

B LIQUIDITY HOARDING AND INTERBANK MARKET SPREADS

Interbank markets play a key role in banks' liquidity management and the transmission of monetary policy. With the onset of the financial crisis, liquidity has been reduced in some segments of the interbank market. Moreover, since late September 2008, banks have hoarded liquidity instead of lending excess funds in the interbank market. The malfunctioning of interbank markets endangers the stability of the banking system. This special feature argues that asymmetric information about credit risk is an important factor contributing to these patterns.

INTRODUCTION

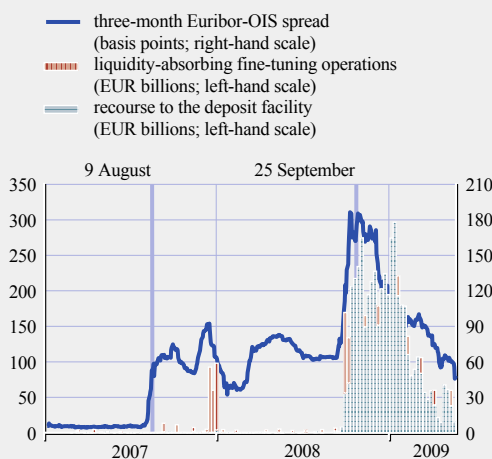
Money markets have undergone a dramatic change during the ongoing financial crisis. Before August 2007, euro area money markets were functioning smoothly. Rates were broadly stable, with little dispersion across counterparties, and the market was liquid, especially at the short end. When tensions originating in the US sub-prime mortgage market spilled over to the euro money market in August 2007, the picture changed. Interest rates jumped to higher levels and market activity declined, particularly in the unsecured money market segment with longer-term maturities.

A standard measure of tensions in the interbank market is the spread between the three-month unsecured interbank rate in the euro area (Euribor) and the three-month overnight index swap (OIS) rate. The OIS is a measure of what the market expects the overnight unsecured rate to be over a three-month period. Since interest rate expectations are controlled for,¹ the spread reflects other factors, such as liquidity effects² and credit risk. This special feature highlights how higher perceived credit risk can affect the functioning of the unsecured interbank market.³

Before August 2007, the Euribor/OIS spread was fairly stable, at around three to five basis points, reflecting the fact that liquidity was flowing smoothly between borrowers and lenders,

Chart B.1 Three phases in the euro area interbank market

(Jan. 2007 – May 2009)



Sources: ECB, Bloomberg, Thomson Financial Datastream and ECB calculations.

Note: The chart shows the spread between three-month bank borrowing costs and the three-month overnight index swap rate in the euro area, recourse to the ECB deposit facility (daily average flows per week in EUR billion), and liquidity-absorbing fine-tuning operations (daily average flows per week in EUR billions).

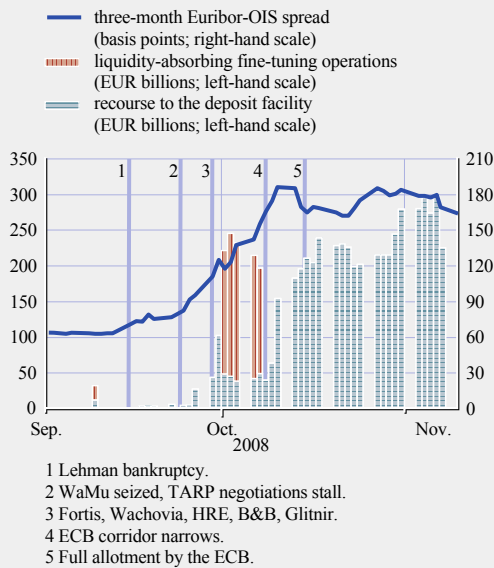
and that the probability of non-repayment of a money market loan was perceived to be low (see Chart B.1). As of August 2007, the spread jumped, and remained wide for around one year. Also, since the onset of the crisis, the overnight interbank market has seen an increase in volume. The average daily volume was €40.9 billion in the year to 9 August 2007. It increased by about 30%, to €52.1 billion, in the period between 9 August 2007 and 26 September 2008. This increase could reflect a substitution towards more short-term financing in the interbank market.

After further tensions emerged in September 2008, the spread again increased to unprecedented levels. The money market entered yet another qualitatively different phase. In addition to a

- 1 Usually, the overnight unsecured rate is very close to the ECB's minimum bid rate (the policy rate).
- 2 Liquidity risk premia in the unsecured interbank market were the subject of analysis in ECB, "Liquidity risk premia in money market spreads", *Financial Stability Review*, December 2008.
- 3 The analysis in this special feature is based on F. Heider, M. Hoerova and C. Holthausen, "Liquidity hoarding and interbank market spreads: the role of counterparty risk", *ECB Working Paper*, forthcoming.

