



# The impact of China's stock market reforms on its international stock market linkages

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## ARTICLE INFO

### Article history:

Received 25 January 2012

Received in revised form 30 August 2012

Accepted 4 October 2012

Available online 13 October 2012

### JEL classification:

C32

G15

### Keywords:

Multivariate GARCH model

Time-varying stock market linkages

China's stock market reforms

Stock market liberalisation

## ABSTRACT

This paper investigates how China's stock market reforms have affected the stock market linkages between China and Korea, Japan and the US respectively. We firstly use a  $4 \times 4$  asymmetric GARCH-BEKK model and a series of likelihood ratio tests to uncover China's regional and global linkages between 1992 and 2010 and during three sub-periods representing the stages of the Chinese reforms. The results show that Chinese stock market is linked to these overseas markets and the reforms permit spillovers to these markets from China. The subsequent regression analyses of the time-varying conditional correlations, in the presence of growing economic integration, exchange rate risk and financial turbulence, further indicate that the interdependences between China and the regional markets increase due to the implementation of liberalisation policies. However, the correlation between China and the global market remains weak even though this correlation responds positively to the institutional reforms on China's stock market additionally.

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## 1. Introduction

International stock market linkages have been extensively investigated on the grounds that the nature and extent of international linkages are most relevant to gauging the gains from international diversification of investment portfolios. While the earlier analyses have mainly focused on major developed markets, recent research has been extended to the linkages between emerging and developed markets on the understanding that benefits of international diversification rely increasingly on investment in emerging markets (Goetzmann, Li, & Rouwenhorst, 2005). Many developing economies have had policy changes to facilitate cross-country investment. Bekaert and Harvey (1997) show that such liberalisation policies often increase stock market correlation, a measurement of the extent of international linkages, decreasing the benefits of international diversification. Ng (2000), studying the market linkages between the six Pacific-Basin emerging economies and the US and Japan, finds that liberalisation has an impact on the spillover effects from the US and Japan, but the effects vary from country to country and from event to event.

During the process of transforming China's centrally planned economy to a more market-oriented one, stock exchanges were

established in Shanghai and Shenzhen respectively in 1990 in response to the incorporation of the state-owned enterprises. Since then, various policies have been implemented to reduce speculation, liberalise the Chinese stock exchanges and most importantly strengthen corporate governance through institutional reforms. However, very few studies have evaluated the impact of China's stock market reforms on its international linkages. Earlier empirical work on China's stock exchanges, such as Brockman and Chung (2003) and Chen, Kim, and Rui (2005), has mainly focused on the effect of a particular reform policy in the domestic context. More recent studies have mostly used a sample period up to 2005 to examine interactions or interdependence between China's stock market and overseas markets and generally found negligible interactions or interdependence between China and developed markets. For instance, Li (2007), using a four-variable asymmetric GARCH-BEKK, finds uni-directional volatility spillover from the stock exchange in Hong Kong to those in Shanghai and Shenzhen, but no direct linkages between the stock markets in the US and mainland China during 2000–2005. Using a tri-variate exponential GARCH model with a constant conditional correlation, Johansson and Ljungwall (2009) find that the Chinese stock market is only influenced by the Taiwanese stock market in terms of return spillover and there are no direct spillover effects between stock markets in Hong Kong and China during 1994–2005. Wang and Wang (2010) apply a tri-variate asymmetric GARCH-BEKK model to the daily open-to-close returns of the US, Japan and various stock

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markets in the Greater China respectively. They find that neither of the two Chinese A-share markets is influenced by the US market, but there is weak evidence of volatility spillover from Japan to the Shanghai A-share market during 1992 and 2004. Relevant to this area of studies on stock market linkages, Lin, Menkveld, and Yang (2009) use a two-step approach within the framework of a dynamic conditional correlation GARCH model to derive cross-market conditional correlations in order to measure the strength of interdependence between stock markets in China and the global and regional economies respectively. They find that Chinese A-share markets have never been correlated with overseas markets during 1992 and 2006 while its B-share markets exhibit negligible correlations with the western markets and slight correlations with the Asian markets.

More related to our study are Lin and Swanson (2008) and Luo, Brooks, and Silvapulle (2011). Lin and Swanson (2008) examine the effect of four reform policies on China's interdependence with some regional and global markets between 1993 and 2005 through VAR modelling. Specifically, they divide the period under study into five sub-periods using the dates when the four policies were introduced and test Granger causality between return and volatility of the Chinese and overseas markets during these five sub-periods. On the basis of mainly weak and minimal causal relationships found in the five sub-periods, they conclude that China's stock market reforms are ineffective and China's stock market is still segmented. Luo et al. (2011), on the other hand, divide their period of study, 1992–2009, using the announcement of opening A shares to foreign investors in 2002 and investigate changes in dependence between financial sectors in China and some overseas economies through contrasting pre- and post-2002 dependence structures (generated by some non-parametric plots) and dependence parameters (estimated by a copula model). They suggest that the opening policy have a limited impact on dependence, given their findings of significant dependences between China and Hong Kong and Singapore, weak dependences between China and Australia, Taiwan and Japan and no dependence between China and Korea or the US in the post-2002 period.

