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Information transmission between U.S. and China index futures markets: An asymmetric DCC GARCH approach☆

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ABSTRACT

The Chinese stock market and its impacts on other stock markets have attracted a lot of attention and have been of a great concern to many countries. This paper aims to shed light on the issue by examining the information transmission between the S&P 500 and the CSI 300 index futures markets. The empirical results reveal that news from one market significantly affects the volatilities of open prices of the other and the impact from U.S. to China is stronger than the other way round. Further, past news of the U.S. has a significant impact on the volatilities of daily trading in China, but not vice versa. These findings indicate that the U.S. stock index futures market is more efficient in impounding information from other markets.

1. Introduction

The informational linkages between stock markets in developed economies are widely observed in the literature (Antoniou, Pescetto, and Violaris, 2003; Eun and Shim, 1989; Hamao, Masulis, and Ng, 1990; King and Wadhwani, 1990; Koutmos and Booth, 1995). It is generally agreed that pricing behavior of domestic securities is determined not only by domestic information but also by news generated internationally (Koutmos and Booth, 1995). News generated in one market may transmit into another one via return and volatility spillovers, resulting in the prices of the latter being partially determined by international risk factors.

However, the patterns of informational linkages observed in the developed economies may not hold for the Chinese stock market due to its short history and some unique features. These features pertain to the ownership types of instrument suppliers, the proportion of different types of investors, and the trading mechanisms. First, securities of the Chinese stock market are mostly supplied by the state-owned enterprises (SOEs). Unfortunately, the tradable shares only account for a small proportion of total shares of SOEs, resulting in the scarcity of security supplies due to the limited number of SOEs in China. This makes the stock market vulnerable to speculation (Chen, Han, Li, and Wu, 2013). Second, the individual and retail investors are the major force driving stock market movements (Chen et al., 2013; Ng and Wu, 2007; Yang, Yang, and Zhou, 2012). Third, a $T+1$ trading rule applies in the Chinese stock market. Those who trade stocks in one trading day cannot do another trade until the next trading day. Thus, the possibility of intraday trading is precluded. In addition, short-sale transactions are difficult to implement due to high transaction costs and a lack of lenders (Chang, Luo, and Ren, 2013; Chen et al., 2013; Xie and Mo, 2014). Finally, the Chinese stock market contains two types of stocks that are available to trade. One type is called 'A-shares' and the other is called 'B-shares'. When domestic investors in China can trade both A-shares and B-shares, foreign qualified investors are only allowed to trade B-share stocks.

To clarify how the Chinese stock market interacts with developed markets given the characteristics above, this study examines the information transmission in terms of daily return and volatility spillovers between the renowned stock index futures market, the Standard & Poor's (S&P) 500 stock index futures market in the U.S., and the recently established China Securities Index (CSI) 300 stock index futures market in China. In this study, we utilize a bivariate Vector Autoregression (VAR) model with a bivariate asymmetric Dynamic Conditional Correlation (A-DCC) Generalized Autoregressive Conditional Heteroskedasticity (GARCH) error structure to estimate the interdependencies of first and second moments of futures returns distributions. The bivariate A-DCC GARCH model can simultaneously capture the time-varying covariance matrix of error structure of the VAR model and the asymmetry of the correlation matrix of error terms.

It should be noted that examining the interaction between the S&P 500 and the CSI 300 stock index futures markets is nearly equivalent to examining the interaction between U.S. and Chinese stock markets. The underlying spot asset of the CSI 300 stock index futures is the CSI 300 stock index, which accounts for approximately 70% of the market capitalization of the Chinese stock market. It is well acknowledged that

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the CSI 300 index is deemed representative of the total performance of the Chinese stock market (Yang et al., 2012). Thus, the CSI 300 index futures market is used as a proxy for the Chinese stock market in this study.[1] In addition, using index futures data is advantageous over spot data to study international information transmission, according to Wu, Li, and Zhang (2005). This is because futures markets appear to impound new information into security prices faster than spot markets. Lower transaction costs and less regulation increase transactional efficiency in the futures market (Chan, 1992).[2]

Although a few studies have been devoted to understanding how the stock market in China interacts with its neighbors and with leading world markets, the conclusions are still not clear. Some studies conclude that information linkages between Chinese and world stock markets are weak and correlations between them are low (Li, 2007; Lin, Menkveld, and Yang, 2009; Long, Tsui, and Zhang, 2014). Others argue that pricing behavior of the Chinese stock market can be affected by international markets while the Chinese market also exerts an important interregional impact (Allen, Amram, and McAleer, 2013; Chow, Liu and Niu, 2011; Guo, Han, Liu, and Ryo, 2013; Johansson and Ljungwall, 2009; Moon and Yu, 2010; Nishimura, Tsutsui, and Hirayama, 2015; So and Tse, 2009). Although there is evidence on information transmission between Chinese and international stock markets, it was obtained based on spot equity data.[3] The recently introduced CSI 300 index futures market provides a new perspective through which this issue can be revisited.

