



Dynamics of integration in East Asian equity markets



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ABSTRACT

This paper investigates the dynamics of integration in East Asian equity markets between 1995 and 2013 using a smooth-transition correlation GARCH model. Our results show that East Asian equity market integration among China and other countries has increased significantly since 2007, whereas among other East Asian equity markets excluding China increased significantly in an earlier period from 1999 to 2001. Additionally, we find that increasing integration has been mostly caused by correlation increases in after-trading hours. These results suggest that stock prices in East Asia are sensitive to Europe and US stocks because Europe and US investors are actively investing in East Asian stocks. Indeed, the periods reflect striking increases in integration that correspond approximately to the start of intensive Europe and US investment activity in East Asian stock markets.

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1. Introduction

The dynamics of international integration in global equity markets plays a crucial role in international asset allocation and risk management. For instance, the weight of an asset in a portfolio and the variance of portfolio return based on the mean-variance approach of modern portfolio theory depend on the correlation of returns among assets.¹ The dynamics of international integration in global equity markets also perform a key function in the estimation of risk measures such as value at risk (VaR) and expected shortfall (ES). Therefore, it is important for empirical finance to analyze the dynamics of international integration in global equity markets. Although some studies examine the dynamics of international integration in global equity markets as discussed below, there are few similar studies on East Asia. Therefore, we investigate international integration dynamics in East Asian equity markets.

For an investigation of international integration in global equity markets, it is important to recognize that integration is likely to fluctuate in the short term as well as the long term. For example, a shock in a market in a country has been more easily trans-

mitted to other countries' markets since the mid-1990s because of the development of IT and the real-time spread of information. Consequently, it is highly possible that global equity markets have tended to comove to a greater extent in recent years. Additionally, international equity market integration is also likely to fluctuate in the short term in conjunction with market uncertainty and investor risk tolerance. Moreover, there may be possible fluctuations in international equity market integration due to financial crises such as the collapse of Lehman Brothers in 2008.

On the other hand, financial market integration has advanced. For instance, Lane and Milesi-Ferretti (2007) note that international financial integration among industrial countries progressed gradually in the 1970s and 1980s and then accelerated in the mid-1990s. The integration of financial markets is also affected by an increase in international macroeconomic policy coordination, the expansion of free-trade, intensification of international economic competition, and the development of the world transportation system. Because these factors have short- and long-term impacts on financial market integration, it is important to capture the time variation of international equity market integration.

One challenges in examining the dynamics of international market integration is that capturing all aspects of time-varying market integration is complex. Therefore, many analyses on the topic have focused on particular aspects, and this paper centers on the long-run trend of East Asian equity market integration. This is relevant because the changes in the long-run trend in market

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¹ Market integration is measured by correlations in this paper. Both terms are used interchangeably.

integration should have one of the largest impacts on the asset allocation and risk management in the long term. Indeed, a number of previous studies investigate the long-run trends in international equity market integration. For instance, [Longin and Solnik \(1995\)](#) study whether there is a positive trend in the international correlation among the US and six major countries' equity markets using a multivariate GARCH model that has a linear trend in correlation. The authors document significant positive trends in international correlations for four pairs among six pairs with a 0.36 increase on average in the correlation across international equity markets between 1960 and 1990.² However, an assumption of a linear trend in correlation is problematic, since correlation would increase at a constant rate and become larger than one eventually. [Berben and Jansen \(2005\)](#) propose a novel bivariate GARCH model for equity returns with a smoothly time-varying correlation to fix such problems and flexibly investigate transitions in correlation among international equity returns. They find that correlations among the German, UK, and US stock markets increased significantly, whereas Japanese correlations with other countries have remained the same by employing the smooth transition correlation (STC) model. In contrast, [Bekaert et al. \(2009\)](#) report no evidence of significant positive trends in international equity market integration, excluding the European equity market, based on their APT (Arbitrage Pricing Theory) model with both international factors constructed from international capital markets and regional factors constructed from capital markets in specific regions.

Recently, [Christoffersen et al. \(2012\)](#) propose a new dynamic conditional copula correlation model to capture general dependence rather than correlation. Using this model, they analyze the long-run trends of equity market integration in developed and emerging countries and find that integration in the equity markets in developed countries has increased significantly, whereas there is only a limited increase in equity market integration in emerging countries. Finally, [Okimoto \(2014\)](#) extends the STC model to a more general model using a copula to examine the asymmetric long-run trend of integration in major international equity markets, namely the French, German, U.S., and UK markets. The article demonstrates that international equity market integration has been asymmetrically increasing between the upper tail and lower tail of international stock returns, but the analysis is limited to those four of the largest markets. Thus, there are still not enough investigation into the long-run trend in international equity market integration, particularly for emerging markets. This paper contributes to the literature by providing new evidence for the East Asian equity markets.

