

Institution: University of Bath		
Unit of Assessment: C17 Business and Management Studies		
Title of case study: Monitoring systemic risk and bank 'interconnectedness' to avert financial crises		
Period when the underpinning research was undertaken: 2010 – 2020		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Simone Giansante	Lecturer (Assistant Professor), previously Research Officer	April 2010 – present
Andreas Krause	Lecturer	September 2000 - present
Period when the claimed impact occurred: August 2013–December 2020		
Is this case study continued from a case study submitted in 2014? No		
1. Summary of the impact		
<p>Research at the University of Bath on threats to financial stability from inadequate monitoring and risk assessments of the financial system (led by Dr Giansante) has informed policy changes in the central banks and regulatory institutions of G20 countries. It has led to the adoption of new processes and the enhancement of strategies for financial stability. A framework for measuring 'interconnectedness' was developed to assess the overall risk of a crisis in the financial system and identify which institutions were contributing most to instability. The framework has been operationalised within the Reserve Bank of India. It has also shaped the work of Banque de France and the International Monetary Fund on global stability.</p>		
2. Underpinning research		
<p>The global financial crisis of 2007/08 highlighted a lack of understanding among economists and financial regulators on the importance of the interconnectedness of financial institutions, both nationally and globally. The deficiencies in regulation that the crisis exposed led (among other initiatives) to the Basel III banking standard. This highlighted the issue of excessive interconnectedness among 'systemically important financial institutions' (SIFIs) as a primary cause of systemic risk. The crisis also raised questions about the transmission channels between the financial and real sides of the economy. Mainstream macroeconomic models envisaged a representative banking sector that did not face problems of illiquidity or insolvency. They were therefore unlikely to predict the domino-like failures that became a reality during the financial crisis.</p> <p>The issue behind the underpinning research at University of Bath concerned the high concentration of risk among a handful of large US investment banks and the need to develop a policy response to what has become known as 'macroprudential regulation'. A key research question related to concerns about the dense interconnections through 'credit default swaps', a form of debt insurance between banks. To address this question, Giansante (with Markose and Shaghaghi, University of Essex) developed a new method to assess systemic risk and forecast financial meltdowns based on a network approach to understanding complex financial linkages among global financial institutions (R1). Giansante (with Markose and Oluwasegun, University of Essex) used a 'multi-agent financial network'</p>		

Impact case study (REF3)

model to quantify the contribution of each institution to financial instability and define the SIFIs that might require targeted intervention by central banks or financial regulators (R3). Giansante (with Krause, University of Bath) disentangled the complexity of solvency shocks and liquidity shortfalls among financial institutions to fit the new Basel III criteria on banks' capital adequacy and liquidity (R2).

A key insight from the research was the importance of central banks and financial regulators collecting detailed data on bilateral contracts among financial institutions in order to assess the extent of interconnectedness and its potential contribution to systemic risk (R1). The results also provided evidence of the complex interplay among liquidity and solvency shocks in contributing to the spread of contagion between financial institutions that can lead to a systemic crisis (R2). The researchers concluded their analysis by recommending the adoption of an early warning real-time financial networks approach based on bilateral leverage data that regulators could use to monitor financial institutions, internalise potential threats of systemic risk, and prevent future financial crises.

3. References to the research

- R1 Markose, S., Giansante, S., & Shaghghi, A.R. (2012) 'Too interconnected to fail' financial network of US CDS market: Topological fragility and systemic risk', *Journal of Economic Behavior and Organization* 83(3), pp. 627–646. DOI: [10.1016/j.jebo.2012.05.016](https://doi.org/10.1016/j.jebo.2012.05.016)
- R2 Krause, A., & Giansante, S. (2012) 'Interbank lending and the spread of bank failures: A network model of systemic risk', *Journal of Economic Behavior and Organization* 83(3), pp. 583–608. DOI: [10.1016/j.jebo.2012.05.015](https://doi.org/10.1016/j.jebo.2012.05.015)
- R3 Markose, S. M., Oluwasegun, B. & Giansante, S. (2014) 'Multi-agent financial network (MAFN) model of US collateralized debt obligations (CDO): Regulatory capital arbitrage, negative CDS carry trade, and systemic risk analysis', in Information Resources Management Association (ed.), *Banking, finance, and accounting: Concepts, methodologies, tools, and applications*. 1-3, Hershey, PA: IGI Global, pp. 561–590. DOI: [10.4018/978-1-4666-6268-1.ch030](https://doi.org/10.4018/978-1-4666-6268-1.ch030)

4. Details of the impact

This research has directly informed policy changes in central banks and regulatory institutions. The software developed by the research team has been a key mechanism for the adoption of new processes and systems by the Reserve Bank of India (RBI) and in relation to the enhancement of strategy for financial stability (S1, S2). The benefits to the Indian financial system, shared with all G20 Finance Ministers and Central Bank Governors during the quarterly Financial Stability Board meetings, promoted interest from European banks and financial institutions, including Banque de France and the IMF. The research team contributed to the Financial Stability Review of Banque de France (S3) and their influence was publicly acknowledged by the Governor of Banque de France (S4). The benefits of this research have also been acknowledged by the IMF and incorporated into the IMF's auditing and advice to central banks (S5).

The Reserve Bank of India (RBI) (2013 – 2020)

The research informed the implementation and operationalisation of 2 new models for policy analysis in RBI: (1) A systemic risk network model of interconnectedness to map the entire Indian financial system along with assessment of financial systems in other countries; (2) A risk assessment contagion model that investigates both solvency shocks and liquidity shortfalls in accordance with Basel III pillars (S5). The models, in the form of bespoke software, provide the means to gather granular information, to assess its implications for systemic risk, and to make targeted interventions (S2). Both models were initially developed and implemented between 2011 and 2015. Between August 2013 and December 2020, they

have been fully embedded into the current RBI systemic risk monitoring framework (S1) and outcomes are published in the RBI semi-annual Financial Stability Reports (S2).

