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Characterizing South-East Asian Stock Market Integration through Time

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ABSTRACT

This article investigates the evolution of the Asian stock market integration with the regional one. First, we estimate the time-varying degree of South East Asian market integration using conditional version of the International Capital Asset Pricing Model (ICAPM) with DCC-GARCH parameters. Secondly, we study the structural breaks in these series. Finally, we relate the obtained results to important facts and economic events.

JEL classifications: *C32, F36, G11.*

Keywords: *time-varying integration; emerging markets; ICAPM; risk premium; DCC-GARCH.*

I. INTRODUCTION

Economic Integration is, first of all, the gradual elimination or abolition of economic barriers which impede free movement of goods, services, capital and people among a group of nations. Today we can distinguish a variety of economic integrations in the world from different perspectives such as "degree", "size" and "diversity". With respect to the "size" of Economic Integration, we can separate regional Economic Integration from the Global Economic Integration, like lowering tariffs in the framework of the rounds under the General Agreement on Tariffs and Trade (GATT) and World Trade Organization (WTO). There are more than 150 regional economic integrations around the world, in which the EU, the North America Free Trade Agreement (NAFTA) and the emerging South East Asian Economic integration are the three biggest regional integrations with respect to their economic size.

These regional trade agreements result in part from a greater openness of the member countries, and a desire to become more competitive in the world market by mobilizing their joint efforts and synergies. However, the links between global and regional integration are not the same in each area. In some regions, international integration preceded the regional one, as happened in Asia, whereas the reverse approach is seen in other areas such as Latin America. Moreover, the speed of this financial integration process may vary over time, and differs from one region to another.

So Globalization and financial integration in particular, can enable emerging markets to achieve better diversification of their risks, efficient allocation of capital, and offers great potential for economic growth. But on the other hand, this may have undesirable effects, including an increase in financial vulnerability due to external shocks, and disparities in their commercial exchanges with developed countries (Levine and Zervos, 1996; Stiglitz, 2002; Bekaert *et al.*, 2002). An assessment of the level of financial integration of these markets is thus crucial, since the latter seems to be inevitable and the source of all the complexities affecting international asset pricing and regional economic-cooperation policies. Studies conducted on this topic can also shed light on other aspects, including the current trend of financial integration, its determinants, and its effects on the risk premium and the cost of capital in an international context.

Although previous studies have provided a general understanding of the global integration process of individual emerging markets over the recent decades (Errunza and Losq, 1985; Bekaert and Harvey, 1995; Jong and Roon, 2005; Carrieri *et al.*, 2007; Pukthuanthong and Roll, 2009), little attention has been paid to the dynamics of the integration of emerging market regions into the world market, which has now become an undeniable trend. Moreover, on the methodological level, the potential time-varying shifts in the integration process that governs stock-market return dynamics, resulting from the structural reforms undertaken by emerging countries, have rarely been considered. This then leads to a biased assessment of the degree of financial integration.

This study contributes to the existing literature by developing a dynamic international capital asset pricing model (ICAPM) allowing for smooth transition between different integration regimes. Specifically, expected returns may move from a perfectly-segmented regime to a perfectly-integrated one, or vice versa, depending on a certain number of national and international factors that are likely to drive the process of regional integration. Our study differs from past studies in that we investigate the integration of emerging market into a regional market, rather than individual emerging markets, using actual real exchange rates as a common source of risk, in addition to regional and domestic sources of risk.

Our results show that the degree of integration in South East Asian emerging market region varied widely through time over the period 1996-2008. Although the general trend is towards increasing financial integration, emerging market seems to be still significantly segmented from the regional market.

The paper is organized as follows. Section II describes the conditional version of the International Capital Asset Pricing Model where world market risk, exchange risk and local risk are priced. Section III presents the empirical methodology. The data is described in Section IV. The results are reported in Section V. Section VI concludes.

II. LITERATURE ON STOCK MARKET INTEGRATION

When dealing with emerging markets, various degrees of financial integration must be considered, and previous studies may be grouped into two main categories: those that tested the perfect integration hypothesis of international capital markets, and those that test the hypothesis of partial integration. Since the relevant literature is extremely extensive, here we will discuss only a few major papers.

Using data from 20 emerging markets, Harvey (1995) tests the international version of the CAPM model developed by Sharpe (1964) and Lintner (1965), and subsequently improved by Solnik (1974). He concludes that the world market risk represented by the MSCI world index is not pertinent, in view of the low betas obtained. This suggests that emerging markets are not fully integrated into the world market. This result remains unchanged after it is adjusted for the effect of discontinuous trading.

