THE EFFECT OF INTEGRATION ON INVESTMENT PORTFOLIO DIVERSIFICATION IN EAST AFRICAN STOCK EXCHANGES

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other university or any other award.

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Finally, to God is the glory for divine facilitation.

DEDICATION

To all those who work hard to make the world a better and humane place. May all scholars continue to find success in their research as I have, by utilizing this and other works in fulfillment of their goals.

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ABBREVIATIONS AND ACRONYMS

AIC	Akaike Information Criterion
APEC	Asian Pacific Economic Cooperation.
ARMA	Autoregressive Moving Average
DGP	Data Generating Process
DSE	Dar-es-salaam Stock Exchange
EAC	East African Community
EACU	East African Customs Union
FPE	Final Prediction Error
KPSS	Kwiatkwoski, Phillips, Schmidt and Shin
NAFTA	North American Free Trade Association
NMCAR	Data Not Missing Completely at Random
NSE	Nairobi Securities Exchange
NYSE	New York Exchange
OPEC	Organization of Petroleum Exporting Countries.
PCC	Pearson's Correlation Coefficient
RE	Regression Error.
REQ	Regression Equation
RRE	Residual Regression Error
SACCU	South African Development Community
SPSS	Statistical Package for Social Sciences
UK	United Kingdom
US	United States
USE	Uganda Securities Exchange
USH	Uganda Shillings
VAR	Vector Autoregression
Var	Variance

DEFINITION OF TERMS

Autocorrelation: A state in which the covariance of two data series does not change with time: A time-invariant covariance.

Breakpoint: A time boundary before and after which a time series is analyzed.

Capital flows: The exchange of money resulting from trading in stock markets.

Correlogram: A function defining the ratio of covariance of two variables to the variance of one of the two variables.

Covariance: The expected value of two series of deviations from the common mean of all the series.

Cross listing: Simultaneous listing of a company in two or more stock markets.

Embargo: A ban on some or all of the trade with one or more countries.

Equilibrium: A state of temporary or long-term stability.

Index: A trade volume-weighted average stock price performance measure used to judge market liquidity. Plural: indexes or indices.

Integration: Regionalization, economic and/or political grouping or merger of trading systems.

Market crash: A rapid and serious fall in the level of prices in a market.

Moving average: A series of averages in a data series, calculated to reduce the effects of temporary seasonal variations.

Portfolio: A mix of financial securities.

Securities: Investments generally, and especially shares and bonds which are bought for future profits or capital gains.

Stationarity: The property of a process in which the mean, variance and covariance are constant over time.

Stochastic: Random, not occurring in a predictable manner.

ABSTRACT

The purpose of this study was to analyze the effect of integration on stock market investment portfolio diversification in East African stock exchanges. The study was based on the Nairobi Securities Exchange, Dar-es-salaam Stock Exchange and Uganda Securities Exchange with the target population of all the companies whose common stocks were traded over the sample time period. Covering a period of 100 months between January 2000 and April 2008, the researcher analyzed the pair-wise index correlation structure, co-movement and cointegration of the markets' Paasches index series. From the daily price lists, month-end trade volumes and prices of each market's trading stocks were extracted, forming the input for the index construction formula. The next step was to test each index for stationarity using the unit root test. The indexes were then paired and divided into pre-and post-breakpoint components with pair-wise deletion of the cases not completely missing at random, using the Customs Union Date (February 29, 2004) as the breakpoint. Accordingly, the sub-period data was used for the analysis of pair-wise comovement structure and market contagion after the application of the breakpoint event, the sign-up of the East African customs union treaty. The final stage of the data analysis involved estimating least squares regression lines. From each market pair, one index series was regressed on the other and the results used for the computation of the regression error and white noise with a one-month lag length. The researcher then tested the regression and residual error variances for unit root stationarity. The findings asserted both co-movement and divergence of the index pairs in the first and second study sub-periods, signifying irregularity of the investment diversification benefits in both cases. Further, each index pair was found to have reacted in its own way to the economic shock distorting the dependency structure. Finally, all least squares regression and residual error variances were non-zero proving that there was no pair-wise cointegration and hence no evidence of diversification debenefit in the long run, in the three securities markets.

CHAPTER ONE
INTRODUCTION

1.1 Background to the Study

On 19th October of 1987 (The Black Monday), the Hong Kong market plummeted and then partially rebounded. These dramatic movements were mirrored in markets in North America, South America, Europe, and the rest of Asia. This was the day when stock markets around the world crashed, shedding a huge value in a very short time. The crash began in Hong Kong and spread west to Europe, hitting the United States after other markets had already declined by a significant margin. The Dow Jones Industrial Average (DJIA) for example, dropped by 508 points to 1738.74 (22.61%), and the crash quickly affected major stock markets around the globe (Zwaniecki, 2007).

A similar situation occurred in December of 1994, when the Mexican market cratered, and this plunge was quickly reflected in other major Latin American markets. Anecdotal evidence also shows that such dramatic movements in one stock market can have a powerful impact on markets of very different sizes and structures throughout the world, in both the short and long run planning horizons (Zuliu, 1995).

These relativities in market movements are deeply rooted in volatility coupling or decoupling. Rajni and Mahendra (2007) argue that country volatility difference is the main investment diversification as well as decision factor. The authors agree that in a particular country context, it may impair the smooth functioning of the financial system and adversely affect economic performance.

Stock market volatility also has a number of other negative implications. One of the ways in which it affects the economy is through its effect on consumer spending (Campbell, 1996; Starr-McCluer, 1998; Ludvigson and Steindel 1999 and Poterba 2000).
The impact of stock market volatility on consumer spending is related via the wealth effect. Increased wealth will drive up consumer spending.

A fall in stock market will conversely weaken consumer confidence and thus drive down consumer spending (Rajni & and Mahendra, 2007).

Stock market volatility may also affect business investment (Zuliu, 1995) and economic growth directly (Levine and Zervos, 1996 and Arestis et al 2001) because a rise in it can be interpreted as a rise in risk of equity investment and thus a shift of funds to less risky assets. This move could lead to a rise in cost of funds to firms and thus new firms might bear this effect as investors will turn to purchase of stock in larger, well known firms. Stock market volatility clustering here becomes a critical investment decision ingredient, as investing in portfolios with similar volatility characteristics will lead to prolonged scary times especially on co-movement price downswings.

Besides the volatility of an individual market's stocks, the study of the comovements between asset markets is a central issue in finance as it has important practical implications in asset allocation and risk management. Since the seminal work of Grubel (1968) on the benefits of international portfolio diversification (see also, Levy and Sarnat (1979) and Agmon (1972)), this topic has received special attention in international finance. According to Rua and Nunes (2009), the study of the comovement of stock market returns is crucial for risk assessment of portfolios. A higher comovement among the assets of a given portfolio implies lower gains, in terms of risk management, stemming from portfolio diversification. Accordingly, the evaluation of the comovement is of prominent importance to the investor so that he can best assess the risk of a portfolio.

1.1.1 Modern portfolio theory and diversification

The fundamental concept behind the Harry Markowitz's (1959) Modern Portfolio Theory (MPT) is that the assets in an investment portfolio should not be selected individually, each on their own merits.

Rather, it is important to consider how each asset changes in price relative to how every other asset in the portfolio changes in price.

The theory has important implications on all sorts of assets, including those in the capital markets and in the latter context it refers to the fact that stock market indexes should be inclusive of the market portfolios.

Empirically, investing is a tradeoff between risk and expected return whereby assets with higher expected returns are riskier (See Mala and Mahendra, 2007). For a given amount of risk therefore, MPT describes how to select a portfolio with the highest possible expected return, or, for a given expected return, MPT explains how to select a portfolio with the lowest possible risk (the targeted expected return cannot be more than the highest-returning available security. This therefore means that MPT is a form of diversification, since under certain assumptions and for specific quantitative definitions of risk and return; it explains how to find the best possible diversification strategy.

MPT assumes that investors are risk averse, meaning that given two portfolios that offer the same expected return, investors will prefer the less risky one. Thus, an investor will take on increased risk only if compensated by higher expected returns. Conversely, an investor who wants higher expected returns must accept more risk. The exact trade-off will be the same for all investors, but different investors will evaluate the trade-off differently based on individual risk aversion characteristics. The implication is that a rational investor will not invest in a portfolio if a second portfolio exists with a more favorable risk-expected return profile – i.e., if for that level of risk an alternative portfolio exists that has better expected returns (Markowitz 1959; Brooks and Del Negro, 2005).

Using the rudiments of the MPT (Modi and Patel, 2010), an investor can reduce portfolio risk simply by holding combinations of instruments that are not perfectly positively correlated (correlation coefficient $-1 \leq \rho_{ij} \leq 1$). In other words, investors can reduce their exposure to individual asset risk by holding a diversified portfolio of assets. Diversification may allow for the same portfolio expected return with reduced risk.

This thought is found throughout literary works dealing with portfolio theory (for instance, Edwin and Gruber, 1997; Krainer, 2002).

1.1.2 Regionalism and stock market investment benefit

Another critical determinant of stock market contagion or divergence is regionalization, the subset of globalization. Regionalism has been prominent since the end of the World War II. According to Moshirian (1998), the Round Table Negotiations in 1986 have facilitated free trade in the services sector, especially in financial services worldwide. The social, economic and technological changes during this post-war period have transformed the trend of nationalism to that of regionalism. Regional economic groupings have since the World War II been instituted, beginning with Europe-the European Union, North American Free Trade Association (NAFTA), Asian Pacific Economic Cooperation (APEC) as the pioneers, based on the signing up of common customs union agreement (Esin, 2004) and East African Customs Union (EACU).

Besides customs agreements, globalization has been fostered by other social economic and technological factors, also affecting the regionalization of financial markets. According to Esin (2004), globalization of financial markets is as a result of competition among them, international differences in savings rates, investment opportunities and international trade imbalance. Moshirian (1998) further argues that the most important factor contributing to the trend of globalization is the one based on the principle of modern portfolio theory, which states that a portion of the risk in any investment can be reduced through diversification.

Globalization allows investors all over the world to diversify their holdings internationally, thereby making it possible to hold portfolios with a systematic risk level that is usually lower than the home country's. Since globalization is a superset of regionalism, it facilitates the opening of both international and regional or domestic markets. East African Community with which Kenya has social, economic and political relations is the focal point of this study.

Globally, recent times have witnessed the integration of trading systems, central depositories and settlement systems and horizontal mergers of stock exchanges and clearance systems. The result is improved trade volumes. This unified operation of Bourses is not universal. In some regions, integration of stock markets is replete with its own setbacks: Calvacanti et al. (2005) for example aver that some European stock markets remain detached from regional groupings, principally due to unbridged regulatory and supervisory gaps.

Other barriers to cross-border securities trading include differences in technical requirements and market practices, tax differences and legal certainty concerns, pointing to possible differences in trade volumes and index disparities across the region.

In the Americas, the integration story is two-faceted (Yarde, 2007): The United States of America (USA) -the only perfect integration case in the world- has a common regulator, the Securities Exchange Commission (SEC), one currency and one regional stock exchange, the New York Stock Exchange (NYSE). Accordingly, Anders (2007) deems it to be the world's most liquid and most efficient regional Bourse. With the recent merger with Europe's Transatlantic Alliance to form the NYSE Euronext, the system is cambered with outline corruption and clamour to national sovereignty (Zwaniecki,2007) although no mention is available, of the trading and diversification statistics.

In contrast to the USA, the Caribbean stock exchanges of Bahamas, Barbados, Eastern Caribbea, Guyana, Jamaica, and Suriname; Trinidad and Tobago, have a total of 139 companies. Theirs is only a centrally networked model- with no common trading platform, regional stock exchange, and cross-listing or harmonized trading rules (Yarde, 2007). This leaves open the possibility of divergent market movements and the analysis diversification benefit is the sole responsibility of the investors.

The experience of Africa and Asia are also typical of those of Southern America and Europe on some grounds.

The case of Asia is that of vibrant Bourses and disharmony at regional level (Suleiman, 2007), occasioning the predominance of individual stock market autonomy and by extension, different performances.

For Africa, the lack of a common operational framework and a unified currency also brings up the hurdles to unified regional blocking as far as financial markets are concerned. Countries within the South African Customs Union (SACCU): Namibia, Botswana and South Africa, there are still challenges to surmount, the major one being import tariffs and lack of a common depository.

Elsewhere, despite the formation of a monetary union, a common central bank and a regional Bourse (Asea,2003), the francophone west African states operate a central Bourse where prices are fixed every day and trading occurs thrice a week, while the individual markets are not merged.

East Africa in its integration endeavour has its own background. The installation (on 29th February 2004), of the East African customs Union (EACU) was the first attempt to integrate the region's financial sectors. EACU became operational on March 2; 2004.This study uses February 29, 2004 as the integration breakpoint, the common customs union operationalization date.

According to Yabara (2012), Capital markets in the East African Community (EAC) have hitherto faced common challenges of low capitalization and illiquidity, but to different degrees. EAC member countries have made noticeable progress in developing domestic capital markets through a regional approach, removing constraints on capital transactions and harmonizing market infrastructure.

Conversely, empirical analysis suggests capital market integration has not deepened during the past few years to (2012) in the EAC, although convergence of investment returns is taking place to some extent. Several investment decision determinants mar the integration effort, or should be addressed before one can talk of a regional financial bloc.

These, as earlier on delineated by Goldstein and Ndungu (2001) are policy convergence, cross-border joint production, liberalization of origin of commodities, similarity of monetary policies and information communication technology. The foregoing sentiments are partially echoed by Yabara (2012) who cites the progress motivators as strengthening of infrastructure, harmonizing markets, strengthening regional surveillance mechanisms, encouraging local currency bond issuance by multilateral financial institutions; and building the capacity of the existing regional institutions.

As of 2007 (yartey and Komla, 2007),the East African Member states Securities Regulatory Authority had only set up under the memorandum of understanding between Kenya, Tanzania and Uganda seeking to promote integration amongst East African exchanges. Only Kenya and Uganda have harmonized trading rules, and the markets are dissimilar in performance when it comes to trading.

These literary works suggest that the regional bloc is far from being fully financially integrated and hence difficulties in unifying the stock market operations is are abundant, rendering differential market returns usual. The idea is emphasized by the UNCTAD report (2012), that although to some degree it is possible to examine patterns of FDI in light of regional integration efforts, it is extremely difficult to establish causality. It is evident that a range of factors beyond the formation of regional blocs affect FDI.

It implies that following the signing of the EAC treaty in 2000 and the institution of the East African Customs Union in 2004, there has been some cross-country investment (just as before). The pattern of these investments is not clearly traceable to the integration effort (although the converse cannot be ruled out). Going by this situation, neither is perfect market comovement certain, nor is complete market ambivalence definite.

1.2 Statement of the Research Problem

While Mwenda (2002) subscribe to a positive relationship between integration and growth in capital flows at national stock markets and Kadri (2005) affirms that integration promotes intra-regional trade, the level of systematic risk and its direction of adjustment with increased integration remain unclear.

Investment diversification is important in that it reduces the level of systematic risk incidental to a portfolio. A low country risk means that asset price fluctuations from the average are low, translating to a low probability of investment value loss. The investment loss reduction effect is only possible if the inter-country price movements of the assets in question have a non-positive correlation structure. While East African investors would like to invest intra-regionally, the systematic risk reduction benefit of cross-country investment diversification is not established. Accordingly, it is difficult for these investors to determine whether diversifying among these markets would lower or increase the portfolio risk amid economic shocks and over time. This market knowledge gap is a business problem because through it, uninformed investors will make sub-optimal investment decisions and lose potential diversification benefits. Moreover, prolonged downside market trends in highly co-movement markets will make investors hold portfolios for long because of the only option of selling at losses.

The study was therefore critical in that it analyzed the degree of stock mart index co-movement among the East African economies with or without shocks and in the long run, with the objective of offering better international investment diversification advice for the EAC investors.

1.3 Research Objectives

This study sought to analyze the effect of East African integration on portfolio systematic risk diversification, on the East African stock markets.

The specific objectives of the study were as follows:

1. To know the index correlation structure of the East African stock exchanges prior to the integration breakpoint.
2. To know the index correlation structure of the East African stock exchanges across the integration breakpoint.
3. To study the contagion nature of the East African stock indexes across the integration breakpoint.

4. To determine the cointegration pattern of the East African stock exchange indexes.
5. To suggest recommendations for enhancing investment diversification benefit in the East African stock markets.

1.4 Research Questions

The specific questions that this research attempted to answer were:

1. What is the index correlation structure of the East African stock exchanges prior to the integration breakpoint?
2. What is the index correlation structure of the East African stock exchanges across the integration breakpoint?
3. What is the contagion nature of the East African stock indexes across the integration breakpoint?
4. What is the cointegration pattern of the East African stock exchange indexes?
5. What recommendations are appropriate for enhancing investment diversification benefits in East African stock markets?

