LATAM) countries' results. It is important to note that Spain was not included with the analysis of the African and Asian countries due to the fact that it formed part of the Portugal, Italy, Greece and SPAIN (PIGS) grouping of countries that suffered significant economic crises following the Sub-Prime crisis in the US which precipitated the Global Financial Crisis.

The preceding sections looked at the integration for all of the countries in the study as though they were one homogenous block. The following section breaks the countries up to analyse whether the drivers of integration change, if the countries are considered as differentiated blocks given that the different county groupings reacted differently to the Global Financial Crisis.

In the following section we will discuss integration for the European and Latin American markets as a group, given that both areas reacted to Global Financial Crisis similarly, i.e. their markets exhibited a structural break as a result of the crisis. For purposes of comparison, the results of two sets of analyses are reported in Appendix A. The one set is with the LATAM data with the structural break in 2007 so that the results can be compared with results of all the countries evaluated together and then more correctly, the structural break is placed in 2006. The coefficients and significance tests of the two periods are reported so as to identify whether in the results of the analysis where all the countries are considered together may be biased by the actual structural break for LATAM countries being in 2006 as opposed to 2007. The discussion below is based on the models that were found to be most informative, for a given location of the structural break.

For ease of reference the table below recaps the models and the relationships being estimated. Models 13 to 18 estimate the parameters before the Crisis. Models 19 to 24 estimate the parameters after the Crisis.

| Model | Hypothesis | Relationship being Tested |
|---|---|---|
| **Model 13 and 19**<br>Geweke = $\propto_1 + \beta_1 KAOPEN + u_1$<br>Geweke = $\propto_2 + \beta_2 GDP + u_2$<br>Geweke = $\propto_3 + \beta_3 TradeFactor + u_3$<br>Geweke = $\propto_4 + \beta_4 Herding + u_4$ | 1 | Direct impact of all the variables on Integration |
| **Model 14 and 20**<br>KAOPEN = $\propto_5 + \beta_5 GDP + u_5$<br>Geweke = $\propto_6 + \beta_6 KAOPEN + u_6$<br>Geweke = $\propto_7 + \beta_7 TradeFactor + u_7$<br>Geweke = $\propto_7 + \beta_7 Herding + u_7$ | 2(a) | Indirect impact of GDP on Integration, acting through Capital Account Openness |
| **Model 15 and 21**<br>Geweke = $\propto_8 + \beta_8 KAOPEN + u_8$<br>Trade = $\propto_9 + \beta_9 GDP + u_9$<br>Geweke = $\propto_{10} + \beta_{10} TradeFactor + u_{10}$<br>Geweke = $\propto_{11} + \beta_{11} Herding + u_{11}$ | 2(b) | Indirect impact of GDP on Integration, acting through Trade |
| **Model 16 and 22**<br>KAOPEN = $\propto_{12} + \beta_{12} GDP + \beta_{13} TradeFactor + u_{12}$<br>Geweke = $\propto_{13} + \beta_{14} KAOPEN + u_{13}$<br>Geweke = $\propto_{14} + \beta_{15} Herding + u_{14}$ | 2(c) | Indirect impact of Trade, acting through Capital Account Openness |
| **Model 17 and 23**<br>GDP = $\propto_{15} + \beta_{16} TradeFactor + u_{15}$<br>KAOPEN = $\propto_{16} + \beta_{17} TradeFactor + u_{16}$<br>Geweke = $\propto_{17} + \beta_{18} GDP + u_{17}$<br>Geweke = $\propto_{18} + \beta_{19} KAOPEN + u_{18}$<br>Geweke = $\propto_{19} + \beta_{20} Herding + u_{19}$ | 2(d) | Indirect impact of Trade, acting through GDP and Capital Account Openness |
| **Model 18 and 24**<br>TradeFactor = $\propto_{20} + \beta_{21} GDP + u_{20}$<br>KAOPEN = $\propto_{21} + \beta_{22} TradeFactor + u_{21}$<br>Geweke = $\propto_{22} + \beta_{23} KAOPEN + u_{22}$<br>Geweke = $\propto_{23} + \beta_{24} Herding + u_{23}$ | 3 | Direct impact of Capital Account Openness with GDP and Trade being indirect and acting through Capital Account Openness |

All of the models were estimated using Path Analysis, which was implemented using Maximum Likelihood estimation, with Bayesian estimation technique used to test for robustness of the MLE parameters. The AIC scores of these models were used to determine which model was best at capturing the relationship between variables under study. The detailed results of the estimation of each model can be found in Appendix A.

### 4.3.1 Integration of European and Latin American (LATAM) Countries to the US during 2003-2007

Table 12 below shows the results of testing the 3 hypotheses for European and LATAM countries.

Table 12: Models AIC Scores Comparison (i.e., the Geweke meausure represents Intergration as the dependent variable, representative of Equations. in Table 4)

| Europe & LATAM 2003-2007 | Hypothesis | KAOPEN | GDP | Herding | Trade | AIC Score |
|---|---|---|---|---|---|---|
| **Model 13** | 1 | 0.056 *(0.939)* | -1.606 *(0.180)* | -4.007 *(0.554)* | 3.418 *(0.018)* | 64.746 |
| **Model 14** | 2(a) | .803 | .627 *(indirectly through KAOPEN)* | .769 | .010 | 66.160 |
| **Model 15** | 2(b) | .803 | .148 *(Indirectly through Trade)* | .769 | .010 | 64.322 |
| **Model 16** | 2(c) | .388 | .111 *(Indirectly through KAOPEN)* | .867 | *** (*Indirectly through KAOPEN)* | 38.713 |
| **Model 17** | 2(d) | 0.578 *(0.399)* | -0.208 *(0.849)* | 0.538 *(0.897)* | -0.970 *(***) (Indirectly through KAOPEN)* -0.160 *(0.150) (indirectly through GDP)* | 41.107 |
| **Model 18** | 3 | 0.587 *(0.392)* | -0.100 *(0.150)* | 0.700 *(0.867)* | -0.970 *(***) (Indirectly through KAOPEN)* | 39.142 |
| **Model 19** | 5 | .083 | .150 | .872 | *** *(Indirectly through KAOPEN and 0.043 directly)* | 37.106 |

****Indicates a p-value that is lower than 0.001*

Model 13 to Model 18 have nothing to say about how the variables influence integration they also have higher AIC scores than Model 19. Due to the importance of Trade from the literature and the fact that Trade was significant in all of the hypotheses modeled above, Model 19 was

estimated. The model looks at Trade and how it influences Integration directly and indirectly. The model basically tests whether Trade influences Integration European and LATAM markets directly as well as through influencing Capital Account Openness. However the model shows that Capital Account Openness has no impact on Integration. The AIC score of this model shows that this model performs the best of all of models for the European and LATAM countries prior to the Global Financial Crisis.

Thus from the model in table 13 it is clear that pre-Crisis, for the European and LATAM countries, only Trade has a significant influence on Integration.

Table 13: Trade Direct and Indirect Impact on Integration Model

| | | | Estimate | S.E. | C.R. | P | Label |
|---|---|---|---|---|---|---|---|
| KAOPEN | <--- | TradeFactor | -.970 | .157 | -6.162 | *** | |
| GEWEKE | <--- | KAOPEN | 1.333 | .769 | 1.734 | .083 | |
| GEWEKE | <--- | Herding | .659 | 4.103 | .161 | .872 | |
| GDP | <--- | TradeFactor | -.160 | .111 | -1.438 | .150 | |
| GEWEKE | <--- | TradeFactor | 3.148 | 1.554 | 2.025 | .043 | |

| Model | AIC |
|---|---|
| Default model | 37.106 |

****Indicates a p-value that is lower than 0.001*

It is clear from Model 19, relative to all the other models that, prior to 2008, for European and LATAM countries, Trade is key influencer of Integration of these markets to the US market. This result is very different from what was found when all the countries were considered together, where Capital Account Openness, together with Trade were influencers of Integration during the Pre-Crisis period. These results show the importance of not indiscriminately grouping countries together when looking at integration. Given that one of the impacts of the Financial Crisis is that it stalled global trade and economic growth in many countries, in the next section we consider how GDP, Capital Account Openness, Trade and Herding interacted with Integration, post the Crisis.

### 4.3.2 Integration of European and Latin American (LATAM) Countries to the US during 2008-2013

The results of the models of relationship between the variables under investigation and Integration of all the countries together into the world market (represented by the US market) showed that there was a difference between how the pertinent variables interacted and influenced Integration prior to and post the Global Financial Crisis. In this section we look at whether the variables changed how they interacted, when they are considered only for European and LATAM countries, after the Global Financial Crisis. Table 14 reports the results of

the models testing the hypothesis 1 to 3 and 5, for European and LATAM countries between the years 2008 and 2012.

Table 14: Europe/LATAM Integration Models AIC Scores Comparison 2008-2012 (i.e., the Geweke meausure represents Intergration as the dependent variable, representative of Equations. in Table 4)

| 2008-2012 Models | Hypothesis | KAOPEN | GDP | Herding | Trade | AIC Score |
|---|---|---|---|---|---|---|
| **Model 20** | 1 | 2.431<br>*(0.005)* | -3.966<br>*(***)* | -2.359<br>*(0.739)* | 0.185<br>*(0.914)* | 42.647 |
| **Model 21** | 2(a) | 1.011<br>*(0.270)* | 0.213<br>*(0.023)*<br>*(Indirectly through KAOPEN)* | 0.610<br>*(0.935)* | 0.416<br>*(0.819)* | 52.421 |
| **Model 22** | 2(b) | 1.011<br>*(0.270)* | -0.081<br>*(0.088)*<br>*(Indirectly through Trade)* | 0.610<br>*(0.935)* | 0.416<br>*(0.819)* | 54.461 |
| **Model 23** | 2(c) | 0.906<br>*(0.325)* | 0.189<br>*(0.040)*<br>*(Indirectly through KAOPEN)* | 0.614<br>*(0.935)* | -0.290<br>*(0.064)*<br>*(Indirectly through KAOPEN)* | 48.977 |
| **Model 24** | 2(d) | 2,386<br>*(0.006)* | -3.970<br>*(***)* | -2.361<br>*(0.739)* | -0.334<br>*(0.036)*<br>*(Indirectly through KAOPEN)*<br>-0.234<br>*(0.088)*<br>*(Indirectly through GDP)* | 37.414 |
| **Model 25** | 3 | 0.906<br>*(0.323)* | -0.081<br>*(0.088)*<br>*(Indirectly through trade)* | 0.614<br>*(0.935)* | -0.334<br>*(0.036)*<br>(indirectly through KAOPEN) | 50.156 |
| **Model 26** | 5 | 1.011<br>*(0.277)* | -0.234<br>*(0.088)* | 0.610<br>*(0.935)* | -0.334<br>(0.036) (indirectly through KAOPEN)<br>0.416<br>(0.821) (directly) | 52.104 |

****Indicates a p-value that is lower than 0.001*

Amongst the Integration models after the Crisis, the model with lowest AIC score was Model 23, which tests Hypothesis 2(d); for ease of reference, the results of the MLE for Model 23 are re-produced in Table 15 below. Hypothesis 2(d) is therefore not rejected based on the model's AIC score.

Table 15: MLE Results for Hypothesis 2(d) (Model 23)

| | | | Estimate | S.E. | C.R. | P | Label |
|---|---|---|---|---|---|---|---|
| KAOPEN | <--- | TradeFactor | -.334 | .159 | -2.102 | .036 | |
| GDP | <--- | TradeFactor | -.234 | .137 | -1.707 | .088 | |
| GEWEKE | <--- | KAOPEN | 2.386 | .867 | 2.752 | .006 | |
| GEWEKE | <--- | Herding | -2.361 | 7.091 | -.333 | .739 | |
| GEWEKE | <--- | GDP | -3.970 | 1.010 | -3.929 | *** | |

****Indicates a p-value that is lower than 0.001*

The results show clearly that after 2007, GDP of European and LATAM countries acts directly on their integration with the US market. GDP is significant at the 99% confidence level. However the relationship is a negative one. Capital Account Openness also acts directly on the integration of these countries with the US market and it is also significant at the 95% level in terms of its influence on Integration. The model shows that GDP and Institutional Arrangements are together key in influencing Integration of European and LATAM countries with the world market post 2007. GDP and Capital Account Openness significantly influence Integration directly and Trade influences it indirectly through Capital Account Openness but not through GDP. Whereas prior to the Financial Crisis, Trade acted directly on Integration, after the crisis, Trade acts indirectly through Capital Account Openness as an intermediate variable. Model 26 is the same as Model 19, which prior to the Crisis had the lowest AIC score of all the pre-Crisis model, as shown in Table 16 below. After the Crisis, the relationships captured in this model are the least informative with an AIC score of 52.104, which is higher than the 37.414 for Model 26.

Table 16: Trade Direct and Indirect Impact on Integration

| | | | Estimate | S.E. | C.R. | P | Label |
|---|---|---|---|---|---|---|---|
| KAOPEN | <--- | TradeFactor | -.334 | .159 | -2.102 | .036 | |
| GEWEKE | <--- | KAOPEN | 1.011 | .930 | 1.087 | .277 | |
| GDP | <--- | TradeFactor | -.234 | .137 | -1.707 | .088 | |
| GEWEKE | <--- | TradeFactor | .416 | 1.841 | .226 | .821 | |
| GEWEKE | <--- | Herding | .610 | 7.504 | .081 | .935 | |

| Model | AIC |
|---|---|
| Default model | 52.104 |

****Indicates a p-value that is lower than 0.001*

Capital Account Openness in turn was not significant prior to 2007, as shown in Table 16, with a score of 0.277, but it becomes significant after the Crisis.

The negative GDP relationship in Model 26 makes sense if one considers that if a country's GDP is strong, investors will look at the country's fundamentals as determinants for the direction that the country's markets will be taking, however if the GDP is weak, investors may look to more dominant markets for direction. Thus the impact of GDP on Integration is that it either leads to segmented markets, if the GDP is high or more integrated markets if the GDP is low.

The economic rationale for this finding is that prior to the crisis, the degree to which European and LATAM countries traded with the US was the key fundamental driving whether their markets were integrated and, Capital Account Openness and GDP were not key. However, post the Crisis economic growth for European and LATAM countries became the key consideration as the countries' economies had to recover from the global financial meltdown and the degree to which they were recovering would then become the driver of how integrated they were with the US markets, which was itself trying to recover from the crash. This contradicts the authors who have argued that GDP is not an important driver of integration, such Eichengreen et al. (1996), who found in their study that trade was more important than GDP. The results here support authors such as Baxter and Kouparitsas (2005); Chen and Zhang (1997); Bracker et al. (1999), who argued for the importance of GDP, but the results do not support these authors in the way that the authors anticipated GDP plays a role in Integration. It turns out that the importance of GDP in driving integration is not constant, but is in fact subject to regime change in the markets.

The same finding holds for Capital Account Openness. Black (1974) and Grubel (1968) in their seminal articles articulated the idea that Capital Account Openness was critical for integration. But they too saw it as a constant factor, they did not anticipate that its significance, in fact, changes over time. Prior to the Financial Crisis, Capital Account Openness was not a significant driver for European and LATAM countries, it was eclipsed by Trade as a key influencing variable. However, after the Crisis, Trade is no longer a primary direct influencer of Integration. In fact, when its direct impact is evaluated it is found not to be significant as was found in Model 19. However in Model 23, when Trade is evaluated as acting through an intermediate variable, in this case Capital Account Openness, it is found to have a direct statistically significant influence on Integration.

Thus Model 23 (Hypothesis 2(d)) captures the relationship of all the fundamental variables of the European and LATAM countries as well as institutional arrangements, with Integration and with each other after the Crisis. The study clearly shows that the relationship between the variables and integration, and the variables themselves is time dependent and is not stable over time. This may explain why authors such as Bakeart and Harvey (1995) have found integration to be time variant, because if one used capital account openness as the only variable influencing Integration, one may find that markets are integrated at one point but not at another.

Interestingly for the European and LATAM countries, Integration is only driven by macroeconomic fundamentals for both periods, before and after the Crisis. Herding is not significant for all the periods for these countries. Thus the European and LATAM countries

support the findings of Choe (2001); Phylaktis and Ravazzolo (2002) and Chambet and Gibson (2008), which were that it is the fundamental variables that drive integration, but not in the way that these authors anticipated. Looking only at the European and LATAM countries, these authors would indeed seem to be correct. However we shall see later in this study, when we look at African and Asian countries, the question of what drives integration is more complex.

For purposes of completeness, the model of Trade impacting Integration directly and indirectly that was tested for time prior to the Crisis is reported in Table 16 below. The AIC score for this model show that for the period after the Crisis this model is not as informative as Model 23. Thus Model 23 is still the most informative model for this period.

## 4.3 Section C: Analysis of Integration of African and Asian Countries to the US, between 2003-2012

In this section we discuss the results of the analysis of the integration between the US and African and Asian markets. These areas are grouped together because the structural break analysis discussed earlier in section B, showed that for these regions, there was no structural break in the data as a result of the Global Financial Crisis.

Model results comparison in Table 17 below, show that Model 31, where Trade acts on Integration directly and via Capital Account Openness indirectly, without Capital Account Openness significantly influencing Integration, is the most informative based on its AIC score. GDP also has a significant influence via Capital Account Openness. It is interesting to note that in this model, when estimated using MLE, Trade followed by Herding, are the significant influencers of integration for the African and Asian countries. However with respect to Herding, this observation is not supported by the Bayesian estimation. This means that the finding that Herding influences integration cannot be relied upon and may be as a result of MLE not being able to deal with the issues of sample size or non-normality of the Herding data. Therefore it is safe to conclude that for the African and Asian markets, which did not experience a structural break after the Crisis, Trade emerges as the most important variable driving integration.

Model 29 is the least informative. In this model Trade acts through Capital Account Openness and GDP. With these two variables not having significant impact on integration and Herding acts directly on Integration and has a significant impact on it in the MLE model, but similar to Model 31, Herding is not significant in the Bayesian estimation based model.

For ease of reference, the table below repeats the hypothesis being tested and the models being estimated.

| Model | Hypothesis | Relationship being Tested |
|---|---|---|
| **Model 27**<br>Geweke = $\propto_1 + \beta_1 KAOPEN + u_1$<br>Geweke = $\propto_2 + \beta_2 GDP + u_2$<br>Geweke = $\propto_3 + \beta_3 TradeFactor + u_3$<br>Geweke = $\propto_4 + \beta_4 Herding + u_4$ | 1 | Direct impact of all the variables on Integration |
| **Model 28**<br>KAOPEN = $\propto_5 + \beta_5 GDP + u_5$<br>Geweke = $\propto_6 + \beta_6 KAOPEN + u_6$<br>Geweke = $\propto_7 + \beta_7 TradeFactor + u_7$<br>Geweke = $\propto_7 + \beta_7 Herding + u_7$ | 2(a) | Indirect impact of GDP on Integration, acting through Capital Account Openness |
| **Model 29**<br>Geweke = $\propto_8 + \beta_8 KAOPEN + u_8$<br>Trade = $\propto_9 + \beta_9 GDP + u_9$<br>Geweke = $\propto_{10} + \beta_{10} TradeFactor + u_{10}$<br>Geweke = $\propto_{11} + \beta_{11} Herding + u_{11}$ | 2(b) | Indirect impact of GDP on Integration, acting through Trade |
| **Model 30**<br>KAOPEN = $\propto_{12} + \beta_{12} GDP + \beta_{13} TradeFactor + u_{12}$<br>Geweke = $\propto_{13} + \beta_{14} KAOPEN + u_{13}$<br>Geweke = $\propto_{14} + \beta_{15} Herding + u_{14}$ | 2(c) | Indirect impact of Trade, acting through Capital Account Openness |
| **Model 31**<br>GDP = $\propto_{15} + \beta_{16} TradeFactor + u_{15}$<br>KAOPEN = $\propto_{16} + \beta_{17} TradeFactor + u_{16}$<br>Geweke = $\propto_{17} + \beta_{18} GDP + u_{17}$<br>Geweke = $\propto_{18} + \beta_{19} KAOPEN + u_{18}$<br>Geweke = $\propto_{19} + \beta_{20} Herding + u_{19}$ | 2(d) | Indirect impact of Trade, acting through GDP and Capital Account Openness |
| **Model 32**<br>TradeFactor = $\propto_{20} + \beta_{21} GDP + u_{20}$<br>KAOPEN = $\propto_{21} + \beta_{22} TradeFactor + u_{21}$<br>Geweke = $\propto_{22} + \beta_{23} KAOPEN + u_{22}$<br>Geweke = $\propto_{23} + \beta_{24} Herding + u_{23}$ | 3 | Direct impact of Capital Account Openness with GDP and Trade being indirect and acting through Capital Account Openness |

All of the models were estimated using Path Analysis, which was implemented using Maximum Likelihood estimation, with Bayesian estimation technique used to test for robustness of the MLE parameters. The AIC scores of these models were used to determine which model was best at capturing the relationship between variables under study. The detailed results of the estimation of each model can be found in Appendix A.

Table 17: African/Asian Integration Model Comparison (i.e., the Geweke meausure represents Intergration as the dependent variable, representative of Equations. in Table 4)

| 2003-2012 Model | Hypothesis | KAOPEN | GDP | Herding | Trade | AIC Score |
|---|---|---|---|---|---|---|
| **Model 27** | 1 | -0.303 *(0.140)* | 0.023 *(0.848)* | 10.090 *(0.046)* | -8.047 *(0.023)* | 49.537 |
| **Model 28** | 2(a) | -0.292 *(0.155)* | 0.135 *(***)* *(Indirectly through KAOPEN)* | 10.211 *(0.043)* | -7.982 *(0.024)* | 36.002 |
| **Model 29** | 2(b) | -0.292 *(0.155)* | 0.004 *(0.097)* *(Indirectly through Trade)* | 10.211 *(0.043)* | -7.982 *(0.024)* | 48.333 |
| **Model 30** | 2(c) | -0.220 *(0.288)* | 0.135 *(***)* *(Indirectly through KAOPEN)* | 10.217 *(0.046)* | -2.787 *(0.013)* *(Indirectly through KAOPEN)* | 34.991 |
| **Model 31** | 2(d) | -0.217 *(0.297)* | -0.009 *(0.937)* | 10.265 *(0.045)* | 4.851 *(0.096)* *(Indirectly through GDP)* -2.633 (0.022) *(Indirectly through KAOPEN)* | 50.100 |
| **Model 32** | 3 | -0.220 *(0.288)* | 0.004 *(0.097)* *(Indirectly through Trade)* | 10.217 *(0.046)* | -2.633 *(0.022)* *(Indirectly through KAOPEN)* | 48.108 |
| **Model 33** | 5 | -0.292 *(0.159)* | 0.135 *(***)* | 10.211 *(0.043)* | -2.787 *(0.013)* (indirectly through KAOPEN) -7.982 *(0.026)* (directly) | 32.051 |

****Indicates a p-value that is lower than 0.001*

Analysis of the African and Asian countries shows that Trade is a significant influencer of integration for these countries, as are is shown clearly by models 26 and 28. GDP is also significant in influencing Capital Account Openness as is shown by these models. However the

AIC score of Model 26 is higher than model 28, although in Model 28 none of the variables (except for Herding) significantly influence Integration. But in model 26, Trading has a significant influence of Integration; even though the model's AIC score is lower than model 28. The difference in AIC scores of the two models however is marginal. Thus, in order to establish whether Trade does indeed have a direct and an indirect impact on Integration, Model 33 was estimated. The same model has been used for looking at Europe/LATAM markets as well as to look at direct and indirect Trade effects for all the countries together

Model 33 (which is reproduced below), was the most informative model of all the models was estimated for African and Asian and it shows the direct and indirect significance of Trade for Integration. Since this model is the most informative, for the purposes of this study, it will be the model that we use for understanding the nature of integration of the African and Asian markets with the US market. The model fits in with the literature in that in shows the importance of Trade for integration, for African and Asian countries. However, in this model, the relationship between Trade and Integration is a negative one, meaning that as trade increases market integration decreases for the Asian and African countries.

For ease of reference Model 33 is reproduced below.

| | | Estimate | S.E. | C.R. | P | Label |
|---|---|---|---|---|---|---|
| KAOPEN <--- | GDP | 0.135 | 0.036 | 3.737 | *** | |
| KAOPEN <--- | TradeFactor | -2.787 | 1.118 | -2.493 | 0.013 | |
| GEWEKE <--- | KAOPEN | -0.292 | 0.208 | -1.407 | 0.159 | |
| GEWEKE <--- | Herding | 10.211 | 5.051 | 2.022 | 0.043 | |
| GEWEKE <--- | TradeFactor | -7.982 | 3.581 | -2.229 | 0.026 | |

| Model | AIC |
|---|---|
| Default model | 32.051 |

****Indicates a p-value that is lower than 0.001*

The model reveals something interesting about the Integration/Trade relationship, that more trade leads to greater segmentation of African and Asian markets from the world market and this inverse relationship was not affected by the Global Financial Crisis. The relationship between economic fundamentals to returns on the stock exchange postulated by Chen et al. (1986), is manifested in African and Asian markets. The authors argued that gains made from trade for example, will drive up share prices of companies listed in the given country's stock market. The link between trade and integration is evident in these markets as well as in the European and LATAM markets. Prior to the Crisis for European and LATAM markets, the effect of Trade was direct, after the crisis, it became indirect, affecting integration through Capital Account Openness. The inverse relationship between Trade and Integration, for African and Asian markets, is the opposite of what the literature would lead us to expect (Chen and Zhang, 1997; Choe, 2001; Chambert and Gibson, 2008), which may mean that the model is incorrect, as there is no apparent economic rationale for why Trade should reduce integration. However it may also be likely that the model is revealing an unexpected aspect of the Trade/Integration relationship.

Although Herding is significant in the MLE models reported above, this finding is not supported by the Bayesian estimation model of the same models and so we will not consider Herding as significant for integration of the African and Asian markets with the US market. Thus the role of Herding in influencing integration remains unclear.

European and LATAM markets data show a structural break in 2007, meaning that the effects of the Financial Crisis may have filtered to European and LATAM markets through fundamental factors. Markets in the African and Asian countries do not exhibit a structural break during the period of the crisis. *Thus the goods traded between the European and LATAM countries respectively and the US may have declined in significance for Integration after crisis, but not for African and Asian countries.*

## 4.4 Review of Findings of Section B and C

These findings of the study suggest that integration is not a one dimensional phenomenon. It is influenced by several factors.

1. Trade is an important influencer of market Integration, however the way it acts on integration changes between direct and indirect action, and also depending on whether there is a crisis in the given market. The influence however may be negative or positive, depending on the market or country in question (It was positive for European and LATAM countries and negative for African and Asian countries).

2. After a crisis in a given market, Trade's may be surpassed by Capital Account Openness in importance, and Trade may instead affect integration through Capital Account Openness.

3. In the absence of a crisis, Trade remains an important direct driver of Integration.

4. The role of GDP is also important for European and LATAM countries, in that a high GDP leads to more segmented markets.

In agreement with Bracker et al. (1999), that there is a linkage between countries with both trade ties and correlated markets, is supported by this study. Prior to 2007, for the European and LATAM countries, Trade influenced integration directly and after 2007 its influence was indirect. The literature supports the importance of trade in linking markets. (Chambert and Gibson, 2008; Phylaktis and Ravazzolo, 2002; Choe, 2001), however this study does not find evidence for trade driving integration in *all* of the markets and all of the times, considered over the period under study. This finding of trade not driving integration all the time, explains the results found by authors who found no linkage between trade and the markets of countries that they have looked at, such as Verma and Ozuna (2005) and Kizys and Pierdzioch (2009), amongst others.

The quantity measurement approaches, that look at flows of capital, as influencers of integration, as outlined by Rajan et al. (2006), are support by this study. The importance of an open capital account for integration of European and LATAM markets into global markets, after

2007, shows that the quantity based measures of integration are indeed measuring a valid dimension of integration. However, similar to the Trade variable, Capital Account Openness is not the key driver of integration on a consistent basis. The findings of this study, when it comes to European and LATAM countries, contradict the argument forwarded by Baele et al. (2004) that institutional arrangements do not matter in considering integration, but the study's findings partially support Baele et al. by adding nuance to their assertion. The results show that institutional arrangements (that affect the Capital Account regime), are in fact important for integration, but not at all times, as was shown in the case of the European and LATAM countries. However in support of the Baele et al. assertion, institutional arrangements did not affect integration for African and Asian countries.

The results of this study for European and LATAM markets after 2007, support Black's (1974) assertion that capital controls can lead to segmented markets, in that it shows that for European and LATAM countries at least, capital account openness is an important factor in driving integration. But, interestingly, as discussed earlier, prior to 2007, Capital Account Openness was not significant in driving integration, thus actually contradicting Black and other authors' assertion of the importance of not having capital controls in order to ensure an integrated market. The results of the study show that prior to 2007 for LATAM and European countries and during the entire 2003-2012 period for African and Asian countries, Capital Account Openness was not a significant driver of integration. Stulz (1981) and Heitala (1989) explain how capital controls lead to segmentation by forcing investors to, for example, only invest in domestic markets, thus leading to segmentation of markets as domestic assets cannot be priced globally. The fact that the study shows that for African and Asian markets, capital controls were not significant in driving integration, stands in contrast to the assertion that one needs to remove Capital Account Controls in order to ensure integration. Chuhan (1994); Kaminsky and Schmukler (2001) in their studies found that, investors find ways around capital restrictions if they want to invest in given markets.

The findings around Herding, when estimated using MLE, lead to the possibility that in the absence of capital restrictions markets could still be integrated through herding, however this will need further study as the results of the Bayesian estimation show that Herding was not statistically significant. Another channel that has been discussed which drives integration besides Capital Account Openness is trade. What this study makes clear is that in the absence of Trade, Capital Account Openness becomes an important driver of Integration.

The findings of this study contradict the assertion by Rigobon (1999) that market linkages occur because of contagion during crises, as is also put forward in crisis contingent models of integration. The integration of African and Asian markets with the US markets was not influenced by the Global Financial Crisis of 2006/7, instead it was tied to trade and not contagion; so the nature of the integration did not change post the Crisis. This is evidenced by the fact that Trading driven integration in these markets and persisted before and after the Crisis, as the data of these countries actually demonstrated no structural break during the Crisis period. The structural break that did occur occurred with European and LATAM countries. Lehkonen (2015) found that integration for developed countries did indeed decrease during the Global Financial Crisis. However in these markets integration was driven by fundamentals and

not psychological/contagion related drivers, i.e. herding. In the European and LATAM markets, Herding was consistently found not to be significant, by the Bayesian estimation, over periods, pre and post the Crisis.

