



# Stress-testing the corporate sector: Microeconomic Approach

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**BANCA NAȚIONALĂ A ROMÂNIEI**



# Outline

- I. Available data
- II. Stress-testing Framework
- III. Stress-testing models
  - a. FX shock
  - b. IR shock
  - c. Liquidity shock

# I. Available data

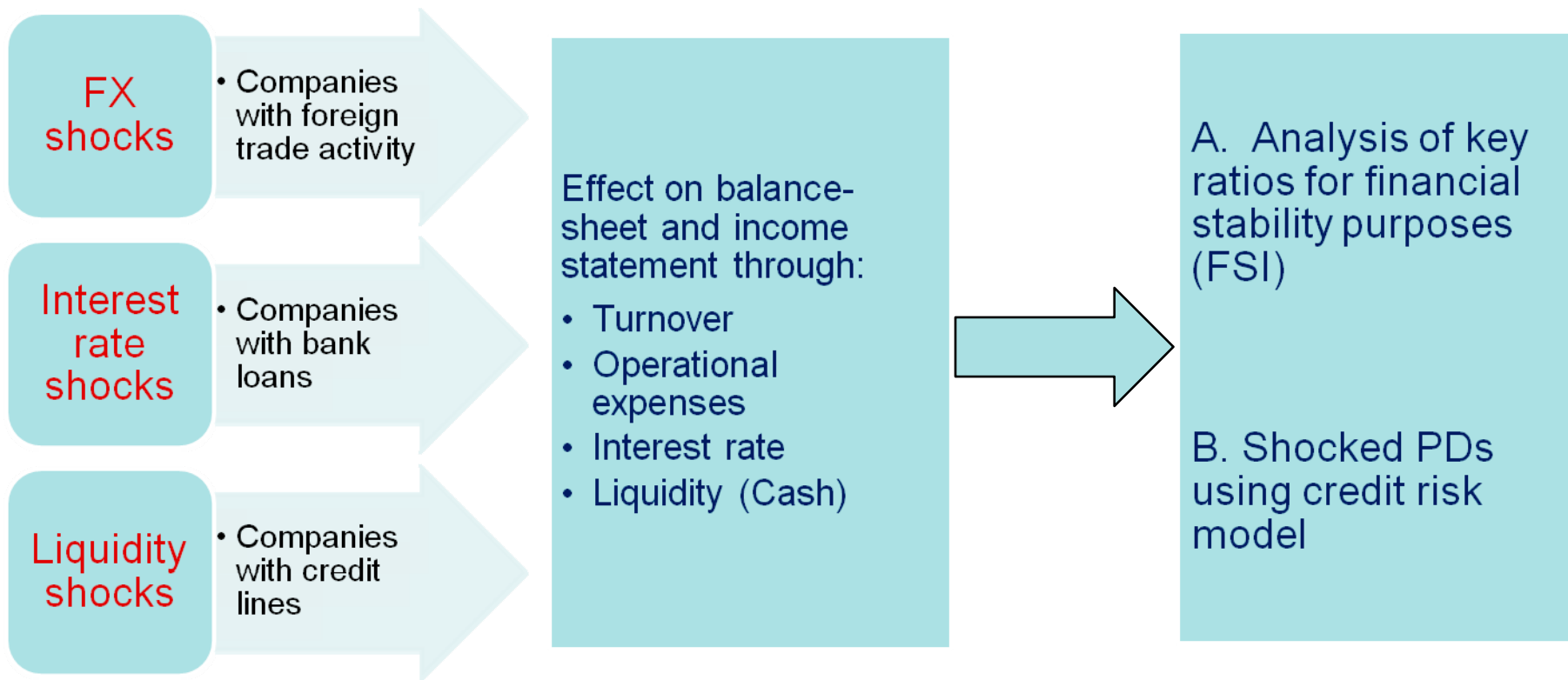
➤ Nonfinancial corporations - data available for the whole population, at firm level:

- Balance Sheet and P&L – biannual data
- Credit Register Bureau – monthly data
- Exports and imports – biannual data, until 2006

➤ Banks:

- Interbank exposure matrix
- Foreign and domestic positions
- Available collateral
- Available reserves

## II. Stress-testing framework



# III. Stress-testing models

## a. FX Shocks

### *Overview*

#### - **First round effects:**

- impact on financial statements of companies with foreign trade activity
- by adjusting quantities, prices and costs
- using sector elasticities
- does not take into account company management response or other correlations between macro variables that may impact economic activity
- it attempts to isolate the first round, direct, impact of an FX shock

- **Second round effects:** Not enough information on companies' net foreign position

### III. Stress-testing models

#### a. FX Shocks

#### *Conceptual framework*

### **Impact assessment:** based on two building blocks

- Import only companies:
  - cost of goods sold changes as a result of FX shocks.
  - as a result, new equilibrium level must be determined: both quantity and price adjust so that profit is maximized (taking into account the elasticity of demand).
  
- Export only companies:
  - RON appreciation – Romania is a price taker in international markets, therefore any adjustment (at least in the short term) is by quantity alone, as price can not be increased.
  - RON depreciation – price in domestic currency rises, resulting in higher profits. In the short run, quantity and price (in foreign currency) do not change.

### III. Stress-testing models

#### a. FX Shocks

##### *Import – only companies*

- Operational expenses effects:

$$dCHE_i^N = I_i^N [(1 + \alpha)(1 - \alpha\tau\beta^N) - 1]$$

- Turnover effects:

$$dCA_i^N = CA_i^N [(1 + \alpha\tau)(1 - \alpha\tau\beta^N) - 1]$$

-  $\tau$  is set to maximize profitability:

$$\max(dCA_i^N - dCHE_i^N)$$

N - NACE class

i – ith firm

$dCHE_i^N$  - adjustments in the operating costs

$dCA_i^N$  - adjustments in turnover

$I_i^N$  - volume of imports in the baseline period respectively

$\alpha$  - FX shock

$\beta^N$  - the elasticity of goods sold by companies from NACE group N

### III. Stress-testing models

#### a. FX Shocks

#### *Export – only companies*

##### 1. RON appreciation (negative effect)

- Operational expenses effects:

$$dCHE_i^N = CHE_i^N \cdot (-x)$$

- Turnover effects:

$$dCA_i^N = E_i^N [(1 + \alpha)(1 - x) - 1]$$

- Survival condition:

$$CPR_i^N + \underbrace{E_i^N [(1 + \alpha)(1 - x) - 1] - CHE_i^N (-x)}_{\text{Change in Retained Earnings}} > 0$$