1.5 Significance of the Study

This study is justified on a number of grounds: To the investors intending to diversify their portfolio risk, it will produce advice on the benefit of investing intra-regionally. To the scholars, it is an addition to the body of knowledge. It will also serve as a basis for further research in finance and economics. Based on the findings, EAC regional planners will be able to evaluate the progress of the East African integration effort, thereby enhancing their plans of action.

1.6 Scope and Limitations of the Study

This study was limited to the instatement of the EAC customs union as the breakpoint. It covers only a period of eight years and four months, defined by the pre-integration and post-integration sub-periods, each lasting fifty months.

The study only covers the stock markets of Kenya, Uganda and Tanzania since the others in the region were either being installed or had not operated for all the period covered by the research. It used secondary data: the trading price lists.

The study did not cover the bonds market as it was focused on the common stock retail investment. It also did not touch on the significance of the statistics and descriptive coefficients of relationship, as it was basic.

There were five major limitations envisaged by the study: First was the difficulty in the access to valid and reliable data. To counter this, the researcher wrote a letter of introduction to the stock market authorities of Uganda and Tanzania, who were in turn expected to give the data from their official records. The second limitation was in the form of inter-country differences in the official index base periods (NSE-1966, USE-2007; DSE-2007), which was countered by the analysis of the data using pair-wise correlations, cointegration and regression which are measures of association between variables. Thirdly, the number of each market's member-companies was not constant over the sample time period, due to delisting, suspension from trading and new listings. This has the effect of over or understating the price index.

The problem was dealt with by using an average price for each market with the presumption that each of these markets was one investment basket. The average price was the result of dividing the trade volume by the number of shares dealt, for each time point. Fourthly, the index construction formulae were not uniform in all the markets, hence comparing them would yield meaningless results. This problem was solved by applying the Paasche's formula to calculate an index series for each market, as is elaborated under data processing in chapter three.

Finally, the official index for Nairobi Securities Exchange was not an all-share index, over the sample period, contrary to the other two.

This has the effect of nullifying the comparison grounds. This problem was tackled by basing the index on all companies for each stock market.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

The search for a correlation structure among stock exchanges following important breakpoints has become popular among scholars after the 1987 crash of the US stock markets. Moreover, the issue of international co-movement of stock exchange indices has become a leading issue, in an endeavour to establish the effect of economic, social and political intra-regional disturbances and the shock transmission mechanisms.

Following the 1997 Asian crisis, two forms of studies have emerged. The first group of studies has sought to subdivide the sample period into two sub-periods on the basis of a given breakpoint in order to examine the relationships among different national stock indices and focus on the transmission mechanisms of shocks. The second group of studies is more inclined to stock market dependencies with shocks and breakpoints but across countries in different economic blocks and inter-regional relationships. Both groups use similar tools in their analyses-correlation and regression. Although this study is devoted to co-movement of economies in general, much of the attention is inclined to the first group of studies-to seek to understand intra-regional mechanism of shock transmission and cointegration. There are thus two contexts under the study:-to seek to understand the transmission mechanisms before and after disturbances, and to establish long run market correlations.

2.2 Studies Analyzing Market Co-movements

In seeking to establish the relationships among indices, Hilliard (1979) used the OPEC embargo announced in October 1973 as a crisis date. Hilliard examined international equity indices on a sample period from July 1973 to April 30, 1974 using daily closing prices of ten world exchanges:-Amsterdam, Paris, London, Milan, Frankfurt, New York, Sydney, Tokyo, Toronto and Zurich. Using the statistics of auto spectrum, coherence, phase angle and tan, the results yielded some close relationships among markets.

Some pairs of markets showed high while others showed low coherence, but there was no common financial factor, since the embargo did not show more coupling among countries. The study concluded that intra-continental prices tend to move together but inter-continental ones do not necessarily follow the trend.

Later studies on intra-continental correlations were done by Eun and shim (1989), with the objective of investigating the nature of international transmission of stock index movements. Using VAR analysis, they sought to find out how much of the movements in one market can be explained by innovations in other markets, whether the US market influenced or was influenced by other markets, and how rapidly the price movements in one market transmitted to other markets. With the sample period 1979 to 1985, they applied the index data series of nine sample markets of Australia, Canada, France, Switzerland, Germany, Hong Kong, Japan, UK and US, with the lag length of 15 trading days for VAR analysis. The correlation results revealed that, in general the intra-regional pair-wise correlations tended to be higher than inter-regional correlations. Specifically the correlations for the US and Canada were the highest, followed by those of Germany and Switzerland whereas those for Canada with France and France with Hong Kong were close to zero. On the dynamism of the response pattern dimension, inter-continental responses were slow and took up to two days but intra-continental ones took effect, at most within a day.

The high intra-regional response tendency is also found in the works of Cheung and Mak (1992). Purposed to examine the causal relationship between the US, the Asia-pacific and the Japanese markets, they sampled 8 countries namely Australia, China, Korea, Malaysia, Philippines, Singapore, Taiwan and Thailand, for the period 1977-1988. The data used were stock returns computed as logarithmic price relatives using weekly price indices from each market. The methods of analysis used were autocorrelations, partial correlations and inverse autocorrelations in order to identify the ARIMA model of each return series.

They checked the model specification accuracy using the Box-Pierce Q-statistic. They further used the pre-whitened return series of the US as the input series and the output series as the other markets' series.

The results indicated that where there were strong restrictions on foreign investment, the countries tended to have low correlations with other regional partners and global factors were more influential to market correlations – in which situation there was potential for international arbitrage due to the lack of quick response between the markets.

2.3 Studies on Sub-period Market Correlations

In an endeavour to provide evidence on the changing patterns of cross-market correlatins in the 1980's, Brocato (1984) investigated the correlation structures among six markets (US, UK, Canada, Japan, West Germany and Hong Kong) on two sub-periods between 1980 and 1987. He examined the weekly value-weighted daily index levels using March 1984 as the breakpoint, in order to run sub-period VAR tests. In this analysis, Brocato found out that sub-period market correlations were low for most cases. The US and Canada had high first sub-period correlations but the correlations declined in the second sub-period except with Japan and West Germany. Moreover, Japan's negative correlation with the US and Canada was reversed in the second sub-period. By this analysis then, each market explained its own variability except for Canada. The results further revealed a decline in the dominance of the US on other markets in the second sub-period. While the US, UK and Hong Kong's linkages declined in the second sub-period, Canada, Japan and West Germany showed increased interdependence over the said time period.

Knif et al. (1996), also employing several crashes in their study analyzed the 1920 to 1993 monthly index returns of Helsinki and Stockholm markets and came up with the conclusion that if two markets have a common feature, one can use past information from one market to predict the other, the common feature being an indication of integration. This observation contradicts the one of changing sub-period interdependence noted earlier in this chapter.

Further studies by Karolyi and Stulz (1996) were carried out to determine the effect of macroeconomic announcements on correlation structures across countries. They used daily and intra-day stock index returns' co-movements on Japanese and US stock markets.

The study classified macroeconomic shocks into three: - global, competitive and idiosyncratic. The results of this study showed that there was variation in correlation across days but no systematic pattern in correlation between days during which the announcements came and days without announcements. The study further concluded that macroeconomic announcements and interest rate shocks had no effect on co-movements.

A later study by Kanas (1998) also using the 1987 crash as a breakpoint examined the US and European equity markets. He tested pair-wise correlations on the six largest European markets (UK, Germany, Italy, France, Switzerland and Netherlands). Using multi-war rate trace statistic, Johansen approach and Breren's test, he analyzed the daily closing stock prices for 1983 to 1996, the results revealed no pair-wise cointegration between the US and European markets. He further applied October 1987 as a breakpoint and the results were the same. By the Johansen method based on VAR analysis there was no pair-wise cointegration before and after the crash. Finally, Breren's non-cointegration test confirmed the absence of pair-wise correlation between the US and European markets, an essential condition for gaining in risk reduction through portfolio diversification.

Another study finding increasing correlations in a regional context is the one by Meric et al. (2001), in their analysis of the stock markets of Brazil, Argentina, Chile, Mexico and the US. The breakpoint applied was the 1987 crash in the US stock markets. They got three sub-periods: 1984-1987 (markets closed to foreign investors), 1987-1991 (markets open to foreign investors, with some regulatory changes); 1991-1995 (large portfolio inflows observed in those emerging markets).

In the study, correlations were found to be increasing between sample markets during the sample period, reducing the benefits of international investment diversification. There was also benefit from investing in a well-diversified domestic portfolio.

2.4 Studies Not Involving Breakpoints

As opposed to the first group of studies, the second does not use breakpoints in the analysis of correlations. It evaluates the correlation structure throughout the whole period of sample years. Prominently, correlation and regression analysis are employed.

One of the earliest studies in the second group was conducted by Christofi and Christofi (1983). On a sample of common stock monthly market price averages of 1959 to 1978, they examined fourteen industrial countries for annual and biennial correlation coefficients of the US with each of the countries. Box-Jenkins tests were conducted and non-parametric tests for annual correlations constructed, then the coefficients examined by dividing the twenty years into two sub-periods, as fixed exchange rate environment and flexible exchange rate environments. The results revealed that the inter-country correlation coefficients remained the same over the sub-period years examined. The study further used the principal components analysis for the same period and two equal sub-periods and concluded that the national stock market indices of the 14 sample countries were interrelated through a common factor whose effect appeared to be consistent over time. It was therefore not possible to benefit from international investment diversification.

In Mathur and Subrahmanyam (1990), a study on the Nordic and US market correlations yielded the results that there were high interdependencies among countries which had high economic interdependency. VAR analysis results indicated that the US market was only influential on Denmark and not any other market hence a replica of the proposition that each market is responsible for own its behaviour.

Roll (1992) argues that stock indices in different countries generally exhibit disparate behaviour, principally due to differences in index construction procedures, industry composition of individual nations and the effect of exchange rates. Using the 1988-1991 time range, he examines the equity prices of 24 countries and presents correlation coefficients computed from daily dollar-denominated returns. The results give correlation levels of below 0.5 (low) for most (276) of the 326 coefficients obtained. Roll went on to calculate correlations from the industry perspective and found them to be different (generally higher) from those computed using raw stock price indices. The conclusion was then, that countries with similar industrial structures had highly correlated markets yet the importance of regional characteristics should not be overlooked.

Corhay and Urbain (1993) disputed the use of correlations arguing that the transformation of a non-stationary process to a stationary one may lose some long run components. They opted to use cointegration or common stochastic trends when the series are stationary, in order to examine whether stock prices of two or more countries move together. They used weekly stock price indices from France, Germany, Italy, Netherlands and the UK for the period March 1975 to September 1991. The authors concluded that cointegration analysis could be used for finding the links between stock markets and the results were the same for all the other European stock markets.

King et al. (1994) attempted to assess the impact of economic variables on the changes in co-movements among stock markets. The study focused on whether the existing co-movement was changing, instead of focusing on the determination of the presence of a co-movement. In their work, they included the economic factors of short-term interest rate, long-term interest rate, dollar/yen exchange rate, dollar/deustche mark exchange rate, industrial production, inflation, US trade account, real money supply, oil price and commodity prices. They examined seventeen world stock markets and tested the contribution of allowable economic factors to variation in conditional covariance.

The study found that the observable economic variables could only explain a small proportion of co-movement between national stock exchanges and their time variation in covariance. The result suggests that unobservable factors may increase co-movements and when volatility of these factors increases, markets show greater inter-correlation. In addition, although it is expected that national stock markets are moving more closely as a result of globalization, the study was unable to find strong evidence to support this idea (Esin, 2004).

Further studies by Erb et al. (1994) found that correlations among the G-7 countries were affected by the business cycle, whereby the correlation was high during recession and low during recovery. They further noted that these correlations were not symmetric in up and down markets.

Another study was conducted by Esin (2004) to examine the effect of economic integration among Turkish and European stock exchanges, seeking to establish the suitability of international portfolio diversification. Similar to the other writers in this review, the researcher used correlation and cointegration techniques, preceded by unit root tests. The study worked on a sample of fifteen EU member-countries and Turkey. He collected both country and continental market index series over the time period 1990-2003 and did the analysis at 1 percent significance level. For stationarity, he administered the unit root test, with the null hypothesis that the series were stationary. The results were a rejection of the null hypothesis implying non-stationarity in their level form, hence no basis of cointegration tests.

Following the rejection, Esin applied the KPSS (1992) formula of first differencing and detected the presence of first difference stationarity for the sub-periods under the study. He found the series to be integrated of the same order and hence it was possible to conduct cointegration tests on them. Esin went to the second step of analysis and this included the test for correlation using the introduction of the Euro as the breakpoint.

The results were that correlations were more synchronized during the post-Euro sub-period than the time period before.

The last step of the data analysis involved cointegration tests with the aim of detecting the presence of long-term relationships among the markets. Esin administered the Johansen cointegration test with the null hypothesis that there was no cointegration among the market index series under study. For model specification, he applied the Final Prediction Error (FPE) and the Akaike Information Criterion (AIC) which both yielded the same lag length. The results were that countries in the same economic bloc had no pair-wise cointegration with regard to the customs union but there was intra-country long-term market relationship.

2.5 Chapter Summary and Research Opportunity

The foregoing literature has highlighted on the benefits of economic, social and political integration both to intra-regional and inter-regional participants. The majority of the studies have been centered on the intra-continent effects of social, economic and political disturbances, as the breakpoints for their analyses.

Market co-movements have also been considered, both with the breakpoints (Hilliard, 1979), and without them (Eun and Shim, 1989). These yielded different analysis results depending on the research-contextual factors.

Other studies only concerned themselves with the interference of country–contextual factors on inter-country index correlations, some in the long run (Corhay and Urbain, 1993) and others in the short run (King et al., 1994). These studies yielded different results for decisions regarding investment portfolio diversification. Besides, they were conducted in countries and continents different from Africa in terms of economic development. They thus lacked an African context hence are not necessarily useful to the EAC economic bloc. Intra-country market co-movement in the short-run was both asserted (Meric et al., 2001), and refuted (Mathur and Subrahmanyam, 1990).

In addition, there was a general concern on the results of intercontinental analysis, with some continents affecting others' markets and others not doing so.
On the cointegration dimension, Corhay and Urbain (1993) advanced the argument that there existed long run stochastic trends among the markets they studied in Europe and the findings were supported by those of Roll (1992) and Esin (2004).

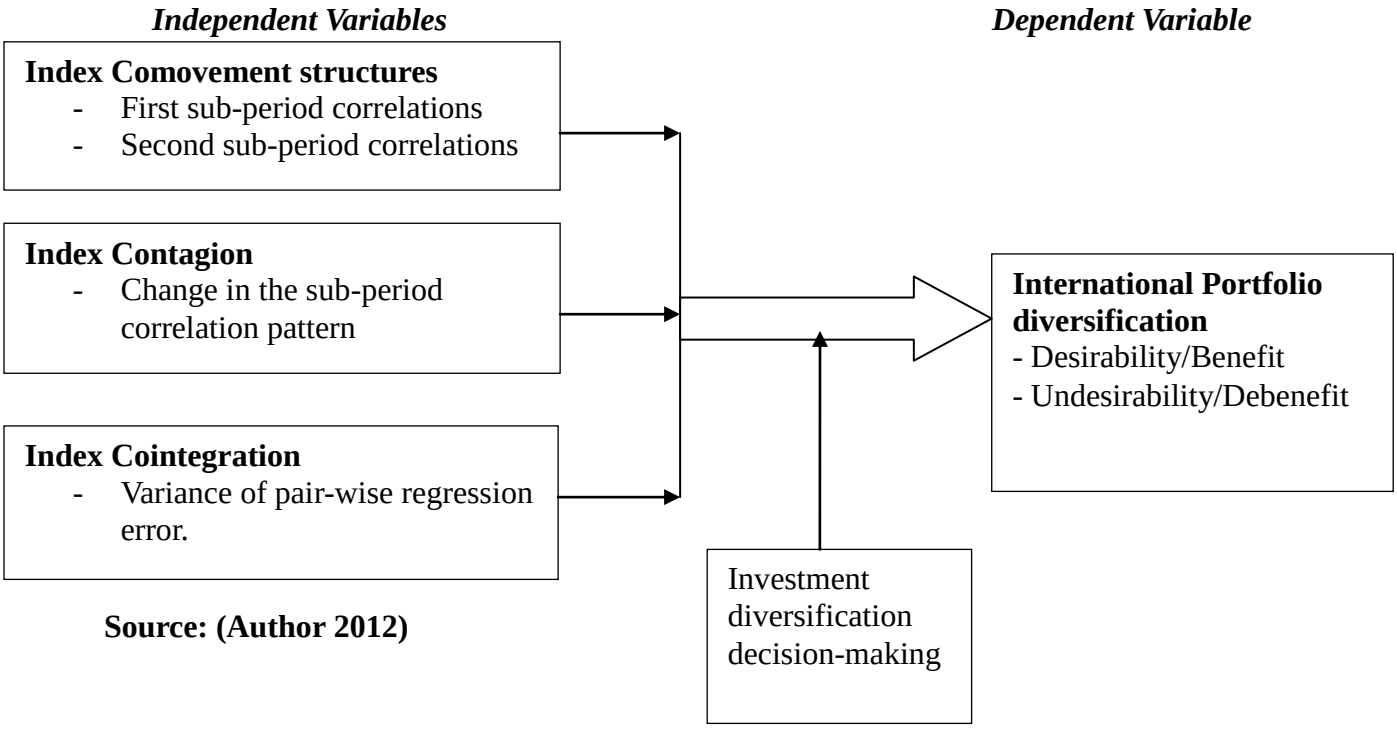
The review first found that all the studies gave a variety of analysis results on stock market dependency, contagion and cointegration. Secondly, much attention was devoted to the developed markets and in continents different from Africa in many economic aspects and hence none of the economic blocs has exactly the same economic environment as the EAC. The essence of this research is hence to contextualize the analyses to an African bloc, particularly to carry out similar analyses on the three stock exchanges of Nairobi (Kenya), Dar-es-salaam (Tanzania) and Uganda (Uganda).
Once achieved, this will be useful in documenting any deviations from the findings about the developed world.

