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Financial crises and dynamic linkages across international stock and currency markets

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ABSTRACT

This paper investigates contagion across stock and currency markets of China, Eurozone, India, Japan and US during global financial crisis and Eurozone crisis. The crisis periods are selected using Markov-switching models for US and Eurozone markets. We, then, utilize the DCC-GARCH model to estimate conditional correlation among the assets and test for contagion/flight to quality effects during the crises. The results show significant contagion as well as flight to quality effects both across and within asset classes. We examine the impact of financial stress index on the correlation across markets and find that portfolio diversification benefits for equity markets may be non-existent.

1. Introduction

The financial crisis of 2008–09 will remain embedded in history as the largest crisis[1] that shook the developed world post the Great Depression of the 1930s. The intensity and spread of the crisis seems to be unparalleled and so are the repercussion effects thereof. This was followed by a sovereign debt crisis in the Eurozone economies in 2010–11. The crises triggered a coordinated fall in financial markets around the world coupled with massive capital outflow from emerging markets. These events have led to an increasing interest in financial contagion, its causes and the role played by Emerging Market Economy (EME) financial markets going forward (Batten and Szilagyi, 2011).

'Contagion'[2] refers to the heightened transmission of shocks during crisis periods vis-à-vis the tranquil periods. The most widely recognised channels of transmission for contagion are trade and financial links. This is because more interlinked economies characterized by high trade dependence or large financial flows are likely to be plagued by faster transmission of shocks.

The objective of international portfolio investment is the diversification of risk and it hinges critically upon the lack of currency risk. Moreover, the simultaneous investment across stock and currency markets allows opportunities for diversification across asset classes. In the backdrop of a lack of consensus regarding the relationship between stock and foreign exchange markets with the uncovered equity parity predicting a positive relationship (Hau and Rey, 2006) and the paper by Cavallo and Ghironi (2002) depicting a negative relationship, it is unclear how investors could leverage gains by investing across these asset classes. The issue assumes significance as exchange rate risk may compound losses for international investors in view of a capital outflow

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[1] The existing literature characterizes a crash as a drastic fall in the price of a single asset. In contrast, a crisis denotes a period marked by high uncertainty and a simultaneous and coordinated fall in prices of multiple assets. Further, it is noteworthy that co-movements across markets are synonymous with correlations among the markets. A rise in co-movement may, however, result from either large common shocks affecting several markets or spillovers that arise due to transmission of shocks originating in one market to other markets or an intensification of the channels of transmission of market-specific shocks. See, Ozer-Imer and Ozkan (2014), Kole (2006) and chapter 3 of the IMF World Economic Outlook Report on Transitions and Tensions (2013) for details.

[2] According to Pericoli and Sbracia (2003), the five most commonly used definitions in the literature are based on (i) a significant increase in the probability of occurrence of crises in other countries in response to a crisis having occurred in one country (changes in probability of crises), (ii) volatility spillover from asset prices in the crisis country to markets in other countries (volatility spillovers), (iii) excess co-movement among asset prices across countries which cannot be accounted for by fundamentals (multiple equilibria), (iv) a significant increase in co-movements of cross-country asset prices post occurrence of a crisis in one or more countries (correlation breakdowns) and (v) intensification of the international transmission channel in response to a shock in one market (shift-contagion).

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synonymous with depreciation of the exchange rate (say, per US Dollar) during episodes of financial crises.

The issue of spread of crises is critical from the perspective of financial stability and is especially relevant for portfolio managers, policymakers and central banks. In general, crisis episodes are characterized by falling asset prices and high volatility which gets transmitted both within and across borders. During financial crises, the relationships between international assets undergo a drastic change and tend to breakdown. This necessitates a relook at risk hedging strategies in view of a change in the correlation across assets. If shocks are transmitted internationally, then, it raises a crucial question regarding existence of portfolio diversification benefits. The increased co-movement of markets during crises has significant implications for the portfolio allocation and risk management strategy of international investors. Rising exchange rate volatility and the resultant currency risks associated with international investments are a cause for alarm. The simultaneous downfall of markets exposes institutions which hold internationally diversified portfolios to danger and may have implications for the payment and settlement process. This is notwithstanding the possible effect on the real economy which may result in severe macroeconomic fluctuations and may trigger correspondingly recessions in several economies.

The pioneering study by King and Wadhwani (1990) seeks to test for contagion between the stock returns of US, UK and Japan during the US stock market crash of 1987 by examining whether the correlations across these markets increased during the event and find existence of significant contagion effects across the markets. However, Forbes and Rigobon (2002) show that cross-market correlation coefficients are biased upwards (as higher volatility translates into higher correlation coefficients) during periods of crisis due to heteroscedasticity in the data. As a result, recent work on correlation breakdowns corrects for the sample selection bias which results from arbitrary selection of crisis periods and focuses on conditional correlations instead of unconditional correlation coefficients.