$E_i^N$  - volume of exports in the baseline period respectively

$CPR_i^N$  - own funds

$x$  - amount of exports reduction



### III. Stress-testing models

#### a. FX Shocks

*Export – only companies*

#### 2. RON depreciation (positive effect)

- Turnover effects:

$$dCA_i^N = E_i^N \cdot \alpha$$

- A depreciation of domestic currency will not trigger caeteris paribus changes in the volume of activity, but only an increase in the level of sales prices

### III. Stress-testing models

#### a. FX Shocks

#### *Export & Import companies*

#### **Subgroups according to business model:**

##### A. Trade companies similar to

- i. Import only
- ii. Export only

##### B. Manufacturing Industry

- i. Active processing – identification: Exports > Imports & Exports > Turnover
- ii. Exports > Imports & Exports < Turnover
- iii. Imports > Exports & Exports < Turnover

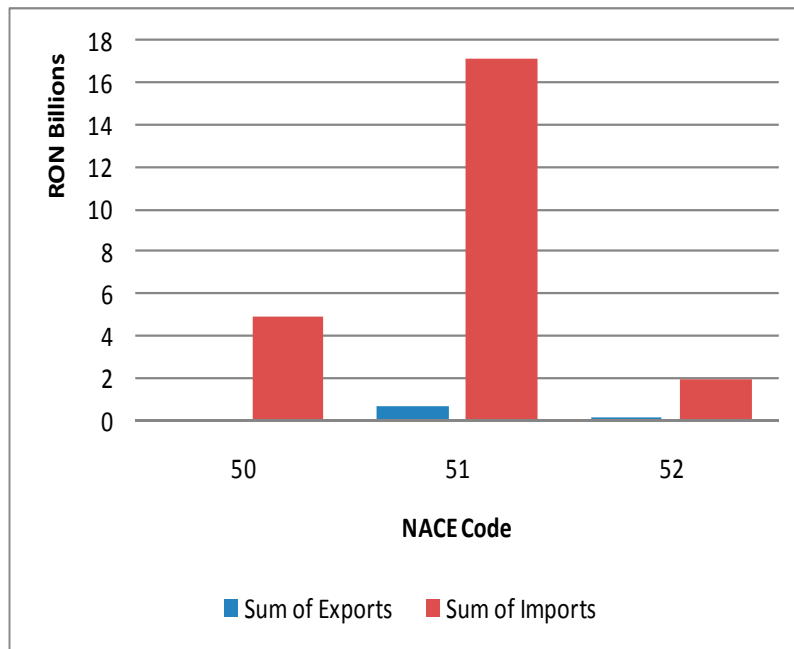
### III. Stress-testing models

#### a. FX Shocks

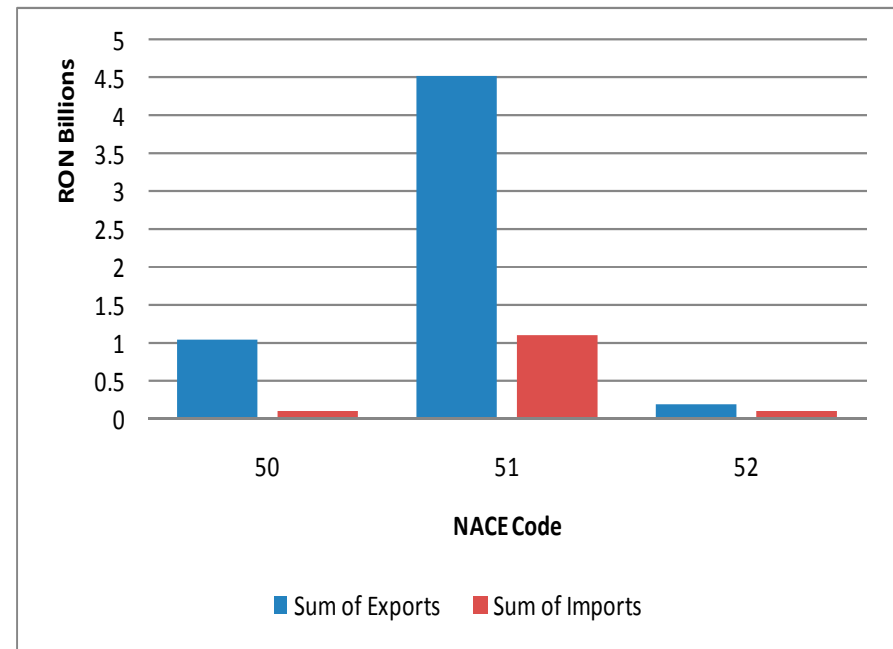
#### *Export & Import companies*

#### A. Trade companies – justifying assumption of similarities with import only and export only companies

Imports > Exports