2.6 Conceptual Framework

A conceptual framework is a model in which descriptive categories are systematically placed in a broad structure of explicit propositions (statements of relationship between two or more empirical properties), to be accepted or rejected (Chava et al., 2005).

The proposed conceptual framework includes the factors for consideration regarding the markets under analysis into a decision regarding stock market investment portfolio diversification. These factors, as highlighted in the entire review touch on the questions of stock market co-movement, shock transmission mechanism or contagion and long-term inter-market relationships, otherwise known as cointegration. This framework is presented in the ensuing figure.

Figure 2.6 Conceptual Framework Diagram



Source: (Author 2012)

In the foregoing conceptual framework, the dependent variable, the benefit of international stock mart portfolio diversification benefit is the dependent variable, affected by three independent variables with the investment diversification decision-making intervening. Each of the three independent variables singly or jointly affects the diversification of investment in the stock markets in terms of the presence or absence of diversification benefit.

In this research, index co-movement pattern was measured using the Karl Pearson's coefficient of simple correlation of the index series in pairs, both before and after the integration breakpoint (sub-period correlations).In both sub-periods, a high correlation coefficient (0.5 and greater) meant that the index pairs were highly co-movement occasioning a diversification debenefit. Accordingly, the greater a positive correlation coefficient the lower the diversification benefit and, the lower a negative correlation coefficient, the higher the investment diversification benefit.

The second independent variable was the contagion pattern. Index contagion was measured across the integration breakpoint by the uniformity of change in the Pearson's (Product Moment) correlation coefficients. In part, the reversal of the correlation sign for a pair of indexes meant there was an increase in the desirability of investment diversification signifying some response to the integration breakpoint event. To other index pairs, this reversal of correlation signs meant obliteration of the investment diversification suitability. The situation in this study was that of no contagion.

The third independent variable was co-integration, which was measured by the variance of the regression error on the first-differenced index pairs. Co-integration affects investment diversification in a similar way to contagion. For co-integrated index pairs, it implies that the index pairs in questions share a common data generating process and hence long run comovement, wiping away the investment diversification benefit.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter is a prelude to the analysis and findings of this research. It contains the research design, target population, data collection and summary procedures and the data analysis sections.

3.2 Research Design

No single research design is entirely applicable for a whole study (Kothari, 2004). A mixture or interaction of research designs was therefore involved. This study used a longitudinal approach where data for the same time point (for example a month) over a given time period related to the variables under study was considered.

Further, the study was weekly experimental of the no-control group sub-design in that it did not have a separate set of sub-periods to be tested for co-movement, contagion and co-integration. This lack of control gives the research the property of being a weak experiment (Cooper and Schindler, 2006). It is also an evaluation research, seeking in a way, to assess the effect of intergovernmental efforts to the improvement portfolio management and performance in the region's bourses. Other minor sub-designs are also involved but are not crucial to mention.

3.3 Target Population

The target population of the study consisted of all equity investors of the countries involved in the East Africa, namely Kenya, Uganda and Tanzania as per the geographical scope of the research. The research also targeted all those other investors with investment interests in East African stock markets.

3.4 Geographical Study Area

The study was conducted on the Nairobi Stock Exchange (NSE) in Kenya, the Dar-es-salaam Stock Exchange (DSE) in Tanzania and the Uganda Securities Exchange (USE).

The reason for the choice of the three markets is the fact at the study time, the other stock markets of the economic bloc (Rwanda, Burundi and Southern Sudan) were too young to have been in vibrant existence over the sample period.

A total population of all the listed companies per stock market per month was studied over a sample time period of 100 months, with pair-wise deletions where the data was not Missing Completely at Random (NMCAR). The number of these companies was sixty-five as at March 31st 2008, as recorded on the daily price lists in appendix A, obtained from the stock market offices during the data collection stage and on the individual exchange websites.

3.5 Modeling

3.5.1 Theoretical model

This study adopted a theoretical model based on the Modern Portfolio Theory (MPT), in which a portfolio was taken as the equity stocks in one Bourse. Here, a retail investor was taken as being capable of investing one portion of their wealth, $\mathbf{W_1}$, in portfolio 1 (Stock market 1) whose expected return is $\mathbf{E(R_1)}$; and the second part of the wealth, **W2** in portfolio (or stock market 2), with an expected return of $\mathbf{E(R_2)}$.Due to country contextual factors, the investor seeks to rationally divide all the available diversifiable wealth **W:**

$\mathbf{W = W_1+W_2}$ at a time. Going by the MPT, the investors are assumed to have different risk-return appetites, so that the portfolio risk-return profiles are not necessarily congruent.

Since the basic assumption underlying the MPT is that investors are risk averse, it proper to say that given two portfolios that offer the same expected return, investors will prefer the less risky one.

Thus, an investor will take on increased risk only if compensated by higher expected returns. Conversely, an investor who wants higher expected returns must accept more risk.

The exact trade-off will be the same for all investors, but different investors will evaluate the trade-off differently based on individual risk aversion characteristics. The implication is that a rational investor will not invest in a portfolio if a second portfolio exists with a more favorable risk-expected return profile – that is, if for that level of risk an alternative portfolio exists that has better expected returns.

What this means is that the investor would want to see to it that the expected returns on the two-portfolio wealth, are maximized, by seeking to maximize $\mathbf{E(R_p) = W_1E(R_1)+W_2E(R_2)}$, where $W_1+W_2 =1$, such that $W_1= (1-W_2)$ or $W_2 = (1- W_1)$

As long as the region's financial markets are undergoing integration, there are stock market volatility differences, occasioning varying portfolio risk differences. The differences will wane at the stage of perfect integration and the dominance be taken by one price. This study uses the standard deviation of return as a proxy for risk, which is valid if asset returns are jointly normally distributed or otherwise elliptically distributed.

According to the model, the individual stock market portfolio risk is given by $\delta_p = \sqrt{(\delta^2_p)}$. If for two portfolios, p_1 and p_2 the volatility is not the same, the investor would have scope for benefitting by diversifying because this means that the two portfolios are different, and not moving in tandem, largely due to dissimilar economic environment. The converse is a case of full integration where there is no scope for diversification of investment. In pursuit of this principle, the retail investor would reduce portfolio risk simply by holding combinations of country portfolios that are not perfectly positively correlated (with correlation coefficient $-1<\rho<+1$).This is the basis of diversification decision for research objectives 1 to 4.

3.5.2 Empirical model

In the context of this study, investment diversification ($\mathbf{I_d}$) was used as the dependent variable, proxied by the presence of diversification benefit or debenefit, so that in the absence of benefit, the investor could not diversify wealth.

On the other hand, the presence of diversification benefit was influenced by the level of financial integration ($\mathbf{I_f}$), of the East African countries hosting the two stock markets considered for investment. This integration level was proxied by sub-period market correlation of index pairs (ρij),sub-period correlation contagion and cointegration status of the index pair such that in a situation of full financial integration, the market pair under consideration would be perfectly positively correlated in both sub-periods (and thus the cross-period index comovement would be perfect) while the market index pair would be cointegrated.

Algebraically, $\mathbf{I_d} = f(\mathbf{I_f})$……1

Where $\mathbf{I_d}$ is a dummy variable representing only two status: That of diversification and that of no diversification. This means that $\mathbf{I_d}$ is basically a change of investment status, measured by (one) full willingness to diversify or none (zero willingness).

On the side of the independent variable, $\mathbf{I_f}$ was measured in terms of a tripod of bivariate descriptive measurements. The extent of market comovement was measured using the Pearson's (or Product Moment) correlation coefficient featured in the research methodology. The sub-period correlation between market **i** and **j** indexes was denoted by $\boldsymbol{\rho_{ij}}$, the cross-period index contagion was measured using the correlation difference $\Delta\ \boldsymbol{\rho_{ij}}$, while cointgration was measured by means of the white noise variance of the regressed index pair, $[\partial_{ij}^2(\boldsymbol{\mu_{1(t)} - \mu_{1(t-1)}})]$. These measures are provided in equation 2:

$\mathbf{I_f} = f(\boldsymbol{\rho_{ij}}, \Delta\ \boldsymbol{\rho_{ij}}, [\partial_{ij}^2(\boldsymbol{\mu_{1(t)} - \mu_{1(t-1)}})])$……2

The empirical model used in the analysis of the stock mart index data hence combined equations 1 and two to address the study objectives in equation 3 as follows:

$\mathbf{I_d} = f(\boldsymbol{\rho_{ij}}, \Delta\ \boldsymbol{\rho_{ij}}, [\partial_{ij}^2(\boldsymbol{\mu_{1(t)} - \mu_{1(t-1)}})])$……3

3.6 Data Collection and Processing Procedures

From each market, the researcher tabulated a secondary panel data series into the MS Excel spreadsheet. The data was provided by the stock exchange research executives themselves. No prior appointments were required as the data was readily available.

Each series contained the average share price, and volumes transacted for all the listed companies, for each month. The time series covered one hundred months between January 1, 2000 and April 30, 2008, both months inclusive, subject to the availability of records. The monthly data for all companies in each market were then tabulated in average price, quantity (transaction volume) and aggregate categories as needed for input in the Paasche's index:

$I = (\sum (P_1Q_1)/ \sum (P_0Q_1))* 100$: where P_0 and P_1 are the respectively the base period and current average prices, Q_0 and Q1 are the respective quantities; I is the index symbol. According to Satyadevi (2006) the formula is price-relative and eliminates the effects of varying quantities in the data series, hence its application in this research.

The researcher personally traveled to the markets to collect the data and did the aggregation by means of the Excel software. The series thus obtained were the inputs for the data analysis.

Where data was missing but 'Not Missing Completely At random' (NMCAR)-as in the case of Nairobi Securities Exchange and Dar-es-Salaam Stock Exchange, the researcher applied pair-wise case deletion in the markets being compared.

This is the universal technique, as provided in the works of Cooper and Schindler (2006), who explicate that this deletion does not have significant effects on research findings.

3.7 Data Analysis

The analysis in this study borrowed from the works of different writers in the whole of the literature review:-from Esin (2004), Eun and Shim (1989), Brocato (1994), Stulz (1996) Cheung and Mak (1992), Kanas (1998), Erb (1994), Meric et al. (2001) and Roll (1992).

The methodology subsumed three specific data processing techniques:

a) Comovement analysis (Pre-and post-breakpoint correlations).
b) Contagion analysis (Pre-and post breakpoint correlation differencing)
c) Cointegration analysis (to study long run dependency).

3.7.1 Correlation analysis

This analysis tests the tendency of two variables to move together by **ρ**, the Pearson's (or Product Moment) correlation coefficient. The correlation coefficient of two series of data, X and Y is given by the formula:

$$\boldsymbol{\rho}_{xy} = \frac{\text{Covariance (x,y)}}{\sqrt{\text{Var (x)}}\sqrt{\text{Var (y)}}} = \frac{\partial_{xy}}{\partial_x \partial_y}$$

and $-1.0 \leq \boldsymbol{\rho} \leq 1.0$ and provided $\boldsymbol{\rho} \neq 0$, any **ρ** value between – 1 and +1 indicates a less-than-perfect correlation. The trivial values of -1 and +1 respectively represent cases of perfect negative and perfect positive correlation.

This study utilized cross-correlations and the possible change in these correlations to achieve the objective of testing the index series between the markets for co-movements and shock transmission mechanisms.

The cross-correlation between series X and Y over two different time periods is denoted as $\boldsymbol{\rho}\, xy_t - \boldsymbol{\rho}\, xy_{t-1}$ for time periods t and (t-1). The hypotheses tested were:

$H_o : \boldsymbol{\rho}\, xy_t - \boldsymbol{\rho}\, xy_{t-1} = 0$

$H_A : \boldsymbol{\rho}\, xy_t - \boldsymbol{\rho}\, xy_{t-1} \neq 0$

If H_0 is rejected, it means that there is a change in the correlation structure with the application of a breakpoint. The sign of change is also material. An increase in ($\boldsymbol{\rho}\, xy_t - \boldsymbol{\rho} xy_{t-1}$) means that there is increased coupling and hence after the breakpoint the benefit of international risk diversification is less desirable.

3.7.2 Cointegration analysis

In order to determine the presence or absence of cointegration, it has to be proved that the index series of the markets in question are integrated of the same order.

First, a stationarity test is necessary, since its results will determine whether or not the processes are nonstationary or not, in their level form (Maddala, 2006).Common methods of stationarity testing include graphical analysis and the examination of the Autocorrelation Function (ACF) and Partial Autocorrelation Function(PACF) (ibid).

In Gujarati and Porter (2009) however, a more recent development is the unit root test. The Authors point out that if a given time series has a unit root, it is nonstationary and the first differences of the random walk process are stationary, that is Integrated of order 1 ((I(1)).This is because the error term of the first-differenced series is purely white noise and is common with all stock prices (ibid). The extension of this position is that if the series are found to be nonstationary (have at a unit root) in their level form, it will be sufficient to say that they are integrated of the same (first) order.

In discussing unit roots: If for a series of stock market indices, the price (P) at time t of a market, i, is such that (P_{it}) is a stationary series, then cointegration can be determined using a single set of realizations on long time series averages.

A stochastic process, which can also be called a random process (P_{it} in this case), is said to be covariance-stationary if the following three conditions are met:

1. $E(P_{it}) = E(P_{t-s}) = \mu$ where μ is constant and (t-s) indicates the time period preceding period t.

   The expected value of the price is hence equal in both time periods and also equal to the mean, which is time-invariant. This means that μ can be used to approximate the mean levels of other time periods.
2. The variance of the price index, ∂^2_p must be time-invariant.

   Thus:

   $E\left[(P_t - \mu)^2\right] = \left[E(P_{t-S} - \mu)^2\right] = \partial^2_p$, and ∂^2_p is constant.

3. The auto-covariances of the price indices must also be time-invariant:

$E[(P_t - \mu)][(P_{t-S} - \mu)] = [E\ P_{t-j} - \mu][P_{t-j-s} - \mu] = \gamma_s$, where γ_s, the auto-covariance coefficient is constant over the different time series: t and (t - s).

A stochastic series meeting the three said conditions is said to be covariance-stationary. For such a series, the autocorrelation between P_t and P_{t-s} can be given by the ratio of γ_s to γ_o. Given a sequence of P_t: (t = 0, 1, 2…n) with mean μ and variance ∂^2, the auto-correlation function or correlogram would be:

$\acute{y}_s = \gamma_s / \gamma_o = E(P_t - \mu)(P_{t-s} - \mu) / \partial^2 : s = 0, 1, 2…T$

$\acute{y}_s$ is time-invariant and covariance–stationary meaning that the mean fluctuates around a constant long run mean and it has a theoretical correlogram that diminishes as the lag length increases.

Unit root tests of stationarity, posited Dickey and Fuller (1979, 1981) and Phillips Peron (1988) often fail to reject the null hypothesis of the existence of a unit root especially when a unit root and a moving average contemporaneously are present in a data series. The two authors recommend the use of the Kwiatkowski, Philips, Schmidt and Shin (KPSS) (1992) test, used to test for the existence of a unit root in the stock index series.

KPSS propose to test the null hypothesis that an observable series is stationary around a deterministic trend.