Rejection of the hypothesis of perfect integration supports naturally the idea of the partial integration of emerging markets, which can be tested using Stehle (1977)'s methodology. In fact, the author proposed the use of a conditional ICAPM in which expected return on an asset depends both on the global systematic risk represented by the covariance between the asset and the world market portfolio, and the local systematic risk represented by the covariance between the asset and the national market portfolio. In the absence of exchange rate risk, Stehle (1977) derives two alternative testable versions: a pricing model for an integrated state and a model for a segmented state. The first model requires that an asset's expected return is a function of the global systematic risk, and the "adjusted" local systematic risk, which corresponds to the uncorrelated portion between the national and world market portfolios. Under the null hypothesis of perfect integration, the local beta should be zero. The pricing model in case of segmented markets is constructed in a similar fashion, except that the roles of the local and global systematic risks are reversed. Claessens and Rhee (1994) use this methodology to examine the risk-return linkages in 16 emerging markets over the period from 1989 to 1992. The empirical results obtained contradict the hypothesis of integration in most of the markets. By combining the two tests, the authors show that emerging countries under consideration (Brazil, Greece, South Korea, Mexico, Pakistan, the Philippines, Taiwan, and Thailand) were segmented from the world market.

In a different way, the empirical evidence documented in studies such as Stulz (1981), Errunza and Losq (1985), and Wheatley (1988) supports the partial segmentation hypothesis in light of the significant effects of legal barriers on asset pricing rules in emerging markets. The study by Errunza and Losq (1985) is of particular interest since it introduces a pricing structure, called "mild segmentation", in which access to the various asset classes is not equal for two types of investors: investors not subject to legal restrictions on holding assets have access to all securities, while investors subject to reference restrictions are able to conduct transactions on only a subset of assets. By analyzing stock market data from nine emerging markets and the United States over the 1976-1980 period, the authors show that emerging markets are neither strictly segmented nor perfectly integrated.

Bekaert and Harvey (1995) agree with the idea of a partial integration, but are against a static measure of the degree of market integration. Accordingly, they develop an alternative model which combines the two extreme cases of perfect segmentation and integration so that at each point in time expected return on an asset (or a market) depends simultaneously on a global risk factor weighted by an integration coefficient, and a local risk factor weighted by a segmentation coefficient. This model is reduced to a domestic CAPM for strictly segmented markets, and to an international CAPM for perfectly integrated markets. Bekaert and Harvey (1995) apply their nested model to 12 emerging markets and show that their level of integration changes over time.

Adler and Qi (2003) examine the integration of the Mexican market into the North-American market during the period 1991-2002. The authors generalize the model of Bekaert and Harvey (1995) to take into account the peso/dollar exchange rate risk and provide evidence that the integration measure experienced a drop during crisis periods and began to rise in the early 2000s. Additionally, the exchange rate risk was priced and relevant in explaining variations in stock returns of the Mexican equity market.

Carrieri *et al.* (2007) extend the model of Errunza and Losq (1985) to assess the integration levels of eight emerging markets using an aggregated measure of financial asset substitution. They argue that full integration is achieved if we can construct a diversified portfolio from all the eligible assets, whose returns mimic those of a portfolio composed of all the assets in an ineligible segment. Conversely, full segmentation corresponds to a null correlation between these two portfolios. The results obtained show that the local pricing factor continues to be relevant in the valuation of emerging market assets, but none of the markets considered is completely segmented from the world market. The authors also question the use of correlations of market-wide indices as an indicator of financial integration, because they significantly underestimate such integration.

Chambet and Gibson (2008) attempt to estimate the degree of integration in 25 emerging markets by using a dynamic model that not only incorporates local and global pricing factors, but also a systematic risk factor for emerging markets. The conditional variances are allowed to fluctuate according to a multivariate GARCH (1,1)-in-Mean process. This paper is particularly interesting in that the authors attempt to explain their integration measure by several economic variables, including the degree of openness and market concentration. The results show that a number of emerging markets still remain segmented, and that the level of segmentation is negatively correlated with the degree of market openness and the diversification of a country's trade structure.

Following the suggestion by Bekaert *et al.* (2007) that the price-to-earnings ratio of an industry must be the same across countries if the growth opportunities are assessed on fully-integrated markets, Bekaert *et al.* (2009) measure a country's degree of segmentation by the weighted average of the absolute differences between the global and local price-to-earnings ratios for industries. According to these authors, the segmentation level of emerging markets remains significant, even if it tends to fall over time.

Our study first focuses on the dynamics of financial integration of South East Asian emerging stock market in an environment of multiple sources of systematic risks, structural change, and interactions between the various return series. We then examine the portions of the returns explained by regional and local risk factors respectively, by carrying out a decomposition of the total risk premium.

