Discussion of "Interbank Lending, Credit-Risk Premia, and Collateral"*

Ernst-Ludwig von Thadden
University of Mannheim

This is an ambitious paper. It studies the interaction between secured interbank lending, unsecured interbank lending, and banks' portfolio choices. It is motivated by a puzzling empirical observation, namely the "decoupling of secured and unsecured lending rates" in the Great Financial Crisis of 2007–09.

The observation made by Heider and Hoerova is that on August 9, 2007, not only did secured three-month interbank rates start to exhibit historically unprecedented discounts to unsecured rates, but the time-series behavior of both rates began to diverge as never before. Furthermore, the discount of secured interbank rates fluctuated more strongly in the United States than in the euro area. While the evidence consists of only two plots of time series, it is obvious without any further econometric analysis that the phenomenon is there and is significant.

The simple observation that unsecured lending became more expensive than secured lending in a period of financial turbulence is not surprising. Any model of lending will produce this result. What is puzzling is the decoupling of the time-series behavior. In order to address this puzzle, Heider and Hoerova propose a model of interbank borrowing that imbeds both types of interbank markets into a model of bank portfolio management under investment risk. This model exhibits a key feature of what seems to have occurred after August 2007: the dramatic change in the risk of bank portfolios has affected secured and unsecured interbank rates differently. While this result is derived in an essentially static model, it is plausible and contributes greatly to our understanding of the crisis.

*Author contact: Ernst-Ludwig von Thadden, University of Mannheim, Department of Economics, L7, D-68131 Mannheim. E-mail: vthadden@uni-mannheim.de.

The model is ambitious because it integrates three assets into a model of liquidity provision by the banking sector—namely cash, bank loans, and government bonds—and links banks by an unsecured interbank market. The model remains tractable because the authors use a clever shortcut to model the repo market: instead of modeling collateralized borrowing literally, they consider the outright sale of safe bonds as a means to generate liquidity, thus ignoring the repurchase leg of the transaction. This means that there are essentially two markets to be considered: the market for unsecured lending and the market for safe bonds, which are linked through a no-arbitrage condition.

Much of the mechanics of the analysis and some of its shortcomings can be understood by dropping the bond market and studying the case of only two assets. This is what I will do in most of the comments that follow. In these comments I will highlight the following conceptual issues:

- balance-sheet liquidity
- equilibrium in the interbank market
- provision of economy-wide liquidity

All of these issues are simplified in one way or another in the paper by Heider and Hoerova and thus provide fertile ground for further research. But while the paper may be too brief or oversimplify on some of these issues, it stands out by blazing a trail through a highly complex set of questions and by providing a benchmark model that is very useful and that I expect to become widely used.

The model features competitive banks in the tradition of Diamond and Dybvig (1983) that manage funds on behalf of households with uncertain liquidity needs. In exchange for collecting the funds of the household sector at date $t = 0$, banks promise households a repayment on demand of either c_1 in $t = 1$ or of c_2 in $t = 2$. In the spirit of Bhattacharya and Gale (1987), aggregate liquidity demand by households in the economy is certain, but liquidity demand at each bank is either λ_l or λ_h, with $\lambda_l < \lambda_h$ and $\lambda = \pi_l\lambda_l + \pi_h\lambda_h$, $\pi_l + \pi_h = 1$. At date $t = 0$, banks are identical, have no equity capital, and can invest their funds into a liquid asset with zero net return ("cash"), or an illiquid risky asset, or in a safe long-term bond that is in limited supply. The illiquid asset repays nothing at date 1 but has a risky return of R with probability p at date 2 (and pays nothing with the complementary probability $1-p$).

The initial balance sheet of a representative bank is therefore

α	Illiquid Risky Asset		
β	Safe Bond	1	Deposits
$1-\alpha-\beta$	Cash		

As noted above, I will here focus mostly on the case $\beta = 0$.

At date 1, each bank holds liquid reserves of $1-\alpha$ and faces liquidity demand of either $\lambda_l c_1$ or $\lambda_h c_1$. In the latter case, the bank borrows inelastically on the (unsecured) interbank market the amount

$$D_h = 1 - \alpha - \lambda_h c_1. \tag{1}$$

In the former case, the bank has excess liquidity and can hold it in terms of cash or lend it in the interbank market at the rate r. Cash holdings C_l and interbank loans L_l are related by the date 1 budget constraint

$$C_l + L_l + \lambda_l c_1 = 1 - \alpha. \tag{2}$$

The bank's date 2 profits now are a random variable with four possible realizations: its illiquid risky asset can pay off or not, and the counterparty in the interbank market can repay or not. Heider and Hoerova assume that banks' portfolio risks are identically and independently distributed. Since a bank that borrows in the interbank market only has illiquid risky assets, the counterparty failure risk $1-\hat{p}$ for the l-type bank is simply the common failure risk of the illiquid risky asset, $1-p$. Assuming that

$$(1-\lambda_l)c_2 \leq \alpha R \text{ and } \lambda_l c_1 \leq 1 - \alpha \tag{3}$$

(as Heider and Hoerova implicitly do), the bank's expected date 2 profit is

$$\begin{aligned}\Pi = {} & p[\alpha R + C_l + \hat{p}(1+r)L_l - (1-\lambda_l)c_2] \\ & + (1-p)\hat{p}\max(0, C_l + (1+r)L_l - (1-\lambda_l)c_2).\end{aligned} \tag{4}$$

The term in square brackets in (4) is the bank's return if its illiquid asset pays off, and the maximum term is its return if its illiquid asset does not pay off but the counterparty is solvent. Let

$$S_l = 1 - \alpha - \lambda_l c_1 - (1 - \lambda_l)c_2 \tag{5}$$

denote the difference of the bank's liquid assets and its expected fixed payout obligations. S_l is a measure of the bank's balance-sheet liquidity.