While there exists a huge body of literature on the propagation of financial crises, the empirical literature tends to focus on the transmission of shocks internationally across a single asset class, mostly equities. The objective of this paper is to investigate the phenomenon of financial contagion across asset classes viz. stocks and currencies internationally[3] for China, Eurozone (EZ), India, Japan and United States (US) during the global financial crisis and the Eurozone debt crisis.

The present study is based on an analysis using conditional correlations and falls within the literature on correlation breakdowns. However, we refrain from an arbitrary selection of crisis periods and use instead a combination of the statistical and the event-based approach (similar to Kenourgios et al., 2011; Ahmad et al., 2013; Dimitriou and Kenourgios, 2013; and Kenourgios et al., 2016). We identify the time periods for the global financial crisis and the Eurozone debt crisis endogenously by utilizing Markov-switching Vector autoregression (MS-VAR) models for the stock and currency markets of the US and EZ respectively. Additionally, we utilize the events during the crises to corroborate our timelines. Subsequently, we estimate the time-varying conditional correlation coefficients across equity and foreign exchange markets of China, EZ, India, Japan and US by employing the DCC-GARCH model (Engle, 2002). Thereafter, we test for the existence of contagion/flight to quality effects/interdependence across the markets. Finally, we utilize the financial stress index[4] constructed by the Federal Reserve Board of St. Louis to appraise the role played by global risk in the transmission process.

It is noteworthy that there is a growing literature on the existence of financial contagion across markets during the recent crises in the US and EZ especially in the context of a single asset market internationally.[5] The present paper contributes to the existing literature in the following aspects. First, we add to the empirical research by examining contagion across multiple asset classes viz. international stock and currency markets during recent crises. Second, empirical examination of the impact of financial crises on dynamics between stock and currency returns tend to focus majorly on EMEs. In this paper, we seek to address the issue of transmission of contagion across developed and emerging markets. Third, we present and analyse the time-varying conditional correlation across the markets during various phases of both the global financial crisis (GFC) and the Eurozone debt crisis (EZDC). Another novel feature of the study is that it investigates the impact of the financial stress index on the linkages across international equity and currency markets. Finally, in order to address the criticism of correlation-based studies by Pesaran and Pick (2007), we select crisis periods by utilizing a statistical as well as event-based approach and also include market-specific regressors and a global factor in our DCC-GARCH model.

The remainder of the paper is organized as follows: Section 2 succinctly reviews the existing theoretical and empirical literature on crises and their impact on international financial markets. The empirical strategy and selection of markets are presented in Section 3. The identification of crisis periods has been expounded in Section 4. We present the dynamic conditional correlation model and discuss its results in Section 5. The impact of the financial stress index on cross-market conditional correlations would form part of Section 6. The last section spells out the conclusions.

2. Crises and impact on financial markets

There are several aspects of contagion that have been highlighted in the existing literature. The theoretical literature attempts to explain the channels which play a role in the transmission of crises and contagion. On the other hand, the empirical literature concerns itself not only with the channels of transmission but also measurement and existence of contagion both within and across asset classes. A lacunae of the existing empirical literature stems from the inadequate attention that has been paid to the transmission of crises across multiple asset classes. We attempt to address this gap in the present study.

According to the theoretical literature, the spread of financial contagion occurs majorly through common global shocks (Masson, 1999; Calvo et al., 1996) or direct economic linkages like close trade ties (Glick and Rose, 1999; Corsetti et al., 2000; Forbes, 2002) and financial inter-relations (Goldfajn and Valdés, 1997; Van Rijckeghem and Weder, 2001) or due to indirect effects such as a change in the global investor attitude.[6] Pavlova and Rigobon (2008) propound a dynamic equilibrium model to examine the inter-linkages between stock prices and exchange rates across Center and Periphery economies and attribute the excess co-movement of stock prices to the portfolio constraints faced by the Center's investors which lead to wealth transfers and contagion effects.

Traditional econometric techniques which a majority of the empirical literature employ is inappropriate for the measurement of contagion since the data are plagued by heteroscedasticity, omitted variable bias and endogeneity (Forbes and Rigobon, 2002; Dungey et al., 2005; Pesaran and Pick, 2007). Some of the techniques which have been routinely employed in testing for contagion effects are correlation-breakdowns, ARCH/GARCH framework, and logit and probit models. In

[3] There are few other studies such as Boschi (2005), Kallberg et al. (2005), Kanas (2005), Flavin et al. (2008), Dungey and Martin (2007), Tai (2007), and Walid et al. (2011) which test for contagion and examine inter-linkages across stock and foreign exchange markets during crises.

[4] The index is constructed by the Federal Reserve Bank of St. Louis using the first principal component of 18 series comprising financial variables for developed markets, interest rates and yield spreads for developed and emerging markets and other indicators related to global financial markets. It, therefore, captures global investment climate, global risk attitude, and the strain exerted on international financial markets by global developments.

[5] Such as Samarakoon, 2011; Syllignakis and Kouretas, 2011; Celik, 2012; Ahmad et al., 2013; Dimitriou and Kenourgios, 2013; Gray, 2014; Ozer-Imer and Ozkan, 2014; and Kenourgios et al., 2016.

[6] See Claessens and Forbes (2004) for details.