The study supports the findings of Forbes and Rigobbon (2002) that market pricing regimes do not change during times of crisis from one driven by contagion to one driven by fundamentals. The authors find that the regime driving prices is constant whether there is a crisis or not. This is what this study found for all African and Asian markets as well as the European and LATAM markets which were driven by fundamentals and there was no switch of key drivers from contagion to fundamentals as a result of the Crisis. Contrary to what Crisis-Driven models of Integration propose, changes in regimes of contagion do not seem to drive integration of the markets in this study. Herding, which was used as the proxy for contagion in this study, was not significant for European and LATAM markets, which are the only markets that exhibited a change in factors driving integration due to the a crisis. Instead, crises, the 2007 Global Financial Crisis in particular, change economic fundamentals that are important in driving integration, as in the case of the European and LATAM countries.

This study shows that crises do not change drivers of integration from contagion to fundamentals, but from one set of fundamentals to another. The findings of this study over a ten year period have shown why different authors of past studies may have documented different results with regards to some finding that markets are integrated, while others find that the same markets are not integrated, this may be because the specific market being studied matters in determining the nature of integration, i.e., what type of fundamentals are driving the integration. The timing also matters; i.e. whether there is a crisis during the period under review or not, or whether the study happens before or after a crisis.

Grubel (1968) first postulated about international stock market segmentation/integration; he attributed segmentation to various factors such as government policies, business cycles, natural and man-made catastrophes. This study has shown that his analysis was correct in so far as integration is influenced by government policy around capital account openness, and also by business cycles or catastrophes. However, contrary to Grubel's assertion that markets are segmented, this study has found different results. This study shows that there is no guarantee that international stock markets will be segmented, irrespective of government policies, business cycles or man-made catastrophes. For European and LATAM markets the interplay of Trade, Capital Account Openness and GDP will determine the degree to which markets will be more or less integrated with the world market. For African and Asian markets, Trade will determine the extent of segmentation from world markets. Thus the international diversification advocated by Grubel and Fadner (1971), is not automatically the best strategy to adopt in managing a portfolio. This study shows that in order for the strategy of international diversification to be an effective one, thought needs to be given to whether the countries that one diversifies into, are integrated with the world market and which factors are driving that integration.

### 4.4.1 Implications for Regulators

The findings of this study suggest that for regulators it will be important to consider the variables that may be driving integration, be it Trade or be it Capital Account Openness, for European and LATAM countries, as changes to one of these variables may or may not influence integration of that market with the US market. For African and Asian markets, the driver of segmentation, as opposed to integration, will be Trade, with an increase in trade resulting in greater segmentation of these markets from the world market. The level of GDP is also an important factor to take into account for all these countries as it could have an inverse effect on Integration. Thus countries with higher GDPs are likely to be less integrated with the US. This will apply for European and LATAM countries. GDP is unlikely to influence integration of African and Asian countries with global markets and so from a regulatory point of view, GDP influences Capital Account Openness, but Capital Account Openness does not influence integration for African and Asian countries. Thus GDP may not need to be emphasized when looking at international financial market policy for African countries.

For African and Asian countries, the variable to monitor in terms of trying to influence the integration of the markets is Trade. The negative relationship between Trade and Integration for the African and Asian markets means that the more an African or Asian country trades with the US the less integrated its markets will be with the US market. Therefore from a regulatory point of view it implies that regulators in African and Asian countries can anticipate fewer spillovers from events in US markets. This is evidenced by the fact that the Global Financial Crisis that originated in the US did not impact African or Asian markets. Anecdotally, neither did the dot.com bubble of 2000; African markets did not lose their value due to the dot.com bubble bursting. The inverse relationship between Trade and Integration, also means however that the less an African or Asian country trades with the US the more likely their markets are to be integrated. This finding is counter intuitive.

The study shows that in assessing the integration of a country's markets, regulators have to take into account the country's unique conditions and not treat integration as one size fits all concepts.

### 4.4.2 Implications for Portfolio Managers

For US based portfolio managers, the results of the study imply that the portfolio managers will need to be aware of which factors are driving market integration and therefore which factors will drive the correlation of asset prices between the US and markets in other countries. The inverse relationship between Trade and Integration implies that for portfolio managers, when it comes to investing in African or Asian countries, they should look for countries that have significant trade ties with the US because these countries' markets will not be integrated with the US markets and therefore their asset prices will not be correlated. For investing in European or LATAM markets, portfolio managers should look for countries with low trade relationships with the US, as these markets will tend to be less integrated with the US, or alternatively they should look for countries that do not exercise an open capital account policy as these countries' markets will not be correlated with the US market. Portfolio managers should also look at

countries with high GDPs as this will lower the degree of integration of the given European or LATAM country with the US. For investing in African or Asian markets, GDP is unlikely to play a role in influencing US investment in African or Asian countries' assets.

### 4.4.3 Implications for Asset Pricing

It was Grubel (1968) who proposed the idea that stock market integration, could be important for asset pricing. The implications of this study for asset pricing are interesting. Grubel proposed considering whether markets were integrated at an international level as part of asset pricing. For asset pricing in European and LATAM markets, the study finds that assets can be priced as though the market is integrated into the world market represented by the US, based on the degree of trade with the US and the given country or based on the openness of its capital account. The higher one of these variables is, the more likely it is that that country's market will be integrated with the US and vice versa.

The situation for the African and Asian markets in this study is less complex. The markets in these countries will be less integrated with the US, the more the given country trades with the US and vice versa. Thus for purposes of pricing financial assets in these countries, the decision about the degree of integration or not of the stock markets in these countries with the US, will be determined by how much the given county trades with the US. In this context, the findings of this study may help to explain the findings of Bakaert and Harvey (1995) that integration seems to be time dependent. In the case of African and Asian markets, Bakeart and Harvey's findings can arise when the variable driving integration is the amount of trade between the US and the African or Asian country, and trade increases, then integration may decline or cease completely and vice versa when trade decreases, thus explaining why at one point markets may be integrated and at another point not.

Or alternatively in the case of European and LATAM markets, if the integration was being measured as being driven by trade and then the relevant driver switched Capital Account Openness, it may seem as though the markets are no longer integrated. The impact of GDP on European and LATAM countries' integration also serves to explain why integration may be seen to be time variant. As countries' GDP levels change so too does the degree of their integration change; thus, European or LATAM countries that may be in recession or experiencing low growth may be found to be integrated with the US, but as soon the GDP starts to grow the integration with the US may diminish.

## 4.5 Conclusion to Section B and Section C

This study sought to address a concern raised by Bailey and Choi (2003, p.400), where they highlight the need for a theoretical framework for stock market integration. This study has found that what drives Integration varies from market to market and from time to time. It is not straightforward; as illustrated by the case of the European and LATAM markets. What drives or

influences Integration can change depending on whether or not those markets experienced a crisis. For these markets the driver of integration can change from Trade to Capital Account Openness depending on the period and the level of GDP. However what drives the integration of African and Asian markets with the world market (represented by the US market) is consistent, in the presence or absence of crises, namely Trade. The implications for theory are that the model of what drives integration consists of multiple factors which vary in significance depending on the country in question and the period under consideration.

For practitioners in portfolio management, financial policy and asset pricing, the country in question is important in determining whether the market in that country is likely to be integrated into the world market (represented by the US).

# Chapter 5: Conclusion

## Purpose of the study:

This study had key two objectives, namely to:

i) Establish a framework that will adequately explain how stock market integration operates and

ii) Use this framework to understand the nature and extent of integration of selected African, Asian and Latin American countries' stock markets, with the global market.

## Problem addressed by the study:

The problem that the study sought to address is one identified by Ip-Wing et al. (2010, p.2875), namely the lack of a framework for looking at integration and what drives it and as identified by Bracker et al. (1999, p.2), the concept of integration covers a wide range of issues related to correlations of returns between equity markets. This problem therefore motivated this study focused on answering the following specific questions.

The research aimed to answer the following questions:

i) Which factors drive stock market integration?

ii) How does stock market integration change over time and what drives those changes?

iii) Which factors driver integration of the selected African, Asian, European and Latin American stock markets?

## Hypotheses Tested

The study aimed to test the following hypotheses;

1. The first hypothesis is that market integration is driven directly by the variables that are hypothesised to work together or individually as part of the mechanism driving integration. To this effect therefore the first hypothesis that was tested was:

   *Market integration is driven directly by the macro-economic variables (GDP and Trade), institutional arrangements (Capital Account Openness) and behavioural factors (Herding).*

2. The second hypothesis is that the macroeconomic and trade variables affect integration indirectly either through each other or through institutional arrangements, the sub-hypotheses under this hypothesis were;
   a. GDP affects integration indirectly through institutional arrangements (Capital Account Openness)
   b. GDP affects integration indirectly through Trade

c. *Trade affects integration indirectly through GDP and institutional arrangements (Capital Account Openness)*
d. *GDP and institutional arrangements (Capital Account Openness) affect integration indirectly through Trade*

3. The third hypothesis that was that institutional arrangements (Capital Account Openness) are the primary driver of market integration, meaning that the macro-economic variables all act on Integration indirectly through the institutional arrangements?

4. The fourth hypothesis is whether the behaviour of economic agents in the markets is a facet of integration with the hypothesis being that:

   *Behavioural biases drive integration*

   However the findings of the study made it impossible to test this hypothesis as the behavioral variable's significance could not be confirmed, as the two estimation approaches produced contradictory results.

5. The last hypothesis was tested for European and Latin American countries and Asian and African countries as two distinct groupings. The hypothesis is that:

*Trade influences Integration both directly and indirectly*

## Summary of the Findings

The findings of this study are interesting and, in some respects, unexpected. The literature proposes many factors that can contribute to stock market integration. Taskin and Muradoglu (2003) have argued that it is capital account liberalisation, much along the lines argued for by Black (1974). Others such as Raj and Dhal (2008) have argued that it is cross-border asset holdings that drive integration. Whereas authors such as French and Poterba (1991) have, instead, argued that the "Home Bias" leads markets to not be integrated, thus driving segmentation of markets as investors choose to invest in their home markets with which they are familiar. But Büttner and Hayo (2011); Erb et al. (1994); Ip-Wing et al. (2010); Bakeart and Harvey (1995) have argued against the Home Bias phenomenon, showing through their studies, that markets do indeed demonstrate integration.

Taskin and Muradoglu (2003) showed that information played a role in the integration of emerging markets prior to liberalisation, thus adding another possible driver of market integration, namely information and the associated psychological effects of information on the market participants. This view was supported by authors such as Baele et al. (2004). Shiller (1995) and Hanousek and Filer (2000), characterised the information and psychological effects as creating a form of herding in the markets. Other authors such as Bodhurta et al. (1989) linked integration to macro-economic factors, building on the earlier work by Chen et al. (1986) which showed a link between macro-economic factors and stock market performance, in the domestic economy. The role of trade in particular in driving integration was supported by many authors: Chen and Zhang (1997); Bracker et al. (1999); Choe (2001); Phylaktis and Ravazzolo (2002); Forbes and Chinn (2004) and Chambet and Gibson (2008).

The factors that in this study, were found to significantly affect integration of the African, Asian and Latin American markets with the world market, support the argument for importance of macro-economic factors as drivers of integration. The factors identified by this study are Trade and Capital Account Openness. The findings around psychological or behavioural factors were more mixed and are discussed in more detail below. The other macro-economic factor that was tested but found not be significant was GDP, but GDP was affected by the two key macro-variables of Trade and Capital Account Openness. So, one could surmise that its impact on Integration is mediated via other macroeconomic variables.

This study found that the prominence of the two factors of Trade and Capital Account Openness, change over time, in ways that had not anticipated by extant literature. Key to the change in the dominance of Trade or Capital Account Openness, are financial crises. Work by Rigobbon (1999) indicated that crises may have a role to play in stock market integration. He argued that market integration takes two forms, integration driven by crisis and integration driven by more structural factors that are independent of crises (ibid).

This study has found that, in fact, crises do play a role in the markets that were studied; however, the role that crises play is not as anticipated by Rigobbon (1999). This study found that crises change the macro-economic factors that drive integration. Rigobbon postulated and viewed crises as a direct driver of integration and structural factors as alternative driver. He did not see crises as catalysts for changing which structural factors drive integration. It is also important to highlight that in the study, crises were only found to be catalysts of change of the structural factor that drove integration in European and Latin American markets, not African and Asian ones. This outcome points to there being a regional dimension that is also at play in the dynamics of market integration and market crises. This highlights the importance of taking the heterogeneity of countries and markets into account when trying to understand integration.

For African and Asian countries, crises had no impact on the drivers of integration. These countries' integration regime remained unchanged before and after the Global Financial Crisis. The study found that the integration of African and Asian countries is driven by Trade primarily and Capital Account Openness does not play a role. These results go against what authors such as Black (1974), had argued, when he highlighted as primary the role played by free capital flows in driving integration. The results of this study indicate that integration is not a 'one size fits all' phenomenon. It seems to be region dependent, maybe even country dependent and varies over time in terms of what drives it.

A finding that was not conclusive in the study but has often been referred to in the literature (Scharfstein and Stein, 1990; Bikhchandani et al., 1992; Chang et al., 2000; Cao et al., 2007; Cipriani and Guarino, 2008 and 2009) is the relationship between market integration and behavioural factors, such as herding. Using a methodology for operationalising herding put forward by Christie and Huang (1995); Chang et al. (2000) and Chiang and Zheng (2010), this study showed conflicting results on herding in the regional markets under study. When Bayesian Analysis is used, no herding effects are found between any of the markets for any meaningful period of time, however when Maximum Likelihood Estimation is used, herding is

found to be significant in African and Asian markets. The two estimation approaches are discussed in more detail in the methodology review. Isolated incidents of herding were found prior to 2008 for the European and Latin American markets, but they were short lived and not correlated with periods of market integration.

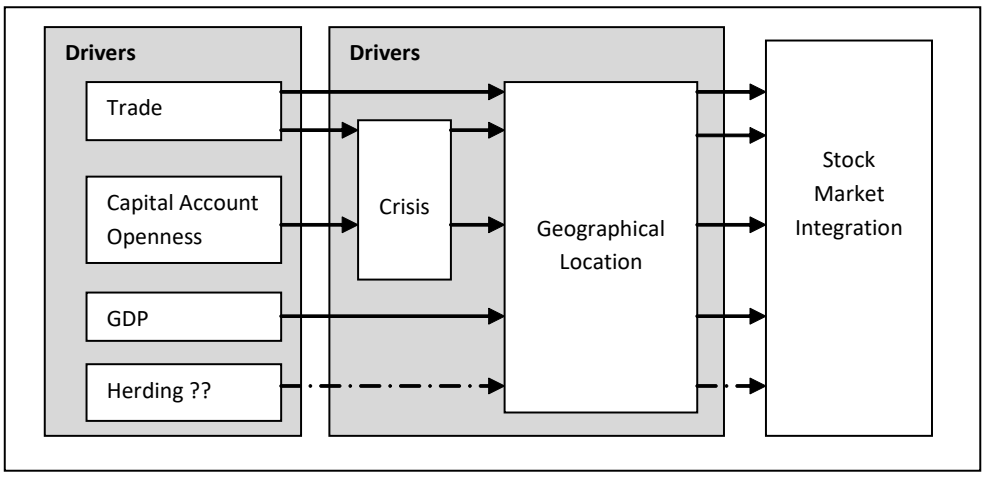
### Contribution to the Literature

These findings are the contribution that this study makes to the literature. This study also found that market integration is more complex and nuanced than shown in previous studies. Trade and Capital Account openness were found by other authors to be significant in driving integration (Black, 1974; Chen and Zhang, 1997; Bracker et al., 1999; Choe, 2001; Phylaktis and Ravazzolo, 2002; Forbes and Chinn, 2004; Chambet and Gibson, 2008), however none of the studies found that these variables can change in their prominence in driving integration in the way the current study has found them to do. That integration may change over time was found by Bakeart and Harvey (1995), but the reason for the change, namely financial crises, in the case of European and LATAM countries and Trade in the case of African and Asian countries, is a new finding of this study.

This study therefore builds on the work around the role of crises on integration (Rigobbon, 1999) by showing that crises can change the integration regime, but not in the way that previous authors had anticipated. This study shows that crises are crucial in understanding integration, but their role is not as part of the framework underpinning integration but, rather, as a catalyst for changing the driver of integration.

The study also found that integration in different markets, is driven by different factors on a regional basis, which none of the other studies surveyed, found. Integration of African and Asian markets was found to be driven differently from integration of Latin American and European markets. This study has added to the literature an understanding of the complex nature of integration and the fact that it cannot be looked at as only consisting of one dimension across time and across geographical regions. This study shows that any framework that aims to understand Integration has to include Trade, Capital Account Openness, Geographical Location and perhaps Herding, as illustrated in the figure below. In conclusion, the study shows that any effort to understand stock market integration has to take into account the heterogeneous nature of markets and the role that specific domestic factors play in influencing the integration of a market with the world market.

Figure 11: Conceptual Framework for Stock Market Integration9




The Framework proposed above is the primary contribution of this study to the literature. The results of this study suggest that depending on the geographical location of a given market, different variables will drive its integration into the world market, as well as how financial crisis affect the variables driving its integration into the world market. These findings are in line with the findings by Johnson and Soenen (2003) on the importance of geographical location, for the integration of Latin American markets, with the US market, and the findings of Ip-Wing Yu et al. (2010) on the importance of geographical location for the integration of Asian markets.

The Framework attempts to capture this essence of what the study shows, namely that Trade, Capital Account Openness, Financial Crises, GDP and possibly Herding, all have a significant impact on the integration of a market into the world market and which variables dominate the integration process, will depend on the country's geographical location. Rajan et al. (2006) had presented taxonomy of approaches used to study integration, but that merely catalogued approaches and did not consider establishing relationships between the drivers of integration and their mediating variables. To our knowledge, this is the first study to present a framework that incorporates multiple factors that contribute to integration, into one holistic structure.

The methodology used in this study is the SEM technique, in particular a subset of SEM, namely Path Analysis. The approach allowed for the establishment of relationships between variables and for having certain variables be treated as mediating variables. These and other features of Path Analysis demonstrated advantages over methods such as basic multiple linear regression, for example. Path relationships were modeled using Maximum Likelihood Estimation and Bayesian analysis was used to test for the robustness checks of the MLE findings.

9 Herding has a question mark in the proposed framework as the findings of MLE and Bayesian estimation are not consistent, the one estimation approach supports the significance of Herding the other does not.

Bayesian analysis was used to test robustness because it is not sensitive to sample sizes and makes no assumptions about the data distribution of the sample, thus allowing it to deal with smaller samples which were present in the study, as well as data arising from non-normal distributions, a feature exhibited by some of the variables in the study. The results of the two approaches were generally consistent, except when it came to the Herding variable. The Maximum Likelihood Estimation found that Herding was significant for African and Asian markets, but this result was not confirmed by the Bayesian Estimation. It may be that MLE found a relationship between Herding and integration due to its sensitivity to sample sizes and to sample data distribution, whereas Bayesian analysis, which is not influenced by the sample data distribution or the sample size, remained robust to these effects.

## Limitations and Challenges of the Study

The poor availability of data for African markets limited the extent to which integration could be studied across a wider range of African markets for comparison with other regions of the world. The lack of higher frequency data for some markets meant that herding could not be studied in greater detail and may account for some of the inconclusive findings around this variable. One of the other challenges of the study was aligning dates for the different markets around the globe. The study effectively covered all the four corners of the world, meaning that when some markets were open, others were closed, or had holidays, or in the case of the Arabic market, the week starts on Sunday and ends on Thursday.

Thus, in order to ensure alignment of days across the different markets, some data had to be removed from the study. This simplified the analysis but reduced the size of the sample; it also meant that if there are any interactions between the markets over the weekends, or over what was a holiday in one country but a work day in other countries, these would be missed in the analysis.

## Suggestions for Further Research

This study has hinted at the existence of a relationship between Herding or psychological factors and integration for African and Asian markets, a relationship that is different for these markets than what it might be for European and Latin American markets. But this relationship could not be firmly established. It therefore presents an opportunity for further investigation, perhaps with richer (possibly higher frequency) data or different statistical techniques. Improving access to the internet and to data storage across the African continent may make it possible at a future date to further investigate integration across a wider range of African markets and comparing these to how other emerging markets are integrated into the world market.

Varying integration was predicted in the literature (Bakeart and Harvey, 1995); however, in the context of this study, a question for further research would be why the integration varied, was it because of changes in trade, capital account regimes or even psychological market dynamics? This study looked at what drives integration overall and not whether or not markets were integrated at one point or another or not, but this line of research may yield further interesting insights into the integration phenomenon and how it reacts to dynamics in the short term.

# Appendix A: Integration Hypothesis Testing Results

In this appendix we discuss the results of the hypothesis tests in more detail. The section is broken down into three sub-sections. The first sub-section (A1) will consider the results of the analysis of all the countries together; in other words, the countries were treated as homogenous group. The second sub-section (B1) looks only at the results for European and Latin American countries together and the third sub-section (C1) looks at the results for the African and Asian countries together. In the hypothesis testing below, p-values that are lower than 0.05, are treated indicative of the significance of the given variables and provide direction regarding whether the data supports the null hypothesis or whether it can be rejected. This study does not use the $R^2$ score to test for model's efficacy, but rather uses the models AIC score, which tests the information content of the models. A lower AIC score means that the model is more informative. Thus models with low are AIC scores are preferred over ones with high scores.

Table 18 below outlines the respective hypotheses being tested and the relevant models for testing a given hypothesis under section A1, B1 and C1. As discussed in the data description of the Analysis section in chapter 4, Capital Account Openness is operationalised through the KAOPEN measure. Trade is operationalised by the Trade Factor variable and agent behavior is operationalised via the Herding variable.

Table 18: Model/Hypotheses Mapping for Test of all the Countries Together

| Model | Hypothesis | Relationship being Tested |
|---|---|---|
| 1 and 7 | 1 | Direct impact of all the variables on Integration |
| 2 and 8 | 2(a) | Indirect impact of GDP, acting through Capital Account Openness |
| 3 and 9 | 2(b) | Indirect impact of GDP, acting through Trade |
| 4 and 10 | 2(c) | Indirect impact of Trade, acting through Capital Account Openness |
| 5 and 11 | 2(d) | Indirect impact of Trade, acting through GDP and Capital Account Openness |
| 6 and 12 | 3 | Direct impact of Capital Account Openness with GDP and Trade being indirect and acting through Capital Account Openness |

# Section A1: Results for All the Countries Together (2003-2007, Pre-Global Financial Crisis)

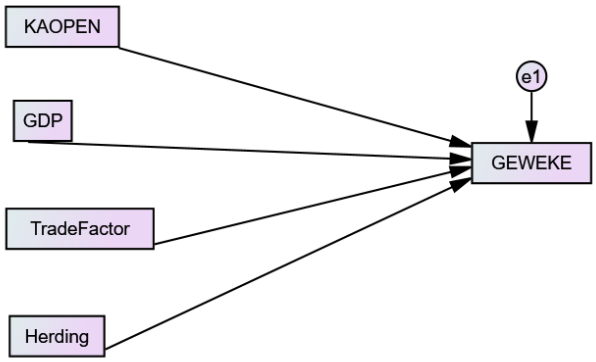
## Model 1 – (All Countries) Direct Influence of Capital Account Openness, GDP and Trade and Herding on Integration

In Model 1 we test the Hypothesis 1, namely whether in the period 2003-2007, Capital Account Openness, GDP, Trade or Herding directly influenced the integration of markets with the US market, when all the countries in the study are considered together.

$H^1_0$: Impact of KAOPEN, GDP, Trade factor and Herding, directly on Integration = 0

$H^1_1$: Impact of KAOPEN, GDP, Trade Factor and Herding directly on Integration ≠ 0

Figure 22: Impact of Capital Account Openness, GDP, Trade and Herding on Integration




The findings from the Maximum Likelihood analysis in Table 19, show that Capital Account Openness, GDP and Herding are not significant in influencing integration for the period 2003-2007, when all the countries are considered together. Trade on the other hand, is significant.

Table 19: ML Estimation of Impact of Capital Account Openness, Trade, GDP and Herding on Integration

| | | | Estimate | S.E. | C.R. | P |
|---|---|---|---|---|---|---|
| GEWEKE | ←- | KAOPEN | 0.657 | 0.357 | 1.839 | 0.066 |
| GEWEKE | ←- | Herding | 1.096 | 3.603 | 0.304 | 0.761 |
| GEWEKE | ←- | TradeFactor | 6.213 | 1.215 | 5.116 | *** |
| GEWEKE | ←- | GDP | 0.511 | 0.341 | 1.500 | 0.134 |

| Model | AIC |
|---|---|
| Default model | 68.699 |

*** indicates a p-value that is lower than 0.001

Model 1 has an AIC score of 68.69. As we shall see later in this section, this is a relatively high AIC score and shows that the model is not very informative about the relationship between the variables.

Table 20: Bayesian Analysis of Impact of Heading, Capital Account Openness, Trade and GDP on Integration

| | Mean | S.E. | S.D. | C.S. | 50% Lower bound | 50% Upper bound |
|---|---|---|---|---|---|---|
| GEWEKE←KAOPEN | 0.685 | 0.014 | 0.401 | 1.001 | 0.403 | 0.958 |
| GEWEKE←Herding | 0.975 | 0.140 | 3.386 | 1.001 | -1.218 | 3.263 |
| GEWEKE←TradeFactor | 6.261 | 0.031 | 1.268 | 1.000 | 5.421 | 7.110 |
| GEWEKE←GDP | 0.502 | 0.015 | 0.342 | 1.001 | 0.278 | 0.723 |

The results of the Bayesian analysis support the results of the Maximum Likelihood analysis, in that the co-efficient of the model from the Bayesian analysis are not too dissimilar to the coefficients generated by MLE approach.

### Model 2 – (All Countries) Direct Influence of Trade, Herding and KAOPEN and Indirect influence of GDP through KAOPEN, on Integration

Model 2 tests whether GDP influences Integration indirectly through Capital Account Openness as outlined in Hypothesis 2, since Model 1 above shows that GDP was not a significant direct contributor to stock market integration prior to 2007, model 2 tests whether it affects Integration through an intermediate variable, when all the countries are considered together.

$H^{2a}_0$: Impact of KAOPEN, Trade Factor, Herding directly on Integration and GDP through KAOPEN = 0

$H^{2a}_1$: Impact of KAOPEN, Trade Factor, Herding directly on Integration and GDP through KAOPEN ≠ 0

In other words, this hypothesis tests whether Capital Account Openness, acts an intermediate variable for GDP's influence on Integration prior to 2007. Figure 23 show the relationships that Model 2 is trying to capture.

Figure 23: Influence of GDP on Capital Account Openness, Trade and Herding on Integration

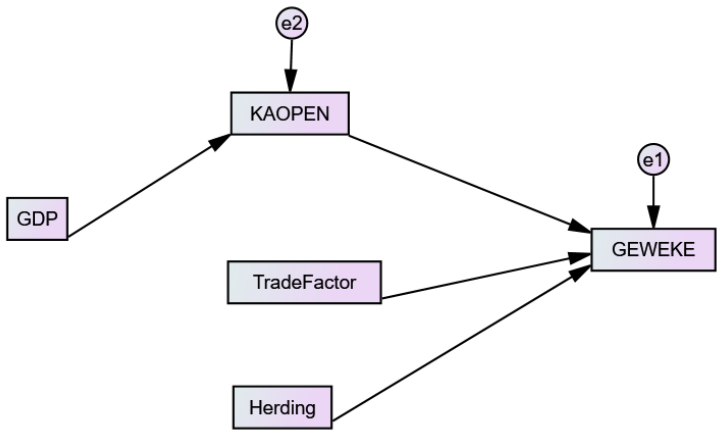



Table 21 below shows that GDP is significant in its influence on Capital Account Openness, with a p-value of less than 0.01. Capital Account Openness and Trade remain significant in their influence on Integration. Herding however is not significant in this model. The null hypothesis for this model is therefore not supported. Model 2 is more informative than Model 1, as Model 2 has an AIC score lower than Model 1, which as we have discussed above, postulates a direct effect of GDP on Integration. Model 2 has an AIC score of 46.28, versus Model 1 which has an AIC score of 68.69. As discussed earlier, the lower the AIC model score, the more informative the model.

Table 21: Maximum Likelihood Estimate of Impact of GDP on Capital Account Openness

| | | | Estimate | S.E. | C.R. | P |
|---|---|---|---|---|---|---|
| KAOPEN | ←- | GDP | 0.305 | 0.053 | 5.698 | *** |
| GEWEKE | ←- | KAOPEN | 0.821 | 0.359 | 2.288 | 0.022 |
| GEWEKE | ←- | Herding | 1.114 | 3.616 | 0.308 | 0.758 |
| GEWEKE | ←- | TradeFactor | 6.458 | 1.219 | 5.296 | *** |

| Model | AIC |
|---|---|
| Default model | 46.284 |

*** indicates a p-value that is lower than 0.001

Table 22 below, which is the Bayesian Estimation of Model 8, confirms the results of Table 21, with coefficients that are similar to the Maximum Likelihood estimates.

Table 22: Bayesian Analysis of Impact of GDP on Capital Account Openness

| | Mean | S.E. | S.D. | C.S. | 50% Lower bound | 50% Upper bound |
|---|---|---|---|---|---|---|
| GEWEKE←KAOPEN | 0.812 | 0.005 | 0.367 | 1.000 | 0.565 | 1.063 |
| GEWEKE←Herding | 1.054 | 0.043 | 3.518 | 1.000 | -1.300 | 3.394 |
| GEWEKE←TradeFactor | 6.432 | 0.021 | 1.265 | 1.000 | 5.582 | 7.297 |
| KAOPEN←GDP | 0.301 | 0.001 | 0.056 | 1.000 | 0.263 | 0.339 |

## Model 3- (All Countries) Direct influence of Trade, Herding and KAOPEN and Indirect Influence of GDP, Through Trade on Integration

In Model 1, we established that GDP was not significant in influencing Integration directly. However, in Model 2 when testing for the impact of GDP through Capital Account Openness prior to 2007, we found that GDP acts indirectly through Capital Account Openness to influence Integration. Model 3 tests Hypothesis 2(b) namely, whether prior to 2007, GDP affected Integration indirectly through Trade, with all the other variables impacting Integration directly, when all the countries are considered together. The economic rationale of this relationship between Trade, GDP and Capital Account Openness is that greater trade may drive economic growth which might in turn affect market Integration between the trading counties.