This study enriches the literature by unveiling new evidence in terms of the interdependency between the CSI 300 and the S&P 500 stock index futures markets. Although Li (2007) and Moon and Yu (2010) find little evidence of the interdependence of the first moment of returns distributions between the two markets, there is clear evidence in our analysis. The finding is somehow consistent with Chow et al. (2011), who find significant cross-market spillover effects of returns between the Shanghai and New York stock exchanges. Furthermore, neither Li (2007) nor Long et al. (2014) find significant evidence on volatility spillovers between the Chinese and U.S. stock markets. This study reveals significant evidence of volatility spillovers between the two markets, where the U.S. market plays a dominant role in the process. The finding partially agrees with Moon and Yu (2010) and Allen et al. (2013). However, compared to Moon and Yu (2010) and Allen et al. (2013), this paper further divides return and volatility spillovers into contemporaneous and lead–lag ones by taking into account close-to-open and open-to-close returns separately.[4] We find significant evidence that daytime trading of the U.S. stock market has an important influence on both the opening prices and the subsequent pricing behavior of the Chinese stock market.

This paper employs a bivariate GARCH framework instead of a univariate GARCH framework for investigating the daily relationship between the U.S. and Chinese stock index futures markets where their trading hours are not overlapped. The literature always employs a univariate GARCH model to examine the interdependence of the developed stock markets that have no overlapping of trading hours. A two-stage estimation procedure is utilized to estimate the spillovers of daily return and volatility (see, e.g., Hamao et al., 1990; Lin, Engle, and Ito, 1994; Pan and Hsueh, 1998; Moon and Yu, 2010) .[5] Compared to the univariate GARCH model, the bivariate GARCH model can capture the linkages between the error terms of return processes, which the univariate model fails to address (Bollerslev, 1990; Engle, 2002). That is, the correlation structure of asset returns is gauged simultaneously with the individual heteroskedastic process. The correlation structure needs to be accounted for because it is one of the core questions to be investigated in this study. Moreover, according to Koutmos and Booth (1995), there are a few advantages to employing a bivariate model over a univariate one for studying international information transmission. First, it avoids problems associated with estimated regressors in the two-stage procedure. Second, it improves the reliance of the tests for cross-market return and volatility spillovers. Third, it is consistent with the notion that the essence of international return and volatility spillovers is the impact of global news on any given market.

The asymmetric DCC (ADCC) GARCH model is superior to the widely employed BEKK and CCC GARCH specifications for the following reasons. First, previous literature has found that the DCC GARCH model yields more accurate estimates of conditional variances than the BEKK GARCH model (Engle, 2002; Tse and Tsui, 2002). Cappiello, Engle, and Sheppard (2006) further unveil that the asymmetric DCC GARCH model outperforms the DCC model in terms of higher log-likelihood value and lower value of the Bayesian information criterion (BIC). Second, the ADCC model can capture the time-varying market integration by obtaining estimates of the dynamic correlation as conditional correlations change over time. Modeling the dynamic correlation structure can provide insight on both markets' synchronization and volatility clustering in financial series. Hence, the ADCC model is more advanced than the CCC model (Lean and Teng, 2013; Majdoub and Mansour, 2014; Syriopoulos, Makram, and Boubaker, 2015). Third, compared to the BEKK model and the symmetric DCC GARCH model proposed by Engle (2002), the ADCC GARCH model allows for conditional asymmetries in correlations of financial series that can be reasonably observed in a world characterized by the capital asset pricing model (CAPM) (Cappiello et al., 2006). The DCC model can be perceived as a special case of the ADCC model without taking into account asymmetries in the dynamic correlation structure. Thus, the ADCC model can provide more accurate estimation of the dynamic correlation structure than the DCC model (Cappiello et al., 2006).

The remainder of this paper is organized as follows. A brief literature review is provided in Section 2. The data and sample statistics are described in Section 3. The methodologies and empirical results are presented in Section 4 and Section 5, respectively. Concluding remarks are made in Section 6.

2. Literature review

Early studies of information transmission across international stock markets primarily focused on developed economies. It is generally agreed that the interdependencies of first and second moments of returns distributions between developed stock markets exist. This has been extensively documented by Eun and Shim (1989), Barclay, Litzenberger and Warner (1990),; King and Wadhwani (1990), Hamao et al. (1990), Koutmos and Booth (1995), Pan and Hsueh (1998), Sim and Zurbreugg (1999), Fratzscher (2002), Antoniou et al. (2003), Wu et al. (2005), Otsubo (2014), Kao, Ho, and Fung (2015), among others. However, some studies, including Lin et al. (1994) and Susmel and Engle (1994), argue that the effect of interdependence is existent but rather weak.

[1] There was no stock index to comprehensively reflect the performance of A-shares stocks in China until the China Securities Index (CSI) 300 index was established in 2005. The CSI 300 index is the largest stock index of the Chinese A-shares market. It is regarded as a good reflection of the overall performance of the Chinese stock market (Chen et al., 2013; Yang et al., 2012).

[2] Although the CSI 300 stock index futures market is newly established, it has grown rapidly (Chen et al., 2013; Yang et al., 2012). Chen et al. (2013) report that the introduction of the index futures market in China enhances the information content of spot index prices and helps to stabilize the Chinese stock market. Hou and Li (2013, 2015) reveal that the CSI 300 index futures market provides a better price discovery function in light of price and volatility levels after one year's development.

[3] Guo et al. (2013) investigate the price discovery and volatility transmission between the CSI 300 and the SGX FTSE Xinhua A50 index futures using intraday data.

[4] In Moon and Yu (2010) and Allen et al. (2013), daily close-to-close returns are analyzed instead of close-to-open and open-to-close returns.

[5] In these studies, daily close-to-close returns are divided into close-to-open and open-to-close components to separate the spillover effect on the opening price of the domestic market from that on the price after market opening. In the two-stage estimation process, foreign shocks of daytime trading are estimated in the first stage; then, spillover effects to the domestic market are estimated by using estimated foreign daytime shocks.