The series is expressed as the sum of the deterministic trend, a random walk and a stationary error. The hypotheses tested for KPSS are formulated as follows:

Let P_t, for t = 0, 1, 2…T be the series under study. Assuming $P_t = \partial_t + \ddot{y}_t + \acute{\varepsilon}_t$ where, as illustrated earlier on: ∂_t is the deterministic trend, $\ddot{y}_t$ is the random walk and $\acute{\varepsilon}_t$ is the stationary error term.

The term $\ddot{y}_t$ is further decomposed in the following manner:

$\ddot{y}_t = \ddot{y}_{t-1} + \mu_t$, where $\mu_t \sim$ iid $(0, \partial^2_u)$ {Independent and Identically distributed with mean zero and a constant variance}

Based on the decomposition equation for $\ddot{y}_t$, the null and alternative hypotheses for the stationarity are postulated as follows:

H_0: $\partial^2_u = 0$ -That the random walk has a zero variance (there is stationarity)

H_1:$\partial^2_u \neq 0$ -That the random walk has a variance greater than zero (there is non-stationarity).

Where the null hypothesis is rejected (indicating there is no stationarity), there is a unit root, meaning that further tests are needed to determine the form of time series that carries the stationarity characteristics. These further tests are the essence of cointegration analysis. If using the KPSS test the null hypothesis is rejected, the series is non-stationary in its level form but stationary around a deterministic linear trend. If for all indices the KPSS unit root test rejects the null hypotheses, it means that the indices are all non-stationary in their level form but at the same time, all are integrated of the first order. In this case it is possible to test for cointegration among these series.

The purpose of using cointegration tests was to find out whether among the stock index data series there are long-term relationships.

The existence of cointegration signifies the presence of a stationary linear combination of variables that are non-linear in their level form. If the null hypothesis that there is no cointegration is rejected, it means there are no debenefits to international long run diversification since the markets under study do not have a long-term comovement.

In order to detect cointegration between two time series, one has to detect whether the two series are integrated of the first order. If both series are so integrated, Esin (2004) recommends the estimation of the following cointegrating parameters:

$Y_t = ß_0 + ß_1X_t + \mu_t$, after which μ_t is tested to see whether it is of order zero (whether the residual term is stationary in its level form) and the next step is to take the first difference of each series and to re-estimate the regression, but this method has been criticized in that long run valuable information may be lost during the first differencing.

If any pair of time series is integrated of order one, that is I(1) an alternative cointegration analysis method is the one advanced by Engle Granger (1987): In this Engle-Granger model (also called the Engle-Granger Error Correction Model), one considers a set of variables in the long run equilibrium such that there is a linear combination of these variables that equals zero as follows:

$ß_1X_{1t} + ß_2X_{2t} + \ldots + ß_nX_{nt} = 0$, so that if **ß** and $\mathbf{X_t}$ respectively denote vectors ($ß_1$, $ß_2$ ... $ß_n$) and (X_{1t}, X_{2t} … X_{nt}), then the system is said to be in long run equilibrium when $\mathbf{ßX_t} = 0$. The deviation from the long run equilibrium is called the equilibrium error, expressed as $é_t$ where $é_t = \mathbf{ßX_t} = 0$. Engle and Granger assert that if the deviation from the long run equilibrium is meaningful, it must be the case that the equilibrium error process is stationary.

The two propose the following definition for cointegration: The components of the vector $\mathbf{X_t} = (X_{1t}, X_{2t} \ldots X_{nt})$ are said to be cointegrated of order (d, b), denoted by $\mathbf{X_t} \sim CI(d, b)$ if the following conditions are met:

1. All components of X_t are integrated of order d.
2. There exists a vector **ß** = ($ß_1$, $ß_2$ ... $ß_n$) such that the linear combination is integrated of order (d, b), where $b \geq 0$. Here **ß** is called the cointegrated vector.
3. A series may have more than one such vectors and the number of such cointegrating vectors is called the cointegrating rank (π).

As it is not enough to get the vectors, the next step is to consider the method proposed by Johansen (1998) for hypothesis testing.

The procedure allows for testing restricted forms of the cointegrating vectors, with the key assumption that if there are ¥ cointegrating vectors, only ¥ linear combinations of the variables are stationary.

If the restrictions are not binding, the number of cointegrating vectors should not diminish while estimating the model and restricting the parameters of π. The multivariate test proposed by Johansen (1998) is suitable for multivariate cointegration of regional economic blocs, where each region has at least three variables for longitudinal analysis.

The test uses statistics to contrast the following hypotheses:

$H_{0:}$ There is a maximum number of ¥ cointegrating vectors (¥ = 0, 1, 2 - 3)

$H_{1:}$ There is not a maximum number of ¥ cointegrating vectors (¥ = 0, 1, 2 - 3)

The rejection of the null hypothesis provides evidence that there is a long run equilibrium relationship among the intra-bloc stock mart index series, signifying the loss of investment portfolio diversification benefits across the region's bourses.

The existence of multivariate cointegration is not necessarily a necessary condition for bivariate cointegration. This argument is confirmed in Maddala (2006). The issue is similar to simple (bivariate) versus multiple (multivariate) regressions, where Y and X_1 may not be cointegrated while Y, X_1 and X_2 are. If for instance Y, X_1 and X_2 are all I (1) and there exists a linear combination of these that is I (0), so that $Y = \beta_1 X_1 + \beta_2 X_2 + ę$ where ę is I (0), then Y, X_1; X_2 are cointegrated. When, however we consider two of these three variables (say, Y and X_1) in $Y = \beta X_1 + \mu$, since $\mu = \beta_2 X_2 + ę$ is I (1), we find Y and X_1 not to be cointegrated.

The trivial and unspecific nature of multivariate cointegration is demonstrated in its inability to provide unequivocal details in terms of which markets are cointregrated and which are not , besides its generalization of the series as either " cointegrated" or not , even when some subsets of such nominal categories give different results. Accordingly, the research adopts the bivariate cointegration test provided in Maddala (ibid), in which the first test is to check whether each pair of variables is I (1).

The next step is to regress either of the variables on the other (Y on X or X on Y – with an X-Y pair) and consider $\mu = Y - \beta X$.

Finally, one applies the KPSS (1992) unit root test on the random walk μ, with the null hypothesis of stationarity of the white noise (the random walk's equilibrium error).

If X and Y are not cointegrated, then $\mu = Y - \beta X$ is I (0), otherwise μ = I (1), thus, the hypotheses to be tested are:

H_0: μ has a unit root (X and Y are integrated in their level form)

H_1: μ has no unit root (X and Y are not integrated in their level form).

One problem with this test is that μ is not observable. In order to counter the problem, the researcher utilized the regression error μ from the cointegration regression.

The unit root test applied on μ was the one based on first differencing of the bivariate series equilibrium error, μ_t, that is, $(\mu_t - \mu_{t-1})$.

CHAPTER FOUR

RESEARCH ANALYSIS AND FINDINGS

4.1 Market Co-movement Analysis

The findings for the structures of pair-wise dependency (correlation) relationships between the East African stock market are tabulated in tables 4.1.1 and 4.1.2.

Table 4.1.1 Pre-breakpoint correlations

STOCK INDEX	**Dar-es-Salaam Stock Exchange**	**Uganda Securities Exchange**	**Nairobi Securities Exchange**
Dar-es-Salaam Stock Exchange	1.00	-	-
Uganda Securities Exchange	0.02	1.00	-
Nairobi Securities Exchange	-0.06	0.21	1.00

Source: Estimated by Author

From this table, the absolute correlations among the stock market indexes are all low, similar to the findings in the research by Meric, Ratner and Meric (2001) which yielded particularly low correlations of stock market indexes of developing countries.

The findings of this table also reveal different comovements among the indexes, for example Uganda-Dar-es-Salaam and Uganda-Nairobi have positive correlations while the correlation of the Nairobi-Dar-es-Salaam index pair is negative (making investment diversification more desirable compared to the Uganda-Dar-es-Salaam; Uganda-Nairobi pairs). Although this agrees with the results of Meric et al. (2001), of low correlations among developing countries,it is in part dissimilar to Cheung and Mak's finding that intra-continental prices tend to move together but inter-continental ones do not necessarily follow the trend.

Table 4.1.2 Post–breakpoint correlations

STOCK INDEX	Dar-es-Salaam Stock Exchange	Uganda Securities Exchange	Nairobi Securities Exchange
Dar-es-Salaam Stock Exchange	1.00	-	-
Uganda Securities Exchange	-0.20	1.00	-
Nairobi Securities Exchange	0.09	-0.06	1.00

Source: Estimated by Author

The post-breakpoint correlations show different correlation directions to the those presented in Table 4.1.1, where: Uganda-Dar-es-Salaam and Uganda-Nairobi have negative correlations (signifying decreased dependencies across the integration breakpoint) while the correlation of the Nairobi-Dar-es-Salaam index pair is now positive. Moreover, the absolute relationships are weak affirming the findings of Meric et al.,(2001) of low correlations among developing countries, and differing with those of Hilliard (1979) of close intra-regional relationships.

Here, we see a reversal of correlation signs in the second sub-period, for all the market pairs. In terms of investment diversification benefit the Nairobi and Dar-es-Salaam pair has coupled (from a decoupled situation before), wiping out the diversification benefits.
Conversely, The Nairobi-Uganda and Dar-es-Salaam-Uganda pairs have changed correlation signs from positive (undesirable for diversification) to negative indicating that the post-breakpoint period was more desirable for investment diversification.
Since the results are disparate, the situation seems to confer with those of Erb et al. (1994), that though correlations may follow business cycles, they may not necessarily be symmetric in up and down markets.

4.2 Market Contagion Analysis

Under this section, the study examined the nature of the East African bourses' pair-wise index co-movement, with the integration breakpoint date in a bid to know the uniformity of shock transmission mechanism.

The researcher compared the three pairs of market correlations, on the basis of prior and post-breakpoint sub-periods, respectively named (t-1) and t.

The object of the analysis was to test the null hypothesis that there was no change in the correlation structure across the breakpoint date.

The null hypotheses (that there were no comovement differences across the integration breakpoint) were postulated as follows:

$H_0 1$: $\boldsymbol{\rho}_{xy(t)} - \boldsymbol{\rho}_{xy(t-1)} = 0$ {For Dar-es-Salaam and Uganda exchanges}

$H_0 2$: $\boldsymbol{\rho}_{xz(t)} - \boldsymbol{\rho}_{xz(t-1)} = 0$ {For Dar-es-Salaam and Nairobi exchanges}, and

$H_0 3$: $\boldsymbol{\rho}_{yz(t)} - \boldsymbol{\rho}_{yz(t-1)} = 0$ {For Uganda and Nairobi exchanges}

with the corresponding absolute hypotheses (that there were comovement differences):

$H_A 1$: $\boldsymbol{\rho}_{xy(t)} - \boldsymbol{\rho}_{xy(t-1)} \neq 0$ {For Dar-es-Salaam and Uganda exchanges}

$H_A 2$: $\boldsymbol{\rho}_{xz(t)} - \boldsymbol{\rho}_{xz(t-1)} \neq 0$ {For Dar-es-Salaam and Nairobi exchanges}, and

$H_A 3$: $\boldsymbol{\rho}_{yz(t)} - \boldsymbol{\rho}_{yz(t-1)} \neq 0$ {For Uganda and Nairobi exchanges},

Where: $\boldsymbol{\rho}$ = the pair-wise Pearson's correlation coefficient; X, Y and Z are respectively the Dar-es-Salaam Stock Exchange, Uganda Securities Exchange and Nairobi Securities Exchange Paasche's indexes. The results are presented in Table 4.2.1.

Table 4.2.1 Market shock transmission mechanisms

	CORRELATIONS AND DIFFERENCES		
INDEX PAIRS	$\boldsymbol{\rho}_{(t)}$	$\boldsymbol{\rho}_{(t-1)}$	$\boldsymbol{\rho}_{(t)} - \boldsymbol{\rho}_{(t-1)}$
Dar-es-Salaam and Uganda (X,Y)	-0.22	0.02	$-0.24 \neq 0$
Dar-es-Salaam and Nairobi (X,Z)	0.09	-0.06	$0.15 \neq 0$
Uganda and Nairobi (Y,Z)	-0.06	0.21	$-0.27 \neq 0$

Source: Estimations by Author

First, it was notable that none of the correlation differences was zero, meaning that all the index correlations had some reaction to the integration initiative.

Secondly, the extents of correlation changes (in absolute terms) were not quite divergent (ranging from 0.15 to 0.27), meaning that the shock adjustment mechanism brought irregular absolute impact. Finally, all index pairs reversed their correlation signs. The findings are similar to those of Karyoli and Stulz (1996), which provided that macroeconomic announcements had no effect on cross-country market comovement structure (see also Meric et al., 2001). Since the correlation differences are all non-zero, we to reject the null hypothesis of the presence of market contagion.

The findings are consistent with those in Mathur and Sabrahmanyam (1990) and Roll (1992) that each market is responsible for its own behavior; but dissimilar from the results in Christofi and Christofi (1983), who found stock mart index coefficients to be the same over time, on the premise that they were interrelated through a common factor. The findings also agree with those in Mathur and Sabrahmanyam (1990) and Roll (1992) that each market is responsible for its own behavior; but dissimilar from the results in Christofi and Christofi (1983), who found stock mart index coefficients to be the same over time, on the premise that they were interrelated through a common factor.

Accordingly, we conclude that integration had mixed implications on the change in the desirability of investment diversification across the integration breakpoint date.

4.3 Cointegration Analysis

The test for cointegration, according to chapter three is a sequel to the index pairs being integrated of the same order. Since financial stock indexes are known to be nonstationary in their level form (Gujarati and Porter, 2006), these index pairs under consideration have a unit root. The authors further argue that if a time series has a unit root, the first differences of the particular series are stationary, meaning the series is integrated of the first order I(1). Accordingly, the researcher sought to know the stationarity of the series in the analysis by performing unit root tests, since it is the basis.

4.3.1 Unit root test results

The unit root tests under this section are tests of difference stationarity. Following the decomposition of the individual indexes into the deterministic trends, the random walk and the error term, the researcher obtained the random walk by means of first differencing of each index series, with a lag length of one time period. This served the purpose of working out the random walk $\acute{Y}_t = \mu_{t-1} + \mu_t$, with $\acute{Y}_t$ as the residual equilibrium error of the regressed series (the white noise).

According to the criteria set out in section 3.6.2 the equilibrium error should have a mean of zero and some variance: $\mu \sim$ iid $(0, \partial^2\mu)$, that is, independent and identically distributed with mean zero and a constant variance.

The hypotheses to be tested were as follows:

H_0: $\partial^2\mu = 0$: the random walk has zero variance and hence the series is difference-stationary.

H_1: $\partial^2\mu \neq 0$: the random walk has a variance greater than zero (because of the non-negativity dimension of variances as with all the squared numbers and their aggregates), hence the trend is non-stationary. The results for unit root tests are provided in Table 4.3.1.

Table 4.3.1 Unit root test results

Bourse	**$\partial^2\mu$**	**Hypothesis rejected**	**State of the Data Generating Process (DGP)**
Uganda	27,347.29>0	Ho: $\partial^2 \mu = 0$	Non-stationary
Dar-es-Salaam	3,921.40>0	Ho: $\partial^2 \mu=0$	Non-stationary
Nairobi	2,441,312.51>0	Ho: $\partial^2 \mu=0$	Non-stationary

Source: Estimated by Author

In all the three index series, the null hypotheses were rejected, implying non-stationarity in each data generating process.

Each of the processes was hence non-stationary in its level form, but first-difference-stationary because of the presence of a unit root in each of them (the indexes were all integrated of the same, first order). This integration of first order in the index pairs was the basis of the Engle-Granger cointegration procedure.

In order to carry out this analysis, the study, eliminated missing indexes through pair-wise deletion.

Consequently, the Nairobi and Uganda securities exchange indexes had 89 common pairs, Dar-es-Salaam and Uganda had 80 pairs while Dar-es-Salaam and Nairobi had 75 such pairs.

4.3.2 Cointegration results

From the SPSS computer software, the researcher used the Ordinary Least Squares regression formula on the index data pairs and obtained the regression coefficients and constants presenting them in column 1 of Table 4.3.2.

From Appendix E, the ordinary regression residual (error correction term) was extracted as the difference between the observed and predicted values of each index pair. The variance of the equilibrium error values was then computed for each pair of regression series and the results provided in column 2 of the summary table. The table results revealed that that each equilibrium error had a unit root and hence non-stationary in its level form. At the same time each of these index series are integrated of the first order. This is the condition necessary for cointegration testing (See Esin, 2004).

Following the detection of unit roots in each of the three regression series in table 4.3.2 (column 2), the next step was to test for the existence of long-term relationships between the pairs analyzed. In each case, the researcher examined the residual error variance, for stationarity.

