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INTERNATIONAL CAPITAL MARKET LINKAGES: A SYNTHESIS OF PRIOR LITERATURE

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Abstract

In recent years, financial market integration has become a central theme in international finance literature, due to its important implications for many parties involved. The contribution of research on this topic has been substantial and covered several relevant issues, whether at the micro or macro level. This study presents a detailed review on the literature of capital market integration along with their possible limitations. In addition, a comparison is provided between the different empirical approaches used in investigating the level to which capital markets are integrated. It can be concluded from the literature survey that capital market integration is still a moot point, as the empirical evidence is rather inconclusive. Thus, the potential gains derived from, and limitations of, cross-border diversification are still at the core of the debate; and that perhaps surprisingly this issue is not yet fully resolved.

Keywords: Market integration; market segmentation; cointegration analysis; asset-pricing models; Vector Error Correction Modeling (VECM).
JEL: C32, G11, G14, G15, F30.

1. Introduction

There are voluminous studies that investigate the level of integration of the world's financial markets over time and across markets. These studies also explore a diversity of issues quite germane to global market linkages, such as short-run and long-run interdependencies, the leaders and followers in a set of financial markets, and the macroeconomic policies that impact trade and fiscal imbalances among countries. Financial market shocks, such as the stock market crash of 1987, the Asian financial crisis of mid–1997, the terrorist attacks of September 2001, and more recently the disastrous subprime mortgage crisis that erupted in the US in 2007, also rekindle the debate over the interaction amongst the world's financial markets.

Even more impressively, whether stock markets are integrated or segmented is closely relevant to the issue of international diversification. As pointed out by Von Furstenberg and Jeon (1989) and Masih and Masih (1997), if stock markets are cointegrated, this means that the potential for making abnormal profits through diversifying internationally in the cointegrated markets would wane in the long run. This is because if the markets are cointegrated, abnormal profits will be arbitraged away in the long run and, in the absence of barriers or potential barriers generating country risk and exchange rate premiums, one would expect similar yields for financial assets of similar risk and liquidity, irrespective of nationality or location. Thus, it is not in the best interest of international investors to invest in cointegrated markets. However, if markets are not cointegrated, there is no arbitrage activity to bring the markets together in the long run. Under these circumstances, investors can potentially obtain long-run gains through international portfolio diversification.

Methodologically, a plenteous portion of the extant empirical literature employs econometric techniques in exploring the linkages among international stock markets. This strand of literature can be parcelled out into two main groups. The first group examines the co-movements of stock market indices around the globe, applying a variety of simple econometric techniques ranging from pairwise correlation, variance-covariance, to spectral analyses. The primary interest in these early works is related to the question of whether international stock markets share short-run relationships over time, which is germane to the issue of the potential benefits of international portfolio diversification.

The second group benefits from the latest developments in time series econometric techniques that warrant more vigorous analyses to be conducted such as Cointegration Analysis, Vector AutoRegression (VAR) modeling, Vector Error Correction Modeling (VECM), Granger Causality tests, Variance Decomposition and Impulse Response Analysis. Instead of merely exploring the co-movements of stock price indices, this group of studies looks at both the short-run and long-run facets of market linkages to investigate further the structure of these linkages in terms of the speed and persistence of the interaction between markets.

Finally, an important strand of empirical literature investigates the issue of stock market integration in conjunction with a particular Asset Pricing Model. The main theme here is to postulate that assets of identical risks should command identical returns regardless of their geographical domicile. This strand of research develops ad hoc models to test this hypothesis, utilizing both macroeconomic and financial variables.

Following this brief introduction, the remainder of this study is structured in the following sequence: section two presents a review of literature that approaches the market integration issue through utilizing asset-pricing models. Section three reviews the empirical studies that utilize econometric methodologies in investigating market integration.[1] Finally, section four offers the summary and the concluding remarks.

[1] It should be noted that this paper does not address the segmentation within a given market. For Readers who are interested in this topic, see for instance, Ariff and Khan (2003) and Arouri et al. (2012).

2. Studies based on Asset Pricing Models.

The modern portfolio theory (MPT) introduced by Markowitz (1952) is regarded as one of the first endeavors to present mathematically the intuitive axiom that markets exhibit a trade-off between risk and reward. The main assumption of this theory is that all the relevant information for an investor to quantify the performance of a particular portfolio of assets is given in terms of two parameters: its expected return, or mean, a measure of central tendency; and its variance, a measure of the propensity of portfolio returns to deviate from the expected value.

Expected return is used as a proxy for the reward attached to holding a given portfolio, while the variance of the returns distribution is taken as a measure of risk. Investors are assumed to seek the portfolio that provides minimum risk for a given level of expected return, or alternatively, they will choose to hold the portfolio that provides maximum expected return for a given level of risk. The relationship plotting the minimum variance attainable for each level of return (or alternatively, the maximum return achievable for each level of risk) is referred to as risk-return frontier (i.e. efficient frontier).

The portfolios whose mean and variance lie on the efficient frontier are referred to as efficient portfolios. Markowitz states that the kernel of his theory is the diversification effect; that is investors can realize the potential gains from diversification when additional yet not highly correlated securities are added into their portfolios. The Markowitz portfolio theory was the start of a new era in finance. By introducing an asset with a risk-free rate of return, zero variance and zero correlation with other risky assets, Sharpe (1964) developed a generalized theory for the pricing of capital assets, the Capital Asset Pricing Model (CAPM). Lintner (1965) and Mossin (1966) came up with similar results individually.

Grounded on various versions of asset-pricing models, many studies began to investigate the issues of international portfolio diversification and financial market integration with different treatments of cross-border investment obstacles such as taxes, transaction costs, short selling, and ownership restrictions. These studies are based on the argument that markets are integrated if securities with the same risk characteristics are priced the same, irrespective of their geographical domicile. In CAPM terms, a country's A securities should fall on the country's B Security Market Line if the equity markets of these two countries are integrated. Otherwise, markets are segmented in the sense that security price movements are driven by various risk factors in different markets (Stehle, 1977; Cumby & Glen, 1990).

By and large, past international asset–pricing models can be partitioned into three broad categories on the strength of the type of risk considered in the pricing expected returns: segmented market models, integrated market models, and partially segmented market models.

In the segmented market models, a country portfolio's risk is merely its returns variance. The variance is rewarded with a country-specific price which is linked to a weighted average risk aversion within the particular country

(Harvey, 2000). Thus, the *segmented* market model assesses the expected equity returns as a function of only the country-specific or idiosyncratic risk represented by the stock returns variance. A vivid example of this category is the domestic CAPM. In its excess return form, the domestic CAPM can be expressed as a single-period equilibrium model as follows:

$$E_{t-1}\left(R_{i,t}\right) = \lambda_{i,t-1} VAR_{t-1}\left(R_{i,t}\right) \tag{1}$$

where $E_{t-1}\left(R_{i,t}\right)$ is the expected excess return on asset *i* above the domestic risk free rate of return for the period of time from *t*-1 to *t* $\lambda_{i,t-1}$ is the price or reward of domestic market risk, and $VAR_{t-1}\left(R_{i,t}\right)$ represents the country-specific risk.

