Journal of Financial Economics 118 (2015) 336–354

Contents lists available at ScienceDirect

Journal of Financial Economics

journal homepage: www.elsevier.com/locate/jfec

# Liquidity hoarding and interbank market rates: The role of counterparty risk ☆

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ARTICLE INFO

*Article history:*
Received 15 December 2014
Accepted 13 February 2015
Available online 15 July 2015

*Keywords:*
Interbank market
Endogenous liquidity
Counterparty risk
Asymmetric information
Market break-down
Financial crisis

*JEL classification:*
G01
G21
D82

ABSTRACT

We develop a model of interbank lending and borrowing with counterparty risk. The model has two key ingredients. First, liquidity in the banking sector is endogenous, so there is an opportunity cost of holding liquid assets. Second, banks are privately informed about the risk of their long-term assets, which can lead to adverse selection and high interest rates in the interbank market. We identify a novel form of a market break-down, which can lead to liquidity hoarding. It arises because adverse selection in the interbank market changes the opportunity cost of holding liquidity. We use the model to shed light on developments in interbank markets prior to and during the 2007–09 financial crisis, as well as the effectiveness of policy interventions aimed at restoring interbank market activity.



## 1. Introduction

Interbank markets provide benchmark rates for the pricing of fixed-income securities throughout the economy, play a key role in the transmission of monetary policy, and are essential to banks' liquidity management. Their functioning in normal times and resilience in times of stress is, however, ill understood. For example, how was it possible that these markets, which are normally among the most liquid ones in the financial sector, were suddenly under severe stress in the 2007–09 financial crisis? And why were these markets dysfunctional throughout this period despite an unprecedented level of policy intervention, including massive injections of liquidity?[1]

We propose a model of interbank borrowing and lending with counterparty risk and analyze how banks' private information about the risk of their assets affects the trading and pricing of liquidity in the interbank market. Our model admits a full-participation equilibrium in which all banks borrow and lend in the interbank market and the interest rate is low. It also admits an adverse selection equilibrium in which only risky banks borrow and the interest rate is higher.

☆ We gratefully acknowledge helpful comments from Gaetano Antinolfi, Ana Babus, Sudipto Bhattacharya, Fabio Castiglionesi, Sudipto Dasgupta, Paolo Fulghieri, Gyöngyi Loranth, Beatriz Mariano, Kjell Nyborg, David Skeie, Javier Suarez and Lucy White (our discussants); Geert Bekaert, Patrick Bolton, Charles Calomiris, Elena Carletti, Nuno Cassola, V.V. Chari, Doug Diamond, Mathias Drehmann, Xavier Freixas, Roman Inderst, Philipp Hartmann, Manfred Kremer, Mike Lemmon, Antoine Martin, Enrico Perotti, Thomas Philippon (one of our referees), Tano Santos, Bill Schwert (the Editor), Elu von Thadden and an anonymous referee. We thank various seminar participants for helpful comments. Marco Lo Duca and Bobby Previti provided excellent research assistance. The views expressed do not necessarily reflect those of the European Central Bank or the Eurosystem.

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[1] The failure of the interbank market to redistribute liquidity was highlighted in a number of accounts of the 2007–09 crisis. See, for example, Brunnermeier (2009).

http://dx.doi.org/10.1016/j.jfineco.2015.07.002
0304-405X/

Finally, there can be a market break-down in which no interest rate is compatible with trade in the interbank market: The interest rate is high as only risky banks want to borrow, but it is not high enough to induce banks with a surplus of liquidity to lend. In anticipation of a market break-down, banks hoard liquidity.

This form of market break-down is novel. It is caused by the interplay of two factors, asymmetric information and endogenous liquidity in the banking system. Asymmetric information can lead to adverse selection in the interbank market. Endogenous liquidity means that borrowing and lending in the interbank market depend on how much liquidity (short-term assets/cash) banks hold ex ante. Creating liquidity ex post is costly because banks would have to liquidate long-term assets. Adverse selection and planning for future liquidity needs create two opposing forces on the interest rate in the interbank market that may lead to a situation in which no interest rate is compatible with a trade equilibrium. On the one hand, the interest rate must be high enough to compensate banks for counterparty risk when lending to an adverse selection of risky borrowers. On the other hand, adverse selection implies that safe banks in need of liquidity prefer to liquidate their long-term asset than to borrow. Anticipating the possibility of liquidation of the long-term asset makes holding the short-term asset more attractive ex ante, which attenuates an upward pressure on the interest rate.[2]