The residual error was obtained through the differencing of the equilibrium errors, with a lag length of one month (in Appendix E), in keeping with the requirements of the research's cointegration testing technique. The results (in column 3) revealed none of the equilibrium errors had a zero variance.

None of the index pairs was thus cointegrated, meaning that in the long run, the index series of the three stock markets will not be coupled and thus there will be no debenefit in investment diversification.

Table 4.3.2 Index cointegration summary

Regression error	**Error Stationarity**	**Cointegration status**
Dar-es-Salaam and Uganda (X,Y): Y = the regressand $Y= 100.545 - 0.3996X + \mu_1$	$\partial^2\mu_1 = 128.76^2 \neq 0$, no first order stationarity	$\partial^2(\mu_{1(t)} - \mu_{1(t-1)}) = 183.41^2 > 0$: No cointegration
Uganda and Nairobi (Y,Z): Y = the regressand $Y = 55.235 - 0.00779Z + \mu_2$	$\partial^2\mu_2 = 124.61^2 \neq 0$, no first order stationarity	$\partial^2(\mu_{2(t)} - \mu_{2(t-1)}) = 175.97^2 > 0$: No cointegration
Dar-es-Salaam and Nairobi (X,Z): Z = the regressand $Z = 129.575 + 0.00322X + \mu_3$	$\partial^2\mu_3 = 45.90^2 \neq 0$, no first order stationarity	$\partial^2(\mu_{3\,(t)} - \mu_{3(t-1)}) = 63.95^2 > 0$: No cointegration

Source: Author (2012)

The finding of non-cointegrated index series was echoed by several authors in the literature review: Esin's (2004) study of 15 European and Turkish stock markets, which found countries in the same economic bloc to have no pair-wise cointegration with regard to the customs Union. Expressly, Esin's findings are similar to those of this study in the integration aspect, pair-wise analysis and sub-regional context scopes.

Others include Kanas (1998) who found no evidence of cointegration using the German, United Kingdom and Italian Bourses with October 1987 as breakpoint and Knif et al. (1996).

They found that for the Finnish and Stocholm markets, as integration increased, the market correlations structure did not change-even across many market crashes. Comparable findings were postulated by Roll (1992), who particularly found that Countries with similar industrial structures and similar regional blocs had highly correlated markets, thus in the long run, investment diversification was objectionable.

Regarding the argument advanced by Corhay and Urbain (1993) in which they dismissed correlation in favour of cointegration analysis to determine long run index co-movement, this analysis partly differs in findings. Through correlation analysis, Nairobi and Uganda securities exchanges exhibited positive overall correlation (signifying they were cointegrated), while the Dar-es-Salaam-Nairobi and Dar-es-Salaam-Uganda exchanges had negative correlation coefficients (meaning they were not cointegrated): respectively -0.29 and -0.07 (from appendix E). Accordingly, there is ground for more research on the validity of Corhay and Urbain's claim.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

Understanding stock market risk and return relationships is important for all investors because the risk in any investment can be reduced through diversification. The relationships are critical in determining the benefit or debenefit of investment diversification in the country or regional portfolios.

While chapter four dealt with the analysis and discussion of the findings from the data collected from the East African stock markets according to the specifications of the research methodology, this chapter is a sequel. In Chapter five, we wrap up the study with a Summary (Section 5.1), Conclusions (Section 5.2) and Recommendations (Section 5.3). The three agenda are consistent with the specific research objectives and corresponding research questions, against the background of desirability of investment diversification in East African Bourses.

5.1.1 Market comovements and investment diversification

The pre-breakpoint correlation coefficients were generally low (below absolute 0.22) for the three pairs of markets analyzed. Here, only one market pair (Kenya-Tanzania) was decoupled, with a -0.06 coefficient, the Tanzania-Uganda as well as Uganda- Kenya index pairs were coupled, with respective correlations of +0.02 and +0.21. This means that the Nairobi-Uganda Bourses pair was the most coupled, followed by the Tanzania-Uganda pair.

With all the pairs considered exhibiting low positive and negative correlations, the region resembles what was witnessed in the studies conducted by Brocato (1984) among the markets of US, UK, Canada, Japan, West Germany and Hong Kong; and Mak and Cheung (1992).

Contrary to the first, the second sub-period correlation coefficient signs were reversed, signifying some reversal of comovements in response to the integration initiative.
Although these coefficients were absolutely below 0.22 and thus weak regardless of their signs, the shock transmissions were disparate, presenting mixed signals on the benefit of systematic risk adjustment. Here, only one market pair (Tanzania- Nairobi) was coupled, but to a trivial 0.09 correlation level. The Tanzania-Uganda and Kenya-Uganda Bourses were decoupled, with respective correlation coefficients of -0.2 and -0.06.In this sub-period therefore the Tanzania-Uganda Bourses were the most ambivalent and the Kenya-Tanzania pair was the most coupled contrary to its being the most ambivalent before the breakpoint.

Overall, it is evident that the greatest positive pre-breakpoint correlation (+0.21 involving the Kenya-Uganda index pair) was conversely replicated by the post-breakpoint of the Tanzania-Uganda correlation (with -0.20 correlation); the Kenya-Uganda post-breakpoint correlation was a replica of the Tanzania-Uganda pre-breakpoint one, both being -0.06. This is to say that both the best diversification opportunity (-0.06) before the breakpoint date and the worst (+0.21) had a replica in the 2nd sub-period, but the index pairs involved were not necessarily the same.

5.1.2 Market contagion and investment diversification

From the shock transmissions section (4.2), the researcher found that all the market pairs had changed their correlation signs across the breakpoint. Table 4.2.1 shows that the rates of change in correlation were not uniform, meaning that the first sub-period co movement structure of the indexes did not stand the integration initiative. In all the three pairs of indexes therefore, there was disparate change in the correlation coefficient sign as well as size, indicating different reactions to the breakpoint event.

Testing for market contagion led to the discovery that none of the three market comovement pairs had zero change across the integration breakpoint date.

This meant that there was no market contagion, thus one could neither use the diversification benefit information on one side of the breakpoint to predict that of the other side, nor predict the correlation behavior of a market pair using the past information of a different pair.

A detailed look at the comovement findings reveals that in the first sub-period, including the Uganda Bourse in a pair led to improved coupling (wiping off the diversification benefit), but including the Tanzania's stock exchange occasioned more decoupling (improving the desirability of investment diversification). Kenya was the prime comovement factor. In the second sub-period, the Kenyan market was again key in influencing comovement but including Uganda in any pair yielded decoupling, meaning more diversification benefit (contrary to the sub-period before).

5.1.3 Cointegration and investment diversification

Using the Engle and Granger error correction model according to its suitability as discussed in chapter three of this study, all the stock index pairs yielded a non-zero residual regression white noise variance, meaning that the pairs are not cointegrated.

Accordingly, there exists long run investment diversification viability, as all the index pairs do not move together in the long run.

5.2 Conclusions

Over the study sample period, the pair-wise correlation relationships between the East African stock market indices under consideration were low, exhibiting disparate reactions to the custom union disturbance, hence different investment diversification suitability signals.

In the first sub-period only the Kenya-Uganda stock market pair was beneficial to diversify in (with - 0.06 correlation).The Kenya market was the main influence of co movement, leading to diversification debenefit, while Tanzania was the main decoupling factor (warding off the diversification debenefit).

In the second sub-period, index pairs with the Ugandan market were decoupled (were beneficial to diversify in) while those with Kenya had either less benefit or debenefit. Only the Kenya-Tanzania market pair was unattractive for investment diversification.

Across the integration breakpoint, there was no contagion; since the market index pair correlation had non-zero differences.

The correlation structure however changed, unequally, and by the reversal of the correlation signs indicating anomalous response to the integration initiative, such that one could not use past information on the benefit of investment diversification to predict the future. This is basic evidence that in the post-breakpoint markets were more decoupled than in the first sub-period, thus with integration came more market divergence meaning increased diversification benefit.

With respect to pair-wise cointegration, the researcher found that none of the market pairs had long run comovement. Using this finding, it can be concluded that in the long run, there is no diversification debenefit, although benefit is not guaranteed. This is because the absence of cointegration is only necessary, but not necessarily sufficient for the absence of zero correlation.

5.3 Recommendations

This study found that the absolute correlations among the East African exchanges index pairs were low, but did not find out how significant the correlation strengths were, especially if they were to be translated to suit investment diversification decisions. This is because a low nonzero correlation coefficient only stands for the terms “benefit” or “debenefit” without telling more on the importance thereof. There is need for inference on this descriptive statistic to determine how seriously the information should be taken to account by investors in decision making.

From this study also, the researcher found uneven responses of all the index pairs, to the integration breakpoint. This was compounded by the finding that that no index pair had a zero cross-breakpoint change, indicating the absence of contagion. The absence of index contagion means that based on a pair of index time series, it is not possible to use pre-breakpoint comovement information to make diversification information for the proceeding sub-period. Accordingly, there is need for a further investigation on the specific integration factors that could be responsible for the market comovements, and what conditioning indicators are important to a consistent inter-temporal coupling or decoupling.

Besides the issues of varying cross-breakpoint index comovement structures, the research found the Nairobi Securities Exchange to be a major coupling factor, while The Uganda and Dar-es-Salaam exchanges influenced decoupling (to enhance investment diversification benefit).The researcher recommends the study of differences in industrial structures to see if they are the causes of this, since in Roll (1992), "countries with similar industrial structures have highly correlated markets, although the importance of regional characteristics should not be overlooked".

Regarding the markets' cointegration, the researcher found that none of the market pairs analyzed had long run comovement. Using this finding only, it is difficult for the investors to judge whether it will be beneficial to diversify investment or not, because the absence of positive correlation does not rule out that of zero correlation. Accordingly, the researcher recommends a another study, sometime in the long run, to find out if this noncointegration means negative or zero correlations, in which case it will be possible to make investment diversification decisions.

To the regional planners, there is need to investigate the risk taking tendencies of the region's investors in order to better understand the importance of intra-regional investment diversification.

This is because it is possible that the investors would hold their wealth in one or more of the region's markets, purely on the basis of risk-return preferences regardless of integration effort.

Finally, it is needful for the governments to harmonize corporate governance practices of their Bourses, so as to leave the investors with certainty into the markets and less decision variables regarding portfolio choice.

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APPENDICES

A: Lists of Listed Companies

NAIROBI SECURITIES EXCHANGE

1. Unilever Tea
2. Sasini Tea
3. Rea Vipingo
4. Kakuzi
5. Access Kenya
6. Marshalls (E.A)
7. Car & General
8. Kenya Airways
9. Hutchings & Biemer
10. CMC Holdings
11. Uchumi Supermarkets
12. Nation Media Group
13. TPS Serena
14. Scan Group
15. Standard Media Group
16. Barclays Bank
17. CFC Bank
18. Kenya Re
19. National Bank
20. Panafrica Insurance
21. Diamond Trust Bank
22. Jubilee Insurance
23. Standard Chartered
24. NIC Bank
25. Equity Bank
26. Athriver Mining
27. BOC Gases
28. British American Tobacco
29. Carbacid Investments
30. East Africa Cables
31. East African Breweries
32. Olympia Capital
33. East African Portland cement
34. Kenya oil
35. Crown Berger
36. Unga Group
37. Kenya Power & Lighting
38. Total Kenya
39. Eveready
40. Kengen
41. Housing Finance
42. Centum Investment
43. Kenya Commercial Bank
44. Mumias Sugar
45. Bamburi Cement
46. Sameer

UGANDA SECURITIES EXCHANCE

1. Uganda Clay
2. East African Breweries
3. Bank of Baroda
4. Stanbic Bank
5. British American Tobacco
6. Kenya Airways
7. Development Finance (Uganda)
8. Jubilee Holdings
9. New Vision Printings & Publishing

DAR-ES-SALAAM STOCK EXCHANGE

1. TOL Gases
2. Tanzania Breweries
3. East African Breweries
4. Tanzania Cigarette
5. Kenya Airways
6. Jubilee Holdings
7. Tanga Cement
8. Tanzania Tea Packers
9. Tanzania Portland Cement
10. Swissport

(Source – Daily Price Lists: 28/04/08)

B: Index Workings

B1: Nairobi securities exchange

MON	(Qi)	(P1Q1)	(P0)	P0Q1	NSE INDEX
1	2,397,000.00	49,500,000.00	20.65	49,500,000.01	**100.00**
2	815,000.00	97,100,000.00	119.14	16,830,413.02	**576.93**
3	MISSING	MISSING	MISSING	MISSING	**MISSING**
4	6,048,000.00	65,800,000.00	10.88	124,896,120.1	**52.68**
5	3,310,000.00	46,300,000.00	13.99	68,354,192.75	**67.74**
6	2,566,000.00	46,980,000.00	18.31	52,989,987.49	**88.66**
7	MISSING	MISSING	MISSING	MISSING	**MISSING**
8	MISSING	MISSING	MISSING	MISSING	**MISSING**
9	MISSING	MISSING	MISSING	MISSING	**MISSING**
10	MISSING	MISSING	MISSING	MISSING	**MISSING**
11	MISSING	MISSING	MISSING	MISSING	**MISSING**
12	589,556,000.00	10,850,000.00	0.02	12,174,811,015.	**0.09**
13	1,939,245.00	39,170,000.00	20.20	40,046,986.86	**97.81**
14	4,042,700.00	198,710,000.0	49.15	83,485,043.82	**238.02**
15	1,369,337.00	38.61	0.00	28,277,923.03	**0.00**
16	1,484,761.00	79.81	0.00	30,661,522.53	**0.00**
17	1,872,979.00	42.20	0.00	38,678,540.06	**0.00**
18	1,375,495.00	43,355.00	0.03	28,405,090.74	**0.15**
19	3,222,023.00	54,149.00	0.02	66,537,396.13	**0.08**
20	1,011,165.00	32.49	0.00	20,881,379.85	**0.00**
21	1,407,817.00	46.34	0.00	29,072,566.34	**0.00**
22	6,277,858.00	64,957.00	0.01	129,642,874.86	**0.05**
23	1,507,513.00	35.17	0.00	31,131,369.84	**0.00**
24	222,274.00	4,828,756.00	21.72	4,590,138.92	**105.20**
25	697,581.00	14,625,647.00	20.97	14,405,615.15	**101.53**
26	2,592,738.00	56,442,640.00	21.77	53,542,148.94	**105.42**

27	3,953,646.00	63,097,541.00	15.96	81,646,006.27	**77.28**
28	1,779,619.00	33,760,890.00	18.97	36,750,580.11	**91.86**
29	1,312,252.00	43,518,769.00	33.16	27,099,071.34	**160.59**
30	895,107.00	21,933,274.00	24.50	18,484,687.74	**118.66**
31	2,602,162.00	54,297,010.00	20.87	53,736,762.21	**101.04**
32	1,617,343.00	41,561,660.00	25.70	33,399,448.69	**124.44**
33	4,285,344.00	48,018,225.00	11.21	88,495,839.81	**54.26**
34	4,146,848.00	86,795,459.00	20.93	85,635,784.74	**101.35**
35	MISSING	MISSING	MISSING	MISSING	**MISSING**
36	3,622,214.00	58,376,291.00	16.12	74,801,665.84	**78.04**
37	6,991,613.00	168,497,673.0	24.10	144,382,496.27	**116.70**
38	4,166,736.00	122,205,692.0	29.33	86,046,488.12	**142.02**
39	5,494,308.00	161,996,727.0	29.48	113,461,929.93	**142.78**
40	5,162,368.00	175,744,518.0	34.04	106,607,098.89	**164.85**
41	5,753,756.00	216,586,939.0	37.64	118,819,742.20	**182.28**
42	7,355,525.00	218,940,463.0	29.77	151,897,575.12	**144.14**
43	6,449,205.00	167,557,347.0	25.98	133,181,329.81	**125.81**
44	6,153,612.00	148,882,811.00	24.19	127,077,093.89	**117.16**
45	8,607,197.00	354,562,514.0	41.19	177,745,620.18	**199.48**
46	10,343,221.00	387,852,144.0	37.50	213,595,928.07	**181.58**
47	8,281,795.00	325,091,606.0	39.25	171,025,804.16	**190.08**
48	1,977,771.00	93,693,715.00	47.37	40,842,580.11	**229.40**
49	24,161,952.00	1,146,702,643.0	47.46	498,963,965.03	**229.82**
50	16,197,669.00	1,002,118,448.0	61.87	334,495,041.98	**299.59**
51	10,361,412.00	286,931,247.00	27.69	213,971,587.02	**134.10**
52	6,095,408.00	276,973,305.00	45.44	125,875,133.94	**220.04**
53	6,856,059.00	283,976,079.00	41.42	141,583,195.89	**200.57**
54	36,417,404.00	482,362,372.00	13.25	752,049,018.89	**64.14**
55	22,152,451.00	401,902,271.00	18.14	457,466,134.61	**87.85**

