Systemic interconnectedness among Asian Banks

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A B S T R A C T

The recent global financial crisis (GFC) has drawn much attention to systemic risk, particularly its measurement and key contributing institutions. Following this severe event, the economic and finance literature has been flooded with numerous quantitative measures of systemic risk. However, researchers have largely ignored the systemic risk potential of regions such as Asia, instead focusing on financial systems in the U.S. and Europe. This paper empirically examines systemic risk potential for banking institutions in Asia, drawing on recent systemic risk analytics. This paper employs two methods, using the Conditional Value-at-Risk method to measure the systemic contribution of institutions and the Granger-causality network approach to determine their degree of interconnectedness. The analysis reveals that the degree of interconnectedness has generally increased among banks in Asia. Nevertheless, the causal network among the banks has become less dense since the GFC (2007–2009). Thus, banks in developed Asian economies generally have higher potential for systemic risk than those in other emerging markets. Finally, we find a positive relationship between bank size and contribution to systemic risk.

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1. Introduction

Systemic risk can be broadly defined as the risk of an entire financial system or a large number of financial institutions failing in a manner that can potentially disrupt the real economy. Recently, systemic risk has taken centre stage in global economic discourses in light of the bitter experience of the 2007 subprime crisis and the 2008 Global Financial Crisis (GFC), including the collapse of Lehman Brothers, the bailout of AIG and now the extremely slow and painful recovery. During the GFC, the financial system was exhausted due to the distress and in some cases failure of key institutions, leading to further distress and the spread of shocks to the real economy. This situation was also accompanied by regulators, tasked with the duty of ensuring the health of the financial system, being unable to take effective measures to manage the risk because of their limited understanding of the exposure and contribution of relevant institutions to systemic risk.

Following these two events, the literature has been inundated with various methods to study risk and dependence across firms. Some existing methods to estimate systemic risk include the Conditional Value-at-Risk (CoVaR) measure of Adrian and Brunnermeier (2010), which uses quantile regression to estimate the tail loss of financial market returns conditional on a given financial institution reaching its VaR level. Acharya (2009) proposed the systemic expected shortfall (SES) method and applied it to estimate the amount by which banks are undercapitalised when the financial system as a whole is undercapitalised because of a systemic event.

Most empirical studies concerning these measures have primarily focused on developed markets in Europe and the United States. The subprime crisis and GFC originated from financial institutions in the United States whereas the European sovereign debt crisis, which begun in 2010, had its origins in Europe. Therefore, it is not surprising that existing methods are widely tested or applied in the context of institutions from these two regions. Concerning Asian institutions, a handful of studies (Lee et al., 2012; Sheu and Cheng, 2013) address systemic risk and financial fragility in Asian economies. However, none address the issue in a regional context; instead, existing studies focus on individual economies.

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While financial institutions in Asia were not at the epicentre of the two major systemic crises, it is undeniable that some suffered from the negative economic shocks that followed from the crisis in the West. The shocks emanating from the GFC had negative impacts on real economic activities in almost every Asian country. Furthermore, even though the region was generally resilient to the GFC, it currently has to cope with newly emerging developments. To recover from the GFC, most of the major economies are engaged in quantitative easing, an unconventional monetary policy aimed at driving down long-term interest rates via large-scale central bank asset purchases. Much of the excess capital outflows associated with this policy have ended up in Asian financial markets because of their connectivity with the global financial system. However, as the major economies recover and scale back their unconventional monetary easing, the result is heightened volatility accompanied by spillovers to emerging markets, of which most Asian markets form an integral part. Although the region's financial stability has been preserved, this transition in the global and economic landscape poses a great future challenge (Aziz, 2014). Therefore, while the Asian financial system has remained relatively calm, the potential for future systemic disruption cannot be ignored. Thus, how should Asian banking regulators prepare for the risk associated with a systemic event? How could they account for spillover risk from the United States entering emerging markets in Asia or risk from an extreme shock within the region?

