



Contagion effect of the European financial crisis on China's stock markets: Interdependence and pure contagion



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ABSTRACT

This paper examines the contagion effect of the European debt crisis on China's stock market. The analysis tests pure contagion effects and interdependence by utilizing the Kalman filter approach to estimate the time-varying correlation coefficients of the stock market indices between the Eurozone and China. The empirical results indicate that after controlling the macro fundamental variables and global shocks, the crisis contagion's effect on investors' psychology in the Chinese capital market is limited. The result of variance analysis demonstrates that macroeconomic variables have played a major role in stock market between China and the Eurozone. The model provides a mechanism for tracing the time varying correlation coefficients in a structured way after controlling the fundamental variables and global shocks and can reflect the changing market dynamics accurately.

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1. Introduction

This paper examines the contagion effect of the European debt crisis on China's stock market. A series of national sovereign ratings were downgraded in the Eurozone starting from the end of 2009. Led by Greece, the crisis spread quickly to most European countries. Subsequently, the financial markets and real economy also became affected. The trading partner countries will also be affected by this type of change and economic growth around the world will also be hindered. During the past 10 years, the Sino-European trade relationship has developed stably. The Eurozone has become China's largest export market and an important source of foreign investment to China. Besides, the investors' confidence and expectations of China's investors may be affected by the Eurozone market during crisis. Given the strong links between China and the Eurozone, researchers and policy makers should be concerned about the channels through which the contagion is transmitted and the negative effects of the crisis.

A great deal of contemporary literature on contagion effect analysis focuses on the transmission mechanisms that describe the response of macroeconomic variables such as output, bank behavior, interest rate and exchange rate to a variety of shocks. This fundamentals-based transmission mechanism reflects interdependence (Masson, 1999).

It implies that financial crisis appears to be contagious due to macroeconomic similarity and financial linkages (Haile and Pozo, 2008). The trade transmission mechanism usually describes the process by which a crisis in one country causes the macroeconomic fundamentals of its trade partner countries to deteriorate. This mechanism is considered one of the main transmission channels of financial crises, such as the currency crises of Thailand, Argentina and Russia (Çatik and Martin, 2012; Chan et al., 2011). Haidar (2012) introduces a three-country dynamic general equilibrium model to analyze how a currency crisis can transmit through the trade sector channel of the economy. Furthermore, "trade contagion" is decomposed into competitive effect, income effect and cheap-import effect (Forbes, 2001). Regarding these three effects, currency depreciation and the income effect leads to the deterioration of a country's exports to its trading partners. Therefore, the trade deficit and foreign reserves play a primary role in financial crisis. However, there are obvious deficiencies to the trade contagion concept. It cannot explain the phenomenon of infection crisis without the close trade relations between countries (Gebka and Serwa, 2006).

The mutually dependent and highly correlated financial system between countries is one facet of interdependence. In the run-up to the American subprime financial crisis, banks in affected countries invested in bonds that provided high yields but were backed by low quality mortgages. Thus, when the crisis began in the originating country, these banks automatically lost their investments through asset price downgrades (Ueda, 2012). When they face liquidity risk and hedge this risk in a world interbank market, credit risk transfer can be detrimental to the welfare crisis (Allen and Carletti, 2006). Second, the

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failure of the banking system in one country may have caused a shortage of liquidity, leading to capital outflows from the rest of the world (Honohan, 1999). Third, financial contagion may have resulted in sectoral contagion: persistent liquidity shortages are also likely to cause a systematic impact on non-financial sectors (Gimet, 2007). One possible explanation for this phenomenon is that a fear of insolvency makes banks reluctant to ease their lines of credit. Meanwhile, increased costs of borrowing that are caused by strict credit lending can further raise the probability of a firm's insolvency.

This interdependence theory emphasizes real linkage and fundamental integration as channels for transmission shocks between countries and markets in both crisis and non-crisis periods. Our study emphasizes the inherent linkage between the Eurozone and Chinese stock markets, a linkage that goes beyond macroeconomic integration. This paper follows the Theory of Pure Contagion (Masson, 1999), which indicates that crisis in one country can coordinate and influence investors' confidence and expectations by shifting another economy's equilibrium from good to bad. There exists a largely unpredictable, higher correlation in cross market linkages during crisis times compared to normal times. This theory of pure contagion is rooted in features that are independent of economic fundamentals and that differ from the traditional channels characterizing the interdependence between economies. Such contagion is more likely to occur in financial markets. Moreover, it is often caused by the financial markets' sentiment, which consists of irrationality behavior, financial panic, incomplete information or risk aversion. In other words, contagion is not necessarily induced by economic linkages but is instead a consequence of investors' psychological behavior. This infection mechanism in reality can be described by the herding mechanism (Khan and Park, 2009) and informational-friction mechanisms (Calvo and Mendoza, 2000). Based on these considerations, it should be recognized that the role of market sentiment is very important in capturing cross country contagion beyond the macroeconomic fundamentals.