56	7,050,306.00	344,058,527.00	48.80	145,594,554.46	**236.31**
57	5,776,537.00	268,080,986.00	46.41	119,290,188.38	**224.73**
58	6,797,344.00	231,026,330.00	33.99	140,370,683.38	**164.58**
59	6,849,179.00	360,987,355.00	52.71	141,441,118.29	**255.22**
60	1,845,609.00	87,259,725.00	47.28	38,113,327.29	**228.95**
61	9,487,632.00	267,300,379.00	28.17	195,927,319.18	**136.43**
62	13,475,710.00	520,082,953.00	38.59	278,284,374.26	**186.89**
63	4,881,051.00	310,206,412.00	63.55	100,797,673.98	**307.75**
64	10,168,679.00	520,772,111.00	51.21	209,991,493.77	**248.00**
65	20,343,431.00	77,289,412.00	3.80	420,108,399.94	**18.40**
66	22,950,126.00	85,601,931.00	3.73	473,938,772.29	**18.06**
67	15,157,345.00	790,845,520.00	52.18	313,011,505.05	**252.66**
68	11,199,470.00	555,954,258.00	49.64	231,278,166.49	**240.38**
69	15,324,723.00	776,472,161.00	50.67	316,467,996.92	**245.36**
70	19,406,161.00	998,518,121.00	51.45	400,753,011.95	**249.16**
71	10,160,373.00	587,880,633.00	57.86	209,819,968.12	**280.18**
72	18,766,601.00	498,077,073.00	26.54	387,545,577.66	**128.52**
73	16,061,913.00	771,264,830.00	48.02	331,691,570.14	**232.52**
74	16,282,525.00	834,161,322.00	51.23	336,247,387.41	**248.08**
75	1,319,075.00	999,342,558.00	757.61	27,239,971.84	**3,668.66**
76	30,650,964.00	1,369,999,671.00	44.70	632,967,341.77	**216.44**
77	44,818,598.00	1,530,046,554.00	34.14	925,540,509.53	**165.31**
78	31,290,389.00	1,898,029,576.00	60.66	646,171,988.21	**293.73**
79	22,744,438.00	1,001,850,974.00	44.05	469,691,147.76	**213.30**
80	23,859,564.00	1,310,872,882.00	54.94	492,719,406.83	**266.05**
81	MISSING	MISSING	MISSING	MISSING	**MISSING**
82	MISSING	MISSING	MISSING	MISSING	**MISSING**
83	MISSING	MISSING	MISSING	MISSING	**MISSING**
84	MISSING	MISSING	MISSING	MISSING	**MISSING**

85	31,551,668.00	2,008,821,378.00	63.67	651,567,612.11	**308.31**
86	27,515,334.00	2,226,643,137.00	80.92	568,214,031.37	**391.87**
87	21,076,808.00	1,128,853,587.00	53.56	435,253,231.60	**259.36**
88	24,391,416.00	1,322,327,985.00	54.21	503,702,583.30	**262.52**
89	21,192,783.00	1,216,905,013.00	57.42	437,648,209.70	**278.06**
90	49,490,299.00	1,876,352,922.00	37.91	1,022,014,935.70	**183.59**
91	31,871,217.00	1,291,603,297.00	40.53	658,166,558.92	**196.24**
92	97,260,688.00	2,807,508,521.00	28.87	2,008,512,330.71	**139.78**
93	58,818,401.00	1,223,095,961.00	20.79	1,214,647,830.60	**100.70**
94	676,534.00	1,375,865,445.00	2,033.70	13,970,977.47	**9,848.03**
95	40,931,350.00	1,822,213,801.00	44.52	845,265,675.97	**215.58**
96	43,215,413.00	1,973,574,074.00	45.67	892,433,435.05	**221.15**
97	42,591,491.00	1,546,770,019.00	36.32	879,548,938.18	**175.86**
98	44,487,490.00	2,147,555,175.00	48.27	918,702,859.96	**233.76**
99	30,844,604.00	1,139,083,329.00	36.93	636,966,165.30	**178.83**
100	33,520,879.00	1,456,902,854.00	43.46	692,233,421.26	**210.46**

B2: Dar-es-salaam stock exchange

		TURNOVER			
MONTH	**VOLUME(Qi)**	**(TSH.'M)**	**(P1)**	**P0Q1 TOTALS**	**INDEX**
21	9,200.00	7.11	772.83	7,110,000.00	**100.00**
22	9,114.00	7.27	797.67	7,043,536.96	**103.22**
23	7,501.00	8.37	1,115.85	5,796,968.48	**144.39**
24	4,369.00	4.84	1,107.80	3,376,477.17	**143.34**
25	3,430.00	2.57	749.27	2,650,793.48	**96.95**
26	7,510.00	13.95	1,857.52	5,803,923.91	**240.35**
27	714,783.00	27.99	39.16	552,402,948.94	**5.07**
28	12,600.00	20.24	1,606.35	9,737,608.70	**207.85**
29	1,441,196.00	780.46	541.54	1,113,793,865.28	**70.07**
30	4,610.00	7.60	1,648.59	3,562,728.26	**213.32**
31	133,301.00	215.23	1,614.62	103,018,490.22	**208.92**
32	41,687.00	65.93	1,581.55	32,216,801.09	**204.64**
33	159,580.00	81.75	512.28	123,327,586.96	**66.29**
34	30,921.00	24.76	800.75	23,896,555.44	**103.61**
35	19,860.00	13.97	703.42	15,348,326.09	**91.02**
36	7,366.00	6.31	856.64	5,692,636.96	**110.84**
37	272,590.00	316.40	1,160.72	210,664,663.06	**150.19**
38	604,773.00	433.87	717.41	467,384,351.11	**92.83**
39	25,332.00	25.16	993.21	19,577,230.44	**128.52**
40	174,023.00	145.13	833.97	134,489,514.14	**107.91**
41	17,592.00	11.93	678.15	13,595,556.52	**87.75**
42	47,969.00	21.30	444.04	37,071,694.57	**57.46**
43	158,253.00	123.30	779.13	122,302,046.75	**100.82**
44	26,010.00	21.07	810.07	20,101,206.52	**104.82**
45	26,925.00	16.09	597.59	20,808,342.39	**77.32**
46	144,434.00	173.20	1,199.16	111,622,363.05	**155.17**

47	35,593.00	23.16	650.69	27,507,198.91	**84.20**
48	47,174.00	46.95	995.25	36,457,297.83	**128.78**
49	13,350.00	14.58	1,092.13	10,317,228.26	**141.32**
50	17,757.00	13.55	763.08	13,723,072.83	**98.74**
51	12,459.00	7.96	638.90	9,628,640.22	**82.67**
52	140,321.00	90.31	643.60	108,443,729.35	**83.28**
53	25,905.00	11.75	453.58	20,020,059.78	**58.69**
54	24,117.00	21.93	909.32	18,638,246.74	**117.66**
55	5,029.00	4.26	847.09	3,886,542.39	**109.61**
56	102,499.00	122.13	1,191.52	79,213,901.09	**154.18**
57	8,728.00	9.84	1,127.41	6,745,226.09	**145.88**
58	28,640.00	36.83	1,285.96	22,133,739.13	**166.40**
59	86,868.00	120.34	1,385.32	67,133,856.53	**179.25**
60	340,234.00	379.31	1,114.85	262,941,710.88	**144.26**
61	39,711.00	63.04	1,587.47	30,689,696.74	**205.41**
62	80,871.00	52.94	654.62	62,499,218.48	**84.71**
63	20,255.00	24.82	1,225.38	15,653,592.39	**158.56**
64	980.00	0.96	979.59	757,369.57	**126.75**
65	5,138.00	4.67	908.91	3,970,780.44	**117.61**
66	2,644.00	1.64	620.27	2,043,352.17	**80.26**
67	21,519.00	26.73	1,242.16	16,630,444.57	**160.73**
68	8,211.00	10.85	1,321.40	6,345,675.00	**170.98**
69	64,124.00	96.19	1,500.06	49,556,700.00	**194.10**
70	14,252.00	19.13	1,342.27	11,014,317.39	**173.68**
71	184,675.00	111.43	603.38	142,721,657.62	**78.08**
72	28,789.00	36.26	1,259.51	22,248,890.22	**162.97**
73	33,778.00	28.86	854.40	26,104,519.57	**110.56**
74	18,047.00	16.19	897.10	13,947,192.39	**116.08**
75	1,993.00	2.88	1,445.06	1,540,242.39	**186.98**

76	12,655.00	15.90	1,256.42	9,780,114.13	**162.57**
77	527.00	0.78	1,480.08	407,279.35	**191.51**
78	8,259.00	6.82	825.77	6,382,770.65	**106.85**
79	3,620.00	2.21	610.50	2,797,630.43	**79.00**
80	16,513.00	14.03	849.63	12,761,677.17	**109.94**
81	687,104.00	488.45	710.88	531,011,895.68	**91.98**
82	30,080.00	31.80	1,057.18	23,246,608.70	**136.79**
83	372,337.00	253.03	679.57	287,751,746.76	**87.93**
84	4,097.00	3.27	798.14	3,166,268.48	**103.28**
85	101,158.00	69.39	685.96	78,177,541.31	**88.76**
86	35,324.00	21.84	618.28	27,299,308.70	**80.00**
87	19,698.00	23.76	1,206.21	15,223,128.26	**156.08**
88	96,981.00	108.53	1,119.09	74,949,446.74	**144.80**
89	60,931.00	55.90	917.43	47,089,066.31	**118.71**
90	138,429.00	100.79	728.10	106,981,542.40	**94.21**
91	175,811.00	200.83	1,142.31	135,871,327.18	**147.81**
92	18,019.00	17.00	943.45	13,925,553.26	**122.08**
93	13,146.00	10.02	762.21	10,159,571.74	**98.63**
94	114,357.00	126.70	1,107.93	88,378,072.83	**143.36**
95	7,972.00	9.32	1,169.09	6,160,969.57	**151.27**
96	7,874.00	9.19	1,167.13	6,085,232.61	**151.02**
97	4,102.00	5.60	1,365.19	3,170,132.61	**176.65**
98	37,957.00	45.86	1,208.21	29,334,159.78	**156.34**
99	109,993.00	177.20	1,611.01	85,005,459.79	**208.46**
100	25,000.00	40.74	1,629.60	19,320,652.18	**210.86**

B3: Uganda securities exchange

MON	(Qi)	(PiQi)	P1	P0Q1	INDEX
1	880.00	3,980,000.00	4,522.73	3,979,999.96	**100.00**
2	1,930.00	8,750,000.00	4,533.68	8,728,863.55	**100.24**
3	1,270.00	5,780,000.00	4,551.18	5,743,863.58	**100.63**
4	575.00	2,620,000.00	4,556.52	2,600,568.16	**100.75**
5	570.00	2,610,000.00	4,578.95	2,577,954.52	**101.24**
6	270.00	1,240,000.00	4,592.59	1,221,136.35	**101.54**
7	50.00	300,000.00	6,000.00	226,136.36	**132.66**
8	690.00	3,180,000.00	4,608.70	3,120,681.79	**101.90**
9	405.00	1,870,000.00	4,617.28	1,831,704.53	**102.09**
10	10,470.00	13,060,000.00	1,247.37	47,352,954.10	**27.58**
11	5,470.00	6,500,000.00	1,188.30	24,739,317.95	**26.27**
12	53,850.00	70,800,000.00	1,314.76	243,548,861.34	**29.07**
13	19,295.00	24,280,000.00	1,258.36	87,266,021.90	**27.82**
14	32,576.00	23,730,000.00	728.45	147,332,362.24	**16.11**
15	78,760.00	111,240,000.00	1,412.39	356,209,996.63	**31.23**
16	65,327.00	82,540,000.00	1,263.49	295,456,201.75	**27.94**
17	69,050.00	133,000,000.00	1,926.14	312,294,315.23	**42.59**
18	39,712.00	52,760,000.00	1,328.57	179,606,543.76	**29.38**
19	50,830.00	62,490,000.00	1,229.39	229,890,225.10	**27.18**
20	380.00	1,760,000.00	4,631.58	1,718,636.35	**102.41**
21	13,530.00	16,380,000.00	1,210.64	61,192,499.42	**26.77**
22	245.00	1,140,000.00	4,653.06	1,108,068.17	**102.88**
23	1,450.00	15,790,000.00	10,889.66	6,557,954.48	**240.78**
24	1,805.00	2,940,000.00	1,628.81	8,163,522.65	**36.01**
25	4,515.00	20,770,000.00	4,600.22	20,420,113.44	**101.71**
26	174,773.00	240,750,000.00	1,377.50	790,450,606.17	**30.46**
27	40,784.00	43,580,000.00	1,068.56	184,454,907.35	**23.63**

28	66,251.00	34,780,000.00	524.97	299,635,201.71	**11.61**
29	178,203.00	95,710,000.00	537.08	805,963,560.57	**11.88**
30	867,412.00	419,640,000.00	483.78	3,923,067,872.03	**10.70**
31	230,722.00	257,070,000.00	1,114.20	1,043,492,671.96	**24.64**
32	177,661.00	652,590,000.00	3,673.23	803,512,242.41	**81.22**
33	6,769.00	5,970,000.00	881.96	30,614,340.62	**19.50**
34	63,693.00	25,960,000.00	407.58	288,066,065.46	**9.01**
35	66,546.00	56,130,000.00	843.48	300,969,406.25	**18.65**
36	20,800.00	14,870,000.00	714.90	94,072,726.38	**15.81**
37	1,075.00	1,820,000.00	1,693.02	4,861,931.77	**37.43**
38	1,130.00	5,250,000.00	4,646.02	5,110,681.77	**102.73**
39	5,153.00	16,880,000.00	3,275.76	23,305,613.42	**72.43**
40	21,029.00	40,060,000.00	1,904.99	95,108,430.92	**42.12**
41	6,189.00	27,490,000.00	4,441.75	27,991,158.83	**98.21**
42	4,465.00	11,080,000.00	2,481.52	20,193,977.08	**54.87**
43	29,201.00	49,590,000.00	1,698.23	132,068,157.84	**37.55**
44	2,798.00	12,060,000.00	4,310.22	12,654,590.79	**95.30**
45	154,508.00	123,330,000.00	798.21	698,797,538.85	**17.65**
46	6,995.00	32,250,000.00	4,610.44	31,636,476.97	**101.94**
47	2,002.00	4,480,000.00	2,237.76	9,054,499.91	**49.48**
48	797.00	5,980,000.00	7,503.14	3,604,613.60	**165.90**
49	3,427.00	23,630,000.00	6,895.24	15,499,386.22	**152.46**
50	7,102.00	51,550,000.00	7,258.52	32,120,408.79	**160.49**
51	96,897.00	61,290,000.00	632.53	438,238,700.41	**13.99**
52	11,390.00	77,300,000.00	6,786.65	51,513,863.15	**150.06**
53	6,040.00	600,000.00	99.34	27,317,272.47	**2.20**
54	29,031.00	27,270,000.00	939.34	131,299,294.21	**20.77**
55	31,274.00	50,870,000.00	1,626.59	141,443,771.39	**35.96**
56	3,064.00	19,980,000.00	6,520.89	13,857,636.23	**144.18**

57	1,186.00	5,170,000.00	4,359.19	5,363,954.49	**96.38**
58	15,261.00	20,230,000.00	1,325.60	69,021,340.26	**29.31**
59	153,550.00	47,160,000.00	307.13	694,464,766.17	**6.79**
60	92,424.00	27,440,000.00	296.89	418,008,541.51	**6.56**
61	29,941.00	10,030,000.00	334.99	135,414,975.99	**7.41**
62	175,376.00	48,510,000.00	276.61	793,177,810.69	**6.12**
63	1,452,061.00	282,820,000.00	194.77	6,567,275,824.32	**4.31**
64	75,254.00	28,420,000.00	377.65	340,353,314.97	**8.35**
65	4,582,075.00	2,215,060,000.00	483.42	20,723,475,372.40	**10.69**
66	8,950.00	451,780,000.00	50,478.21	40,478,408.71	**1,116.10**
67	1,063,354.00	383,890,000.00	361.02	4,809,260,090.93	**7.98**
68	332,601.00	126,100,000.00	379.13	1,504,263,599.43	**8.38**
69	172,934.00	117,180,000.00	677.60	782,133,310.79	**14.98**
70	244,694.00	135,530,000.00	553.88	1,106,684,216.82	**12.25**
71	89,380.00	51,890,000.00	580.55	404,241,359.82	**12.84**
72	4,188,439.00	1,642,610,000.00	392.18	18,943,167,116.49	**8.67**
73	348,615.00	158,220,000.00	453.85	1,576,690,553.29	**10.03**
74	2,442,597.00	1,174,400,000.00	480.80	11,047,199,963.82	**10.63**
75	208,018.00	111,010,000.00	533.66	940,808,672.93	**11.80**
76	662,574.00	361,090,000.00	544.98	2,996,641,471.69	**12.05**
77	142,768.00	78,960,000.00	553.07	645,700,721.17	**12.23**
78	492,882.00	243,120,000.00	493.26	2,229,170,842.58	**10.91**
79	383,910.00	394,460,000.00	1,027.48	1,736,320,210.87	**22.72**
80	627,004.00	326,390,000.00	520.55	2,835,768,064.12	**11.51**
81	2,713,055.00	1,207,650,000.00	445.13	12,270,407,724.99	**9.84**
82	994,827.00	507,470,000.00	510.11	4,499,331,162.04	**11.28**
83	2,176,163.00	933,460,000.00	428.95	9,842,191,657.02	**9.48**
84	3,625,281.00	1,535,870,000.00	423.66	16,396,157,095.10	**9.37**
85	36,096,503.00	8,332,920,000.00	230.85	163,254,637,025.88	**5.10**

