Distress Propagation in the EU Banking System: Assessing Cross-Country Sovereign Debt Exposures

Executive Summary

Master's Thesis

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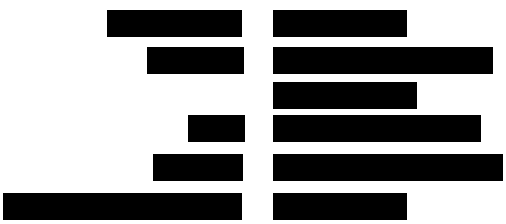

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Motivation

Preventing financial crises has become a top priority for policymakers given their long-lasting social and economic impact, as well as their potential to rapidly spread across the globe. Research in systemic risk aims at contributing to their prevention by identifying the sources of risk and understanding the mechanisms of its propagation. While most of the current regulatory stress-test exercises do not consider network effects, research has shown that this could lead to a serious underestimation of systemic risk. Several works in the field have quantified this underestimation for specific banking systems and under different assumptions. Many of these assumptions are implicit in the model used to propagate distress and can strongly impact the results. Understanding each model's impact is therefore key to interpreting stress-test results, drawing conclusions out of them, and making policy recommendations.

Objective

This thesis focuses on the sovereign debt exposures of the EU banking system to perform a series of empirical and counterfactual stress-test exercises. The results of these stress-tests aim at contributing to a better understanding of the distress propagation dynamics in the EU banking system. From an empirical perspective, the goal is to identify systemically important financial institutions and sovereign debt issuers, and to assess the system's vulnerability to shocks in the sovereign sector. From a theoretical perspective, the focus centers in assessing how alternative exposure structures affect the system's stability. The aim is to determine whether some exposure structures can enhance financial stability and – if so – under which conditions. This thesis implements four models of distress propagation: the model by Eisenberg and Noe (2001) (EN-model), the model by Rogers and Veraart (2013) (RV-model), the model by Battiston et al. (2012b) (aDR-model) and the model by Bardoscia et al. (2015) (cDR-model). This allows to discuss behavioral aspects of the models, and show their influence on the stress-test results.

Methodology

The stress-tests were performed on the 51 largest banks in the European Union, by assets. The banks' exposure to sovereign debt was taken from data released by the European Banking Authority (EBA) in the context of their yearly transparency exercise. Similarly to the banks' balance sheet information, this data is publicly available and additionally split by issuing country. The data on the interbank exposures was estimated, as is usual in similar studies, given that this information is not publicly available. Additionally, the banks' sovereign exposures were "reshuffled" to create three alternative synthetic exposure structures: a structure that maximizes geographical diversification, one that maximizes domestic exposure, and one that maximizes

foreign exposure. All synthetic exposure structures respect both the total debt held by each bank, and the total debt issued by each country.

The stress-tests consider three main shock scenarios. First, each bank is assumed to default. This allows determining the banks' impact on the system, and identify systemically important financial institutions. Secondly, the banks' sovereign exposures are shocked simultaneously with shocks of varying sizes. This scenario allows to measure the system's vulnerability to the sovereign sector, and to replicate behavioral results of the models previously found in the literature. The third stress-test scenario considers the case of isolated sovereign defaults. The goal of this scenario is to assess the impact of the individual sovereign debt issuers, and to determine their systemic importance. This stress-test is repeated for all synthetic exposure structures, allowing to identify any potential enhancement of financial stability due to their topological properties.

Results

The first empirical exercise finds that the highest impact of a bank's default, measured as the resulting global vulnerability, is 10.50% with the EN-model, 12.75% with the RV-model, 14.45% with the aDR-model and 22.82% with the cDR-model. The results also show that seven German banks rank among the top 10 most vulnerable banks in the interbank market. This indicates that the German banking system can be particularly vulnerable, even to shocks in assets it is not directly exposed to. The second empirical exercise shows that very large simultaneous shocks would be needed in the sovereign sector, to severely affect the banking system. It also shows how the models differ in assessing vulnerability. A 1.00% shock to the sovereign sector produces a 1.53% global vulnerability with the EN- and RV-model, 2.51% with the aDR-model and 7.08% with the cDR-model. The third empirical exercise shows that the models can produce different rankings of systemic importance. The models coincide, however, that Germany, Italy, France, Spain, and the US rank among the top 5. The impact of a German default, which ranks first in all models, can range from 17.86% in the EN-model, to 48.54% in the cDR-model.

The stress-tests performed on the synthetic exposure structures exhibit an inverse relation between the number of defaults and the global vulnerability. While the number of defaults is typically decreasing in the degree of diversification of the exposures, the global vulnerability increases. The reason lies in the definition of global vulnerability within the framework used in this thesis. The cDR-model is the only model that produces an increasing number of defaults, when diversification increases. This behavior provides an example of the well documented "robust-yet-fragile" property of connected networks. In this scenario, the cDR-model creates the necessary conditions, for diversification to act as a shock-amplification mechanism, instead of a shock-absorption one. An additional exercise suggests that there might exist a relation between the interbank market's geographical integration and the stability of the banking system.