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Abstract

In recent years, various emerging market regions have actively taken part in the movements of globalization and world market integration. However, the process of financial integration appears to vary over time and differs significantly across emerging market regions. This paper attempts to evaluate the time-varying integration of emerging markets from a regional perspective (Asia, Latin America, Middle East, and Southeast Europe) based on a conditional version of the International Capital Asset Pricing Model (ICAPM) with DCC-GARCH parameters that allows for dynamic changes in the degree of market integration, global market risk premium, regional exchange-rate risk premium, and local market risk premium. Overall, our findings reveal several interesting facts. First, the time-varying degree of integration of four emerging regions, satisfactorily explained by the regional level of trade openness and the term premium of US interest rates, has recently tended to increase, but these markets still remain substantially segmented from the world market. Second, the local market risk premium is found to explain more than 50% of the total risk premium for emerging market returns. Finally, we show that conditional correlations usually underestimate and overstate the measure of time-varying market integration. The empirical results of this study have some important implications for both global investors and policy makers with respect to dedicated portfolio investments in emerging markets and policy adjustments.

Keywords: time-varying integration, emerging markets, ICAPM, risk premium, DCC-GARCH
JEL classification:

1. Introduction

The development of the contemporary world economy has been particularly characterized by the intensive globalization of national capital markets. If we compare the two types of globalization - one operating in the financial markets, the other in the market for goods - we find that over the last fifteen years trading in financial assets has grown three times faster than trading in goods. The globalization process is thus more strikingly displayed on the financial markets. This ever-growing globalization of the financial markets results on the one hand from the intensity of cross-border capital mobility, and on the other from the increased openness of national economies. Besides the accelerating wave of deregulation affecting the financial markets in almost every country, their ability to communicate directly, made possible by the technologic revolutions in information and communications, has enabled a substantial integration of national financial markets.

Emerging markets have begun to play an active role in this movement towards financial globalization during the 1980s by initiating a general process of financial liberalization, which included internal policies aimed at deregulating interest and exchange rates, as well as decisions designed to reduce the barriers to receiving international investments (Bekaert, 1995; Demirgüç-Kunt and Huizinga, 1995; Bekaert and Harvey, 2000). We then observed a spectacular development of international exchanges with these markets (Bekaert et al., 2002a). As reported by the International Finance Corporation in its 2008 annual report, net flows of private capital towards emerging markets, including direct foreign investments and portfolio investments, had already reached 616 billion USD in 2007, whereas little capital had been invested before 1980 because of the lack of products and financial services available to foreigners. In recent years emerging markets have accounted for about 50% of the world's economic growth.

In parallel with the movement towards the globalization of national markets, a number of economic areas have continued to develop their institutional aspects, as shown by the growing number of regional economic agreements (NAFTA, ASEAN, EU, MERCOSUR, etc.). These regional trade agreements result in part from a greater openness of the member countries, and a desire to become more competitive in world markets by mobilizing their joint efforts and synergies. Several emerging regions such as Asia, Central and Eastern Europe, and Latin America are also in keeping with this dynamics, both on the regional and global levels. However, the links between global and regional integration are not the same in every area. In some regions international integration preceded the regional integration, 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.

However, if globalization, and financial integration in particular, can enable emerging markets to obtain a better diversification of their risks, a more efficient allocation of capital, and a better potential for economic growth, they 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, 1998; Stiglitz, 2002; Bekaert et al., 2002b). 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 financial integration. Although the proposed model was developed in the spirit of that presented by Bekaert and Harvey (1995), it allows for the dynamic conditional correlations between stock returns by using the multivariate DCC-GARCH model of Engle (2002). It also enables an examination of the relevance of the dynamic measure of financial integration over the conditional correlations, very frequently used in the literature when referring to the level of integration. Lastly, our study differs from past studies in that we investigate the integration of emerging market regions into the world market, rather than individual emerging markets, using actual real exchange rates as a common source of risk, in addition to world and domestic sources of risk.

Our results show that the integration degree in four emerging market regions (Latin America, Asia, Southeastern Europe, and the Middle East) varied widely through time over the period 1996-2008, and this can be satisfactorily explained by the level of trade openness and variations in the US term premium. Although the general trend is towards increasing financial integration, emerging market areas seem to be still significantly segmented from the global market. Indeed, a breakdown of the total risk premium confirms this, in that it underlines the dominant role of the local risk factor in explaining variations in the expected returns for the four areas considered. Finally, a close inspection of the conditional correlations indicates that they constitute a biased indicator of financial integration.

The remainder of the article is organized as follows. Section 2 presents a brief review of the literature on financial integration in emerging markets. Section 3 describes the empirical approach which we employ to measure and investigate the level of emerging market integration over time. Section 4 presents and discusses the results obtained. Section 5 provides some concluding remarks.

2. Literature on the integration of emerging markets

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[1]. 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. Indeed, the author proposed the use of an international CAPM 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, whereas the segmentation hypothesis is not rejected in any 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. In addition, the exchange rate risk was priced and relevant in explaining variations in stock returns of the Mexican equity market.

[1] Ferson and Harvey (1994), Harvey and Zhou (1993), and Harvey (1991) show that the MSCI world market index provides a satisfactory explanation of relationship between return and risk in developed markets.

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.

Pukthuanthong and Roll (2009) suggest a measure of financial integration based on the adjusted coefficient of determination (R^2) of a multifactor asset pricing model. After identifying the global pricing factors by principal component analysis, the authors estimate a multiple regression model relating stock returns to global factors for each market in their sample of 82 developed and emerging markets. Inspection of the time profile of the adjusted R^2 – the proposed measure of integration – indicates that the general l trend is an increase in financial integration for the majority of markets over the last three decades, but the extent of the changes varies considerably among the markets. It should be noted that some markets, such as Pakistan, Sri Lanka, and Zimbabwe, have experienced reverse evolutions.

Taken together, the preceding studies show that: *i*) regulations regarding the international mobility of capital flows, the diversified trade structure, political risk, and the low level of stock market development are among the most important segmentation factors for emerging markets; *ii*) emerging markets are only partially integrated into the world market, but their degree of integration change through time. This suggests that dynamic approaches may be the most appropriate ones for modeling their levels of integration; and *iii*) asset pricing models with a global factor do not correctly describe the structure of emerging market returns because it has been shown that the local risk factor and the exchange rate risk are actually priced.

Our study first focuses on the dynamics of financial integration of emerging market regions 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 global and local risk factors respectively, by carrying out a decomposition of the total risk premium.

3. Empirical approach

The basic form of our asset pricing model draws on the conditional ICAPM developed by Bekaert and Harvey (1995), which allows a local market's expected return to vary over time according to its covariance with the world market return and its own variance. In a perfectly integrated market only the covariance risk is priced, whereas the variance risk is solely relevant in a strictly segmented market. Although the model proposed by Bekaert and Harvey (1995) does not rely on any asset pricing theory, their approach successfully combines the two major models for valuing international financial assets, i.e., complete segmentation and complete integration.