We have chosen to focus on the East Asian equity markets for a couple of reasons, to make our contribution to the literature clear. First, although a number of preceding studies analyze the East Asian equity market integration,³ there are few studies on the long-run trend. For example, [Chi et al. \(2006\)](#) suggest that East Asian equity markets have become more integrated within the region, and with the Japanese market than with the U.S. market between 1991 and 2005, based on the international capital asset pricing model (ICAPM) model. [Yu et al. \(2010\)](#) show that the financial integration in major East Asian equity markets has promoted in 2007–08, based on the several indicators of market integration. In addition, [Park and Lee \(2011\)](#) assert that East Asian equity markets have become increasingly globally integrated since the 1997–

98 Asian financial crisis. Similarly, [Kim and Lee \(2012\)](#) document the financial integration of East Asian financial markets, including equity markets, noting that they have increased substantially during the aftermath of the Asian crisis. Finally, [Boubakri and Guillaumin \(2015\)](#) find an upward trend in regional integration of East Asian stock markets after 2008, based on the ICAPM with the dynamic conditional correlation (DCC) model.

None of the above studies focus on the long-run trend in the East Asian market integration. Therefore, the first contribution of our paper offers an investigation of the long-run trend of equity market integration in East Asia, namely China, Hong Kong, Japan, and South Korea, using the STC model based on the work of [Berben and Jansen \(2005\)](#) and [Kumar and Okimoto \(2011\)](#). One advantage of concentrating on the long-run trend is that we can test the statistical significance of changes in market integration more easily and powerfully, abstracting the short-run fluctuations. On the other hand, if we utilize the DCC model, which is one of the most popular models for analyzing the time-varying market integration, it will be hard to test the significance of changes. In addition, the DCC model is, typically, a stationary model with constant unconditional correlation, meaning that the time-varying market integration must eventually return to the stationary level of market integration within the DCC framework. Therefore, the DCC model is not suitable for detecting long-run changes in market integration, although it can capture the short-run fluctuations of market integration. In contrast, the STC model can reveal changes in the long-run trend by allowing for regime changes in market integration.

Additionally, we note in the article the fact that East Asian equity markets open at almost the same time and decompose the equity returns into returns during trading hours (trading-hours returns) and returns after trading hours (after-trading-hours returns). Then, we examine the extent to which returns contribute more to changes in integration in East Asian equity markets. This represents another contribution of the paper, since there are few studies that analyze the dynamics of integration in global equity markets in a similar way. On the other hand, several previous studies, such as [Chi et al. \(2006\)](#) and [Boubakri and Guillaumin \(2015\)](#), compare regional integration and global integration based on ICAPM. Our analysis provides an alternative method of comparing the sources of market integration, which is only possible if we focus on East Asian equity markets with similar trading hours.

Our analysis is summarized as follows. First, the analysis based on a two-regime STC model indicates that while there is little integration in the East Asian equity markets around the year 1995, the degree of integration has been increasing and is significantly greater around the year 2013 than the year 1995. Specifically, integration in the East Asian equity market significantly increased between 1995 and 2003 and has remained on a moderate upward trend since that period.

Second, our analysis using the decomposed returns demonstrates that a rise in integration after trading hours contributes to the increasing integration of East Asian equity markets to a greater extent than an increase in integration during trading hours.

Third, we also examine the dynamics of East Asian equity market integration in a more flexible manner based on the three-regime STC model. We show that while the integrations between China and the other three countries have been growing significantly since 2007, integration among the three countries other than China has increased significantly between 1998 and 2001. We also find that this integration growth is caused by the correlation increases in after-trading hours. The period from 1998 to 2001, in which equity market integration among three countries other than China was promoted, is the period when the Asian currency crisis that began in 1997 came to an end, deregulation was conducted in the South Korean equity market, and the Hong Kong Stock Exchange was reformed. As a result, investments by European and US

² The countries where a significant rise in correlation with the US equity market is observed are France, Japan, Switzerland, and the UK. On the other hand, the countries where a significant rise in correlation is not observed are Canada and Germany.

³ Several recent studies also investigate the East Asian financial market integration from other perspectives, such as bond and capital markets. Those examples include [Guillaumin \(2009\)](#), [Baharumshah et al. \(2011\)](#), [Park and Lee \(2011\)](#), [Kim and Lee \(2012\)](#), and [Gan \(2014\)](#).

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