$H^{2b}_0$: Impact of KAOPEN, Trade Factor, Herding directly on Integration, and GDP, indirectly through Trade = 0

$H^{2b}_1$: Impact of KAOPEN, Trade Factor, Herding directly on Integration, and GDP, indirectly through Trade ≠ 0

Figure 24: GDP through Trade

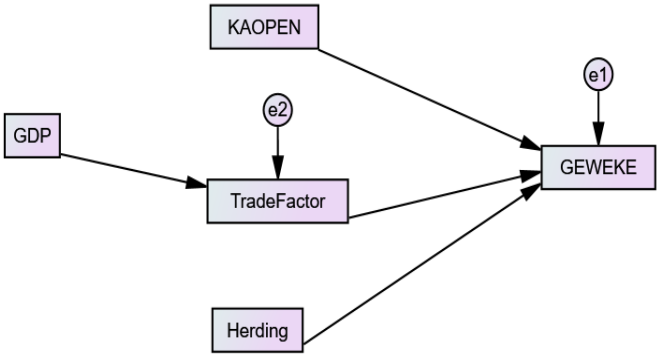



Table 23 below shows that the null hypothesis is supported, GDP is not a significant in influencing Trade. The other variables that were significant in Model 2 are still significant. The

AIC score of this model, which is reported below, is higher than the model in Model 2, meaning that the model is less informative than Model 2.

Table 23: Impact of GDP on Trade

| | | | Estimate | S.E. | C.R. | P |
|---|---|---|---|---|---|---|
| TradeFactor | ←- | GDP | 0.019 | 0.017 | 1.081 | 0.280 |
| GEWEKE | ←- | KAOPEN | 0.821 | 0.359 | 2.288 | 0.022 |
| GEWEKE | ←- | Herding | 1.114 | 3.616 | 0.308 | 0.758 |
| GEWEKE | ←- | TradeFactor | 6.458 | 1.219 | 5.296 | *** |

| Model | AIC |
|---|---|
| Default model | 69.613 |

*** indicates a p-value that is lower than 0.001

The results of the Bayesian Estimation, given in Table 24 below, confirm the Maximum Likelihood results, with the coefficients generated by the Bayesian Estimation being similar to the MLE coefficient estimates.

Table 24: Bayesian Estimation of GDP Impact on Trade

| | Mean | S.E. | S.D. | C.S. | 95% Lower bound | 95% Upper bound |
|---|---|---|---|---|---|---|
| GEWEKE←KAOPEN | 0.826 | 0.012 | 0.376 | 1.001 | 0.091 | 1.557 |
| GEWEKE←Herding | 1.246 | 0.108 | 3.529 | 1.000 | -5.618 | 8.158 |
| GEWEKE←TradeFactor | 6.448 | 0.044 | 1.273 | 1.001 | 3.917 | 8.900 |
| TradeFactor←GDP | 0.019 | 0.000 | 0.016 | 1.000 | -0.011 | 0.050 |

### Model 4 – (All Countries) Direct Influence of KAOPEN and Herding and Indirect Influence of GDP and Trade, Through KAOPEN on Integration

Having established that prior to 2007, GDP acted on Integration through Capital Account Openness, Model 4 seeks to test whether this also applies to Trade prior to 2007, i.e. did Trade also act indirectly through Capital Account Openness as postulated in Hypothesis 2(c) The economic rationale for Trade possibly acting through Capital Account Openness would be that countries with more open capital accounts, would also trade more freely. This line of thinking would imply that the impact of Trade on Integration which was seen in Model 1, where Trade had a significant impact on Integration, may in fact be the result of Trade acting through Capital Accounts Openness. It is this likelihood that is what Model 4 tests.

$H^{2(c)}_0$: Impact of KAOPEN and Herding, directly on Integration, and GDP and Trade through KAOPEN = 0

$H^{2(c)}_1$: Impact of KAOPEN and Herding, directly on Integration, and GDP and Trade through KAOPEN ≠ 0

Figure 25: Does Trade act through Capital Account Openness

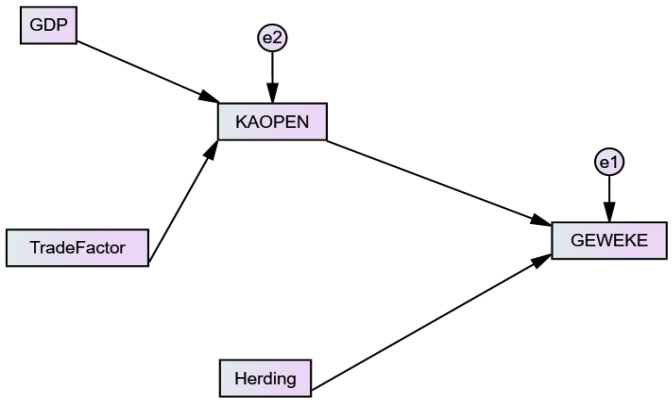



Table 25 below shows that in this model, Trade is significant in its effect on Capital Account Openness, so too is GDP. Both these variables are significant at the 99% level. However, the direction of the influence of Trade on Capital Account Openness is the opposite of what we would expect and what the literature predicts, in that Trade has a negative coefficient. According to the results of the MLE analysis, the greater the trade between European and LATAM countries, and the US, the less open their capital accounts will be. This result contradicts what one would expect to find, but also is not supported by the Capital Account Openness data observed for the European countries in the study.

There was less variability in the European countries' KAOPEN scores, which operationalise Capital Account Openness in the study. Their scores were essentially constant for the period. The Latin American countries' Capital Account Openness varied during the period of the crisis and may explain the reason for the findings, in that the findings may reflect the variability arising from the Latin American markets rather than the European markets. This is a potential area for further research.

Capital Account Openness with this model is not significant in its influence on Integration. The AIC score is higher than for Model 1, meaning that this model is not as informative as Model 1. Thus even though Trade is significant in its influence on Capital Account Openness, the fact that Capital Account Openness is not significant and the high AIC score, are indicative of problems with this model, supported by the high AIC score at 60.682.

Table 25: Maximum Likelihood Impact of Trade on Capital Account Openness

| | | | Estimate | S.E. | C.R. | P |
|---|---|---|---|---|---|---|
| KAOPEN | ← | TradeFactor | -0.664 | 0.195 | -3.415 | *** |
| KAOPEN | ← | GDP | 0.328 | 0.052 | 6.362 | *** |
| GEWEKE | ← | KAOPEN | 0.506 | 0.375 | 1.351 | 0.177 |
| GEWEKE | ← | Herding | 1.857 | 3.801 | 0.488 | 0.625 |

| Model | AIC |
|---|---|
| Default model | 60.682 |

*** indicates a p-value that is lower than 0.001

The results of Bayesian Estimation of the model given in Table 26, support the findings of the Maximum Likelihood estimation shown in Table 25, with Bayesian Estimate coefficients not being very different from the MLE estimated coefficients and the significance of the variables also being similar, except for Herding, which is not significant in the Bayesian Estimated model. We will discuss this latter fact later in this paper.

Table 26: Bayesian Estimation of Impact of Trade on Capital Account Openness

| | Mean | S.E. | S.D. | C.S. | 95% Lower bound | 95% Upper bound |
|---|---|---|---|---|---|---|
| GEWEKE←KAOPEN | 0.495 | 0.016 | 0.376 | 1.001 | -0.240 | 1.231 |
| GEWEKE←Herding | 1.891 | 0.093 | 3.672 | 1.000 | -5.364 | 9.032 |
| KAOPEN←TradeFactor | -0.663 | 0.005 | 0.192 | 1.000 | -1.040 | -0.283 |
| KAOPEN←GDP | 0.323 | 0.002 | 0.055 | 1.001 | 0.212 | 0.427 |

## Model 5: (All Countries) Direct Influence of GDP, KAOPEN and Herding and Indirect Influence of Trade, Through GDP and KAOPEN on Integration

In Model 5 we tested whether Trade affects Integration indirectly through GDP and Capital Account Openness. Figure 26 illustrates the relationship being investigated in Model 5. The model essentially tests Hypothesis 2(d). The economic rationale of this relationship between Trade and Capital Account Openness is outlined in Hypothesis 2(d) namely that greater Trade may interact with economic growth which might in turn affect market Integration between the trading counties. The other variables are postulated to affect Integration directly.

$H^{2(d)}_0$: Impact of KAOPEN, Herding, GDP directly on Integration
and Trade through KAOPEN and GDP = 0

$H^{2(d)}_1$: Impact of KAOPEN, Herding, GDP directly on Integration and Trade through KAOPEN and GDP ≠ 0

Figure 26: Trade through GDP or Capital Account Openness

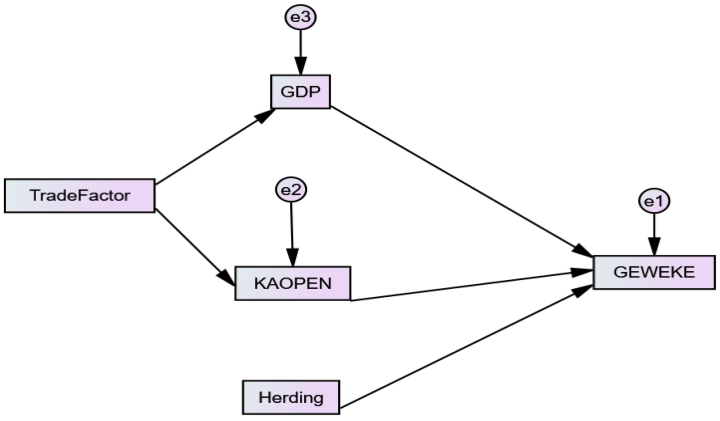



Table 27 below shows that Trade, at a p-value below 0.05, has a significant impact on Capital Account Openness. Interestingly the impact of Trade on GDP is not significant, but in this model GDP becomes significant in its impact on Integration. The other variables are not significant. This includes Capital Account Openness. Looking at this model's AIC score of 85.95 however, shows that the model is much less informative than the preceding models and thus does not do a better job of modeling the relationship between the variables than the preceding models.

Table 27: Impact of Trade on GDP and Capital Account Openness

| | | | Estimate | S.E. | C.R. | P |
|---|---|---|---|---|---|---|
| GDP | ←- | TradeFactor | 0.318 | 0.278 | 1.145 | 0.252 |
| KAOPEN | ←- | TradeFactor | -0.556 | 0.208 | -2.671 | 0.008 |
| GEWEKE | ←- | KAOPEN | 0.279 | 0.374 | 0.744 | 0.457 |
| GEWEKE | ←- | Herding | 1.775 | 3.773 | 0.470 | 0.638 |
| GEWEKE | ←- | GDP | 0.747 | 0.356 | 2.101 | 0.036 |

| Model | AIC |
|---|---|
| Default model | 85.958 |

Table 28 shows the Bayesian Estimation of the model which confirms the results of the coefficients from the Maximum Likelihood model, except for the Herding coefficient, which is not close to MLE estimation. Herding is not significant in the MLE estimation and so the wide difference in coefficient does not impact the interpretation of the MLE findings about the Herding to a significant degree.

Table 28: Bayesian Estimation of the Impact of Trade on GDP and Capital Account Openness

| | Mean | S.E. | S.D. | C.S. | 95% Lower bound | 95% Upper bound |
|---|---|---|---|---|---|---|
| GEWEKE←KAOPEN | 0.298 | 0.015 | 0.387 | 1.001 | -0.468 | 1.044 |
| GEWEKE←Herding | 2.046 | 0.114 | 3.646 | 1.000 | -5.007 | 9.521 |
| GDP←TradeFactor | 0.324 | 0.011 | 0.250 | 1.001 | -0.165 | 0.823 |
| KAOPEN←TradeFactor | -0.550 | 0.009 | 0.211 | 1.001 | -0.978 | -0.133 |
| GEWEKE←GDP | 0.721 | 0.015 | 0.358 | 1.001 | 0.038 | 1.422 |

## Model 6 – (All Countries) Direct Influence of KAOPEN and Herding and Indirect Influence of GDP through Trade and Influence of Trade through KAOPEN on Integration

The question that Model 6 seeks to answer is that posed in Hypothesis 3, namely whether GDP affects Integration indirectly through Trade, which in turn acts indirectly on Integration through Capital Account Openness. In other words, do the macro-economic factors affect Integration through institutional arrangements?

$H^3_0$: Impact of KAOPEN, Herding directly on Integration
and GDP through Trade, and Trade through KAOPEN = 0

$H^3_1$: Impact of KAOPEN, Herding directly on Integration
and GDP through Trade, and Trade through KAOPEN ≠ 0

The economic rationale for this model is that GDP may cause more Trade between countries, as one country's economy grows thus driving demand for imported goods and consequently Trade. The greater Trade may drive greater Capital Account Openness and as has been discussed earlier this study, the trading companies' share prices may then move to reflect the impact of revenues resulting from the increased trade. Figure 27 below illustrates the relationship that is being tested in Model 6.

Figure 27: Does GDP act through Trade and does Trade act through Capital Account Openness

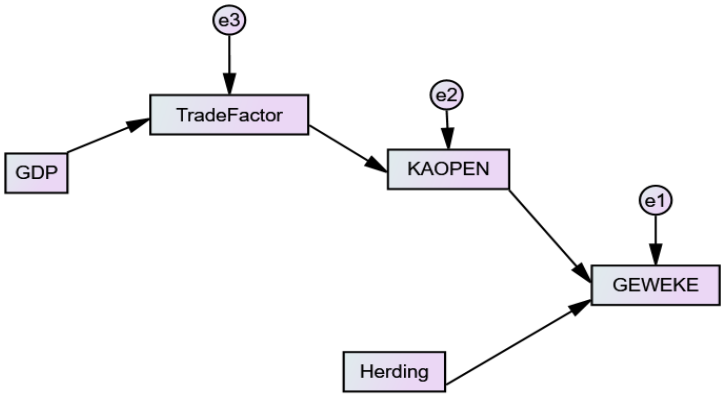



Table 29 below which shows the results of ML estimation, shows that GDP does not significantly influence Trade but that Trade does significantly influence Capital Account Openness. However, Capital Account Openness and Herding do not significantly affect Integration.

Table 29: GDP through Trade and Capital Account Openness

| | | | Estimate | S.E. | C.R. | P |
|---|---|---|---|---|---|---|
| TradeFactor | ←- | GDP | 0.019 | 0.017 | 1.081 | 0.280 |
| KAOPEN | ←- | TradeFactor | -0.556 | 0.208 | -2.671 | 0.008 |
| GEWEKE | ←- | KAOPEN | 0.506 | 0.377 | 1.342 | 0.179 |
| GEWEKE | ←- | Herding | 1.857 | 3.801 | 0.488 | 0.625 |

| Model | AIC |
|---|---|
| Default model | 88.487 |

The AIC score of the model shows that the model is not very informative. The score is higher than any of the other models considered thus far.

Table 30 shows the results of the Bayesian Estimation of the model. The coefficient results support the findings of the ML estimation, except for Herding where there is a 0.100 point difference in the coefficient generated by MLE versus the Bayesian Estimate generated coefficient. But because of the high AIC score, the MLE results of this model are not considered as providing any useful insight and so the results from the Bayesian Estimation will also not be considered in the analysis.

Table 30: Bayesian Analysis of GDP through Trade and Capital Account Openness

| | Mean | S.E. | S.D. | C.S. | 95% Lower bound | 95% Upper bound |
|---|---|---|---|---|---|---|
| GEWEKE←KAOPEN | 0.507 | 0.014 | 0.386 | 1.001 | -0.252 | 1.246 |
| GEWEKE←Herding | 1.958 | 0.102 | 3.638 | 1.000 | -5.266 | 8.977 |
| KAOPEN←TradeFactor | -0.553 | 0.009 | 0.207 | 1.001 | -0.950 | -0.136 |
| TradeFactor←GDP | 0.019 | 0.001 | 0.016 | 1.001 | -0.013 | 0.049 |

# Section A2: Results for All the Countries Together (2008-2012, Post Global Financial Crisis)

The preceding section provided the results of how the different variables interacted with Integration prior to the 2007 Global Financial Crisis, when all countries are considered together as one group. The following section provides the results of the interactions of the variables after the Crisis. Herding which was found not to be significant in the prior period was not included in the analysis.

## Model 7 – (All Countries) Direct Influence of Capital Account Openness, GDP and Trade on Integration

Model 7 tests Hypothesis 1, after the Global Financial Crisis. The model tests whether Capital Account Openness, GDP and Trade impact Integration directly.

$H^1_0$: Impact of KAOPEN, GDP and Trade, directly on Integration = 0

$H^1_1$: Impact of KAOPEN, GDP and Trade, directly on Integration ≠ 0

The hypothesis is not asserting that all the variables, simultaneously, have no impact on Integration, but rather that each one separately, has no impact on Integration.

Table 31 below reports the results of the model in Figure 28. The MLE regression results, show that Capital Account Openness and Trade have a significant impact on Integration, with Capital Account Openness being significant at the 99% level and Trade at the 95% level . However, GDP, does not significantly impact Integration of the respective markets with the US market.

Figure 28: Impact of Capital Account Openness, GDP and Trade on Market

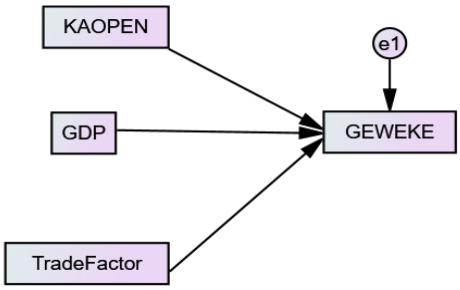



Table 31: ML estimates of impact of Trade, GDP and Capital Account Openness on Integration

| | | | Estimate | S.E. | C.R. | P |
|---|---|---|---|---|---|---|
| GEWEKE | ←- | KAOPEN | 2.768 | 0.506 | 5.473 | *** |
| GEWEKE | ←- | GDP | -0.250 | 0.297 | -0.841 | 0.400 |
| GEWEKE | ←- | TradeFactor | 4.245 | 1.693 | 2.508 | 0.012 |

| Model | AIC |
|---|---|
| Default model | 28.878 |

*** indicates a p-value that is lower than 0.001

The parameter estimates from Bayesian Estimation are given in Table 32. The Bayesian estimates for the coefficients are not vastly different from the MLE results.

Table 32: Bayesian Estimates of Integration v Openness, GDP and Trade Factor (Including European Countries)

| | Mean | S.E. | S.D. | C.S. | 95% Lower bound | 95% Upper bound |
|---|---|---|---|---|---|---|
| GEWEKE←KAOPEN | 2.764 | 0.016 | 0.520 | 1.000 | 1.743 | 3.787 |
| GEWEKE←GDP | -0.241 | 0.010 | 0.299 | 1.001 | -0.819 | 0.341 |
| GEWEKE←TradeFactor | 4.177 | 0.049 | 1.680 | 1.000 | 0.843 | 7.384 |

## Model 8- (All Countries) Direct Influence of Trade and KAOPEN and Indirect influence of GDP through KAOPEN, on Integration

Model 8 tests whether GDP, after the Global Financial Crisis, works through Capital Account Openness as outlined in Hypothesis 2(a), which was found to be the case in Model 2, prior to the Crisis.

$H^{2a}_0$: Impact of KAOPEN, Trade, directly on Integration, and GDP through KAOPEN = 0

$H^{2a}_1$: Impact of KAOPEN, Trade, directly on Integration, and GDP through KAOPEN ≠ 0

In other words, after the Financial Crisis, is Capital Account Openness a mediating variable for GDP's influence on Integration? Figure 29 shows the relationships that Model 8 tests, which are the same relationships that were, tested Model 2, before the Crisis.

Figure 29: Hypothesis 2 – Does GDP act through Capital Account Openness

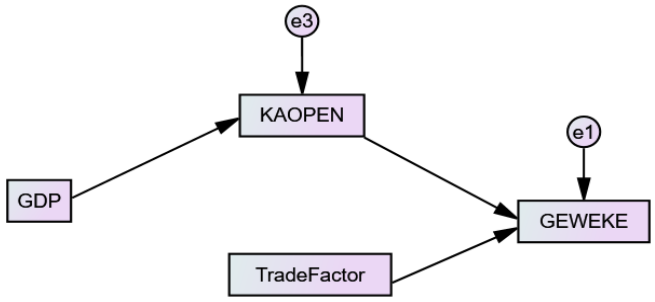



Table 33 below shows the results of the ML estimation of the model, the Bayesian Estimation results are shown in table 32. As both tables show, GDP becomes significant if one looks at its impact, through Capital Account Openness, after the Crisis. The null hypothesis that the GDP variable is equal to zero is therefore rejected, which was also the case with Model 2, which modeled the same relationships before the Crisis. This means that the GDP of a country does influence its Integration indirectly and it does so through Capital Account Openness. An interesting result in this model is that after the Crisis, GDP has a negative relation to Capital Account Openness, meaning that for every unit increase in GDP, the KAOPEN measure declines by just under 0.08 points. This is interesting because it means that, after the Crisis, greater economic growth lessens the impact of Capital Account Openness on Integration, meaning that the greater the economic growth of the country, the less the impact of Capital Account Openness on Integration, i.e. the less capital account openness matters.

This is a very important finding, in that it means that for rapidly growing economies, after the Crisis, the impact of Capital Account Openness on Integration is lower, but still significant. From this finding it shows that high GDP growth lowers the level of Capital Account Openness required for a country to be integrated into the world market, after the Crisis. This means that stock markets of rapidly growing economies are more integrated into world economy at a lower level of Capital Account Openness than slower growing economies, after a Crisis in the markets. This implies that Capital Account Openness cannot be looked at in isolation as a key variable affecting integration. If the economy is a fast growing one, the country may be more integrated into the world market, through a lower level of Capital Account Openness, than if the economy is growing slowly, given a market crisis. Thus, even though emerging economies may have lower levels of Capital Account Openness they may none the less be integrated with the world economy.

Table 33: ML estimation of Capital Account Openness as a Mediating Variable for GDP

| | Estimate | S.E. | C.R. | P |
|---|---|---|---|---|
| KAOPEN ←- GDP | -0.080 | 0.035 | -2.292 | 0.022 |
| GEWEKE ←- KAOPEN | 2.821 | 0.506 | 5.571 | *** |
| GEWEKE ←- TradeFactor | 4.280 | 1.695 | 2.525 | 0.012 |

| Model | AIC |
|---|---|
| Default model | 24.893 |

*** indicates a p-value that is lower than 0.001

The AIC score of this model is very low at 24.893, relative to other models, which means that this model is very informative. The relationships captured in this model are revealing more information about the interactions of the variables, than the previous model for the post Crisis period.

Table 34: Bayesian Estimate of Openness as Intervening Variable for GDP

| | Mean | S.E. | S.D. | C.S. | Median | 95% Lower bound | 95% Upper bound |
|---|---|---|---|---|---|---|---|
| KAOPEN←GDP | -0.079 | 0.001 | 0.037 | 1.001 | -0.080 | -0.150 | -0.006 |
| GEWEKE←KAOPEN | 2.840 | 0.013 | 0.510 | 1.000 | 2.849 | 1.840 | 3.829 |
| GEWEKE←TradeFactor | 4.309 | 0.064 | 1.736 | 1.001 | 4.307 | 0.880 | 7.678 |

## Model 9- (All Countries) Direct influence of Trade and KAOPEN and Indirect Influence of GDP through Trade on Integration

We have established in Hypothesis 1 (Models 1 and 7, before and after the Crisis respectively) that GDP was not significant in influencing Integration directly. However in Hypothesis 2(a) (Models 2 and 8 before and after the Crisis, respectively) we found that GDP acts through Capital Account Openness to influence Integration. Model 9 tests whether after the Global Financial Crisis, GDP works through Trade to influence Integration as outlined in Hypothesis 2(b).

$H^{2b}_0$: Impact of KAOPEN and Trade, directly on Integration, and GDP through Trade = 0

$H^{2b}_1$: Impact of KAOPEN and Trade, directly on Integration, and GDP through Trade ≠ 0

Figure 30 below illustrates the relationships being tested Hypothesis 2(b) (Model 9).

Figure 30: GDP Action through Trade

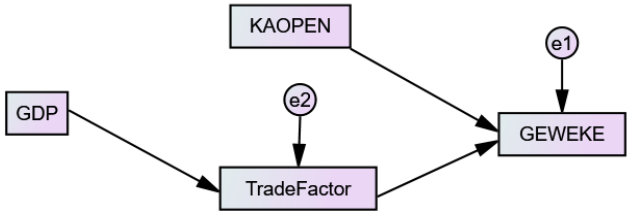



Table 35 below, shows the ML estimation of Figure 30 and Table 36 the Bayesian Estimation. Both estimation methods show that GDP is not significant in the model. Hypothesis 2(b), which states that the influence of GDP on Integration is zero after the Global Financial Crisis, is therefore not rejected when all the countries are considered together as one group. This means that GDP does not act through Trade to influence market Integration. This is an unexpected finding as economic intuition would have led one to expect that the faster an economy grows, the more it would be trading, the more integrated its equity market would be therefore. The finding makes sense however, if one considers that countries may do more Trade with countries other than the US. Meaning that even though the country's economy is growing, its Trade with the US may not be growing correspondingly, and thus the Integration between the markets will not be affected through Trade by economic growth of the country. Trade on its own however remains an important factor in determining Integration as shown in both Tables 35 and 36.

Table 35: ML Estimation of GDP Effect through Trade

| | | | Estimate | S.E. | C.R. | P |
|---|---|---|---|---|---|---|
| TradeFactor | ←- | GDP | -0.003 | 0.012 | -0.273 | 0.785 |
| GEWEKE | ←- | KAOPEN | 2.821 | 0.506 | 5.570 | *** |
| GEWEKE | ←- | TradeFactor | 4.268 | 1.696 | 2.517 | 0.012 |

| Model | AIC |
|---|---|
| Default model | 29.524 |

*** indicates a p-value that is lower than 0.001

Table 36: Bayesian Estimation of GDP Effect through Trade

| | Mean | S.E. | S.D. | C.S. | Median | 95% Lower bound | 95% Upper bound |
|---|---|---|---|---|---|---|---|
| GEWEKE←KAOPEN | 2.823 | 0.018 | 0.510 | 1.001 | 2.832 | 1.818 | 3.814 |
| TradeFactor←GDP | -0.003 | 0.000 | 0.011 | 1.001 | -0.003 | -0.025 | 0.019 |
| GEWEKE←TradeFactor | 4.207 | 0.056 | 1.706 | 1.001 | 4.196 | 0.916 | 7.495 |

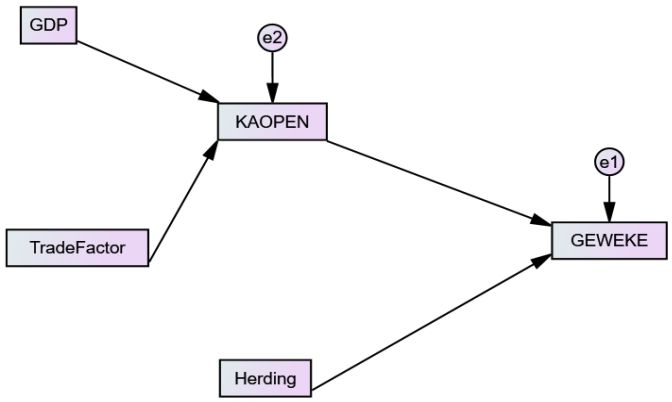
## Model 10: (All Countries) Direct Influence of KAOPEN and Indirect Influence of GDP and Trade, Through KAOPEN on Integration

Having established that GDP acts on Integration through Capital Account Openness, in Models 2 and 8, Model 10 seeks to test Hypothesis 2 namely whether Trade, like GDP, also acts indirectly through Capital Account Openness. The economic rationale for Trade possibly acting through Capital Account Openness would be that countries with more open capital accounts, would also Trade more freely. This line of thinking would imply that the impact of Trade on Integration that was seen in Hypothesis 1, may in fact be the result of Trade acting through Capital Accounts Openness. Figure 31 below illustrates the relationships being tested in Model 10.

$H^3_0$: Impact of KAOPEN directly on Integration
and GDP through Trade, and Trade through KAOPEN = 0

$H^3_1$: Impact of KAOPEN directly on Integration
and GDP through Trade, and Trade through KAOPEN ≠ 0

Figure 31: Trade Effects on Integration through Capital Account Openness




The results in Tables 37 and 48 (ML estimation and Bayesian Estimation, respectively) show that Trade does not act through Capital Account Openness to affect stock market Integration, this relationship is not significant in both estimation approaches. Thus Hypothesis 3 for the post-Crisis period cannot be rejected. The significance of GDP through Capital Account Openness is also confirmed by this model.

Table 37: ML Estimation of Trade Effects through Capital Account Openness

| | Estimate | S.E. | C.R. | P |
|---|---|---|---|---|
| KAOPEN ←- GDP | -0.082 | 0.035 | -2.357 | 0.018 |
| KAOPEN ←- TradeFactor | -0.279 | 0.199 | -1.402 | 0.161 |
| GEWEKE ←- KAOPEN | 2.714 | 0.512 | 5.302 | *** |

| Model | AIC |
|---|---|
| Default model | 29.365 |

*** indicates a p-value that is lower than 0.001

The AIC score for this model is lower than the preceding two models but is a little bit higher than Models 7 and 8, which were 28.878 and 24.893 respectively and it is little lower than Model 9, which was 29.524. Thus the model is slightly more informative than model 9, but less informative than Models 7 and 8. Therefore it should not be considered in further analysis, in favour of the most informative model, namely Model 8.

Table 38: Bayesian Estimation of Trade Effects through Capital Account Openness

| | Mean | S.E. | S.D. | C.S. | Median | 95% Lower bound | 95% Upper bound |
|---|---|---|---|---|---|---|---|
| KAOPEN←GDP | -0.082 | 0.001 | 0.036 | 1.001 | -0.082 | -0,153 | -0.012 |
| GEWEKE←KAOPEN | 2.710 | 0.017 | 0.515 | 1.001 | 2.704 | 1.710 | 3.722 |
| KAOPEN←TradeFactor | -0.268 | 0.005 | 0.198 | 1.000 | -0.269 | -0.661 | 0.116 |

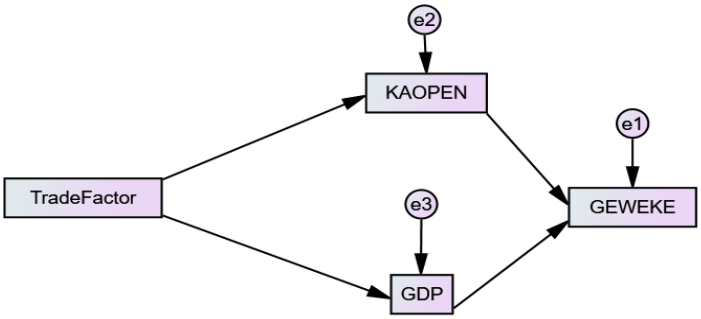
## Model 11 – (All Countries) Direct Influence of GDP, KAOPEN and Indirect Influence of Trade, through GDP and KAOPEN on Integration

Model 11 tests Hypothesis 2(d), in that it seeks to answer the question, after the Crisis, does Trade affect Integration through GDP and Capital Account Openness? Model 5 tested this relationship prior to the Crisis. Figure 31 illustrates the relationship being tested in Model 11. The economic rationale of model is the same as that for Model 5, namely that greater Trade may drive economic growth which might in turn affect market Integration between the trading counties.