III. EMPIRICAL APPROACH

Consider first a fully integrated regional financial market in which purchasing power parity holds. Under these assumptions, several authors (Adler and Dumas, 1983; Solnik, 1977) have extended the domestic CAPM of Sharpe (1964) to an international setting. Formally, a conditional version of the model can be written as:

$$E_{t-1}(R_{it}^{c} / \psi_{t-1}) = \delta_{reg,t-1} Cov(R_{it}^{c}, R_{reg,t}^{c} / \psi_{t-1}) \tag{1}$$

where $E_{t-1}(R_{it}^{c})$ is the excess return issued in country *i*, conditionally on a set of information ψ_{t-1} that is available to investors up to time *t*-1. $R_{reg,t}^{c}$ is the return on the regional market portfolio. Cov is the conditional covariance between the security's return and the region market returns. $\delta_{reg,t-1}$ refers to the conditionally expected regional price of covariance risk.

However, the existence of explicit restrictions to capital flows in emerging markets, and the empirical record (e.g., Bekaert and Harvey, 1995, 1997) suggests that emerging markets, may not be fully integrated. Errunza and Losq (1985, 1989) extend the ICAPM to account for mild segmentation between markets: a subset of the assets is available to all investors, while ownership of the remaining assets is restricted to a subset of the investors. Under these assumptions, expected returns are a function of two risk factors: exposure to global market risk and exposure to non-diversifiable national risk. This model can be written as follows:

$$\begin{aligned} E_{t-1}(R_{it}^{c}) = \Omega_{t-1}^{i}\left[\delta_{reg,t-1} Cov(R_{it}^{c}, R_{reg,t}^{c}) + \sum_{k=1}^{l} \delta_{k,t-1} Cov(R_{it}^{c}, t_{kt}^{c})\right] \\ + (1-\Omega_{t-1}^{i})\delta_{i,t-1} Var(R_{it}^{c}) \end{aligned} \tag{2}$$

where t_{kt}^{c} is the return on the exchange rate of the currency of country *k* against the currency of the reference country *c*. $\delta_{k,t-1}$ expresses the expected price of the exchange risk for currency k. l is the number of markets included in the sample. Exponent *c* indicates that returns are expressed in the currency of the reference country. $\delta_{reg,t-1}$

refers to the conditionally expected regional price of covariance risk. Ω^{i}_{t-1} is the conditional probability of transition between segmentation and integration states, which falls within the interval [0,1] and can be thus interpreted as a conditional measure of integration of market *i* into the regional market. If $\Omega^{i}_{t-1} = 1$, only the covariance risk is priced and the strict segmentation hypothesis is rejected. If $\Omega^{i}_{t-1} = 0$, the unique source of systematic risk is the variance and the pricing relationship in a strictly segmented market applies.

At the empirical stage, the pricing formula in Equation (2) will be simultaneously estimated for the regional market and for four emerging market. That is, we have a system of five equations where the expected return on the regional market portfolio is given bb

$$\begin{aligned} E_{t-1}(R^{c}_{reg,t}) &= \lambda_{reg,t-1}Var_{t-1}(R^{c}_{reg,t}) + \lambda_{ML,t-1}Cov_{t-1}(R^{c}_{reg,t}, t^{c}_{ML,t}) \\ &+ \lambda_{TA,t-1}Cov_{t-1}(R^{c}_{reg,t}, t^{c}_{TA,t}) + \lambda_{SL,t-1}Cov_{t-1}(R^{c}_{reg,t}, t^{c}_{SL,t}) + \lambda_{SN,t-1}Cov_{t-1}(R^{c}_{reg,t}, t^{c}_{SN,t}) \end{aligned} \quad (3)$$

and the expected return for market *i* is expressed as follows

$$\begin{aligned} E_{t-1}(R^{c}_{it}) = \Omega^{i}_{t-1} &\begin{bmatrix} \lambda_{reg,t-1}Cov_{t-1}(R^{c}_{it}, R^{c}_{reg,t}) + \lambda_{ML,t-1}Cov_{t-1}(R^{c}_{it}, R^{c}_{rML,t}) \\ + \lambda_{TA,t-1}Cov_{t-1}(R^{c}_{it}, R^{c}_{TA,t}) + \lambda_{SL,t-1}Cov_{t-1}(R^{c}_{it}, R^{c}_{SL,t}) \\ + \lambda_{SN,t-1}Cov_{t-1}(R^{c}_{it}, R^{c}_{SN,t}) \end{bmatrix} \\ &+ (1-\Omega^{i}_{t-1})\lambda_{i,t-1}VAR_{t-1}(R^{c}_{it}) \end{aligned} \quad (4)$$

where i = ML (Malaysia), TA(Thailand), SL (Sri Lanka), and SN (Singapore)

In Equation (4), $t^{c}_{MLt}, t^{c}_{TAt}, t^{c}_{SLt}$ and t^{c}_{SNt} are respectively the returns on the real exchange rate indices of the four markets under consideration, and $\lambda_{ML,t-1}, \lambda_{TA,t-1}, \lambda_{SR,t-1}$ and $\lambda_{SN,t-1}$ refer to the expected prices of the exchange rate risk.

