Regional stock market integration in Singapore: A multivariate analysis

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ABSTRACT

This paper evaluates the time-varying integration of the Singapore stock market in the ASEAN-5 region based on a conditional version of the International Capital Asset Pricing Model (ICAPM) with c-DCC-FIAPARCH parameters. This model allows for dynamic changes in the degree of market integration, regional market risk premium, regional exchange-rate risk premium, and domestic market risk premium. Our findings show several interesting facts. First, the time-varying degree of integration in the Singapore market is satisfactorily explained by the level of trade openness and the term premium of US interest rates, which have recently tended to increase, however these markets remain substantially segmented from the world market. Second, the local market risk premium is found to explain a significant proportion of the total risk premium for emerging market returns. Our findings illustrate several important implications for portfolio hedgers for making optimal portfolio allocations, engaging in risk management and forecasting future volatility in equity markets. Our results are also of interest for both policymakers and investors, with respect to regional development policies and dedicated portfolio investment strategies in the ASEAN-5 region.

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1. Introduction

Over the last 10 years, emergent capital markets have attracted substantial capital flows in the context of relaxation of foreign investment restrictions. The integration of the emerging markets of Asia in global finance has become an important element in the overall portfolio decision. We investigate the issue through a longitudinal study of a single stock market. Singapore is one of the countries with greater political stability in Asia, but this economy has been shaken by the turbulence associated with sharp increases in the prices of oil and raw materials and the financial turmoil from the subprime crisis triggered by the mortgage market in the United States.

Within the limits of defining integration as the weight of the South Asia factor premium in emerging markets members' expected returns, we argue that integration in general is influenced by regional as much as by local events and does not necessarily start immediately after local capital markets are liberalized.

Our study differs from previous contributions in that we test the hypothesis of the time-varying regional integration of Singapore in the ASEAN-5 region (Indonesia, Malaysia, Thailand, Philippines and Singapore). The international asset-pricing model we use is built so that it characterizes the changes in market integration through time owing to the impacts of the gradual removal of direct and indirect barriers to emerging market investments. We also examine the proportions of the returns explained by regional and domestic risk factors, by carrying out a decomposition of the total risk premium.

This paper contributes to the existing literature by developing a dynamic international capital asset pricing model (ICAPM) that allows for the 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 regional factors that are likely to drive the process of regional integration. Although the proposed model was developed in the spirit of that presented by Bekaert and Harvey (1995), it allows for dynamic conditional correlations between stock returns by using the multivariate corrected Dynamic Conditional Correlation Fractionally integrated (c-DCC-FIAPARCH) model of Engle (2002). It also enables an examination of the relevance of the dynamic measure of financial integration over risk premiums, 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 the Singapore market into the regional market by using an actual real effective exchange rate (REER) index as a common source of risk, in addition to regional and national sources of risk.

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The remainder of the article is organized as follows. Section 2 presents a review of the literature on financial integration in emerging markets. Section 3 presents the asset-pricing model and methodology used to test it. Section 4 presents and discusses the results obtained. Section 5 provides concluding remarks.

2. Review of the literature

The literature on the integration of emerging countries in global finance has become abundant since these countries have dismantled some of the regulations that prevented the flow of capital. International Capital Asset Pricing models can be differentiated according to the type of risk considered in the price of expected returns: namely models of segmented markets, integrated market models and partially segmented market models:

i) Models of market segmentation evaluate expected equity returns as a function of only the country-specific risk represented by stock return variance. This is the approach taken by Sharpe (1964), Lintner (1965) and Black (1972) for a single country;

ii) Integrated market models assume that the international financial market is fully globalized and thus that the conceptualization of risk is from the covariance of local stock market returns with the world market portfolio. This corresponds to the classical models of Solnik (1983) and Bekaert and Hodrick (1992);

iii) An alternative asset pricing model provides a framework in which the polar segmented/integrated cases are replaced by a mild segmentation pricing structure. Thus in the models of Errunza and Losq (1985) and Errunza et al. (1992) access to the various asset classes is not equal for two types of investors: investors that are 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. Their empirical results show that emerging markets are neither strictly segmented nor perfectly integrated.

