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Spreading crisis: Evidence of financial stress spillovers in the Asian financial markets

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ABSTRACT

Employing a generalized vector autoregression (VAR) framework, this paper examines financial stress spillovers in five Asian countries, namely, China, South Korea, Malaysia, Thailand, and the Philippines, during turmoil periods. Our data span the period from the end of 1997 to early 2009, encompassing the impact of the 2007–2009 global financial crisis on several Asian economies. We use a financial stress index specifically designed for emerging economies as a proxy for financial stress, and our findings reveal significant cross-country stress spillover effects, where China is the dominant stress transmitter among the five countries during stressful periods. Further, the generalized impulse responses (GIRs) on stress innovations show a positive short-run effect up to one standard deviation before it fades away. Overall, our findings shed light on the dynamics of financial stress spillovers in the Asian financial markets.

1. Introduction

The Asian crisis has been extensively examined from the perspective of financial market co-movements and contagion effects. However, little attention has been devoted to contagion effects in the most recent financial crisis. We study the underlying dynamic relationship between financial stress episodes during the period from 1997 to 2009 in five Asian countries, namely, China, South Korea, Malaysia, Thailand, and the Philippines. While the literature on the transmission of financial stress spillovers between countries remains nascent, financial stress episodes are frequently connected with economic downturns, as they destabilize the financial system and its capability to operate smoothly. Moreover, by employing a financial stress index (FSI), recent research has focused on the transmission of financial stress and examined the likelihood that such stressful episodes engender economic downturns (Balakrishnan, Danninger, Tytell, & Elekdag, 2009; Cardarelli, Elekdag, & Lall, 2009). Compared with the use of single market indices, the use of an aggregate FSI contributes to a better understanding of financial stability. High levels of financial stress signal the inability of the financial system to effectively perform its tasks, and extreme levels of financial instability are related to financial crises and recessions. Cardarelli et al. (2009), Cardarelli, Elekdag, and Lall (2011) use an FSI to examine why certain financial stress episodes lead to economic downturns. In a similar line of research, Balakrishnan et al. (2009) use an FSI to study how financial stress, defined as periods of impaired financial intermediation, is transmitted from advanced to emerging economies. Davig and Hakkio (2010) explore the linkages between financial stress and economic

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activity. Specifically, they use an FSI and employ impulse response functions to find evidence of a link between the index and economic activity. Baxa, Horváth, and Vašíček (2013) use Cardarelli et al. (2011) FSI to examine the relationship between financial instability and monetary policy. Melvin and Taylor (2009) use an FSI to examine the effect of the most recent global financial crisis on foreign exchange markets. In a cross-country analysis, Apostolakis and Papadopoulos (2014) use an FSI to examine the transmission of financial stress in the G7 advanced economies. In a later paper, the authors examine the relationships among financial stability, monetary stability and growth and provide insights into the spillover effects in major financial markets, such as the banking, securities and foreign exchange markets (Apostolakis & Papadopoulos, 2015).

The Asian currency crisis of 1997 spread quickly from Thailand to other Asian countries, affecting primarily Indonesia, South Korea, Thailand, Malaysia and the Philippines and, to a lesser extent, China. Much of the literature has focused on investigating contagion and the interdependence of the Asian stock markets in the aftermath of 1997 Asian currency turmoil. In this regard, Forbes and Rigobon (2002) provide a clear distinction between interdependence and contagion effects: a contagion effect is characterized by bursts and by a significant increase in cross-market co-movements during turmoil periods, whereas interdependence is characterized by a continued high level of correlation and, thus, stronger linkages among countries. The recent global financial crisis had an adverse effect on most Asian markets, such as those in China, where the Shanghai market experienced a sharp drop.

