THE INTER-TEMPORAL COMOVEMENT OF WORLD EQUITY RETURNS AFTER THE 1987 CRASH

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ABSTRACT

Now that the world is a global village, the pursuit of profiteering opportunity, can be done gainfully. This study sought to evaluate the investment diversification benefit across world stock markets, in terms of index risk and return characteristics and coupling with the treatment of economic integration and development clustering. Study panel data was obtained from the World Federation of Exchanges (WFE) database on the sample period 1993-2012, and country regional categorization adopted from the same database. The index series were then first-differenced and the differences expressed as percentage changes over one lag. The aggregated indexes were then grouped on continental and economic development clusters, making up a sampling base of 67 series. The descriptive analysis techniques involved included the simple and compounded arithmetic means, the coefficient of variation, Correlation ratio (eta), and Pearson's correlation coefficient. The study used a 5% significance t- test, ANOVA and the Pearson's Chi-square of independence on the data. The empirical result affirmed that while economic integration did not affect stock market return co movement.

Keywords: Development, Integration, Co movement, Diversification.

INTRODUCTION
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). Another occurrence that intensified the need to understand international stock market co-movements and transmission mechanisms of shocks was Asian crisis in 1997. Contrary to the U.S. crash in 1987, this crisis started in Thailand as a currency crisis after devaluation of Thai baht. The turmoil spread to East Asia and Russia (which

defaulted in 1998) and subsequently to Brazil.

These relativities in market movements are explained severally by different authors, but the central cause volatility differences. 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.

Owing to the issue of market contagion and volatility differences, world equity markets constitute a fertile ground for investment growth with no serious concerns over the agency problems and hence the reason they are of particular interest, at least to individual stock market investors. Inherent in the national, undemutualized or less advanced markets however, are challenges like state patronage, improper corporate governance structures high illiquidity and undesirably small size. These, according to Mensa (2005) are deeply seated in developing countries' stock markets. The picture may not necessarily be the same across continental frontiers, though the economic development status may be.

Statement of the Research Problem

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, Modern Portfolio Theory (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, thus the theory is about risk-return evaluation.

The theory 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.

What this means is that given two portfolios to invest in; the rational investor has to consider two variables: The risk and expected return. These, according to Marckowitz (1959), are observable through examining the correlation of returns, where in the context of investment in national stock exchanges, it is the index correlation structure that needs scrutiny. Studies aimed at establishing the

evidence of intra-regional (between-countries) stock market index co movements have yielded both affirmative findings (Mwenda, 2005) and conditional ambivalence in results (Kadri, 2005, Esin, 2004). Anecdotal evidence of index coupling affirms that markets within the same economic grouping have closely correlated indexes (Cheung & Mak, 1992) and the converse applies to distant or inter-regional index dependencies (Knif et al., 1996).This view is contrasted by another group of writers (such as Yabara, 2012; Goldstein and Ndungu, 2001) who find out that each market is responsible for its own behavior and regional-economic grouping have a little role to play if any.

Given the mix of findings, the argument in support of causation between industrialization level or economic integration and stock mart risk-return correlations falls apart. This makes the investors amenable to sub-optimal diversification decision-making.

Research Objectives

The principal objective of this study to find out the inter-temporal effects of economic development and economic integration on the co movement of world equity returns after the 1987 crash. This is because of the investment diversification implications imminent from the findings.

Specific Research Objectives

The specific objectives that this study seeks to answer are as follows:
1. To examine the risk-return patterns of the world equity portfolios over the sample study period.
2. To know the effect of economic integration on the co movement of the world equity returns.
3. To suggest recommendations for enhancing investment diversification on world equity markets.

LITERATURE REVIEW
Introduction

One of the critical determinants of stock market contagion or divergence is regionalization, the subset of globalization: - It follows from the story of the United States of America that a unified trading system-a complete merger of all the trading functions (Andres, 2007), typical of the New York Stock exchange (NYSE), is a strong basis of determining the co movement of stock prices.

Where the regionalization initiative is incomplete, the results are mixed. Some Burses will tend to exhibit high inter-temporal co movement of stock mart indices while others will not, as in the case of East Africa (Suva, 2013). This situation of mixed diversification implications is also typified in South America, where the regulatory scheme is the same but market are not integrated, so the prices are on their own (Yarde, 2007); Asia where the defining characteristic is the dominance of one national stock exchange over the others in the region (Suleiman ,2005).