We follow previous works to specify the evolution of prices of risk. These prices are modeled as a function of information variables: $\lambda_{reg,t-1} = Exp(\delta'_{reg}X_{reg,t-1})$, $\lambda_{i,t-1} = Exp(\gamma'_{i}X_{i,t-1})$ and $\lambda_{k,t-1} = (\delta'_{k}X_{reg,t-1})$, where $X_{reg,t-1}$ and $X_{i,t-1}$ are respectively a set of regional and local variables. The degree of integration of country *i* into the regional market, Ω^{i}_{t-1}, is modeled by using an exponential function that satisfies the condition $0 \le \Omega^{i}_{t-1} \le 1$, as follows $\Omega^{i}_{t-1} = Exp(-|g'_{i}X_{i,t-1}|)$, where $X_{i,t-1}$ is the vector of information variables available at time t-1 that are susceptible to drive the integration degree of country *i*.

More specifically, the econometric specification of the model to be estimated, i.e., Equations (3) and (4), is characterized by the following system of equations

$$R_{it} = \Omega_{t-1}^{i}(\lambda_{reg,t-1}h_{ireg,t} + \lambda_{TA,t-1}h_{iTA,t} + \lambda_{ML,t-1}h_{iML,t} + \lambda_{SR,t-1}h_{iSR,t} + \lambda_{M,t-1}h_{iSN,t})$$
$$+ (1-\Omega_{t-1}^{i})\lambda_{i,t-1}h_{ii,t} + \varepsilon_{it}$$
$$\varepsilon_t = (\varepsilon_{reg,t}, \varepsilon_{TA,t}^{c}, \varepsilon_{ML,t}^{c}, \varepsilon_{SR,t}^{c}, \varepsilon_{SN,t}^{c}, \varepsilon_{TA,t}, \varepsilon_{ML,t}, \varepsilon_{SR,t}, \varepsilon_{SN,t}) / \psi_{t-1} \sim N(0, H_t)$$
$$H_t = D_t R_t D_t^{'} \tag{5}$$
$$R_t = (diag(Q_t))^{-1/2} Q_t (diag(Q_t))^{-1/2}$$
$$\lambda_{reg,t-1} = Exp(\delta_{reg} X_{reg,t-1}); \lambda_{i,t-1} = Exp(\gamma_i^{'} X_{i,t-1}); \lambda_{k,t-1} = Exp(\delta_k X_{reg,t-1})$$
$$\Omega_{t-1}^{i} = Exp(-\left|g_i^{'} X_{i,t-1}\right|)$$

where R_{it} refers to the (9×1) vector of excess returns which are assumed to be normally distributed. H_t is the variance-covariance matrix of returns at time t. R_t is the (9×9) symmetric matrix of dynamic conditional correlations. Q_t is a (9×9) variance-covariance matrix of standardized residuals ($u_t = \varepsilon_t / \sqrt{h_t}$) which is defined as follows:

$$Q_t = (1-\theta_1-\theta_2)\overline{Q} + \theta_1 \mu_{t-1}\mu_{t-1}^{'} + \theta_2 Q_{t-1} \tag{6}$$

where $\overline{Q_t} = E(u_t, u_t^{\prime})$ refers to a (9×9) symmetric positively-defined matrix of the unconditional variance-covariance of standardized residuals. θ_1 and θ_2 are the unknown parameters to be estimated. The sum of these coefficients must be less than one in order to insure positivity of the matrix Q_t.

We adopt a 2-stage procedure to estimate the pricing system (5) since the simultaneous estimation of the full model is not feasible given a large number of unknown parameters. We first estimate a subsystem of five equations for excess returns on market and four real exchange rate indices. This stage allows us to obtain the conditional variance of market and real exchange rate indices, their conditional covariance as well as the prices of market and exchange rate risks. In the second stage, we estimate the price of local market risk and the time-varying level of integration for each emerging market in the system (5) by imposing the estimators obtained from the first stage. Note that by doing so we explicitly maintain the same prices of regional market and exchange rate risks across different emerging market. The estimation of the vector of unknown parameters (θ) is carried out by the quasi-maximum likelihood estimation method.

IV. DATA

This study investigates the regional integration process of four emerging market (Malaysia, Thailand, Singapore, and Sri Lanka). Monthly data are collected for stock market indices, regional stock market index, and real effective exchange rate indices over the period from March 31, 1996 to March 31, 2008. All returns are expressed in US dollars and are converted into excess returns by subtracting the one-month Eurodollar interest rate, taken as the risk-free rate in our study. We use the real effective exchange rate (REER) index to represent the exchange rate risk since variations in the inflation rates of emerging markets are much significant in comparison to those in the exchange rates.

