
The transmission of liquidity shocks during the crisis

The latest research suggests the emergence of new channels through which liquidity shocks were transmitted.

The rapid transmission of the subprime mortgage crisis in the United States to other domestic and foreign financial markets raises several questions of great importance to central banks and financial regulators. Through which mechanisms were the liquidity shocks transmitted across financial markets during this period? Why did the episode of funding illiquidity in structured investment vehicles (SIVs) and conduits turn into an issue of bank insolvency?

Conceptually, a number of new transmission mechanisms are likely to have been established (or become more important than usual) during periods of turbulence, either through increased market liquidity, funding liquidity, or even default risks. The relative strength of the interaction between these factors during the subprime crisis of 2007 is an empirical question, which we analyse in our research.¹

The mechanisms through which liquidity shocks influence various markets during normal times may operate through different channels to those that appear during times of financial stress. During tranquil periods, market illiquidity shocks are typically short-lived as they create opportunities for traders to profit and, in doing so, provide liquidity and contribute to the price-discovery process. **Good vs bad times**

However, during periods of crisis, several mechanisms may amplify liquidity shocks across financial markets, creating systemic risks. These mechanisms can operate through direct linkages between the balance sheets of financial institutions, but also indirectly through asset prices. As the current crisis has demonstrated, these price movements are set in motion when financial institutions face marked-to-market losses. As a consequence, positions are deleveraged, and if the value of the corresponding assets is significantly affected, the creditworthiness of the respective institutions will deteriorate due to increasing default risk. Clearly, then, leverage is procyclical and amplifies the financial cycle.

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An anatomy of the crisis

In investigating how the various segments of financial market in the United States were affected during the subprime crisis, we distinguish between “market liquidity” and “funding liquidity”. Market liquidity is an asset-specific characteristic measuring the ease with which positions can be traded, without significantly affecting their corresponding asset price. In contrast, funding liquidity refers to the availability of funds such that a solvent agent is able to borrow in the market in order to service outstanding obligations.

It is useful to briefly review the chronology of the recent turbulence, starting in the summer of 2007. As is well-known, the initial shock came in the form of deteriorating quality of subprime mortgages in the United States. This was essentially a credit, rather than a liquidity event. This shock spread across different asset classes and financial markets due to a high degree of asymmetric information associated with the complexity of the structured mortgage products. This process was subsequently strengthened by a widespread re-pricing of risk and a general decrease in investors’ risk appetite.

The next step in the crisis saw an increase in delinquencies on subprime mortgages leading to greater uncertainty surrounding the value of a number of other structured credit products that had these assets in their underlying portfolios. Consequently, rating agencies downgraded many of these securities and announced changes in their methodologies, first in mid July but then again in mid August and in mid October. Meanwhile, structured credit mortgage-backed instruments measured by the asset-back security indices (ABX) saw rapid declines, and the liquidity for initially tradable securities in their respective secondary markets evaporated. The losses, downgrades, and changes in methodologies shattered investor confidence in the rating agencies’ abilities to evaluate risks of complex securities. As a result, investors pulled back from structured products en masse.

Spotlight on SIVs It soon became apparent that a wide range of financial institutions had exposures to many of these mortgage-backed securities, often off-balance sheet entities, such as conduits and structured investment vehicles (SIVs), which were funded through the issuance of short-term asset-backed commercial paper (ABCP) in order to take advantage of a yield differential resulting in a maturity mismatch. This created an inherent maturity mismatch. Due to the increasing uncertainty associated with exposures to the underlying mortgage-backed securities (and their values), investors became unwilling to roll over the corresponding ABCP.

As the problems with SIVs and conduits deepened, banks came under increasing pressure to rescue those that they had sponsored by providing liquidity or by taking their respective assets onto their own balance sheets. As a result, the balance sheets of these banks were particularly strained. A further strain on banks’ balance sheets came from warehousing a higher than expected amount of mortgages and leveraged loans, the latter usually passed on to investors in order to fund the highly leveraged debt deals of private equity firms. Both the market for mortgages and leveraged loans dried up due to the collapse of transactions in the mortgage-related securitisation market and collateralised loan obligations. Banks also felt obliged to honour liquidity commitments to alternative market participants, such as hedge funds and other financial institutions, which were also suffering from the drain of liquidity. Consequently, the level of interbank

lending declined both for reasons of liquidity and credit risk. Money markets were affected, as was evident from a widening of the Libor–overnight index swap spreads, which in turn led to increased funding costs.

As turbulence related to subprime mortgages heightened, financial markets more generally showed signs of stress and investor preference moved away from complex structured products in a flight to liquidity. Subsequently, positions were shifted in order to invest in only the safest and most liquid of assets, such as Treasury bonds. **Flight to liquidity**

Hedge funds too felt the sting of reduced liquidity. Those that held asset-backed securities and other structured products were burdened by increased margin requirements, driven in turn by greater market volatility. As a consequence, they attempted to offload the more liquid parts of their portfolios in order to meet these margin calls and also limited possible redemptions by investors.

The evident deterioration of market and funding liquidity conditions had implications for the solvency position of banks for several reasons. First, financial institutions saw a decline in the values of the securitised mortgages and structured securities on their balance sheets, resulting in extensive write-downs. Second, funding liquidity pressures forced rapid deleveraging during this period, further depressing asset prices. Third, funding costs increased due to rising money market spreads, which was amplified by an increasing reliance on funding from wholesale money markets. These pressures resulted in declining capital ratios throughout the banking sector and significant increases in credit default swap spreads across the banking sector. **The spectre of insolvency**

Data and methodology

The transmission mechanisms of liquidity shocks across differing financial markets outlined so far have been described as being unidirectional and sequential. But in periods of financial stress re-enforcing liquidity spirals are likely to be set in motion. The likely multi-directionality with which shocks are transmitted during a crisis motivates the use of a Dynamic Conditional Correlation GARCH specification to test these effects.² This specification allows us to model the correlation dynamics between asset classes in order to evaluate whether the co-movement between different markets increased during the crisis.