Then, using (2) to eliminate C_l and rearranging (4), we have

$$\Pi = \begin{cases} p\alpha R + pS_l + p(\hat{p}(1+r) - 1)L_l & \text{if } rL_l + S_l \leq 0 \\ p\alpha R + (p + (1-p)\hat{p})S_l + (\hat{p}r - p(1-\hat{p}))L_l & \text{if } rL_l + S_l \geq 0 \end{cases} \tag{6}$$

At date 1, the bank maximizes Π over $0 \leq L_l \leq 1 - \alpha - \lambda_l c_1$. In their analysis, Heider and Hoerova implicitly assume that $rL_l + S_l \leq 0$. Under this assumption, their analysis is correct, but it is not clear that this assumption is justified. The bank's balance-sheet liquidity is an important part of the bank's date 0 optimization problem, and it may well be optimal to set it at levels that invalidate Heider and Hoerova's assumption.

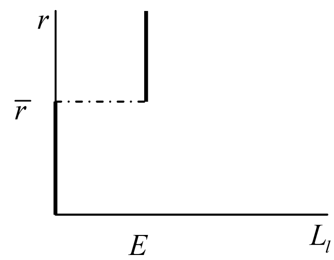
Turning to the supply of loanable funds in the interbank market, (6) shows that this supply is bang-bang: for small interest rates r it is 0, and for sufficiently large rates it is equal to the total amount of excess cash (per lending bank):

$$E = 1 - \alpha - \lambda_l c_1. \tag{7}$$

In between, there is an interest $\overline{r}$ at which the banks with high liquidity (l-type) are indifferent as to how much they want to lend. Hence, the supply function of loanable funds by the individual bank looks like that shown in figure 1.

Using (6), it can be shown that the critical interest rate satisfies $\overline{r} < \frac{1}{\hat{p}} - 1$. Equilibrium in the interbank market requires that the total supply of loanable funds, $\pi_l L_l$, be equal to the total demand for loans, $\pi_h D_h$. There can be two types of equilibria—either $L_l = E$ with an arbitrary equilibrium interest rate $r \geq \hat{r}$, or $L_l < E$ and $r = \hat{r}$. Figure 2 provides examples of both types of equilibria.

Figure 1. Individual Loan Supply

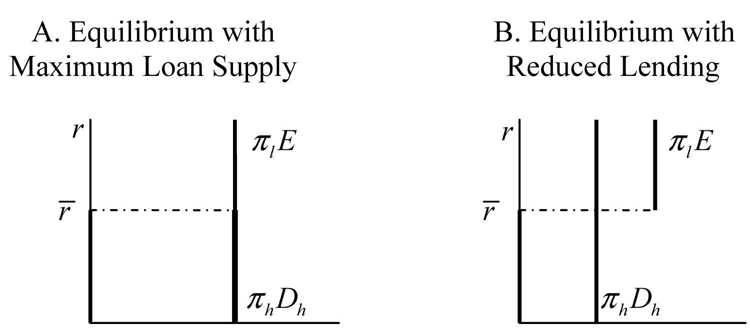


In the former equilibrium (figure 2A), (1) and (7) imply that

$$1 - \alpha = \lambda c_1, \tag{8}$$

which is the situation considered in lemma 3 (and correspondingly, in lemma 6) of the paper. But what about equilibria of the type depicted in figure 2B? There are parameter constellations under which such equilibria can exist as well, and it would be interesting to know more about them. In such equilibria, banks hoard liquidity at date 0. Therefore, banks with liquidity needs at date 1 only need to borrow little, and banks with excess liquidity only provide what is needed, keeping the rest on their balance sheet. Such behavior corresponds to more "prudent" banking and therefore may not be a good description of what happened in the run-up to the Great Financial Crisis. But they exist, and it may be interesting to investigate also theoretically why they may not be selected.

Figure 2. Equilibrium in the Interbank Market



A final question that is left open by the analysis in the paper is the question of what determines the consumption allocations (c_1, c_2). In the paper, this is taken as exogenous, and the equilibrium allocations are computed as a function of (c_1, c_2). This is certainly a useful first step but should be carried further in subsequent work. One way to endogenize bank liabilities is, of course, the classical motive of liquidity insurance by Diamond and Dybvig (1983). It may well be that this way to close the model can simply be added to the existing analysis, but care needs to be taken with respect to the many implicit assumptions in the model such as (3) above. But if this is done properly, it may well be that endogenizing bank liabilities even solves the multiplicity problem noted earlier. There are a number of questions that this paper leaves open, but the research agenda opened by Heider and Hoerova is very promising.

References

Diamond, D. W., and P. H. Dybvig. 1983 "Bank Runs, Deposit Insurance, and Liquidity." *Journal of Political Economy* 91 (3): 401–19.

Bhattacharya, S., and D. Gale. 1987. "Preference Shocks, Liquidity, and Central Bank Policy." In *New Approaches to Monetary Economics*, ed. W. A. Barnett and K. J. Singleton. Cambridge: Cambridge University Press.