BANCO CENTRAL DO BRASIL

Stress Testing Liquidity: A National Approach

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Agenda

- Objectives of liquidity monitoring
- Characteristics of the Brazilian Financial System
- The liquidity monitoring system
  - Data sources
  - Available liquidity
  - Estimated liquidity needs
- Case Study
- Advantages and disadvantages
- Limitations

Objectives of Liquidity Monitoring

- **The main objectives are:**
  - Evaluating if the banks maintain adequate liquidity levels for stress situations, given their characteristics (avoiding individual and systemic risk); and
  - Providing supervision with timely and updated information at moments of liquidity crises (a greater agility for supervisory acting).

❖ In line with the "Principles for the Assessment of Liquidity Management in Banking Organisations" edited by the BIS.

The Brazilian Market

- **Registration of securities and derivatives issued in the country in Clearing Houses**: It is mandatory to identify the final holder of the security (approximately 46% of assets, 48% of liabilities and 100% of derivatives).
- **Credit Information System:** details the nature of the credits, such as type, cash flow. Above R$ 5,000.00, name and internal rating are included. (representing 36% of assets).
- **Banks' positions abroad:** Low exposure 5.5% of assets and 6% of liabilities.
- **Regulation**: follows BIS principles. Minimum liquidity limits have not been set.
- **Secondary market for securities and credits**: for government bonds and derivatives (futures) the market is well developed. For credits it is incipient - only 6% of the total of the credit portfolio has been negotiated.
- **Number of banks** (conglomerates): 145 (Dec/05)

The Liquidity Monitoring System

- **The approach** used in this system is known as ‘mixed approach’, which combines elements of the cash flow matching approach and the stock approach.
- **Methodology**: it analyses the ratio between two basic concepts: available liquidity and estimated liquidity needs.
  - **Available liquidity**: the amount of funds the bank can raise in a short period of time; includes the stock of assets and short-term repurchase agreements with other banks and the Stock and Commodity Exchanges; and
  - **estimated liquidity needs**: how much liquidity the bank needs according to its nature, maturity gap and the effect of scenarios on the main assets, liabilities and derivatives;
  - Both the available liquidity and the liquidity needs incorporate elements of scenarios and stress situations.
  - Elaboration of scenarios automatically

Information Sources

- **From the Clearing House**: banks' positions recorded in a daily basis;
- **From the banks**: information of deposits in a daily basis, and balance sheets and deposit statement in a monthly basis;
- **From the Central Bank**: securities prices to be used in transactions collateralised by federal government bonds.

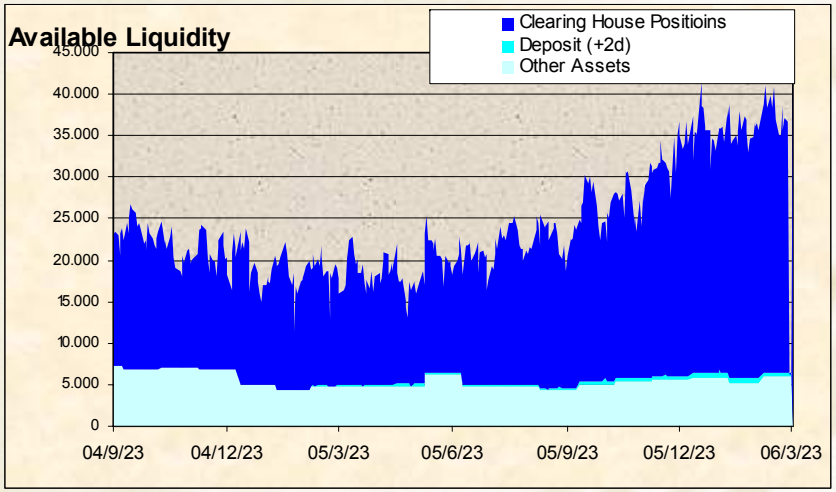
Available Liquidity - Premises

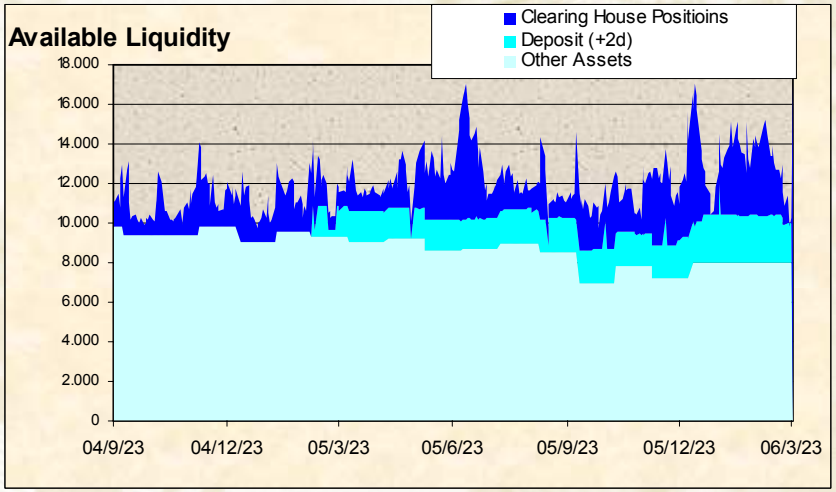
- **Only free assets:** excluded the securities tied to any kind of commitment or co-obligation.
- **Net positions:** in short term operations between two banks, net amounts were considered due to the systemic effects;
- **Asset values**:
  - Federal government securities: are priced on the value accepted by the Central Bank in repurchase agreements (the minimum price the bank obtain in the market).
  - Other assets: a haircut was applied, by maturity, when available, or by type of asset;
- **Cash Operating Accounts**: used as a liquidity source, since the volatility of deposits is a component of the estimated liquidity needs.
- **Positions abroad:** same treatment as the other assets;