Such a framework is appropriate if the market is wholly segmented or if it represents a proxy for the world market. The appropriateness of this model has however, diminished over the years because the market capitalization of any one single market as a proportion of the world market has decreased (Phylaktis & Ravazzolo, 2004).

In contrast, under the category of integrated market models, capital assets within a particular country are rewarded in terms of their contribution to a well-diversified world portfolio. Thus, if capital markets are fully integrated, the expected return of a country portfolio should solely be determined by the country's exposure to world covariance risk. What matters is the covariance with the world portfolio. There is also a world price of covariance risk that translates the contribution into expected returns. The world price is directly linked to the weighted average risk aversion in the world. A higher risk aversion implies a higher world price of covariance risk (Harvey, 2000).

One of the earliest models of this category is the international CAPM (Grauer et al., 1976), which can be expressed as follows:

$$E_{t-1}\left(R_{i,t}\right) = \lambda_{i,t-1} COV_{t-1}\left(R_{i,t}, R_{w,t}\right) \tag{2}$$

where $E_{t-1}\left(R_{i,t}\right)$ and $R_{w,t}$ are expected returns on asset i and the world market portfolio. Both returns are in excess of the local risk free rate of return for the period of time from *t*-1 to *t*. $\lambda_{i,t-1}$ is the price or reward of world market risk and $COV_{t-1}\left(R_{i,t}, R_{w,t}\right)$ is the world covariance risk. The world market portfolio includes all the assets in the world in proportion to their capitalization relative to world wealth.

Additionally, the category of asset–pricing models for *integrated* markets encompasses studies of a world consumption-based model (Wheatley, 1988), world arbitrage pricing theory (Solnik, 1983), world latent factor models (Campbell & Hamao, 1992; Bekaert & Hodrick, 1992), and world multi-betas models (Ferson & Harvey, 1993; 1994).

Nonetheless, it is widely believed that many markets are not fully integrated into the world capital markets but they are not fully segmented either. Furthermore, Bekeart and Harvey (1995) and Stulz (1999) stress the fact that the degree to which markets are integrated or segmented is not constant, but changes gradually through time and that capital market liberalizations are not one-shot events. Consequently, the results of these two polar extremes (i.e. segmented/integrated world) have been fairly, on the whole, dismal.

The last category of international asset–pricing models considers a framework in which the polar extremes are replaced by a mild segmentation structure. A well-cited paper in this context is that of Errunza et al. (1992) in which they test the competing hypotheses of full integration, mild segmentation, and full segmentation. For the empirical part of their study, Errunza et al. collect the end-of-month prices and cash dividends for 381 common stocks from eight emerging markets (i.e. Argentina, Brazil, Chile, Greece, India, Korea, Mexico & Zimbabwe) and 833 NYSE securities, for the period between January 1976 and December 1987. All returns are expressed in US dollar terms. They apply a theoretical unconditional CAPM framework that reasonably captures the real world institutional capital flow barriers imposed by several emerging markets.

The studys empirical findings for Brazil, Chile, Greece, Korea and Mexico overwhelmingly suggest a market structure consistent with the mild segmentation hypothesis. For all these countries, both the extreme cases of full integration and complete segmentation paradigms are rejected. Argentina and Zimbabwe appear to lie in a continuum from mild segmentation to complete segmentation (only full integration is rejected). Finally, since all three hypotheses are rejected for India, it is conjectured that an as-yet-unspecified non polar market structure may fairly be appropriate for this market.

In fact, while the model employed in the Errunza et al. (1992) study provides a unique opportunity to investigate the intermediate non-polar case of mild segmentation, it fails to capture the time-varying nature of market segmentation, i.e it suffers from selecting a degree of segmentation that is invariant through time.

In an attempt to circumvent Errunza et al.'s limitation, Bekaert and Harvey (1995) present a measure of time-varying market integration using a conditional regime- switching model that accounts for periods when national markets were segmented from world capital markets and when they became integrated later in the sample. In the polar case of market integration, their model reduces to the world CAPM, while in the polar case of market segmentation, their model reduces to a local CAPM.

They allow the switching between segmentation and integration by attaching probabilities to the respective asset–pricing models. Another important feature of Bekaert and Harvey's model is that it is conditional on a past information set that includes lagged dividend yields and lagged equity capitalization as a proportion of Gross Domestic Product (GDP) to control their effects on asset returns. Their model has the following form:

$$E_{t-1}[r_{i,t}] = \emptyset_{i,t-1}\lambda_{i,t-1}cov_{t-1}[r_{i,t}r_{w,t}] + (1-\emptyset_{i,t-1})\lambda_{i,t-1}var_{i,t-1}[r_{i,t}] \quad (3)$$

where $r_{i,t}$ and $r_{w,t}$ denote the returns on asset i and the world market portfolio, respectively $\lambda_{i,t}$ is the market price of risk for asset i at time t, and $\phi_{i,t}$ is the transition probability coefficient that captures the assessment of the degree of market integration. Bekaert and Harvey assume that $\phi_{i,t}$ is a logistic function of the information variables. Therefore, their model indicates that the conditional asset return is equal to the product of the probability that markets are integrated and the asset return implied by the complete integrated asset pricing model, plus the product of the probability that the markets are segmented and the asset return implied by the complete segmented asset pricing model.

Bekaert and Harvey apply the model to monthly observations of equity returns for 21 developed markets over the period of January 1970 to December 1992, and 12 emerging markets over the period of January 1976 to December 1992. They provide evidence that the degree of market integration of these countries varied considerably during the 1980s and the second half of the 1970s. They suggest that the evidence of varying degrees of market integration are linked to the capital market liberalization process in the countries studied.

Although the regime-switching model takes into account the varying nature of market integration through time, caution must be exercised in interpreting Bekaert and Harvey's results as their tests use the simplest asset–pricing framework- the single factor model. Omitted factors may elicit variation in the integration measure that is not related to market integration.

To Provide a new investigation to changes in the level of integration inherent in the world capital markets, Alford and Folks (1996) developed an asset–pricing model which explicitly not only incorporates the barriers to international investment (i.e. ownership restrictions from both the home country of the investor and the country receiving the investment), but also gives a statistic (i.e. a coefficient of integration) which can lead to an analysis of bilateral integration and of the intertemporal changes in the level of integration. The coefficient of integration, defined as γ_i, is based on the ratio of the return per unit of risk for a security and the return per unit of risk for the market portfolio. This relationship for the price of risk in a barrier–constrained capital market is shown as follows:

$$\frac{R_i - R_f}{\sigma_{im}} = \frac{R_m - R_f}{\sigma^2_m} \frac{(1-\lambda_i/\sigma_{im})}{(1-\lambda/\sigma^2_m)} \quad (4)$$

where R_f is the risk-free rate of return; R_i is the expected return on asset i ; R_m is the return on market portfolio; σ_{im} is the covariance of asset i with the market portfolio, and λ and λ_i represent the Lagrangean multipliers arising from the ownership restrictions on the asset i. Alford and Folks state that if two markets are integrated, the value for γ_i will be one. Correspondingly, the deviation of this

coefficient from unity, γ_i -1, defines the coefficient of segmentation for the i^{th} asset relative to the world market portfolio.