Economic development level is also an important influence on the coupling of stock market indexes, hence a vital investment diversification decision input. The afore-mentioned contrast between the USA and the Americas' 139 stock markets is a timely case. Here, it is apparent that

for a developed economic region, the Bourses will operate in tandem, while ambivalence will set in with decrease in economic development level.

The theory is however self-defeating in that: For developing countries (for example in Africa and Asia), stock market index correlations are not even (Esin, 2004); for the developing regions (for example Europe), higher economic development status does not change the decoupling of the indexes. This is because stock exchanges remain detached from the regional grouping through unbridged regulatory gaps (Calvacanti, 2005). Other relevant literature is summarized in Figure 1.

Figure 1 Literature Review Summary

Author(s), Year	Markets Studied, sample period, study description.	Methodology	Findings
Eun and Shim (1989)	Australia, Canada, France, Germany, Hong-Kong, Japan, Switzerland, Britain, USA :1980-1985	VAR model, Impulse responses	Inter-continental responses were slower than intra-continental ones
Mulliaris and Urrutia (1992)	USA, Japan, Britain, Hong Kong, Singapore, Australia 1987-1988	Granger Causality test	No causality
Chen, Firm and Rui (2000)	Brazil, Mexico, Chile, Argentina, Colombia, Venezuela 1995-2000	Co integration test	No co integration
Huang, Yang and Hu (2000)	USA, Japan, China, Hong Kong, Taiwan, South China: 1992-1997	Cointegration test, Granger causality test	No co-integration
Meric, Mitchell, Ratner, Meric (2006)	Egyptian, Israeli, Jordanian, and Turkish, USA and UK: 1996-2006	Correlation, rolling correlation; Principal Components Analysis	Low correlations among developing countries
Allali Abdelwahab, Oueslati Amor, Trabelsi Abdelwahab (2005)	United States, United Kingdom, Japan, Germany, Canada Hong Kong, France, Switzerland, Australia :2000-2005	Correlation, Graphical Models	Reliable conditional association structure of the returns (conditional comovement)
Martikainen and Ken (1997)	Denmark, Norway, Sweden, Finland : 1988-1994	Multivariate VAR FGARCH model	Independence of markets despite trade ties
Richards (1995)	Australia, Austria, Canada, France, Germany, Denmark, Hong Kong, Italy, USA, Japan, Britain, Sweden, Switzerland, Holland, Norway, Spain :1970-1994	Co integration test	No evidence of market dependency

Hilliard (1979)	Amsterdam, Paris, London, Milan, Frankfurt, New York, Sydney, Tokyo, Toronto and Zurich: July 1973 to April 30, 1974 using daily closing over the 1973 OPEC oil embargo.	Auto spectrum, coherence, phase angle and tan	Intra-continental prices tend to move together but inter-continental ones do not necessarily follow the trend.
Cheung and Mak (1992)	Australia, China, Korea, Malaysia, Philippines, Singapore, Taiwan and Thailand:1977-1988	Partial correlations and inverse utocorrelations in order to identify the ARIMA model of each return series	Low correlations with high foreign trade restrictions; global factors were more influential to market correlations
Brocato (1984)	US, UK, Canada, Japan, West Germany and Hong Kong: 1980-1987 in a study of cross-market correlation patterns	Sub-period VAR tests with March 1984 as the breakpoint	Higher correlations with decreased US dominance.
Knif et al. (1996)	Helsinki and Stockholm: 1920-1993 across several crashes	Correlation analysis	Integration had no effect on market correlation structure
Karolyi and Stulz (1996)	Japanese and US stock markets:1996 daily and intra-day stock index returns' co-movements	Correlation analysis with macroeconomic announcements as treatments.	No systematic pattern in correlation between days of the announcements
Kanas (1998)	UK, Germany, Italy, France, Switzerland and Netherlands: 1983-1996 with October 1987 as the breakpoint.	Multi-war rate trace statistic, Johansen approach based on VAR analysis and Breren's test	No pair-wise cointegration among the markets, thus there was portfolio diversification benefit.
Meric et al. (2001)	Brazil, Argentina, Chile, Mexico and the US: 1984-1987, 1987-991; 1991-1995, with different market restrictions.	Correlation analysis.	Investment benefit waning with integration, but present in well-diversified portfolios.
Christofi and Christofi (1983)	14 industrial countries for annual and biennial correlations of the US with each of them :1959-1978 with ten-year sub-periods	PCA, Box-Jenkins and nonparametric tests on two equal sub-periods	The markets were interrelated over time hence no diversification benefit.
Mathur and Subrahmanyam (1990)	Nordic and US markets: 1990	VAR analysis	High interdependencies with high economic interdependency
Roll (1992)	24 countries : 1988-1991	Correlation analysis	High correlation with high integration and regionalism