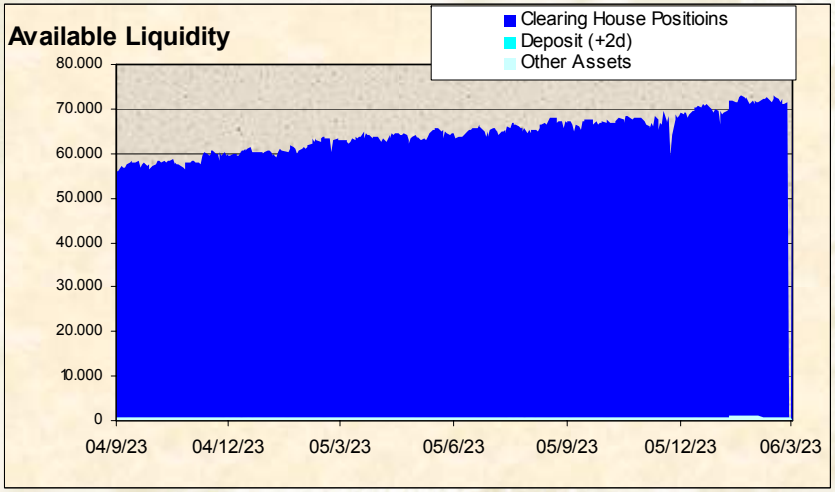
Available Liquidity - Composition

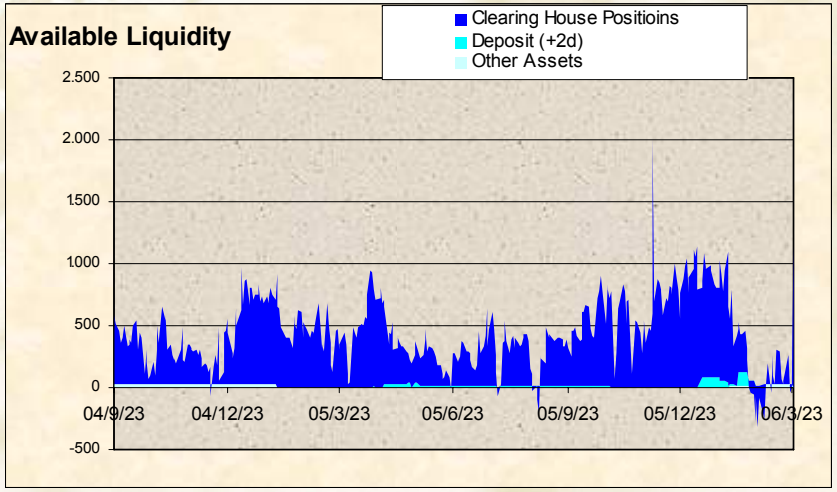
- Represents the amount that the bank can raise in a short period, already including the short term commitments.
- Daily data:
  - Net positions in interbank deposits maturing within 1 working day;
  - Net positions in time deposits maturing within 1 working day;
  - Net positions in Repos;
  - Free Federal government securities;
  - Amount to be paid or received on the following working day due to profits or losses at the futures exchange; and
  - BDCs and IDs (only assets positions) maturing after 2 days.
- Monthly data:
  - Other assets (shares, foreign currency, gold, fund quotas, available funds, securities abroad).

Available Liquidity - Charts









Estimated Liquidity Needs

- Represents how much each bank, given its nature and open position, would need to meet the potential liquidity demands in stress situations (10 working days).
- **Components**:
  - Market risk stress on liquidity;
  - Concentration of the deposits portfolio: by type of deposit and by amount of deposit;
  - Volatility of deposits (IDs excluded);
  - IDs maturing after 1 day, with a haircut on the face value by maturity bands;
  - Other existing liabilities;

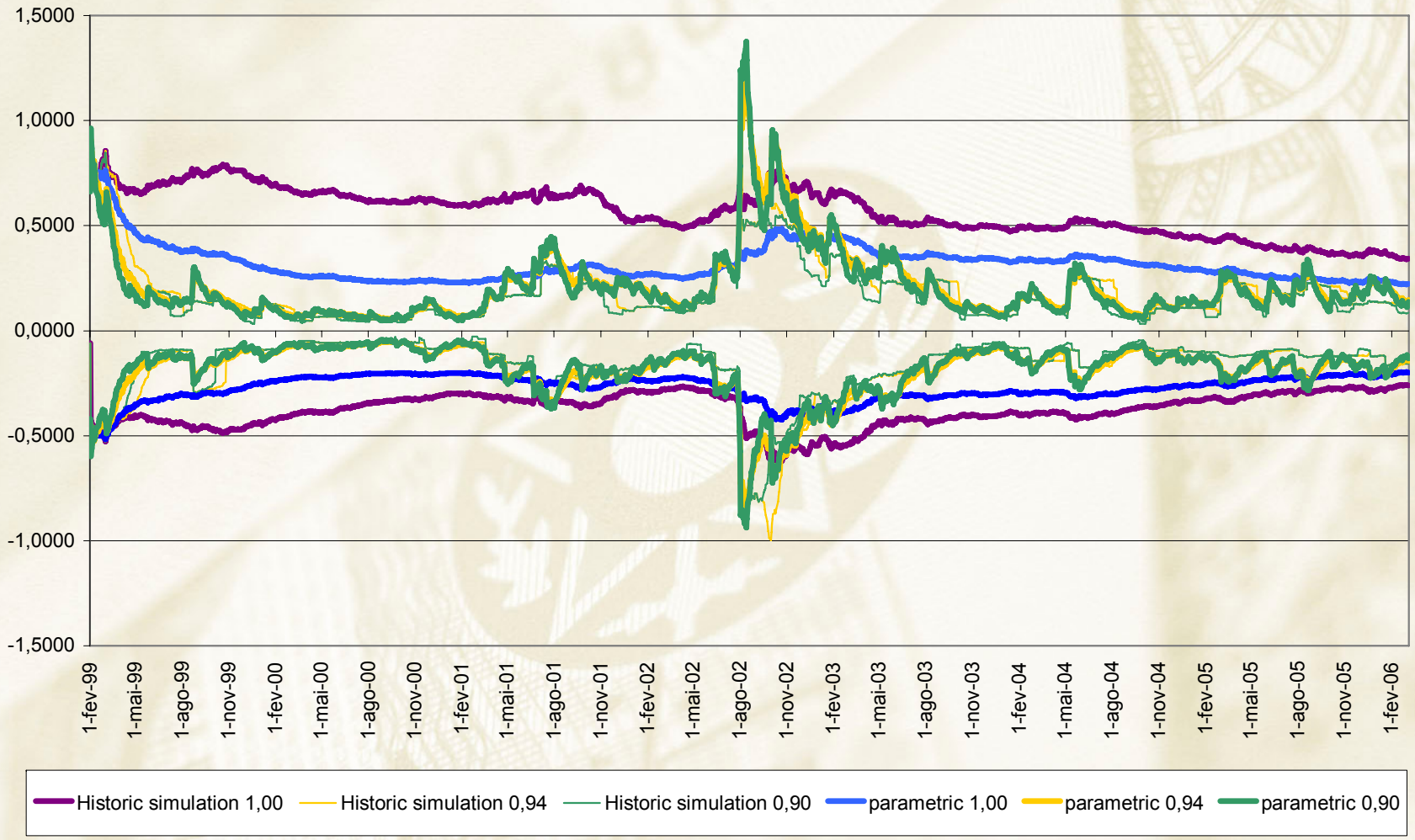
Market Risk Stress on Liquidity (1)

- The Bank needs to have sufficient liquidity to face a stress on market risk.
- main risk factors considered
- holding period of **10 working** days and significance level **over 99%.**
- **applied on:**
  - assets that would have their prices immediately affected by a variation in the market risk (free or not);
  - derivatives that would affect the short term cash flow (maturity, adjustment payments or additional call for collateral); and
  - hedge effect considered.