Global instrumental variables are used to explain changes in the prices of regional markets and foreign exchange risk. We employ the following variables: the dividend yield of the region in excess of the 30-day Eurodollar interest rate which is denoted by (RDY), the return of regional market index (RRENT) and the region term premium which is denoted by (RPRM), The local instrumental variable include the dividend yield of a market portfolio (RDIV), the return on the stock market index in excess of the 30-day Eurodollar interest rate (RRI), and the variation in the inflation rate (VIR). The data for the research is extracted from MSCI and Datastream International.

Two information variables are used in this study to capture the evolution of market integration. These are the variation in the US term premium (USV) and the level of market openness (OPEM). The US term premium is found to have significant impacts on the formation of the total risk premium (Fama and French, 1992; Priso, 2001), and to reflect variations in investors' average risk aversion (Avramov, 2002). Moreover, Chinn and Forbes (2003), and Kose *et al.* (2003), among others, show that international interest rates have substantial effects on valuation and on financial asset allocation in international context. For their part, Adler and Qi (2003) use the interest rate spread as a factor of financial integration, and find that this variable affects the mobility of international capital flows which, in turn, leads to changes in the level of market integration.

The degree of market openness of a region is measured by the ratio of imports plus exports to GDP. This variable is computed using data from MSCI, World Bank's International Finance Corporation, and Datastream International. It is useful in that trade liberalization is commonly considered as a factor of convergence between markets as well as a key element for the elaboration of international development strategy. This liberalization process has sharply accelerated in a number of emerging market countries during the early 1980s in order to deal with the lack of resources available to finance economic growth, and to remedy the poor performance of their financial markets. Bekaert and Harvey (1997, 2000), Rajan and Zingales (2001), and Bhattacharya and Daouk (2002) document that higher degree of market openness led to increase the exposure of national markets to global risk factors. Thus, as the markets became more open to foreign trade and capital flows, their level of economic integration would rise, and asset exchanges became significant. Accordingly, the degree of market openness can be a potential factor in promoting financial integration.

V. EMPIRICAL RESULTS

A. Prices of Regional Market and Foreign Exchange Risks

Panel A of Table 1 presents the estimated parameters for the price of exchange rate. The price of currency risk for Malaysia and Thailand are explained by three variables (RDY), (RRENT) and (RPRM). For Singapore market, the price of currency risk is mainly determined by (RRENT) and (RPRM). The price of currency risk for Thailand is explained by (RDY), (RRENT) and (RPRM). The result of Wald test shows that the price of currency risk are significantly different from zero and vary over time for all

Table 1
Prices of regional market and real exchange rate risks

	Constant	RPY	RRENT	RPRM
Panel A : Price of exchange rate risk				
Malaysia	0.346***	0.0002***	-0.004***	0.021***
	(0.146)	(0.00001)	(0.001)	(0.007)
Singapore	0.715***	0.0001	-0.007***	0.011***
	(0.056)	(0.0002)	(0.0005)	(0.002)
Sri-Lanka	0.636***	0.0001	-0.007***	0.012
	(0.178)	(0.0001)	(0.001)	(0.010)
Thailand	0.149	0.0001***	-0.002**	0.013**
	(0.120)	(0.00002)	(0.001)	(0.006)
Panel B : Price of regional market risk				
Asia	0.08***	0.081**	0.009***	0.003***
	(0.013)	(0.073)	(0.0001)	(0.001)

Panel C– Specification test of price of regional and exchange rate risk

Null Hypothesis	χ^2	p-value
The price of market risk of the South East Asian region =0? $H_0 : \lambda_t = 0$	120.23	0.0000
The price of market risk of the South East Asian region is constant $H_0 : \lambda_t = 1$	92.131***	0.0000
The price of exchange rate risk of the South East Asian markets is jointly zero $H_0 : \lambda_t = 1$	18.122*	0.0000

Panel D- Analysis of residuals

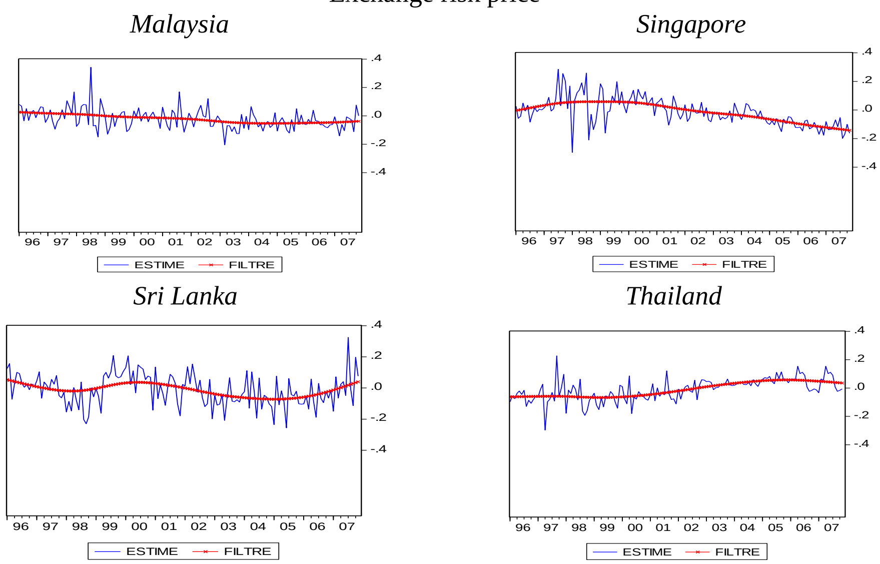
	Skewness	Kurtosis	J.B	Q(6)	ARCH(1)
Malaisie	1.172**	5.441***	67.786+++	13.392	0.403
Singapour	-0.382**	5.843***	51.282+++	16.801	0.016
Sri Lanka	1.418***	15.368***	952.563+++	9.739	0.072
Thaïlande	0.29	3.247	2.356	5.873	0.472
Asie	1.514***	16.244***	1092.131+++	13.32	0.169