Assuming complete market integration, and in the absence of exchange risk, the conditional ICAPM can be written as follows

$$E_{t-1}(R_{it}^{r}) = \delta_{m,t-1} Cov_{t-1}(R_{it}^{r}, R_{mt}) \quad (1)$$

where $E_{t-1}(R_{it}^{r})$ is the excess return of security *r*, issued in country *i*, conditionally on a set of information ψ_{t-1} that is available to investors up to time *t*-1. R_{mt} is the return on the world market portfolio. Cov_{t-1} is the conditional covariance between the security *r*'s return and the world market returns. $\delta_{m,t-1}$ refers to the conditionally expected world price of covariance risk. When aggregating at the national level, Equation (1) is written as

$$E_{t-1}(R_{it}) = \delta_{m,t-1} Cov_{t-1}(R_{it}, R_{mt}) \quad (2)$$

The security *r* is priced with respect to a domestic CAPM if the national market is strictly segmented from the world market and there is no exposure to exchange risk. That is

$$E_{t-1}(R_{it}^{r}) = \delta_{i,t-1} Cov_{t-1}(R_{it}^{r}, R_{it}) \quad (3)$$

Equation (3) shows that the expected excess return on security *r* depends upon its conditional covariance with the return on a national market portfolio R_{it} and the price of the local risk $\delta_{i,t-1}$. Let $Var_{t-1}(R_{it})$ be the conditional variance of national market return, the pricing relationship in Equation (3) at the national level is given by

$$E_{t-1}(R_{it}) = \delta_{i,t-1} Var_{t-1}(R_{it}) \quad (4)$$

If the national market is neither perfectly integrated nor strictly segmented, none of the two above-mentioned conditional versions of the ICAPM adequately explains the expected return on market *i*. Bekaert and Harvey (1995) combine these models to build a more general asset pricing model allowing for regime-switching market integration. At each point in time, the market *i*'s expected excess return is determined by

$$E_{t-1}(R_{it}) = \Omega_{t-1}^{i}(\delta_{m,t-1} Cov_{t-1}(R_{it}, R_{mt})) + (1 - \Omega_{t-1}^{i})\delta_{i,t-1} Var(R_{it}) \quad (5)$$

Ω_{t-1}^{i} 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 world market. If Ω_{t-1}^{i}= 1, only the covariance risk is priced and the strict segmentation hypothesis is rejected. If Ω_{t-1}^{i}= 0, the unique source of systematic risk is the variance and the pricing relationship in a strictly segmented market applies. Otherwise, we have an asset pricing model for partially integrated markets. In their study, Bekaert and Harvey (1995) model the integration measure Ω_{t-1}^{i} by a logistic transition function of instrumental variables that are likely to affect the integration level. $\delta_{m,t-1}$ and $\delta_{i,t-1}$ are allowed to vary over time according to a set of information variables that reflect economic fluctuations and investors' expectations[2].

So far we assume that the purchasing power parity (PPP) holds across countries. If this condition is violated, the model in Equation (5) must then incorporate rewards for exchange rate risk (Adler and Dumas, 1983; Carrieri et al., 2007; Tai, 2007), and is expressed as

$$E_{t-1}(R_{it}^c) = \Omega_{t-1}^i \left[\delta_{m,t-1} Cov_{t-1}(R_{it}^c, R_{mt}^c) + \sum_{k=1}^{L} \delta_{k,t-1} Cov_{t-1}(R_{it}^c, R_{kt}^c) \right] + (1-\Omega_{t-1}^i)\delta_{i,t-1} Var_{t-1}(R_{it}^c) \qquad (6)$$

R_{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*, conditionally on the information available up to *t*-1. *L* is the number of markets included in the sample. Exponent *c* indicates that returns are expressed in the currency of the reference country.

Since we attempt to analyze the financial integration of four emerging market regions (Latin America, Asia, Southeastern Europe, and the Middle East), *L* must be 4. R_{it}^c and R_{kt}^c respectively represent the excess return on the stock market index of region *i* and the rate of return on the real exchange rate index for each region. The latter corresponds to the geometric weighted average of the real exchange rates for the states comprising a region, where the weights are the share of each country in the foreign trade with the United States. Note that the use of the real exchange rate index allows substantial variations in the inflation rates of the emerging countries to be taken into account.

At the empirical stage, the pricing formula in Equation (6) will be simultaneously estimated for the world market and for four emerging market regions. That is, we have a system of five equations where the expected return on the world market portfolio is given by

$$\begin{aligned} E_{t-1}(R_{mt}^c) = {} & \lambda_{m,t-1} Var_{t-1}(R_{mt}^c) + \lambda_{L,t-1} Cov_{t-1}(R_{mt}^c, R_{Lt}^c) + \lambda_{A,t-1} Cov_{t-1}(R_{mt}^c, R_{At}^c) \\ & + \lambda_{E,t-1} Cov_{t-1}(R_{mt}^c, R_{Et}^c) + \lambda_{M,t-1} Cov_{t-1}(R_{mt}^c, R_{Mt}^c) \end{aligned} \qquad (7)$$

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

$$E_{t-1}(R_{it}^c) = \Omega_{t-1}^i \begin{bmatrix} \lambda_{m,t-1} Cov_{t-1}(R_{it}^c, R_{mt}^c) + \lambda_{L,t-1} Cov_{t-1}(R_{it}^c, R_{Lt}^c) \\ + \lambda_{A,t-1} Cov_{t-1}(R_{it}^c, R_{At}^c) + \lambda_{E,t-1} Cov_{t-1}(R_{it}^c, R_{Et}^c) \\ + \lambda_{M,t-1} Cov_{t-1}(R_{it}^c, R_{Mt}^c) \end{bmatrix} + (1-\Omega_{t-1}^i)\lambda_{i,t-1} Var_{t-1}(R_{it}^c) \quad (8)$$

with $i = L$ (Latin America), *A* (Asia), *E* (Southeastern Europe), and *M* (Middle East)

In Equation (8), $R_{Lt}^c, R_{At}^c, R_{Et}^c$ and R_{Mt}^c are respectively the returns on the real exchange rate indices of the four regions under consideration, and $\lambda_{L,t-1}, \lambda_{A,t-1}, \lambda_{E,t-1}$ and $\lambda_{M,t-1}$ refer to the expected prices of the exchange rate risk.