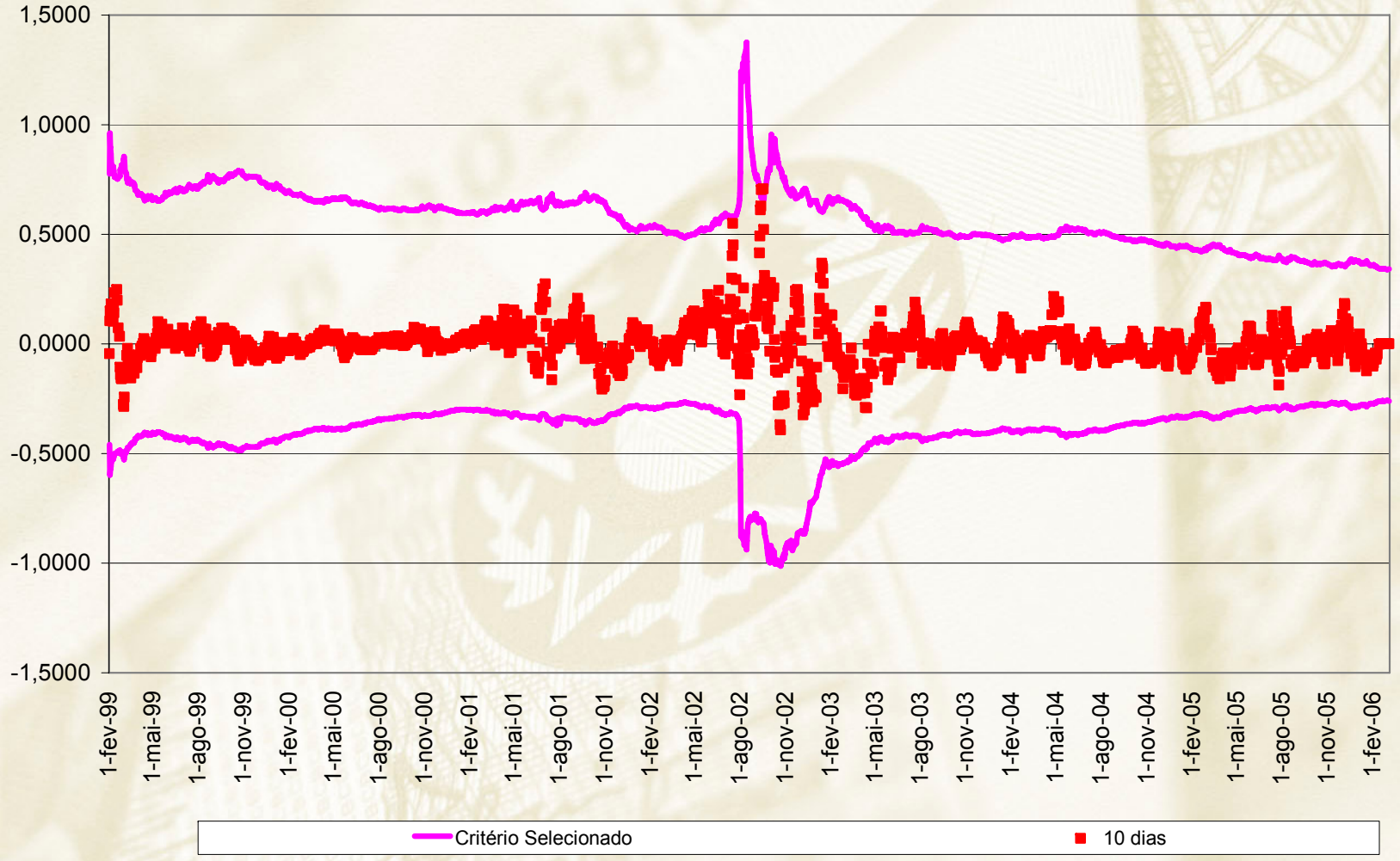
Market Risk Stress on Liquidity (2)

- **Methodology**
  - for the definition of the upward scenarios for each risk factor is calculated 12 volatilities using two approaches (parametric and hybrid historical simulation), both with exponential smoothing, and six different decaying factors (lambdas), choosing the highest result among them.
  - The downward scenario is calculated the same way, but now to the hybrid historical simulation the return are ordered from the lesser to higher.
- **Selection of Results**
  - After calculated the impact on different scenarios for each risk factors, the system select the worst result for each bank. It means that for different bank the system could select different scenarios.