Exports > Imports



### III. Stress-testing models

#### a. FX Shocks

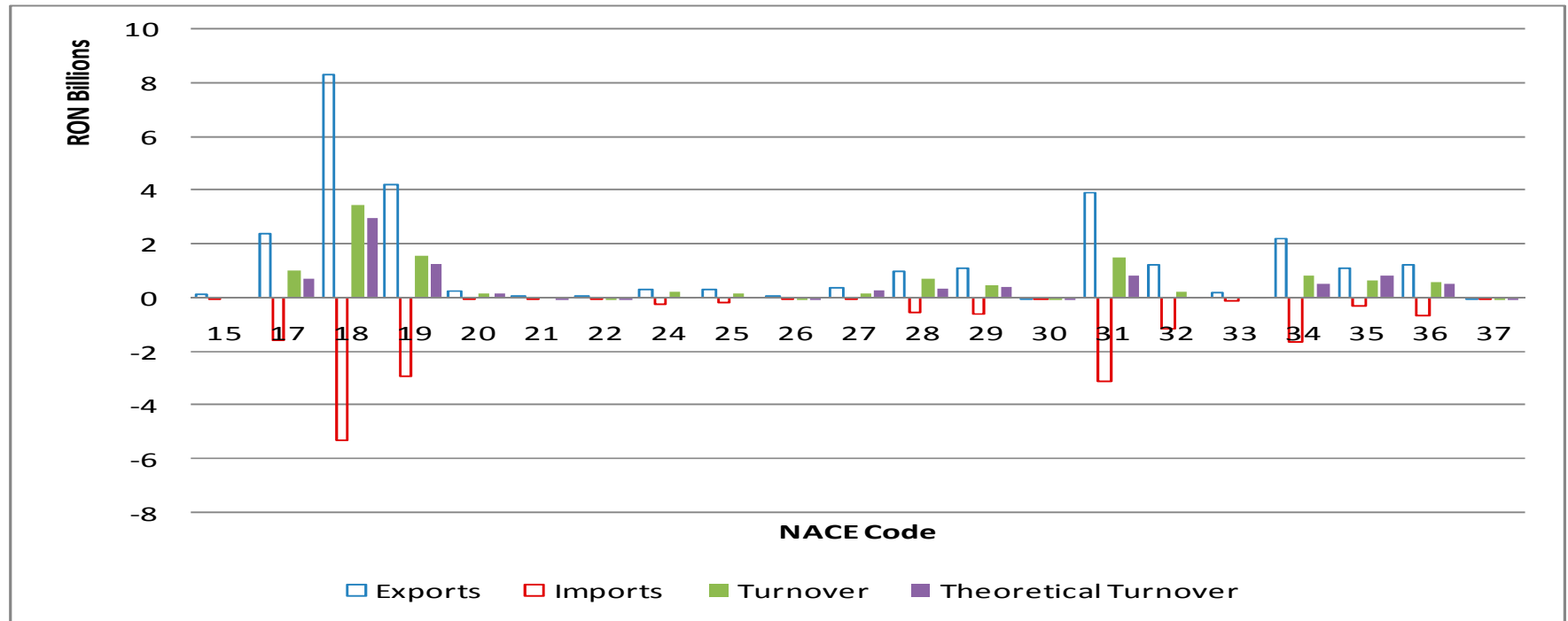
#### *Export & Import companies*

#### B. Industry companies

##### i. Active processing firms (Lohn)

Characteristics:

- **Exports~Imports+Turnover**
- Imports and exports do not pass through BS or IS (empirical observation)



### III. Stress-testing models

#### a. FX Shocks

#### *Export & Import companies*

#### B. Industry companies

- i. Active processing firms (Lohn) – **Export only companies model** considering the level of Net Exports (Exports-Imports)

#### RON appreciation

$$dCHE_i^N = CHE_i^N \cdot (-x)$$

$$dCA_i^N = E_i^N [(1 + \alpha)(1 - x) - 1]$$

$$CPR_i^N + E_i^N [(1 + \alpha)(1 - x) - 1] - CHE_i^N (-x) > 0$$

#### RON depreciation

$$dCA_i^N = E_i^N \cdot \alpha$$

Net exports

### III. Stress-testing models

#### a. FX Shocks

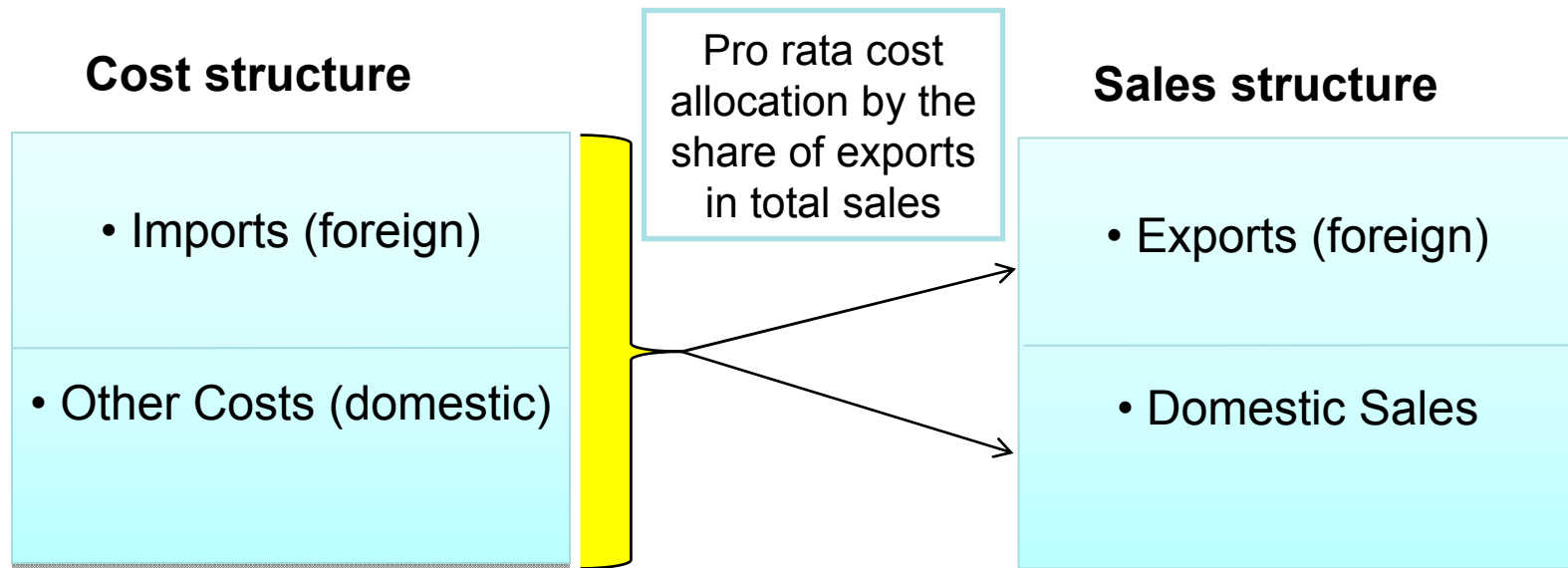
#### *Export & Import companies*

#### B. Industry companies

- ii. Exports > Imports & Exports < Turnover (most important export segment ~ 43%)

Characteristics:

