EUROPEAN CENTRAL BANK

EUROSYSTEM

Repo markets, counterparty risk, and the 2007/2008 liquidity crisis

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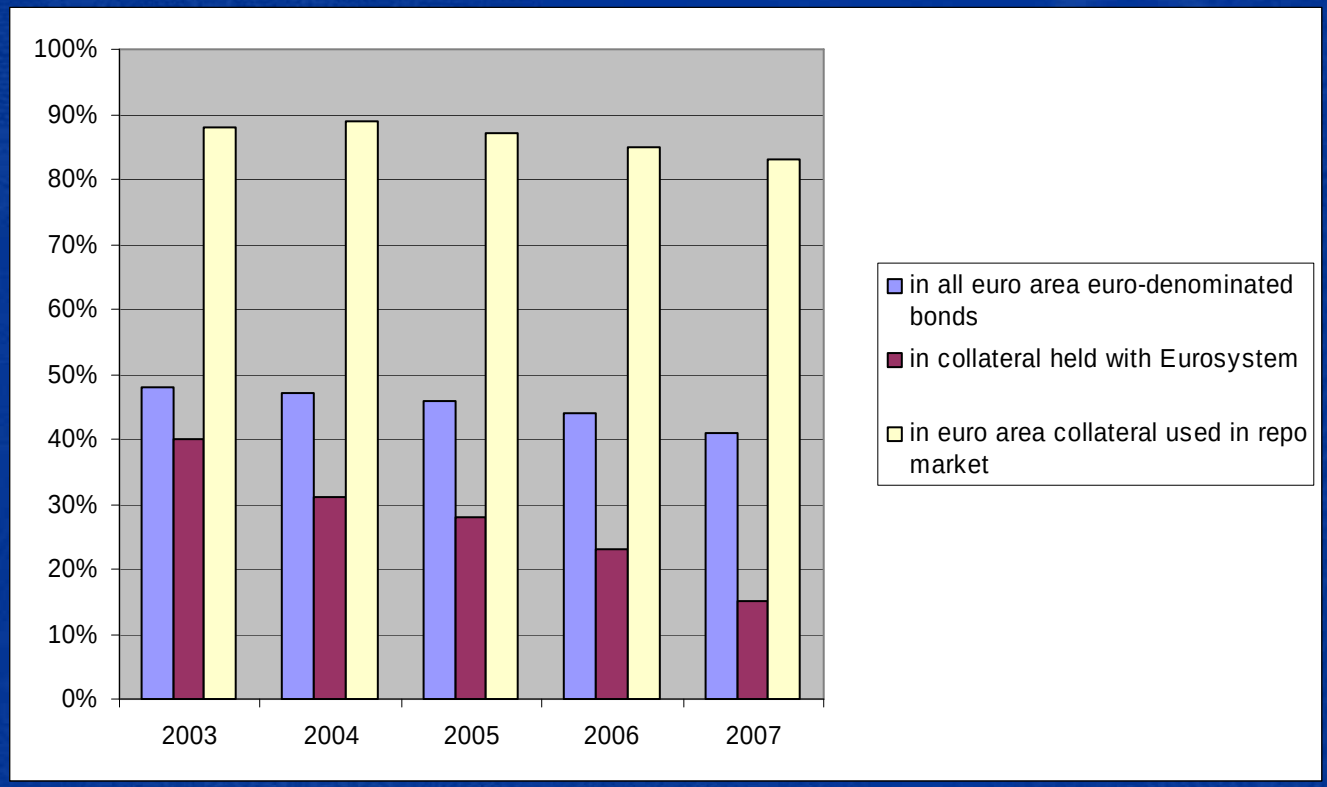
Questions

Percentage shares of central government bonds



Source: ICMA repo market survey 2007, own calculations, ECB.

Questions

Why are illiquid/risky assets hardly used as collateral in repo markets?

Why have illiquid/risky assets been used even less in repo markets during the turmoil?

Why are illiquid/risky assets so much used as collateral with the Eurosystem?

Why have illiquid/risky assets been used even more with the Eurosystem during the turmoil?

What are the (short-term) welfare effect if a central bank broadens its range of eligible collateral assets?

Questions

The answers may appear to be obvious:

"The *protection of the cash lender* is better if he receives liquid/safe assets as collateral rather than illiquid/risky assets."

"It is too difficult to calculate the fair price that ensures sufficient *protection of the cash lender* if illiquid assets are used as collateral."

But: why not simply applying sufficiently high haircuts if illiquid/risky assets are used?

"Higher haircuts imply higher *collateral costs* for the cash borrower."