Our paper is related to two recent literatures, one that highlights the role of asymmetric information for market malfunctioning during the financial crisis, and another that examines the role of endogenous liquidity in banking. Focusing on the role of asymmetric information, Bolton, Santos, and Scheinkman (2011) and Malherbe (2014) model a situation in which buyers outside the banking system do not know whether the reason for a bank's asset sale is its liquidity need or its knowledge that the asset is of poor quality.[3] In Bolton, Santos, and Scheinkman (2011), this information asymmetry can lead to inefficient, early asset sales that take place before liquidity shocks occur. In Malherbe (2014), it can generate a self-fulfilling loop between future market illiquidity and current cash holdings. Neither paper obtains a complete market break-down.[4]

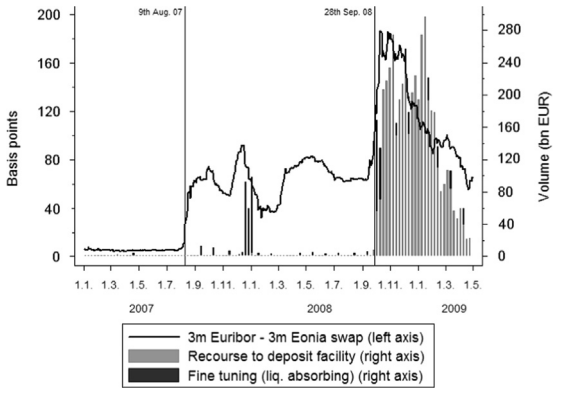


**Fig. 1.** Normal times, turmoil, and crisis in the euro area interbank market prior to and during the 2007–09 financial crisis. The (3m Euribor – 3m Eonia swap) spread (black line) is the euro area equivalent of the 3-month Libor-OIS spread. The 3-month Eonia swap is a measure of what the market expects the overnight unsecured rate (Eonia) to be over a three-month period and thus controls for interest rate expectations. Banks can hold excess reserves with the European Central Bank in two ways. First, they can access the Deposit Facility (gray bars), which is a standing facility available for banks on a continuous basis for overnight deposits. These are remunerated at a punitive rate, usually 100 basis points below the policy rate (the rate at Main Refinancing Operations). Second, the ECB occasionally offers banks the possibility to deposit funds for a short period of time at the policy rate, the so-called liquidity-absorbing Fine-Tuning Operations (black bars). Rates and volumes are weekly averages of daily data.

In the other strand of the literature, Diamond and Rajan (2005, 2011) explore the consequences of endogenous liquidity in banking but they do not consider asymmetric information or trade among banks. In Diamond and Rajan (2005), aggregate liquidity shortages lead to contagious bank failures because of an interplay of illiquidity (maturity mismatch) and insolvency. In Diamond and Rajan (2011), a shock to liquidity undermines bank value as investors anticipate the fire-sale of bank assets and require a higher rate of return ex ante.

We add to the literature by combining endogenous liquidity within the banking system with borrowing and lending among banks in the interbank market under asymmetric information about counterparty risk. In our model, the motive for trade does not reveal any information about asset quality. Instead, asymmetric information about asset quality leads to asymmetric information about counterparty risk in the interbank market.

Our model provides a coherent interpretation of the impact of the recent financial crisis on interbank market functioning based on asymmetric information about the risk of bank assets.[5] The three outcomes in our model (full participation, adverse selection, market break-down leading to liquidity hoarding) resemble the different phases of the (mal)functioning of the interbank market during the 2007–09 financial crisis. Fig. 1 plots the spread between

[2] By liquidating their long-term asset, safe banks exert a negative externality on risky banks. The liquidation may lower the interest rate to the point where lenders are not sufficiently compensated for counterparty risk. The standard negative externality of adverse selection is different and works in the opposite direction. There, the presence of risky banks increases the cost of borrowing for safe banks. In a recent paper, Milbradt and Oehmke (2015) study another, related negative information externality. In their analysis, firms that could not find long-term financing enter the market for short-term financing. This worsens the pool of short-term borrowers and drives better short-term projects into even shorter funding maturities setting in motion a short-termism spiral.

[3] Philippon and Skreta (2012) and Tirole (2012) take a normative approach and study optimal government interventions when markets are impaired by asymmetric information problems of the kind described above. Philippon and Schnabl (2013) study optimal interventions to address the issue of debt overhang.

[4] Bond and Leitner (2015) show how adverse selection leads to lower asset prices, which feed back into lower valuations of inventories and

(*footnote continued*)
tightens borrowing constraints. This feedback can be so strong that trade becomes overall unprofitable.

[5] Gorton (2008) explains how asymmetric information about the size and location of risk, and the accompanying fear of counterparty default, contributed to the 2007–09 financial crisis.