Some studies (Bekaert and Harvey, 1995; De Santis and Gérard, 1997; Gérard et al., 2003) show that the prices of risk, representing the degree of risk aversion aggregate over all

[2] Bekaert and Harvey (1995) employ four global instrumental variables: the dividend yield of the world market in excess of the 30-day Eurodollar interest rate, the default premium (differences between yields on Aaa and Baa bonds as quoted by Moody's), the change in the term premium (yield on ten-year US Treasury bonds minus yield on 3-month US Treasury bills), and the change in the 30-day Eurodollar interest rate. The local information variables include returns on the local stock market, changes in the local exchange rate, local dividend yields, and the ratio of market capitalization to the gross domestic product (GDP).

investors, vary over time. In this study we also model their dynamics as an exponential function of a set of conditioning information variables that are related to macroeconomic uncertainties, and to specific conditions of the international financial markets[3]. Formally, let $X_{m,t-1}$ represent the vector of global information variables, observable and available up to *t*-1, the expected price of world market risk is

$$\lambda_{m,t-1} = Exp(\delta'_m X_{m,t-1}) \tag{9}$$

Assume also that there is a vector $X_{i,t-1}$ containing all the observable regional information variables for region *i* up to *t*-1, then the expected price of regional market risk can be modeled as

$$\lambda_{i,t-1} = Exp(\gamma'_i X_{i,t-1}) \tag{10}$$

As to the price of exchange risk, it can theoretically be either positive or negative depending on whether the inverse ratio of the level of aggregate risk aversion is greater or less than one (Adler and Qi, 2003; Hardouvelis et al., 2006). Here we consider the real price of exchange risk, and allow it to vary in a linear fashion, according to a set of instrumental variables. We also make the same assumption as the earlier studies (Carrieri, 2001; De Santis et al., 2003), under which the set of instrumental variables affecting the real currency indices is the same as the set of global information variables. We thus have

$$\lambda_{k,t-1} = (\delta'_k X_{m,t-1}); \qquad k = L, A, E, M \tag{11}$$

The degree of integration of region *i* into the world 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

$$\Omega^i_{t-1} = Exp(-\left|g'_i X_{i,t-1}\right|) \tag{12}$$

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 region *i*.

We employ the multivariate generalized autoregressive conditional heteroskedasticity (MGARCH) methodology to estimate the international asset pricing model described by Equations (7) and (8). This multivariate framework is more suitable than the bivariate one for taking into account the dynamic interactions between all the variables included in the system. A number of MGARCH models have now been developed to capture the conditional heteroskedasticity of financial return series. Examples of most commonly-used models include the constant conditional correlation - GARCH (CCC-GARCH) of Bollerslev (1990), the full parameterized BEKK-GARCH model of Engle and Kroner (1995), and the dynamic conditional correlation - GARCH (DCC-GARCH) model of Engle (2002). It is commonly accepted that if the CCC-GARCH permits to considerably reduce the number of parameters to be estimated in the BEKK-GARCH, it has a major drawback by imposing the constancy of conditional correlations between the model's innovations, as compared to the DCC-GARCH. Accordingly, we decide to adopt the multivariate DCC-GARCH model to gauge the time-variations of the variance-covariance matrix, and conditional correlations. This class of models is distinguished by its simplicity and efficacy when estimating a large conditional covariance matrix because each return series is allowed to follow a univariate GARCH specification.

[3] Our modeling approach is similar to that of Dumas and Solnik (1995), De Santis and Gérard (1998), Carrieri (2001), De Santis et al. (2003), and Hardouvelis et al. (2006).

More specifically, the econometric specification of the model to be estimated, i.e., Equations (7) and (8), is characterized by the following system of equations

$$
\begin{aligned}
R_{it} &= \lambda_{0,i} + \Omega_{t-1}^{i}(\lambda_{m,t-1}h_{im,t} + \lambda_{L,t-1}h_{iL,t} + \lambda_{A,t-1}h_{iA,t} + \lambda_{E,t-1}h_{iE,t} + \lambda_{M,t-1}h_{iM,t}) \\
&\quad + (1-\Omega_{t-1}^{i})\lambda_{i,t-1}h_{ii,t} + \varepsilon_{it} \\
\varepsilon_t &= (\varepsilon_{mt}, \varepsilon_{Lt}^{c}, \varepsilon_{At}^{c}, \varepsilon_{Et}^{c}, \varepsilon_{Mt}^{c}, \varepsilon_{Lt}, \varepsilon_{At}, \varepsilon_{Et}, \varepsilon_{Mt}) / \psi_{t-1} \sim N(0, H_t) \\
H_t &= D_t R_t D_t' \\
R_t &= (diag(Q_t))^{-1/2} Q_t (diag(Q_t))^{-1/2} \\
D_t &= diag(\sqrt{h_{11,t}}, \sqrt{h_{22,t}}, ..., \sqrt{h_{nn,t}}) \\
\lambda_{m,t-1} &= Exp(\delta_m' X_{m,t-1}); \lambda_{i,t-1} = Exp(\gamma_i' X_{i,t-1}); \lambda_{k,t-1} = (\delta_k' X_{m,t-1}); k = L, A, E, M \\
\Omega_{t-1}^{i} &= Exp(-|g_i' X_{i,t-1}|)
\end{aligned}
\tag{13}
$$

where $R_{it} = (R_{mt}, R_{Lt}^{c}, R_{At}^{c}, R_{Et}^{c}, R_{Mt}^{c}, R_{Lt}, R_{At}, R_{Et}, R_{Mt})'$ 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. D_t is a diagonal matrix of conditional standard deviations for each of the return series, obtained from estimating a univariate GARCH process in Equation (14).

$$h_{ii,t} = w_i + \alpha_i \varepsilon_{ii,t-1}^2 + \beta_i h_{ii,t-1}^2 \tag{14}$$

Q_t is a (9×9) variance-covariance matrix of standardized residuals ($u_t = \varepsilon_t / \sqrt{h_t}$) which is defined as follows

$$Q_t = (1-\theta_1-\theta_2)\overline{Q} + \theta_1 u_{t-1}u_{t-1}' + \theta_2 Q_{t-1} \tag{15}$$

where $\overline{Q_t} = E(u_t, u')$ 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.

It is important to stress that the DCC process relies on the decomposition of the conditional covariances as the product of conditional standard deviations and conditional correlations between two markets *i* and *j* such that

$$h_{ij,t} = \rho_{ij,t}\sqrt{h_{ii,t}h_{jj,t}} \tag{16}$$

Therefore, for a pair of markets *i* and *j*, their conditional correlation at time *t* can be written as

$$\rho_{ijt} = \frac{(1-\theta_1-\theta_2)\overline{q}_{ij} + \theta_1 u_{i,t-1}u_{j,t-1} + \theta_2 q_{ij,t-1}}{((1-\theta_1-\theta_2)\overline{q}_{ii} + \theta_1 u_{i,t-1}^2 + \theta_2 q_{ii,t-1})^{1/2}((1-\theta_1-\theta_2)\overline{q}_{jj} + \theta_1 u_{j,t-1}^2 + \theta_2 q_{jj,t-1})^{1/2}} \tag{17}$$

where q_{ij} is the element on the i^{th} line and j^{th} column of the matrix Q_t.

Following Bekaert and Harvey (1995) and Hardouvelis et al. (2006), we adopt a 2-stage procedure to estimate the pricing system (13) since the simultaneous estimation of the full model is not feasible given a large number of unknown parameters. We first estimate a sub-system of five equations for excess returns on world market and four real exchange rate indices. This stage allows us to obtain the conditional variance of world market and real exchange rate indices, their conditional covariances as well as the prices of world 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 region in the system (13) by imposing the estimators obtained from the first stage. Note that by doing so we explicitly maintain the same prices of world market and exchange rate risks across different emerging market regions. The estimation of the vector of unknown parameters (θ) is carried out by the quasi-maximum likelihood estimation (QMLE) method which is robust to departures from normality of return series under some regular conditions (see, Bollerslev and Wooldridge, 1992). The log-likelihood function to be maximized is expressed as

$$L(\theta) = -\frac{1}{2}\sum_{t=1}^{T}(n\log(2\pi) + 2\log|D_t| + \log|R_t| + u_t^{'}R_t^{-1}u_t)$$

with $u_t = \varepsilon_t / \sqrt{h_t} = D_t^{-1}\varepsilon_t$

Summarizing all, we can, based on estimation results, analyze not only the formation of the total risk premium, but also assess the relevance of the time-varying measure of market integration, as compared to the dynamic conditional correlations which are commonly used to infer the degree of market integration.