But: what are collateral costs of highly illiquid assets?

Questions

The answers above put the protection of the cash lender against a default of the cash borrower into the center of the considerations.

But also the cash borrower in a repo transaction may be exposed to counterparty risk as also the cash lender may default – in which case the borrower may incur losses for example if he had agreed to a high haircut!

The basic model

- Three periods *0*, *1* and *2*.
- Cash and *m* other assets $j = 1,\ldots,m$.
- Two (private) banks $i = 1,2$ with initial endowments of cash c_i and other assets $q_{j,i}$ in $t = 0$.
- Central bank will be introduced later.
- Each bank *i* has to hold initial amount of cash c_i also at the end of $t = 1$ (required reserves).
- Customer transfer of cash $\lambda = 1$ in $t = 1$ from $i = B$ to $i = L$. (*B* and *L* are random.)
- *B* to borrow *d* in $t = 1$ from *L* against collateral for one period to fulfil reserve requirements. Negotiations on haircut (*h*), repo rate (*r*) and collateral compositions $(y_1, \ldots, y_m)$.
- Repo contract matures in $t = 2$.

The basic model

- With probability π_G : no default, *B* pays *1+r* to *L* and *L* returns collateral.
- With probability π_B :
  - *B* defaults.
  - L sells collateral at (random) liquidation prices $p_{j,b}$.
  - If liquidation value of collateral below *1+r* : *L* incurs loss;
  - If liquidation value of collateral above *1+r* : excess returned to insolvency mass of *B*.
- With probability π_L :
  - *L* defaults.
  - *B* buys back collateral at (random) repurchase prices $p_{j,a}$.
  - If repurchase value of collateral above *1+r* : *B* incurs loss;
  - If repurchase value of collateral below *1+r* : excess returned to insolvency mass of *L*.

Main innovation of paper: $\pi_L > 0$

(Recovery rate of zero!)

The basic model

- Liquidation prices and repurchase prices (slightly simplifies):

$$p_b^j = p_b^{j-1} + \xi^j - \varepsilon_b^j$$
$$p_a^j = p_a^{j-1} + \xi^j + \varepsilon_a^j$$

with

$$p_b^0 = p_a^0 = 1,$$
$$\xi^1, \ldots, \xi^m, \varepsilon_b^1, \ldots, \varepsilon_b^m, \varepsilon_a^1, \ldots, \varepsilon_a^m \text{ i.d. random variables and}$$
$$E[\xi^j] = 0, E[\varepsilon_b^j] > 0, E[\varepsilon_a^j] > 0$$

The basic model

- Liquidation prices and repurchase prices:
  - expected liquidation price (strictly) lower than expected repurchase price (e.g. positive bid-ask spread)
  - *m* different assets ranked according to how illiquid/risky they are:

    Asset *j* has

    (i) lower expected spread between repurchase price and liquidation price

    (ii) lower volatility of spread between repurchase price and liquidation price

    (iii) lower volatility of mid-price (i.e. average of repurchase price and liquidation price)

    than asset *j+1*.

- Maximization of expected utility u_i from payoffs in $t = 2$.

Results of the basic model

- Both parties will be exposed to credit risk. (The probability that *L* incurs losses if *B* defaults is positive; And the probability that *B* incurs losses if *L* defaults is positive.)

- Pareto optimality requires that the collateral (composition) is as liquid/safe as possible. Thus, the best assets that *B* has will be used first.

- Assume that *B* has (exogenous) outside options r_B (borrowing rate) and *L* has (exogenous) outside option r_D (deposit rate) Then a repo transaction between *L* and *B* may not be possible even if $r_D < r_B$ and *B* has ample collateral.

The extended model

- Bank $i = 1,2$ received before $t = 0$ a loan D_i from the central bank that matures after $t = 2$.
- This loan has to be collateralized. The set of central bank eligible collateral is $J = \{1, \dots, m_{CB}\}$.
- The central bank applies (exogenous) haircut η_j to asset j.
- Collateral deposited with the central bank can be substituted at all times (as long as collateral value after haircut is not below D_i.
- Cash transfer λ now random (with full support).
- No market break-down (unless λ is very high).

Result of the extended model

- If there are positive costs of substituting collateral deposited with the central bank, no matter how small these costs are, then both banks will always use the least liquid/safe assets as collateral with the central bank.

- Broadening the set of central bank eligible collateral is a (weak) potential Pareto improvement (at least if the new collateral policy does not improve B's outside option).

  Of course: If the range of eligible collateral is already broad, a further broadening may have no welfare effects!