- Imports and exports pass through BS or IS



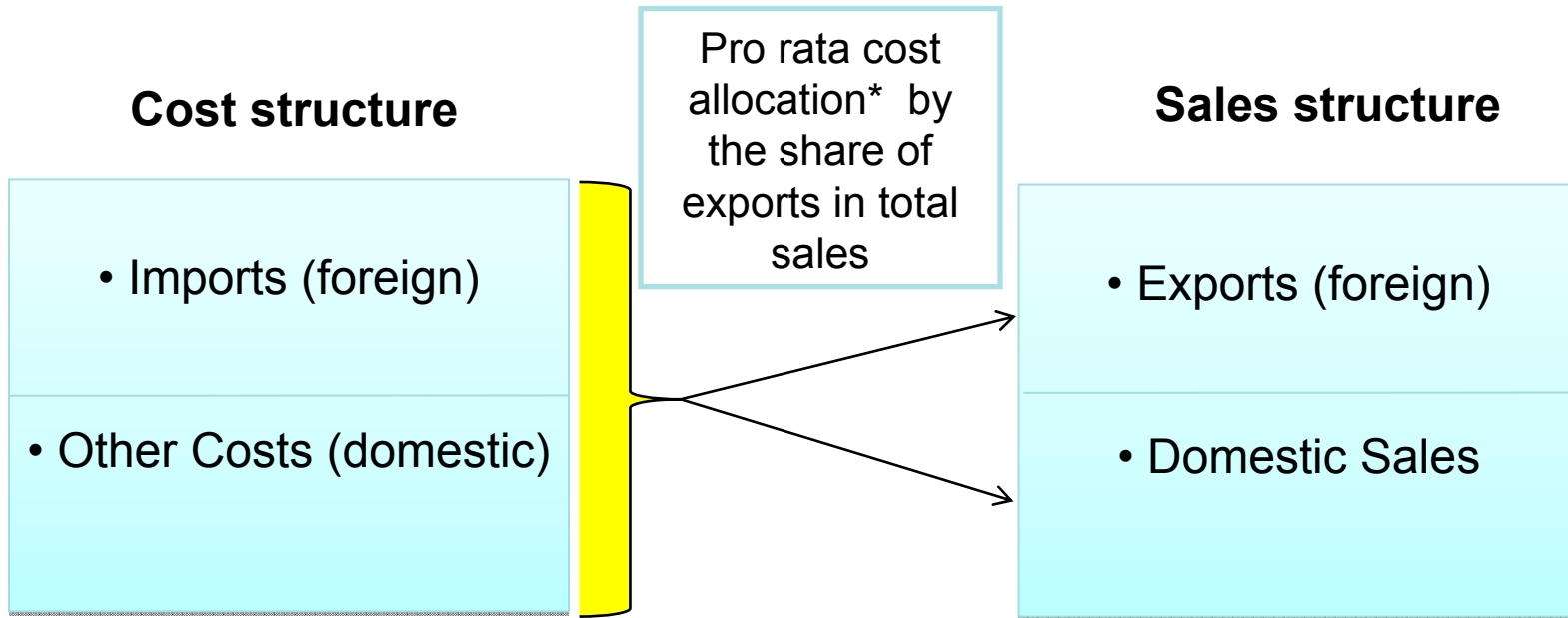
### III. Stress-testing models

#### a. FX Shocks

#### *Export & Import companies*

#### B. Industry companies

- iii. **Imports > Exports & Exports < Turnover** – similar to companies with Exports > Imports & Exports < Turnover

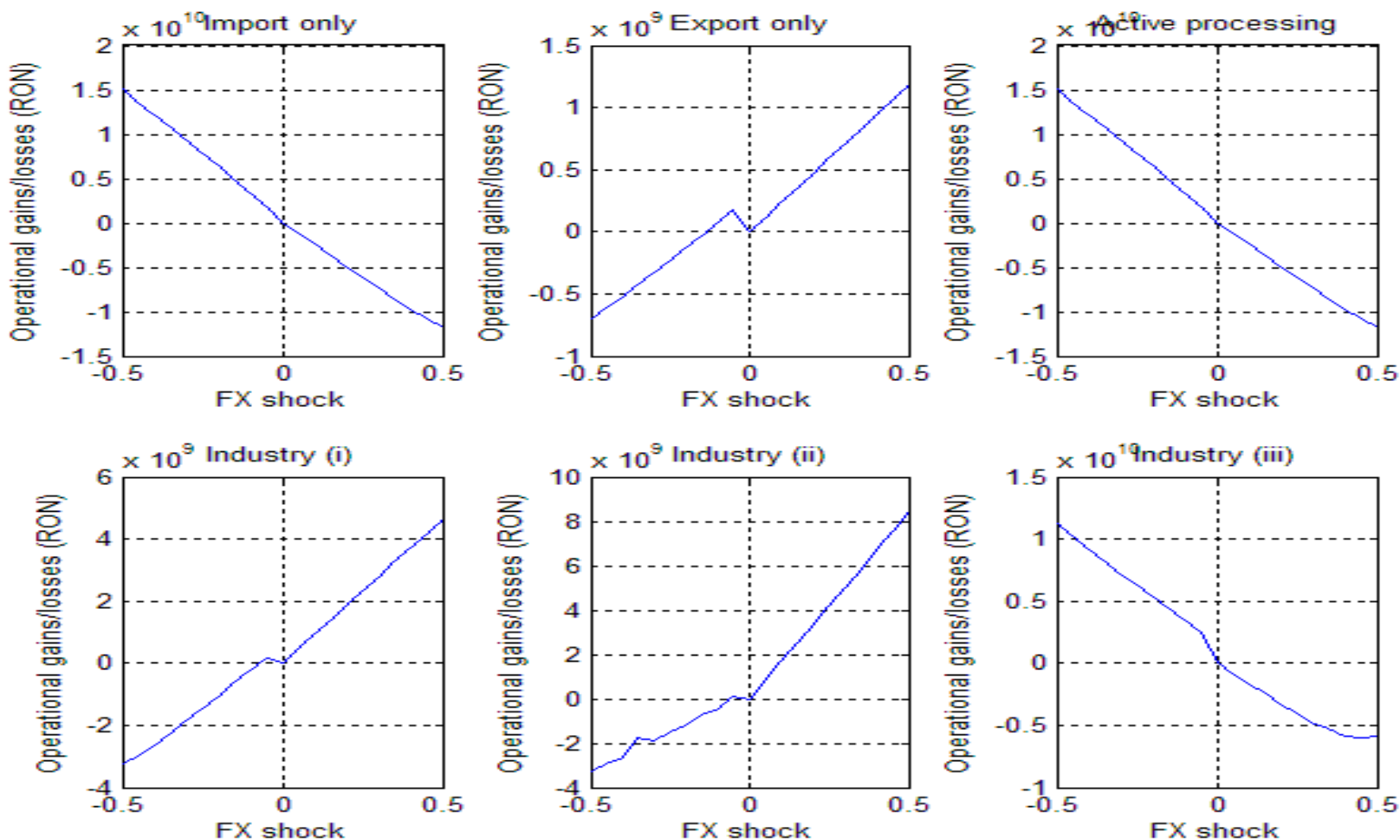


\* Adjustment is made if imports allocated to foreign sales (exports) exceed the actual level of imports