Chart B.2 Transition to the third phase and major events in September – October 2008

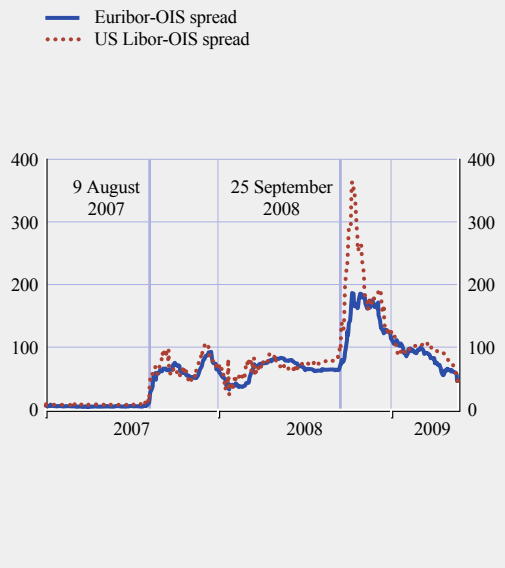
(Sep. 2008 – Nov. 2008)



Sources: ECB, Bloomberg, Thomson Financial Datastream and ECB calculations.
 Notes: The chart zooms in on the period between September and November 2008. It shows the spread between three-month bank borrowing costs and the overnight index swap in three months' time in the euro area, recourse to the ECB deposit facility, liquidity-absorbing fine-tuning operations, along with the major events in the time period.

Chart B.3 Three-month interbank spreads in the United States and the euro area

(Jan. 2007 – May 2009; basis points)



Sources: Bloomberg, Thomson Financial Datastream and ECB calculations.
 Note: The chart shows the spread between three-month bank borrowing costs and the three-month overnight index swap in the euro area and in the United States.

continuing rise in the spread, this third phase can be distinguished by a dramatic increase in the usage of the deposit facility by banks. The total liquidity absorbed by the ECB (deposits plus liquidity-absorbing open market operations) rose from a daily average of €0.09 billion in the week beginning 1 September 2008 to €169.4 billion in the week beginning 29 September 2008. Between the week beginning 22 September and the following week, the average daily volume in the overnight unsecured interbank market (not shown) in the euro area almost halved, a drop of €29.3 billion, while the amount of liquidity absorbed by the ECB increased by €152.9 billion. Banks seemed to prefer hoarding funds rather than lending them out even overnight.

The transition to the third phase and the major developments of the financial crisis at the time are depicted in more detail in Chart B.2. The amounts deposited with the ECB start rising after the collapse of Washington

Mutual, when the crisis spread beyond the US investment banking sphere. The process intensified when the crisis put some European banks under severe pressure at the end of September 2008. Importantly, this rise preceded the ECB announcement of a change in its tender procedure and in the standing facilities corridor on 8 October 2008.

A similar pattern in the three-month interbank market spread can be observed in the United States in the aforementioned time period, as documented in Chart B.3.⁴

Central banks are particularly concerned with the proper functioning of the interbank market because it is an important element in the transmission of monetary policy, and because it may affect financing conditions faced by non-financial corporations and households.

4 See also Box 3 in ECB, *Financial Stability Review*, December 2008.

As monopoly providers of base money, central banks are in a key position when it comes to ensuring its functioning. In many countries, central banks have reacted to events by introducing measures to support the interbank market, trying to prevent market-wide liquidity problems from turning into solvency problems for individual institutions, and thus threatening financial stability.

In particular, since the beginning of the turmoil, many central banks have increasingly become intermediaries for interbank transactions, as witnessed by the sharp increase in the size of their balance sheets (the size of the Eurosystem's balance sheet, for example, had temporarily almost doubled, compared with early 2007). Especially since the introduction of fixed rate tenders with full allotment in the Eurosystem's weekly refinancing operations, coupled with a narrower corridor for standing facilities, banks have been borrowing very large amounts in the Eurosystem refinancing operations. At the same time, banks have significantly increased their recourse to the regular deposit facility offered by the Eurosystem. Depositing with, and lending from, central banks has thus to some extent replaced interbank trading. More recently, at the beginning of 2009, the Eurosystem widened the corridor between its standing facility rates again, in an effort to reduce its intermediation role and to revive the interbank market.