Corhay and Urbain (1993)	France, Germany, Italy, Netherlands and the UK :March 1975 to September 1991.	Cointegration tests	Disparate market interrelations
King et al. (1994)	Seventeen world stock markets: 1994	Correlation as a result of economic fundamentals	Index only correlations followed unobserved macro factors.
Erb et al. (1994)	The G-7 countries: 1994	Correlation analysis	Correlation high during recession and low during recovery, but not symmetric in up and down markets.
Esin (2004)	Turkish and European stock exchanges 1990-2003: to examine the suitability of international diversification in the markets.	KPSS (1992) formula of first differencing, with the introduction of Euro as the breakpoint.	High 2nd sub-period correlations, No evidence of cointegration.
Dutt and Milhov (2008)	58 world stock markets: 2008 to know the effect of industrial structure on return coupling	Pairwise correlation analysis	High return correlations for similar industrial structures
Arouri et al., (2008)	Latin America and USA :2008: studying the possibility of investment diversification benefit	-Engel & Granger's (2002) DCC-GARCH Model, -Bai & Perron (2003) Structural Break Analysis	Market correlations influenced regime changes and coupling was high at times of crises.
Suva (2013)	Uganda, Nairobi; Dar-es-Salaam stock markets: 2002-2008, testing the pairwise comovement, contagion and cointegration	-Unit root test -Unconditional correlation analysis -Cointegration Error Correction Model	Disparate market co movements; mixed contagion results; no market cointegration.

Literature Summary and Research Gap

The foregoing literature examines different markets at different times and time ranges. Using different research analysis methodologies, the researchers come up with different findings regarding investment diversification. The literature seems to suggest two main sets of realization:

The first set of findings regards regional economic integration. Arguments for diversification debenefit are affirmed by several authors. In the work of Kanas (1998) for instance, the stock market index correlations increased with increased integration thereby wiping away the investment diversification benefit. This is supported by Roll (1992) and Mathur and Subrahmanyam (1990).

Conversely, some studies determine otherwise: These include Esin (2004) and Kanas (1998) who find no evidence of intra-regional stock mart cointegration, thus no diversification benefit, Corhay and Urbain (1993) and Suva (2013) who find disparate intra-bloc market behavior, Knif et al., (1996) with no effect of regionalism on stock return co movements, and Erb et al., (1994) who find that intra-regional bourses have varying inter-temporal correlation structures.

The second basis of assessing the literature is the level of economic development, or the industrial structure of the country hosting the stock market under study. From the literature, the study seeks to answer the question of whether differences in the levels of economic development are a critical determinant of stock market co movement or not.

To this question, the literature seems to present an imprecise answer. To begin with, Dutt and Milhov (2008) suggest a Yes, by finding that countries with similar industrial structures exhibiting high correlation of stock returns, thus offering no diversification benefit to the investor. This Yes finding is echoed (though in contrast) by Meric et al, (2006), who determine that market correlations are low among developing countries. These two results present the tacit truth that countries with similar industrial structure can have either a high or low correlation relations among the stock returns.

A second standpoint on this subject is that there is no tangible effect of economic development on the co movement of stock markets: Here, Richards (1995) say there is no evidence of market dependency, Martikainen and Ken (1997) posit that among the markets of their study (Denmark, Norway, Sweden; Finland) there was no evidence of dependency despite trade ties and similarity in industrialization levels. For Chen, Firm and Rui (2008), their study of Brazil, Mexico, Chile, Argentina, Colombia and Venezuela also gave results similar to those of Martikainen and Ken.

The literature falls short of responses to the following two essential investment puzzles:
1. Where will good returns come from: The developed or emerging markets?
2. Will diversification benefit come from economic integration or not?

METHODOLOGY
Data

The data used for the study were obtained from the World Federation of Exchanges (WFE) database. This was mainly panel data, constituting the year-end index series enlisted on the database. Twenty three of the 67 Burses did not have records at the start year (1993), so the research mainly concentrated on the remaining 45 exchanges.

Each of the year-end data series were then first-differenced to get the absolute returns, which in turn were aggregated as conditional percentages (R_{ik}). Accordingly, $(R_{ik}) = \{100(X_{ik} - X_{i,(k-1)})\}/X_{ik}$, where X_{ik} was the index of market *i* at the end of year *k*.