86	58,117,945.00	6,070,850,000.00	104.46	262,851,612,403.14	**2.31**
87	76,995,316.00	11,808,720,000.00	153.37	348,228,812,255.66	**3.39**
88	36,062,277.00	6,391,320,000.00	177.23	163,099,842,163.70	**3.92**
89	53,136,097.00	7,976,980,000.00	150.12	240,320,072,797.82	**3.32**
90	23,963,740.00	3,398,590,000.00	141.82	108,381,459,430.64	**3.14**
91	29,323,215.00	4,772,330,000.00	162.75	132,620,902,951.64	**3.60**
92	30,043,417.00	4,587,330,000.00	152.69	135,878,180,148.15	**3.38**
93	26,534,875.00	3,929,060,000.00	148.07	120,010,001,707.15	**3.27**
94	63,050,669.00	11,940,780,000.00	189.38	285,160,977,556.02	**4.19**
95	29,507,904.00	6,140,480,000.00	208.10	133,456,200,921.03	**4.60**
96	43,855,244.00	10,500,030,000.00	239.42	198,345,306,217.09	**5.29**
97	15,764,023.00	3,858,210,000.00	244.75	71,296,376,076.45	**5.41**
98	30,244,416.00	13,544,440,000.00	447.83	136,787,243,798.65	**9.90**
99	20,526,468.00	18,818,190,000.00	916.78	92,835,615,759.32	**20.27**
100	16,663,090.00	16,152,190,000.00	969.34	75,362,610,878.94	**21.43**

C: Sub-period Correlations

C1: Pre-breakpoint correlation

PAIR ONE			PAIR TWO			PAIR THREE		
MON	**NSE(Z)**	**USE(Y)**	**MONTH**	**DSE(X)**	**NSE(Z)**	**MONTH**	**DSE(X)**	**USE(Y)**
1	100	100	21	100	0	21	100	26.77
2	576.93	100.24	22	103.22	0.05	22	103.22	102.88
4	52.68	100.75	23	144.39	0	23	144.39	240.78
5	67.74	101.24	24	143.34	105.2	24	143.34	36.01
6	88.66	101.54	25	96.95	101.53	25	96.95	101.71
12	0.09	29.07	26	240.35	105.42	26	240.35	30.46
13	97.81	27.82	27	5.07	77.28	27	5.07	23.63
14	238.02	16.11	28	207.85	91.86	28	207.85	11.61
15	0	31.23	29	70.07	160.59	29	70.07	11.88
16	0	27.94	30	213.32	118.66	30	213.32	10.7
17	0	42.59	31	208.92	101.04	31	208.92	24.64
18	0.15	29.38	32	204.64	124.44	32	204.64	81.22
19	0.08	27.18	33	66.29	54.26	33	66.29	19.5
20	0	102.41	34	103.61	101.35	34	103.61	9.01
21	0	26.77	36	110.84	78.04	35	91.02	18.65
22	0.05	102.88	37	150.19	116.7	36	110.84	15.81
23	0	240.78	38	92.83	142.02	37	150.19	37.43
24	105.2	36.01	39	128.52	142.78	38	92.83	102.73
25	101.53	101.71	40	107.91	164.85	39	128.52	72.43
26	105.42	30.46	41	87.75	182.28	40	107.91	42.12
27	77.28	23.63	42	57.46	144.14	41	87.75	98.21
28	91.86	11.61	43	100.82	125.81	42	57.46	54.87
29	160.59	11.88	44	104.82	117.16	43	100.82	37.55
30	118.66	10.7	45	77.32	199.48	44	104.82	95.3
31	101.04	24.64	46	155.17	181.58	45	77.32	17.65

32	124.44	81.22	47	84.2	190.08	46	155.17	101.94
33	54.26	19.5	48	128.78	229.4	47	84.2	49.48
34	101.35	9.01	49	141.32	229.82	48	128.78	165.9
36	78.04	15.81	50	98.74	299.59	49	141.32	152.46
37	116.7	37.43				50	98.74	160.49
38	142.02	102.73	**PCC = -0.06**			**PCC = 0.02**		
39	142.78	72.43						
40	164.85	42.12						
41	182.28	98.21						
42	144.14	54.87						
43	125.81	37.55						
44	117.16	95.3						
45	199.48	17.65						
46	181.58	101.94						
47	190.08	49.48						
48	229.4	165.9						
49	229.82	152.46						
50	299.59	160.49						

PCC = 0.21

C2: Post-breakpoint correlations

MON	DSE(X)	USE(Y)	MONTH	DSE(X)	NSE(Z)	MONTH	NSE(Z)	USE(Y)
51	82.67	13.99	50	98.74	299.59	50	299.59	160.49
52	83.28	150.06	51	82.67	134.10	51	134.10	13.99
53	58.69	2.20	52	83.28	220.04	52	220.04	150.06
54	117.66	20.77	53	58.69	200.57	53	200.57	2.20
55	109.61	35.96	54	117.66	64.14	54	64.14	20.77
56	154.18	144.18	55	109.61	87.85	55	87.85	35.96
57	145.88	96.38	56	154.18	236.31	56	236.31	144.18
58	166.40	29.31	57	145.88	224.73	57	224.73	96.38
59	179.25	6.79	58	166.40	164.58	58	164.58	29.31
60	144.26	6.56	59	179.25	255.22	59	255.22	6.79
61	205.41	7.41	60	144.26	228.95	60	228.95	6.56
62	84.71	6.12	61	205.41	136.43	61	136.43	7.41
63	158.56	4.31	62	84.71	186.89	62	186.89	6.12
64	126.75	8.35	63	158.56	307.75	63	307.75	4.31
65	117.61	10.69	64	126.75	248.00	64	248.00	8.35
66	80.26	1,116.10	65	117.61	18.40	65	18.40	10.69
67	160.73	7.98	66	80.26	18.06	66	18.06	1116.10
68	170.98	8.38	67	160.73	252.66	67	252.66	7.98
69	194.10	14.98	68	170.98	240.38	68	240.38	8.38
70	173.68	12.25	69	194.10	245.36	69	245.36	14.98
71	78.08	12.84	70	173.68	249.16	70	249.16	12.25
72	162.97	8.67	71	78.08	280.18	71	280.18	12.84
73	110.56	10.03	72	162.97	128.52	72	128.52	8.67
74	116.08	10.63	73	110.56	232.52	73	232.52	10.03
75	186.98	11.80	74	116.08	248.08	74	248.08	10.63
76	162.57	12.05	75	186.98	3,668.66	75	3,668.66	11.80
77	191.51	12.23	76	162.57	216.44	76	216.44	12.05

78	106.85	10.91	77	191.51	165.31	77	165.31	12.23
79	79.00	22.72	78	106.85	293.73	78	293.73	10.91
80	109.94	11.51	79	79.00	213.30	79	213.30	22.72
81	91.98	9.84	80	109.94	266.05	80	266.05	11.51
82	136.79	11.28	85	88.76	308.31	85	308.31	5.10
83	87.93	9.48	86	80.00	391.87	86	391.87	2.31
84	103.28	9.37	87	156.08	259.36	87	259.36	3.39
85	88.76	5.10	88	144.80	262.52	88	262.52	3.92
86	80.00	2.31	89	118.71	278.06	89	278.06	3.32
87	156.08	3.39	90	94.21	183.59	90	183.59	3.14
88	144.80	3.92	91	147.81	196.24	91	196.24	3.60
89	118.71	3.32	92	122.08	139.78	92	139.78	3.38
90	94.21	3.14	93	98.63	100.70	93	100.70	3.27
91	147.81	3.60	94	143.36	9,848.03	94	9,848.03	4.19
92	122.08	3.38	95	151.27	215.58	95	215.58	4.60
93	98.63	3.27	96	151.02	221.15	96	221.15	5.29
94	143.36	4.19	97	176.65	175.86	97	175.86	5.41
95	151.27	4.60	98	156.34	233.76	98	233.76	9.90
96	151.02	5.29	99	208.46	178.83	99	178.83	20.27
97	176.65	5.41	100	210.86	210.46	100	210.46	21.43
98	156.34	9.90	**PCC = 0.09**			**PCC = -0.06**		
99	208.46	20.27						
100	210.86	21.43						
PCC = -0.20								

D: Unit Root Workings

MON	USE	Erro	MON	NSE	Error	MON	DSE	Error
1	**100**		1	**100**		21	**100**	
2	**100.24**	0.24	2	**576.93**	476.93	22	**103.22**	3.22
3	**100.63**	0.39	4	**52.68**	-524.25	23	**144.39**	41.17
4	**100.75**	0.12	5	**67.74**	15.05	24	**143.34**	-1.04
5	**101.24**	0.5	6	**88.66**	20.92	25	**96.95**	-46.39
6	**101.54**	0.3	12	**0.09**	-88.57	26	**240.35**	143.4
7	**132.66**	31.12	13	**97.81**	97.72	27	**5.07**	-235.29
8	**101.9**	-30.76	14	**238.02**	140.21	28	**207.85**	202.79
9	**102.09**	0.19	15	**0**	-238.02	29	**70.07**	-137.78
10	**27.58**	-74.51	16	**0**	0	30	**213.32**	143.25
11	**26.27**	-1.31	17	**0**	0	31	**208.92**	-4.4
12	**29.07**	2.8	18	**0.15**	0.15	32	**204.64**	-4.28
13	**27.82**	-1.25	19	**0.08**	-0.07	33	**66.29**	-138.36
14	**16.11**	-11.72	20	**0**	-0.08	34	**103.61**	37.33
15	**31.23**	15.12	21	**0**	0	35	**91.02**	-12.59
16	**27.94**	-3.29	22	**0.05**	0.05	36	**110.84**	19.83
17	**42.59**	14.65	23	**0**	-0.05	37	**150.19**	39.35
18	**29.38**	-13.21	24	**105.2**	105.2	38	**92.83**	-57.36
19	**27.18**	-2.19	25	**101.53**	-3.67	39	**128.52**	35.69
20	**102.41**	75.22	26	**105.42**	3.89	40	**107.91**	-20.6
21	**26.77**	-75.64	27	**77.28**	-28.14	41	**87.75**	-20.16
22	**102.88**	76.11	28	**91.86**	14.58	42	**57.46**	-30.29
23	**240.78**	137.89	29	**160.59**	68.73	43	**100.82**	43.36
24	**36.01**	-204.76	30	**118.66**	-41.93	44	**104.82**	4
25	**101.71**	65.7	31	**101.04**	-17.61	45	**77.32**	-27.49
26	**30.46**	-71.26	32	**124.44**	23.4	46	**155.17**	77.84
27	**23.63**	-6.83	33	**54.26**	-70.18	47	**84.2**	-70.97

28	**11.61**	-12.02	34	**101.35**	47.09	48	**128.78**	44.58
29	**11.88**	0.27	36	**78.04**	-23.31	49	**141.32**	12.54
30	**10.7**	-1.18	37	**116.7**	38.66	50	**98.74**	-42.58
31	**24.64**	13.94	38	**142.02**	25.32	51	**82.67**	-16.07
32	**81.22**	56.58	39	**142.78**	0.75	52	**83.28**	0.61
33	**19.5**	-61.72	40	**164.85**	22.08	53	**58.69**	-24.59
34	**9.01**	-10.49	41	**182.28**	17.43	54	**117.66**	58.97
35	**18.65**	9.64	42	**144.14**	-38.15	55	**109.61**	-8.05
36	**15.81**	-2.84	43	**125.81**	-18.33	56	**154.18**	44.57
37	**37.43**	21.63	44	**117.16**	-8.65	57	**145.88**	-8.3
38	**102.73**	65.29	45	**199.48**	82.32	58	**166.4**	20.52
39	**72.43**	-30.3	46	**181.58**	-17.9	59	**179.25**	12.86
40	**42.12**	-30.31	47	**190.08**	8.5	60	**144.26**	-35
41	**98.21**	56.09	48	**229.4**	39.32	61	**205.41**	61.15
42	**54.87**	-43.34	49	**229.82**	0.41	62	**84.71**	-120.71
43	**37.55**	-17.32	50	**299.59**	69.77	63	**158.56**	73.85
44	**95.3**	57.75	51	**134.1**	-165.49	64	**126.75**	-31.8
45	**17.65**	-77.65	52	**220.04**	85.94	65	**117.61**	-9.15
46	**101.94**	84.29	53	**200.57**	-19.47	66	**80.26**	-37.35
47	**49.48**	-52.46	54	**64.14**	-136.43	67	**160.73**	80.47
48	**165.9**	116.42	55	**87.85**	23.71	68	**170.98**	10.25
49	**152.46**	-13.44	56	**236.31**	148.46	69	**194.1**	23.12
50	**160.49**	8.03	57	**224.73**	-11.58	70	**173.68**	-20.42
51	**13.99**	-146.5	58	**164.58**	-60.15	71	**78.08**	-95.61
52	**150.06**	136.07	59	**255.22**	90.64	72	**162.97**	84.9
53	**2.2**	-147.86	60	**228.95**	-26.27	73	**110.56**	-52.42
54	**20.77**	18.57	61	**136.43**	-92.52	74	**116.08**	5.53
55	**35.96**	15.2	62	**186.89**	50.46	75	**186.98**	70.9
56	**144.18**	108.22	63	**307.75**	120.86	76	**162.57**	-24.41

57	**96.38**	-47.8	64	**248**	-59.75	77	**191.51**	28.94
58	**29.31**	-67.07	65	**18.4**	-229.6	78	**106.85**	-84.66
59	**6.79**	-22.52	66	**18.06**	-0.34	79	**79**	-27.85
60	**6.56**	-0.23	67	**252.66**	234.6	80	**109.94**	30.94
61	**7.41**	0.84	68	**240.38**	-12.27	81	**91.98**	-17.95
62	**6.12**	-1.29	69	**245.36**	4.97	82	**136.79**	44.81
63	**4.31**	-1.81	70	**249.16**	3.8	83	**87.93**	-48.86
64	**8.35**	4.04	71	**280.18**	31.02	84	**103.28**	15.34
65	**10.69**	2.34	72	**128.52**	-151.66	85	**88.76**	-14.52
66	**1116.1**	1,105.41	73	**232.52**	104	86	**80**	-8.76
67	**7.98**	-1,108.12	74	**248.08**	15.55	87	**156.08**	76.08
68	**8.38**	0.4	75	**3,668.66**	3,420.58	88	**144.8**	-11.27
69	**14.98**	6.6	76	**216.44**	-3,452.22	89	**118.71**	-26.09
70	**12.25**	-2.74	77	**165.31**	-51.13	90	**94.21**	-24.5
71	**12.84**	0.59	78	**293.73**	128.42	91	**147.81**	53.6
72	**8.67**	-4.17	79	**213.3**	-80.43	92	**122.08**	-25.73
73	**10.03**	1.36	80	**266.05**	52.75	93	**98.63**	-23.45
74	**10.63**	0.6	85	**308.31**	42.26	94	**143.36**	44.74
75	**11.8**	1.17	86	**391.87**	83.56	95	**151.27**	7.91
76	**12.05**	0.25	87	**259.36**	-132.51	96	**151.02**	-0.25
77	**12.23**	0.18	88	**262.52**	3.17	97	**176.65**	25.63
78	**10.91**	-1.32	89	**278.06**	15.53	98	**156.34**	-20.31
79	**22.72**	11.81	90	**183.59**	-94.46	99	**208.46**	52.12
80	**11.51**	-11.21	91	**196.24**	12.65	100	**210.86**	2.41
81	**9.84**	-1.67	92	**139.78**	-56.46		**Mean**	**2.81**
82	**11.28**	1.44	93	**100.7**	-39.08		**S.D.**	**62.62**
83	**9.48**	-1.79	94	**9,848.03**	9,747.33		**Var**	**3,921.4**
84	**9.37**	-0.12	95	**215.58**	-9,632.45			
85	**5.1**	-4.26	96	**221.15**	5.57			