RESEARCH ON INTERBANK MARKETS: SOME BACKGROUND

The research on which this special feature is based relates to a recent and growing literature that identifies potential sources of inefficiencies in the interbank market and examines the appropriate policy interventions to mitigate them. One possible friction is imperfect competition.⁴ Market power can make it possible for liquidity-rich banks to extract surpluses from banks that need liquidity to keep funding projects, which results in an inefficient allocation of resources. The role of a central bank would then be to provide an outside option for the banks suffering from a liquidity squeeze.

A second potential friction in interbank markets could arise if banks are subject to aggregate liquidity shocks, in addition to idiosyncratic liquidity shocks.⁵ Whereas interbank markets are well equipped to deal with the latter, difficulties can emerge with the former. Aggregate shocks can lead to volatile prices, even in secured interbank markets. In order to insure against such volatility, banks may want to hold excess liquidity, which is inefficient, as this implies passing up on profitable investment opportunities. Using open market operations, a central bank can commit to withdrawing excess liquidity in the event of low aggregate liquidity shocks, and to providing liquidity to the banking sector in the event of high aggregate liquidity shocks. A third source of inefficiency is the existence of multiple equilibria in interbank markets, some of which are more efficient than others.⁶ By steering interest rates, a central bank can act as a coordination device for market participants and ensure that a more efficient equilibrium is reached.

The analysis in this special feature adds asymmetric information about counterparty risk to the list of possible frictions.⁷ Asymmetric information has been singled out by commentators, market participants and policy-makers as an important ingredient in the breakdown of interbank markets.⁸ For example, it has been argued that it is important to distinguish between general uncertainty and asymmetric information when examining their

- 5 V. Acharya, D. Gromb and T. Yorulmazer, "Imperfect competition in the interbank market for liquidity as a rationale for central banking", *London Business School Working Paper*, 2008.
- 6 F. Allen, E. Carletti and D. Gale, "Interbank market liquidity and central bank intervention", *Journal of Monetary Economics*, forthcoming.
- 7 X. Freixas, A. Martin and D. Skeie, "Bank liquidity, interbank markets and monetary policy", *Federal Reserve Bank of New York Working Paper*, 2008.
- 8 D. Greenlaw, J. Hatzius, A. Kashyap and H. Shin, "Leveraged losses: lessons from the mortgage market meltdown", *U.S. Monetary Policy Forum Report No.2*, 2008; J. Danielsson and C. de Vries, "Money market on strike", *Financial Times*, 9 November 2008; and N. Cassola, C. Holthausen and F. Würtz, "The 2007/2008 experience of the European Central Bank", paper presented at the FRB Chicago and ECB Conference on "The Credit Market Turmoil of 2007-08: Implications for Public Policy", November 2008.

role in the dynamics and scope of the turmoil, as well as in the transmission of the original shocks in the US sub-prime market across the financial sector.⁹ Moreover, under asymmetric information, monetary transmission may not be solely based on the interest rate channel, but may also depend on a rationing channel. When monetary policy tightens, bank deposits decline and banks with less liquid balance sheets may additionally be rationed in the interbank market. Both effects reinforce each other and lead to a reduction in bank lending.¹⁰

THE ROLE OF COUNTERPARTY RISK

Asymmetric information about counterparty risk can generate various regimes in the unsecured interbank market, akin to those observed before and during the current financial crisis. In the first regime, borrowers and lenders participate fully in the interbank market, despite asymmetric information. There is no impairment to the market functioning. In the second regime, the interbank market is characterised by adverse selection. There is still borrowing and lending in the market. However, safer banks in need of liquidity find the interest rate too high and prefer to obtain liquidity elsewhere. The interest rate rises to reflect the fact that only riskier banks are continuing to borrow in the unsecured market. In the third regime, the interbank market breaks down. This happens either because lenders prefer to hoard liquidity instead of lending it to an adverse selection of borrowers (lack of supply), or because even riskier borrowers find the interest rate too high to borrow (lack of demand).

The analysis has a number of building blocks. First of all, the business of banks is assumed to be maturity transformation, i.e. banks take in deposits and use these funds to make loans. Loans are illiquid investments in that the return on the investment will be low if a bank needs to call in a loan prematurely. As deposits can be withdrawn on demand, banks also hold some liquidity buffers in order to be able to repay depositors. However, there is uncertainty about the demand for withdrawals a bank will face, with some banks having high levels of

withdrawals and others having low levels. This uncertainty, also known as idiosyncratic liquidity shocks, motivates banks' trading in the interbank market. Banks with a liquidity shortage can borrow from banks that have a surplus of liquidity. Lending in the interbank market is not risk-free, since banks' illiquid investments are risky. Banks whose investments fail to produce good returns may well find it difficult to repay interbank loans. Lenders anticipate this, and charge a risk premium for the part of the interbank transaction that is not secured.¹¹