$H^{2(c)}_0$: Impact of KAOPEN and GDP directly on Integration, and Trade through KAOPEN and GDP = 0

$H^{2(c)}_1$: Impact of KAOPEN and GDP directly on Integration, and Trade through KAOPEN and GDP ≠ 0

Figure 32: Trade Effects on Integration through Capital Account Openness and GDP




The results from the ML estimation are again similar to findings from Bayesian Estimation, as shown in Table 39 and Table 40, respectively. Trade does not impact Integration indirectly through either Capital Account Openness or GDP, as both the coefficients of these relationships are not significant. Thus Model 11 demonstrates that Hypothesis 2(d) cannot be rejected. The model also confirms that after the Global Financial Crisis GDP does not act on Integration directly as established in Models 7. This implies that Trade does not require open capital account for it to affect market Integration, the relationship between Trade and Integration seems to be a direct one, as established in Hypothesis 1.

Table 39: ML Estimation of Trade Effects on Market Integration through GDP and Capital Account Openness

| | | | Estimate | S.E. | C.R. | P |
|---|---|---|---|---|---|---|
| KAOPEN | ←- | TradeFactor | -0.265 | 0.201 | -1.318 | 0.188 |
| GDP | ←- | TradeFactor | -0.131 | 0.383 | -0.342 | 0.732 |
| GEWEKE | ←- | KAOPEN | 2.658 | 0.511 | 5.197 | *** |
| GEWEKE | ←- | GDP | -0.271 | 0.301 | -0.900 | 0.368 |

| **Model** | **AIC** |
|---|---|
| Default model | 35.340 |

*** indicates a p-value that is lower than 0.001

The AIC score for this model is higher than for the other two models for the post Crisis period (Models 8 and 9), meaning that this model is less informative than the preceding two models, thus it should not be considered further in the analysis.

Table 40: Bayesian Estimation of Trade Effects on Market Integration through GDP and Capital Account Openness

| | Mean | S.E. | S.D. | C.S. | Median | 95% Lower bound | 95% Upper bound |
|---|---|---|---|---|---|---|---|
| KAOPEN←TradeFactor | -0.252 | 0.007 | 0.197 | 1.001 | -0.255 | -0.635 | 0.141 |
| GEWEKE←GDP | -0.287 | 0.010 | 0.300 | 1.001 | -0.283 | -0.882 | 0.292 |
| GEWEKE←KAOPEN | 2.640 | 0.016 | 0.516 | 1.000 | 2.637 | 1.621 | 3.669 |
| GDP←TradeFactor | | 0.008 | 0.362 | 1.000 | -0.139 | -0.862 | 0.560 |

## Model 12 – (All Countries) Direct Influence of KAOPEN and Indirect Influence of GDP through Trade and Influence of Trade through KAOPEN on Integration

The question that Model 12 seeks to answer is the question posed in Hypothesis 3 for the post Crisis period, whether GDP acts through Capital Account Openness and Capital Account Openness in turn works indirectly through Trade to impact Integration.

$H^{2(d)}_0$: Impact of KAOPEN directly on Integration, and GDP acts indirectly through Trade and Trade indirectly through KAOPEN = 0

$H^{2(d)}_1$: Impact of KAOPEN directly on Integration, and GDP acts indirectly through Trade and Trade indirectly through KAOPEN ≠ 0

Table 41 shows that Trade does not act indirectly through Capital Account Openness and the KAOPEN variable is not significant in the model shown in Figure 33. Thus, Hypothesis 3 cannot be rejected that Capital Account Openness does not impact Integration indirectly through Trade. However, Trade is significant in its direct influence on Integration. GDP is also significant in its direct impact on Capital Account Openness, even though Capital Account Openness does not significantly impact Trade.

Figure 33: Capital Account Openness Effects on Market Integration through Trade

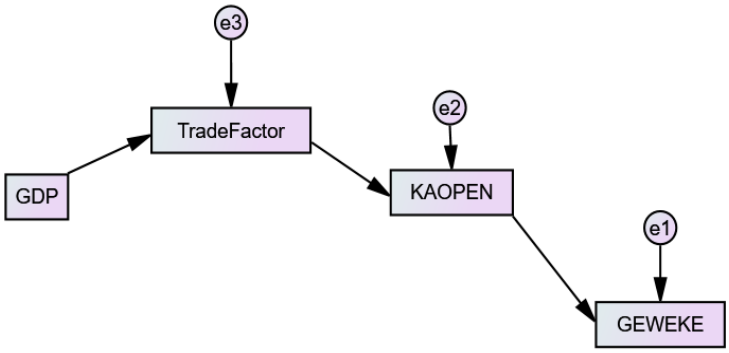



Table 41: ML Estimation of Effects Capital Account Openness on Market Integration through Trade

| | | | Estimate | S.E. | C.R. | P |
|---|---|---|---|---|---|---|
| KAOPEN | ←- | GDP | -0.080 | 0.035 | -2.292 | 0.022 |
| TradeFactor | ←- | KAOPEN | -0.026 | 0.021 | -1.279 | 0.201 |
| GEWEKE | ←- | TradeFactor | 3.460 | 1.790 | 1.933 | 0.053 |

| Model | AIC |
|---|---|
| Default model | 52.472 |

*** indicates a p-value that is lower than 0.001

The AIC score of this model is the highest of all the post Crisis models considered thus far. This means that this model is the least informative of all the post Crisis models considered up to now. It should therefore not be factored into any further analysis.

Table 42: Bayesian Estimation of Effects Capital Account Openness on Market Integration through Trade

| | **Mean** | **S.E.** | **S.D.** | **C.S.** | **Median** | **95% Lower bound** | **95% Upper bound** |
|---|---|---|---|---|---|---|---|
| KAOPEN←GDP | -0.080 | 0.001 | 0.036 | 1.001 | -0.082 | -0.151 | -0.008 |
| GEWEKE←TradeFactor | 3.485 | 0.046 | 1.725 | 1.000 | 3.485 | 0.095 | 6.894 |
| TradeFactor←KAOPEN | -0.026 | 0.001 | 0.021 | 1.001 | -0.026 | -0.067 | 0.015 |

# Section B1: Results for European and Latin American Countries (2003-2007 Pre-Global Financial Crisis)

Similar to when all the countries were being tested together, the same hypotheses are tested in this section for European and Latin American countries.

Table 43: Hypotheses to be tested for European and Latin American Countries

| Model | Hypothesis | Relationship being Tested |
|---|---|---|
| 13 and 20 | 1 | Direct impact of all the variables on Integration |
| 14 and 21 | 2(a) | Indirect impact of GDP, acting through Capital Account Openness |
| 15 and 22 | 2(b) | Indirect impact of GDP, acting through Trade |
| 16 and 23 | 2(c) | Indirect impact of Trade, acting through Capital Account Openness |
| 17 and 24 | 2(d) | Indirect impact of Trade, acting through GDP and Capital Account Openness |
| 18 and 25 | 3 | Direct impact of Capital Account Openness with GDP and Trade being indirect and acting through Capital Account Openness |
| 19 and 26 | 5 | Direct and indirect impact of Trade |

In this section we test the Integration of the European counties and the Latin American (LATAM) countries to the US markets separately from the African and Asian countries, prior to the 2007 Global Financial Crisis. In the preceding two sections the analysis dealt with all of the countries together as one homogenous group. The structural break analysis discussed above, in Section A, shows that the European and Latin American countries all experienced a break in their data during the 2006/7 period, whereas the African and Asian countries did not. This provides the basis for why the clusters of countries can be can be considered in more detail as distinct from each other. We will again test Hypothesis 1 to 3 for the different groupings of countries.

## Model 13 – (Europe and LATAM) Direct Influence of Capital Account Openness, GDP and Trade and Herding on Integration

In Model 13 we again test Hypothesis 1, that is to say whether Capital Account Openness, GDP, Trade or Herding directly influenced the Integration of the European and Asian markets with the US market, that is to say without any intermediate variables in between. In Model 13 we test the hypothesis for the period 2003 to 2007.

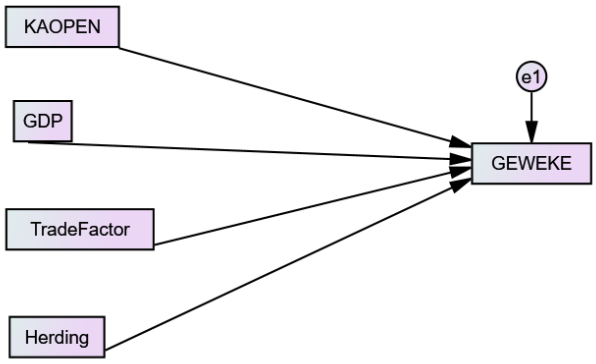
Similar to the pre 2007 models estimated in the preceding section, we have included the Herding variable in the regressions that follow so as to be able to juxtapose it against the results of testing Integration in the African and Asian markets, which will be discussed later.

$H^1_0$: Impact of KAOPEN, GDP, Trade Factor and Herding, directly on Integration = 0

$H^1_1$: Impact of KAOPEN, GDP, Trade Factor and Herding directly on Integration ≠ 0

Figure 34 below illustrates the relationships being tested in model 13.

Figure 34: Impact of Capital Account Openness, GDP, Trade and Herding on Integration




The results of the ML estimation in Table 44 below are for data with the structural break in 2007 and they show that, prior to the Financial Crisis, only Trade has a direct significant influence on Integration of the European and LATAM markets to the US. None of the other variables are significant, including Capital Account Openness, which was significant at the 99% level, when we considered all the countries together, , in Model 1 (prior to the financial Crisis). Looking at countries that experienced a structural break in their data, after the Crisis, reveals a different picture with regards to the role of Trade versus Capital Account Openness and their influence on Integration, from when all the countries are lumped together. We will see how the roles of Trade and Capital Account Openness change when one considers different groups of countries as opposed to looking at all the countries as one group, later in the study.

Table 44: ML Estimation of Impact of Capital Account Openness, Trade, GDP and Herding on Integration

| | | Estimate | S.E. | C.R. | P |
|---|---|---|---|---|---|
| GEWEKE <--- | KAOPEN | 0.056 | 0.734 | 0.076 | 0.939 |
| GEWEKE <--- | GDP | -1.606 | 1.199 | -1.340 | 0.180 |
| GEWEKE <--- | TradeFactor | 3.418 | 1.442 | 2.370 | 0.018 |
| GEWEKE <--- | Herding | -4.007 | 6.767 | -0.592 | 0.554 |

| Model | AIC |
|---|---|
| Default model | 64.746 |

The AIC score for this model is high, compared to score for Model 1, when all the countries were considered together, which was a score of 28.878. Thus, this model is does not carry as much information as the model for all the countries together.

The results of the Bayesian Estimation reported in Table 45 below, support the findings of the ML estimation, in that the coefficients from the Bayesian Estimation are not vastly different from the MLE coefficients and also Trade is the only significant variable in the Bayesian analysis.

Table 45: Bayesian Analysis of Impact of Heading, Capital Account Openness, Trade and GDP on Integration

| | **Mean** | **S.E.** | **S.D.** | **C.S.** | **95% Lower bound** | **95% Upper bound** |
|---|---|---|---|---|---|---|
| GEWEKE<--KAOPEN | 0,073 | 0,024 | 0,855 | 1,000 | -1,584 | 1,741 |
| GEWEKE<--GDP | -1,699 | 0,032 | 1,260 | 1,000 | -4,130 | 0,799 |
| GEWEKE<--TradeFactor | 3,429 | 0,051 | 1,640 | 1,000 | 0,182 | 6,630 |
| GEWEKE<--Herding | -4,039 | 0,165 | 6,878 | 1,000 | -17,538 | 9,506 |

*Analysis of the data with the break for LATAM countries being in 2006:* The MLE results for the break occurring in 2006 show that analysing the data with the period in which the break actually happens for LATAM countries, causes the coefficients to change and it also changes which variables are significant. Whereas only Trade was significant in the analysis of the break in 2007, when the break is placed in 2006, both Capital Account Openness and Trade are significant. However the AIC score for this model shows that the model is not very informative, with a score of 70.347 versus 64.746 when the break is set during 2007. Even though the results of the MLE analysis imply that there may be value in looking at the data for the LATAM countries with a break in 2006, the AIC score shows that this model is not an improvement on the model where the break in the data is set in 2007.

| | | Estimate | S.E. | C.R. | P |
|---|---|---|---|---|---|
| GEWEKE | <--- KAOPEN | 1.353 | 0.675 | 2.006 | 0.045 |
| GEWEKE | <--- Herding | 0.807 | 4.102 | 0.197 | 0.844 |
| GEWEKE | <--- TradeFactor | 3.199 | 1.364 | 2.346 | 0.019 |
| GEWEKE | <--- GDP | 0.200 | 1.079 | 0.186 | 0.853 |

| Model | AIC |
|---|---|
| Default model | 70.347 |

The results of the Bayesian analysis do not support the MLE results for significance of the Capital Account Openness variable. They do however; support the significance of the Trade variable. All the other variables are not significant as was the case in the MLE analysis.

| | Mean | S.E. | S.D. | C.S. | 95% Lower bound | 95% Upper bound |
|---|---|---|---|---|---|---|
| GEWEKE<--KAOPEN | 1.417 | 0.042 | 0.791 | 1.001 | -0.152 | 2.934 |
| GEWEKE<--Herding | 0.404 | 0.173 | 4.265 | 1.001 | -7.858 | 8.599 |
| GEWEKE<--TradeFactor | 3.320 | 0.096 | 1.560 | 1.002 | 0.128 | 6.378 |
| GEWEKE<--GDP | 0.158 | 0.065 | 1.161 | 1.002 | -2.108 | 2.466 |

## Model 14 – (Europe and LATAM) Direct Influence of Trade, Herding and KAOPEN and Indirect influence of GDP through KAOPEN on Integration

Model 13 above showed that GDP did not directly influence stock market Integration of European and LATAM countries to the US, prior to 2007. Model 2 and Model 8, when all the countries in the study were considered together, showed that GDP had a significant on Capital Account Openness, albeit a negative influence, prior to 2007. Model 14 tests whether this is also the case when one only considers European and LATAM countries. This model tests Hypothesis 2(a).

$H^{2a}_0$: Impact of KAOPEN, Trade Factor, Herding directly on Integration and GDP through KAOPEN = 0

$H^{2a}_1$: Impact of KAOPEN, Trade Factor, Herding directly on Integration and GDP through KAOPEN ≠ 0

Figure 35 below shows the relationships that Model 14 is testing.

Figure 35: Influence of GDP on Capital Account Openness, Trade and Herding on Integration

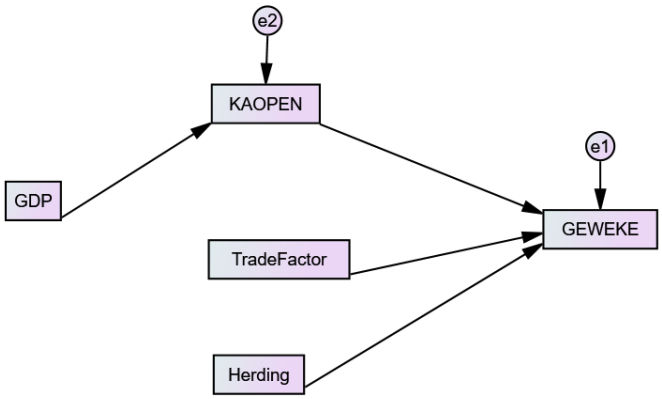



Table 46: Maximum Likelihood Estimate of Impact of GDP on Capital Account Openness

| | | Estimate | S.E. | C.R. | P |
|---|---|---|---|---|---|
| KAOPEN <--- | GDP | -0.067 | 0.138 | -0.487 | 0.627 |
| GEWEKE <--- | KAOPEN | 0.184 | 0.739 | 0.249 | 0.803 |
| GEWEKE <--- | TradeFactor | 3.747 | 1.450 | 2.584 | 0.010 |
| GEWEKE <--- | Herding | -2.002 | 6.814 | -0.294 | 0.769 |

| Model | AIC |
|---|---|
| Default model | 66.160 |

Interestingly the results of the model which are shown in Table 46 indicate that Trade is still the only significant variable. In contrast to when all the countries were considered together, when only European and LATAM countries are looked at, prior to 2007, GDP has no significant influence on Capital Account Openness. This is a different result from what was found in Model 2 and Model 8, where all the countries were considered together, where GDP was found to have significant impact on Capital Account Openness. When one looks at countries relative to how they reacted to the Financial Crisis, instead of lumping them all together, it becomes clear that Integration is complex. Similar to Model 13 though, this model's AIC score shows that the model is not very informative.

The Bayesian Estimation shown in Table 47 below only supports the Capital Account Openness coefficient estimates. The remaining Bayesian estimated coefficients vary from the MLE estimates by wide margins, with the GDP coefficient varying by over 0.300 points and the Trade coefficient varying by over 0.150 points. The disagreement between the Bayesian estimates and the MLE estimates indicates that the MLE model may not be reliably dealing with the nature of the variables. MLE assumes asymptotically large, normally distributed samples whereas our data set is not vary large, nor are some of the variables normally distributed. Thus, where the results of the Bayesian analysis do not support the results of the MLE, we infer that reliance cannot be placed on findings of the MLE model. The high AIC score also indicates, as

stated above that this model does not contain much information about the relationship between the variables, compared to the models of when the countries are considered together.

Table 47: Bayesian Analysis of Impact of GDP on Capital Account Openness

| | Mean | S.E. | S.D. | C.S. | 95% Lower bound | 95% Upper bound |
|---|---|---|---|---|---|---|
| GEWEKE<--KAOPEN | 0.117 | 0.034 | 0.833 | 1.001 | -1.526 | 1.720 |
| GEWEKE<--TradeFactor | 3.597 | 0.067 | 1.624 | 1.001 | 0.472 | 6.801 |
| GEWEKE<--Herding | -2.325 | 0.320 | 6.826 | 1.001 | -16.010 | 10.851 |
| KAOPEN<--GDP | -0.067 | 0.007 | 0.144 | 1.001 | -0.346 | 0.211 |

*Analysis of the data with the break for LATAM countries being in 2006:* Similar to the results in Model 13 above, Capital Account Openness becomes significant when we look at the structural break occurring in 2006 instead of 2007. Trade remains significant in this model as it was with the structural break being placed in 2007. However similar to the results in Model 13, the AIC score of this model is also not more informative than when the break is placed in 2007, with a score of 69.916 versus 66.160. Thus, considering the data with the structural break in 2006 does not add further insight into the model.

Table 48: Structural Break in 2006

| | Estimate | S.E. | C.R. | P |
|---|---|---|---|---|
| KAOPEN <--- GDP | -0.096 | 0.142 | -0.681 | 0.496 |
| GEWEKE <--- KAOPEN | 1.333 | 0.675 | 1.977 | 0.048 |
| GEWEKE <--- Herding | 0.659 | 4.103 | 0.161 | 0.872 |
| GEWEKE <--- TradeFactor | 3.148 | 1.364 | 2.308 | 0.021 |

| Model | AIC |
|---|---|
| Default model | 69.916 |

The results of the Bayesian analysis do not support the results of the MLE for the Capital Account Openness variable, with regards to its statistical significance versus the findings of the MLE where it is significant. The other variables are supported by the Bayesian analysis including Trade, which is significant according the Bayesian analysis.

Table 49: Structural Break in 2006

| | Mean | S.E. | S.D. | C.S. | 95% Lower bound | 95% Upper bound |
|---|---|---|---|---|---|---|
| GEWEKE<--KAOPEN | 1.391 | 0.025 | 0.757 | 1.001 | -0.129 | 2.881 |
| GEWEKE<--Herding | 0.653 | 0.150 | 4.053 | 1.001 | -7.267 | 8.514 |
| GEWEKE<--TradeFactor | 3.208 | 0.071 | 1.526 | 1.001 | 0.220 | 6.177 |
| KAOPEN<--GDP | -0.095 | 0.004 | 0.143 | 1.000 | -0.374 | 0.186 |

Thus, only Trade acting directly on Integration, is supported as being significant in the model. Neither Capital Account Openness nor GDP are significant in the Bayesian Estimation of this model.

## Model 15 - (Europe and LATAM) Direct influence of Trade, Herding and KAOPEN and Indirect Influence of GDP through Trade on Integration

We have established in Model 13 that GDP was not significant in influencing Integration directly, nor did it significantly influence Capital Account Openness for European and LATAM countries prior to 2007, as was established in Model 14. Model 15 tests whether prior to 2007, GDP works through Trade to influence Integration. This model is testing Hypothesis 2(b) for European and LATAM countries prior to the Crisis. When all the countries were tested together in Model 9, Trade and Capital Account Openness were found to be significant, but that GDP was not.

$H^{2b}_0$: Impact of KAOPEN, Trade Factor, Herding directly and GDP indirectly through Trade on Integration = 0

$H^{2b}_1$: Impact of KAOPEN, Trade Factor, Herding directly and GDP indirectly through Trade on Integration ≠ 0

Figure 36 below illustrates the relationships that Model 15 tests.

Figure 36: Does GDP Act Through Trade to Influence Integration

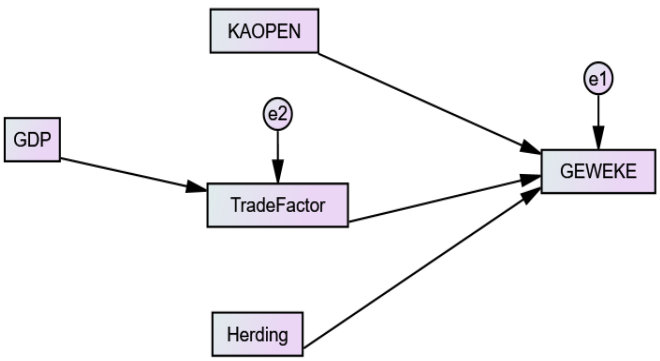



Table 50 reports the results of the MLE and shows that GDP does not significantly influence Trade for European and LATAM countries prior to 2007. However as in the models above, Trade itself, remains significant in its influence on Integration for these countries. Capital Account Openness is not significant in this model. This result is different from the findings of Model 3, when all the countries were considered together, where both Trade and Capital Account Openness were significant.

Table 50: Impact of GDP on Trade

| | | | Estimate | S.E. | C.R. | P |
|---|---|---|---|---|---|---|
| TradeFactor | <--- | GDP | -0.101 | 0.070 | -1.446 | 0.148 |
| GEWEKE | <--- | KAOPEN | 0.184 | 0.739 | 0.249 | 0.803 |
| GEWEKE | <--- | TradeFactor | 3.747 | 1.450 | 2.584 | 0.010 |
| GEWEKE | <--- | Herding | -2.002 | 6.814 | -0.294 | 0.769 |

| Model | AIC |
|---|---|
| Default model | 64.322 |

This model's AIC score shows that the model is not very informative. It is better than the preceding models, but its AIC is still relatively high compared to models for all the counties modelled together.

The Bayesian Estimation of the model supports the results of the MLE except for the Herding variable. There is a difference of over 0.190 points between the MLE estimated and the Bayesian Estimated coefficient, for this variable. However, because Herding is not significant in both models, we will take it that for the significant variables, the findings of the MLE model are confirmed by the Bayesian Estimation.

Table 51: Bayesian Estimation of GDP Impact on Trade

| | Mean | S.E. | S.D. | C.S. | 95% Lower bound | 95% Upper bound |
|---|---|---|---|---|---|---|
| GEWEKE<--KAOPEN | 0.157 | 0.047 | 0.853 | 1.002 | -1.582 | 1.764 |
| GEWEKE<--TradeFactor | 3.817 | 0.105 | 1.719 | 1.002 | 0.439 | 7.240 |
| GEWEKE<--Herding | -2.197 | 0.361 | 6.948 | 1.001 | -16.021 | 11.398 |
| TradeFactor<--GDP | -0.101 | 0.002 | 0.072 | 1.000 | -0.244 | 0.036 |

*Analysis of the data with the break for LATAM countries being in 2006:* The results of placing the break in the data in 2006 are similar for this model, as it is for the preceding two models. Capital Account Openness becomes significant, when the break is in 2006. The AIC score for the model with a break in 2006 is not more informative that the model with the break in 2007, with the score at 68.328 versus at 64.322 for the model with the break in 2007. Thus, the model with the break in 2006 is less informative than the model with the break in 2007.

Table 52: MLE Results with Structural Break in 2006

| | | | Estimate | S.E. | C.R. | P |
|---|---|---|---|---|---|---|
| TradeFactor | <--- | GDP | -0.100 | 0.070 | -1.438 | 0.150 |
| GEWEKE | <--- | KAOPEN | 1.333 | 0.675 | 1.977 | 0.048 |
| GEWEKE | <--- | Herding | 0.659 | 4.103 | 0.161 | 0.872 |
| GEWEKE | <--- | TradeFactor | 3.148 | 1.364 | 2.308 | 0.021 |

| Model | AIC |
|---|---|
| Default model | 68.328 |

The Bayesian analysis does not support the MLE results for Capital Account Openness or for Trade; none of these variables are significant in the Bayesian analysis. The non-significance of the other variables is supported by the Bayesian analysis.

Table 53: Bayesian Analysis Results with Structural Break in 2006

| | Mean | S.E. | S.D. | C.S. | 95% Lower bound | 95% Upper bound |
|---|---|---|---|---|---|---|
| GEWEKE<--KAOPEN | 1.301 | 0.042 | 0.838 | 1.001 | -0.350 | 3.038 |
| GEWEKE<--Herding | 0.727 | 0.171 | 4.059 | 1.001 | -7.214 | 8.695 |
| GEWEKE<--TradeFactor | 3.050 | 0.064 | 1.622 | 1.001 | -0.103 | 6.269 |
| TradeFactor<--GDP | -0.097 | 0.002 | 0.070 | 1.001 | -0.236 | 0.036 |

Thus, due to the conflicting results of the MLE versus the Bayesian Estimates, the results for this model are inconclusive in terms of which variables are significant in influencing Integration.

## Model 16 - (Europe and LATAM) Direct Influence of KAOPEN and Herding and Indirect Influence of GDP and Trade, through KAOPEN on Integration

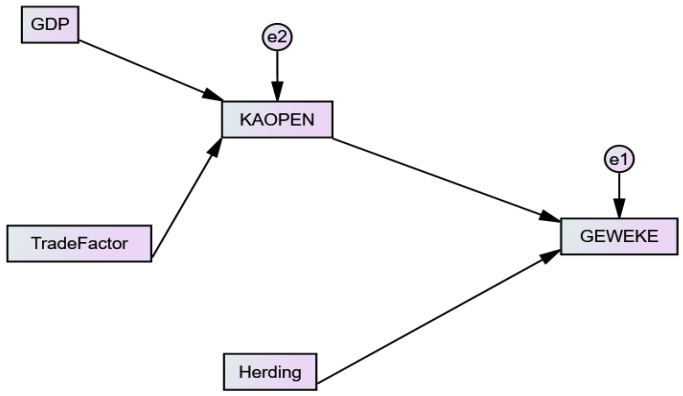
In Model 15 we established that prior to 2007, Trade acted directly on Integration for European and LATAM countries, whereas GDP was not significant, although the model was not very informative in terms of its AIC score. We now wish to establish whether Trade also acts indirectly through Capital Account Openness, on Integration. We also test whether GDP acts through Capital Account Openness. The economic rationale for Trade possibly acting through Capital Account Openness remains the same as outlined in Model 10, i.e. countries with more open capital accounts, would also trade more freely. This model tests whether, similar to what was proposed earlier, the impact of Trade on Integration for the European and LATAM countries, is in fact as a result of Trade acting through Capital Accounts Openness.

$H^{2(c)}_0$: Impact of KAOPEN, Herding, GDP directly on Integration and of Trade indirectly through KAOPEN = 0

$H^{2(c)}_1$: Impact of KAOPEN, Herding, GDP directly on Integration and of Trade indirectly through KAOPEN ≠ 0

Figure 37 below illustrates the relationships that are being tested in this model.

Figure 37: Does Trade act through Capital Account Openness




The results of the MLE are reported in Table 55 below and they show an interesting outcome. Trade is indeed significant in its impact on Capital Account Openness; however the impact is a negative one. The MLE shows that increase in Trade resulted in a decline in Capital Account Openness for European and LATAM countries prior to 2007. This is an unusual and counter intuitive finding. Capital Account Openness should encourage Trade and relationship should be a positive one. One of the reasons that this finding would make sense would be if Trade was dominated by imports with the result of weakening the currencies of the affected countries. The response of the monetary authorities in this case would then be to impose capital controls in an effort to protect the currency. The other reason for imposing capital controls would be if there was instability in the financial markets or in the macroeconomy. Looking at the KAOPEN scores of the Latin American countries in Table 54 below, shows that the monetary authorities did indeed change the capital control policies after the Crisis period, whereas none of the European countries changed their policies with regards to openness of their capital accounts.

Table 54: KAOPEN Scores of LATAM versus European Countries from 2003 to 2007

| **LATAM Country** | **2003 to 2007 KAOPEN Score Range** | | | **European Country** | **2003 to 2007 KAOPEN Score Range** |
|---|---|---|---|---|---|
| Brazil | 2003 | 0.194059 | | Germany | |
| | 2007 | 0.90701 | | United Kingdom | |
| Mexico | 2003 | 0.035746 | | France | 2.389668 |
| | 2007 | 1.093394 | | Spain | |
| Argentina | 2003 | -0.92325 | | | |
| | 2007 | 0.83125 | | | |

Table 55: Maximum Likelihood Impact of Trade on Capital Account Openness

| | | Estimate | S.E. | C.R. | P |
|---|---|---|---|---|---|
| KAOPEN | <--- GDP | -0.152 | 0.126 | -1.207 | 0.228 |
| KAOPEN | <--- TradeFactor | -0.832 | 0.151 | -5.508 | *** |
| GEWEKE | <--- KAOPEN | -0.605 | 0.750 | -0.807 | 0.420 |
| GEWEKE | <--- Herding | -2.292 | 6.948 | -0.330 | 0.741 |

| Model | AIC |
|---|---|
| Default model | 44.515 |

*** indicates a p-value that is lower than 0.001

The AIC score of the model is lower than the preceding models and is therefore relatively more informative.

