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System-wide implications of funding risk

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HIGHLIGHTS

- Agent-based model of solvency and liquidity interactions of banks and asset managers, brought to real data.
- Channels included: (A) eligible liquidity buffers, (B) interbank funding, (C) fire sales; (D) funding cost vs solvency; (E) information contagion; (F) default risk.
- The main drivers of shock propagation identified.
- Policy relevant simulations included, i.e. a sensitivity analysis of macroprudential instruments.

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ABSTRACT

Funding risk has a systemic aspect that is frequently neglected in research and risk management applications. We build a model that focuses on systemic consequences of funding risk and its links with solvency conditions and account for pertinent interactions between market participants in an agent-based modelling fashion. The model is brought to a set of real banking system data of the stress test component of the 2014 Comprehensive Assessment in the EU, covering all the major banking groups in the EU. The potential shock amplification role of asset managers is studied in the theoretical part of the model, with some styled calibration and simulations. We investigate importance of the channels through which the funding shock hitting financial institutions can propagate across the financial system. We find that the drivers of the contagion transmission, related to available liquidity and capital buffers, sensitivities of funding cost to loss absorption capacity and asset prices to fire sales of assets depend on the heterogeneity of the agents in the financial system. Second, liquidity requirements are effective instruments to mitigate contagion risk. Third, the relationship between funding shocks and contagion losses is nonlinear and exhibits cliff effects. Fourth, we find evidence of an active cross-border channel of contagion with losses spreading from one country to another. Finally, behaviours of the agents under adverse funding conditions can influence the structure of the financial market and the topology of the interbank network under stress depends on the stringency of the regulatory requirements.

1. Introduction

Liquidity is the ability of an institution to generate cash using its assets to timely meet its obligations. Solvency is such a structure of the balance sheet that, with a high likelihood and in a given horizon the value of the balance sheet assets would cover the value of external funding. Liquidity and solvency are usually treated separately. For instance, capital requirements and liquidity requirements for credit institutions are stipulated in two disjoint parts of the European CRD IV regulation.[2]

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1 Some of the results presented in the paper were obtained when the author was an employee of the European Central Bank.

2 http://data.europa.eu/eli/dir/2013/36/2015-01-01

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Moreover, stress testing activities are split into solvency stress testing (e.g. ECB stress testing[3]) and liquidity stress tests (e.g. Deu [1]). But liquidity and solvency conditions are closely linked influencing each other through behaviours of market participants, especially in stressful market conditions. We explore this relationship in our model. We demonstrate the importance of feedback effects between solvency constraints and liquidity position and we test it in a detailed representation of the European banking system.

Our model is motivated by the fact that tools applied to understand and control liquidity and funding of banks usually lack a systemic perspective and do not account for strategic behaviours of market participants that may fuel systemic risk. A standard set of measures of systemic risk provisioned in the CRD IV and supporting bank supervisors, market overseers and macroprudential policymakers takes into account interconnectedness but in a simplified, rather static manner. Specifically, a systemic-risk scoring to impose a systemic risk capital buffer for banks deemed particularly important for the stability of the financial system includes measures of banks' assets and liabilities towards financial system. Moreover, the European Central Bank (ECB) identifies macroprudential risks and their early warnings using network-based measures and visualisation maps [2]. However, these methods exclude some important behavioural aspects of the financial market. The regulators, see BCB [3] have started to advocate *that authorities should emphasise developing integrated liquidity and solvency stress tests (as opposed to stand-alone liquidity stress test exercises)*. The approach taken in the article tries to fulfil a postulate of Demekas [4] to embed elements of agent-based models into the macroprudential stress tests. The agent-based models allow for *emergence of outcomes that could not have been predicted based on the past behaviour of individual agents in the financial system*. As Hałaj and Henry [5] notice, stress tests, especially those focused on liquidity, traditionally analyse financial institutions in isolation. The complexity of market connections makes it more difficult to unravel the channels of a potential contagion spreading. Behaviours and network topology matter as shown in sociology [6], epidemiology [7], transportation [8] or economics [9] but the market for funding and liquidity is particularly dependent on agents' dynamic behaviours and their interconnectedness.

In reality, a strong relationship between solvency and liquidity can be observed and we are particularly mindful about this entanglement in our model. One of the most prominent examples was the outburst of the 2007–2008 crises that was mainly driven by liquidity issues but translated into bankruptcies of some largest market players in the market (e.g. Lehman or AIG). There is also a reverse relationship whereby solvency risk translates into funding risk. Poor capitalisation of banks was reflected in the funding cost spreads, aggravated by solvency risk of some European sovereigns in 2010 as the second phase of the recent financial crisis erupted.

Agent-based models are useful to improve decision makers' understanding of effectiveness of policy instruments to mitigate systemic risk related to extreme funding conditions. Liquidity is in the scope of the macroprudential measures, even though not in the first line of instruments which focus directly on the provision of credit to the economy. However, in the contraction phase of the economic cycle, as specified by [10], LCR and NFSR limits can be effective but may not be sufficient. Liquidity Coverage Ratio (LCR) and Net Stable Funding Ratio (NSFR) are the instruments to control capacity of the assets to generate enough cash to cover short term liquidity outflows and appropriateness of the balance sheet structure to sustainedly finance the selected investment strategy. Difficulties are in the implementation: there may not be enough market depth to build up the cushion. Consequently, a severe funding shock may be amplified by banks and other market participants trying to tap liquidity from a drying up market. According to a study released by BIS Committee on the Global Financial System [11], the additional global demand for high quality liquid assets needed to meet the requirement of a sufficiently high LCR may amount to 1.8 trillion USD raising concerns about possible collateral shortages. Moreover, the increase of the liquidity buffers may have macroeconomic side effects of a reduced loan supply. Liquid instruments do not necessarily stimulate financing of the long-term projects in the economy. As Vítor Constâncio (the vice-president of the European Central Bank) claimed[4] the stress tests – one of the approaches to the macroprudential policy assessment – should embrace *a macro liquidity stress test in the solvency stress testing framework*.

Our model of funding and solvency interactions includes several parameters that can be controlled by standard macroprudential instruments. First, it is the so-called systemic risk buffer, i.e. the additional capital requirement imposed on the systemically important institutions. In our context, they can be perceived as those institutions providing liquidity to the system or amplifying liquidity shocks. Second, LCR and NFSR are the limits in the Basel III regulatory liquidity requirements that are potentiometers for the liquidity conditions imposed on banks. The baseline liquidity requirement assumes a full coverage of the liquidity outflows in a broad market stress conditions with the high quality assets. But the limit can be tuned according to the macroprudential needs. The model is useful for detection of the efficient limits in dampening the initial shocks and deactivating the financial contagion channels.

We contribute to the research on liquidity and solvency in the following way. First, we develop a framework of a consistent treatment of coupled liquidity and solvency conditions of banks which is a novel approach to a system-wide stress tests studying resilience to extreme funding conditions in the market. We call our ABM a 6-step model. That is because the main features of the framework are: (A) utilisation of direct liquidity buffers, i.e. the most liquid instruments equivalent of cash; (B) presence of the interbank funding channel; (C) ability to capture the amplification effects of funding shocks via fire sales; (D) relationship between funding cost of the rolled-over debt and changes in solvency ratios; (E) capturing the information

3 https://www.bankingsupervision.europa.eu/banking/comprehensive/html/index.en.html

4 See speech: https://www.ecb.europa.eu/press/key/date/2015/html/sp151029.en.html