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Contagion risk in the Czech financial system: A network analysis and simulation approach

Václav Hausenblas [a,b,*], Ivana Kubicová [a,c], Jitka Lešanovská [a,b]

[a] Czech National Bank, Na Příkopě 28, 115 03 Praha 1, Czech Republic
[b] Charles University, Prague, Czech Republic
[c] VSB-Technical University, Ostrava, Czech Republic

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ABSTRACT

This paper examines the potential for contagion within the Czech banking system via the channel of interbank exposures of domestic banks, enriched by a liquidity channel and an asset price channel, over the period March 2007 to June 2012. A computational model is used to assess the resilience of the Czech banking system to interbank contagion, taking into account the size and structure of interbank exposures as well as balance sheet and regulatory characteristics of individual banks in the network. The simulation results suggest that the potential for contagion due to credit losses on interbank exposures was rather limited. Even after the introduction of a liquidity condition into the simulations, the average contagion was below 3.8% of the remaining banking sector assets, with the exception of the period from December 2007 to September 2008. Activation of the asset price channel further increases the losses due to interbank contagion, showing that the liquidity of government bonds would be essential for the stability of Czech banks in stress situations. Finally, the simulation results for both idiosyncratic and multiple bank failure shocks suggest that the potential for contagion in the Czech banking system has decreased since the onset of the global financial crisis.

* Corresponding author at: Czech National Bank, Na Příkopě 28, 115 03 Praha 1, Czech Republic. Tel.: +420 224412078.
E-mail addresses: vaclav.hausenblas@cnb.cz (V. Hausenblas), ivana.kubicova@cnb.cz (I. Kubicová), jitka.lesanovska@cnb.cz (J. Lešanovská).

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1. Nontechnical summary

This paper assesses the resilience of the Czech banking system to interbank contagion. Interbank exposures such as interbank loans and cross holdings of securities can serve as a channel for interbank contagion. Banks and their interbank exposures create a so-called interbank network, where banks represent the nodes and financial exposures create the links between those nodes. The resilience of such a network depends on both the financial soundness of individual banks and the structure of the interbank links within the network. Therefore, network analysis is employed in order to understand the structure of the Czech interbank market. The results of the interbank network analysis indicate that the network is relatively sparse and highly heterogeneous. It points to several banks that are important for the stability of the network and whose failure could potentially have systemic consequences.

The exploratory data analysis is followed by a description of a computational model of interbank contagion which combines information on the stability of individual banks, bilateral interbank exposures, and the structure of the interbank network. The resilience of the system is assessed using a simulation approach where the initial shocks have the form of either individual or multiple bank failures. More specifically, we assume three potential channels of interbank contagion: a credit channel, a liquidity channel, and an asset price channel. The credit channel is active when banks in the system are defaulting due to credit losses on interbank exposures. Additionally, a bank might default when it is illiquid, i.e., when liquid assets such as cash, central bank balances, interbank lending and domestic government bonds are not sufficient to cover short-term interbank liabilities. Finally, the asset price channel is activated in the model when government bonds are no longer considered to be highly liquid assets, and hence it is not possible to exchange these bonds for cash without a price discount. The simulations incorporating the asset price channel represent a theoretical exercise where banks selling government bonds in the market face less than perfectly elastic demand for government bonds. When an unusual volume of government bonds is placed on the market, their price decreases, resulting in losses due to the revaluation of these assets in the balance sheets of all banks holding government bonds.

The potential for contagion was assessed over the period from March 2007 to June 2012. The simulation results for the idiosyncratic shock suggest very low potential for interbank contagion across scenarios due to pure credit losses on interbank exposures in the Czech banking sector. The contagion amounted to 3% of the remaining banking sector assets after the initial idiosyncratic shock in the worst-case scenarios over the period in focus. After the introduction of the liquidity condition into the simulations, the average contagion was below 3.8% of the remaining banking sector assets, with the exception of the period from December 2007 to September 2008. Activation of the asset price channel further increases the losses due to interbank contagion, showing that the liquidity of government bonds would be essential for the stability of Czech banks in stress situations. Finally, the simulation results for both idiosyncratic and multiple bank failure shocks suggest that the potential for contagion in the Czech banking system has decreased since the onset of the global financial crisis.

By providing a tool for the assessment of systemic risk in its structural dimension that better controls for heterogeneity in the banking system and endogenous financial variables, this work might contribute to the analytical framework of macroprudential policy authorities.

2. Introduction

The current global financial crisis has shown that the stability of individual institutions and the stability of the system as a whole do not necessarily overlap, since there are important financial linkages between individual institutions making the system more complex. The interconnectedness of financial institutions can be direct (direct exposures via loans, cross holdings of securities, etc.) or indirect (common exposures to a particular class of assets or even to the very same debtor). Both types of exposures create channels for potential contagion within the financial system.

In this paper, we narrow our focus to contagion within a banking system where the interbank market network is composed of banks (representing nodes) and financial exposures (links). In normal times, the interbank market ensures efficient liquidity redistribution from banks with surplus