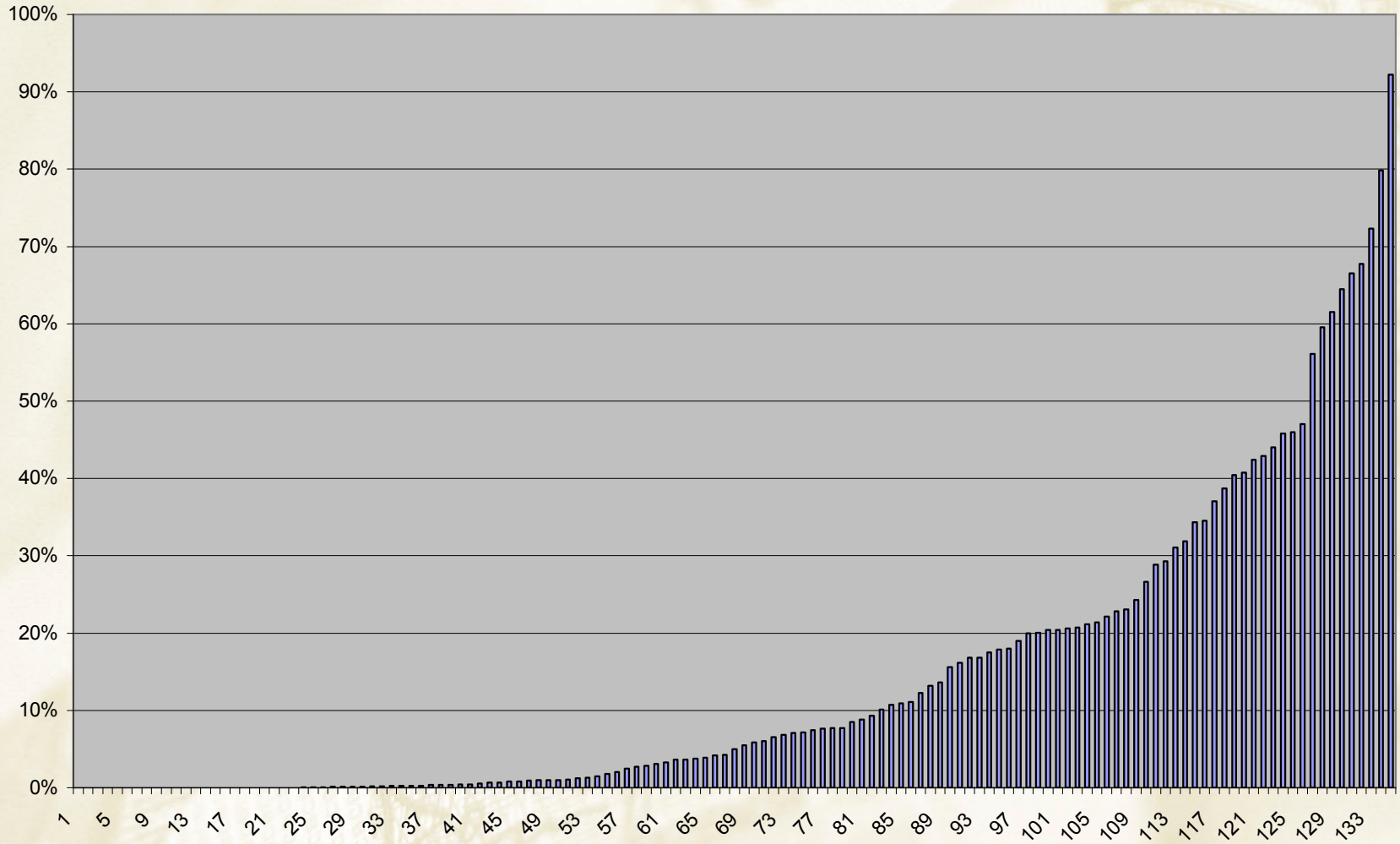
Selection of Scenarios



Back Testing Market Stress



Market Stress: % of ELN per FIs



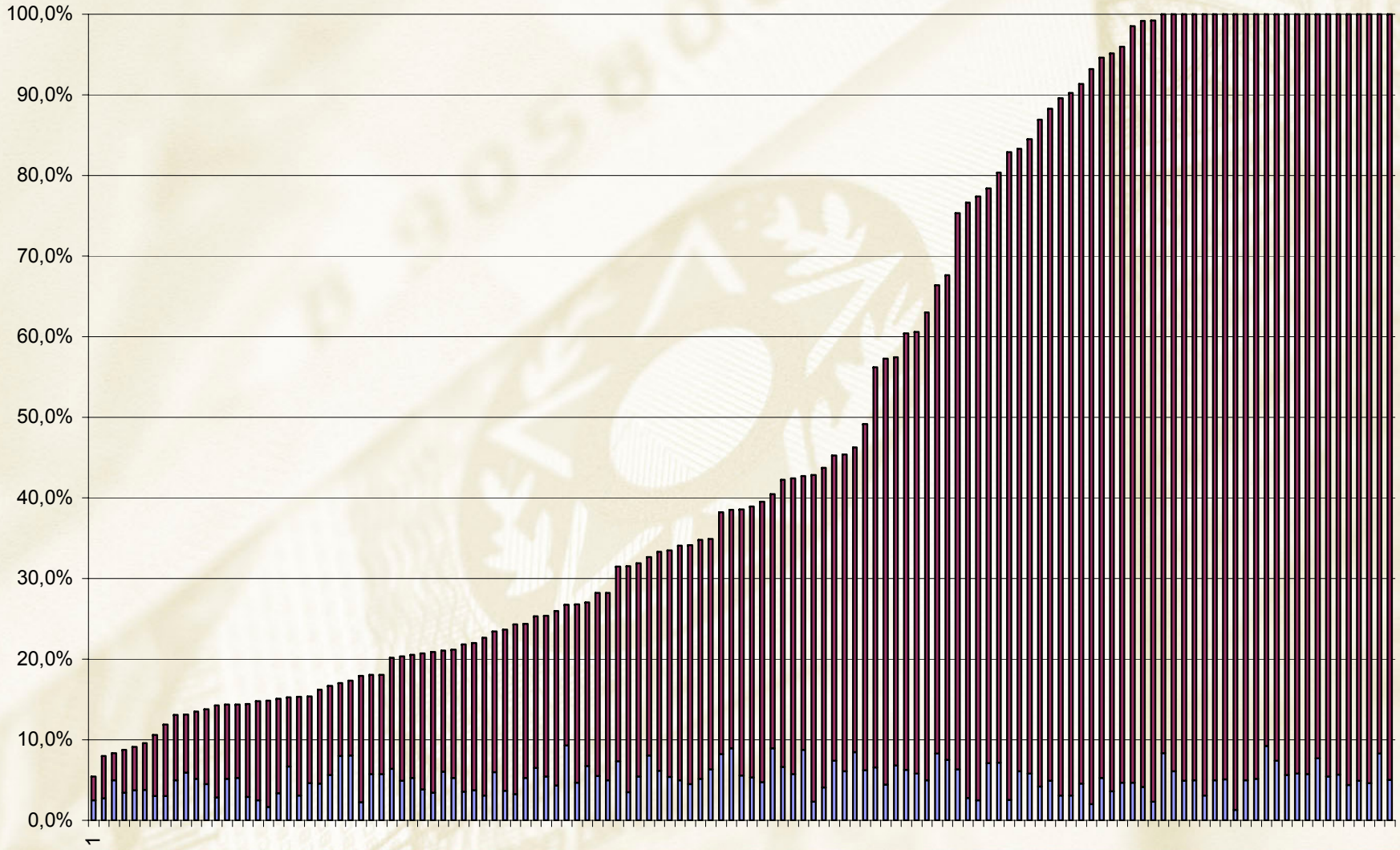
Deposits – Concentration

- **Deposits portfolio concentration:** according to the composition of the deposits portfolio and the perceived risk of the bank (rating), a percentage of the stock must be available to face unexpected outflows:
    - By type of depositor: each one with specific percentage. Wholesale Funding Providers are more credit risk sensitive than individuals;
    - By deposited amount: each range with specific percentage. Higher depositors have access to more information than small depositors.