4. Data and stochastic properties

This study investigates the global integration process of four emerging market regions (Latin America, Asia, Southeastern Europe, and Middle East). Monthly data are collected for regional stock market indices, world stock market index, and real effective exchange rate indices over the period from March 31, 1996 to March 31, 2008.

4.1 Stock market returns

We use the Morgan Stanley Capital International (MSCI) World market index, which is the value-weighted global market index consisting of the 21-national indices, as a proxy for the global market. For each of the four regions we consider, the value-weighted national market index series constructed by MSCI is used. The returns on world market and on each country index are computed from taking the difference in logarithm between two consecutive index prices. 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. The Eurodollar rate is obtained from Datastream International database.

4.2 Real exchange rate indices

We use the real effective exchange rate (REER) indices to represent the exchange rate risk since variations in the inflation rates of emerging countries are much significant in comparison to those in the exchange rates. For each emerging region, the REER index is measured by the geometric weighted average of all individual countries' exchange rates against the US dollar, where the weights are the share of each country in the foreign trade with the United States. These indices are calculated monthly by using exchange rate and trade data from Datastream International, the Federal Reserve Bank of St Louis, and the IMF's International Financial Statistics. Their returns are computed from taking the difference in logarithm between two consecutive index values. By construction, the REER index also allows for cross-country comparisons of changes in trade competitiveness.

4.3 Global and local information variables

Global instrumental variables are used to explain changes in the prices of world market and foreign exchange risks. Following Hardouvelis et al. (2006) and Carrieri et al. (2007), we employ the following variables: the dividend yield (dividend-to-price ratio) of the world market portfolio (MSCI World index) in excess of the 30-day Eurodollar interest rate which is denoted by WDY, the variation in the US term premium (USTP) which is measured by the yield spread between 10-year US Treasury notes and 3-month US Treasury bills, the return on the S&P's 500 stock market index (RSP)[4], and the variation in the 1-month US Treasury bill yield (1mUSTB). Data concerning these information variables are obtained from MSCI and the IMF's International Financial Statistics databases.

The local instrumental variables for each region, which are used to infer the changes in the local price of risk, include the dividend yield of a regional market portfolio (RDY), the return on the regional stock market index in excess of the 30-day Eurodollar interest rate (RRI), and the variation in the trade-weighted average regional inflation rate (VIR). Data are extracted from MSCI and Datastream International.

4.4 Instruments for the dynamic measure of financial integration

Two information variables are used in this study to capture the evolution of market integration. They are the variation in the US term premium (USTP) and the level of market openness of the region under consideration. Accordingly, the time-varying degree of market integration is modeled as follows[5]:

$$\Omega_{t-1}^{i} = Exp(-\left|\alpha_0 + \alpha_1 OPENNESS_{i,t-1} + \alpha_2 USTP_{i,t-1}\right|) \tag{20}$$

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.

As to the US term premium, it 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.

4.5 Stochastic properties of the data

[4] Hardouvelis et al. (2006) consider the default premium, measured by the difference in yields between a bond rated Baa by Moody's and a bond rated Aaa, as a global information variable.

[5] Since there is a numerical convergence problem at the estimation stage when we have more than two unknown parameters, only two information variables are used to explain the changes in financial integration measure.

Table 1 reports the main statistics of return series for stock market indices and real exchange rate indices for four emerging regions considered. Examination of these statistics shows that the Emerging Middle-East region has the highest average excess return (0.454%), followed by the Emerging Southeastern Europe (0.365%), Emerging Latin America (0.029%), and Emerging Asia (-0.043%). The Emerging Southeastern Europe was the most volatile during the studied period in terms of standard deviation (12.761%), while the Emerging Asia was the least volatile (2.34%). The skewness coefficients are negative for all the regions, except for the Emerging Southeastern Europe. They are significantly different from zero for almost all regions, indicating the presence of asymmetry in the return generating process. In addition, all the return series are characterized by a kurtosis coefficient statistically significant and greater than 3, and have, as a result, distribution tails that are thicker than those in a normal distribution. The findings from Jarque-Bera test, which are not presented here for concision purpose, confirm the rejection of normality.

Regarding the real exchange rate indices, the statistics presented in Panel B of Table 1 indicate that average returns range from 0.789% (Emerging Southeastern Europe) to 2.248 (Emerging Latin America). As with the stock market returns, the hypothesis of normality is rejected for all the indices considered.

Panel C of Table 1 shows the unconditional correlation matrix of return series considered. The highest correlation is observed for the pair of Emerging Latin America and world stock market (0.70). This can be explained by the relatively large share of Latin American emerging markets in the world market. The Emerging Southeastern Europe has the lowest unconditional correlation with the world market (0.39). The correlations of the Emerging Asia and Middle East with the world market are 0.54 and 0.56 respectively. As for correlations between regional stock returns and real exchange-rate index returns, we note in particular a negative correlation in the case of Emerging Asia and Southeastern Europe (-0.01).

We also perform Engle (1982)'s test for the 6^{th} order of conditional heteroscedasticity and cannot reject the hypothesis of no ARCH effects for all return series considered, which motivates our choice of GARCH modeling approach for conditional variance processes.

Table 2 shows the autocorrelations and partial autocorrelations of excess returns on stock market indices and returns on real exchange rate indices. We note in particular that only the first-order autocorrelations are significant at the 5% level for stock returns, and at the 1% level for currency returns.

5. Empirical results

5.1 Prices of world market and foreign exchange risks

As discussed above, we first estimate the system (13) for excess returns on world market, and returns on four real exchange rate indices. The estimation results and residual diagnosis are reported in Table 3. Panel A presents the estimated parameters for the price of world market risk. Accordingly, the coefficients associated with the US term premium, returns on S&P's 500 index, and variation in the yield of 1-month US Treasury bills are significant at the 10% level. The excess dividend yield of the world market has, however, insignificant effect on the evolution of the price of world market risk. Results of the Wald tests of nullity and constancy restrictions on the price of world 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).