86	**2.31**	-2.79	97	**175.86**	-45.29
87	**3.39**	1.08	98	**233.76**	57.9
88	**3.92**	0.53	99	**178.83**	-54.93
89	**3.32**	-0.6	100	**210.46**	31.63
90	**3.14**	-0.18		**Mean**	**1.26**
91	**3.6**	0.46		**S.D.**	**1,562.47**
92	**3.38**	-0.22		**Variance**	**2,441,312.**
93	**3.27**	-0.1			
94	**4.19**	0.91			
95	**4.6**	0.41			
96	**5.29**	0.69			
97	**5.41**	0.12			
98	**9.9**	4.49			
99	**20.27**	10.37			
100	**21.43**	1.16			
	Mean	**-0.79**			
	S.D.	**165.37**			
	Variance	**27,347.29**			

E: Cointegration Results

E1: USE regressed on DSE

COUNT	MONTH	DSE(X)	USE(Y)	REQ	RE1	RRE1
1	21	100.00	26.77	60.04	-33.27	
2	22	103.22	102.88	58.76	44.13	77.40
3	23	144.39	240.78	42.30	198.47	154.35
4	24	143.34	36.01	42.72	-6.71	-205.18
5	25	96.95	101.71	61.26	40.46	47.16
6	26	240.35	30.46	3.95	26.50	-13.95
7	27	5.07	23.63	97.98	-74.35	-100.85
8	28	207.85	11.61	16.94	-5.33	69.01
9	29	70.07	11.88	72.00	-60.12	-54.79
10	30	213.32	10.70	14.76	-4.06	56.06
11	31	208.92	24.64	16.51	8.12	12.18
12	32	204.64	81.22	18.22	62.99	54.87
13	33	66.29	19.50	73.51	-54.01	-117.00
14	34	103.61	9.01	58.60	-49.58	4.43
15	35	91.02	18.65	63.63	-44.98	4.61
16	36	110.84	15.81	55.71	-39.90	5.08
17	37	150.19	37.43	39.98	-2.55	37.35
18	38	92.83	102.73	62.91	39.82	42.37
19	39	128.52	72.43	48.64	23.78	-16.04
20	40	107.91	42.12	56.88	-14.76	-38.54
21	41	87.75	98.21	64.94	33.27	48.03
22	42	57.46	54.87	77.04	-22.17	-55.45
23	43	100.82	37.55	59.71	-22.17	0.01
24	44	104.82	95.30	58.11	37.19	59.35
25	45	77.32	17.65	69.10	-51.45	-88.64
26	46	155.17	101.94	38.00	63.94	115.40

27	47	84.20	49.48	66.36	-16.88	-80.82
28	48	128.78	165.90	48.54	117.36	134.24
29	49	141.32	152.46	43.53	108.93	-8.43
30	50	98.74	160.49	60.54	99.95	-8.98
31	51	82.67	13.99	66.97	-52.98	-152.93
32	52	83.28	150.06	66.72	83.33	136.31
33	53	58.69	2.20	76.55	-74.35	-157.69
34	54	117.66	20.77	52.98	-32.21	42.14
35	55	109.61	35.96	56.20	-20.24	11.98
36	56	154.18	144.18	38.39	105.79	126.03
37	57	145.88	96.38	41.71	54.68	-51.11
38	58	166.40	29.31	33.51	-4.20	-58.88
39	59	179.25	6.79	28.37	-21.58	-17.38
40	60	144.26	6.56	42.36	-35.79	-14.21
41	61	205.41	7.41	17.92	-10.51	25.28
42	62	84.71	6.12	66.15	-60.04	-49.53
43	63	158.56	4.31	36.64	-32.33	27.70
44	64	126.75	8.35	49.35	-41.00	-8.66
45	65	117.61	10.69	53.00	-42.31	-1.32
46	66	80.26	1116.10	67.93	1048.17	1090.49
47	67	160.73	7.98	35.77	-27.79	-1075.96
48	68	170.98	8.38	31.68	-23.29	4.50
49	69	194.10	14.98	22.44	-7.46	15.84
50	70	173.68	12.25	30.60	-18.35	-10.89
51	71	78.08	12.84	68.80	-55.96	-37.62
52	72	162.97	8.67	34.88	-26.20	29.76
53	73	110.56	10.03	55.82	-45.79	-19.58
54	74	116.08	10.63	53.61	-42.98	2.80
55	75	186.98	11.80	25.28	-13.48	29.50

56	76	162.57	12.05	35.04	-22.99	-9.50
57	77	191.51	12.23	23.47	-11.24	11.74
58	78	106.85	10.91	57.30	-46.40	-35.15
59	79	79.00	22.72	68.43	-45.72	0.68
60	80	109.94	11.51	56.07	-44.56	1.16
61	81	91.98	9.84	63.24	-53.40	-8.84
62	82	136.79	11.28	45.34	-34.06	19.34
63	83	87.93	9.48	64.86	-55.38	-21.32
64	84	103.28	9.37	58.73	-49.36	6.01
65	85	88.76	5.10	64.53	-59.43	-10.06
66	86	80.00	2.31	68.03	-65.72	-6.29
67	87	156.08	3.39	37.63	-34.24	31.48
68	88	144.80	3.92	42.14	-38.22	-3.98
69	89	118.71	3.32	52.56	-49.24	-11.03
70	90	94.21	3.14	62.35	-59.22	-9.97
71	91	147.81	3.60	40.94	-37.34	21.88
72	92	122.08	3.38	51.22	-47.84	-10.50
73	93	98.63	3.27	60.59	-57.32	-9.47
74	94	143.36	4.19	42.71	-38.53	18.79
75	95	151.27	4.60	39.55	-34.95	3.58
76	96	151.02	5.29	39.65	-34.36	0.59
77	97	176.65	5.41	29.41	-24.00	10.36
78	98	156.34	9.90	37.53	-27.63	-3.63
79	99	208.46	20.27	16.70	3.57	31.20
80	100	210.86	21.43	15.74	5.69	2.12
				AVG	**0.55**	**0.49**
				S.D.	**128.76**	**183.41**

E2: USE regressed on NSE

COUNT	MONTH	NSE (Z)	USE(Y)	REQ	RE2	RRE2
1	1	100.00	100.00	56.01	43.99	
2	2	576.93	100.24	59.73	40.51	-3.47
3	4	52.68	100.75	55.65	45.10	4.59
4	5	67.74	101.24	55.76	45.48	0.38
5	6	88.66	101.54	55.93	45.62	0.14
6	12	0.09	29.07	55.24	-26.17	-71.78
7	13	97.81	27.82	56.00	-28.17	-2.01
8	14	238.02	16.11	57.09	-40.98	-12.81
9	15	0.00	31.23	55.24	-24.01	16.98
10	16	0.00	27.94	55.24	-27.30	-3.29
11	17	0.00	42.59	55.24	-12.65	14.65
12	18	0.15	29.38	55.24	-25.86	-13.21
13	19	0.08	27.18	55.24	-28.05	-2.19
14	20	0.00	102.41	55.24	47.17	75.22
15	21	0.00	26.77	55.24	-28.47	-75.64
16	22	0.05	102.88	55.24	47.65	76.11
17	23	0.00	240.78	55.24	185.54	137.89
18	24	105.20	36.01	56.05	-20.04	-205.58
19	25	101.53	101.71	56.03	45.69	65.73
20	26	105.42	30.46	56.06	-25.60	-71.29
21	27	77.28	23.63	55.84	-32.21	-6.61
22	28	91.86	11.61	55.95	-44.34	-12.13
23	29	160.59	11.88	56.49	-44.61	-0.27
24	30	118.66	10.70	56.16	-45.46	-0.85
25	31	101.04	24.64	56.02	-31.39	14.08
26	32	124.44	81.22	56.20	25.01	56.40
27	33	54.26	19.50	55.66	-36.16	-61.17

28	34	101.35	9.01	56.02	-47.01	-10.86
29	36	78.04	15.81	55.84	-40.04	6.98
30	37	116.70	37.43	56.14	-18.71	21.33
31	38	142.02	102.73	56.34	46.38	65.10
32	39	142.78	72.43	56.35	16.08	-30.30
33	40	164.85	42.12	56.52	-14.40	-30.48
34	41	182.28	98.21	56.65	41.55	55.95
35	42	144.14	54.87	56.36	-1.49	-43.04
36	43	125.81	37.55	56.22	-18.67	-17.18
37	44	117.16	95.30	56.15	39.15	57.82
38	45	199.48	17.65	56.79	-39.14	-78.29
39	46	181.58	101.94	56.65	45.29	84.43
40	47	190.08	49.48	56.72	-7.24	-52.53
41	48	229.40	165.90	57.02	108.88	116.11
42	49	229.82	152.46	57.03	95.43	-13.44
43	50	299.59	160.49	57.57	102.92	7.49
44	51	134.10	13.99	56.28	-42.29	-145.22
45	52	220.04	150.06	56.95	93.11	135.40
46	53	200.57	2.20	56.80	-54.60	-147.71
47	54	64.14	20.77	55.73	-34.97	19.64
48	55	87.85	35.96	55.92	-19.95	15.01
49	56	236.31	144.18	57.08	87.10	107.06
50	57	224.73	96.38	56.99	39.40	-47.71
51	58	164.58	29.31	56.52	-27.21	-66.61
52	59	255.22	6.79	57.22	-50.43	-23.23
53	60	228.95	6.56	57.02	-50.45	-0.02
54	61	136.43	7.41	56.30	-48.89	1.56
55	62	186.89	6.12	56.69	-50.57	-1.68
56	63	307.75	4.31	57.63	-53.33	-2.75

57	64	248.00	8.35	57.17	-48.82	4.51
58	65	18.40	10.69	55.38	-44.69	4.13
59	66	18.06	1116.10	55.38	1060.73	1105.42
60	67	252.66	7.98	57.20	-49.22	1109.95
61	68	240.38	8.38	57.11	-48.72	0.50
62	69	245.36	14.98	57.15	-42.16	6.56
63	70	249.16	12.25	57.18	-44.93	-2.77
64	71	280.18	12.84	57.42	-44.58	0.35
65	72	128.52	8.67	56.24	-47.56	-2.98
66	73	232.52	10.03	57.05	-47.01	0.55
67	74	248.08	10.63	57.17	-46.54	0.47
68	75	3668.66	11.80	83.81	-72.01	-25.48
69	76	216.44	12.05	56.92	-44.87	27.14
70	77	165.31	12.23	56.52	-44.29	0.58
71	78	293.73	10.91	57.52	-46.62	-2.32
72	79	213.30	22.72	56.90	-34.18	12.44
73	80	266.05	11.51	57.31	-45.80	-11.62
74	85	308.31	5.10	57.64	-52.53	-6.73
75	86	391.87	2.31	58.29	-55.98	-3.45
76	87	259.36	3.39	57.26	-53.86	2.11
77	88	262.52	3.92	57.28	-53.36	0.50
78	89	278.06	3.32	57.40	-54.08	-0.72
79	90	183.59	3.14	56.67	-53.53	0.55
80	91	196.24	3.60	56.76	-53.17	0.36
81	92	139.78	3.38	56.32	-52.95	0.22
82	93	100.70	3.27	56.02	-52.75	0.20
83	94	9848.03	4.19	131.95	-127.76	-75.02
84	95	215.58	4.60	56.91	-52.31	75.45
85	96	221.15	5.29	56.96	-51.66	0.65

86	97	175.86	5.41	56.60	-51.19	0.47
87	98	233.76	9.90	57.06	-47.15	4.04
88	99	178.83	20.27	56.63	-36.36	10.80
89	100	210.46	21.43	56.87	-35.44	0.92
				AVG	**-4.82**	**-0.90**
				S.D.	**124.61**	**175.97**

E3: DSE regressed on NSE

COUNT	MONTH	DSE (X)	NSE (Z)	REQ	RE3	RRE3
1	21	100.00	0.00	129.58	-29.58	
2	22	103.22	0.05	129.58	-26.36	3.22
3	23	144.39	0.00	129.58	14.81	41.17
4	24	143.34	105.20	129.91	13.43	-1.38
5	25	96.95	101.53	129.90	-32.95	-46.38
6	26	240.35	105.42	129.91	110.44	143.39
7	27	5.07	77.28	129.82	124.76	235.20
8	28	207.85	91.86	129.87	77.98	202.74
9	29	70.07	160.59	130.09	-60.02	138.00
10	30	213.32	118.66	129.96	83.36	143.38
11	31	208.92	101.04	129.90	79.02	-4.34
12	32	204.64	124.44	129.98	74.67	-4.35
13	33	66.29	54.26	129.75	-63.46	138.13
14	34	103.61	101.35	129.90	-26.29	37.17
15	36	110.84	78.04	129.83	-18.98	7.31
16	37	150.19	116.70	129.95	20.24	39.22
17	38	92.83	142.02	130.03	-37.20	-57.44
18	39	128.52	142.78	130.03	-1.52	35.68
19	40	107.91	164.85	130.11	-22.19	-20.68
20	41	87.75	182.28	130.16	-42.41	-20.22
21	42	57.46	144.14	130.04	-72.58	-30.17
22	43	100.82	125.81	129.98	-29.16	43.42
23	44	104.82	117.16	129.95	-25.13	4.03
24	45	77.32	199.48	130.22	-52.89	-27.76
25	46	155.17	181.58	130.16	25.01	77.90
26	47	84.20	190.08	130.19	-45.99	-71.00
27	48	128.78	229.40	130.31	-1.53	44.46

28	49	141.32	229.82	130.32	11.00	12.53
29	50	98.74	299.59	130.54	-31.80	-42.80
30	51	82.67	134.10	130.01	-47.34	-15.54
31	52	83.28	220.04	130.28	-47.01	0.33
32	53	58.69	200.57	130.22	-71.53	-24.52
33	54	117.66	64.14	129.78	-12.12	59.41
34	55	109.61	87.85	129.86	-20.25	-8.13
35	56	154.18	236.31	130.34	23.84	44.09
36	57	145.88	224.73	130.30	15.58	-8.26
37	58	166.40	164.58	130.10	36.29	20.71
38	59	179.25	255.22	130.40	48.86	12.56
39	60	144.26	228.95	130.31	13.94	-34.91
40	61	205.41	136.43	130.01	75.40	61.45
41	62	84.71	186.89	130.18	-45.47	120.87
42	63	158.56	307.75	130.57	27.99	73.46
43	64	126.75	248.00	130.37	-3.62	-31.61
44	65	117.61	18.40	129.63	-12.03	-8.41
45	66	80.26	18.06	129.63	-49.37	-37.35
46	67	160.73	252.66	130.39	30.34	79.71
47	68	170.98	240.38	130.35	40.63	10.29
48	69	194.10	245.36	130.37	63.74	23.10
49	70	173.68	249.16	130.38	43.31	-20.43
50	71	78.08	280.18	130.48	-52.40	-95.71
51	72	162.97	128.52	129.99	32.99	85.39
52	73	110.56	232.52	130.32	-19.77	-52.75
53	74	116.08	248.08	130.37	-14.29	5.48
54	75	186.98	3668.66	141.39	45.60	59.89
55	76	162.57	216.44	130.27	32.30	-13.29
56	77	191.51	165.31	130.11	61.41	29.10

57	78	106.85	293.73	130.52	-23.67	-85.08
58	79	79.00	213.30	130.26	-51.27	-27.60
59	80	109.94	266.05	130.43	-20.49	30.77
60	85	88.76	308.31	130.57	-41.81	-21.32
61	86	80.00	391.87	130.84	-50.83	-9.03
62	87	156.08	259.36	130.41	25.67	76.50
63	88	144.80	262.52	130.42	14.38	-11.28
64	89	118.71	278.06	130.47	-11.76	-26.14
65	90	94.21	183.59	130.17	-35.95	-24.19
66	91	147.81	196.24	130.21	17.60	53.56
67	92	122.08	139.78	130.03	-7.95	-25.55
68	93	98.63	100.70	129.90	-31.27	-23.33
69	94	143.36	9848.03	161.29	-17.92	13.35
70	95	151.27	215.58	130.27	21.01	38.93
71	96	151.02	221.15	130.29	20.73	-0.27
72	97	176.65	175.86	130.14	46.51	25.77
73	98	156.34	233.76	130.33	26.01	-20.50
74	99	208.46	178.83	130.15	78.31	52.30
75	100	210.86	210.46	130.25	80.61	2.30
				AVG	**0.00**	**1.49**
				S.D.	**45.90**	**63.95**