



# The co-movement of stock markets in East Asia Did the 1997–1998 Asian financial crisis really strengthen stock market integration?

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## ABSTRACT

This paper examines the integration and causality of interdependencies among seven major East Asian stock exchanges before, during, and after the 1997–1998 Asian financial crisis. For this purpose, we use daily stock market data from July 1, 1992 to June 30, 2003 in local currency as well as US dollar terms. The data reveal that the relationships among East Asian stock markets are time varying. While stock market interactions are limited before the Asian financial crisis, we find that Hong Kong and Singapore respond significantly to shocks in most other East Asian markets, including Shanghai and Shenzhen, during this crisis. After the crisis, shocks in Hong Kong and Singapore largely affect other East Asian stock markets, except for those in Mainland China. Finally, considering the role of the USA shows that it strongly influences stock returns in East Asia – except for Mainland China – in all periods, while the reverse does not hold true.

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## 1. Introduction

Numerous studies have investigated the transmission mechanisms of stock price movements across international equity markets and how these mechanisms may change over time. This is indeed a non-trivial research question, as shifts in the covariance structure of cross-country stock returns affect the return volatility of investment portfolios, asset prices, and hence also the cost of capital for individual firms (see, for example, [Stulz \(1995\)](#) and [Karolyi and Stulz \(1996\)](#), among others). For developed countries, the literature has pointed out a high degree of stock market integration (e.g., [Friedman & Shachmurove, 1997](#); [Westermann, 2004](#); [Quan & Huyghebaert, 2006](#)). Yet, stock markets in emerging countries tend to be less globally integrated. [Korajczyk \(1996\)](#) notes that economic growth, financial market development, and explicit capital controls all affect the degree of stock market integration. This scholar also shows that stock market segmentation has declined over time. However, not all research points in this same direction. [Bekaert and Harvey \(1995\)](#), for example, estimate the extent of stock market integration for 21 developed and 12 emerging-market economies during 1969–1992. They conclude that although some emerging markets did become more integrated over time, others – for instance Chile and India – have become less so.<sup>1</sup>

In this paper, we wish to examine the degree of stock market integration in East Asia, considering seven major exchanges from developed as well as emerging countries (Shanghai, Shenzhen, Hong Kong, Taiwan, Singapore, South Korea, and Japan). We additionally include the USA in the analyses to examine its linkages with East Asian stock markets. For one thing, empirical studies

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<sup>1</sup> Besides, [Bekaert and Harvey \(1995\)](#) show that the return volatility is larger in emerging markets than in developed ones. In addition, emerging markets may have greater leptokurtosis, with more pronounced fluctuations (see also [Huang et al., 2000](#)).

on the co-integration of stock markets in Asia up till now have yielded mixed results (e.g., Chung & Liu, 1994; DeFusco, Geppert, & Tsetsekos, 1996; Masih & Masih, 1999; Ghosh, Saidi, & Johnson, 1999; Yang, Kolari, & Min, 2003). Besides, we want to find out the direction (causality) of stock market interdependencies and determine whether the enhanced importance of China in the region and in the world has affected the co-movement of stock markets in East Asia. Indeed, China has received scant attention in prior research on Asian stock market integration. One exception is Huang, Yang, and Hu (2000), who examine the bivariate co-integrating relationships and causality among the stock markets of the South China Growth Triangle (i.e. Shanghai, Shenzhen, Hong Kong, and Taiwan), Japan, and the USA using daily data in local currencies from October 1992 to June 1997. Huang et al. document a strong interaction – without co-integration – between Shanghai and Shenzhen. Also, these exchanges hardly interact with the other markets in their sample. Hsiao, Hsiao, and Yamashita (2003) confirm China's isolation in a multivariate Vector Auto-Regressive (VAR) model using daily local-currency data from Shanghai, Taiwan, South Korea, Japan, and the USA from September 2001 to December 2002. Bahang and Shin (2003) reach similar conclusions from examining Shanghai, South Korea, Japan, and the NYSE composite index during 1991–2000.<sup>2</sup> Although Bahang and Shin analyze a longer period, they do not explore the possibility of changes in China's integration with other stock markets over time. Nonetheless, following Korajczyk (1996), China's stock market integration within Asia and even the world may have been affected, given its huge economic growth, its enhanced economic interactions with the world through FDI and imports/exports, and the fast development of its stock markets since the beginning of the 1990s.<sup>3</sup> So, in this paper we intend to re-examine the co-movement of stock markets in East Asia during a relatively long window, from July 1, 1992 to June 30, 2003, thereby considering potential changes in stock market interdependencies over time.