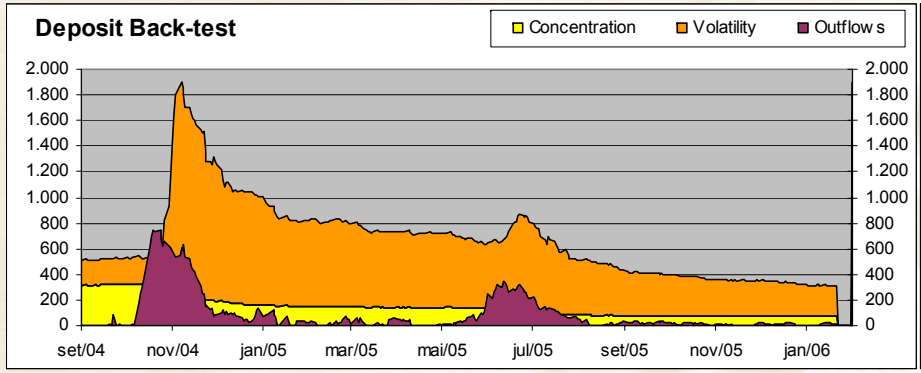
Deposits –Volatility

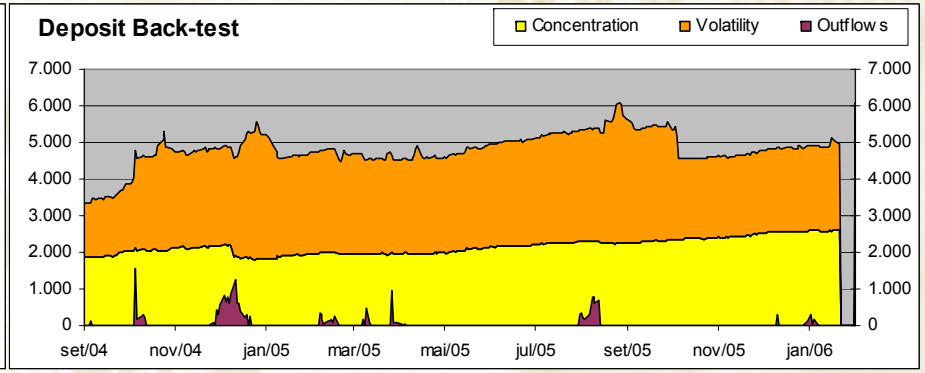
- **Volatility of the deposits**: according to the volatility of the deposits portfolio a percentage of the stock must be available to face the normal outflow:
  - 12 volatilities are calculated over a 12-month series of outflows and inflows, sixth for each one, using hybrid historical simulation with different weights for recent observations. The highest value among those volatilities is chosen as the scenario to be applied (holding period of 10 working days and significance level over 99%)

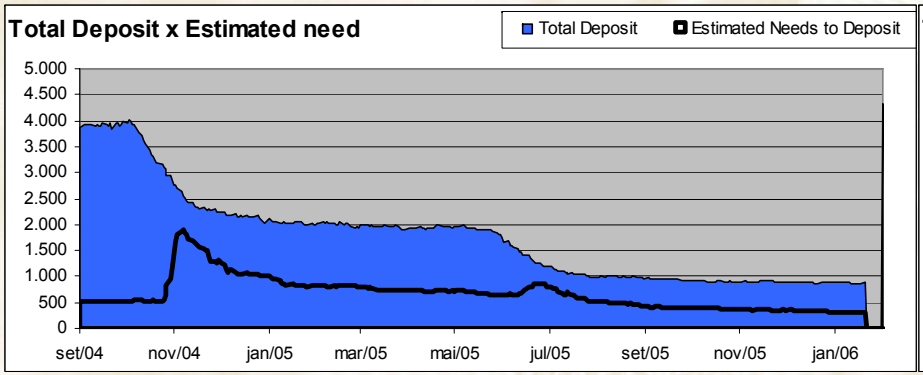
Deposits – charts: % of total Dep. per FIs

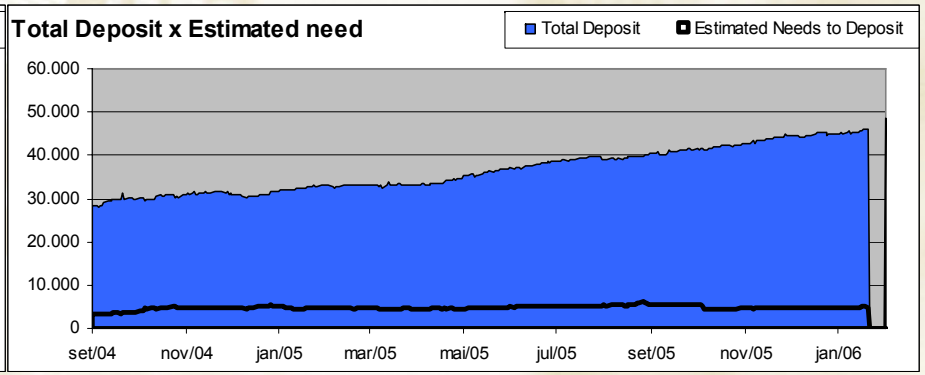


Deposits – backtest (1)