Turning out to the analysis of the prices of foreign exchange risk associated with fluctuations of each of the four regional trade-weighted real exchange rate indices vis-à-vis the US dollar, we first observe that they are mainly driven by the excess dividend yields of the world market, the S&P's 500 index returns, and the change in the yield of the 1-th US treasury bills because the associated coefficients are statistically significant at the conventional levels in all cases (Panel B). Note however that the change in the 1-month US Treasury bill rate is not significant in case of Emerging Middle East, while the US term premium, contrary to common expectations, provides information about the price of real exchange rate risk for only one (Emerging Asia) out of four cases. Second, we employ the Wald test to investigate the null hypotheses that the price of exchange risk is zero and constant respectively. The obtained results, reported in Panel D of Table 3, indicate the rejection of these null hypotheses at the 1% level for all emerging regions considered. These findings are effectively in agreement with those of previous studies, including Carrieri et al. (2007) and Tai (2007), in that the exchange rate risk is a relevant factor of risk for asset pricing in emerging markets, and that they change over time. We finally examine the hypotheses of joint nullity and constancy of all the four prices of exchange rate risk and find evidence against their validity.

Panel E of Table 3 presents a detailed analysis of the model's residuals where we examine their normality, autocorrelation and conditional heteroscedasticity properties. It appears that normality of estimated residuals can be rejected for four currency returns. The departure from normality decreases substantially for world returns, but it remains significant at the 10% level. This finding globally justifies the use of QMLE procedures. The Ljung-Box test reveals that the first-order autocorrelations of the standardized residuals still remain significant, but their values decrease substantially. 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. We note finally that although all the coefficients in the multivariate DCC-GARCH process for conditional variances and covariances are not reported, most of them are significantly different from zero at the 1% and 5% levels. Overall, this confirms the time-variation in both prices and quantities of risk as we have found based on Wald tests.

5.2 Time-varying world market integration of emerging market regions

Table 4 reports the descriptive statistics of our time-varying measure of market integration, which is obtained by estimating the whole system (13), while imposing the estimates from the subsystem for world and four exchange rate index returns[6]. The four emerging market regions are only weakly integrated into world markets since the integration measures average between 0.321 (Emerging Asia) and 0.430 (Emerging Latin America). The statistical significance of most coefficients associated with the degree of trade openness and US term spread suggests that they are important determinants of the degree of market integration.

In Figure 1 we depict the time-paths of financial integration measure for four emerging market regions. We see at the first sight that both the evolution and the level of market integration are not identical across different regions. Specifically, the degree of market integration of Emerging Latin America fluctuates sharply over time and has experienced several reversals, in particular during financial crisis times (e.g., the Asian crisis 1997-1998, the Brazilian crisis in 1999 and the Argentinean crisis in 2001). The low level of integration during the earlier 1990s can be explained by the divergence of economic policies among the member countries because they followed a strategy of decoupling from world market and international competition. Since the beginning of 2000s, this region exhibits increasing integration following

[6] Most of the estimates of the individual coefficients on the local information variables are significant, which suggests time-variation in the local prices of risk. They are available under request to the corresponding author.

greater degrees of stock market liberalization and economic cooperation at both regional and international levels. Arouri (2006) investigates the global integration of five Latin American countries over the period 1973-2003, and documents an average level of integration of 0.403, which is very close to our result. His work offers an indication of increasing integration in recent years and explains this by the creation of new financial instruments such as American Depository Receipts and Closed-end Country Funds. Our study shows further that the trend towards full integration of the Emerging Latin America cannot be confirmed using more r-cent data.

The Emerging Asia shows a far lower level of world integration than the Emerging Latin America. With an average level of about 0.321, it is the least integrated region within the world market. Its process of financial integration has begun with structural reforms aimed at stimulating the private sector and opening markets to foreign investors in the late 1980s (Nicolas, 1997). A close inspection of the integration patterns for this region indicates a level of integration greater than 0.50 during crisis period (2001-2002), and a sharp increase in the level of integration beginning in 2006. Carrieri et al. (2007) show, however, an increasing trend of integration for the Emerging Asia since 2002 and onwards. Arouri (2006) finds an average integration level for the Asian markets of 0.56. This level is higher than ours because the author considers seven Asian markets including two developed ones (Hong Kong and Singapore). Moreover, the rise in the level of financial integration during the recent period can be explained by the greater openness of the Asian area to foreign trade, high growth rates, and the impacts of international financial shocks. According to Bormann et al. (1995), growth seems to be the main factor contributing to strengthening the regional and global integration of Asian area countries. The economic success of Japan and the newly-industrialized countries has encouraged private firms to invest in the developing countries in the region and thereby improves the dynamics of regional financial markets.

In regard to the Emerging Southeastern Europe, its average level of financial integration is fairly high in comparison to other areas (0.416) despite the relatively slow progress towards maturity of equity markets and the regional disparities among member countries in terms of both economic policies and financial infrastructure. This area reached a significant peak in its integration level in May 2001 with a value very close to 0.9. This peak is likely to be related to the financial shock transmission following terrorist attacks on the US World Trade Center rather than to the adhesion of Southeastern European countries to the Euro zone. Between the end of 2002 and the end of 2004, the Emerging Southeastern Europe was characterized by an average level of global integration higher than during other subperiods. We think that its member countries' entrance into the European Union seems to have contributed to this dynamic and made the markets more interdependent. It is also interesting to note that the financial integration of this area has significantly increased since early 2007 after briefly falling during 2005-2006, probably because of the higher interdependencies generated by shocks associated with the US subprime and banking crises. For years to come we may expect a higher level of integration resulting from the establishment of a transnational cooperation program among 16 Southeastern European countries over the 2007-2013, which is intended to strengthen competitiveness and the integration of the area into the European Union and the world market.

The integration level of the Emerging Middle East varied widely over time, between less than 0.1 and more than 0.8, with an average of 0.351. The results obtained are similar to those presented in Arouri (2006), who found an average level of about 0.334. Note that this region was more integrated into the world market during the 2002-2003 period than in other subperiods, with a rising trend beginning in 2007.

Generally speaking, the dynamics of the global integration process of four emerging market regions shows a slight upward trend in recent years. These results are reasonably reliable because the high values observed for the integration measures seem to reflect the economic conditions of the regions studied, and to not necessarily coincide with crisis or turbulence episodes. We subsequently examine the relevance of our integration measures by comparing them with conditional correlations which capture financial interdependences.

5.3 Market integration and formation of total risk premium

The total risk premium (T_RPR) can be broken down into two components. The first component, called a global risk premium (G_RPR), consists of world market risk premium and exchange rate risk premium. It is weighted by the level of integration Ω_{t-1}^{i}. The second one, referred to as the local risk premium (L_RPR), is weighted by the level of market segmentation $(1-\Omega_{t-1}^{i})$. Formally, the total risk premium for region *i* (*i* = L, A, E, and M) is given by

$$T\_RPR_{i,t} = G\_RPR_{i,t} + L\_RPR_{i,t} \tag{18}$$

$$G\_RPR_{i,t} = \Omega_{t-1}^{i}\begin{bmatrix}\lambda_{m,t-1}Cov_{t-1}(R_{it}^{c},R_{mt}^{c}) + \lambda_{L,t-1}Cov_{t-1}(R_{it}^{c},R_{Lt}^{c}) \\ +\lambda_{A,t-1}Cov_{t-1}(R_{it}^{c},R_{At}^{c}) + \lambda_{E,t-1}Cov_{t-1}(R_{it}^{c},R_{Et}^{c}) \\ +\lambda_{M,t-1}Cov_{t-1}(R_{it}^{c},R_{Mt}^{c})\end{bmatrix}$$