The Bayesian Estimation results are shown in Table 56 and they support the results of the ML estimation of the coefficients of the model. According to the model there is a negative relationship between Trade and Capital Account Openness for the Europe and the LATAM countries prior to 2007. Importantly however, as indicated in Table 54, the KAOPEN scores of the LATAM group of countries are more variable than the European KAOPEN scores and this may contribute to this finding. As indicated when the countries were considered together as one group, why this relationship exists may be an area for further research.

Table 51: Bayesian Estimation of Impact of Trade on Capital Account Openness

| | Mean | S.E. | S.D. | C.S. | 95% Lower bound | 95% Upper bound |
|---|---|---|---|---|---|---|
| GEWEKE<--KAOPEN | -0.600 | 0.019 | 0.786 | 1.000 | -2.156 | 0.935 |
| GEWEKE<--Herding | -2.316 | 0.155 | 6.988 | 1.000 | -16.033 | 11.277 |
| KAOPEN<--GDP | -0.152 | 0.003 | 0.132 | 1.000 | -0.409 | 0.110 |
| KAOPEN<--TradeFactor | -0.831 | 0.003 | 0.156 | 1.000 | -1.136 | -0.527 |

*Analysis of the data with the break for LATAM countries being in 2006:* Although the models for both periods produce similar results in terms of the significant variables, the coefficients of the models from the two periods are different. There is also a clear difference in AIC scores for this model from the 2007 model. The AIC score for the model with the structural break in 2006 is lower, at 38.713 versus 44.515. This means that the model with structural break in 2006 carries more information, we should therefore consider this model in our analysis.

Table 52: Structural Break in 2006 MLE

| | | | Estimate | S.E. | C.R. | P | Label |
|---|---|---|---|---|---|---|---|
| KAOPEN | <--- | GDP | -0.197 | 0.123 | -1.595 | 0.111 | |
| KAOPEN | <--- | TradeFactor | -1.001 | 0.156 | -6.424 | *** | |
| GEWEKE | <--- | KAOPEN | 0.587 | 0.680 | 0.862 | 0.388 | |
| GEWEKE | <--- | Herding | 0.700 | 4.168 | 0.168 | 0.867 | |

| Model | AIC |
|---|---|
| Default model | 38.713 |

*** indicates a p-value that is lower than 0.001

The results of the Bayesian analysis support the findings of the MLE analysis, further lending support to using the 2006 period as the structural break instead of 2007. The difference in the coefficients of the Trade variable for the two periods is not very large at 0.015 points. The sign of the variable remains negative in this analysis, meaning that it carries the same interpretation as when we considered the break as occurring in 2007.

Table 53: Structural Break in 2006 Bayesian Analysis

| | Mean | S.E. | S.D. | C.S. | 95% Lower bound | 95% Upper bound |
|---|---|---|---|---|---|---|
| GEWEKE<--KAOPEN | 0.602 | 0.027 | 0.703 | 1.001 | -0.756 | 1.999 |
| GEWEKE<--Herding | 0.673 | 0.216 | 4.197 | 1.001 | -7.425 | 9.137 |
| KAOPEN<--GDP | -0.185 | 0.006 | 0.125 | 1.001 | -0.417 | 0.066 |
| KAOPEN<--TradeFactor | -0.985 | 0.009 | 0.162 | 1.002 | -1.303 | -0.658 |

Thus, when we consider whether Trade acted through Capital Account Openness in the period prior to 2007 for LATAM and European countries, we find that this is indeed the case. However, the relationship between Trade and Capital Account Openness was a negative one.

## Model 17: (Europe and LATAM) Direct Influence of GDP, KAOPEN and Herding and Indirect Influence of Trade, Through GDP and KAOPEN on Integration

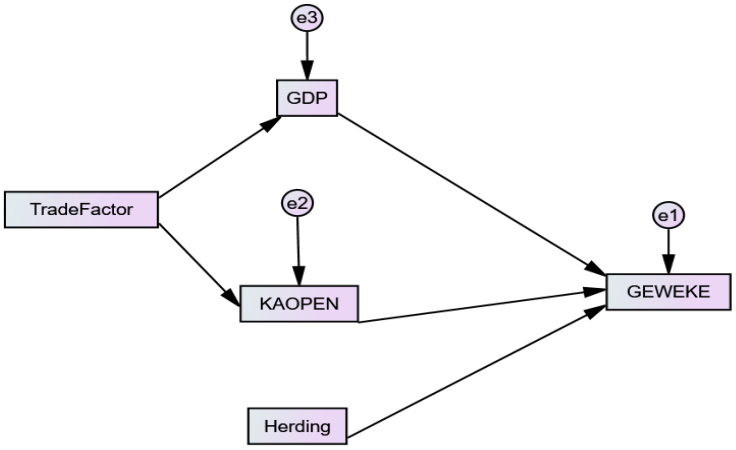
Having seen in Model 16 that Trade significantly affects Capital Account Openness, but does not affect Integration through Capital Account Openness, in Model 17 we test whether Trade affects Integration through GDP and Capital Account Openness in this model we test Hypothesis 2(d) for European and LATAM countries prior to the Crisis. Figure 38 illustrates the relationship being tested in Model 17. As indicated earlier, the economic rationale of this relationship between Trade, GDP and Capital Account Openness is outlined in Model 5, namely that greater Trade may drive economic growth which might in turn affect market Integration between the trading counties. In Model 11 we tested this model for all the countries together and found that Trade was significant in its influence of Capital Account Openness, although the sign was

opposite to what we expected. GDP was also found to be significant in its influence of Capital Account Openness, although the model was found not to be very informative. The hypothesis being tested in this model is:

$H^{2(d)}_0$: Impact of KAOPEN, Herding, GDP directly on Integration and of Trade indirectly through KAOPEN and GDP = 0

$H^{2(d)}_1$: Impact of KAOPEN, Herding, GDP directly on Integration and of Trade indirectly through KAOPEN and GDP ≠ 0

Figure 38: Trade through GDP or Capital Account Openness




The results of the MLE reconfirm the findings of Model 16, in that the impact of Trade on Capital Account Openness remains significant, however the impact of Trade on GDP is not significant. Similar to the findings in Model 16 and Model 11, Trade has a negative effect on Capital Account Openness. The issue around the negative Trade co-efficient was discussed under the results for Model 11 and 16. None of the other variables are significant in the model.

Table 54: Impact of Trade on GDP and Capital Account Openness

| | | | Estimate | S.E. | C.R. | P |
|---|---|---|---|---|---|---|
| KAOPEN | <--- | TradeFactor | -0.809 | 0.152 | -5.334 | *** |
| GDP | <--- | TradeFactor | -0.146 | 0.101 | -1.446 | 0.148 |
| GEWEKE | <--- | KAOPEN | -0.679 | 0.747 | -0.909 | 0.363 |
| GEWEKE | <--- | Herding | -4.927 | 6.870 | -0.717 | 0.473 |
| GEWEKE | <--- | GDP | -2.037 | 1.220 | -1.669 | 0.095 |

| Model | AIC |
|---|---|
| Default model | 43.245 |

*** indicates a p-value that is lower than 0.001

The AIC score of this model is slightly lower than the model in Model 16, when the structural break is taken as occurring in 2007, meaning that the model is more informative than Model 16

(with a 2007 structural break), but only just marginally. Though it is worth mentioning that when the structural break is placed in 2006, Model 16 has a lower AIC score.

In this model, the Bayesian Estimation confirms the results of the MLE. The coefficients for the all the variables are almost similar for both MLE and Bayesian Estimation approaches, except for the Herding variable. As in the preceding models, Herding is not significant in the model and so we will take the results of the significant variables into account.

Table 5: Bayesian Estimation of the Impact of Trade on GDP and Capital Account Openness

| | Mean | S.E. | S.D. | C.S. | 95% Lower bound | 95% Upper bound |
|---|---|---|---|---|---|---|
| GEWEKE<--KAOPEN | -0.665 | 0.010 | 0.755 | 1.000 | -2.119 | 0.833 |
| GEWEKE<--Herding | -4.705 | 0.217 | 7.251 | 1.000 | -18.595 | 9.616 |
| KAOPEN<--TradeFactor | -0.816 | 0.004 | 0.157 | 1.000 | -1.120 | -0.507 |
| GEWEKE<--GDP | -2.094 | 0.033 | 1.284 | 1.000 | -4.597 | 0.435 |
| GDP<--TradeFactor | -0.145 | 0.003 | 0.104 | 1.000 | -0.348 | 0.061 |

*Analysis of the data with the break for LATAM countries being in 2006:* Again, similar to the 2006 model in Model 16, the results of the MLE analysis are similar to the 2007 break analysis, in so far as Trade being significant and the other variables not. Also, similar to the preceding hypothesis, the AIC score for the 2006 structural data break is lower than the 2007 score at 41.107 as opposed to 43.245. The results of the Bayesian analysis support the MLE results.

Table 61: Structural break at 2006 MLE

| | | | Estimate | S.E. | C.R. | P | Label |
|---|---|---|---|---|---|---|---|
| KAOPEN | <--- | TradeFactor | -0.970 | 0.157 | -6.162 | *** | |
| GDP | <--- | TradeFactor | -0.160 | 0.111 | -1.438 | 0.150 | |
| GEWEKE | <--- | KAOPEN | 0.578 | 0.687 | 0.843 | 0.399 | |
| GEWEKE | <--- | Herding | 0.538 | 4.168 | 0.129 | 0.897 | |
| GEWEKE | <--- | GDP | -0.208 | 1.098 | -0.190 | 0.849 | |

| Model | AIC |
|---|---|
| Default model | 41.107 |

*** indicates a p-value that is lower than 0.001

Table 62: Structural Break at 2006 Bayesian Analysis

| | Mean | S.E. | S.D. | C.S. | 95% Lower bound | 95% Upper bound |
|---|---|---|---|---|---|---|
| GEWEKE<--KAOPEN | 0.573 | 0.032 | 0.708 | 1.001 | -0.848 | 1.989 |
| GEWEKE<--Herding | 0.599 | 0.229 | 4.288 | 1.001 | -7.777 | 8.906 |
| GEWEKE<--GDP | -0.201 | 0.049 | 1.101 | 1.001 | -2.454 | 1.934 |
| KAOPEN<--TradeFactor | -0.971 | 0.006 | 0.165 | 1.001 | -1.316 | -0.659 |
| GDP<--TradeFactor | -0.150 | 0.006 | 0.114 | 1.001 | -0.366 | 0.078 |

## Model 18 – (Europe and LATAM) Direct Influence of KAOPEN and Herding and Indirect Influence of GDP Through Trade and Influence of Trade Through KAOPEN on Integration

In Model 18 we test whether GDP acts through Trade, which in turn influences Capital Account Openness, to eventually then influence Integration for European and LATAM countries prior to 2007. This is the postulate of Hypothesis 3, namely that, institutional arrangements in the case of this study represented by Capital Account Openness, are the key influencer of market Integration and that the economic factors of Trade and GDP act on Integration through Capital Account Openness. The economic rationale for this estimated relationship is that economic growth will drive Trade between countries, which in turn will drive Capital Account Openness, which will then influence the Integration of markets.

$H^3_0$: Impact of KAOPEN, Herding directly on Integration
and GDP indirectly through Trade, and Trade through KAOPEN = 0

$H^3_1$: Impact of KAOPEN, Herding directly on Integration
and GDP indirectly through Trade, and Trade through KAOPEN ≠ 0

Figure 39 below illustrates the relationships being tested in Model 18.

Figure 39: GDP through Trade and Capital Account Openness

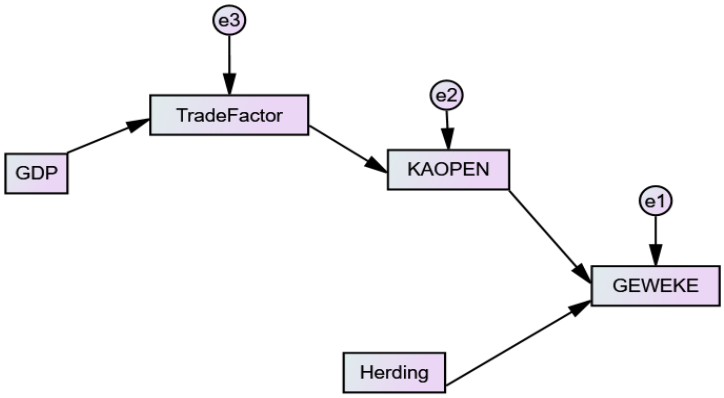



Table 63 below reports the results of the ML estimation. The results of this MLE indicate that Trade is significant in the model, but none of the other variables are. The direction of the relationship however is similar to the two preceding models, namely Models 16 and 17, in that Trade negatively affects Capital Account Openness. GDP in particular, does not significantly influence Trade. In this model, Capital Account Openness is not significant in its influence on Integration. The AIC score of this model is higher at 43.867, than that of Model 17, which was 43.245. Meaning that, this model is less informative than Model 17. Models 15, 16 and 17 have AIC scores that are relatively similar for when the structural break in the data is placed in 2007, indicating that the information content of these models does not vary significantly. We will discuss the implications of this finding later in this section.

Table 63: GDP through Trade and Capital Account Openness

| | | | Estimate | S.E. | C.R. | P |
|---|---|---|---|---|---|---|
| TradeFactor | <--- | GDP | -0,101 | 0,070 | -1,446 | 0,148 |
| KAOPEN | <--- | TradeFactor | -0,809 | 0,152 | -5,334 | *** |
| GEWEKE | <--- | KAOPEN | -0,605 | 0,753 | -0,803 | 0,422 |
| GEWEKE | <--- | Herding | -2,292 | 6,948 | -0,330 | 0,741 |

| Model | AIC |
|---|---|
| Default model | 43,867 |

*** indicates a p-value that is lower than 0.001

The Bayesian Estimation results support the results of the ML estimation. Again though, Herding is the variable that has the greatest variance between the two estimation approaches, but it still remains non-significant in the overall model.

Table 64: Bayesian Analysis of GDP through Trade and Capital Account Openness

| | Mean | S.E. | S.D. | C.S. | 95% Lower bound | 95% Upper bound |
|---|---|---|---|---|---|---|
| GEWEKE<--KAOPEN | -0,662 | 0,034 | 0,773 | 1,001 | -2,202 | 0,820 |
| GEWEKE<--Herding | -2,516 | 0,362 | 7,214 | 1,001 | -16,445 | 11,606 |
| KAOPEN<--TradeFactor | -0,822 | 0,008 | 0,150 | 1,001 | -1,122 | -0,525 |
| TradeFactor<--GDP | -0,100 | 0,004 | 0,071 | 1,001 | -0,240 | 0,041 |

*Analysis of the data with the break for LATAM countries being in 2006:* The results of the MLE for this model, with the break in 2006, are similar to the preceding three hypotheses. Where the results of the significant and non-significant variables are similar, with slightly different coefficients for the Trade variable, however the AIC score is lower for the analysis with the break in 2006. The 2006 break AIC score is 39.142 versus 43.867, for the break in 2007. This means that the model with the break in 2006 is more informative than the model with the break in 2007. When the model is tested with the break in 2006, the AIC score tells us that the model is much more informative than with the break in 2007.

Table 65: Structural Break in 2006 MLE

| | | | Estimate | S.E. | C.R. | P |
|---|---|---|---|---|---|---|
| TradeFactor | <--- | GDP | -0.100 | 0.070 | -1.438 | 0.150 |
| KAOPEN | <--- | TradeFactor | -0.970 | 0.157 | -6.162 | *** |
| GEWEKE | <--- | KAOPEN | 0.587 | 0.685 | 0.856 | 0.392 |
| GEWEKE | <--- | Herding | 0.700 | 4.168 | 0.168 | 0.867 |

| Model | AIC |
|---|---|
| Default model | 39.142 |

*** indicates a p-value that is lower than 0.001

The significance of the Trade variable with the structural break in 2006, is supported by the Bayesian analysis. All the other variables are similar to the estimation with the break in 2007.

Table 66: Structural Break in 2006 Bayesian

| | Mean | S.E. | S.D. | C.S. | 95% Lower bound | 95% Upper bound |
|---|---|---|---|---|---|---|
| GEWEKE<--KAOPEN | 0.637 | 0.026 | 0.715 | 1.001 | -0.774 | 2.027 |
| GEWEKE<--Herding | 0.633 | 0.205 | 4.372 | 1.001 | -7.923 | 9.094 |
| KAOPEN<--TradeFactor | -0.982 | 0.006 | 0.161 | 1.001 | -1.299 | -0.666 |
| TradeFactor<--GDP | -0.104 | 0.002 | 0.070 | 1.000 | -0.242 | 0.037 |

# Section C1: Results for European and Latin American Countries (2008-2012 Post Global Financial Crisis)

In the preceding section we considered the influence of Trade, Capital Account Openness, GDP and Herding on the Integration between European and LATAM countries and the US market prior to the Global Financial Crisis, through various models. In the following section we consider the same models, for the period following the Crises, that is to say from 2008 to 2012.

## Model 19 – (Europe and LATAM) Direct Influence of Capital Account Openness, GDP and Trade and Herding on Integration

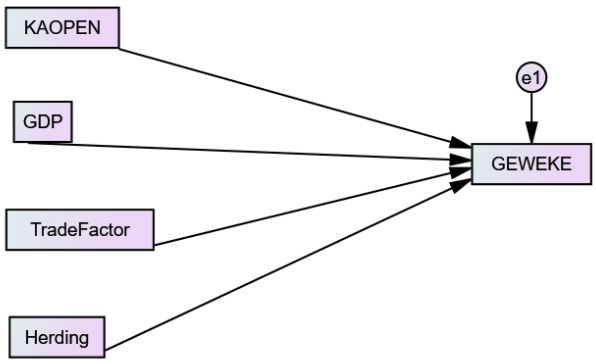
In Model 13 we tested whether Capital Account Openness, GDP, Trade and Herding affected Integration directly, as postulated in Hypothesis 1, prior to the 2007/8 Financial Crisis. In Model 19 we test Hypothesis 1, that is to say, whether these variables directly influenced the Integration of European and LATAM markets with the US market, post the Financial Crisis.

$H^1_0$: Impact of KAOPEN, GDP, Trade Factor and Herding, directly on Integration = 0

$H^1_1$: Impact of KAOPEN, GDP, Trade Factor and Herding directly on Integration ≠ 0

Figure 40 below illustrates the relationships being tested in Model 19.

Figure 40: Impact of Capital Account Openness, GDP, Trade and Herding on Integration




The MLE results of the Model 19 show that the Financial Crisis actually changed the significance of the macroeconomic variables with regards to Integration, from the period preceding the Crisis. Post the Crisis, Capital Account Openness and GDP became significant in influencing Integration of the European and LATAM markets with the US. This is in contrast to the period prior to the Crisis, where *none of these variables were significant* as shown in Model 13. When all the countries were considered together, post Crisis in Model 7, Trade and Capital Account Openness were significant and GDP was not.

Thus, separating the countries has enabled us to clearly see the impact of the Financial Crisis on which variables were significant in influencing Integration pre and post Crisis, for the European and LATAM country cluster. Trade, which was significant when all the countries were considered together and which was significant in almost all of the models considered for European and LATAM countries prior to the Crisis, is no longer significant in this post Crisis model. This may be as a result of the effect of the Crisis on global Trade, in that global Trade was stalled by the Crisis (Shelburne R.C., 2010; Čerović S. et al., 2014)

Table 67: ML Estimation of Impact of Capital Account Openness, Trade, GDP and Herding on Integration

| | | Estimate | S.E. | C.R. | P |
|---|---|---|---|---|---|
| GEWEKE | <--- KAOPEN | 3.766 | 0.934 | 4.034 | *** |
| GEWEKE | <--- Herding | -1.607 | 7.275 | -0.221 | 0.825 |
| GEWEKE | <--- GDP | -3.795 | 1.073 | -3.538 | *** |
| GEWEKE | <--- TradeFactor | 0.559 | 1.883 | 0.297 | 0.767 |

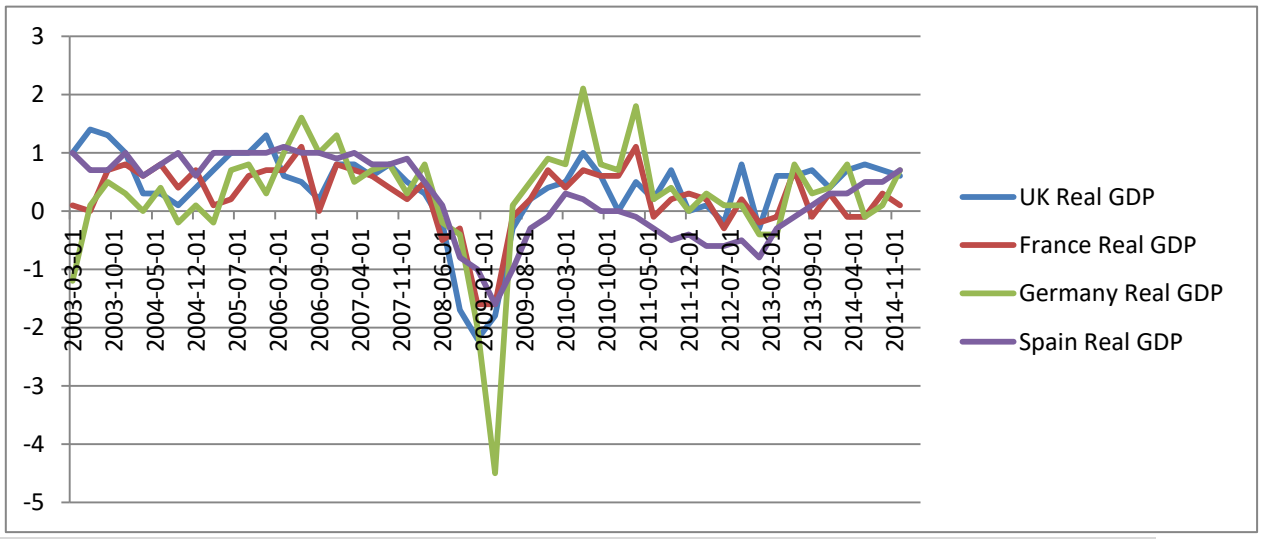
| Model | AIC |
|---|---|
| Default model | 41.844 |

*** indicates a p-value that is lower than 0.001

The AIC score of the model is lower than the scores of many of the models prior to the Crisis meaning that this model does indeed is carry more information about the relationship between the variables.

The Bayesian Estimation supports the findings of the ML estimation, thus confirming that the model is indeed capturing relevant relationships. Interestingly though, GDP has a negative effect on Integration for European and LATAM countries during this period. This would imply that as GDP of the country grows it becomes less integrated with the US and vice versa. Post the Crisis, the economic growth of many countries declined steeply and even went into recession as shown in Figure 41 below.

Figure 41: European Countries GDP 2003-2015



The negative relationship between GDP and Integration implies that as the European countries went into recession, Integration continued between the countries and the US, this implies that as economic growth in the European and LATAM markets slowed, they acted and behaved more in unison with the US market. One possible reason for this might be that the market participants in these markets began to take their cues from the US market as their own economies became less important in driving the market activity.

However this would imply that there were herding effects that were driving Integration, but the tests for Herding in these markets show that this was not the case. This indicates that as GDP growth slowed in European and LATAM countries, other factors became more important in influencing Integration, some of these factors may however not be captured in the model and are potential areas for future research.

Table 68: Bayesian Analysis of Impact of Heading, Capital Account Openness, Trade and GDP on Integration

| | **Mean** | **S.E.** | **S.D.** | **C.S.** | **95% Lower bound** | **95% Upper bound** |
|---|---|---|---|---|---|---|
| GEWEKE<--KAOPEN | 3.789 | 0.096 | 1.750 | 1.002 | 0.559 | 7.439 |
| GEWEKE<--Herding | -1.616 | 0.140 | 6.541 | 1.000 | -14.517 | 11.087 |
| GEWEKE<--GDP | -3.811 | 0.038 | 1.066 | 1.001 | -5.901 | -1.738 |
| GEWEKE<--TradeFactor | 0.524 | 0.090 | 2.057 | 1.001 | -3.490 | 4.533 |

*Analysis of the data with the break for LATAM countries being in 2006:* The results of the MLE analysis for the structural break occurring in 2006 are similar to the results for 2007 in terms of which variables are significant. The coefficients of the variables are slightly different. However, the AIC score of the 2006 model is slightly higher than the 2007 model with 42.647 as opposed to 41.844. However, because the structural break occurred in 2006, we will use the 2006 results.

Table 69: Structural Break in 2006 MLE

| | | **Estimate** | **S.E.** | **C.R.** | **P** |
|---|---|---|---|---|---|
| GEWEKE | <--- KAOPEN | 2.431 | 0.866 | 2.805 | 0.005 |
| GEWEKE | <--- Herding | -2.359 | 7.091 | -0.333 | 0.739 |
| GEWEKE | <--- GDP | -3.966 | 1.010 | -3.927 | *** |
| GEWEKE | <--- TradeFactor | 0.185 | 1.715 | 0.108 | 0.914 |

| **Model** | **AIC** |
|---|---|
| Default model | 42.647 |

*** indicates a p-value that is lower than 0.001

The Bayesian analysis only supports the significance of the GDP variable, although the coefficients of all of the variables are similar to the MLE analysis. Thus the significance of the other variables cannot be taken into consideration as it is not supported by the Bayesian analysis. It is likely that the MLE may be falling victim to the deficiencies in the data, which Bayesian analysis is able to overcome, as discussed in Chapter 4.

Table 70: Structural Break in 2006 Bayesian

| | Mean | S.E. | S.D. | C.S. | 95% Lower bound | 95% Upper bound |
|---|---|---|---|---|---|---|
| GEWEKE<--KAOPEN | 2.431 | 0.016 | 1.332 | 1.000 | -0.185 | 5.057 |
| GEWEKE<--Herding | -2.334 | 0.059 | 6.545 | 1.000 | -15.097 | 10.525 |
| GEWEKE<--GDP | -3.966 | 0.014 | 1.040 | 1.000 | -6.027 | -1.917 |
| GEWEKE<--TradeFactor | 0.171 | 0.021 | 1.795 | 1.000 | -3.375 | 3.679 |

## Model 20 – (Europe and LATAM) Direct Influence of Trade, Herding and KAOPEN and Indirect influence of GDP through KAOPEN on Integration

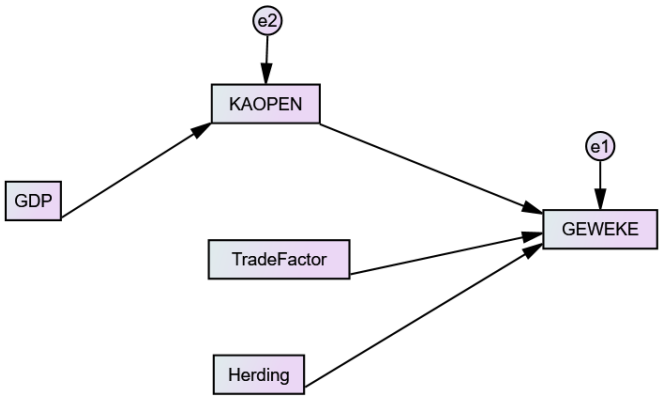
Model 19 above showed that GDP, when evaluated for its direct impact on Integration, was a significant contributor to the Integration of European and LATAM markets with the US market after 2007, even though the effect on Integration was not in the direction that one would anticipate. In Model 20 we test whether for European and LATAM countries, after the Crisis, GDP acts on Integration through Capital Openness as an intermediate variable.

$H^{2a}_0$: Impact of KAOPEN, Trade Factor, Herding directly on Integration and GDP indirectly through KAOPEN = 0

$H^{2a}_1$: Impact of KAOPEN, Trade Factor, Herding directly on Integration and GDP indirectly through KAOPEN ≠ 0

Figure 42 shows the relationships that Model 20 tests.

Figure 42: Influence of GDP on Capital Account Openness, Trade and Herding on Integration




The results of the MLE in Table 71 below show that GDP remains significant when considered with Capital Account Openness as an intermediate variable. Thus, GDP continues to affect Integration through Capital Account Openness after 2007, however the effect is no longer a negative one. None of the other variables are significant in the model. As noted earlier from Model 19, Trade ceased to be significant post the Crisis. It appears from this model that post

the Crisis, it becomes more important that countries have open capital accounts and their economic growth becomes a more significant in influencing Integration. This assertion is supported by both this model and Model 19.

Table 71: Maximum Likelihood Estimate of Impact of GDP on Capital Account Openness

| | | Estimate | S.E. | C.R. | P |
|---|---|---|---|---|---|
| KAOPEN | <--- GDP | 0.187 | 0.097 | 1.933 | 0.053 |
| GEWEKE | <--- KAOPEN | 2.226 | 0.984 | 2.263 | 0.024 |
| GEWEKE | <--- Herding | 1.361 | 7.667 | 0.178 | 0.859 |
| GEWEKE | <--- TradeFactor | 0.589 | 1.984 | 0.297 | 0.767 |

| Model | AIC |
|---|---|
| Default model | 50.425 |

The AIC score of this model is much higher than the model in Model 19, meaning that this model is less informative than the previous one.

The results of the Bayesian analysis support the coefficient estimates from the MLE. Thus the veracity of variables coefficients is supported by both modelling approaches. Although the Bayesian analysis only supports the significance of the influence of GDP on Capital Account Openness, but not the significance of the influence of Capital Account Openness on Integration.

Table 72: Bayesian Analysis of Impact of GDP on Capital Account Openness

| | Mean | S.E. | S.D. | C.S. | 95% Lower bound | 95% Upper bound |
|---|---|---|---|---|---|---|
| GEWEKE<--KAOPEN | 2.261 | 0.097 | 1.802 | 1.001 | -1.133 | 5.954 |
| GEWEKE<--Herding | 1.392 | 0.148 | 7.022 | 1.000 | -12.246 | 15.121 |
| GEWEKE<--TradeFactor | 0.585 | 0.083 | 2.173 | 1.001 | -3.728 | 4.825 |
| KAOPEN<--GDP | 0.187 | 0.003 | 0.097 | 1.000 | 0.004 | 0.380 |

*Analysis of the data with the break for LATAM countries being in 2006:* Taking the structural break for Model 20 in 2006 instead of 2007 changes the significance of the Capital Account Openness variable, in that it ceases to be significant in this model, only GDP remains significant. The coefficients change marginally for all the variables. However, the AIC score for the 2006 model is higher than the score for the 2007 model, with 2006 being 52.241 and 2007 being 50.425, meaning that the more informative model is the 2007 model, however we have to consider the more technically correct model, which is the 2006 model.