Whenever possible, banks prefer to manage their liquidity needs in the interbank market rather than calling in loans. However, asymmetric information about the risk of illiquid investment can impair the functioning of the interbank market. Suppose that a bank knows more about the risk of its own investments than about the investments of other banks, and vice versa. Then, banks have private information about their own ability to pay back interbank loans: there is asymmetric information about counterparty risk. An example of such a situation would be that some banks are holding sub-prime assets with a default probability of, say, 10%, while holdings of other banks have a default probability of 30%. Even though the average probability of default in the economy is known to be 20% and there is no underestimation of risk on average, counterparties cannot distinguish between banks with safer and banks with riskier investments.

Both safer and riskier banks may face high demand for withdrawals, and would thus like to borrow in the interbank market. However, riskier banks impose an externality on banks with safer investments. Lenders in the interbank market know that they are imperfectly

9 N. Cassola, M. Drehmann, P. Hartmann, M. Lo Duca and M. Scheicher, "A research perspective on the propagation of the credit market turmoil", *ECB Research Bulletin*, June 2008.

10 X. Freixas and J. Jorje, "The role of interbank markets in monetary policy: a model with rationing", *Journal of Money, Credit and Banking*, Vol. 40, No 6, September 2008.

11 In order to clearly spell out the role of counterparty risk in the interbank market, the analysis abstracts from aggregate liquidity shocks, i.e. shocks affecting the liquidity needs of all banks at the same time.

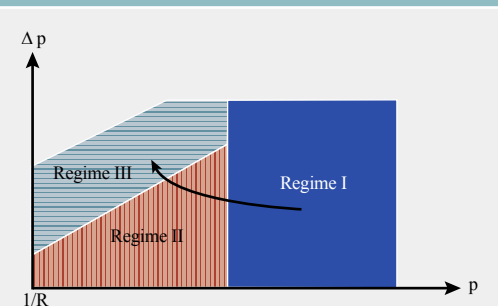
informed about counterparty risk and protect themselves by charging a risk premium based on the average level of counterparty risk, i.e. banks with safer investments subsidise the cost of liquidity of banks with relatively riskier investments. There will be a point when the cost of the subsidy will be higher than the cost of obtaining liquidity outside the unsecured interbank market. Since banks with safer investments hold better-quality assets, they have better options for obtaining liquidity elsewhere. Thus, they are the first to leave the unsecured market if the interest rate becomes too high. It is therefore possible that there is an *adverse selection* of risky borrowers in the unsecured interbank market.

Under adverse selection, the interest rate in the interbank market rises. There are two effects, both of which work to increase the interest rate. First, from the point of view of the lender, counterparty risk is higher. In addition, there is also a composition effect, as only risky banks borrow in the interbank market.

Although the interest rate rises, it does not immediately mean that lenders will want to lend to an adverse selection of borrowers. In particular, if riskier banks are expected to be close to insolvency, then liquidity-rich banks may refuse to lend to such risky borrowers. Instead, they will prefer to store their liquidity, e.g. using cash or a central bank's deposit facility. The interbank market then breaks down due to a lack of supply. Alternatively, the market can also break down due to lack of demand. This occurs when adverse selection causes the interest rate to increase so much that even risky banks find it too expensive to borrow unsecured funds and prefer to get liquidity elsewhere.

To sum up, there are three distinct regimes in the interbank market when there is asymmetric information about counterparty risk: normal times with full participation of safe and risky borrowers (Regime I), adverse selection (participation of risky borrowers only) (Regime II) and market breakdown (Regime III). Chart B.4 illustrates which regime occurs under different parameters

Chart B.4 Transition between regimes



Sources: F. Heider, M. Hoerova and C. Holthausen, "Liquidity hoarding and interbank market spreads: the role of counterparty risk", *ECB Working Paper*, forthcoming.

Note: The chart shows which regime occurs under different values for average counterparty risk, p , and the dispersion of counterparty risk, Δp . A higher value of p indicates a lower amount of counterparty risk, and vice versa. The figure is drawn for levels of counterparty risk such that the expected net return on bank loans is positive, i.e. p remains above $1/R$ where R stands for the return on bank loans.

for average counterparty risk (the horizontal axis), and the dispersion of counterparty risk, i.e. the difference in the probability of default between safer and riskier banks (the vertical axis).