In other words, the coefficient of integration relates the ratio of the price of risk for the i^{th} security to that of the price of risk for the world portfolio. It measures the apparent mispricing of this security relative to the market portfolio caused by barriers to investment. If markets are integrated, barriers to investment become less costly, and the extent of mispricing of assets should diminish, and the value of γ_i should approach one for all *i*.

The empirical analysis used returns from 18 countries over the period 1970 through 1991. All market returns were calculated using the US dollar as the numeraire currency. The interest rate on 90-day US Treasury Bills was employed as a proxy for the risk-free rate for all investors.

Based on the results of the model developed in their study, Alford and Folks provide sufficient evidence to support the hypothesis of increased world capital market integration. They demonstrate that segmentation costs have attenuated over time implying that assets are priced more in an international setting.

However, a potential limitation to this study should be considered. A key assumption in the model development is that investors are only concerned with expected return and expected covariance of an asset. If this assumption is invalid, then the results obtained will be skewed and not be reflective of the structure of the world capital markets. This assumption is further complicated since these expected returns and variances are predicted on knowledge of the barriers to international investment. As these barriers change, the expected returns change as the underlying prices change, further distorting the empirical results.

In a similar spirit, De Santis and Imrohoroglu (1997) utilized the Multivariate Generalized Autoregressive Conditional Heteroskedasticity-in-Mean (MGARCH-M) approach. They introduced a dynamic integration version of the classic CAPM framework that assumes full market segmentation until the official liberalization date of each market and complete integration thereafter, in order to capture the fact that the analyzed markets were legally segmented for part of the sample period. The model takes this form:

$$E_{t-1}(R_{i,t}) = m_{10,i} + m_{11,i} R_{i,t-1} + m_{12,i} h_{ii,t} DC_{i,t} + m_{15,i} h_{im,t} (1 - DC_{i,t}) \qquad (5)$$

where $E_{t-1}(R_{i,t})$ is the expected return on the market index of country *i* between the time *t-1* and *t*; $h_{ii,t}$ is the conditional variance of the market portfolio in country *I*; $h_{im,t}$ represents the conditional covariance between the returns on the market index of country *i* and the returns of a selected world market portfolio; DC_i is a dummy variable which is equal to one before the opening date of market *i* to foreign investors but zero otherwise; $m_{10,t}$ and $m_{11,t}$ are (k+1) dimensional vectors of unknown parameters, and $m_{12,t}$ is the unknown price of market risk that is

common across countries. The dynamic integration framework of equation (4) assumes that the price of risk is country-specific before liberalization, which is represented by $h_{ii,t}$, and the world market when markets become integrated, which is represented by $h_{im,t}$.

The model is applied to weekly observations of equity returns for a group of emerging countries covering the regions of Latin America, Europe/ Mid-East and Asia. To have a benchmark for their empirical results, De Santis and Imrohoroglu exteneded the analysis to weekly return series from four developed markets: Germany, Japan, the UK, and the US. All returns were measured in local currency terms. The sample period extended from the last week of December 1988 to the second week of May 1996, rendering a total of *T* = 384 weekly observations.

Interestingly, the empirical results show that neither the country-specific risk is priced when markets are segmented, nor the world market risk when they are integrated. Although most of the markets analyzed were legally segmented during part of the sampling period, De Santis and Imrohoroglu find no evidence of a relation between ship expected returns and country-specific volatility. Moreover, the prediction that liberalization process would bump up market volatility is not supported in this study.

Following the methodology of Harvey (1991), Jan et al. (2000) investigated whether expected rates of return on the Pacific Basin stock markets could be explained by an international CAPM. They employed a version of conditional ICAPM that allowed for time-varying expected returns, conditional variances, and conditional covariances to study the risk-return relationships. Jan et al. further utilized the test of Ghysels and Hall (1990a, 1990b) in order to examine the structural stability of the conditional ICAPM.

For the empirical analysis, they collected monthly observations of equity returns for ten Pacific Basin stock markets, including Australia, Hong Kong, Indonesia, Japan, Malaysia, the Philippines, Singapore, South Korea, Taiwan, Thailand as well as the US. The world market portfolio was represented by the Morgan Stanley Capital International (MSCI) world index. The sample period for seven markets was started from January 1979 to July 1995, and data for the Philippines and Australia started from January 1986, while data for Indonesia started from December 1987. All the market returns were computed in US dollars and represented as an excess return over the holding yield on the 1-month US Treasury bill rate.

The results show that the tests of the conditional ICAPM formulations were not rejected in most individual markets, but were rejected in multiple markets. This suggests that the estimates of the reward to risk ratio for the world market are not the same across the Pacific Basin stock markets. Thus, it is inappropriate to use the ICAPM to compare the investment performance amongst the markets under study. The results also show that the conditional ICAPM formulations lacked the stability to connect the expected return to the risk in the Pacific Basin stock markets.

Nevertheless, there are two caveats in this study. First, Jan et al. assume that the stock markets under study are integrated with the world market. However, these markets may exhibit a time-varying degree of market integration with world market, as demonstrated by Bekaert and Harvey (1995). This may also make out the reason why the structural stability tests are rejected in the Pacific Basin stock markets. Second, using the single factor model to explain the investment risk may ignore the market infrastructure of the Pacific Basin stock markets. Thus, omitting factors such as country and currency risks may disturb the conditional CAPM and make the formulations to be rejected.

Along the same line of research, Gerard et al. (2003) tested a conditional version of the international CAPM with both world market and domestic risk included as independent pricing factors for five East Asian markets, the US and world markets. They modeled conditional second moments and risk exposures using a bi-diagonal multivariate GARCH (1,1) process. The aim of their study was to examine whether key markets in the East Asian region were fully integrated or partially segmented from the world capital markets. Gerard et al. conducted their analysis within the framework of the partially segmented international asset pricing model of Errunza and Losq (1985; 1989) which takes into account the fact that some markets may not be fully integrated in world markets. Their model takes the following form:

$$E\left\langle R_{it}\middle|\Im_{t-1}\right\rangle - R_{ft} = \delta_{m,t-1}\mathrm{COV}\left\langle R_{it}, R_{mt}\middle|\Im_{t-1}\right\rangle + \delta_{di,t-1}\mathrm{VAR}_{t-1}\left\langle \mathrm{Res}_{it}\middle|\Im_{t-1}\right\rangle \quad (6)$$

where R_{it} represents the returns on local market portfolio from any mildly segmented country *i*; R_f is the risk-free rate of return; R_{mt} is the return on the world market portfolio; $\delta_{di,t-1}$ is the price of domestic risk; $\delta_{m,t-1}$ is the price of world market risk; Res_{it} captures the local market nondiversifiable risk uncorrelated to global risk, and $\Im_{t-1}$ represents the information set available at time *t*-1.