Since 2005, the Chinese authorities have further implemented policies such as the non-tradable share reform to improve the ownership structure of listed companies and the Qualified Domestic Institutional Investors (QDII) scheme to allow investment on overseas developed stock markets. These policy changes call for re-estimation of the international linkages of China's stock exchanges. Although they find bi-directional volatility spillovers between the stock markets in the US and China in a post-2005 period, Moon and Yu (2010) have not investigated the causes of the international linkages. In order to fill the gap in the literature, this paper will examine if and to what extent the policy changes have altered China's international stock market linkages. On the basis of the empirical evidence that stock linkages are related to trade links (Bekaert, Harvey, & Ng, 2005; Chen & Zhang, 1997) and stock markets within the same geographical region are more correlated due to their overlapping opening hours (Janakiraman & Lamba, 1998; Koch & Koch, 1991), we will select the stock exchanges in the US, Japan and Korea to represent the global stock market and the regional developed and emerging stock markets, respectively. Motivated by Longin and Solnik (1995) who find an increase in the international correlations over time, we will use a multivariate GARCH-BEKK model which can correctly characterise fundamental market linkages in an environment of time-varying market interdependence. Specifically, we will firstly estimate this GARCH-BEKK model to uncover and estimate the nature and extent of linkages between the Shanghai stock exchange

and the regional and global stock markets during 1992–2010. Secondly, we will investigate the effect of China's reform and liberalisation policies on these international linkages. In order to observe the 'reform effect' on these international linkages, we will re-estimate the GARCH-BEKK model on three sub-periods representing the stages of the stock market development in China: expansion during 1992–1997, clean-up during 1997–2003 and liberalisation during 2003–2010. In order to estimate the effects of the reform and liberalisation policies, we will carry out a regression analysis directly on the time-varying market interdependences, measured by the conditional correlations derived through estimating the GARCH-BEKK model on the period between 1992 and 2010.

Longin and Solnik (1995) document that interdependence of national equity markets increases over time due to growing international economic, political and financial integration and the international market linkages are strengthened by common factors that affect all economies at the same time. Subsequent studies, such as Karolyi and Stulz (1996) and Forbes and Rigobon (2002), confirm that markets are more highly correlated in periods when global factors, such as crises, cause stock market turbulence. Since investing in foreign stock market entails exposure to exchange rate risk, currency risk premium has been priced in most international asset pricing models. Karolyi and Stulz (1996) examine the relationship between foreign exchange shocks and the stock market correlation between the US and Japan and find that foreign exchange shocks have a positive impact on the US/Japanese stock market correlation. The Chinese exchange rate regime experienced a dual-rate system before 1994, a dollar-peg regime with a narrow band of fluctuations between 1994 and 2005 and then a managed floating-rate system with a peg to a basket of currencies after 2005. It is of interest to see if changes in the exchange rate regime of an emerging economy like China influence international stock market linkages. Hence, in the regression analysis of the derived time-varying conditional correlations, we will control for growing economic and financial integration, financial crises and volatility of the exchange rate between the Chinese currency and that of Korea, Japan or the US.

This paper will contribute to the literature in the following two ways. Firstly, we will estimate China's international stock market linkages in a more realistic specification than the mostly pair-wise or tri-variate modelling of the existing literature. In our  $4 \times 4$  asymmetric GARCH-BEKK model, we consider possible linkages between China and the global market and the regional developed and emerging markets simultaneously, shedding light in the interactions between emerging markets and between emerging and matured markets. On the contrary, pair-wise and tri-variate modelling implicitly assumes zero linkages via markets not in the pair or system and is therefore at higher risk of specification errors and estimation bias when this assumption is invalid. Secondly, the existing literature like Lin and Swanson (2008) and Luo et al. (2011) can only deduce a 'reform effect' by repeating Granger Causality test on sub-period data or contrasting sub-period dependence structures and parameters. Instead we will analyse directly the effects of not only liberalisation but also institutional reforms on the stock market interdependence in the presence of some controlled variables. These results will have important policy implications for other emerging economies. The remainder of the paper is organised as follows. In Section 2 we summarise the major reforms implemented on China's stock exchanges and its exchange rate regime during 1992–2010. We describe the methodology and data in Section 3 and report the empirical results in Section 4. Section 5 concludes.

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