Notes: Numbers in parenthesis are the associated standard deviations. JB, Q(6), and ARCH(6) are the empirical statistics of the Jarque-Bera test for normality, Ljung-Box test for serial correlation of order 1, and Engle (1982)'s test for conditional heteroscedasticity. *, **, and *** indicate that the coefficients are significant at the 10%, 5%, and 1% levels respectively. +, ++, and +++ indicate that the null hypothesis of normality and autocorrelation is rejected at the 10%, 5% and 1% levels respectively.

markets under study. Figure 1 shows that the price of local market risk varies over time. This is also confirmed by the Wald test as it rejects the basic assumptions that the national risk prices are constant. For the regional price of risk, the coefficients of (RDY), (RRENT) and (RPRM) are significant. Panel D presents a detailed analysis of the model's residuals where we examine their normality, autocorrelation and conditional heteroscedastic properties. It appears that, except for the Thailand, normality of estimated residuals can be rejected for four currency returns. The Engle (1982)'s test for conditional heteroscedasticity of the standardized residuals indicates that ARCH effects no longer exist in all cases, thus revealing the appropriateness of the GARCH modeling approach.

Results of the Wald tests of nullity and constancy restrictions on the price of regional market risk, reported in Panel C, clearly rejects the null hypotheses that the latter is equal to zero and constant, which confirms the findings of previous studies including Bekaert and Harvey (1995), and Carrieri *et al.* (2007).

Figure 1
Exchange risk price



B. Dynamics of Intra-regional Integration

Degree of intra-regional integration differs from market to market which is a reflexion of the heterogeneity of the economic and monetary policies followed by the member countries of the regions. After a decline during the sub-period 1996-1998, the Singapore market reached high level of integration above the 60%. This is the most integrated market in the South East Asian region. This result is expected because of the Singapore's role as a financial hub in Asia. The Singapore market tends to compensate deficiencies in local markets which are insufficiently open. And it also serves as an intermediary to less developed markets like Malaysia and Indonesia. The least integrated market in the region is the Thai market. It records an average of 30.8%. Sri Lankan market recorded an average of 5.28%, in that way, the intra-regional financial integration had increased from the 2000s.

Table 2
Dynamics of stock market integration

Panel A: Parameters of the market integration measure			
	Constant	OPEM	USV
Sri Lanka	0.198*** (0.037)	0.131*** (0.033)	-0.14*** (0.0035)
Malaysia	0.376*** (0.08)	0.161*** (0.076)	0.193*** (0.073)
Singapore	0.631*** (0.079)	0.07*** (0.005)	0.118*** (0.076)
Thailand	0.281*** (0.022)	0.407*** (0.006)	-0.022*** (0.005)
Panel B: Statistics of market integration			
	Ω mean	Ω max	Ω min
Sri Lanka	0.528*** (0.009)	0.846	0.214
Malaysia	0.326*** (0.006)	0.994	0.000
Singapore	0.743*** (0.229)	0.999	0.013
Thailand	0.308*** (0.030)	0.981	0.000