According to this model, if capital markets are completely integrated, the expected return of a country portfolio should solely be determined by the country's exposure to world covariance risk. In contrast, market segmentation implies that the risk-return relationship in each national market is determined mainly by domestic factors. Hence, when capital markets are partially segmented, expected returns would be determined by the country's exposure to both world and country-pecific risk factors.

The five markets included the three emerging markets of Korea, Malaysia and Thailand and the two developed markets of Hong Kong and Japan. The sample period was January 1985 to December 1998. The data set encompassed two distinct groups of data: the monthly US dollar-denominated returns on stock indices upon which the asset-pricing model is estimated, and the global and local information variables used to reflect the information available to investors and to condition the estimation.

The results revealed that there was little evidence of either partial or total market segmentation for the five Asian markets. Much as the premium for world market risk is significant for all assets, the prices and associated premiums for domestic risks are not significant. However, Gerard et al. found that residual returns were significantly related to exchange rate variables. This suggests that although domestic returns volatility is not priced, exposure to currency risk may underlie the cross-country differences in expected returns. Additionally, they found that the bi-diagonal GARCH of the GARCH process fitted the data significantly better than the simple diagonal GARCH specification.

Gerard et al. ended off their study by emphasizing that the scope of their conclusions may be limited for several reasons. First, currency risk was not specifically included as a pricing factor in the model, much as they provided some evidence of the importance of exchange risk in explaining the cross-section of expected equity returns. Second, the selected local information variables may not capture adequately the expectations about local economic conditions in each emerging market. Lastly, the MSCI world market index may not be duly a good representative of the world market portfolio in relation to the set of assets investigated.

To overcome the shortcomings of past works that ignored foreign exchange risk, Phylaktis and Ravazzolo (2004) extended the dynamic integration conditional CAPM of De Santis and Imrohoroglu (1997) by including currency risk. They utilized a parsimonious multivariate GARCH-in-Mean (MGARCH-M) process that explicitly allowed for the examination of the effects of capital market liberalization and the Asian financial crisis of mid 1997 on the volatilities of stock and currency returns.

Focusing on the Pacific Basin Rim, Phylaktis and Ravazzolo applied their model to data from Korea, Malaysia, Taiwan and Thailand. The data consisted of end-of-month observations of stock market index prices, and local bilateral spot exchange rates expressed as units of US dollar against one unit of each country's local currency. The sample period extended from January 1980 to May 2000. The dynamic integration ICAPM process inclusive of currency risk is that the estimate is as follows:

$$\begin{aligned} R_{i,t} &= m_{10,i} - X_{i\$,t} + \sum_{k=1}^{p} m_{11k,i}\left(R_{i,t-k} + X_{i\$,t-k}\right) + m_{12,i}\, h_{ii,t}\, DC_{i,t} \\ &+ m_{13,i}\, h_{xx,t}\, DC_{i,t} + 2m_{14,i}\, h_{ix,t}\, DC_{i,t} + m_{15,i}\, h_{im,t}\left(1\text{-}DC_{i,t}\right) + \\ &+ m_{16,i}\, h_{xm,t}\left(1\text{-}DC_{i,t}\right) + m_{17,i}\, h_{ix,t}\left(1\text{-}DC_{i,t}\right) + m_{18,i}\, h_{xx,t}\left(1\text{-}DC_{i,t}\right) + \varepsilon_{i,t} \cdots \end{aligned} \tag{7}$$

where $R_{i,t}$ represents the rate of return on market index i expressed in local currency; $X_{i\$,t}$ indicates the rate of appreciation of the local currency against the US dollar; h_{ii} is the variance of the returns expressed in local currency of the market index i; h_{xx} is the variance of the rate of appreciation (depreciation) of the local currency against the US dollar; h_{ix} is the covariance of the returns

expressed in the local currency of market index *i* with the rate of appreciation (depreciation) of the local currency with respect to the US dollar; h_{im} is the covariance of the returns expressed in the local currency of market index *I* with the world market portfolio, and h_{xm} is the covariance between the world market portfolio and the rate of appreciation (depreciation) of the local currency against the US dollar. DC_i is a dummy variable that assumes the value of one before liberalization and zero otherwise.

Phylaktis and Ravazzolo found strong support for the specification of an ICAPM that incorporated both market and currency risks. Moreover, the risk was priced in both pre and post-liberalization periods. They concluded that an ICAPM without exchange rate as a source of risk would be misspecified. Thus, the models used by De Santis and Imrohoroglu (1997) and Gerard et al. (2003) which did not consider currency risk in pricing international assets might be misspecified.

In addition, consistent with prior studies, such as Bekaert and Harvey (1995), the empirical results indicated that the Pacific Basin capital markets were integrated with world markets. However, the authors noted that the world market coefficients assume small values indicating that even if these countries are integrated, there are still possibilities for obtaining portfolio diversification gains. The empirical results also revealed that the components of the risk premiums vary significantly over time and across markets. The currency risk premium was substantial and formed a big part of the total risk premium, dominating it at times. It was also bigger and more variable when markets were segmented. In post-Asian financial crisis period, it became negative across all markets and once again substantially variable. Finally, the results showed that market liberalisation and the Asian financial crisis of mid–1997 affected the conditional variances of the stock and foreign exchange returns.

Although this study demonstrated empirically the importance of currency risk as a component in international asset-pricing models, it was still, as was De Santis and Imrohoroglu's (1997), limited by the assumption that the date when each country switched from being fully segmented to being fully integrated was changeless and the process was irreversible.

On the other hand, with a view to examining both contagion during crisis periods and time variation in world and regional market integration, Bekaert et al. (2005) proposed a two-factor model with time-varying loadings. The two factors were the US equity market return and a regional equity portfolio return. Different from previous asset-pricing frameworks that focussed principally on the effects of a single international market (often the US or world market) on other stock markets, their framework uniquely nested three models: a world CAPM, a CAPM with the US equity return as the benchmark asset, and a regional CAPM with a regional portfolio as the benchmark.

Bekaert et al. measured contagion by gauging the correlation of the model's idiosyncratic shocks or unexpected returns. They set up a baseline level of contagion by examining shock correlations estimated over the full sample period.

Their volatility model was related to Bekaert and Harvey (1997) and Ng (2000) in that equity return volatilities follow univariate GARCH processes with asymmetry. Hence, negative news regarding the world or regional market may increase volatility of the factor more than positive news and lead to increased correlations between stock markets. Moreover, the model incorporated time-varying betas, where betas were influenced by the trade patterns.

