BANCA NAȚIONALĂ A ROMÂNIEI

Annual Reginal Seminar on Financial Stability Issues

Sinaia, October 20-21, 2016

A method for determining the relative risk ranking of credit institutions

Virgil Dăscălescu, Alina Bîrțoiu, Anca Diniță

National Bank of Romania

Note: The opinions expressed in this presentation are those of the author and do not necessarily reflect the views of the National Bank of Romania

Outline

I. The Purpose of the Study

II. Methodology and Challenges in the Modelling Process

III. Further Improvements and Developments of the model

IV. Conclusions and Policy Implications

I. The Purpose of the Study

EBA *Guidelines on contributions and payment commitments to deposit guarantee scheme* (May 2015)

- Contribution level of each bank is determined as:

$$Ci = CR \times ARWi \times CDi \times \mu$$

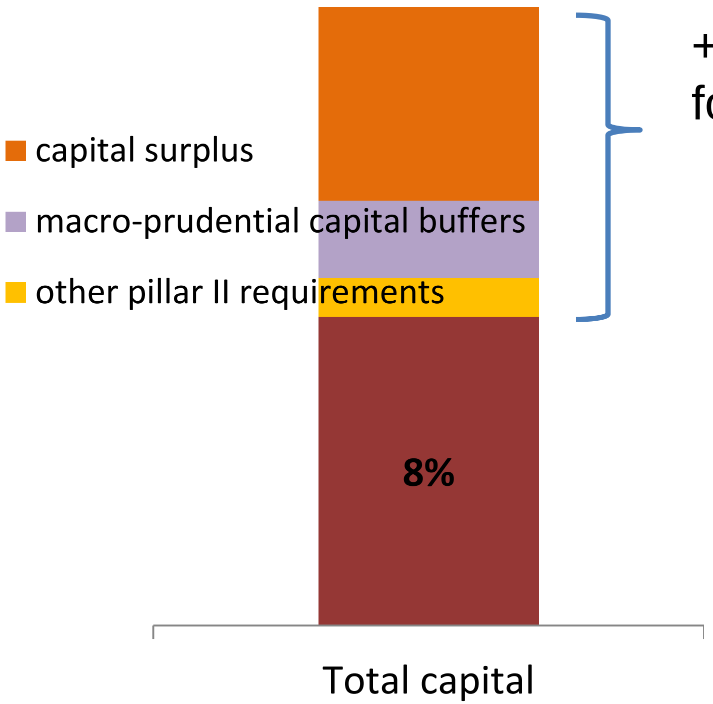
- Contribution level depends on
  - level of covered deposits
  - risk profile of credit institutions
    - a. Capital
    - b. Liquidity and funding
    - c. Asset quality
    - d. Business model and management
    - e. Potential losses for the DGS

Consider Introducing a New Indicator

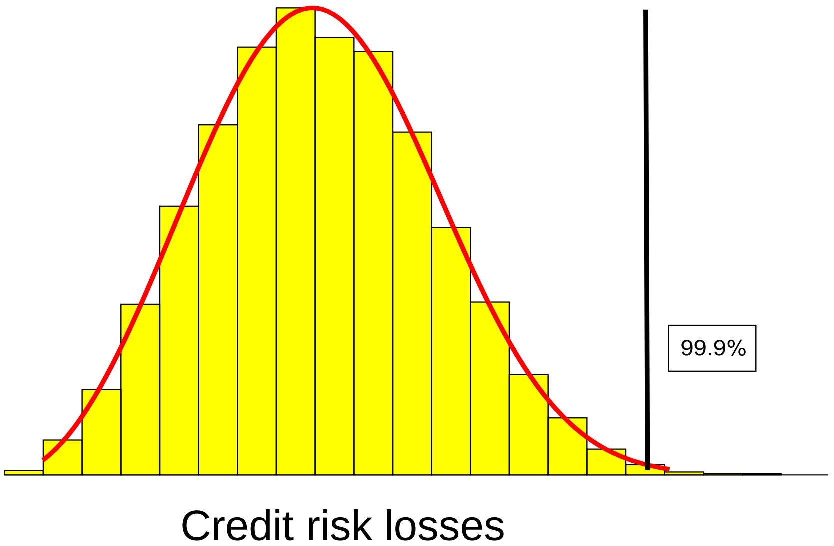
- Main risk faced by credit institutions in Romania -> **credit risk**
- Find a way to measure the relative risk to capital posed by banks due to the credit risk, depending on available capital surplus
- Classify each bank in terms of its average potential shortfall relative to the other banks, for a specified threshold of a loss distribution

$$\frac{average\ deficit_{bank\ i}}{\sum_i average\ deficit_{bank\ i}}$$

II. Model Set-up



+ operational profit
for the period



$\boldsymbol{Deficit_i}$ = MIN (0, Total capital + operational profit for the period – 8%* REA – $\boldsymbol{Loss_i}$)

not accounting for the scenarios where the loss is greater than a pre-specified threshold of the loss distribution (e.g. 99,9)