Research analysis techniques

The Risk-return characteristics: While the level of aggregate index returns was measured using simple and compound arithmetic mean of the conditional returns; the portfolio risk level

was measured using the coefficient of variation of the aggregated returns. Each of the two descriptive procedures was applied on the data by regional, integration and industrialization clusters, for the purposes of comparison.

Correlation analysis: Pearson's conditional correlation analysis was engaged on the index pairs under each of the market clusters. The analysis was useful in determining the level and direction of index return co movement, as the findings formed the basis of detecting the desirability of investment diversification.

The last step of the data analysis involves the correlation ratio (Eta), used to identify the cause of the overall dispersion in returns. This Eta was used to tell whether it was due to economic integration or economic development which is responsible for the said variability.

RESULTS

In this section, the results of the study are presented according to the specific research objectives.

Risk and Return patterns

Continental risk and return aggregates are presented in Table 1. In Table 2 the study investigates whether these risk-return characteristics are related to the countries' industrial structure differences. Table 3 is a summary of the ANOVA test of difference

Table 1: Risk and Return Rankings

Continent	Return averages	No. of markets	Std. Deviation	(CV)	Return rank	Risk rank
South America	63.4067	6	62.29609	98.2	1	1
Middle-East	33.726	5	28.00101	83.0	2	2
Africa	29.4675	4	18.88177	64.1	3	4
Asia-Pacific	17.8247	15	12.76219	71.6	4	3
Europe	12.1808	12	4.45675	36.0	5	5
US and Canada	9.78	5	3.51595	36.0	6	5

Table 2: Average Returns and Economic Development Rankings

Development Ranking	Return averages	No. of markets	Std. Deviation	CV
Developed	11.1176	25	4.50472	40.5
Developing	38.7018	22	37.75619	97.6
Total		47		

Economic Integration and Return Co movement

The study re-sampled the individual stock exchanges into two sub-samples: The integrated and disparate. The integrated category consisted of 26 markets in the following categories (see also

the appendix): The Americas-Southern sub-continent (5), The Americas-Northern sub-continent (6), Nordic NASDAQ OMX exchanges (3), Euronext Europe (4); Asia-pacific- China, Japan, India, Oceania (8).Out of these, the study obtained 38 Pearson's correlation pairs.

The second sample of markets was from the independent (disparate) category- those that did not belong to economic integration zones. They were taken from the WFE database of the biggest world exchanges by trade volumes according to the WFE 2012 monthly reports.

Table 2: ANOVA Table of Return Differences

Return Variations	Sum of Squares	df	Mean Square	F-statistic	Significance
Between Groups	8904.021	1	8904.021	13.170	.001
Within Groups	30423.144	45	676.070		
Total	39327.165	46			

From this list, each country was limited to only one exchange representation even if it had more on the WFE list. Where no region was represented; the researcher included one of the markets, the biggest in terms of annual trading volumes as per the WFE categorization. This ensured that no country had more than one representation and no continent was unrepresented. In total, there were 14 such markets, yielding 105 bivariate return correlations.

In all, the conditional return correlations were 143 (or 38+105), for which a 2x2 Yate's Chi-square test of independence worked out as follows.

Table 3: Yate's Chi-square Table of market returns

	Coupled	Other results	TOTALS
Integrated market pairs	30	8	**38**
Disintegrated market pairs	104	1	**105**
TOTALS	**134**	**9**	143

Yate's χ^2 = [{30(1)- 104(8)}^{2}*143]/{134(9)(38)(105)} = 0.024 compared to the tabular Chi-square value at 5% significance and 1 degree of freedom: χ^2_t = 3.81 > 0.024. Accordingly, it can be inferred that economic integration had no effect on market return correlations. Furthermore, a greater proportion exhibited high co movement without the integration conditioning (104 of the 105 disparate correlations, compared to the 30 of the 38 integrated markets).

DISCUSSION

The empirical findings of the research revealed that higher risks were positively associated with higher returns. South American markets were the most gainful while the US and Canada trailed the returns list. Return averages were also found to be higher for the emerging as compared to those of the developed markets.

Regarding economic integration, the study found that the return averages between the two integration categories were significantly different. More integrated markets had lower stock returns than less integrated ones. Moreover, return co movements for the integrated markets were

lower than those from disintegrated ones. The Yate's Chi-square results showed insignificance in correlation differences across the integration clusters.

CONCLUSIONS

From the findings of this study, it can be concluded that:-
1. The lower the economic development level of a market's host country: the higher is the stock market returns.
2. The lower the integration level of an economic bloc, the lower is the level of stock market returns.
3. Economic integration does not have a significant effect on co movement of stock returns; hence it has no diversification benefit implications.

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