The findings revealed that there was no evidence of additional contagion caused by the Mexican Peso crisis of 1994. However, there were economically meaningful increases in residual correlation, especially in Asia during the Asian financial crisis of mid–1997. Moreover, Bekaert et al. found strong evidence of predictable and persistent time-varying volatility in all markets. Their tests for regional and global integration revealed substantial support for increased regional and global integration.

Finally, much as Bekaert et al. believe that it is more palatable to frame statements about excess correlation in the context of an asset-pricing model, one should be cautious when drawing conclusions from their analysis because it is possible that their model of correlations is incorrect and contagion could simply be a result of model misspecification.

Driven by the event of the Economic and Monetary Union (EMU) and the imposition of a common currency, the Euro, Hardouvelis et al. (2006) examined whether or not the European stock markets became more integrated during the 1990s. They estimated a conditional asset-pricing model with a time-varying degree of integration, which measured the importance of the EU-wide market and currency risks relative to country-specific risk. In the model, each Euro zone country had its own time-varying degree of stock market integration. This degree of integration was bounded between zero and unity and conditioned on a broad set of monetary, currency, and business cycle variables. These variables were proxies for the gradual nominal and real convergence of the European economies during the pre-monetary union period. Their empirical model resembled that of Bekaert and Harvey (1995) and was based on the theoretical models of partial integration of Black (1974) and Errunza and Losq (1985). In general, the conditional mean excess return on the *i*th stock market can be expressed as follows:

$$E_{t-1}\left(r_{i,t}\right) = \varphi_{i,t-1}\left[\lambda_{\mathrm{EU},t-1}\mathrm{COV}_{t-1}\left(r_{i,t}, r_{\mathrm{EU},t}\right) + \lambda_{C,t-1}\mathrm{COV}_{t-1}\left(r_{i,t}, r_{C,t}\right)\right] \quad (8)$$
$$+\left(1-\varphi_{i,t-1}\right)\lambda_{i,t-1}\mathrm{VAR}_{t-1}\left(r_{i,t}\right)$$

where $E_{t-1}\left(r_{i,t}\right)$ is the expected excess return on the local stock market index *i* given information up to time *t*-1; $r_{\mathrm{EU},t}$ is the excess return on the EU stock market index ; $r_{C,t}$ is the excess currency return; $\lambda_{\mathrm{EU},t-1}$ is the price of EU market risk; $\lambda_{C,t}$ is the price of currency risk; $\lambda_{i,t-1}$ is the price of local risk; COV_{t-1} is the conditional covariance operator, and VAR_{t-1} is the

conditional variance operator. The time-varying parameter $\varphi_{i,t-1}$ measures the conditional level of integration of market *i* based on information up to time *t*-1 ($0 \leq \varphi_i \leq 1$). Alternatively, in the context of a regime-switching model, $\varphi_{i,t-1}$ can be interpreted as the conditional probability that market *i* is fully integrated (Bakaert and Harvey, 1995).

The empirical results indicated that the degree of integration had ups and downs, but in the second half of the 1990s stock markets converged toward complete integration. Hardouvelis et al. contend that two main factors drive the increase in the level of integration: the evolution of the probability of joining the single currency and the evolution of inflation differentials (i.e. the ability of a country with a high inflation to achieve nominal convergence and satisfy a major criterion for admittance into the Euro zone). However, the EU country that shows no signs of increased integration with the EU stock market is the UK. This indicates that the experience in the UK is fundamentally different from the rest of the European countries, and that the forces behind the formation of the Euro zone have a special role in stock market integration.

To sum up, the CAPM has been developed with respect to major capital markets in the world. It is well accepted and widely used by professional portfolio managers to analyze the pricing of securities in national capital markets. Nonetheless, there are subtle problems inherent in the international version of the CAPM due to the likelihood that many of the stringent assumptions underlying the domestic version become very tenuous in an international context.

One serious problem in applying the CAPM to international finance is the assumption of perfect capital markets which implies that markets are fully integrated. Empirical evidence shows that there are many direct and indirect forms of investment barriers, especially in emerging markets, imposed on foreign investors, signifying that different national markets exhibit different levels of integration to international capital markets and that the degree of integration varies over time. Consequently, despite the international CAPM meeting with some success in being applied to mature markets, the same model flops when applied to emerging markets.

Moreover, although most of these studies recognize that asset-pricing model tests rely on the currency in which returns are denominated, they arbitrarily choose a numeraire currency, typically the US dollar. Thus, the empirical results are heavily dependent on the particular behaviour of the US currency.

Even more importantly, asset-pricing models are plagued by the criticism that such tests are actually joint tests of the hypotheses that: (a) markets are integrated, and (b) the pricing model being used is correct. That is, any test of market integration based on a particular asset-pricing model is a joint test of market integration as well as this particular asset-pricing model. Thus, the negative test results could stem from the rejection of the market integration hypothesis or the failure of the asset-pricing model. Indeed, this joint hypothesis test dilemma unequivocally undermines the efficacy of utilizing asset-pricing models in investigating the issue of market integration.

Not surprisingly, past empirical research of market integration based on asset- pricing models renders a wide range of rather inconclusive evidence. Indeed, the results differ by the markets explored, the time periods covered, the frequency of observations, and the asset-pricing model employed in the analysis.

3. Studies Based on Econometric Techniques

As mentioned earlier, there is a plethora of empirical research that examines the controversial issue of stock market integration utilizing a variety of econometric methodologies such as pairwise correlation analysis, Vector AutoRegression (VAR) modeling, Vector Error Correction Modeling (VECM), Granger Causality Analysis, and the most commonly used Cointegration Analysis.

Koch and Koch (1991) examined how dynamic interrelationships across national stock market indices have evolved since 1972. They developed a dynamic simultaneous equations model that was specified to reveal the nature and extent of international market linkages after accounting for current and lagged market effects. The data employed were daily stock indices and bilateral exchange rates with the US dollar, from Morgan Stanley Corporation International (MSCI).

The results unveiled that the national markets under study had grown more interdependent. Yet, this mounting interdependence was concentrated among countries in the same geographical region, whose trading hours overlapped. Moreover, the roles of Japanese and US markets have changed over time. Since 1972, the Japanese market had shown fewer responses to other markets, while the US market had displayed a tendency to respond more to other markets in 1980 and 1987. On the other hand, while Japan has displayed a significant impact on two or three markets in all the three different years investigated, the US had influenced fewer markets in 1980 and 1987 than in 1972. Thus, Japan had grown to be more of a market leader, while the US market's influence had waned.

A relatively recent feature of the literature of capital market integration is the use of tests for cointegration and common stochastic trends. When capital markets are found to share a single common stochastic trend, then this connotes that these markets are attracted towards each other over long horizons. As a result, the gains from global diversification in these markets would eventually dissipate.