### III. Stress-testing models

#### a. FX Shocks

#### *Empirical results*

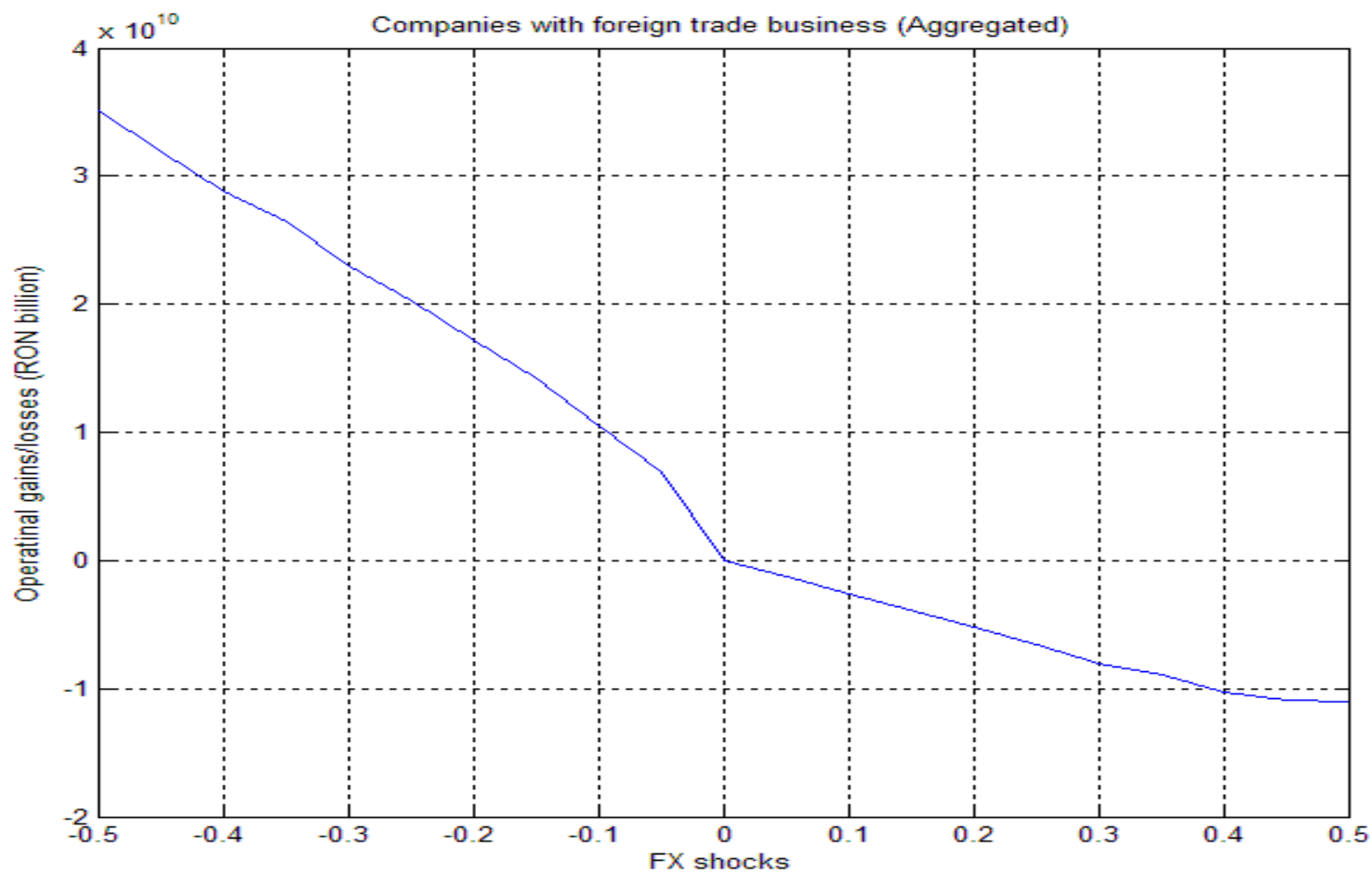




### III. Stress-testing models

#### a. FX Shocks

#### *Empirical results*



### III. Stress-testing models

#### b. Interest Rate Shocks

##### *Conceptual framework*

- **Hypothesis:** all bank loans (domestic and foreign) to firms are made at variable rate

- **Interest rate shock propagation:** Interest expenses (direct linear effect) → Net profit (Cashflows) → Equity → Leverage...