In this study, we pay special attention to the effects of the 1997–1998 Asian financial crisis. The reason is that major economic events can influence the relationships among stock markets. Granger and Morgenstern (1970), for example, argue that existing linkages tend to intensify in the case of a crisis, due to a market *contagion effect*.<sup>4</sup> However, it is not entirely clear whether crises have a long-lasting effect on stock market interdependencies. Chan, Gup, and Pan (1997) conclude that the 1987 stock market crash did not promote any enduring integration among the 18 countries in their sample. In contrast, Tan and Tse (2002) and Yang et al. (2003), who also focus on the 1997–1998 Asian financial crisis, conclude that both long-run equilibrium relationships and short-term causal linkages among Asian stock markets were strengthened in a lasting manner following this crisis. We therefore will re-examine carefully the effects of the Asian financial crisis on the co-movement of stock markets in East Asia. Interestingly, China, longing for a larger role in the region and in the world, has played an important role in curbing this crisis. First, China did not devalue its currency, which alleviated the burden for its Asian neighbors that were devaluing theirs, by allowing these countries to improve their competitive position in terms of FDI inflows and exports. Second, China strongly advocated substantial funding packages at low conditions for the afflicted Asian economies. China's sense of solidarity with its neighbors was further demonstrated by its willingness to contribute to these support packages.

To investigate the above research questions, we cautiously develop our research design. Indeed, mixed results in prior studies on East Asian stock market integration could be due in part to different research methodologies, sampling frequencies, and sample periods. So, we try to deal with these issues by examining the co-movement of stock markets in a multivariate VAR framework instead of studying their bivariate relationships. Thereby, we meticulously account for the structural breaks that the Asian financial crisis may have engendered. Also, as the lag length is a crucial parameter in these models and the tests that are based upon it, we use Sims' likelihood-ratio test to correctly specify our various VAR models. We implement co-integration tests to examine the long-run equilibrium relationships – if any – among the stock markets in our sample. To figure out their short-term causal linkages, we employ generalized rather than traditional orthogonalized impulse response analysis. We collect daily data in both local currency and US dollar terms to conduct these analyses. Finally, we examine a longer time period, from July 1, 1992 to June 30, 2003, thereby covering five years before and five years after the 1997–1998 Asian financial crisis. We thus should be able to identify a possible time-variant integration among East Asian stock markets, and its relation with the Asian financial crisis.

Overall, the data reveal that stock markets in East Asia in general do not exhibit joint underlying forces that drive their long-run swings and thus bear no long-run equilibrium relationship. Only during the Asian financial crisis do we find evidence of a co-integrating vector. Besides, during this crisis a one unit shock in one market sometimes leads to a response that spans several days in another market, suggesting that East Asian stock markets are not highly efficient in that window. In contrast, we find that responses generally arise on the same day before as well as after the Asian financial crisis. When it takes two days to react, this can be attributed to differences in time zone and – for stock markets in the same time zone – to differences in the opening hours of the exchanges.

Our analyses further point out that the relationships among East Asian stock markets are time varying. Before the 1997–1998 Asian financial crisis, stock markets in East Asia are largely segmented. The strongest interaction occurs between the exchanges of Shanghai and Shenzhen. Yet, stock markets in Hong Kong, Taiwan, Singapore, and Japan all respond significantly to shocks in the USA. The Asian financial crisis considerably strengthens East Asian stock market integration, albeit in an impermanent manner.

<sup>2</sup> For completeness, we also add the research by Groenewold, Tang, and Wu (2004) and Hatemi and Roca (2004), who both analyze the interactions of Shanghai and Shenzhen with China-related markets, in particular Hong Kong and Taiwan. Hatemi and Roca additionally include Singapore, given that it also shares the Chinese culture. Groenewold et al. estimate a VAR model in first differences using daily data in local currencies, whereas Hatemi and Roca collect daily data in US dollar terms for their multivariate VAR model.

<sup>3</sup> Recently, Girardin and Liu (2007) do explore the potential time-varying co-integration among the stock exchanges of Shanghai, Hong Kong, and New York during 1992–2005. Yet, their findings depend on whether they use end-of-week or mid-week closing prices for the indices versus weekly averaged index values.

<sup>4</sup> Karolyi and Stulz (1996) argue that *contagion* results when (lack of) enthusiasm for stocks in one market brings about (lack of) enthusiasm for stocks in other markets, regardless of the evolution of market fundamentals.

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