Table 73: Structural Break in 2006 MLE

| | Estimate | S.E. | C.R. | P |
|---|---|---|---|---|
| KAOPEN <--- GDP | 0.213 | 0.093 | 2.279 | 0.023 |
| GEWEKE <--- KAOPEN | 1.011 | 0.916 | 1.103 | 0.270 |
| GEWEKE <--- Herding | 0.610 | 7.504 | 0.081 | 0.935 |
| GEWEKE <--- TradeFactor | 0.416 | 1.814 | 0.229 | 0.819 |

| Model | AIC |
|---|---|
| Default model | 52.241 |

The Bayesian analysis, similar to the MLE only supports the significance of the GDP variable. The coefficients for all the variables are marginally different from the MLE results.

| | Mean | S.E. | S.D. | C.S. | 95% Lower bound | 95% Upper bound |
|---|---|---|---|---|---|---|
| GEWEKE<--KAOPEN | 0.954 | 0.075 | 1.358 | 1.002 | -1.745 | 3.602 |
| GEWEKE<--Herding | 0.851 | 0.207 | 6.868 | 1.000 | -12.759 | 14.222 |
| GEWEKE<--TradeFactor | 0.349 | 0.077 | 1.901 | 1.001 | -3.340 | 4.083 |
| KAOPEN<--GDP | 0.211 | 0.003 | 0.095 | 1.001 | 0.022 | 0.400 |

## Model 21- (Europe and LATAM) Direct influence of Trade, Herding and KAOPEN and Indirect Influence of GDP, through Trade on Integration

In Model 20 we established that GDP was significant when acting on Capital Account Openness as an intermediate variable, between GDP and Integration, but Capital Account Openness itself was not significant in its influence on Integration. Although the Model had a high AIC score, making its usefulness doubtful, given that other models have previously had lower scores. In Model 21 we test Hypothesis 2(b) for European and LATAM countries, post Crisis, that is to say whether GDP acts through Trade as intermediate variable instead of Capital Account Openness. The economic rationale for this model is that economic growth will drive more Trade.

Figure 43 illustrates the relationships being tested in this model.

$H^{2b}_0$: Impact of KAOPEN, Trade Factor, Herding directly on Integration and GDP indirectly through Trade = 0

$H^{2b}_1$: Impact of KAOPEN, Trade Factor, Herding directly on Integration and GDP indirectly through Trade ≠ 0

Figure 43: GDP through Trade

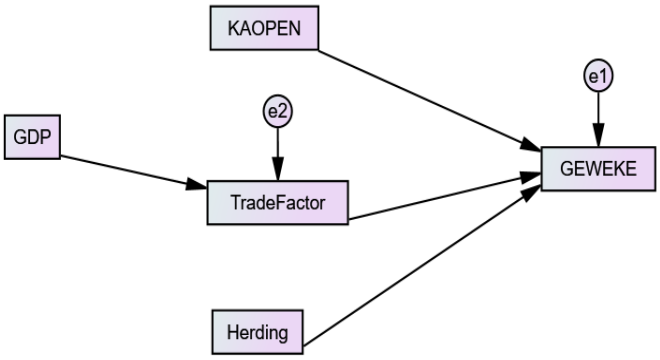



Table 74 below reports the results of the ML estimation of Model 21. The only significant variable in this model is Capital Account Openness that influences Integration directly. GDP ceases to be significant completely and its relationship with Trade becomes negative.

Table 74: Impact of GDP on Trade

| | | | Estimate | S.E. | C.R. | P |
|---|---|---|---|---|---|---|
| TradeFactor | <--- | GDP | -0.075 | 0.048 | -1.547 | 0.122 |
| GEWEKE | <--- | KAOPEN | 2.226 | 0.984 | 2.263 | 0.024 |
| GEWEKE | <--- | Herding | 1.361 | 7.667 | 0.178 | 0.859 |
| GEWEKE | <--- | TradeFactor | 0.589 | 1.984 | 0.297 | 0.767 |

| Model | AIC |
|---|---|
| Default model | 51.737 |

The AIC score of this model is higher than the AIC score for Model 19 or 20, meaning that this model is less informative than the previous two models and so should not be used in further analysis of the relationships between the variables. The Bayesian Estimation supports the findings of the ML estimation of the coefficients.

Table 75: Bayesian Estimation of GDP Impact on Trade

| | Mean | S.E. | S.D. | C.S. | 95% Lower bound | 95% Upper bound |
|---|---|---|---|---|---|---|
| GEWEKE<--KAOPEN | 2.282 | 0.043 | 1.773 | 1.000 | -1.170 | 5.820 |
| GEWEKE<--Herding | 1.364 | 0.113 | 6.980 | 1.000 | -12.250 | 15.030 |
| GEWEKE<--TradeFactor | 0.613 | 0.039 | 2.188 | 1.000 | -3.692 | 4.944 |
| TradeFactor<--GDP | -0.074 | 0.000 | 0.049 | 1.000 | -0.171 | 0.020 |

*Analysis of the data with the break for LATAM countries being in 2006:* The MLE results of moving the structural break from 2007 to 2006 changes the significance of the GDP variable, the

variable becomes non-significant, along with all the other variables in the model. However, the AIC score of the 2006 model is higher than the 2007 model, even though technically we have to use the results from the 2006 model, it is less informative than the 2007 model.

Table 76: Structural Break in 2006 MLE

| | | | Estimate | S.E. | C.R. | P |
|---|---|---|---|---|---|---|
| TradeFactor | <--- | GDP | -0.081 | 0.047 | -1.707 | 0.088 |
| GEWEKE | <--- | KAOPEN | 1.011 | 0.916 | 1.103 | 0.270 |
| GEWEKE | <--- | Herding | 0.610 | 7.504 | 0.081 | 0.935 |
| GEWEKE | <--- | TradeFactor | 0.416 | 1.814 | 0.229 | 0.819 |

| Model | AIC |
|---|---|
| Default model | 54.461 |

Table 77: Structural Break in 2006 Bayesian

| | Mean | S.E. | S.D. | C.S. | 95% Lower bound | 95% Upper bound |
|---|---|---|---|---|---|---|
| GEWEKE<--KAOPEN | 1.023 | 0.059 | 1.374 | 1.001 | -1.686 | 3.704 |
| GEWEKE<--Herding | 0.402 | 0.136 | 6.890 | 1.000 | -13.173 | 13.711 |
| GEWEKE<--TradeFactor | 0.457 | 0.059 | 1.904 | 1.000 | -3.197 | 4.190 |
| TradeFactor<--GDP | -0.081 | 0.001 | 0.051 | 1.000 | -0.179 | 0.018 |

## Model 22 - (Europe and LATAM) Direct Influence of KAOPEN and Herding and Indirect Influence of GDP and Trade, through KAOPEN on Integration

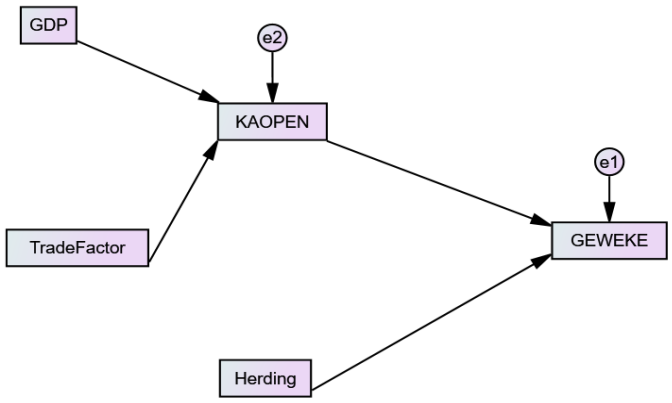
From the preceding models, we have established that post 2007, Trade is not significant for European and LATAM markets' Integration to the US, but that GDP is. In Model 22 we test whether Trade acts on integration through an intermediate variable for the European and LATAM countries post the Financial Crisis, i.e. did Trade act through Capital Account Openness as an intermediate variable as postulated in hypothesis 2(b).

$H^{2(c)}_0$: Impact of KAOPEN, Herding, GDP directly on Integration and Trade indirectly through KAOPEN = 0

$H^{2(c)}_1$: Impact of KAOPEN, Herding, GDP directly on Integration and Trade indirectly through KAOPEN ≠ 0

Figure 44 below illustrates the relationships being tested in Model 22.

Figure 44: Does Trade act through Capital Account Openness




The results of the ML estimation of this model, provided in Table 78 below, show that indeed Trade becomes significant when it acts through a Capital Account Openness as an intermediate variable, for European and LATAM countries post the Financial Crisis. GDP however ceased being significant in its influence on Integration. Capital Account Openness continues to be significant in its impact on Integration. The other variables are not significant. However the relationship between Trade and Capital Account Openness is an inverse one, i.e. higher trade leads to less Capital Account Openness.

Table 78: Maximum Likelihood Impact of Trade on Capital Account Openness

| | | | Estimate | S.E. | C.R. | P |
|---|---|---|---|---|---|---|
| KAOPEN | <--- | TradeFactor | -0.360 | 0.167 | -2.150 | 0.032 |
| KAOPEN | <--- | GDP | 0.160 | 0.095 | 1.683 | 0.092 |
| GEWEKE | <--- | KAOPEN | 2.010 | 0.987 | 2.036 | 0.042 |
| GEWEKE | <--- | Herding | 1.349 | 7.669 | 0.176 | 0.860 |

| Model | AIC |
|---|---|
| Default model | 46.037 |

This model's AIC score is lower than the scores of the preceding two models, meaning that this model is much more informative about the relationship between the variables. It appears that Trade did affect Capital Account Openness in Europe and LATAM counties, post the Crisis, and the Capital Account Openness in turn affected Integration. The effect of Trade on Capital Account Openness was however a negative one. This model is however, not as informative as Model 19, which tested Hypothesis 1, where the variables act directly on Integration. Model 19's AIC score was 41.844.

The Bayesian Estimation shown in Table 79, supports the coefficients found from the MLE, none of the variables' coefficients are vastly different, nor do they change in significance when estimated using Bayesian Estimation.

Table 79: Bayesian Estimation of Impact of Trade on Capital Account Openness

| | Mean | S.E. | S.D. | C.S. | 95% Lower bound | 95% Upper bound |
|---|---|---|---|---|---|---|
| GEWEKE<--KAOPEN | 2.008 | 0.096 | 1.558 | 1.002 | -1.078 | 5.029 |
| GEWEKE<--Herding | 1.438 | 0.223 | 6.897 | 1.001 | -12.224 | 14.992 |
| KAOPEN<--TradeFactor | -0.359 | 0.004 | 0.166 | 1.000 | -0.681 | -0.028 |
| KAOPEN<--GDP | 0.163 | 0.003 | 0.098 | 1.000 | -0.028 | 0.355 |

*Analysis of the data with the break for LATAM countries being in 2006:* The results of the ML estimation for the structural break in 2006, change the significance of both the GDP and Trade variables in that GDP becomes significant and Trade becomes non-significant. This accords more with what was actually experienced in the real world in that Trade collapsed and as such could not be a driver for Integration. The other variables remain as they were in the 2007 estimation. The AIC score of this model is less informative than the 2007 model, however we will consider the results from the 2006 model as this is the technically correct model. The AIC score of this model with the structural break in 2006, is higher than the AIC of the model with the break in 2007.

Table 80: Structural Break in 2006 MLE

| | | Estimate | S.E. | C.R. | P |
|---|---|---|---|---|---|
| KAOPEN | <--- GDP | 0.189 | 0.092 | 2.050 | 0.040 |
| KAOPEN | <--- TradeFactor | -0.290 | 0.157 | -1.849 | 0.064 |
| GEWEKE | <--- KAOPEN | 0.906 | 0.920 | 0.985 | 0.325 |
| GEWEKE | <--- Herding | 0.614 | 7.506 | 0.082 | 0.935 |

| Model | AIC |
|---|---|
| Default model | 48.977 |

The MLE results are supported by the Bayesian Estimation for the 2006 structural break period in that GDP remains the only significant variable of all of the variables in the model.

Table 81: Structural Break in 2006 Bayesian

| | Mean | S.E. | S.D. | C.S. | 95% Lower bound | 95% Upper bound |
|---|---|---|---|---|---|---|
| GEWEKE<--KAOPEN | 0.814 | 0.068 | 1.272 | 1.001 | -1.574 | 3.408 |
| GEWEKE<--Herding | 0.417 | 0.169 | 6.838 | 1.000 | -12.786 | 13.978 |
| KAOPEN<--GDP | 0.195 | 0.003 | 0.095 | 1.001 | 0.010 | 0.383 |
| KAOPEN<--TradeFactor | -0.287 | 0.006 | 0.162 | 1.001 | -0.607 | 0.027 |

## Model 23: (Europe and LATAM) Direct Influence of GDP, KAOPEN and Herding and Indirect Influence of Trade, through GDP and KAOPEN on Integration

In Model 23 we test whether Trade affects Integration through GDP and Capital Account Openness? Figure 45 below illustrates the relationship being investigated in Model 23. The economic rationale of this relationship between Trade and Integration is outlined in Model 5, namely that greater Trade may drive economic growth which might in turn affect market Integration between the trading counties.

$H^{2(d)}_0$: Impact of KAOPEN, Herding, GDP directly on Integration and Trade indirectly through KAOPEN and GDP = 0

$H^{2(d)}_1$: Impact of KAOPEN, Herding, GDP directly on Integration and Trade indirectly through KAOPEN and GDP ≠ 0

Figure 45: Trade through GDP or Capital Account Openness

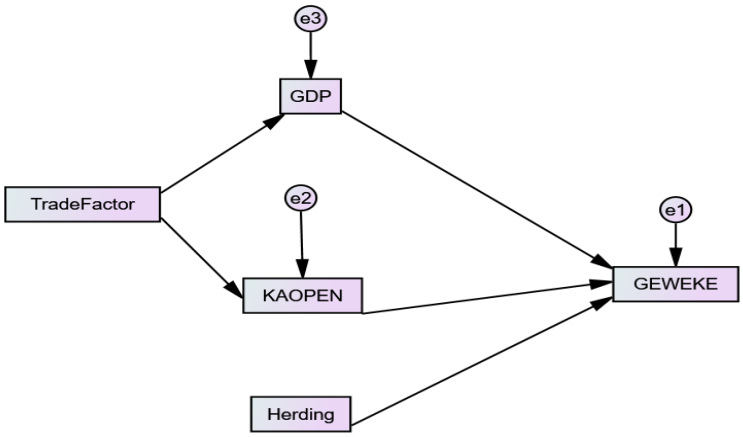



Table 82 below shows the results of the ML estimation of the model. The results show that Trade is significant in its influence of Capital Account Openness, which in turn is significant at a 99% level, in influencing Integration. GDP is also significant in its direct influence on integration. GDP however is not significantly influenced by Trade in this model and GDP also has a negative relationship with Integration meaning that as GDP grows, Integration weakens. The model also shows that Trade acts on Integration through Capital Account Openness, which is significant in this model.

Table 82: Impact of Trade on GDP and Capital Account Openness

| | | | Estimate | S.E. | C.R. | P |
|---|---|---|---|---|---|---|
| KAOPEN | <--- | TradeFactor | -0.396 | 0.169 | -2.347 | 0.019 |
| GDP | <--- | TradeFactor | -0.230 | 0.149 | -1.547 | 0.122 |
| GEWEKE | <--- | KAOPEN | 3.562 | 0.934 | 3.812 | *** |
| GEWEKE | <--- | Herding | -1.622 | 7.277 | -0.223 | 0.824 |
| GEWEKE | <--- | GDP | -3.796 | 1.073 | -3.537 | *** |

| Model | AIC |
|---|---|
| Default model | 36.151 |

*** indicates a p-value that is lower than 0.001

The AIC score for this model is the lowest of the models considered for the European and LATAM countries after 2007. This indicates that the model is very much more informative than the previous models of the relationship between the variables and Integration for European and LATAM countries and the US.

The results of the Bayesian analysis support the findings of the ML estimation. Since the Bayesian Estimation works even with data that is not normally distributed or where the sample size are small, we can be certain that the results from this model are not biased by these limiting factors.

Table 83: Bayesian Estimation of the Impact of Trade on GDP and Capital Account Openness

| | Mean | S.E. | S.D. | C.S. | 95% Lower bound | 95% Upper bound |
|---|---|---|---|---|---|---|
| GEWEKE<--KAOPEN | 3.640 | 0.069 | 1.477 | 1.001 | 0.776 | 6.514 |
| GEWEKE<--Herding | -1.767 | 0.120 | 6.473 | 1.000 | -14.264 | 10.996 |
| KAOPEN<--TradeFactor | -0.396 | 0.005 | 0.174 | 1.000 | -0.735 | -0.052 |
| GEWEKE<--GDP | -3.795 | 0.026 | 1.093 | 1.000 | -5.955 | -1.633 |
| GDP<--TradeFactor | -0.233 | 0.004 | 0.153 | 1.000 | -0.535 | 0.069 |

*Analysis of the data with the break for LATAM countries being in 2006:* The 2006 MLE model results are similar to the 2007 MLE model results in terms of which variables are significant, i.e. Trade in its influence of Capital Account Openness, Capital Account Openness on Integration and GDP's influence on Integration. The other variables are not significant in the models with structural breaks in either 2006 or 2007. The AIC score for the 2006 model is slightly higher than the 2007 model, with the 2006 at 37.414 and the 2007 model at 36.151. The interpretation of the coefficients does not change between the two periods' models, GDP still contributes negatively to Integration and Capital Account Openness contributes positively to integration.

Table 84: Structural Break in 2006 MLE

| | | | Estimate | S.E. | C.R. | P |
|---|---|---|---|---|---|---|
| KAOPEN | <--- | TradeFactor | -0,334 | 0,159 | -2,102 | 0,036 |
| GDP | <--- | TradeFactor | -0,234 | 0,137 | -1,707 | 0,088 |
| GEWEKE | <--- | KAOPEN | 2,386 | 0,867 | 2,752 | 0,006 |
| GEWEKE | <--- | Herding | -2,361 | 7,091 | -0,333 | 0,739 |
| GEWEKE | <--- | GDP | -3,970 | 1,010 | -3,929 | *** |

| Model | AIC |
|---|---|
| Default model | 37,414 |

*** indicates a p-value that is lower than 0.001

The Bayesian Estimation results support the findings of the MLE in terms of the significance of the variables.

Table 85: Structural Break in 2006 Bayesian

| | Mean | S.E. | S.D. | C.S. | 95% Lower bound | 95% Upper bound |
|---|---|---|---|---|---|---|
| GEWEKE<--KAOPEN | 2,499 | 0,055 | 1,211 | 1,001 | 0,093 | 4,831 |
| GEWEKE<--Herding | -2,444 | 0,236 | 6,669 | 1,001 | -15,291 | 10,644 |
| KAOPEN<--TradeFactor | -0,334 | 0,005 | 0,160 | 1,001 | -0,648 | -0,018 |
| GEWEKE<--GDP | -3,998 | 0,040 | 1,023 | 1,001 | -6,022 | -1,980 |
| GDP<--TradeFactor | -0,235 | 0,004 | 0,142 | 1,000 | -0,510 | 0,040 |

## Model 24 – (Europe and LATAM) Direct Influence of KAOPEN and Herding and Indirect Influence of GDP, through Trade and Influence of Trade Through KAOPEN on Integration

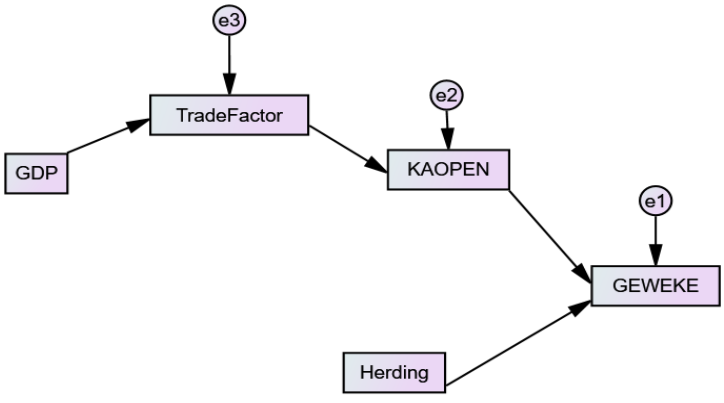
Model 24, is similar to Model 18 in the period preceding 2007, in that both models test Hypothesis 3. In Model 24 we test whether GDP acts through Trade, which in turn may act through Capital Account Openness to influence Integration, post the 2007.

$H^3_0$: Impact of KAOPEN, Herding directly on Integration
and GDP indirectly through Trade, and Trade through KAOPEN = 0

$H^3_1$: Impact of KAOPEN, Herding directly on Integration
and GDP indirectly through Trade, and Trade through KAOPEN ≠ 0

Figure 46 below illustrates the relationships being tested in this model.

Figure 46: GDP through Trade and Capital Account Openness




The results of the MLE are shown in Table 86. They show that none of the variables are significant except for Capital Account Openness and Trade and their direct impact on Integration.

Table 86: GDP through Trade and Capital Account Openness

| | | | Estimate | S.E. | C.R. | P |
|---|---|---|---|---|---|---|
| TradeFactor | <--- | GDP | -0.075 | 0.048 | -1.547 | 0.122 |
| KAOPEN | <--- | TradeFactor | -0.396 | 0.169 | -2.347 | 0.019 |
| GEWEKE | <--- | KAOPEN | 2.010 | 0.984 | 2.043 | 0.041 |
| GEWEKE | <--- | Herding | 1.349 | 7.669 | 0.176 | 0.860 |

| Model | AIC |
|---|---|
| Default model | 46.418 |

The AIC score of this model is higher than for Model 23, which means that this model is less informative than the previous model and the difference in the scores is not a marginal one.

The results of the MLE coefficients are not supported by the Bayesian Estimation. For example, there is a 1.63 point difference for the KAOPEN coefficient for the MLE versus the Bayesian Estimation. There is a 0.400 point difference in the Herding coefficient and the sign changes in the Bayesian Estimation. However, the direction of the significance for Capital Account Openness and Trade are supported by the Bayesian Estimation. Thus, the findings regarding the coefficients from the ML estimation cannot be relied upon, but the significance of the given variables is supported by the Bayesian analysis.

Table 87: Bayesian Analysis of GDP through Trade and Capital Account Openness

| | Mean | S.E. | S.D. | C.S. | 95% Lower bound | 95% Upper bound |
|---|---|---|---|---|---|---|
| GEWEKE<--KAOPEN | 3.640 | 0.069 | 1.477 | 1.001 | 0.776 | 6.514 |
| GEWEKE<--Herding | -1.767 | 0.120 | 6.473 | 1.000 | -14.264 | 10.996 |
| KAOPEN<--TradeFactor | -0.396 | 0.005 | 0.174 | 1.000 | -0.735 | -0.052 |
| GEWEKE<--GDP | -3.795 | 0.026 | 1.093 | 1.000 | -5.955 | -1.633 |
| GDP<--TradeFactor | -0.233 | 0.004 | 0.153 | 1.000 | -0.535 | 0.069 |

*Analysis of the data with the break for LATAM countries being in 2006:* The results of the 2006 structural break MLE model differ from the 2007 model in that Capital Account Openness ceases to be significant, Trade however remains significant, the other variables remain non-significant. However, the AIC score for the 2006 model is higher than the score for the 2007 model.

Table 88: Structural Break in 2006 MLE

| | | | Estimate | S.E. | C.R. | P |
|---|---|---|---|---|---|---|
| TradeFactor | <--- | GDP | -0.081 | 0.047 | -1.707 | 0.088 |
| KAOPEN | <--- | TradeFactor | -0.334 | 0.159 | -2.102 | 0.036 |
| GEWEKE | <--- | KAOPEN | 0.906 | 0.917 | 0.988 | 0.323 |
| GEWEKE | <--- | Herding | 0.614 | 7.506 | 0.082 | 0.935 |

| Model | AIC |
|---|---|
| Default model | 50.156 |

The Bayesian Estimation supports the results of ML estimation with regards to the significance of the variables.

Table 89: Structural Break in 2006 Bayesian

| | Mean | S.E. | S.D. | C.S. | 95% Lower bound | 95% Upper bound |
|---|---|---|---|---|---|---|
| GEWEKE<--KAOPEN | 0.860 | 0.047 | 1.245 | 1.001 | -1.585 | 3.297 |
| GEWEKE<--Herding | 1.115 | 0.200 | 6.803 | 1.000 | -12.060 | 14.477 |
| KAOPEN<--TradeFactor | -0.341 | 0.006 | 0.160 | 1.001 | -0.652 | -0.026 |
| TradeFactor<--GDP | -0.082 | 0.002 | 0.048 | 1.001 | -0.178 | 0.011 |

# Section C2: Results for African and Asian Countries (2003-2012)

### Integration of African and Asian Countries to US Markets between 2003 and 2012

In this final section of the results report, the Integration of African and Asian countries with the US market for the period 2003 to 2012, is considered. This section looks at this grouping of Asian and African countries together because the analysis of the structural breaks in the data, showed that this grouping of countries exhibited no effects from the Crisis, in that there was no structural break in the data for African and Asian countries, for the entire period.

The same hypotheses are tested for African and Asian markets, as were tested in the preceding sections where all the countries were tested together and where the European and LATAM countries were tested as a grouping. The hypotheses are given below with each of the models in which the respective hypothesis is tested.

| Model | Hypothesis | Relationship being Tested |
|---|---|---|
| 27 | 1 | Direct impact of all the variables on Integration |
| 28 | 2(a) | Indirect impact of GDP, acting through Capital Account Openness |
| 29 | 2(b) | Indirect impact of GDP, acting through Trade |
| 20 | 2(c) | Indirect impact of Trade, acting through Capital Account Openness |
| 31 | 2(d) | Indirect impact of Trade, acting through GDP and Capital Account Openness |
| 32 | 3 | Direct impact of Capital Account Openness with GDP and Trade being indirect and acting through Capital Account Openness |
| 33 | 5 | Direct and indirect impact of Trade |

## Model 25 – (Africa and Asia) Direct Influence of Capital Account Openness, GDP and Trade and Herding on Integration

In Model 25 we test whether Capital Openness, GDP, Trade and Herding directly influence Integration of African and Asian countries with the US market for the period 2003-2012. This is similar to the test in Model 1 and Model 7, where all the countries were tested together and Model 13 and Model 19 where only European and Latin American markets were tested. In the pre and post Crisis tests of European and LATAM markets, we also tested for the role of Herding and found that it was not significant in influencing Integration, we have also included the Herding variable in the regressions that follow, so as to be able to juxtapose it against the results of the European and Latin American markets, as well as when all countries when considered together.

$H^1_0$: Impact of KAOPEN, GDP, Trade Factor and Herding, directly on Integration = 0

$H^1_1$: Impact of KAOPEN, GDP, Trade Factor and Herding directly on Integration ≠ 0

Figure 47 below depicts the relationships that Model 25 is attempting to capture.

Figure 47: Impact of Capital Account Openness, GDP, Trade and Herding on African and Asian Countries

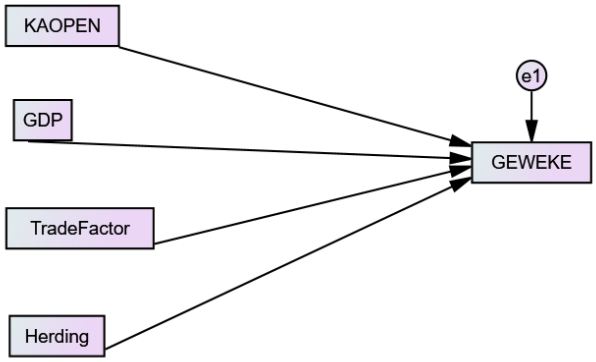



Table 90 below reports the results of the Maximum Likelihood Estimation for the model and shows that only Trade and Herding are significant in their influence on Integration. This result is different from what was found for Model 1 and Model 7, where all the countries were considered together and Models 13 and 19, where the European and LATAM markets were considered. In all these preceding cases, Herding was not found to be significant, the situation is very different for the African and Asian countries. Also interesting with these countries, is that increases in Capital Account Openness, reduces Integration, this is captured in the negative coefficient for Capital Account Openness. This means that the more open a country's capital account is, the less integrated it is likely to be with the US market. This is contrary to what theory leads one to expect (Black, 1974; Stulz, 1981; Heitala, 1989; Domowitz et al., 1997).

This finding may in fact line with the findings of authors such as Chuhan (1994), Kaminsky and Schmukler (2001) and Phylaktis and Ravazzolo (2002), who found that formal barriers do not

necessarily cause markets to become segmented as investors find ways around the controls, if the investment returns that can be earned are attractive enough. The model results also indicate that more Trade, will likely lead to less Integration, which is also in contrast to what theory leads one to expect (Chen and Zhang, 1997; Bracker et al., 1999; Choe, 2001; Chambert and Gibson, 2008). However, there are other authors who found that Trade and other economic variables did not impact Integration (Canova and DeNicole, 1995 and Schmitt-Grohe, 1998). Although this model finds that the relationship is between Trade and Integration is a negative one for African and Asian countries for the period under review. This is in fact a new and unexpected finding.

Table 90: Non-European Capital Account Openness Test

| | | Estimate | S.E. | C.R. | P |
|---|---|---|---|---|---|
| GEWEKE <--- | KAOPEN | -0.303 | 0.205 | -1.475 | 0.140 |
| GEWEKE <--- | GDP | 0.023 | 0.118 | 0.192 | 0.848 |
| GEWEKE <--- | TradeFactor | -8.047 | 3.534 | -2.277 | 0.023 |
| GEWEKE <--- | Herding | 10.090 | 5.053 | 1.997 | 0.046 |

| Model | AIC |
|---|---|
| Default model | 49.537 |

The AIC score for this model is however relatively high, meaning that the model is not as informative as for example, all but two of the models in the preceding section, where European and LATAM countries were considered.

The results of the Maximum Likelihood estimate are supported by the Bayesian analysis results shown in Table 91, except for the Herding variable, which the Bayesian analysis show a variance of over 0,300 points in the Herding coefficient. For the other variables, the variance between the ML estimates and the Bayesian Estimates is not very wide. Interestingly, Herding is not significant under the Bayesian estimation. This means that the significance that we find for Herding under MLE may be as a result of MLE not being able effectively deal with the small sample size and the non-normality of the data, thus making the finding of significance for Herding under MLE, suspect.