Bekaert and Harvey (1995) consider a one-factor asset-pricing model that allows the conditional expected returns of a country to be affected by their covariance with a world benchmark portfolio and by the variance of country returns. If the market is perfectly integrated then only the covariance is counted; while if the market is completely segmented then variance is a relevant measure of market risk. These authors use a conditional regime-switching model to account for periods when national markets are segmented from the global capital market and when they become integrated in other periods. This analysis was borrowed by De Santis and Imrohoroglu (1997).

The findings of this study should be considered with caution for many reasons. First, the model studied assumes a static relationship between expected returns and local and international instrumental variables. However, previous studies show that there are other more relevant variables that affect the exchange rate of the stock returns. Indeed, Phylaktis and Ravazzolo (2002) show that the convergence of business cycles may be a factor underlying the emergence of common trends in the price movements of financial assets. Similarly, Lane and Milesi-Ferretti (2003) shows that foreign assets to GDP ratio are significantly correlated with changes in stock returns.

In the spirit of the current literature following the model of Bekaert and Harvey (1995), Adler and Qi (2003) investigate the evolution of the process of integration between the Mexican and North American equity markets between 1991 and 2002. They use a model that combines the domestic and international versions of the capital asset pricing model. This model tests the power of local factors relative to that of common factors to explain expected returns and empirically infer segmentation when the weight of the local factors is high. They show that the degree of market integration is higher at the end of the period than it is at the beginning but that it exhibits wide swings related to both global and local events. They also discover that Mexico's currency risk is priced.

Further, the currency returns process shows strongly significant asymmetric volatility that is strongly related to the asymmetric volatility of the Mexican equity market returns process.

Carrieri et al. (2007) generalize the model of Errunza and Losq (1985) to assess the integration levels of eight emerging markets using an aggregated measure of financial asset substitution over the period 1977–2000. The results obtained indicate that local pricing continues to be relevant in the valuation of emerging market assets, but that none of the markets considered is completely segmented from the world market.

Guesmi and Nguyen (2011) extend the model of Bekaert and Harvey (1995) to evaluate the dynamics of the global integration process of four emerging market regions (Latin America, Asia, Southeastern Europe, and the Middle East) into the world market based on a conditional version of the ICAPM. Their results show that the integration degree in these four emerging market regions varied widely over the period 1996–2008, because of regional factors.

While these works concur that the degree of emerging market integration varies over time, empirical results are relatively divergent regarding the identification procedure of market integration determinants. They opt for an arbitrary choice of two or three financial and macroeconomic variables to model the dynamics of integration. These methods may be subject to criticism because they arbitrarily introduce certain information variables to assess financial integration before they are considered as candidate variables that might explain financial integration.

Berger and Pozzi (2013) suggest a measure of financial integration based on the conditional variances of country-specific and common international risk premiums in equity excess returns. The inspection of the time profile of the proposed measure of integration for Germany, France, the UK, the US, and Japan over the period 1970–2011 show that all countries exhibit several shorter periods of disintegration. The authors conclude that stock market integration is measured as a dynamic process that fluctuates in the short run while gradually increasing in the long run.

The empirical approach used to estimate the time-varying degree of financial market integration is new. It is based on the estimated conditional variances of the country-specific premiums in equity excess returns. Country-specific premiums are derived theoretically from an international CAPM with market imperfections by using the state space methods that allow for GARCH errors. Rather than being estimated from large sets of conditioning variables or instruments they are estimated from the latent factor decomposition implied by the theory.

3. Model and econometric specification

3.1. The model

The model of Bekaert and Harvey (1995) is the point of departure of our methodology. This model combines the domestic and international versions of the ICAPM. It tests the power of domestic factors relative to that of common factors to explain expected returns and empirically infers segmentation when the weight of the domestic factors is high. In this paper we use a conditional version of the International Capital Asset Pricing Model (ICAPM) with multivariate cDCC-FIAPARCH parameters. The advantage of the DCC-FIAPARCH technique is that it allows for dynamic changes in the degree of market integration and risk premium. This framework incorporates the features of asymmetries and persistence, typically observed in stock markets. This choice has the following advantages: (i) it nests other GARCH processes that exist in the literature; and (ii) it is relatively parsimonious compared with other multivariate models.

De Santis et al. (2003), Carrieri et al. (2007) and Tai (2007) all find evidence to support the partial integration hypothesis and time-varying world market integration for most individual markets.