The model uses a system of five corresponding variables to capture key linkages, which act as proxies for overall market liquidity, funding liquidity, default risk and volatility. Firstly, **funding liquidity** conditions in the **asset-backed commercial paper market** are modelled by the spread between the yield of three-month ABCP and that of three-month US Treasury bills. The second variable examined in the system is the spread between the three-month US interbank Libor rate and the overnight index swap, which measures **bank funding liquidity** pressures. Thirdly, S&P 500 stock market returns are included into the reduced form model, whereby in its second moment it serves as a proxy for **market volatility**. The spread between the yield on two-year on-the-run (the most recently issued) and the off-the-run (previously issued) US Treasuries captures **overall market liquidity** conditions. Finally, **default risk** of banks is modelled by the credit default swap spreads of 12 large complex financial institutions.

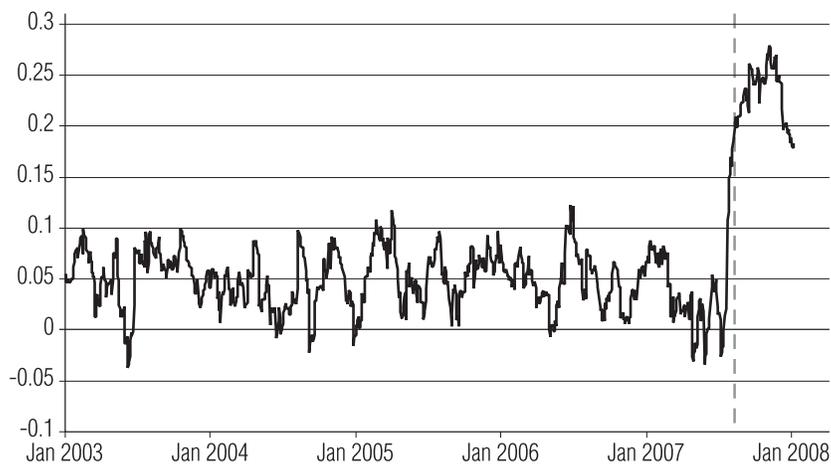
Results

The results from our model indicate a sharply increased interaction between the various proxies for market and funding liquidity. The implied correlations between the ABCP and Libor spreads rise from a pre-crisis average of approximately 0.3 to above 0.5, a level at which they remain. Furthermore, the linkages between these two funding liquidity measures and the two-year on-the-run/off-the-run spread jump from around zero to 0.2 (see Figure 1 for example). Stronger interactions between the market liquidity in the bond market and the stock market return volatility are evident with S&P 500 returns and the two year on-the-run spread becoming more highly correlated with each other and with all other variables. Finally, the co-movement between liquidity and solvency also increases sharply, as illustrated in Figure 2. Prior to the hypothesised structural break at the end of July 2007, changes in the credit default swap spreads remain approximately uncorrelated with all other measures.

Figure 1: Conditional correlation - Libor and two-year bond spread



Figure 2: Conditional correlation - ABCP and CDS



In summary, the various proxies for funding and market liquidity, stock market volatility and bank default risk exhibited extraordinary co-movement during the subprime crisis. As the correlations on these variables were fairly small in the pre-crisis period, the results suggest that new channels for transmission of liquidity shocks were established during the second half of 2007. The results of a very pronounced interaction between market and funding liquidity are consistent with the emergence of re-enforcing liquidity spirals during the crisis. On the one side of this liquidity spiral, financial institutions were exposed to refinancing needs in the form of issuing ABCP, a situation where market illiquidity in complex structured products led to funding illiquidity. In this regard, the results also show that increased correlations between the asset-back commercial paper and Libor spreads reduced the possibilities of funding from the interbank money market, thus highlighting systemic risks. Though not shown explicitly in the paper, on the other side of this spiral, many European banks with large exposures to American asset-backed securities had difficulties accessing wholesale funding, leading to subsequent market illiquidity in different market segments.

From liquidity to solvency concerns

In addition to the described period of illiquidity, the subprime crisis increasingly became one of insolvency, as banks such as Northern Rock, IKB and Bear Stearns had to be rescued. This is captured by the implied correlations between the credit default swaps and other variables in the model, which show clear signs of a structural break during the crisis period. Furthermore, these correlations have remained at elevated levels since then, suggesting that solvency concerns remain an issue.

Finally, it is also shown that seemingly unrelated stock and bond markets were affected during these times of severe stress. These transmission mechanisms were not restricted to the financial markets in the United States, but were also observed across other advanced and key emerging market economies. □

Notes

1. See Frank, González-Hermosillo and Heiko Hesse (2008) and Chapter 3 in the latest Global Financial Stability Report (IMF, 2008).
2. We employ the specification developed by Capiello, Engle and Sheppard (2006). This allows for an evaluation of the time variation in the conditional correlations between variables, in addition to accounting for structural breaks in their respective data generating processes. The multivariate GARCH framework also takes the heteroskedasticity exhibited by the data into account, which is particularly useful for the analysis of crisis periods.

References

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