Against this background, this paper evaluates how a potential systemic risk could play out across banking institutions in Asia. Our main objective is to apply some of the existing metrics to analyse the systemic risk potential of Asian banks. Broadly, it is important to measure the potential systemic risk stemming from the externalities associated with the failure of an institution, which include the cost related to deposit insurance, bailout costs and the loss of intermediation in the real sector (Acharya and Steffen, 2013). One can outline two other important reasons why we should measure the exposure or contribution of Asian financial institutions to systemic risk. First, knowing the risk exposure of institutions will enable regulators to examine those that are possible candidates for rescue in the event of a crisis. Second, the scale of an institution's exposure to systemic risk will make it possible for academics and regulators to identify the underlying causes or drivers of their risk exposure. Accordingly, this paper analyses systemically important financial institutions in Asia during the 2007 to 2009 financial crisis. Specifically, it tries to answer the following questions: What were the systemically important banks during the recent GFC? What were the systemically important economies during that period? Has the potential for systemic risk decreased since the GFC? Does bank size matter in systemic risk contributions?

The paper makes three key contributions. First, it fills important gaps in the literature by providing a detailed analysis of the systemic risk potential among Asian banks, using stock and accounting data on 83 banking institutions in 11 Asian countries. Banks play a vital role in the financial system and the economy. As a crucial part of the financial system, banks efficiently allocate funds from savers to borrowers. Banks provide specialised financial services that reduce the cost of gathering data about both saving and borrowing opportunities and so increase the efficiency of the overall economy. However, Asian banks have received relatively little attention in the finance literature. This paper provides a thorough insight into the systemic risk potential. For example, it explores both the contribution of each institution to risk in the Asian financial system and the extent of connectedness among individual institutions, as well as identifying the systemically important institutions and economies in the region.

The second contribution of this paper is that it applies a battery of econometric techniques. For instance, it explores the linear relationship between institutional pairs using the linear Granger-causality technique as used by Billio et al. (2010). The paper also measures the systemic contribution of individual banks using the CoVaR method, based on Adrian and Brunnermeier (2010). This method measures the value-at-risk of the financial system conditional on an institution being in a distressed state and subsequently captures an institution's contribution to systemic risk at various quantiles.

The third contribution of the paper rests on its use of firm-level data. We focus on equity and accounting data for 83 banking institutions in Asia. Analysing comovement at the industry level broadens our knowledge of the pattern of correlation among Asian countries. This part of the paper contributes to the strand of literature that examines whether differences in equity-return comovements are linked to differences in industrial structure (Griffin and Karolyi, 1998; Heston and Rouwenhorst, 1994; Roll, 1992).

The remainder of the paper is structured as follows. Section 2 presents the methodology and Section 3 presents the data and summary statistics. Section 4 measures the marginal contributions of banks to systemic risk during the 2007–2009 financial crisis, analyses the effect of idiosyncratic risk and bank size on systemic risk and discusses country and subperiod rankings. Finally, Section 5 focuses on the implications for banking regulation and offers concluding remarks.

2. Measures of systemic risk

This section presents two measures of connectedness that are designed to capture changes in correlation, causality among financial institutions and the contribution of financial institutions to systemic risk. To analyse the potential systemic risk of Asian banks, we employ two different methodologies proposed in the literature. First, the causal links between the banks are computed using the method proposed by Billio et al. (2010) to determine the overall systemic risk faced by the financial system. Second, a bank's systemic contribution is computed using the CoVaR measure proposed by Adrian and Brunnermeier (2010).

2.1. Granger-causality measure

Billio et al. (2010) adopted the Granger causality tests (Granger, 1969, 1980) to measure the degree of interconnectedness between financial institutions and to determine the direction of the relationship between institutions. Construction of this measure was based on monthly return indices on hedge funds, banks, broker/dealers and insurance companies, and shows that Granger-causality networks are highly dynamic and become densely interconnected in the period preceding systemic shocks. Billio et al. (2010) modified the Granger-causality tests to measure the interconnectedness and direction of the relationship between financial institutions in the financial system. Specifically, X is said to Granger-cause Y if previous values of X contain information that helps predict Y above and beyond that contained in past values of Y alone. The form of the Granger-causality equation is specified as

$$X_t = \sum_{j=1}^{m} a_j X_{t-j} + \sum_{j=1}^{m} b_j Y_{t-j} + \varepsilon_t \tag{1}$$

$$Y_t = \sum_{j=1}^{m} c_j X_{t-j} + \sum_{j=1}^{m} d_j Y_{t-j} + \omega_t, \tag{2}$$

where m denotes the maximum lag length and ε_t and ω_t are two uncorrelated white noise processes. Furthermore, Y is said to cause X when b_j is not equal to zero. Similarly, X causes Y when c_j is significantly different from zero; that is, if the p-value is less than