Table 91: Bayesian Analysis of Capital Account Openness Significance

| | Mean | S.E. | S.D. | C.S. | 95% Lower bound | 95% Upper bound |
|---|---|---|---|---|---|---|
| GEWEKE<--KAOPEN | -0.292 | 0.005 | 0.225 | 1.000 | -0.732 | 0.153 |
| GEWEKE<--GDP | 0.020 | 0.004 | 0.107 | 1.001 | -0.187 | 0.237 |
| GEWEKE<--TradeFactor | -8.124 | 0.109 | 3.699 | 1.000 | -15.193 | -0.754 |
| GEWEKE<--Herding | 10.432 | 0.273 | 6.575 | 1.001 | -2.936 | 22.733 |

## Model 26 – Direct Influence of Trade, Herding and KAOPEN and Indirect influence of GDP through KAOPEN on Integration

The results of Model 2 and 8, where Hypothesis 2(a) was being tested for all the countries together, show that GDP did not directly significantly influence stock market Integration, but rather acted indirectly through Capital Account Openness. In Model 26 we test whether this is also the case when we look only at African and Asian markets.

$H^{2a}_0$: Impact of KAOPEN, Trade Factor, Herding directly on Integration and GDP indirectly through KAOPEN = 0

$H^{2a}_1$: Impact of KAOPEN, Trade Factor, Herding directly on Integration and GDP indirectly through KAOPEN ≠ 0

Figure 48 shows the relationships that model 26 is trying to capture.

Figure 48: Impact of GDP through Capital Account Openness for African and Asian countries

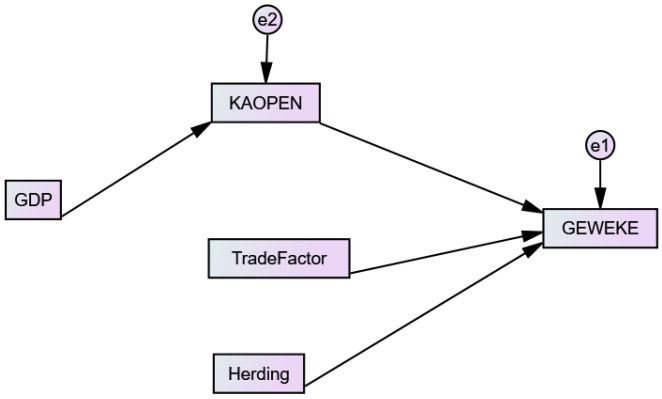



Table 92 below, shows the results of the MLE. Similar to the findings of the analyses for the European and LATAM markets, we find that GDP's influence on Capital Account Openness is significant and Trade is still significant. But what is different from the findings for these countries is that for African and Asian countries, Capital Account Openness is not significant in influencing Integration for the period under review. The direction of the relationship between Trade and integration is also negative for this model, which is similar to the preceding model. Herding is found to be significant for the African and Asian markets under ML estimation.

Table 92: GDP Impact on integration

| | | Estimate | S.E. | C.R. | P | Label |
|---|---|---|---|---|---|---|
| KAOPEN <--- | GDP | .135 | .037 | 3.684 | *** | |
| GEWEKE <--- | KAOPEN | -.292 | .205 | -1.424 | .155 | |
| GEWEKE <--- | TradeFactor | -7.982 | 3.534 | -2.259 | .024 | |
| GEWEKE <--- | Herding | 10.211 | 5.051 | 2.022 | .043 | |

| Model | AIC |
|---|---|
| Default model | 36.002 |

*** indicates a p-value that is lower than 0.001

The AIC score for this model is lower than for Model 25, which is 49.537, indicating that the current model is more informative than Model 25. The results of the Bayesian analysis support the findings of the MLE, except for the Herding variable. There is a 0.400 point variance in the Herding coefficient from the two estimation approaches and Herding is not significant under Bayesian Estimation. This means that the coefficient and the significance level for the Herding variable in the MLE model cannot be relied upon.

Table 93: Bayesian Analysis of GDP through Capital Account Openness

| | Mean | S.E. | S.D. | C.S. | 95% Lower bound | 95% Upper bound |
|---|---|---|---|---|---|---|
| GEWEKE<--KAOPEN | -0.288 | 0.009 | 0.211 | 1.001 | -0.706 | 0.129 |
| GEWEKE<--TradeFactor | -7.958 | 0.152 | 3.702 | 1.001 | -15.120 | -0.722 |
| GEWEKE<--Herding | 9.823 | 0.272 | 6.490 | 1.001 | -2.570 | 22.608 |
| KAOPEN<--GDP | 0.134 | 0.001 | 0.035 | 1.001 | 0.063 | 0.201 |

## Model 27- Direct influence of Trade, Herding and KAOPEN and Indirect Influence of GDP, through Trade on Integration

We have established in Models 1, 7, 13 and 19 above that GDP does not influence Integration directly. We found that GDP acts through mediating variables as was seen in Models 2, 8 and 26 above, where the influence of GDP on Capital Account Openness was significant. In Model 27 we test whether GDP works through Trade to influence Integration for African and Asian countries.

$H^{2b}_0$: Impact of KAOPEN, Trade Factor, Herding directly on Integration and GDP indirectly through Trade = 0

$H^{2b}_1$: Impact of KAOPEN, Trade Factor, Herding directly on Integration and GDP indirectly through Trade ≠ 0

Figure 49 below illustrates the relationships tested in Model 27

Figure 49: GDP through Trade

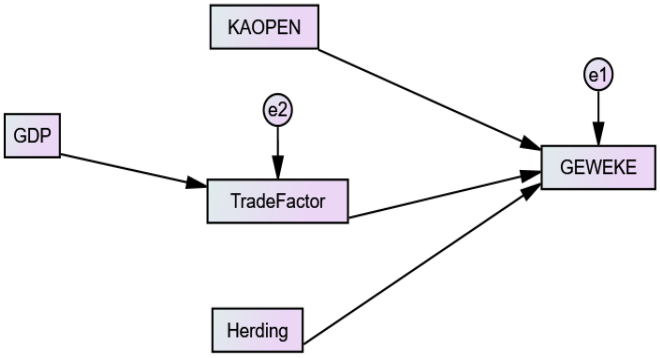



Table 94 below, shows that GDP does not act through Trade to influence Integration. Capital Account Openness is still not significant in this model, but Herding and Trade remain significant in their influence on Integration and the direction of the influence of Trade remains negative, as it was in the preceding two models.

Table 94: GDP Acting Through Trade for African and Asian Countries

| | | | Estimate | S.E. | C.R. | P | Label |
|---|---|---|---|---|---|---|---|
| TradeFactor | <--- | GDP | 0.004 | 0.002 | 1.658 | 0.097 | |
| GEWEKE | <--- | KAOPEN | -0.292 | 0.205 | -1.424 | 0.155 | |
| GEWEKE | <--- | TradeFactor | -7.982 | 3.534 | -2.259 | 0.024 | |
| GEWEKE | <--- | Herding | 10.211 | 5.051 | 2.022 | 0.043 | |

| Model | AIC |
|---|---|
| Default model | 48.333 |

The AIC score for this model is more than the model for Model 25, which is 36.002, but it is lower than for Model 26, which is 49.537, meaning that the model is more informative than Model 26, but less informative than Model 25. Table 95 below shows that the Bayesian analysis supports the results of the ML estimation for coefficients of all the variables, but only the significance of the Trade variable is supported and not the Herding variable.

Table 95: Bayesian Analysis of GDP on Trade

| | Mean | S.E. | S.D. | C.S. | 95% Lower bound | 95% Upper bound |
|---|---|---|---|---|---|---|
| GEWEKE<--KAOPEN | -0,286 | 0,008 | 0,212 | 1,001 | -0,706 | 0,141 |
| GEWEKE<--TradeFactor | -7,910 | 0,117 | 3,627 | 1,001 | -15,057 | -0,488 |
| GEWEKE<--Herding | 9,948 | 0,251 | 6,488 | 1,001 | -3,032 | 22,252 |
| TradeFactor<--GDP | 0,003 | 0,000 | 0,003 | 1,001 | -0,003 | 0,009 |

## Model 28 - Direct Influence of KAOPEN and Herding and Indirect Influence of GDP and Trade, through KAOPEN on Integration

It was previously established that GDP acted on Integration through Capital Account Openness before and after 2007/8 when all countries were considered together and when European and Latin American countries were considered separately. Model 26 established that this is also true for African and Asian countries for the period under review. Model 28 combines this relationship and tests whether Trade also acts indirectly through Capital Account Openness for African and Asian countries?

$H^{2(c)}_0$: Impact of KAOPEN, Herding, GDP directly on Integration and Trade indirectly through KAOPEN = 0

$H^{2(c)}_1$: Impact of KAOPEN, Herding, GDP directly on Integration and Trade indirectly through KAOPEN ≠ 0

Figure 50 below illustrates the relationships being tested in model 28.

Figure 50: GDP and Trade through Capital Account Openness

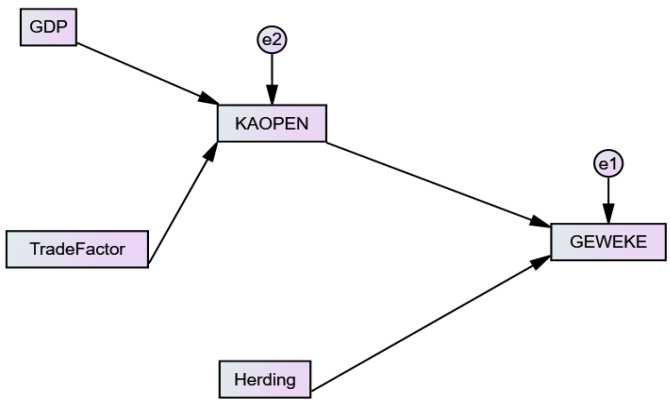



Table 96 shows that Trade has a significant influence on Capital Account Openness and GDP also remains significant, although Capital Account Openness itself is not significant in influencing Integration. Herding remains significant in its influence on Integration. This model also finds a counter intuitive result in the relationship between Trade and Capital Account Openness. This relationship is negative, whereas the literature leads us to expect the relationship to be positive (Stulz, 1981; Bonser-Neal et al., 1990; Domowitz et al. 1997; Kaminsky and Schmukler, 2001; Phylaktis and Ravazzolo, 2002; Nishiotis, 2004; Berkel, 2004; Phylaktis and Ravazzolo, 2002; Forbes and Chinn, 2004; Chambet and Gibson, 2008). The model leads one to expect that more Trade will lead to lower Capital Account Openness for Asian and African countries. A similar result was found for the European and Latin American countries after the Financial Crisis. For African and Asian countries, this relationship was constant over the period and not Crisis dependent.

Table 96: Trade through Capital Account Openness for African and Asian Countries

| | | | Estimate | S.E. | C.R. | P | Label |
|---|---|---|---|---|---|---|---|
| KAOPEN | <--- | GDP | 0.135 | 0.036 | 3.737 | *** | |
| KAOPEN | <--- | TradeFactor | -2.787 | 1.118 | -2.493 | 0.013 | |
| GEWEKE | <--- | KAOPEN | -0.220 | 0.207 | -1.063 | 0.288 | |
| GEWEKE | <--- | Herding | 10.217 | 5.109 | 2.000 | 0.046 | |

| Model | AIC |
|---|---|
| Default model | 34.991 |

*** indicates a p-value that is lower than 0.001

The AIC score of this model indicates that this model is more informative than the preceding models. The Bayesian Estimation supports the findings of MLE for the model.

The Bayesian Estimation of the model shown in Table 97 supports all of the coefficients found in the MLE except for the Herding coefficient. There is a variance of over 0.140 points between the two estimation methods. This means that the coefficient from the MLE approach cannot be relied upon.

Table 97: Bayesian Analysis of Trade through Capital Account Openness

| | Mean | S.E. | S.D. | C.S. | 95% Lower bound | 95% Upper bound |
|---|---|---|---|---|---|---|
| GEWEKE<--KAOPEN | -0.223 | 0.006 | 0.211 | 1.000 | -0.633 | 0.195 |
| GEWEKE<--Herding | 10.071 | 0.318 | 6.972 | 1.001 | -4.165 | 23.251 |
| KAOPEN<--GDP | 0.133 | 0.001 | 0.035 | 1.001 | 0.062 | 0.199 |
| KAOPEN<--TradeFactor | -2.691 | 0.033 | 1.132 | 1.000 | -4.928 | -0.446 |

## Model 29: Direct Influence of GDP, KAOPEN and Herding and Indirect Influence of Trade, through GDP and KAOPEN on Integration

Model 29 tests whether Trade affects Integration through GDP and Capital Account Openness for African and Asian countries (similar to what was tested for in Model 5 for all the countries combined and Model 11 for European and LATAM countries). Figure 51 illustrates the relationship being investigated in Model 29. The economic rationale of this relationship for African and Asian countries remains the same as envisaged under Models 5 and 11, namely that greater Trade may drive economic growth which might in turn affect market Integration between the trading counties.

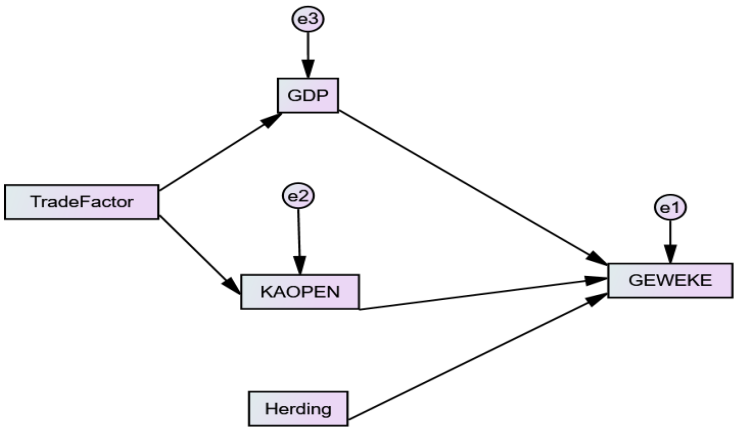
$H^{2(d)}_0$: Impact of KAOPEN, Herding, GDP directly on Integration,
and Trade indirectly through KAOPEN and GDP = 0

$H^{2(d)}_1$: Impact of KAOPEN, Herding, GDP directly on Integration,

and Trade indirectly through KAOPEN and GDP ≠ 0

Figure 51 below illustrates the model being tested.

Figure 51: Trade through GDP and Capital Account Openness




The findings in Table 98, show that in this model, Trade does not significantly influence GDP to influence Integration, but does in fact significantly influence Capital Account Openness. GDP and Capital Account Openness, themselves are however, not significant in influencing Integration, Herding on the other hand is significant. The findings of the significance of Herding are different from the findings when European and Latin American markets were considered under the same hypothesis, where under the MLE, Herding was not significant in these markets.

Table 98: Trade through Capital Account Openness and GDP for Asian and African countries

| | | | Estimate | S.E. | C.R. | P |
|---|---|---|---|---|---|---|
| GDP | <--- | TradeFactor | 4.851 | 2.918 | 1.662 | 0.096 |
| KAOPEN | <--- | TradeFactor | -2.633 | 1.152 | -2.286 | 0.022 |
| GEWEKE | <--- | KAOPEN | -0.217 | 0.208 | -1.044 | 0.297 |
| GEWEKE | <--- | Herding | 10.265 | 5.109 | 2.009 | 0.045 |
| GEWEKE | <--- | GDP | -0.009 | 0.118 | -0.079 | 0.937 |

| Model | AIC |
|---|---|
| Default model | 50.100 |

The AIC score of the model however means that this model is not as informative as Models 26, 27 and 28 above. This model does not perform better than the previous models and therefore will not be considered in further analysis. The Bayesian Estimation in Table 99 supports the findings of the Maximum Likelihood estimation in Table 98, except with regards to the coefficient for the Herding variable, where there is a variance of over 0.250 points between the two estimation approaches. With regards to the significance of Herding the Bayesian Estimation finds that Herding is not significant in influencing Integration for African and Asian markets.

Table 99: Bayesian Analysis of impact of Trade on GDP and Openness

| | Mean | S.E. | S.D. | C.S. | 95% Lower bound | 95% Upper bound |
|---|---|---|---|---|---|---|
| GEWEKE<--KAOPEN | -0.214 | 0.006 | 0.213 | 1.000 | -0.643 | 0.190 |
| GEWEKE<--Herding | 10.031 | 0.255 | 6.717 | 1.001 | -3.528 | 22.470 |
| GEWEKE<--GDP | -0.006 | 0.002 | 0.107 | 1.000 | -0.218 | 0.206 |
| GDP<--TradeFactor | 4.733 | 0.159 | 4.201 | 1.001 | -3.296 | 13.054 |
| KAOPEN<--TradeFactor | -2.604 | 0.034 | 1.166 | 1.000 | -4.858 | -0.354 |

## Model 30 – Direct Influence of KAOPEN and Herding and Indirect Influence of GDP, through Trade and Influence of Trade Through KAOPEN on Integration

In Models 6 and 12 we tested whether GDP works indirectly through Trade to affect Capital Account Openness and then Integration. In Models 18 and 24 we tested this relationship for European and Latin American countries over two time periods, namely 2003-2007 and 2008-2012. In Model 30 we will do the same test for African and Asian countries only over the period 2003-2012.

$H^3_0$: Impact of KAOPEN, Herding directly on Integration
and GDP indirectly through Trade, and Trade through KAOPEN = 0

$H^3_1$: Impact of KAOPEN, Herding directly on Integration
and GDP indirectly through Trade, and Trade through KAOPEN ≠ 0

Figure 52 illustrates the relationship being modeled.

Figure 52: GDP through Trade and Capital Account Openness

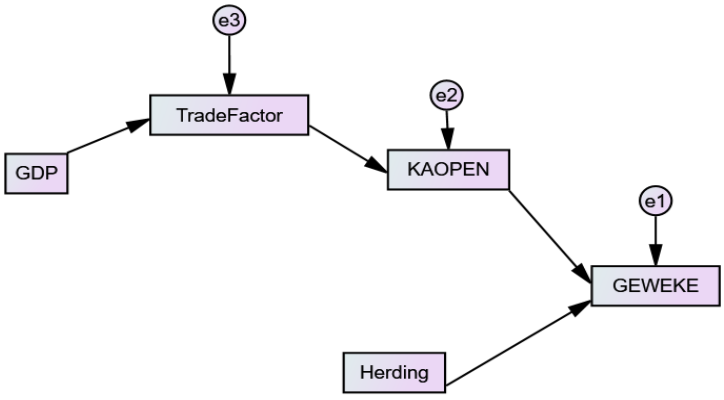



Table 100 shows that GDP does not significantly influence Trade. However, Trade still significantly influences Capital Account Openness. Capital Account Openness, remains not significant in its influence on Integration for African and Asian countries. Herding also remains

significant in its influence on Integration in the MLE model. These results are supported by the Bayesian Estimation reported in Table 101.

Table 100: GDP through Trade and Capital Account Openness

| | | | Estimate | S.E. | C.R. | P |
|---|---|---|---|---|---|---|
| TradeFactor | <--- | GDP | 0.004 | 0.002 | 1.658 | 0.097 |
| KAOPEN | <--- | TradeFactor | -2.633 | 1.152 | -2.286 | 0.022 |
| GEWEKE | <--- | KAOPEN | -0.220 | 0.208 | -1.062 | 0.288 |
| GEWEKE | <--- | Herding | 10.217 | 5.109 | 2.000 | 0.046 |

| Model | AIC |
|---|---|
| Default model | 48.108 |

*** indicates a p-value that is lower than 0.001

The AIC score for this model shows that this model is more informative than the preceding model.

The Bayesian Estimation supports the coefficients found by the MLE approach, with minor variances in the coefficients arrived at by the two different approaches. However, only the Trade variable is significant. Herding is also not significant, based on the Bayesian Estimation.

Table 101: Bayesian Analysis of GDP impact on Trade and Capital Account Openness

| | Mean | S.E. | S.D. | C.S. | 95% Lower bound | 95% Upper bound |
|---|---|---|---|---|---|---|
| GEWEKE<--KAOPEN | -0.215 | 0.008 | 0.209 | 1.001 | -0.620 | 0.200 |
| GEWEKE<--Herding | 10.304 | 0.301 | 6.979 | 1.001 | -3.565 | 23.734 |
| KAOPEN<--TradeFactor | -2.571 | 0.044 | 1.166 | 1.001 | -4.747 | -0.191 |
| TradeFactor<--GDP | 0.003 | 0.000 | 0.003 | 1.001 | -0.004 | 0.009 |

## Model 31 – Direct Influence of Herding and KAOPEN and Trade and Indirect Influence of GDP and Trade through KAOPEN on Integration

In Model 31 the pre-eminent role of Trade in Integration is tested, to establish whether as the literature has proposed a critical variable in understanding Integration is Trade, with specific focus on African and Asian countries. The recurring importance of Trade in the analysis thus far, leads us to postulate that for African and Asian countries, Trade may in fact be driving Integration directly and indirectly through Capital Account Openness.

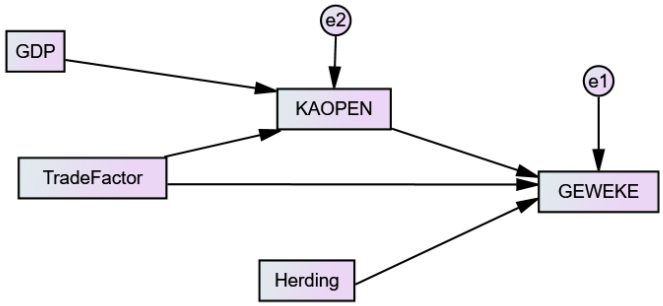
In Model 31 we test whether Trade acts on integration directly as well as indirectly through Capital Account Openness. The rational for this model is that Trade may influence Integration through the companies that are involved in international trade being listed on the respective country's stock exchange and thus the benefits for Trade would come through on the relevant

company's earnings and subsequently their share price. Trade may also affect Capital Account Openness in that, greater Trade may drive the authorities towards more liberalised stances in terms of capital flows.

$H^5_0$: Impact of Trade, Herding and KAOPEN on Integration directly, and Trade and GDP indirectly through KAOPEN = 0

$H^5_1$: Impact of Trade, Herding and KAOPEN on Integration directly, and Trade and GDP indirectly through KAOPEN ≠ 0

Figure 53: Trade direct and indirect influence on Integration




The results of the MLE show that indeed Trade does influence Integration directly but that it also influences Capital Account Openness, although Capital Account Openness, in turn, does not influence Integration. This finding points to the danger of only looking at the indirect influence of Trade on Integration without at the same time looking at its direct impact on Integration.
GDP is also significant in influencing Capital Account Openness. Thus the macro-economic variables are important in driving Capital Account Openness for African and Asian countries. However for these countries, Capital Account Openness is significant in driving Integration with the US. The two macro-economic variables have opposite effects on Capital Account Openness according to Model 31. This means that although Trade may drive increased Integration, it will lower the openness of the capital account. While greater economic growth will lead to greater openness of the capital account.

The AIC score of the model, 32.051, indicates that this model is much more informative than any of the preceding models as it the lowest score of any of the models. This MLE results of this model show that Trade is the most significant factor influencing Integration of all the variables considered for the African and Asian countries. Herding is also significant however, given that in previous models, the Bayesian analysis did not confirm the significance of the Herding variable, we will need to confirm whether in this model, Herding is still significant if we test it using Bayesian Estimation. The results of the Bayesian Estimation are shown in Table 102, below.

Table 102: MLE Estimation of Direct and Indirect Trade Effects

| | | | Estimate | S.E. | C.R. | P | Label |
|---|---|---|---|---|---|---|---|
| KAOPEN | <--- | GDP | 0.135 | 0.036 | 3.737 | *** | |
| KAOPEN | <--- | TradeFactor | -2.787 | 1.118 | -2.493 | 0.013 | |
| GEWEKE | <--- | KAOPEN | -0.292 | 0.208 | -1.407 | 0.159 | |
| GEWEKE | <--- | Herding | 10.211 | 5.051 | 2.022 | 0.043 | |
| GEWEKE | <--- | TradeFactor | -7.982 | 3.581 | -2.229 | 0.026 | |

| Model | AIC |
|---|---|
| Default model | 32.051 |

*** indicates a p-value that is lower than 0.001

The results of the Bayesian Estimation of the hypothesised model confirm the results of the MLE, except for the Herding variable. Similar to the findings of the preceding models, the Bayesian Estimation does not confirm the significance of the Herding variable that was found in the MLE. We therefore, for purposes of this study will not treat the Herding variable as significant, for the same reasons as discussed previously, regarding the inability of MLE to deal with non-normal and small sample data.

Table 103: Bayesian Estimation of Direct and Indirect Trade Effects

| | Mean | S.E. | S.D. | C.S. | 95% Lower bound | 95% Upper bound |
|---|---|---|---|---|---|---|
| GEWEKE<--KAOPEN | -0.285 | 0.012 | 0.212 | 1.001 | -0.703 | 0.119 |
| GEWEKE<--Herding | 9.971 | 0.399 | 6.704 | 1.002 | -3.538 | 22.414 |
| GEWEKE<--TradeFactor | -7.848 | 0.112 | 3.582 | 1.000 | -14.504 | -0.668 |
| KAOPEN<--GDP | 0.137 | 0.001 | 0.035 | 1.001 | 0.070 | 0.208 |
| KAOPEN<--TradeFactor | -2.746 | 0.056 | 1.140 | 1.001 | -4.985 | -0.469 |

# Appendix B Methodology

**Structural Equation Modelling (SEM)**

In order to build a holistic theoretical model that relates all the elements of a proposed model, Structural Equation Modelling (SEM) can be used. SEM approaches the analysis of relationships through establishing two mutually dependent models, namely the measurement model and the structural model. The measurement model expresses the hypothesised relationship between the manifest variables and latent constructs (Hair et al., 2010; Loehlin, 2004). The manifest variables are the variables that can be measured directly. The latent variables are those variables that cannot be measured directly, but are theorised to influence the manifest variables. The structural model expresses the links between the manifest (measurable) variables. Both these models then make up the model that is tested in SEM (ibid.).

The two models are normally expressed as

$$Y = v + \Lambda\eta + \varepsilon \quad \text{.....(16)}$$
$$\eta = \alpha + B\eta + \zeta \quad \text{.....(17)}$$

Equation 16 is the measurement model where Y is given as the vector of p observed variables, with p > 1, $v$ represents the p x 1 vector of observed variable intercepts, $\Lambda$ is a p x q matrix of latent factor loadings, $\eta$ is a vector of q latent factors where q > 0 and $\varepsilon$ is a vector of error terms.

Equation number 17 is the structural model of the standard SEM formulation, wherein $\alpha$ represents the q x 1 vector of latent variable intercepts and $\zeta$ is a qx1 vector of latent disturbance terms and the I-B matrix is assumed to be invertible (Raykov and Marcoulides, 2006).
Through the appropriate algrebraic manipulation, equations 16 and 17 yield

$$\Sigma = \Lambda(I\text{-}B)^{-1}\,\psi(I\text{-}B)^{-1}\Lambda' + \Theta \quad \text{.....(18)}$$

which is the implied covariance matrix from the data/sample. $\Psi$ is the covariance matrix of latent disturbance terms and $\Theta$ is the covariance matrix of the residuals in the measurement model. OLS/GLS/ML uses these matrixes to estimate the parameter values in the SEM model. A theoretical $\Sigma'$, is estimated and the aim of the OLS/GLS/ML approaches is to reduce the distance or gap between $\Sigma$ and $\Sigma'$. Whichever SEM model has the lowest gap will provide the best parameter estimates, given the data and the proposed model. It is clear from the preceding discussion that the original data is not used after the variance/covariance matrix has been derived in OLS/GLS/ML estimation. As discussed in the section on Bayesian estimation, the Bayesian approach will utilize the raw data in arriving at parameter estimates using the MCMC algorithm, which uses the raw data to estimate a distribution from which the data is likely to have been drawn. This estimated distribution is then used to estimate the parameters.

As indicated however, these estimation approaches are reliant on a variance/covariance matrix which assumes large samples and uncorrelated errors. This standard SEM formulation is unable to model data with correlated error terms. Time series data exhibit correlated error terms.