Regarding methodology, most studies of contagion have focused on providing evidence of significant increases in cross-country correlations of stock returns in the region, following the classical contagion definition of Forbes and Rigobon (2002). The Theory of Correlation Increase emphasizes that the transmission of a crisis from one country to another can be identified as contagion through a structural correlation breakdown in the crisis transmission mechanism. For example, King and Wadhvani (1990) state that the cross-market correlation between the U.S., U.K. and Japan has significantly increased after the U.S. stock market crash of 1987. Calvo and Reinhart (1996) and Baig and Goldfajn (1999) use a similar approach to indicate the presence of shift-contagion after the 1994 Mexican Peso Crisis and the 1997 Asian Crisis. Other researchers suggest that there may be no significant increase in correlation between asset returns in pairs of crisis-hit countries after accounting for heteroskedasticity. As noted by Billio and Pelizzon (2003), the results may be biased due to financial data heteroskedasticity and simultaneous omitted variable problems. Heteroskedasticity-adjusted simple correlation analysis is applied to investigate the relationship between the stock returns of different countries during the Asian Financial Crisis with a Dynamic Conditional Correlation Model (Chiang et al., 2007). This model is also applied to examine the financial contagion phenomenon following the American Subprime Crisis (Hwang et al., 2010; Longstaff, 2010; Naoui et al., 2010; Syllignakis and Kouretas, 2011). This kind of method is always used to test the contagion effect of developed countries to emerging markets. Celik (2012) finds that emerging markets seem to be the most influenced by the contagion effects during U.S. subprime crisis. Hemche et al. (forthcoming) conclude that the "pure" contagion hypothesis is not rejected for France, Italy, the UK or Mexico at the level of 1%, and for Argentina at 10%, and for China, the pure contagion is not statistically significant. Except for stock market contagions, Sensoy et al. (2014) estimate the dynamic conditional correlations of Turkey and 13 European countries using DCC-GARCH model, but they choose credit

default spreads (CDSs), which is a good representative of how global investors view these markets to study the cross-country independence. Kenourgios and Dimitriou (2015) investigate the contagion effects of the Global Financial Crisis (2007–2009) by examining ten sectors in six developed and emerging regions during different phases of the crisis by utilizing dynamic conditional correlation from the multivariate Fractionally Integrated Asymmetric Power ARCH (FIAPARCH) model. This model is also in accordance with a conclusion that differs from the result of "no contagion, but interdependence" introduced by Forbes and Rigobon (2002). Besides, the tests for financial contagion are highly affected by the data generating process and can lead to misdiagnosis. To overcome this limitation, Fazio (2007) introduces the Irrelevant Probability Technique to separate extreme interdependence and contagion. This technique indicates that pure contagion occurred in a limited number of country pairs generally belonging to the same region. Boubaker and Salma (2011) and Aloui et al. (2011) capture the dynamic patterns of interdependences beyond a simple analysis of correlation breakdown by using the Copula Function with daily data. Moreover, their similar results give strong evidence of time varying dependence between markets and countries in the characterization of nonlinearity and asymptotic dependence. In addition, other studies have implemented a frequency domain based test for contagion instead of a conventional time domain framework. The studies also indicate a clear differentiation between contagion and interdependence by associating each with its corresponding frequency component (Bodart and Candelon, 2009; Gellagati, 2012; Orlov, 2009).

Furthermore, relations between pairs of countries have been studied frequently. However, early literature contained a lack of guidance regarding how to measure the inherent market sensitivity within a group of countries. It should be noted that failure to control for global shocks or macroeconomic fundamentals can produce an upward bias in the estimated correlation coefficients. Admittedly, a high correlation among the variables could simply be the result of the similarities in economic fundamentals and common global shocks. The above mentioned methods of contagion use very high frequency data (e.g., daily, weekly). This limits the ability of a researcher to control for macroeconomic fundamentals and global shocks, which are reported at a lower frequency. Based on these considerations, our interest focuses on pure contagion, and it is thus necessary to control for macro-fundamentals and global shocks. The co-movement of asset prices is usually affected by economic fundamentals and market sentiment. The stock market movements thus reflect not only the influence of macroeconomic factors on capital flow but also the transformation of investors' expectations and confidence in the markets. However, the above-mentioned methods have been applied directly to stock returns as the research object without any processing. Consequently, results that contain interference by macroeconomic variables have motivated our interest in pure contagion. We must renew the classical definition of contagion from Forbes and Rigobon (2002), strictly as a significant increase in cross market co-movement that is beyond what could be foreseen by the linkages between fundamentals and global shocks.

This paper has similar themes, samples and conclusions to Ahmad et al. (2013), with important differences in terms of data types, approach and methodology. Ahmad analyzed the contagion effects of GIPSI (Greece, Ireland, Portugal, Spain and Italy) stock markets on BRIICKS (Brazil, Russia, India, Indonesia, China, South Korea and South Africa) stock markets utilizing the DCC-GARCH model to estimate the dynamic conditional correlations across sample markets during the Eurozone crisis period. Our paper examines the interdependence and pure contagion effects of the European debt crisis on China's stock market by adopting the time-varying correlation model with the Kalman filter approach. Ahmad just used daily dates of stock-price indices to test the short-run interdependence of GIPSI to BRIICKS. They treated the cross market correlation always at high levels as interdependence and increasing significantly during the turmoil period as contagion, they found that China has low correlation with GIPSI countries and

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