A well-cited paper in this context is Kasa (1992), one of the first to apply multivariate cointegration analysis with a view to estimating the permanent and transitory components of stock price indices and examining the existence of a single common trend as a driver of the cointegrated system of stock price indices. The sample of stock markets investigated in Kasa's study encompassed those of Canada, Germany, Japan, the UK and the US. The data consisted of end-of-month and quarterly observations of stock price indices. All indices were converted to the US dollar terms and further deflated by the US consumer price index.

Through Johansen's maximum likelihood estimation approach (1991), Kasa initially presented results using monthly data from February 1974 to

August 1990, which suggested the presence of a single cointegrating vector. Using quarterly data for January 1974 to March 1990 and two lags in the VAR, the results continued to imply the presence of a single cointegrating vector, though for a VAR of ten lags the results imply the presence of three or four cointegrating vectors. Kasa concluded that there were four cointegrating vectors, implying that stock prices in the sampled countries were all driven by a single common stochastic trend.

However, Richards (1995) questioned this conclusion because VARs in Kasa's work include up to ten quarters of lagged data with a view to capturing the possible effect of mean reversion in equity prices and to making the error terms from the VARs more consistent with the Gaussian/i.i.d assumption under which the Johansen methodology is derived. Richards noted that serial correlation was not present in the lower order VARs estimated by Kasa and that the inclusion of extra lags to remove the non-normality of residuals was inappropriate if changes in stock prices were fundamentally fat-tailed or otherwise non-normal.

Park and Fatemi (1993) were interested in investigating the question of the dependence structure of equity markets of seven countries in the Pacific Basin region (i.e. Australia, Hong Kong, Korea, New Zealand, Singapore, Taiwan and Thailand) to the equity markets of three major industrialized countries (i.e. Japan, the UK and the US). More definitely, they examined the relative influence of the Japanese, the UK and the US markets on each of the seven Pacific Basin equity markets and the response patterns of these markets to the innovations originating from one of the three industrialized markets. The authors estimated a four-variable VAR model for each of the seven Pacific Basin equity markets. Each VAR model is composed of daily rates of return on the market indices of the US, the UK, Japan, and one of the seven Pacific Basin equity markets.

The results indicated that despite their strong economic integration with major developed countries, the Pacific Basin equity markets exhibited a weak linkage to the US, UK, and Japanese equity markets. Further, a substantial amount of variation was observed in the strength of that linkage across the seven Pacific Basin markets. The results also provided evidence of the association between movements in the equities market and economic activity.

Complementing Kasa's work, Chung and Liu (1994) investigated the common stochastic trends amongst national stock prices of the US and five East Asian countries, including Hong Kong, Japan, Singapore, South Korea and Taiwan. The US market was included in the analysis so as to examine the inter-continental stock price relationship between North America and the Pacific Rim of East Asia. The data used in this study embraced weekly national stock price indices based on domestic currencies.

Through Johansen's maximum likelihood estimation procedure (1988; 1991) and Johansen and Juselius (1990), two cointegrating relationships were identified and the six stock price variables were found to share four common unit roots. The result showed that the stochastic trends dictated by the four common unit roots are important to the long-run movement of the stock prices, particularly

those of the US and Taiwan. Though not conclusive, the result suggested that the US and Taiwan markets might not belong to a "common" stock region encompassing the remaining four countries. The result also revealed that most countries had the same adjustment speed in moving from short-run disequilibria toward the common trend.

In tune with the research on market integration, Richards (1995) intended to test for cointegration between the total return indices for a group of countries with a capitalization –weighted 'rest-of-world' series calculated for each country. This test offered an indication of the tendency for the return indices of domestic and foreign assets not to drift too far apart, and might provide the simplest answer to the question of whether a typical investor will gain long-run diversification benefits from investing abroad.

For the empirical analysis, Richards collected the data of end-quarter total equity return (capital gains plus dividends) indices of sixteen national markets over the time period end-December 1969 through end-December 1994. All data were denominated in the US dollar terms. The cointegration tests indicated that foreign and domestic equity markets would generally move in a significantly different manner in the long-run, implying that there will typically be substantial risk-reduction benefits for investing abroad.

With the focus on emerging stock markets, Defusco et al. (1996) utilized cointegration analysis to look into the long-run diversification gains. They initially pointed out that their study was similar to Kasa (1992) in that tests for cointegrating relationships were conducted among national markets. Unlike Kasa, the relationship between the correlation coefficients and the length of the investment horizon in the presence of more than one common stochastic trend was explicitly modelled.

Weekly price index levels published by the International Finance Corporation (IFC) for 13 emerging capital markets were collected for 228 weeks from January 1989 to May 1993. All indices were denominated in US dollars. In addition, weekly data on Standard and Poor's 500 index from January 1993 to May 1993 were collected from the Wall Street Journal.

The empirical results showed that none of the three regions possessed cointegrated markets. The lack of cointegration indicated that the correlation between returns from each market was independent of the investment horizon. Consequently, weekly return data could be used to measure the long investment horizon correlation. The results also showed that return correlations among these countries were, on average, low and occasionally negative. The distances that separated these national markets did not appear to influence the degree of correlation. Even countries that were located within the same region of the world had low and/or negative correlations.

Adopting the viewpoint of a Canadian investor, Kanas (1998) explored the potential for long-run diversification benefits by examining whether the Canadian equity market was pairwise (bivariate) cointegrated with major world equity markets.

The data used were daily stock market index prices for the equity markets in Canada, France, Germany, Italy, Japan, Switzerland, the Netherlands, the UK

and the US. All indices were denominated in Canadian dollars. The sample period extended from January 3, 1983 to November 29, 1996, with a total of *T* = 3630 observations. The analysis also considered the pre-October 1987 crash period (January 3, 1983 to September 30, 1987) and the post-October 1987 period (November 1, 1987 to November 29, 1996).

Kanas's empirical evidence unveiled that, for the entire period, there were no long-run linkages between the Canadian equity market and each of the other equity markets, in the sense that the Canadian market tended to drift far apart from these markets in the long-run. For the pre- and post-October crash periods, the results interestingly led to a similar conclusion. Consequently, Kanas interpreted his results as evidence that there existed long-run benefits for a Canadian investor from diversifying in any of the major world equity markets under study. More importantly, such benefits existed not only during the entire period, but during the pre- and post-October crash periods as well.

In the same vein, Masih and Masih (2002) assessed the patterns of dynamic linkages (in terms of lead-lag relationships) among national stock prices of six major stock markets with particular reference to what impact the development of global markets (or the globalization phenomenon) had upon the leading stock markets, such as those in the US, Japan, and the UK. In particular, the focus of this paper was in what ways, if any, the role of these leading markets had changed since globalization.