# Appendix C

Figure 54: Bayesian Estimate of GDP Mean

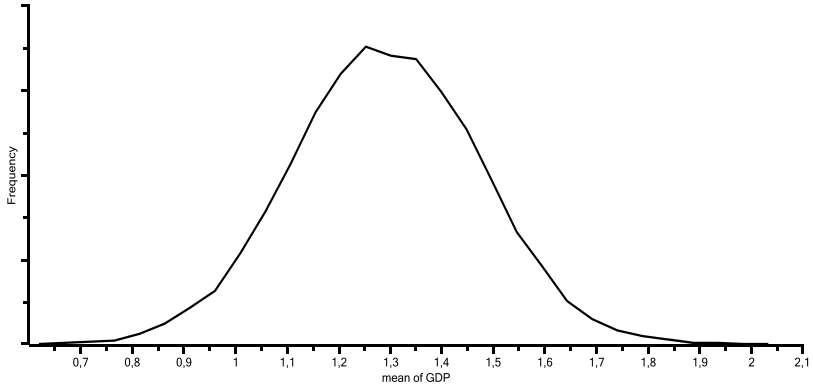



Figure 55: Trace of Bayesian GDP Mean Estimate

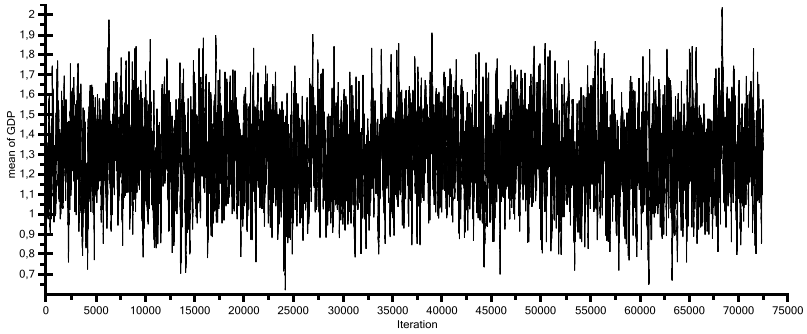



Figure 19: Correlelogram of Bayesian Mean Estimate

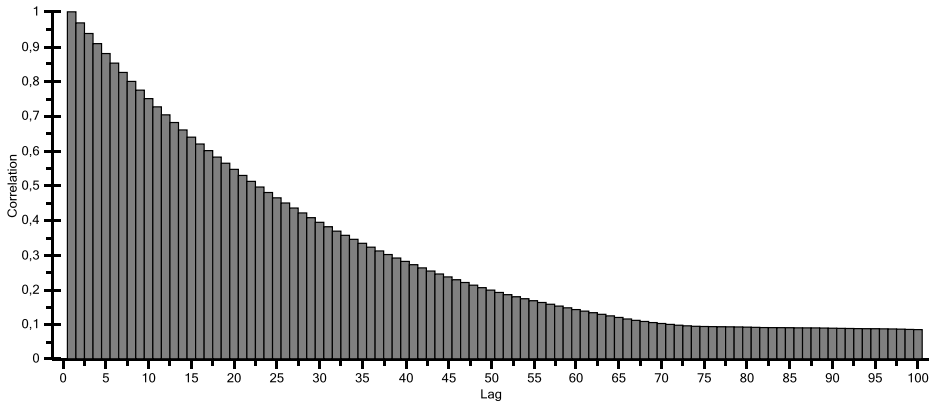


Figure 20: Bayesian Estimate of KAOPEN Mean

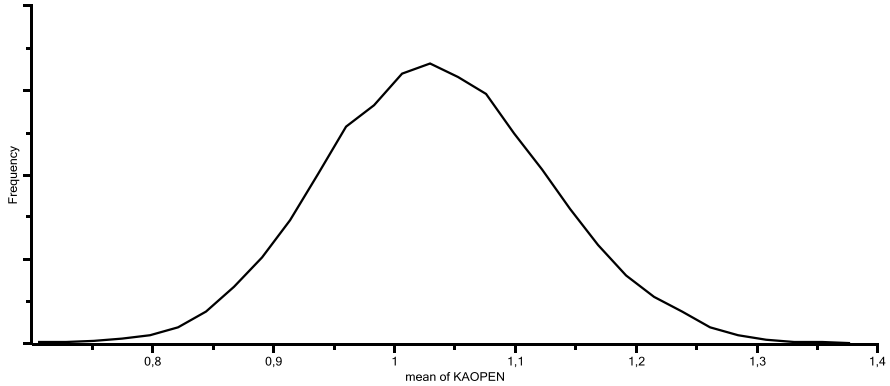



Figure 21: Trace of Bayesian KAOPEN Mean Estimate

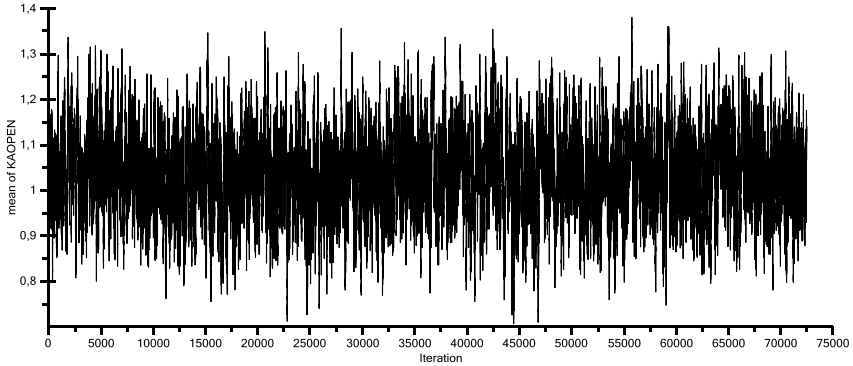
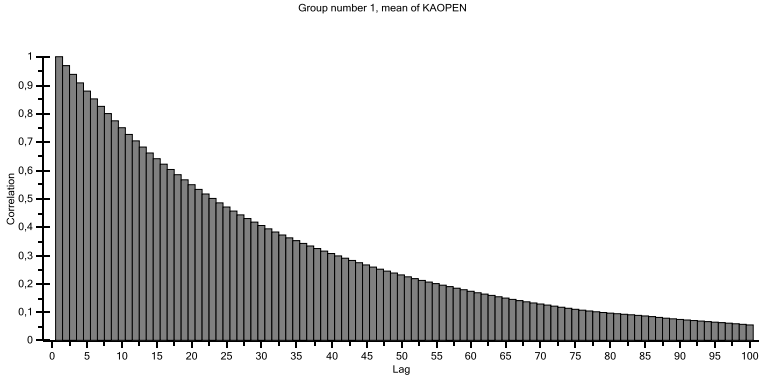



Figure 22: Correlelogram of Bayesian KOAPEN Mean Estimate



**References**


1. Abdullah R. A. and Mishra A. V. (2017) Time varying international financial integration for GCC stock markets. The Quarterly Review of Economics and Finance, Volume 63, pp. 66-78

2. Adler M. and Dumas B. (1983). International Portfolio Choice and Corporation Finance: A Synthesis, The Journal of Finance, Vol. 38, No. 3, pp. 925-984

3. Adjasi C.K.D. and Biekpe N. (2006). Conintegration and Dynamic Causal Links amongst African Stock Markets, Investment Management and Financial Innovations Vol. 4, pp 102-119

4. Ahmed S., Coulibaly B., Zlate A. (2017) International Financial Spillovers to Emerging Market Economies: How important are economic fundamentals? Journal of International Money and Finance, Volume 76, pp. 133-152

5. Armandi A. A. (2004). Equity Home Bias: A Disappearing Phenomenon? Available at http://ssrn.com/abstract=540662 or http://dx.doi.org/doi.org/10.2139/ssrn.540662

6. Agnor P. (2001). Benefits and Costs of Financial Integration Theory and Facts. World Bank Policy Research Working Paper 2699

7. Apergis N. and Tsoumas C.(2009). A survey of the Feldstein Horioka puzzle: What has been done and where we stand, Research in Economics 63 pp. 64-76

8. Baca S. P., Garbe B. L. and Weiss R. A. (2000). Rise of Sector Effects in Major Equity Markets, Financial Analysts Journal, Vol. 56, No. 5, pp.34-40

9. Baele L., Ferrando A., Hördahl P., Krylova E. and Monnet C. (2004). Measuring financial integration in the euro area. Occasional Paper Series 14, European Central Bank.

10. Bailey W. and Choi J., (2003). International Market Linkages, Journal of Economics and Business 55, pp. 399 - 404.

11. Bailey W., Karolyi A.G. and Salva C. (2006). The economic consequences of increased disclosure: Evidence from international cross-listings, Journal of Financial Economics, vol. 81(1), pp. 175-213

12. Bangake C. and Eggoh J.C. (2011). The Feldstein–Horioka puzzle in African countries: A panel cointegration analysis Economic Modelling 28 pp. 939–947

13. Baxter M. and Kouparitsas M. A. (2005). Determinants of business cycle co-movement: a robust analysis, Journal of Monetary Economics, 52, pp.113–157

14. Bekaert G. and Harvey C. R. (1995). Time-Varying World Market Integration, The Journal of Finance, Vol. 50, No. 2 pp. 403-444

15. Bekaert G. and Harvey C. R. (2000). Capital Flows and Behaviour of Emerging Market Equity Returns, Capital Flows and the Emerging Economies: Theory, Evidence, and Controversies, University of Chicago Press

16. Bekaert G., Hodrick R.J. and Zhang X. (2009). International Stock Return Comovements. The Journal of Finance, Vol. 64, No. 6 pp. 2591-2626

17. Beirne J., Caporale G.M., Schulze-Ghattas M. and Spagnolo N.(2009). Volatility Spillovers and Contagion from Mature to Emerging Stock Markets CESifo Working Paper Series 2545, CESifo Group Munich.

18. Berkel B.(2004). Institutional Determinants of International Equity Portfolios - A Country-Level Analysis, MEA discussion paper series 04061, Munich Center for the Economics of Aging (MEA) at the Max Planck Institute for Social Law and Social Policy.

19. Billio M. and Pelizzon L. (2003). Contagion and interdependence in stock markets: Have they been misdiagnosed?. Journal of Economics and Business 55, 405–426

20. Black F.(1974). International Capital Market Equilibrium with Investment Barriers. Journal of Financial Economics 1 pp. 337-352.

21. Blunch N. J. (2013). Introduction to Structural Equation Modeling Using IBM SPSS Statistics and AMOS, Second Edition, Sage Publications, London

22. Bikhchandani S., Hirshleifer D. and Welch I. (1992). A Theory of Fads, Fashion, Custom, and Cultural Change as Informational Cascades. Journal of Political Economy, Vol. 100, No. 5 pp. 992-1026

23. Bodhura J.N., Cho D.C. and Senbet L.W. (1989). Economic forces and the stock market: An international perspective. The Global Finance Journal, Volume 1, Number 1, pp. 21-46.

24. Bonser-Neal C., Brauer B., Neal R. and Wheatley S. (1990). International Investment Restrictions and Closed-End Country Fund Prices. The Journal of Finance, Vol. 45, No. 2, pp. 523-547

25. Bracker K., Docking D. S. and Koch P. D. (1999). Economic determinants of evolution in international stock market integration. Journal of Empirical Finance 6. pp. 1–27

26. Bravo-Ortega C.(2005). Does Asymmetric Information Cause the Home Equity Bias? World Bank, ISSN: 1813-9450

27. Brooks C.(2008) Introductory Econometrics for Finance, Second Edition. Cambridge: Cambridge University Press.

28. Bundoo S.K. (2017). Stock Market Development and Integration in SADC (Southern African Development Community), Review of Development Finance 7, pp.64-72

29. Burnham K. P. and Anderson D. R. (2002). Model Selection and Multimodel Inference: A Practical Information-Theoretic Approach, 2nd Ed. New York: Springer, pp. 74.

30. Büttner D. and Hayo B. (2011). Determinants of European Stock Market Integration Economic Systems, Vol. 35, No. 4, 2011.

31. Byrne B. M. (2010). Structural Equation Modeling with AMOS Basic Concepts, Applications and Programming (Second Edition). Routlegde Taylor and Francis Group, New York.

32. Campbell J.Y. and Hamao Y. (1992). Predictable Stock Returns in the United States and Japan: A Study of Long-Term Capital Market Integration The Journal of Finance Vol.47, No 1, pp. 43-69

33. Cao H., Han B., Hirshleifer D. and Zhang H. (2007). Fear of the Unknown: Familiarity and Economic Decisions. Available at http://mpra.ub.uni-muenchen.de/6512/ MPRA Paper No. 6512,

34. Canova F. and Dellas H. (1993). Trade interdependence and the international business cycle Journal of International Economics, 34, pp.23-47.

35. Canova F. and De Nicole G. (1995). Stock returns and real activity: A structural approach, European Economic Review, vol. 39(5), pp.981-1015

36. Čerović S., Pepić M., Petrović P. and Čerović S. (2014). The Impact Of The Global Financial Crisis On World Trade. Economic Themes. 52 (1), pp.13-32.

37. Chaiporn V. and Sriyalatha K. (2016). Financial development, international trade integration, and stock market integration: Evidence from Asia Journal of Multinational Financial Management, Volume 35, June 2016, pp. 79-92

38. Chambert A. and Gibson R. (2008). Financial integration, economic instability and trade structure in emerging markets, Journal of International Money and Finance 27, pp.654–675

39. Chang E.C., Cheng J.W. and Khorana A. (2000). An examination of herd behavior in equity markets: An international perspective. Journal of Banking and Finance 24, pp.1651-1679

40. Chen N. and Zhang F. (1997). Correlations, trades and stock returns of the Pacific-Basin markets. Pacific-Basin Finance Journal, 5, pp.559–577

41. Chen N., Roll R. and Ross S.A. Economic (1986). Forces and the Stock Market. The Journal of Business, Vol. 59, No. 3, pp. 383-403

42. Chen P. (2018) Understanding International Stock Market Co-movements: A Comparison of Developed and Emerging Markets. International Review of Economics & Finance, Volume 56, pp. 451-464

43. Chib S. and Greenberg E. (1996). Markov Chain Monte Carlo Simulation Methods In Econometrics Econometric Theory, 12, 409-431.

44. Choe J. (2001). An impact of economic integration through trade: on business cycles for 10 East Asian countries. Journal of Asian Economics, 12, pp.569–586

45. Christie W. G. and Huang R. D. (1995). Following the Pied Piper: Do Individual Returns Herd around the Market? Financial Analysts Journal, vol. 51, no. 4, pp. 31–37

46. Christoffersen S. and Tang Y. (2010). Institutional Herding and Information Cascades: Evidence from daily trades Available at SSRN: http://ssrn.com/abstract=1572726

47. Chuhan P. (1994). Are Institutional Investors an Important Source of Portfolio Investment in Emerging Markets? Policy Research Working Paper Series 1243. The World Bank

48. Ciner C. (2006). A further look at linkages between NAFTA equity markets The Quarterly Review of Economics and Finance, 46, pp.338–352

49. Cipriani M. and Guarino A (2009). Herd Behavior in Financial Markets: An Experiment with Financial Market Professionals. Journal of the European Economic Association. vol. 7(1), pp. 206-233

50. *Cipriani, M.* and *Guarino, A.* (2008). Herd behavior and contagion in financial markets. The Journal of Theoretical Economics, vol 8, Issue 1, pp.1-54

51. Chinn M.D. and Ito H. (2008). A new Measure of Financial Openness. Journal of Comparative Policy Analysis, Volume 10, Issue 3 September, pp. 309 - 322

52. Claessens S. and Rhee M. (1994). The effects of barriers on equity investment in developing countries, Policy Research Working Paper Series 1263, The World Bank.

53. Coakley J., Kulasi F. and Smith R. (1998). The Feldstein-Horioka Puzzle and Capital Mobility: A Review. International Journal of Finance and Economics vol. 3(2), pp. 169-88

54. Corsetti, G., Pericoli M. and Sbracia M. (2005). Some contagion, some interdependence: More pitfalls in tests of financial contagion. Journal of International Money and Finance, vol. 24(8), pp. 1177-1199

55. Daly K. and Vo V. X. (2012). The determinants of home bias puzzle in equity portfolio investment. Australia International Review of Financial Analysis (Article in Press)

56. Dicle, Mehmet F. and Levendis, John, Estimating Geweke's (1982) Measure of Instantaneous Feedback (August 13, 2012). Stata Journal, Vol. 13, No 1, pp. 136-140, 2013. Available at SSRN: https://ssrn.com/abstract=1927519 or http://dx.doi.org/10.2139/ssrn.1927519

57. Domowitz I., Glen J. and Madhavan A. (1997). Market Segmentation and Stock Prices: Evidence from an Emerging Market. The Journal of Finance, Vol. 52, No. 3, Papers and Proceedings Fifty-Seventh Annual Meeting, American Finance Association, New Orleans, Louisiana January 4-6, pp. 1059-1085

58. Dunson D.B., Palomo J., and Bollen K. (2005). Bayesian Structural Equation Modeling, Statistical and Applied Mathematical Sciences Institute.

59. Ehrlich I., Shin J.K., and Yin Y. (2011). Private Information, Human Capital, and Optimal "Home Bias" in Financial Markets, NBER Working Paper No. 15668

60. Eichengreen B., Rose K. A. and Wyplosz C. (1996). Contagious Currency Crises. Working Paper 5681. NBER Working Paper Series

61. Eiling E., Gerard B., Hillion P. and de Roon F.A. (2012). International portfolio diversification: Currency, industry and country effects revisited. Journal of International Money and Finance 31, pp. 1249–1278

62. Emiris M. (2002). Measuring capital market integration. Bank for International Settlements BIS Paper 12, 200-221

63. Engle R.F. , Ito T. and Lin W. (1990). Meteor Showers or Heat Waves? Heteroskedastic Intra-Daily Volatility in the Foreign Exchange Market. Econometrica, Vol. 58, No. 3, pp. 525-542.

64. Erb C.B., Harvey C.R. and Viskanta T.E. (1994). Forecasting International Equity Correlations Financial Analysts Journal, Vol 50 No 6, 32-45

65. Feldstein M. and Horioka C. (1980). Domestic Saving and International Capital Flows. The Economic Journal, Vol. 90, No. 358, pp. 314–329

66. J. Foo and D. Witkowska (2016). A Comparison of Global Financial Market Recovery After the 2008 Global Financial Crisis. Folia Oeconomica Stetinensia. DOI: 10.1515/foli-2017-0009

67. Forbes J. and Chinn M.D. (2004). A Decomposition of Global Linkages in Financial Markets Over Time, The Review of Economics and Statistics, vol. 86(3), pp. 705-722

68. Forbes J.K. and Rigobbon R. (2002). No Contagion, Only Interdependence: Measuring Stock Market Co-movements. The Journal of Finance Vol. LVII, No. 5, pp. 2223-2261

69. Frankel J.A. and Rose A.K., (1996). The Endogeneity of the Optimum Currency Area Criteria, NBER Working Papers 5700, National Bureau of Economic Research, Inc.

70. French K. R. and Poterba J. M. (May, 1991). Investor Diversification and International Equity Markets, The American Economic Review, Vol. 81, No. 2, Papers and Proceedings of the Hundred and Third Annual Meeting of the American Economic Association, pp.222-226

71. Fratzscher M. (2002). Financial Market Integration in Europe: On the Effects of EMU on Stock Markets, International Journal of Finance and Economics, vol. 7(3), pp 165-93

72. Geman S. and Geman D. (1984). Stochastic Relaxation, Gibbs Distributions, and the Bayesian Restoration of Images, IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol. PAMI-6, NO. 6

73. Geweke, J. (1982). Measurement of linear dependence and feedback between multiple time series. Journal of the American Statistical Association 77, 304-313.

74. Griffin J.M. and Karolyi G.A. (1998). Another look at the role of the industrial structure of markets for international diversification strategies, Journal of Financial Economics 50, pp. 351-373

75. Grubel H.G. (1968). Internationally Diversified Portfolios: Welfare Gains and Capital Flows. *The American Economic Review Vol. 58*. No. 5, pp. 1299-1314

76. Grubel H.G. and Fadner K. (1971). The Interdependence of International Equity Markets. The Journal of Finance, Vol. 26, No. 1 (Mar., 1971), pp. 89-94

77. Guesmi K., Ftiti Z.and Abid I. (2013) Greece's Stock Market Integration with Southeast Europe. Journal of Economic Integration, Vol. 28, No. 4 pp. 668-682

78. Hair Jnr. J.F., Black W.C., Babin B.J. and Anderson E.R. (2010). Multivariate Data Analysis, A Global Perspective, Seventh Edition, Pearson Education Inc.

79. Hanousek J. and Filer K.R. (1997). The Relationship Between Economic Factors and Equity Markets in Central Europe, William Davidson Institute Working Papers Series 78, William Davidson Institute at the University of Michigan.

80. Hearn B. and Piesse J. (2002). Equity Market Integration versus Segmentation in Three Dominant Markets of the Southern African Customs Union: Cointegration and Causality Tests. Applied Econometrics, 34(14), pp. 1711-1722

81. Heston S.L. and Rouwenhorst K.G.(1994). Does industrial structure explain the benefits of international diversification? Journal of Financial Economics Vol. 36, Issue 1, pp. 3–27

82. Hietala P.T. (1989). Asset Pricing in Partially Segmented Markets: Evidence from the Finnish Market. The Journal of Finance, Vol. 44, No. 3, Papers and Proceedings of the Forty-Eighth Annual Meeting of the American Finance Association, New York, New York, December 28-30, pp. 697-718

83. Ip-Wing Yu, Kang-Por Fung and Chi-Sang Tam (2010). Assessing financial market integration in Asia – Equity markets. *Journal of Banking and Finance 34,* pp. 2874–2885.

84. Iversen G. R. (1984). Bayesian Statistical Inference. A Sage Publication Inc. Carlifonia

85. Jackman S. (Apr., 2000). Estimation and Inference via Bayesian Simulation: An Introduction to Markov Chain Monte Carlo, *American Journal of Political Science*, Vol. 44, No. 2, pp. 375-404.

86. Johnson R. and Soenen L. (2003). Economic integration and stock market comovement in the Americas, Journal of Multinational Financial Management 13, pp. 85-100

87. Kaminsky G. and Schmukler S.(2001). Short and long-run integration: do capital controls matter?. Policy Research Working Paper Series 2660, The World Bank.

88. Kahneman D. and Tversky A. (1979). Prospect Theory: An Analysis of Decision under Risk Econometrica, 47(2), pp. 263-291,

89. Kato K., Linn S. and Schallheim J. (1991). Are There Arbitrage Opportunities in the Market for American Depository Receipts? Journal of International Financial Markets, Institutions & Money 1, pp. 73-89.

90. Karolyi G. A. and Stulz R. M. (2003). Are Financial Assets Priced Locally or Globally? Working Paper 8994. NBER Working Paper Series

91. Kenning K. and Mohr P. and Erk S., Walter H. and Plassmann H. (2006). The role of fear in home-biased decision making: insights from neuroeconomics. Available at http://mpra.ub.uni-muenchen.de/1076/MPRA Paper No. 1076

92. King, M. A. and Wadhwani S. (1990). Transmission of Volatility between Stock Markets. Review of Financial Studies, Society for Financial Studies, vol. 3(1), pp. 5-33.

93. Kodongo O. and Ojah K. (2012). A Comparative Examination of Currency Risk Pricing and Market Integration in the Stock Markets of Nigeria and South Africa. Review of Development Finance 2, pp. 118-129

94. Kodongo O. and Ojah K. (2011). Foreign exchange risk pricing and equity market segmentation in Africa. *Journal of Banking & Finance*, Vol. 35, issue 9, pp. 2295-2310

95. Kose M. A. and Yi K. (2006) Can the standard international business cycle model explain the relation between trade and comovement? Journal of International Economics 68, pp. 267 – 295

96. Korajczyk R.A. (1995). A Measure of Stock Market Integration for Developed and Emerging Markets. *Policy Research Working Paper 1482*, The World Bank

97. Kizys R. and Pierdzioch C. (2009). Changes in the international comovement of stock returns and asymmetric macroeconomic shocks International Financial Markets, Institutions and Money, 19, pp.289–305

98. *Kordes,L.* and *Pritsker* M. (2002). A Rational Expectations Model of Financial Contagion, Journal of Finance 57(2), pp. 769-799

99. Kline R. B. (2005). Principles and Practice of Structural Equation Modeling (Second Edition), The Guilford Press, New York

100. Knight M. (1998). Developing Countries and the Globalisation of Financial Markets. World Development Vol. 26, No. 7, 1185-1200

101. Kremer, S. and Nautz, D. (2013) Causes and Consequences of Short-Term Institutional Herding. Journal of Banking & Finance, 37, 1676-1686.

102. Kruschke J. K. (2011). Doing Bayesian Data Analysis, A tutorial with R and BUGS. Elsevier Inc., USA.

103. Lamont O.A. and Thaler R.H. (2003). Anomalies: The Law of One Price in Financial Markets. Journal of Economic Perspectives, Volume 17, Number 4, 191–202

104. Lee C.H. (1969). A Stock-Adjustment Analysis of Capital Movements: The United States-Canadian Case. Journal of Political Economy, Vol. 77, No. 4, Part 1, pp. 512-523

105. Lee S. (2007). Structural Equation Modeling, A Bayesian Approach. John Wiley and Sons Ltd, England

106. Levine R. and Zervos S. (1996). Stock Market Development and Long Run Growth. Policy Research Working Paper 1582. The World Bank

107. Lessard D.R. (1976). World, Country, and Industry Relationships in Equity Returns Implications for Risk Reduction Through International Diversification, Financial Analyst Journal, Vol.32, No 1, pp.32-38

108. Lintner J. (1969). The Review of Economics and Statistics, Vol. 51, No. 2, pp. 222-224

109. Loehlin J.C. (2004). Latent Variable Model, 4th Edition, An Introduction to Factor, Path, and Structural Equation Analysis, Lawrence Erlbaum Associates, London

110. Lehkonen H. (2015). Stock Market Integration and the Global Financial Crisis. Review of Finance, 19 (5), pp. 2039-2094

111. Longin F. and Solnik B. (1995). Is the correlation in international equity returns constant: 1960-1990? Journal of International Money and Finance vol. 14(1), pp. 3-26

112. Marashdeh H.A. and Shrestha M. B. (2010). Stock Market Integration in the GCC Countries. *International Research Journal of Finance and Economics*, Issue 37, 102-114

113. Markowitz H. M. (1952). Portfolio Selection. *Journal of Finance* 7, pp.77-91.

114. Merton R. C. (1973). An Intertemporal Capital Asset Pricing Model. Econometrica Vol. 41 No. 5, 867-887.

115. Merton, R. C. (1987). A simple model of capital market equilibrium with incomplete information. Working papers 1869-87., Massachusetts Institute of Technology (MIT), Sloan School of Management.

116. Mondria J. and Wu T. (2010). The puzzling evolution of the home bias, information processing and financial openness. Journal of Economic Dynamics and Control, 34, pp.875–896

117. Moor L. and Sercu P. (2010). Country versus sector effects in equity returns and the roles of geographical and firm-size coverage, Small Business Economics, vol. 35(4), pp. 433-448

118. Morse A. and Shive S. (2011). Patriotism in your portfolio. Journal of Financial Markets, 14, pp.411–440

119. Narayan S., Sriananthakumar S., Islam S. Z. (2014) Stock market integration of emerging Asian economies: Patterns and causes Economic Modelling, Volume 39, pp. 19-31

120. Nikkinen J., Omran M., Sahlström P. and Äijö J. (2006) Global stock market reactions to scheduled U.S. macroeconomic news announcements. Global Finance Journal 17, pp. 92–104

121. Nishiotis G. P. (2004). Do Indirect Investment Barriers Contribute to Capital Market Segmentation?. Journal of Financial and Quantitative Analysis, vol. 39(03), pp. 613-630

122. Nocetti D. (2006). Markowitz meets Kahneman: Portfolio selection under divided attention. Finance Research Letters, 3, pp.106–113

123. Nofsinger, J.R. and Sias, R.W. (1999) Herding and Feedback Trading by Institutional and Individual Investors. The Journal of Finance, 54, 2263-2295.

124. Patterson, D. M. and Sharma V.(2010). The Incidence Of Informational Cascades And The Behavior Of Trade Interarrival Times During The Stock Market Bubble. Macroeconomic Dynamics, Cambridge University Press, vol. 14(S1), pp 111-136.

125. Phylaktis, K. and Ravazzolo, F. (2002). Measuring financial and economic integration with equity prices in emerging markets. Journal of International Money and Finance, vol. 21(6), pp. 879-903.

126. Pretorius E. (2002) Economic determinants of emerging stock market interdependence Emerging Markets Review 3, pp. 84-105

127. Rafaat M. R., Charter N. and Frith C. (2009). Herding in Humans. Trends in Cognitive Sciences, Vol 13, Issue 10, pp. 420-428

128. Raj J. and Dhal S. (2008). Integration of India's Stock Market with Global and Major Regional Markets. BIS Papers Chapters in: Bank for International Settlements (ed.), Regional Financial Integration in Asia: Present and Future, Volume 42, 202-236

129. Rajan R. S., Siregar R. Y. and Cavoli T. (2006). Financial Integration in East Asia: How Far? How Much Further to Go?, Working Papers id:372, eSocialSciences.

130. Raykov T. and Marcoulides G.A. (2006). A First Course in Structural Equation Modeling (Second Edition), Lawrence Erlbaum Associates Publishers, New Jersey

131. Rigobon R. (1999). On the Measurement of the International Propagation of Shocks. Working Paper 7354, NBER Working Paper Series

132. Roll R. (1992), Industrial Structure and the Comparative Behaviour of International Stock Market Indices, The Journal of Finance, Vol. 47, No. 1, pp. 3-41

133. Ross S. A. (1976). The Arbitrage Theory of Capital Asset Pricing. *Journal of Economic Theory 13*, pp341-360

134. Scharfstein, D.S. and Stein J. C. (1990). Herd Behavior and Investment, American Economic Review, American Economic Association, vol. 80(3), pp. 465-79

135. Shelburne R.C. (2010). The Global Financial Crisis And Its Impact On Trade: The World And The European Emerging Economies. Discussion Paper Series No. 2010.2. United Nations Economic Commission For Europe, Geneva, Switzerland

136. Schmitt–Grohe S. (1998). The international transmission of economic fluctuations: Effects of U.S. business cycles on the Canadian economy Journal of International Economics 44, pp.257–287

137. Schwert G.W. (1990). Stock Returns and Real Activity: A century of evidence. Journal of Finance, Vol. XLV, No. 4, pp. 1237-1257

138. Schumacker R.E. and Marcoulides G. A. (1998). Interaction and Non-Linear Effects in Structural Equation Modeling. Lawrence Erlbaum Associates, Publishers, New Jersey

139. Sercu P. (1980). A Generalization of the International Asset Pricing Model, *Revue de l'Association Française de Finance* 1(1), pp. 91-135.

140. Sharpe W. F. (1964). Capital Asset Prices: A Theory Of Market Equilibrium Under Conditions Of Risk. Journal of Finance, American Finance Association, vol. 19(3), pp. 425-442

141. Shiller R. (1995). Conversation, Information, and Herd Behavior. American Economic Review Papers and Proceedings 85, 181-85.

142. Shiller J.P. and Pound J. (1989). Survey Evidence on Diffusion of Investment Among Institutional Investors Journal of Economic Behavior and Organization vol. 12, pp. 47-66 1989

143. Shyu J. and Sun H.M. (2010). Do Institutional Investors Herd in Emerging Markets? Evidence from the Taiwan Stock Market. Asian Journal of Finance and Accounting, Vol. 2, No. 2

144. Solnik B. (1974). An Equilibrium Model of the International Capital Market, Journal of Economic Theory. 8, pp. 500-524

145. Solnik B. (1983). International arbitrage pricing theory. Journal of Finance 38, 449-457

146. Stulz, R. M. (1981). A model of international asset pricing. Journal of Financial Economics, Vol. 9(4), pp. 383-406.

147. Stulz R. (1981). On the Effects of Barriers to International Investment. The Journal of Finance, Vol XXXVI, No 4

148. Tai, C. (2007). Market integration and contagion: Evidence from Asian emerging stock and foreign exchange markets. Emerging Markets Review Vol. 8 No. 4, 264-283.

149. Taskin F. and Muradoglu G. (2003). Financial liberalisation: from segmented to integrated economies. Journal of Economics and Business 55, 529–555

150. Tesar L. and Werner I.M. (1995). Home bias and high turnover, *Journal of International Money and Finance,* Vol. 14, No. 4, pp. 467-492

151. Tobin J. (1958). Liquidity Preference as Behavior Towards Risk, Review of Economic Studies (1958), 67, pp.65-86

152. Tsiakas I. (2006) Periodic Stochastic Volatility and Fat Tails, Journal of Financial Econometrics, Volume 4, Issue 1, pp. 90–135

153. Verma R. and Ozuna T. (2005), Are emerging equity markets responsive to cross-country macroeconomic movements? Evidence from Latin America. Journal of International Financial Markets, Institutions and Money 15, pp.73–87

154. Wang Y. and Fan T. (2011) Journal of Statistical Planning and Inference, 141, 2071–2078

155. World Federation of Exchanges Monthly Report. https://www.world-exchanges.org/our-work/statistics