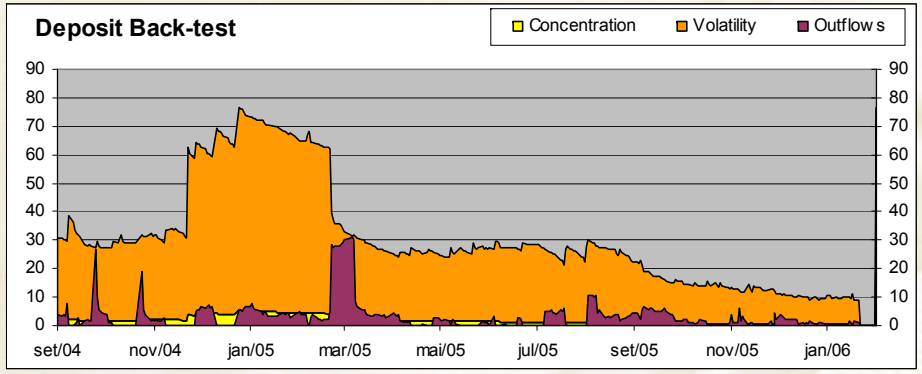


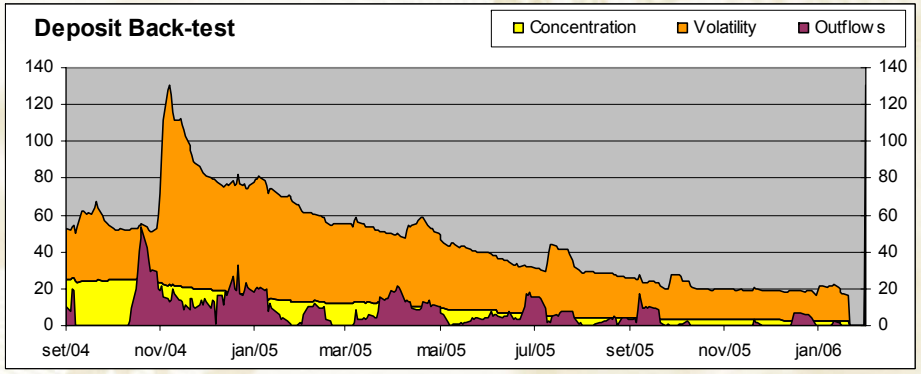


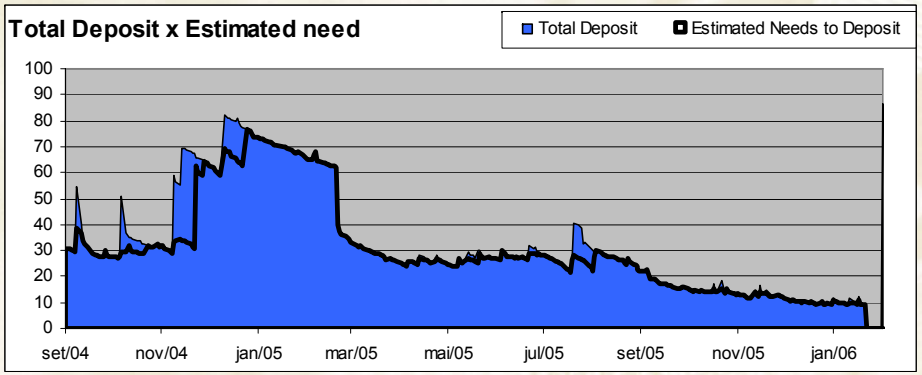


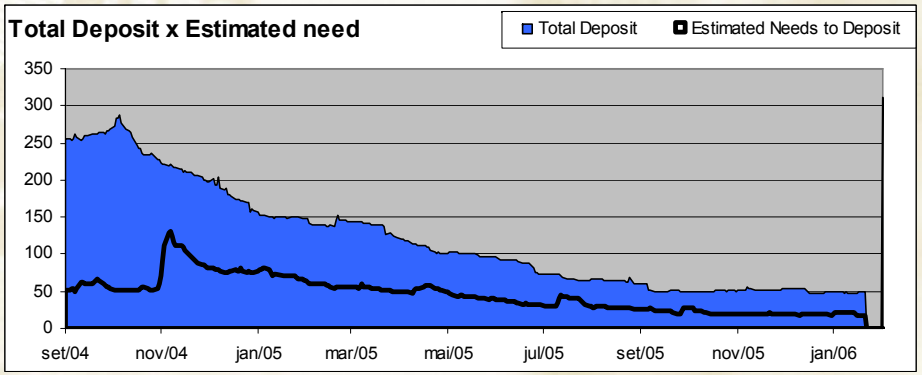


Deposits – backtest (2)