$$dIC_i^N = L_i^N \delta$$

$dIC_i^N$  – change in interest expenses

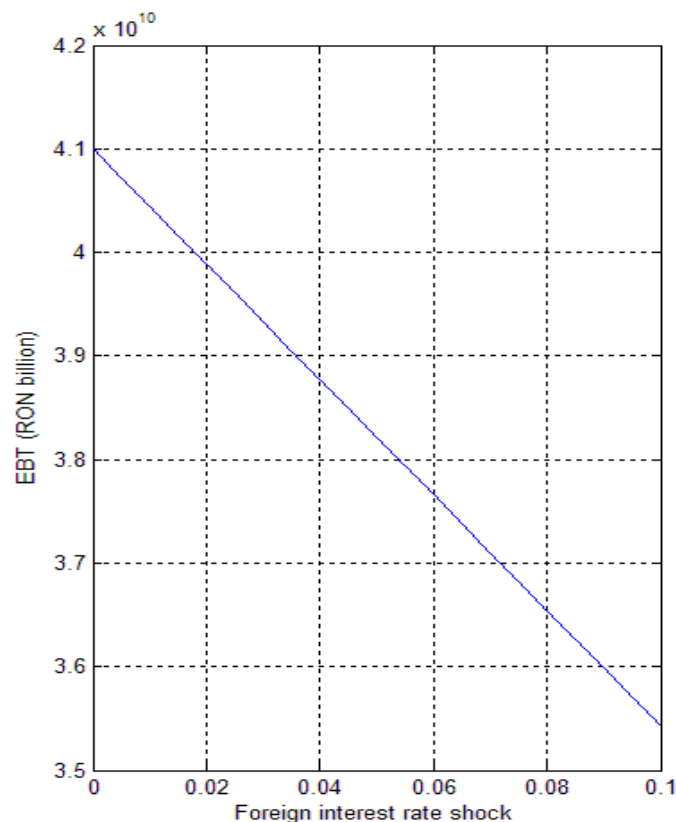
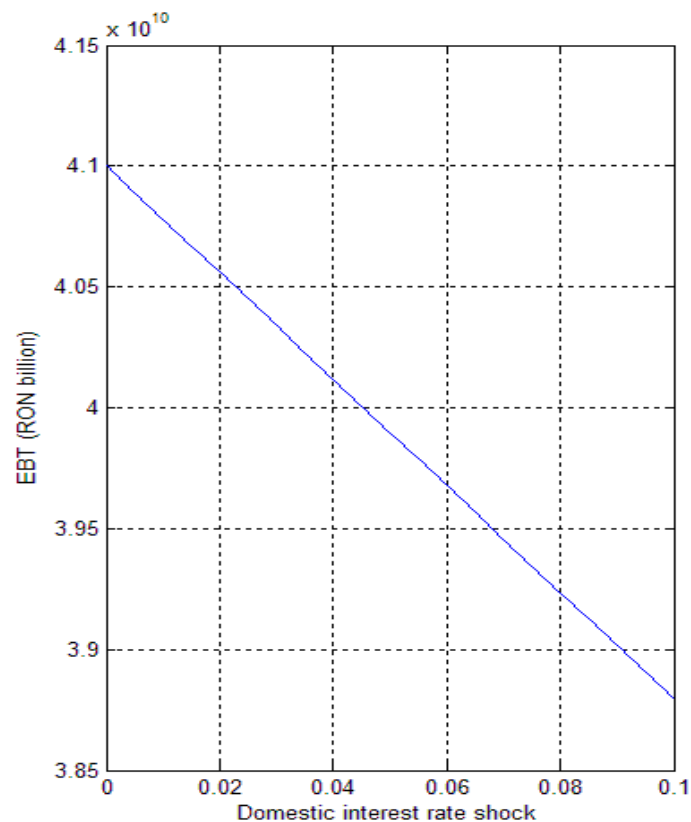
$L_i^N$  – total bank loans

$\delta$  - interest rate shock

# III. Stress-testing models

## b. Interest Rate Shocks

### *Empirical results*



### III. Stress-testing models

#### c. Liquidity Shocks

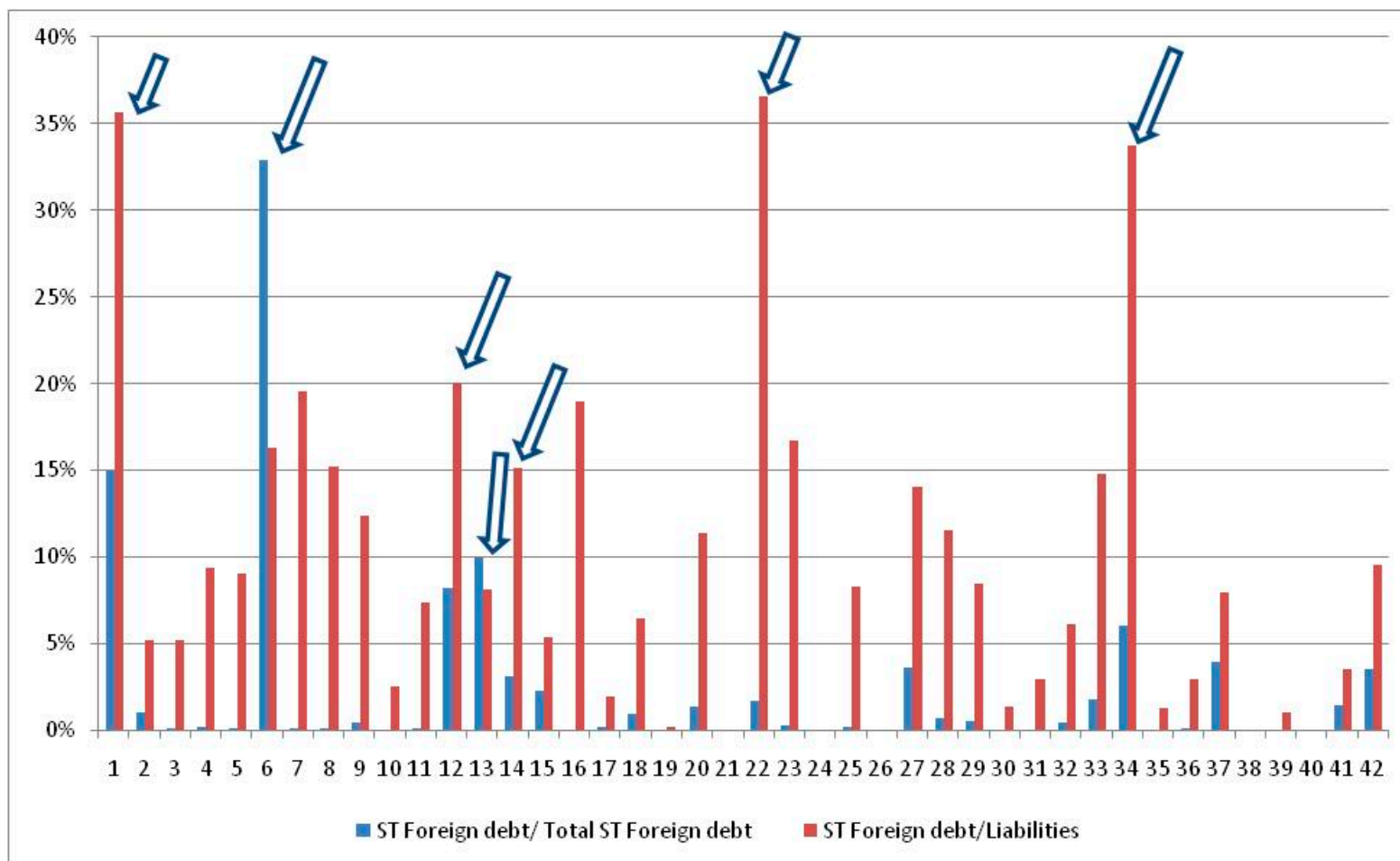
##### *Conceptual framework*

- External liquidity shock
- Impact on domestic banking system through repayment of short term foreign debt
- Domestic banking sector: significant foreign exposure (25% of total foreign exchange liabilities)
- High concentration of short term foreign debt: 5 banks account for 79%
- Domestic banks are highly dependent on parent financing