$$L\_RPR_{i,t} = (1-\Omega_{t-1}^{i})\lambda_{i,t-1}Var_{t-1}(R_{it}^{c})$$

The time-variations of the total risk premium and its local component for each emerging region are shown in Figure 2. We see that the total risk premium changes considerably over time according to international and regional economic conditions, and that it is mainly composed of local risk premium. Specifically, for the Emerging Latin America the total risk premium firstly had very high values during the 1997-1998 Asian financial crisis, and then rose during 2001, 2002, and 2007. The local risk premium, being the main component of the total risk premium, is very significant during the 1996-2001 subperiod, which indicates that the dynamics of expected returns in this region is better explained by the local risk factor than by the global and exchange rate risk factors. There are also several short periods where international investments are not attractive since the global risk premiums were negative (e.g., third quarter of 2004, and end of 2006). As regards the Emerging Asia, the local risk premium seems to be particularly low during the 2000-2003 subperiod, and from 2006 onwards. This confirms the increase in the level of this region's integration during these subperiods because stock returns depend more on global risk factors than on the local risk factor. The 1997 subperiod preceding the Asian crisis is also characterized by a low degree of segmentation. Similar to the two previous regions, the Emerging Southeastern Europe has a very variable total risk premium throughout the study period, and experienced in particular two peaks, one in 1997 and the other in 2001. Here again, the local risk premium constitutes the principal component of the total risk premium, in spite of a downward trend during recent years which reduces the global risk premium, and as a result the overall financial risk of this region. Apart from a low level of risk premium during the Asian crisis, very seminar tendencies, in particular the dominance of the local risk premium, are observed for the Emerging Middle East. When relating the evolution of total risk premiums to that of time-varying market integration, it appears that the periods of high global integration of emerging regions were coupled with lower risk premiums. This can be fundamentally explained by the greater access of emerging markets to global financial markets that reduces the overall cost of capital.

Table 5 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 regions considered. The Emerging Middle

East has the highest total risk premium (11%), followed by Emerging Latin America (8.4%), Southeastern Europe (5.5%), and Asia (5%). The local risk premiums are on average greater than the global premiums for Emerging Asia, Southeastern Europe, and Middle East. The local risk premium in Emerging Middle East is the largest and represents 84.13% of the total risk premium. This result is in fact expected, given the high risk exposure of this region's member countries, e.g., repeated political and economic crises. For the remaining regions, the proportion of local risk premium in the total risk premium ranges from 50% (Latin America) to 73.6% (Southeastern Europe). The analysis of risk premiums thus confirms our previous findings that Emerging Latin America is the most integrated region into the world market.

5.4 Time-varying integration measure versus dynamic conditional correlation

Modern portfolio theory states that global investors can obtain diversification benefits from adding into their portfolios the assets that are negatively and weakly correlated. Longin and Solnik (1995) show that correlations of international stock markets vary over time, while Ang and Bekaert (1999) detect an increase in correlations during periods of falling markets and a reduction in the correlation in periods of rising markets. Other studies, including King and Wadhwani (1990), and Calvo and Reinhart (1995), document that correlations between international stock markets are higher during crisis periods than during normal periods. However, the correlation coefficient might be a biased indicator of the level of market integration because they tend to increase during periods of high volatility, and to decline during periods of low volatility. Moreover, we know that a market's index return depends upon two components: a common component connected to the world market fluctuations which are expected to affect all the individual markets, and an intrinsic component which belongs to the market considered. For this reason, two markets may be perfectly integrated (i.e., prices of risk are identical) without being strongly correlated, if the respective intrinsic components are much more important than the common component. Pukthuanthong and Roll (2009) demonstrate formally that the correlation among index returns is an imperfect measure of financial integration. Carrieri et al. (2007) also conclude that the correlation of an emerging market's index returns with the world market significantly underestimates the integration index, whose estimation is conditional on real economic activities. To further shed lights on this issue, we now compare the integration index of an emerging region to its dynamic conditional correlation (DCC) with the world market, obtained from estimating the system (13) which incorporates the multivariate DCC-GARCH process.

We report in Table 6 several statistics of the DCC series, and depict in Figure 3 the time-variations of the DCC series together with the time-varying market integration measures. The results suggest that, in general, conditional correlations overestimate the degree of global integration of emerging market regions with the world market during certain periods, and underestimate it during others. They also appear to be more stable than the integration measure which varies depending on the degree of trade openness and the US term premium. A region-by-region analysis shows that, on average, the conditional correlation between the Emerging Latin America and the world market is slightly weaker than the market integration index (0.405 versus 0.435). The average values of conditional correlations exceed those of market integration indices for the Emerging Southeastern Europe (0.469 versus 0.416), and Emerging Middle East (0.394 versus 0.351). The Emerging Asia's average conditional correlation with the world market is 0.61, almost twice the average integration level (0.321).

Overall, our results show that on average conditional correlations overestimate the level of emerging market integration, except for the Latin American region. At the same time, they do not exhibit any particular tendency to rise or fall, whereas we find an increase in the level of market integration during crisis periods, and a rising trend beginning in 2004. This evidence clearly suspects the pertinence of correlation coefficient as indicator of market integration.

6. Conclusion

The purpose of this paper is to study the dynamics of the global integration process of four emerging market regions into the world market, while taking into account the importance of exchange rate and local market risk. An international capital asset pricing model suitable for partially integrated markets and departure from purchasing power parity was developed in the spirit of Bekaert and Harvey (1995)'s regime-switching model in order to explain the time-variations in expected returns on regional emerging market indices. In its fully functional form, the model allows the market integration measure as well as the global and local risk premiums to vary through time.

Overall, we find that the level of market integration varies widely over time and is satisfactorily explained by the degree of trade openness and variation in the US term premium. 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 regions considered still remain substantially segmented from the world 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 the Emerging Middle East (84.13%). Finally, time-varying conditional correlations, estimated from the multivariate DCC-GARCH process, appear to be a biased indicator of financial integration.

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Table 1 – Descriptive statistics of return series

	Mean (%)	Std. dev. (%)	Skewness	Kurtosis	Jarque-Bera	ARCH(6)
Panel A: Excess returns on regional stock market indices						
Latin America	1,00	4.393	-0.542	4.139	14.96^{+++}	34.897^{+++}
Asia	0,99	2.343	-0.411	4.426	19.35^{+++}	37.284^{+++}
Southeastern Europe	1,00	12.761	6.603	76.045	313.89^{+++}	8.987^{++}
Middle East	1,01	3.451	-0.607	4.385	22.79^{+++}	9.326^{++}
Panel B: Returns on real exchange rate indices						
Latin America	2.248	10.04	0.766	8,45	191.34^{+++}	12.145^{++}
Asia	2.074	8.173	-0.714	8,02	169.96^{+++}	25.044^{+++}
Southeastern Europe	0.789	8.128	0.634	8,03	180.82^{+++}	22.696^{+++}
Middle East	1.744	7.312	0.155	9,02	224.82^{+++}	19.894^{+++}
Correlations	Exchange rate index (L)	Exchange rate index (A)	Exchange rate index (E)	Exchange rate index (M)	World market	
Latin America	0.12	0.39	0.24	0.03	0.54	
Asia	0.33	0.17	0.26	0.09	0.70	
Southeastern Europe	0.15	-0.01	0.26	0.06	0.56	
Middle East	0.10	0.12	0.10	0.03	0.39	

Notes: L, A, E, and M identify the emerging market regions of Latin America, Asia, Southeastern Europe, and the Middle East. ARCH(6) is the empirical statistics of the Engle (1982)'s test for the 6th order of ARCH effects. $^{+}$, $^{++}$, and $^{+++}$ indicate that the null hypothesis of no ARCH effects is rejected at the 10%, 5% and 1% levels respectively.