Structure of the Model

System level **Bank level**

1. Portfolio segmentation

2. Determine the empirical distributions of default rates

3. Select theoretical distributions that would fit the data

4. Find a suitable specification for the joint distribution of default rates

5. Simulate scenarios by drawing default rates for the portfolios using the joint distribution (Monte Carlo approach)

6. Translate the simulated default rates at bank level for each portfolio

7. Based on an average transition matrix determine the default rates specific to different prudential rating classes, in each portfolio ; calibrate default rates in terms of scenarios

8. Compute the amount of loss for each simulated values of default rates

Step 1. Portfolio Segmentation

- Splitting loans into relatively homogeneous portfolios that would also make sense from a risk management perspective

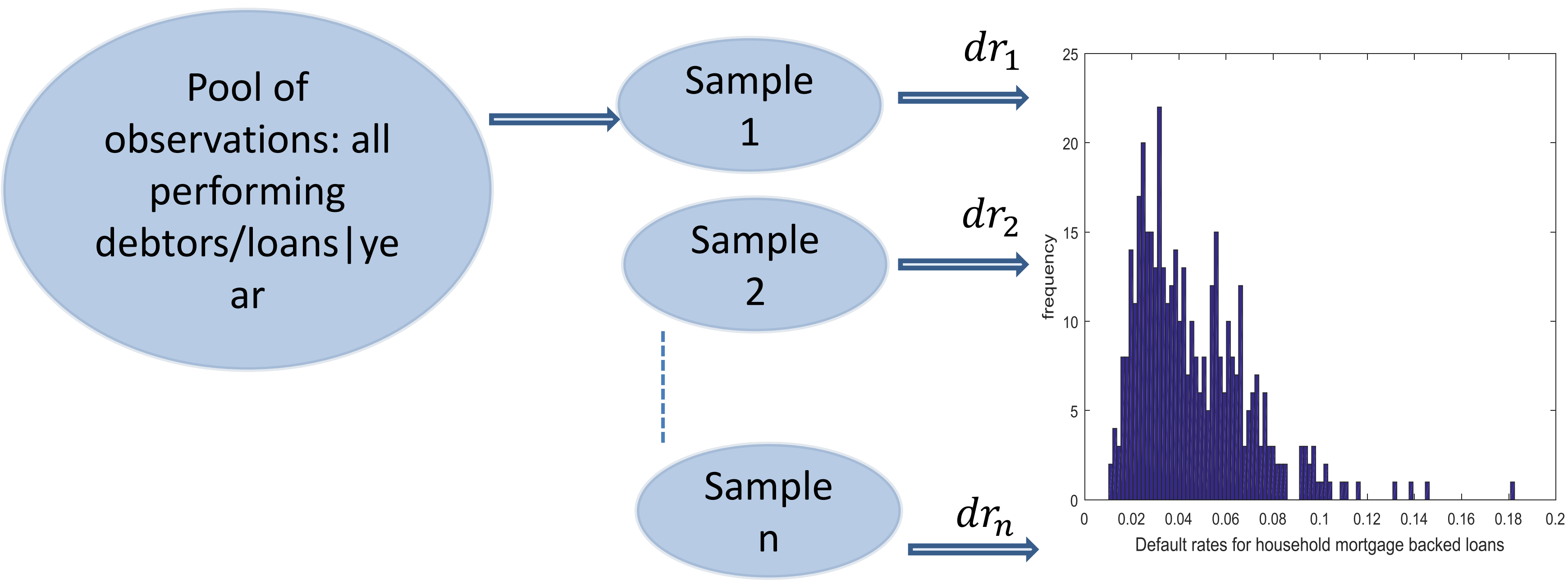
6 portfolios

Households	Non-financial institutions
Mortgage backed loans	Corporates and large SMEs
Revolving	Medium and small SMEs
Others	Others