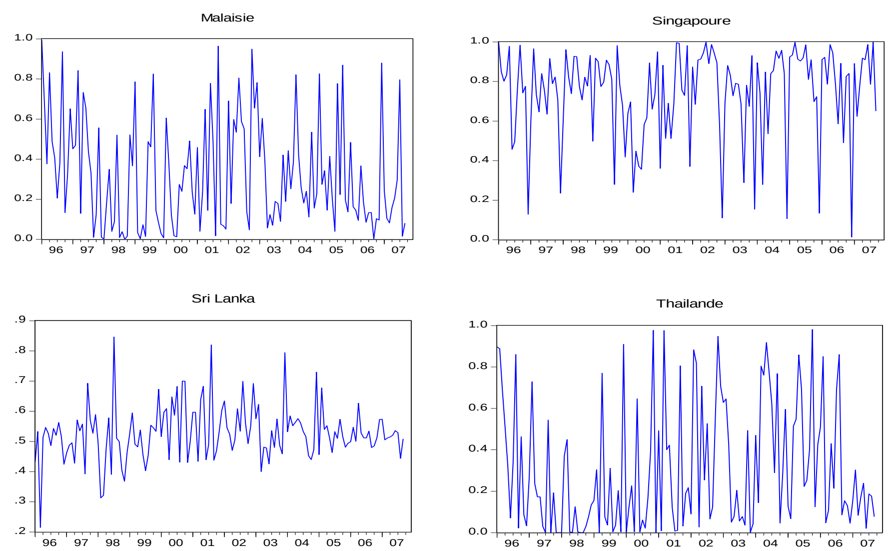
Panel C : Specification test of price of local risk		
Null Hypothesis	χ^2	p-value
Is the price of local risk in Thailand zero? $H_0 : \lambda_T = 0$	7.487	0.1123
Is the price of local risk in Thailand constant? $H_0 : \lambda_T = 1$	86.889***	0.0014
Is the price of local risk in Singapore zero? $H_0 : \lambda_S = 0$	69.351***	0.0000
Is the price of local risk in Singapore constant? $H_0 : \lambda_S = 1$	98.588***	0.0000
Is the price of local risk in Sri Lanka zero? $H_0 : \lambda_{SR} = 0$	21.175***	0.0003
Is the price of local risk in Sri Lanka constant? $H_0 : \lambda_{SR} = 1$	24.707***	0.0000
Is the price of local risk in Malaysia zero? $H_0 : \lambda_M = 0$	9.812**	0.0437
Is the price of local risk in Malaysia constant? $H_0 : \lambda_M = 1$	23.120***	0.0000

Notes: Numbers in parenthesis are the associated standard deviations. *, **, and *** indicate that the coefficients are significant at the 10%, 5%, and 1% levels respectively.

In Figure 2 we depict the time-paths of financial integration measure for four emerging market. Malaysia has experienced a decline in the degree of integration early in the period 1996-1998 before resuming the upward movement from the years 1999-2000. These results were expected as the rate of trade openness of economies and the development of financial markets had significantly increased since the 1990s. We can deduce that except Singapore market, the other markets of member countries are not strongly integrated in the study area. Petri (1993) finds that the geographical proximity effects are not significant in the South East Asian region, indicating that the strategy of developing Asian countries is turned to the conquest of foreign markets. These results are verified by Frankel and Wei (1993) and Frankel *et al.* (1993) showing that the intra-regional trade integration in Asia is influenced more by the rapid growth in these countries than by a genuine commitment to economic integration.

Figure 2

Dynamic integration of emerging market regions into the regional market



C. Market Integration and Formation of Total Risk Premium

The total risk premium (TPR) can be broken down into two components. The first component, called a global risk premium (GPR), consists of regional market risk premium and exchange rate risk premium. It is weighted by the level of integration Ω^{i}_{t-1}. The second one, referred to as the local risk premium (LRP), is weighted by the level of market segmentation $(1-\Omega^{i}_{t-1})$. Formally, the total risk premium for market *i* with *i* = ML, TA, SL, and SN is given by: $TPR_{i,t} = GPR_{i,t} + LPR_{i,t}$. Table 3 reports the average values of the total, the global and local risk premiums. The two-sided Student-t test indicates that both the global and local risk premiums are significantly different from zero at the 1% level for all the markets considered. Sri Lanka market has the highest total risk premium (17.5%), followed by Malaysia (15.25%), Singapore (9.5%), and Thailand (6.82%). The local risk premiums are on average greater than the global premiums for all countries. The local risk premium in Sri Lanka is the largest and represents 90% of the total risk premium. This result is in fact expected, given the high risk exposure of this market, e.g., repeated economic crises. For the remaining countries, the proportion of local risk premium in the total risk premium ranges from 85% (Malaysia) to 100% (Singapore). The analysis of risk premiums thus confirms our previous findings that these countries are not perfectly integrated into the regional market.

Table 3
Decomposition of the total risk premium

	TPR	DPR	GPR
Malaysia	15.240^{+++} (0.187)	13.343^{+++} (0.124)	1.897^{+++} (0.230)
Singapore	10.283^{+++} (0.251)	8.877^{+++} (0.101)	1.406^{+++} (0.259)
Sri Lanka	15.498^{+++} (0.235)	14.440^{+++} (0.145)	1.058^{+++} (0.292)
Thailand	7.636^{+++} (0.183)	6.628^{+++} (0.044)	1.008^{+++} (0.176)

Notes: +++ indicates that the average risk premiums are significantly different from zero at the 1% level with respect to the two-sided Student-t test.