Using the Johansen-Juselius maximum likelihood procedure (Johansen,1988; Johansen and Juselius, 1990), the authors found sufficient evidence in support of two and one cointegrating relationships in each of the pre- and post-globalization models. For this result, Masih and Masih underlined that while the Efficient Market Hypothesis (EMH) implies two different asset prices cannot be cointegrated, the converse of this was not necessarily valid lack of cointegration did not necessarily imply market efficiency. The absence of cointegration simply ruled out the existence of a long-run equilibrium tending relationship, but did not invalidate any short-run relationships, which might arise due to profit-seeking opportunities in transactions. The residuals from these vectors were then embedded in a six-dimensional VECM, so as to gauge short- and long-run Granger causality. Next, the analysis extended to a decomposition of variance and impulse response functions.

Yang et al. (2003) examined the long-run relationships and the short-run dynamic causal linkages among two developed markets (i.e. Japan and the US) and ten Asian emerging markets (i.e. Hong Kong, India, Indonesia, Korea, Malaysia, Pakistan, Philippines, Singapore, Thailand and Taiwan), with particular attention to the 1997-1998 Asian financial crisis.

The data set embraced daily stock index closing prices of the twelve markets considered in this study. All stock indices were expressed in both local currency and US dollar terms. The sample period extended from January 2, 1995 to May 15, 2001, giving 1662 daily observations for each series. To comprehensively investigate the impact of the Asian financial crisis on the long-run relationships among sample stock markets, numbers of cointegrating vectors

among these markets were compared in four non-overlapping periods: pre-crisis (from January 2, 1995 to December 31, 1996), crisis (from July 1, 1997 to June 30, 1998), transition period (from July 1, 1998 to June 30, 1999), and post-crisis (from July 1, 1999 to May 15, 2001).

Using local currencies and excluding a linear trend term, the empirical results indicated no cointegrating vector existed in the pre-crisis and the transition periods but two cointegrating vectors existed in both the crisis and the post-crisis periods. With a linear trend term, similar results were found across periods. The finding in the pre-crisis period was consistent with DeFusco et al. (1996) and Sheng and Tu (2000), however, unlike Sheng and Tu (2000), two, rather than one cointegrating vectors were found during the crisis. These results suggested that long-run cointegration relationships were strengthened in the crisis and the post-crisis periods relative to the pre-crisis period. Equally important, the results were unchanged using the US dollars. The only difference is that one rather than zero cointegrating vector was found in the pre-crisis period, which was in accordance with Masih and Masih (2002). Hence, allowance for the exchange rate adjustment could affect the number of cointegrating vectors.

Focusing on the emerging stock markets of South Asia, Narayan et al. (2004) contributed to the meagre published literature on interdependencies amongst emerging markets through assessing the dynamic linkages amongst the stock price indices of Bangladesh, India, Pakistan and Sri Lanka. They employed daily stock price indices for the period January 2, 1995 to November 23, 2001, which gave a total of $T = 1800$ observations. All stock market indices were expressed in local currency terms. They stated that using daily data was preferable to using lower frequency data such as weekly or monthly data because longer time horizons could obscure transient processes to innovations that may last only a few days.

Employing the AutoRegressive Distributive Lag (ARDL) approach, the authors reported evidence that there was a long-run relationship amongst stock prices of the four countries when the stock prices in Pakistan was the dependent variable. These results implied that the gains derived from international diversification for investors with long holding periods in South Asia were limited.

The results of the Granger causality approach indicated that, in the long run, stock prices in Bangladesh, India and Sri Lanka Granger-caused stock prices in Pakistan, meaning that the Pakistani market bone the burden of any disturbance in the long-run equilibrium relationship. In the short run, there was unidirectional Granger causality from stock prices in Pakistan to India, stock prices in Sri Lanka to India, and from stock prices in Pakistan to Sri Lanka. Therefore, Narayan et al. concluded that despite Pakistan being the most dependent market in the long run, it had a transitory effect on the Indian and Sri Lankan stock markets.

Phengpis and Apilado (2004) re-examined whether economic interdependence was an important contributing factor explaining cointegration and common stochastic trends in national stock markets.

A comparative analysis was conducted between stock market price indices for five countries from the Economic and Monetary Union (EMU) and five non-EMU countries, exemplifying the groups of countries whose economies were and were not strongly interdependent, respectively. The EMU countries included France, Germany, Italy, Netherlands, and Spain, whereas the non-EMU countries were Australia, Hong Kong, Japan, Singapore and Switzerland. The US and the UK indices were then added into each group as control variables. The data consisted of monthly stock market price indices over the period beginning January 1979 and ending June 2002. All indices obtained were denominated in the US dollar terms.

The application of the Johansen cointegration tests (1988;1991) revealed some important findings. First, the stock market price indices of the included non-EMU countries were not cointegrated over the full sample period, or over time, or after taking into account the 1987 US stock market crash or the 1997 Asian financial crisis. The absence of cointegration implied that each national stock market was driven by its own unique stochastic trends or fundamentals, which in return implied that the global significance of the US economy and the established roles as financial centres of the US and UK stock markets did not make these two markets influence the long-run paths and performances of others. Second, the stock market price indices of the five EMU countries were cointegrated over the full sample period, over time, and even after controlling for the 1987 stock market crash or the 1997 Asian financial crisis. The strength of cointegrating relations over the passage of time reflected the extent of economic interdependence among the EMU countries.

Third, the comparative results of the EMU and non-EMU groups suggested that economic interdependence among the subject countries appeared to be an important contributing factor to cointegration and common stochastic trends in their stock markets. International investors might improve diversification gains over long-time horizons by allocating their portfolios into stock markets of the countries which did not have considerable economic ties.

Focusing on the consequences of the tragic events of September 11, 2001, Mun (2005) investigated evidence of contagion in both returns and volatility of the terrorist attacks across the major stock exchanges. Besides, he examined the extent to which national stock markets could be destabilized by shocks that arose in the US.

The data analyzed were based on a newly compiled two-day average series for the period from November 20, 2000 to June 27, 2002, providing a sample size of $T = 203$ observations. The data were composed of closing stock market indices of Germany, Japan, the UK and the US. The indices were expressed in US dollars. Moreover, to examine the time series behavior of the national stock markets before and after the terrorist attacks, Mun divided the whole sample period into two non-overlapping sub periods: (a) pre-attack period spanning from November 20, 2000 to September 10, 2001 and (b) post-

attack period spanning from September 20, 2001 to June 27, 2002. The exact date of division of the sample period was chosen to make the sample size of each period balanced.

To conduct the empirical analyses, Mun first used a bivariate Generalized Autoregressive Conditional Heteroskedastic (GARCH) model to obtain the dynamic volatility and correlation coefficients across markets. Then, he estimated a multivariate GARCH model with constant conditional correlations in order to test for contagion from the US to other markets.

Mun's empirical results suggested that to the extent that significantly higher correlations with the US market could enhance contagion effects from the US, the attacks elicited volatility contagion (rather than return contagion) from the US to the UK and German markets. In contrast, the Japanese market had return contagion (rather than volatility contagion) from the US market. After the attacks, a US shock had a strongly positive effect on the US/Japan return correlation but had little or no effect in response functions of the return correlation for the US/UK and the US/German markets.

