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Banking crises and financial integration: Insights from networks science☆

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ABSTRACT

This paper explores whether the level of *de facto* financial integration of banks in a country increases the incidence of systemic banking crises. The paper computes a measure of financial integration based on network statistics of banks participating in the global market of inter-bank syndicated loans. The network statistics used are indegree, outdegree, betweenness, clustering coefficients, authority, and hub centrality. The paper fits a count data model in the cross-section for the period 1980–2007, and finds that the level of financial integration of the average bank in a country is a robust determinant of the incidence of banking crises. While borrowing (weighted indegree) is positively associated with a higher incidence of crises, betweenness is associated with a lower incidence. That is, the more important is the average bank of a country to the global bank network, as captured by betweenness, the smaller the number of crises the country experiences.

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1. Introduction

Following the Global Financial Crisis of 2007/2008, there has been a revival of the literature on financial crises and the factors exacerbating risks in the financial sector. The discussion emphasizes the role of international financial integration as a factor exacerbating the vulnerability of the banking system. One strand of the literature focuses on the association between financial crises and *de facto* financial integration, proxied by the stock of foreign liabilities, and finds non-conclusive results.[1]

[1] For example, Bonfiglioli (2008) reports a positive link in developed countries between banking crises and the aggregate stock of foreign liabilities, but she finds no association in developing countries. Joyce (2010) and Ahrend and Goujard (2012) find a robust association between the likelihood of banking crises and the stock of foreign debt liabilities in emerging economies – with the latter study also reporting a greater probability of crises the larger the share of debt in foreign liabilities. However, Gourinchas and Obstfeld (2012) fail to find any association between the share of debt in total external liabilities and the probability of banking crises in emerging markets – although they do find a robust association in high-income countries.

On the other hand, a new breed of papers is increasingly successful in linking rapid inflow growth with an increased probability of crises. This literature also finds that the type of inflows does matter, debt inflows being particularly problematic.[2]

Despite the prolific of the literature, the issue of the association of crises with increased financial globalization through the banking system, or the banking flows themselves, has been less explored. This paper aims to shed some light on this issue, employing a novel approach and modeling the financial globalization of banks using tools from networks science.

An advantage of a network approach is that it can capture different dimensions of how connected each node (bank or country) is to a network. It allows us to think not only in terms of the size of the flows going into a node (borrowing or inflows), but also on how connected or important is a node to the network (e.g., this can be captured by network statistics such as *betweenness*).

The paper studies the association of *de facto* financial integration of banks on the incidence of systemic banking crises using network statistics for the average bank in a country to proxy for the country's *de facto* financial integration. These network statistics are computed from lending and borrowing flows among banks in the inter-bank syndicated loans market. I then use these network statistics averaged out at the country level to perform non-parametric and regression analyses of the relationship between the *de facto* financial integration of the average bank and the incidence of banking crises in 116 countries in the cross-section of the period 1980–2007.

The different degrees of connectedness or the position relative to the network may be important for understanding how different shocks affect each node in a network. Intuitively, we can think that a more connected node would be more affected by a systemic shock. However, as shown by Albert et al. (2000) and, more recently emphasized by Haldane (2009), the structure of a network can make it simultaneously fragile and robust. For example, being well connected to the global banking network may allow a country easier access to the international capital markets when it needs it the most and hence enable that country to withstand different shocks that otherwise may trigger a financial crisis.[3]

Furthermore, there is growing evidence showing that a higher level of connectedness may be associated with an increased ability to dissipate economic shocks. For example, Kali and Reyes (2010) find that countries that were well integrated into the global trade network were able to cushion the impact of financial shocks, such as the Mexican and Asian crises, while Caballero et al. (2009) show that countries where banks were more connected to the global network of syndicated loans prior to the 2008/2009 crisis were less affected by it. Chinazzi et al. (2013) found similar results for connectedness measured in a global network of security holdings.

The paper uses the network statistics *betweenness*, *clustering coefficient*, *hub centrality*, *authority*, *indegree* and *outdegree* to capture the connectedness of the average bank of a country to the global bank network. Betweenness and clustering coefficient are measures based on the link structure of the network and capture the importance of a bank as intermediary in the network (intermediary in the sense of being a potential intermediary of bank relationships). Indegree and outdegree are measures based on the number of incoming and outgoing links, measuring the number of borrowing and lending relationships of a bank. Hub centrality and authority are hybrid measures, based on both the link structure of the network and the number of links of the nodes. I use both unweighted and weighted measures (weighting the bank-level statistics by the size of borrowing and lending of each bank). Throughout the text, I refer to these network statistics as the *de facto* financial integration of the average bank of a country.

The core of the analysis is based on a regression model for the number of systemic banking crises in the period 1980–2007. The paper fits a count data model using a Generalized Linear Model technique, which is a novel approach to study financial crises.[4]

The main finding is that the level of financial integration of the average bank in a country is a robust determinant of the incidence of banking crises. I find that increased *de facto* integration of banks as measured by total borrowing (sum of weighted indegree for all banks in a country) is positively associated with the incidence of banking crises. Furthermore, using the proxy for *de jure* financial integration of Chinn and Ito (2008), I find that a higher level of *de jure* integration is also associated with a higher incidence of crises.

The results also indicate that other factors are at work, and potentially can have a much bigger role as determinants of banking crises. In particular, prudential banking regulation (supervision) seems to play a crucial role in reducing the incidence of crises.

The results also indicate that the level of integration of banks into international markets, as measured by betweenness of the average bank, is negatively associated with the incidence of banking crises. That is, the more important the average bank of a country is to the global bank network, the smaller the number of crises the country experiences, even after controlling for borrowing, the degree of *de jure* capital account openness, and the quality of banking supervision.

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[2] See e.g., Reinhart and Reinhart (2009), Furceri et al. (2012), and Caballero (2014).

[3] One argument from relational banking is that bank lending, as well as much of economic activity, crucially depends on available information, trust, and relationships. One can expect that the higher the connectedness of a country in the global banking system, the stronger the relationships this country has, and, hence, the easier its access to international capital markets. One can also think in terms of the literature on financial crises (e.g. (Chang and Velasco, 2001)) and sudden stops (e.g. (Calvo, 1998), emphasizing the inability to obtain short-term debt or that being starved of financial inflows can trigger a banking crisis or a sudden stop event that ends in a crisis.

[4] After an extensive search, I was not able to find other papers that fit a count data model for the number of financial crises in a country. The most similar paper I found is Eichengreen (2002). However, this paper fits a count data model on the number of crises in the world during a year, not for the number of crises in a country in a cross-section of time.