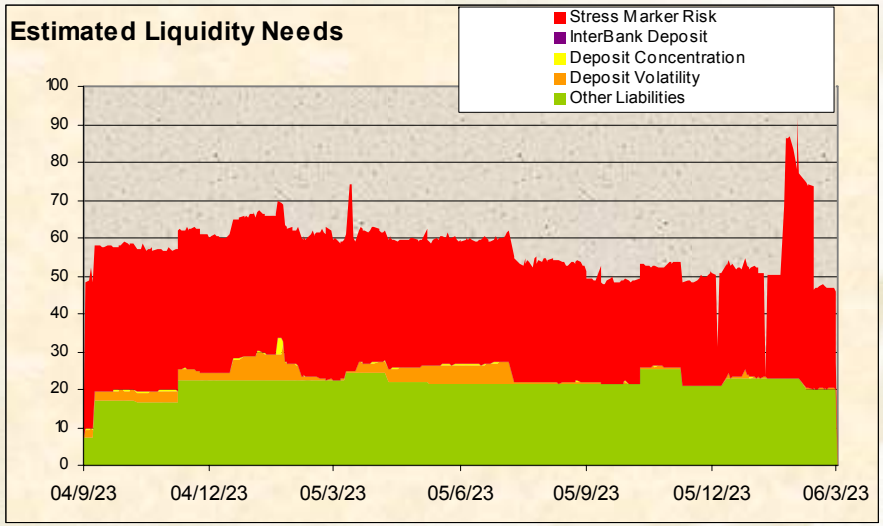


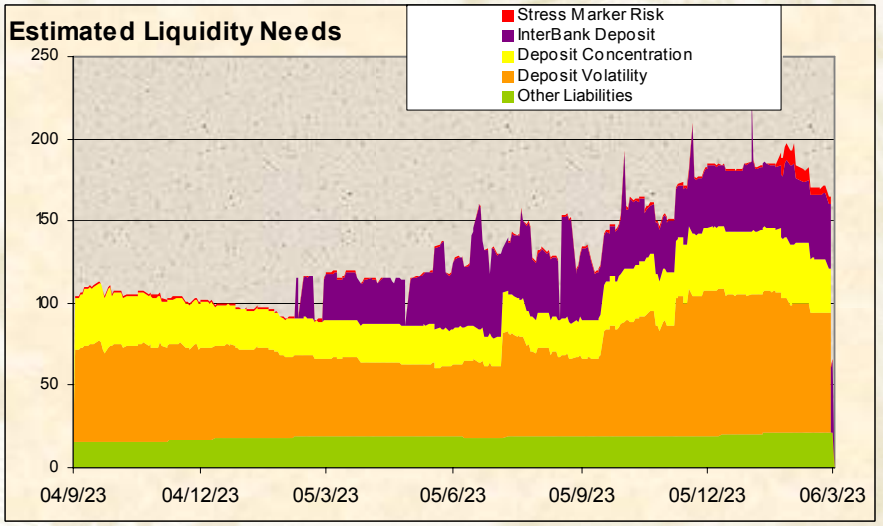


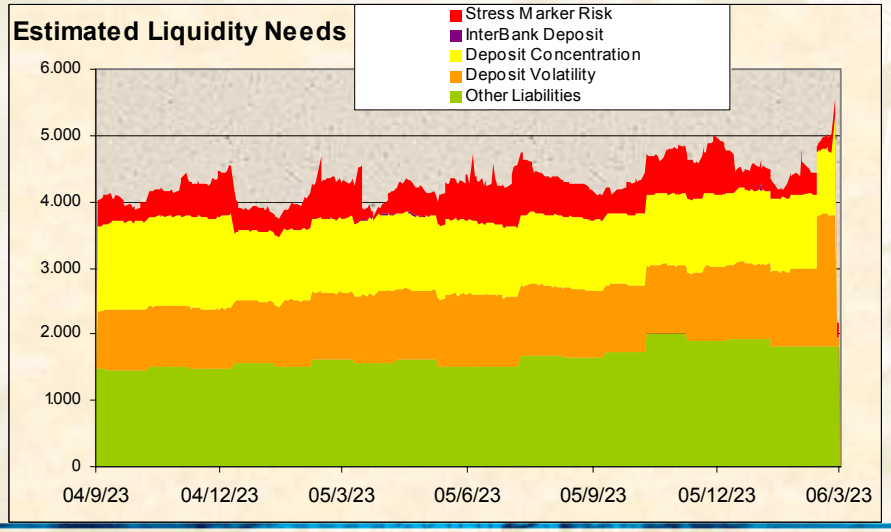
Other Existing Liabilities

- Applied the highest value among the volatilities of the latest months calculated for the bank and the average volatility of the latest months calculated for the bank and for the system as a whole.
- Even though this is not the optimum approach, the main objective is to incorporate information associated to other liabilities in order that, in case these other liabilities are of importance, this will be reflected in the estimated liquidity needs composition, meriting the analyst's attention.

ELN – charts


Estimated Liquidity Needs
Stress Marker Risk
InterBank Deposit
Deposit Concentration
Deposit Volatility
Other Liabilities
100
90
80
70
60
50
40
30
20
10
0
04/9/23
04/12/23
05/3/23
05/6/23
05/9/23
05/12/23
06/3/23


Estimated Liquidity Needs
Stress Marker Risk
InterBank Deposit
Deposit Concentration
Deposit Volatility
Other Liabilities
250
200
150
100
50
0
04/9/23
04/12/23
05/3/23
05/6/23
05/9/23
05/12/23
06/3/23


Estimated Liquidity Needs
Stress Marker Risk
InterBank Deposit
Deposit Concentration
Deposit Volatility
Other Liabilities
6.000
5.000
4.000
3.000
2.000
1.000
0
04/9/23
04/12/23
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05/6/23
05/9/23
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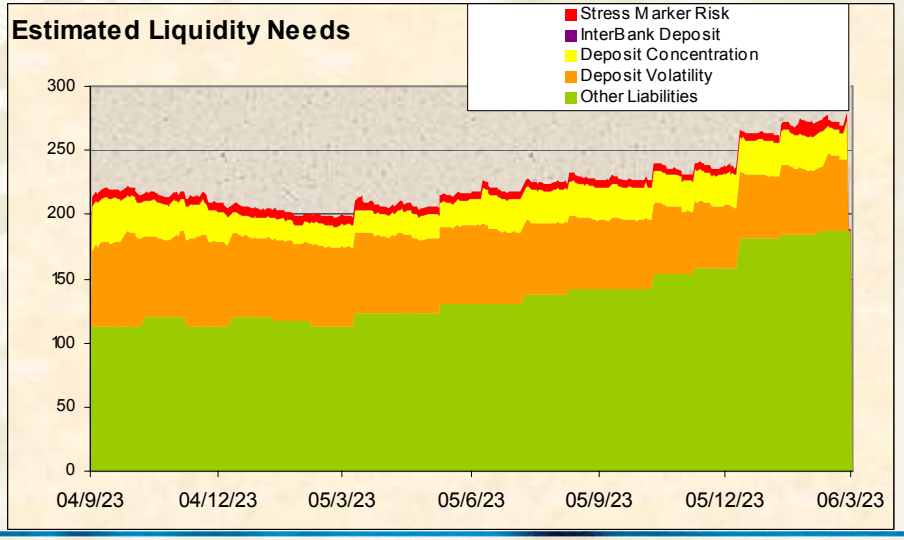
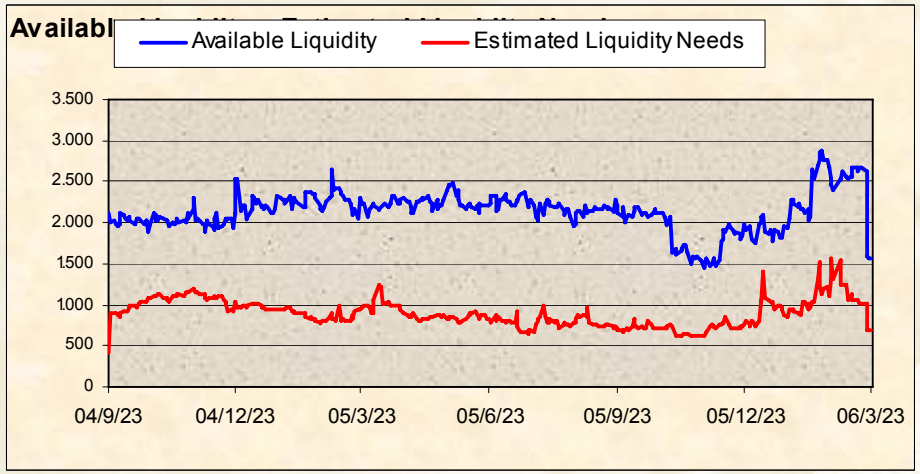
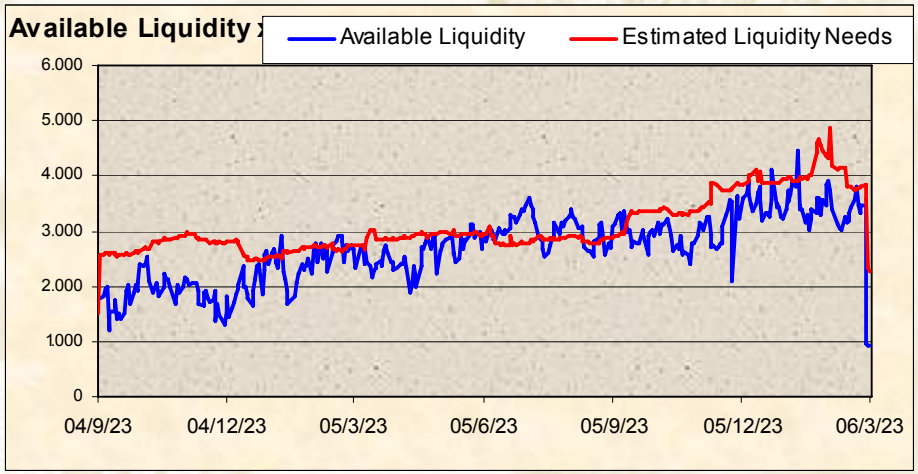
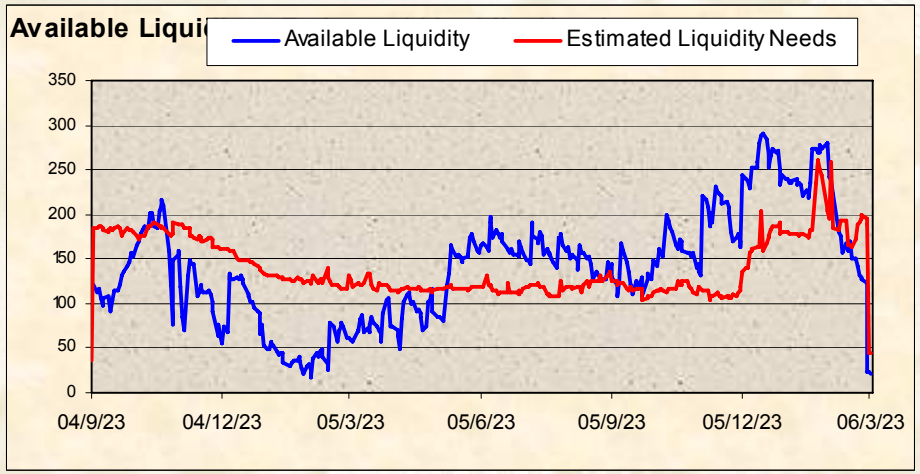
06/3/23