- **Data**: loans reflected in the Credit Register (June 2005 – June 2016)
- **Default definition**: { 90 days past due and
  Prudential category = Loss }

Step 2. Empirical Distribution of Default Rates

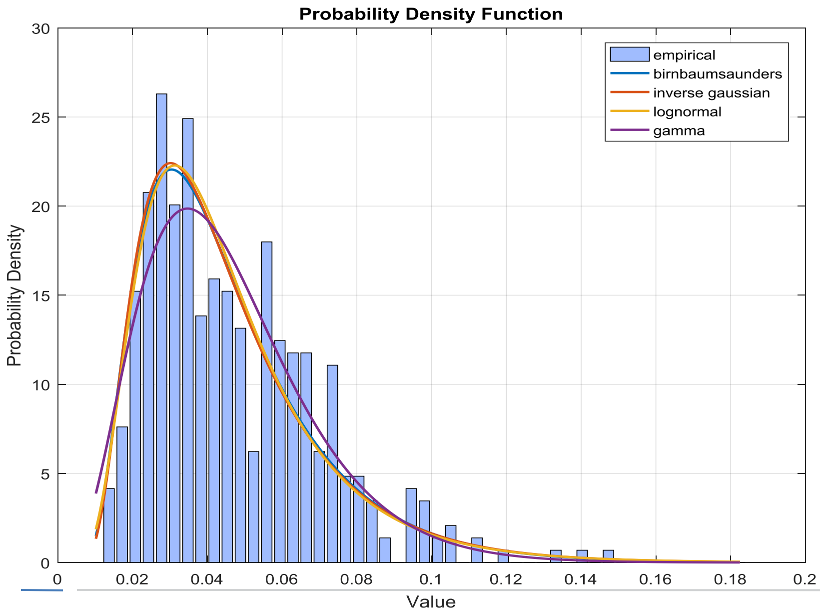
- Long term distribution of default rates (unconditional)
- Bootstrap method using sampling without reposition



Step 3. Fit and Select Theoretical Distributions for Each Portfolio

- Choose a series of suitable theoretical distributions
- Estimate the theoretical distribution parameters based on the data
- Check the goodness-of-fit of the theoretical distribution