### III. Stress-testing models

#### c. Liquidity Shocks

#### *Banking sector exposures*



### III. Stress-testing models

#### c. Liquidity Shocks

##### *Selected banks for the stress-testing scenario*

- 7 banks with significant short term foreign debt exposure
- Criteria:
  - To account for a significant part of total short term foreign debt ( as a measure of systemic importance)
  - To have a significant share of short term foreign debt in total liabilities
- These 7 banks account for:
  - 25 bn. RON (app. 7 bn. Euro) short term foreign debt
  - 79% of total short term foreign debt
  - 58% market share

### III. Stress-testing models

#### c. Liquidity Shocks

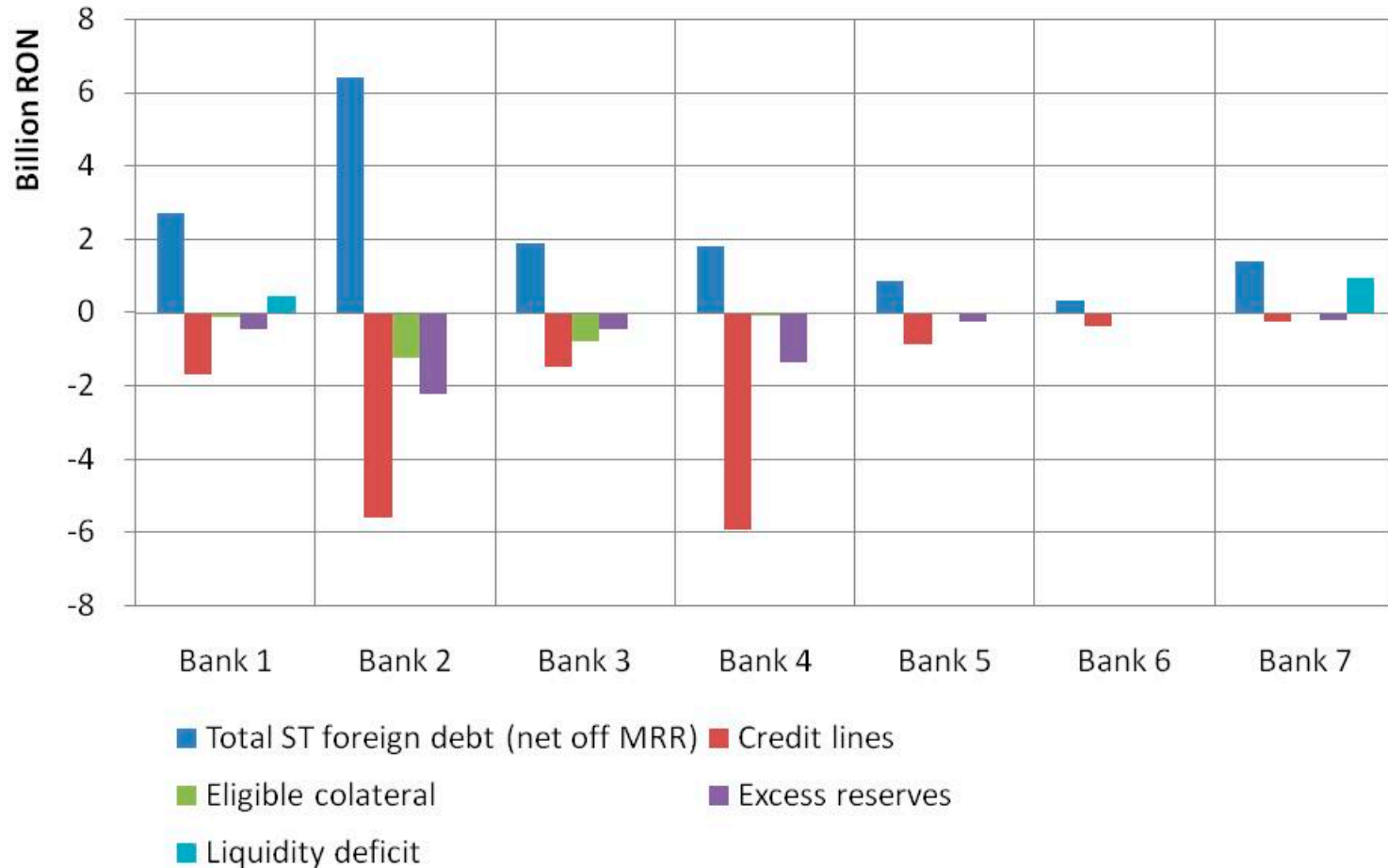
##### *Sources of liquidity for the banking system (II)*

- Extreme scenario: the 7 banks considered have to pay 100% of their short term foreign debt (25 bn. RON)
- Sources of liquidity (used sequentially):
  1. Minimum required reserves
  2. Excess reserves at NBR
  3. NBR financing
  4. Not extending (in total or in part) the credit lines to non-financial corporations

### III. Stress-testing models

#### c. Liquidity Shocks

#### *Sources of liquidity for the banking system (II)*





### III. Stress-testing models

#### c. Liquidity Shocks

*Formula for liquidity deficit*

$$D = \sum_{i=1}^n ((I_{F_i > S_i} (F_i - S_i) - T_i) I_{(F_i > S_i) - T_i > 0} - L_i) I_{F_i > S_i} I_{(F_i > S_i) - T_i > 0} - L_i > 0$$

D – total deficit

I – indicator function

$F_i$  – short term external debt of bank  $i$ , net off MRR and short term external assets