The process of this contribution was as follows. First, working with the members of RBI's Financial Stability Unit (FSU), the research team developed a contextually specific conceptual framework and software through which to operationalise a data-driven model of interconnectedness of the Indian financial system. This allowed the FSU to monitor and manage systemic risk within and across multiple financial sectors. Second, the new models for analysis made it possible to collect data on the bilateral positions of more than 70 leading financial institutions, including public, private and foreign banks, cooperative banks, mutual funds, pension funds and insurance companies. This dramatically changed the way that the RBI mandated and analysed financial positions among institutions. Dr Giansante provided training for the FSU team in the meticulous gathering of detailed information, and was part of the analysis process with RBI Deputy Governors, Executive Directors and Division Heads. The Assistant General Manager of the RBI stated:

"A multi-layer financial network software was developed by Dr Giansante ..., which is used to assess the interconnectedness, liquidity and solvency of risks of the Indian financial systems. As the project was done over a period of four years ... Giansante had interactions with top management and apprised them about the nuances and significance of the model ... [and] trained RBI personal in the use of the network model" (S1).

The software solution has been fully adopted by the RBI as its main risk assessment tool for the interconnectedness and contagion risks of financial institutions. As an example, the new system informed RBI about the decline of the interbank market size with risk of financial contagion in the second semester of 2014, as highlighted in the FSR press release of December 2014:

"Analysis of the interconnectedness indicates that the size of the interbank market in relation to total banking sector assets has been on a steady decline. However, contagion analysis with top five most connected banks reveals that the banking system could potentially lose significant portion of its total Tier-I capital under the joint solvency-liquidity condition in the event of a particular bank triggering a contagion" (S2).

Banque de France and the International Monetary Fund (2016 – 2018)

As a result of the proven benefits for RBI, the research outcomes and related tools for risk assessment have also been disseminated in Europe, including for central counterparty clearing platforms. The Governor of Banque de France invited the research team to contribute to its 2017 Financial Stability Review (S3) and he has directly acknowledged the contribution made to the resilience of the global financial system (S4). Specifically, the stability review presents all major models for risk assessment adopted by financial regulators that have made the global financial system more robust since the G20 action plan of 2009. The Governor of Banque De France stated:

"Thank you very much for the high-quality contribution you make to the Financial Stability Review of Banque de France on the impact of financial reforms. This 21st edition shows that the banking and financial regulations adopted since the crisis constitute a major acquis [body of knowledge] to be preserved because they have made the financial system more robust ... [and] the importance of the regular assessment of their impacts in order to consolidate this acquis" (S4).

The achievement of these tools, including the research team models, has been echoed by other policymakers and financial practitioners, including Mark Carney (Chair, FSB and then Governor, Bank of England), Axel Weber (Chairman, UBS) and Tobias Adrian (Director, IMF) during the IMF Spring Meetings in Washington on the 20 April 2017 for the presentation of the review document (S5). The benefits of the research have also been

acknowledged by the IMF and the models have been included in the IMF's auditing and advice to central banks (S5).

In addition to RBI, Banque de France and the IMF, direct support has been provided by Dr Giansante to the Bank of Finland (2014) to monitor systemic risk in China and Russia (S6), to Banca d'Italia (2015) on the development of 'interbank networks' (S7), and to Banco de Mexico (2016) on the implementation of network models, stress testing and financial stability monitoring (S8).

5. Sources to corroborate the impact

- S1 Letter from Assistant General Manager, Reserve Bank of India, Financial Stability Unit, dated October 2020.
- S2 RBI. Financial Stability Reports and Press Releases: Issue 8, Dec 2013; Issue 9, June 2014; Issue 10, Dec 2014; Issue 11, June 2015; Issue 12, Dec 2015; Issue 13, June 2016; Issue 14, Dec 2016; Issue 15, June 2017; Issue 16, Dec 2017; Issue 17, June 2018; Issue 18, Dec 2018; Issue 19, June 2019; Issue 20, Dec 2019; Issue 21, June 2020, Issue 22, Dec. 2020. Available at: <https://www.rbi.org.in/SCRIPTS/FsReports.aspx>
- S3 Banque de France. (2017) 'The Impact of Financial Reforms', *Financial Stability Review*, 21. Available at https://publications.banque-france.fr/sites/default/files/medias/documents/fsr21_web.pdf
- S4 Letter from the Governor of Banque de France, dated April 2017.
- S5 Villeroy de Galhau, F. (2017) 'A panel discussion on the Banque de France's Financial Stability Review' *Bank De France, The global financial system: safer than ever before? The impact of financial reforms*, IMF HQ2, IMF Spring Meetings. Washington.
- S6 Bank of Finland (2014) *BOFIT Visiting Researchers Programme. Former visitors: 2014*. Available at: <https://www.bofit.fi/en/visiting-researchers-programme/former-visitors/#panel-Aikaisematvierailijat-5>
- S7 Letter from Deputy Head of Statistical Analysis Directorate, Banca d'Italia, dated June 2014.
- S8 Banco de Mexico. (2015) 'Program for the November 2015 conference: *Network models, stress testing and other tools for financial stability monitoring and macroprudential policy design and implementation*'. Banco de Mexico, 11-12 November. Ciudad de Mexico: Bank de Mexico Available at: <https://www.banxico.org.mx/publicaciones-y-prensa/seminarios/network-models--stress-testing-and-other-tools-for/network-models-macroprudencia.html>