Table 2 – Autocorrelations of return series

Panel A: Autocorrelations of excess returns on stock market indices

Lag	World		Latin America		Middle East		Asia		Southeastern Europe	
	AC	PAC	AC	PAC	AC	PAC	AC	PAC	AC	PAC
1	-0.450***	-0.450***	-0.492***	-0.492***	-0.483	-0.483	-0.524***	-0.524***	-0.531***	-0.531***
2	-0.075	-0.347	0.020	-0.292	-0.031	-0.345	0.194	-0.111	0.060	-0.310
3	0.070	-0.186	-0.057	-0.271	0.029	-0.234	-0.126	-0.099	-0.029	-0.234
4	-0.110	-0.266	0.029	-0.212	0.034	-0.114	-0.172	-0.374	0.053	-0.106
5	0.025	-0.255	0.010	-0.155	-0.089	-0.177	0.161	-0.180	-0.158	-0.276
6	0.080	-0.147	-0.056	-0.214	0.015	-0.186	-0.228	-0.356	0.103	-0.241

Panel A: Autocorrelations of returns on real exchange rate indices

Lag	Latin America		Middle East		Asia		Southeastern Europe	
	AC	PAC	AC	PAC	AC	PAC	AC	PAC
1	-0.502**	-0.502**	-0.486**	-0.486**	-0.462**	-0.462**	-0.531***	-0.531***
2	-0.022	-0.366	0.032	-0.267	-0.120	-0.424	0.060	-0.310
3	-0.041	-0.371	-0.171	-0.397	0.144	-0.202	-0.029	-0.234
4	0.076	-0.281	0.244	-0.094	0.003	-0.082	0.053	-0.106
5	0.074	-0.082	-0.165	-0.181	-0.173	-0.250	-0.158	-0.276
6	-0.124	-0.129	0.011	-0.240	0.150	-0.125	0.103	-0.241

Notes: this table reports the serial correlation and partial autocorrelation functions for excess stock market returns, and real exchange rate returns. ** and *** indicate the significance at the 5% and 1% levels respectively.

Table 3 – Prices of world market and real exchange rate risks

	WDY	USTP	RSP	1mUSTB
Panel A: Price of world market risk				
World	-0.264	-0.381***	20.960***	-18.007***
	(2.252)	(0.056)	(2.410)	(1.730)
Panel B: Price of exchange rate risk				
Latin America	3.020*	0.054	22.061***	7.214***
	(1.736)	0.075	(1.948)	(1.599)
Asia	0.634	0.691***	6.810***	5.534***
	(0.372)	(0.014)	(0.424)	(0.273)
Southeastern Europe	2.542*	-0.066	12.239***	-0.952*
	(1.470)	(0.060)	(1.649)	(0.488)
Middle East	2.540*	-0.070	12.689***	-0.952
	(1.470)	(0.060)	(1.649)	(1.490)

	χ^2	*df*	*p-value*
Panel C: Specification test of price of world market risk			
Is the world risk price null? – $H_{0:}$ $\lambda_i = 0$	236.810	5	0.000
Is the world risk price constant? – $H_{0:}$ $\lambda_i = 1$	843.130	4	0.000
Panel D – Specification test of prices of exchange rate risk			
Is the price of exchange rate risk in the Emerging Latin America zero? $H_{0:}$ $\lambda_L = 0$	414.332	5	0.000
Is the price of exchange rate risk in the Emerging Latin America constant? $H_{0:}$ $\lambda_L = 1$	459.321	4	0.000
Is the price of exchange rate risk in the Emerging Asia zero? $H_{0:}$ $\lambda_A = 0$	2243.607	5	0.000
Is the price of exchange rate risk in the Emerging Asia constant? $H_{0:}$ $\lambda_A = 1$	7929.783	4	0.000
Is the price of exchange rate risk in the Emerging Southeastern Europe zero? $H_{0:}$ $\lambda_E = 0$	229.320	5	0.000
Is the price of exchange rate risk in the Emerging Southeastern Europe constant? $H_{0:}$ $\lambda_E = 1$	1286.840	4	0.000
Is the price of exchange rate risk in the Emerging Middle East zero? $H_{0:}$ $\lambda_M = 0$	243.590	5	0.000
Is the price of exchange rate risk in the Emerging Middle East constant? $H_{0:}$ $\lambda_M = 1$	1272.000	4	0.000
Are the prices of the exchange rate risks jointly null? $H_{0:}$ $\lambda_i = 0$	116.692	20	0.000
Are the prices of the exchange rate risks jointly constant? $H_{0:}$ $\lambda_i = 1$	86.683	18	0.000

Panel E – Analysis of residuals

	Latin America	Asia	Southeastern Europe	Middle East	World
Skewness	0.571	0.146	0.054	1.117	-0.672
Kurtosis	9.344	8.261	7.262	11.935	3.733
JB	245.902^{+++}	164.901^{+++}	107.578^{+++}	501.932^{+++}	13.974^{+++}
Q(1)	3.162^{++}	0.965^{++}	1.989^{+++}	1.211^{+++}	0.318^{+++}
ARCH(6)	0.700	0.700	1.882	4.368	3.542

Notes: This table presents the estimation results of the system (13) for world market and four real exchange index returns. L, A, E, and M identify the emerging market regions of Latin America, Asia, Southeastern Europe, and the Middle East. WDY, USTP, RSP and 1mUSTB refer respectively to the dividend yield of the world market portfolio in excess of the 30-day Eurodollar interest rate, the variation in the US term premium, the return on the S&P's 500 stock market index, and the variation in the 1-month US Treasury bill yield. Numbers in parenthesis are the associated standard deviations. JB, Q(1), 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.

Table 4 – Dynamics of stock market integration

	Latin America	Asia	Southeastern Europe	Middle East
Panel A: Parameters of the market integration measure				
Constant	18,051***	7,764***	19,060***	-6,824*
	(2,886)	(2,325)	(6,290)	(4,034)
OPENNESS	1,107***	13,050***	12,998***	-3,503*
	(0,273)	(3,612)	(4,276)	(1,924)
USTP	3,601***	2,976***	-9,820	1,902*
	(0,311)	(0,432)	(9,640)	(0,140)
Panel B: Statistics of market integration measure				
Ω max	0.762	0.611	0.874	0.841
Ω min	0.098	0.092	0.116	0.043
Ω mean	0.430+++	0.321+++	0.416+++	0.351+++
Std. dev.	0.172	0.096	0.157	0.152

Notes: this table reports the estimates of the parameters describing the dynamics of integration measure. OPENNESS and USTP refer to the degree of trade openness and the US term premium respectively. Numbers in parenthesis are the associated standard deviations. Ω max, Ω min, and Ω mean indicate the maximum, minimum and average values of market integration measure. *, **, and *** indicate that the coefficients are significant at the 10%, 5% and 1% levels respectively. +++ indicates that the average degree of integration is significantly different from zero at the 1% level with respect to the two-sided Student-t test.