When the average level of counterparty risk is low, there is full participation in the interbank market (Regime I), regardless of the dispersion of counterparty risk. Asymmetric information about the risk of illiquid investments does not impair the functioning of the interbank market as long as the overall level of risk is low. Once the average counterparty risk rises, driving up the interest rate in the interbank market beyond a certain threshold, safer banks with a liquidity shortage prefer to get liquidity elsewhere. Only an adverse selection of riskier banks keeps borrowing, causing the interest rate to increase even further. Once there is adverse selection in the interbank market (Regime II), the dispersion of counterparty risk matters. Good risks and bad risks no longer cancel each other out in the market. An increase in the dispersion of risk alone, without an increase in the level of risk, can lead to a breakdown of the interbank market and the hoarding of liquidity.

The arrow in Chart B.4 depicts a change in the level and the dispersion of counterparty risk

and a corresponding transition between regimes that echoes the experience of interbank markets before and during the financial crisis of 2007-09. As explained in Chart B.1, three different phases seem to characterise the situation in the interbank market: (i) normal times, (ii) elevated spreads, but no recourse to the ECB deposit facility, and (iii) further increase in spreads with a substantial depositing of funds overnight with the ECB. The phases resemble the different regimes described above. Moreover, the transition across regimes implies a change in the underlying level and dispersion of counterparty risk that is consistent with the development of actual events. First, the transition from Regime I to Regime II occurred at the start of the crisis in August 2007. At that time, sub-prime mortgage-backed securities were discovered in portfolios of banks and bank-sponsored conduits, leading to a reassessment of the level of risk. The extent of exposures was unknown and counterparties could not distinguish safe from risky banks.

Since the onset of the crisis in August 2007, the money market has also become two-tiered, with banks in possession of high-quality (i.e. safe) collateral being able to attract funds at relatively low rates in the repo market, while second-tier (riskier) banks are having difficulties in attracting funds even at higher rates. It appears that not all banks have been equally impacted by credit risk concerns, which corresponds well to the notion of adverse selection.

The transition from Regime II to Regime III occurred at the moment of the dramatic events surrounding the last weekend of September 2008. Before the weekend, Washington Mutual, the largest savings and loan (S&L) institution in the United States, was seized by the Federal Deposit Insurance Corporation (FDIC) and sold to JPMorgan Chase. At the same time, negotiations on the Troubled Asset Relief Program (TARP) rescue package stalled in the US Congress. Over the weekend, it was reported that the crisis had spread to Europe, affecting some banks. These events were signs of the financial crisis spreading outside the realm of

investment banking and into the global financial system. They could be interpreted as a further increase in the level and, possibly, dispersion of counterparty risk.

POLICY RESPONSES

A number of policy interventions were discussed and implemented to deal with the strains observed in the interbank markets since August 2007, strains that posed a threat to financial stability. In this section, several policy interventions are briefly discussed in the light of the arguments above.

The presence of riskier banks in the interbank market can drive up interest rates. Since lenders cannot distinguish between safer and riskier banks, this imposes an externality on safer banks. Central banks can mitigate this by offering ample liquidity to all banks. In order to have a balanced intervention, the central bank can also offer to accept deposits from banks with excess liquidity and possibly remunerate them. The central bank would effectively become an intermediary. It would be the counterparty for all liquidity transactions, replacing the interbank market.

Interbank market guarantees were also discussed as a policy intervention, the aim of which would be to encourage banks to lend to each other. Depending on their scope, guarantees reduce or even eliminate counterparty risk, thus lowering the interbank interest rate. Lower interest rates in turn induce safer banks to borrow again in the interbank market.

At the same time, there are ongoing discussions on regulatory policies, which would help prevent future tensions in the interbank market, and thus promote financial stability. In this context, imposing minimal liquidity requirements on banks has been mentioned. These ensure that banks hold high enough liquidity buffers, which in turn lowers the price of liquidity in the interbank market and encourages full participation. The drawback is that banks are forced to hold more

liquidity and forego part of the return on the profitable illiquid investment. This introduces a distortion into banks' investment decisions.

Finally, enhancing market transparency could prevent future interbank market stress. It would reduce the asymmetry of information and enable lenders to better distinguish between safer and riskier borrowers.

CONCLUDING REMARKS

The failure of the interbank market to redistribute liquidity has become a key feature of the financial crisis. This special feature focuses on the role of counterparty risk as one of the factors affecting the functioning of the unsecured interbank markets and posing a threat to financial stability. The analysis suggests that asymmetric information about counterparty risk can generate various regimes in the interbank market, akin to those observed in the interbank markets before and during the current financial crisis. Against this background, the effects of various policy interventions are analysed.