In addition, the results showed that the terrorist attacks gave rise to a structural change in the dynamics of national stock market correlations. After these attacks, impulse responses of market correlation to a US shock notably increased through volatility for the US/UK and the US/German markets, whereas the corresponding response of the US/Japanese market increased through returns.

Applying Kasa's (1992) approach, Phylaktis and Ravazzolo (2005) examined the potential interrelationships amongst the trending behavior of the stock price indices of a group of Pacific-Basin countries, Japan and the US, using the multivariate cointegration analysis of Johansen (1988; 1991) in both autoregressive and moving average forms.

The data considered in this study were the end-of-month observations of stock market index prices for a group of Pacific-Basin countries, including Hong Kong, Malaysia, Singapore, South Korea, Taiwan and Thailand, in addition to Japan and the US. The overall analyses were conducted over a nineteen-year time period spanning from January 1980 to December 1998.

Their empirical findings can be summarized as follows. First, they found a lack of integration amongst all the markets under investigation, both during the eighties and the nineties, and for the open capital markets of Hong Kong, Malaysia, and Singapore during the eighties. This evidence, which was in contrast to some prior studies (e.g. Chung & Liu,1994; Siklos & Ng, 2001), suggested that the relaxation of foreign exchange restrictions was insufficient for attracting international investment attention and for strengthening international market interrelations. On the other hand, the increase in financial links for open and semi-open markets in the second sub-period suggested that the relaxation of foreign ownership restrictions might have enhanced financial links with world markets. Second, the recursive analysis for the most recent period indicated that the Asian crisis did not have an essential effect on the degree of integration of these markets.

Finally, the estimated common trends mechanisms show end an absence of a dominant country in the region. Neither Japan nor the US had a unique influence in the Pacific Basin region. The US played a role, but small in magnitude, while Japan played a more essential role, but was equally important as that of Thailand. This result stood in contrast with that of Gosh et al. (1999) and Siklos and Ng (2001).

Under a novel spirit, Kim et al. (2006) analyzed the extent to which international stock-bond market integration had been influenced by the establishment of the Economic and Monetary Union (EMU) via documenting and determining the conditional correlation dynamics between daily stock and bond returns in a bivariate Exponential Generalized AutoRegressive Conditional Heteroskedasticity (EGARCH) framework. They stated that whilst international integration within specific financial asset markets had received much attention, the subject of integration across *different* financial asset markets had not, despite its importance for investors' asset allocation and portfolio risk management decisions.

The empirical analysis was conducted for a sample of countries that fall into two distinct groups: (a) Euro zone members including France, Germany, Italy, and Spain and (b) non-Euro zone countries including Japan, the UK and the US. The data set consisted of national total market return share indices and total return government bond indices for maturities greater than ten years, with daily frequency from March 2, 1994 up to September 19, 2003. The indices were all in local currency units.

The empirical findings revealed that as intra-stock and bond market integration with the EMU had strengthened in the sample period, inter-stock-bond market integration at the country level had trended downwards to zero and even negative mean levels in most European countries, Japan and the US, consistent with a flight to quality phenomena in international financial markets. Cross-market volatilities have overall stabilizing effects but bond market return shocks have more influence. Furthermore, there was sufficient evidence that the introduction of the EMU had Granger-caused the apparent segmentation between the bond and the stock markets within Europe but not outside.

To sum up, in investigating the question of international stock market linkages, researchers have adopted a variety of econometric methodologies. Earlier empirical studies were chiefly concerned with the contemporaneous and/or lagged correlation in the rate of returns across equity markets in developed countries. More recent research on the topic has taken advantage of the salient developments in the time series econometric techniques such as the Granger Causality tests, Vector AutoRegression (VAR) modeling, and cointegration analysis. More importantly, dynamic stock market linkages have been explored mainly among mature markets in the US, Europe, Asia, and the Pacific-Basin Rim, whereas the behavior of emerging markets has been rather neglected.

However, prior empirical findings have not been consistent in all studies, depending on the choice of markets, the sample period chosen, the frequency of observations, and the econometric methodologies applied in the analysis. As

a matter of fact, the empirical conclusions remain somewhat ambiguous and contradictory, as statistical evidence supports the presence of cointegration relationships in a number of markets whereas it rejects it in others.

4. Summary and concluding remarks

Throughout this paper, I have provided a review of the ample literature surrounding the issue of stock market integration and its practical implications for investors seeking to diversify their portfolios internationally. Of the selected literature surveyed in this paper, several noteworthy observations stand out. First, stock market integration is still a moot point, as the empirical evidence is rather inconclusive. That is, some studies (e.g. Kasa, 1992; Alford & Folks, 1996; Siklos & Ng, 2001; Hardouvelis et al., 2006) find sufficient evidence for market integration. In contrast, other studies (e.g. Park & Fatemi, 1993; Kanas, 1998; Phylaktis and Ravazzolo, 2005) report little or no evidence for integration amongst the national stock markets. As a result, the potential benefits derived from, and the limitations of, cross-border diversification are still at the core of the debate; and that perhaps is surprising this issue is not yet fully resolved.

Second, some studies that pursue the asset pricing models approach suffer some deficiencies such as ignoring the time-varying nature of market segmentation and ignoring the inclusion of currency risk. Moreover, testing stock market integration using asset-pricing models will run into the joint-test problem. On the other hand, the most commonly used Johansen (1988; 1991) cointegration test is not robust for small sample sizes and it ignores the non-linear dependencies in time series data.

Third, recently, research on market integration has emphasized finding common stochastic trends for a group of capital markets through testing for cointegrating relationships. The implication of this methodology is that when markets share at least one common stochastic trend, it signifies that these markets are perfectly correlated over long horizons, and thus, there are no potential benefits from international diversification (e.g. Kasa, 1992; Chung & Liu, 1994 ; Siklos & Ng, 2001; Phylaktis & Ravazzolo, 2005). Moreover, stock market shocks have sometimes been global in their impact, which implies a high degree of stock market integration, and sometimes local, which implies a high degree of market segmentation.

Fourth, the focal point of prior empirical research is the mature capital markets of the US, Japan, and certain European countries. These markets have been in operation for quite a long time and most international performance benchmarks included only mature markets. Recently, the Asian markets have come into researchers' focus, mostly as a result of their noticeably high rates of economic growth during the 1990s, as well as the repercussions of the Asian financial crisis of mid–1997 and the tragic events of September 11, 2001. Thus, the vast majority of earlier studies have taken the US investor's standpoint using the US dollar as the numeraire currency. Relatively little is known about

the integration of capital markets and international diversification from the perspective of non-US investors. As a result, it is not clear whether or not and to what extent the general findings of these studies are applicable to non-US investors, especially investors in emerging capital markets.

Finally, it is no surprise that the empirical results on capital markets integration are mixed, due to disparate methodologies, variations in sample sizes, selected countries, frequency of observations, and sample periods across exchange rate regimes.

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