$S_i$  – bank  $i$  excess reserves at NBR

$T_i$  – bank  $i$  eligible collateral

$L_i$  – bank  $i$  credit lines to non-financial corporations

### III. Stress-testing models

#### c. Liquidity Shocks

#### *Non-financial corporations: sources of finance*

- Companies would have to repay 6.8 bn. RON, representing approximately 35% of their yearly operational cash-flow
- Balance-sheet structure of non-financial corporations: cash and cash equivalents - 2.2 bn. RON
- Resulting in 4.6 bn. RON bank arrears

### III. Stress-testing models

#### c. Liquidity Shocks

##### *Impact on real economy*

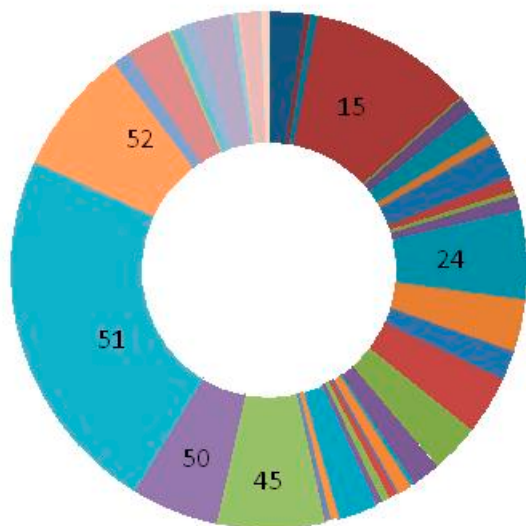
- Banks will cancel, in part, the credit lines (on a pro-rata basis)
- Companies that would not be able to fully repay credit lines have systemic importance:
  - 9% of value added
  - 13% of labor employed

### III. Stress-testing models

#### c. Liquidity Shocks

*Empirical results – structure of new arrears*

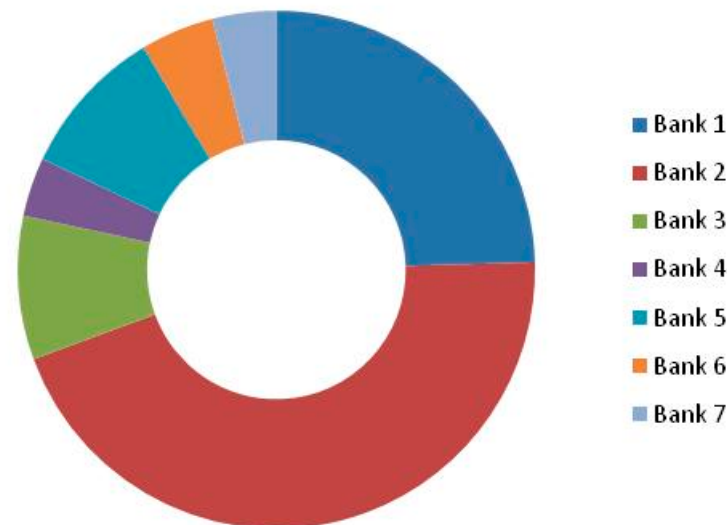
#### New arrears by sector



NACE codes:  
50, 51, 52 – trade  
45 – construction

15 – food and beverages  
24 – chemical products

#### New arrears by bank



- Bank 1
- Bank 2
- Bank 3
- Bank 4
- Bank 5
- Bank 6
- Bank 7

### III. Stress-testing models

#### c. Liquidity Shocks

##### *Collateral*

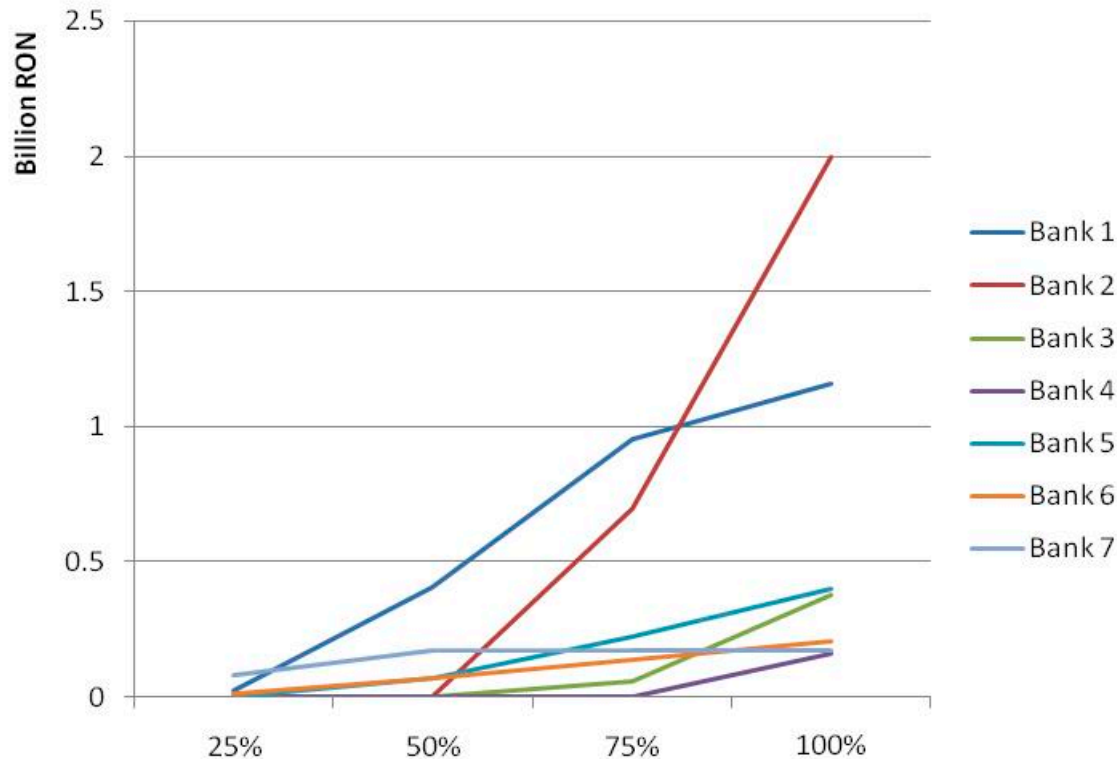
- Most credit lines (97.4%) are collateralized, hence:
  - Medium to long term: limited credit risk
  - Short term: liquidity risk
- 50% of collateral: real estate properties

# III. Stress-testing models

## c. Liquidity Shocks

### *Alternative scenarios*

- Different percentage of short term external debt being repaid by each bank – newly created arrears by bank



Thank you!