Table 5 – Decomposition of the total risk premium

	T_RPR (%)	G_RPR (%)	L_RPR (%)
Latin America	8.433+++	4.270+++	4.164+++
Asia	5.145+++	2.486+++	2.658+++
Southeastern Europe	5.456+++	1.435+++	4.021+++
Middle East	9.154+++	1.435+++	7.710+++

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.

Table 6 – Dynamic conditional correlations between emerging regions and world market

	Latin America	Asia	Southeastern Europe	Middle East
ρ max	0.418	0.684	0.619	0.452
ρ min	0.347	0.184	0.267	0.181
ρ mean	0.405+++	0.621+++	0.469+++	0.394+
Std. dev.	0.103	0.240	0.122	0.257

Notes: this table reports some statistics of dynamic conditional correlations, estimated from the DCC-GARCH model. ρ max, ρ min, and ρ mean indicate the maximum, minimum and average values of dynamic conditional correlations. +, ++, and +++ indicate that the average degree of integration is significantly different from zero at the 10%, 5%, and 1% levels with respect to the two-sided Student-t test, respectively.

Figure 1. Dynamic integration of emerging market regions into the world market

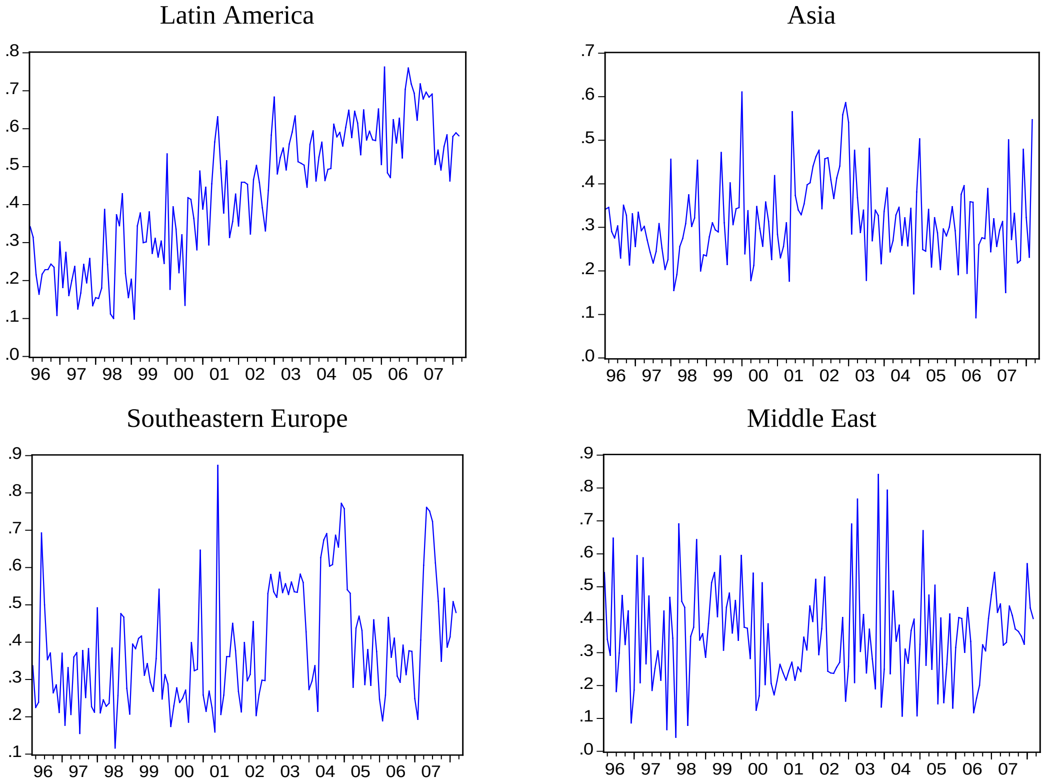

Figure 2. Local (red line) versus Total risk premiums (blue line)

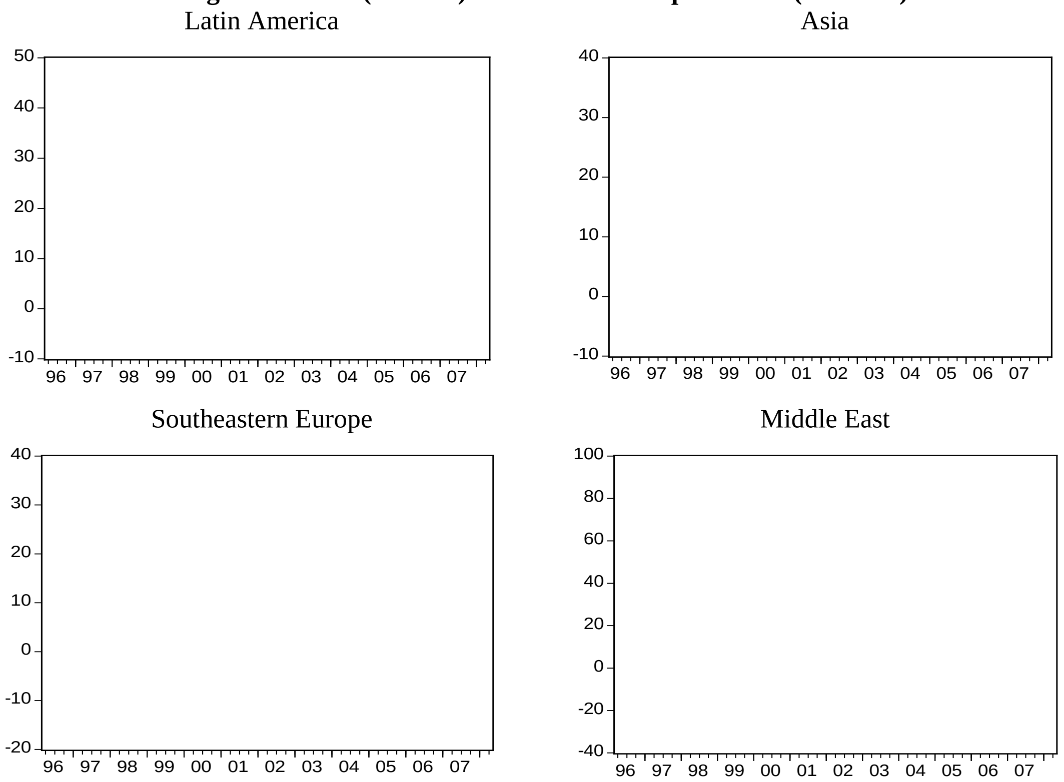

Figure 3. Dynamic conditional correlations