Previous scholars have examined financial market co-movements or contagion effects by using generalized autoregressive conditional heteroscedasticity (GARCH) (Chiang, Jeon, & Li, 2007; Yang, 2005) or vector autoregression (VAR) models (Cheung, Fung, & Tsai, 2010; Dekker, Sen, & Young, 2001; Goh, Wong, & Kok, 2005; Khalid & Kawai, 2003). To investigate the long-run relationships among equity markets, co-integration techniques are used (Fernández-Serrano & Sosvilla-Rivero, 2001; Jang & Sul, 2002; Roca, Selvanathan, & Shepherd, 1998). Several studies find evidence of financial co-movements (Baig & Goldfajn, 1999; Corsetti, Pericoli, & Sbracia, 2005; Sachs, Tornell, & Velasco, 1996), whereas others find evidence supporting a contagion effect in the aftermath of crisis events (Basu, 2002; Bordo & Murshid, 2001; Chiang et al., 2007; Forbes & Rigobon, 2002; Froot, O′connell, & Seasholes, 2001). Using a VARMA model that allows for spillovers, Allen, Amram, and McAleer (2013) examine spillovers from the Chinese equity market to those of its major trading partners.

Our research differs from the existing literature because it uses an FSI to examine stress spillover effects. Specifically, in this study, we examine stress spillover indices by utilizing the framework of Diebold and Yilmaz (2012). The newly developed version of the spillover index involves generalized variance decompositions, and it has recently been applied to investigate the interconnectedness of volatility in financial markets (Antonakakis & Vergos, 2013; Apostolakis & Papadopoulos, 2014, 2015; Yilmaz, 2010). For instance, Yilmaz (2010) examines the interdependence among equity markets in East Asian countries and finds that the volatility spillover index experiences significant jumps during major financial crises. Furthermore, we examine the cross-country Granger causation of financial stress and the dynamics of the VAR model by using generalized impulse response functions. The present study contributes to the rapidly growing literature on financial stability by utilizing an aggregate FSI and by examining financial stress spillovers across Asian countries during the 2008 global financial crisis.

Our results reveal important stress spillover effects among the five Asian countries examined, where China is the dominant stress transmitter among the five countries. Analysis of the spillover plots shows that the transmission of financial stress is amplified during stressful periods, and the generalized impulse responses (GIRs) on stress innovations show a positive short-run effect up to one standard deviation before it fades away. Overall, our findings highlight the interconnectedness of the Asian markets, revealing the increased integration among these markets.

The rest of this paper is organized as follows: Section 2 describes the methods used to identify the stress spillovers among the five examined Asian countries. Section 3 briefly discusses the data utilized in this paper. The results of the empirical analyses are then presented in Section 4. We conclude in Section 5.

2. Empirical method

This article is based on the generalized VAR framework developed by Diebold and Yilmaz (2012) to explore stress spillovers between the five examined Asian countries. We employ an N-variable, p^{th} order VAR, $y_t = \sum_{i=1}^{p} \Phi_i y_{t-i} + \varepsilon_t$, where $y_t = (y_1,\ldots,y_{N,t})'$ is an $N \times 1$ vector, with y denoting a vector of the financial stress indices for the five countries; Φ is an $N \times N$ matrix of the parameters; ε_t is a vector of independently and identically distributed errors; and Σ is the covariance matrix. The moving average representation is given by $y_t = \sum_{i=1}^{\infty} A_i \varepsilon_{t-i}$, where the $N \times N$ coefficient matrices A_i are estimated by the recursion $A_i = \Phi_1 A_{i-1} + \Phi_2 A_{i-2} + \cdots + \Phi_p A_{i-p}$, with A_0 denoting an $N \times N$ identity matrix and with A_i equaling 0 for $i < 0$. In the case of the generalized VAR framework of Koop, Pesaran, and Potter (1996) and Pesaran and Shin (1998) (KPPS), the H-step-ahead forecast error variance decomposition is given by

$$\theta_{ij}^{g}(H) = \frac{\sigma_{jj}^{-1} \sum_{h=0}^{H-1} \left(e_i' A_h \Sigma e_j\right)^2}{\sum_{h=0}^{H-1} \left(e_i' A_h \Sigma A_h' e_i\right)}, \tag{1}$$

where σ_{jj} is the standard deviation of the error term for the j^{th} equation, Σ is the variance matrix for the error vector ε, and e_i is a $N \times 1$ vector, with the i^{th} element taking a value of one and the elements taking zero otherwise. The sum of each row of the