VI. CONCLUSION

This study tests a conditional version of ICAPM where the regional market, exchange and local risk are explicitly parametrized as independent pricing factors. We model conditional second moments using a multivariate DCC-GARCH (1, 1) process. We document that this novel GARCH specification provides a significantly better fit of the covariance process of emerging market returns than a standard specification. Our methodology is fully parametric enabling us to use the model estimates to investigate the relative magnitude and the dynamics of the exchange, regional and local risk premiums.

Overall, we find that the level of market integration varies widely over time and is satisfactorily explained by the US term premium and the level of market openness. Even though it reaches fairly high values during several periods, and exhibit an upward trend towards the end of the estimation period, the emerging market considered still remain substantially segmented from the regional market. These results thus suggest that diversification into emerging market assets continue to produce substantial profits and that the asset pricing rules should reflect a state of partial integration. Our investigation, which addresses the evolution and formation of total risk premiums, confirm this empirically. In fact, decomposition of the total risk premium shows that the local risk factor, i.e., the variance risk related to the regional market index, explains more than 50% of the total risk premium on average. The largest proportion obtained is for Thailand (85%).

The scope of our conclusions may be limited for several reasons. Our investigation has ignored some integration information variables. In fact, an immense amount of evidence shows that stock prices are affected by market, economic and world fundamentals (Chen *et al.*, 1986; Hardouvelis *et al.*, 2006). De Santis and Gerard (1998) and Ng (2004) shows that exchange rate volatility, industrial production and oil price changes (market fundamentals) are important in tests of asset pricing models for market integration . Moreover, these variables are commonly applied in the literature on conditional asset pricing (see Ferson and Harvey, 1993, 1994, 1998; Bekaert *et al.*, 2002; and Gerard *et al.*, 2003). This suggests that returns we use in our tests may not reflect the effect of macroeconomics variables on stock returns. Further research is needed to address these issues.

REFERENCES

Adler, M., and R. Qi, 2003, "Mexico's Integration into the North American Capital Market," *Emerging Economic Review*, 4, 91-120.

Bekaert, G., C.R. Harvey, and R. Lumsdaine, 2002, "The Dynamics of Emerging Market Equity Flows," *Journal of International Money and Finance*, 21, 295-350.

Bollerslev, T., 1990, "Modeling the Coherence in Short-run Nominal Exchange Rates: A Multivariate Generalized ARCH Approach," *Review of Economics and Statistics*, 72, 498-505.

Carrieri, F., V. Errunza, and K. Hogan, 2007, "Characterizing World Market Integration through Time," *Journal of Financial and Quantitative Analysis*, 42(04), 915-940.

De Santis, G., and B. Gerard, 1997, "International Asset Pricing and Portfolio Diversification with Time Varying Risk," *Journal of Finance*, 52, 1881-1912.

De Santis, G., and B. Gerard, 1998,"How Big is the Premium for Currency Risk," *Journal of Financial Economic,* 49, 375-412.

De Santis, G., B. Gerard, and P. Hillion, 2003, "The Relevance of Currency Risk in the EMU," *Journal of Economics and Business*, 55, 427-462.

Dumas, B., and B. Solnik, 1995, "The World Price of Foreign Exchange Rate Risk," *Journal of Finance,* 50, 445-480.

Errunza, V., and E. Losq, 1985, "International Asset Pricing under Mild Segmentation: Theory and Test," *Journal of Finance,* 40, 105-124.

Hardouvelis, G.A., D. Malliaropulos, and R. Priestley, 2006, "EMU an European Stock Market Integration," *Journal of Business*, 79 (1), 365-373.

Jong, F., and F.A. Roon, 2005,"Time-varying Market Integration and Expected Returns in Emerging Markets," *Journal of Financial Economics*, 78, 583–613.

Ng, D.T., 2004,"The International CAPM when Expected Returns are Time-varying," *Journal of International Money and Finance*, 23, 189-230.

Ng, T.H., 2002, "Stock Market Linkages in South-East Asia," *Asian Economic Journal*, 16, 353-377.

Pukthuanthong, K., and R. Roll, 2009, "Global Market Integration: An Alternative Measure and its Application," *Journal of Financial Economics*, 94, 214–232.

Solnik, B., 1974, "An Equilibrium Model of the International Capital Market," *Journal of Economic theory*, 8, 500-524.

Stiglitz, J. E., 2002, "Information and the Change in the Paradigm in Economics," *American Economic Association*, 92(3), 460-501.

Stulz, R., 1981, "A Model of International Asset Pricing," *Journal of Financial Economics,* 9, 383-406.

Tai, C-S., 2007, "Market Integration and Contagion: Evidence from Asian Emerging Stock and Foreign Exchange Markets," *Emerging Markets Review*, 8(4), 264-283.

Tse, Y.K, 2000, "Test for Constant Correlations in a Multivariate GARCH Model," *Journal of Econometrics*, 98(1), 107-127.