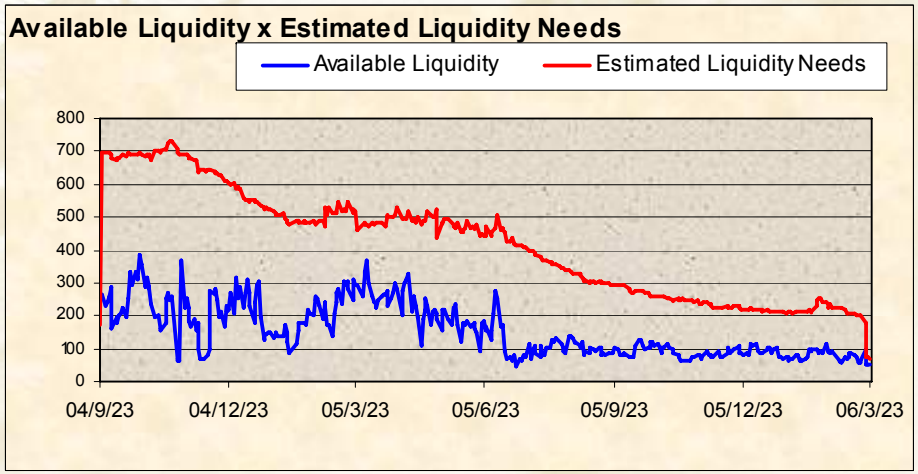

Estimated Liquidity Needs
Stress Marker Risk
InterBank Deposit
Deposit Concentration
Deposit Volatility
Other Liabilities
300
250
200
150
100
50
0
04/9/23
04/12/23
05/3/23
05/6/23
05/9/23
05/12/23
06/3/23

Available Liquidity x Estimated Liquidity Needs









Case study

- **Flight to Quality – November, 2004**
- **cause**: investment funds and institutional investors withdrew their deposits from small and medium-sized banks due to the extra-judicial liquidation of Banco Santos (22 biggest bank of Brazil).
- **Monitoring Selected group**: banks with the highest percentage of the component 'deposit concentration', low liquidity score (ratio AL x ELN) and funding via relevant deposits, after analyst review = 12 banks (2.8% of total deposits);
- **Affected banks**: small and medium-sized. Before the event, they represented 3.9% of total deposits. Two months later, deposits from this segment had been reduced by 30%, representing 3.0%. The average decrease was 25% and the greatest was 57%.

Case Study (2)

	System	Selected
Withdrawals larger than 10% of the deposits after a month	28 banks (3% of total deposits)	8 banks (1.8% of total deposits)
Withdrawals larger than 10% of the deposits after two months	30 banks (3.9% of total deposits)	9 banks (2.3% of total deposits)
Banks that were still in trouble after two months	4 banks (1% of total deposits)	4 banks (1% of total deposits)

Advantages and disadvantages

- **Advantages**
  - Abundance of details and on time information
  - Independent information sources
  - Control over the process
  - Overall view
- **Disadvantages**
  - Investment
  - Large volume of data
  - Constant updating

Limitations and Improvements under Way

- **Limitations:**
  - The system monitors only relevant risks (material risk), that is, the significant risks to the Brazilian financial system;
  - The numbers generated by the system are merely indicative;

- **Improvements under Way**
  - We are performing a project that will use better all available information. Example of expects improvements:
    - Adjust on methodologies
    - Include Lines of credit granted on ELN
    - Include part of the credit portfolio as liquid (negotiable credits) on AL

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