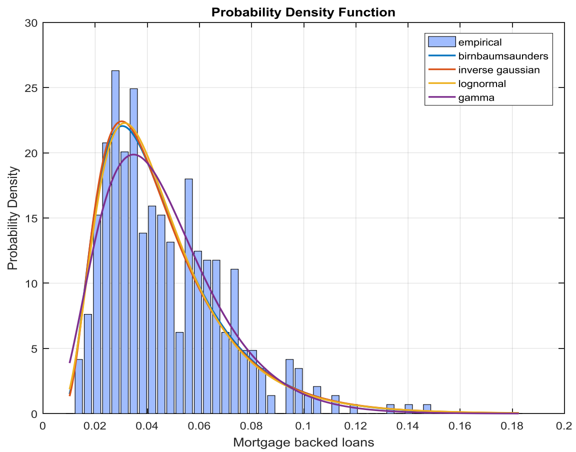
E.g. Mortgage backed loans

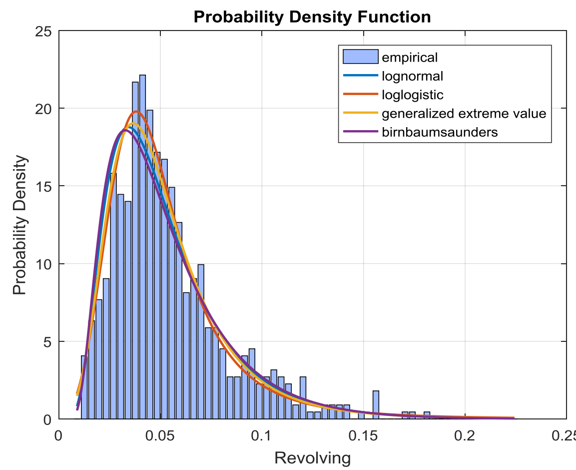


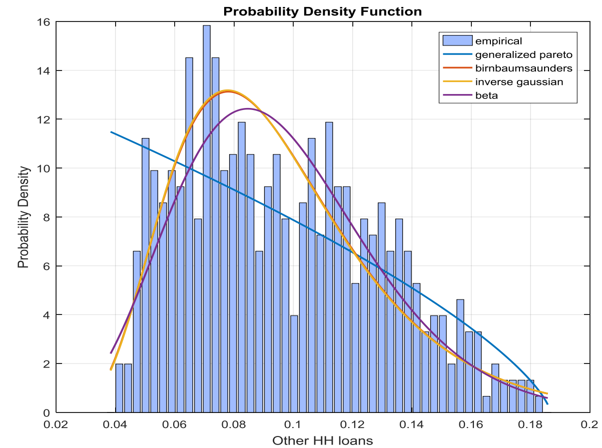
Tested theoretical distributions

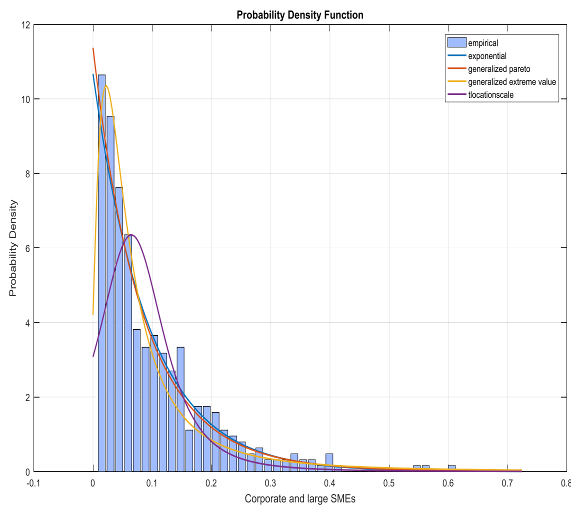
Beta	Lognormal
Birnbaum-Saunders	Nakagami
Exponential	Normal
Extreme value	Rayleigh
Gamma	Rician
Generalized extreme value	t location-scale
Generalized Pareto	Weibull
Inverse Gaussian	Binomial
Logistic	Negative binomial
Log-logistic	Poisson

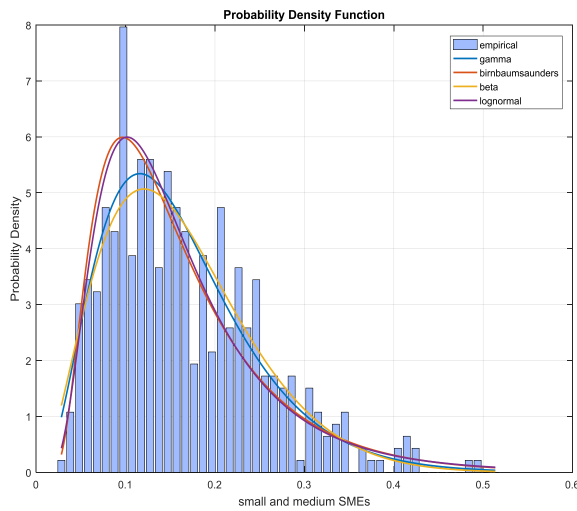
Some Preliminary Results – subsample of banks

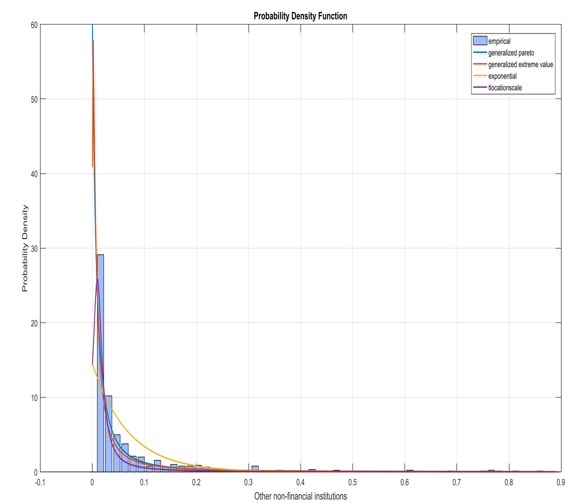












Step 4. Joint Default Rate Distribution

- Univariate distributions of default rates for each of the 6 portfolios considered
- The dependence relation among them, represented by a copula function
- Joint default distribution :

$$F(DR^{p1}, DR^{p2}, DR^{p3}, DR^{p4}, DR^{p5}, DR^{p6}) = \boldsymbol{C}(F_1(DR^{p1}), F_2(DR^{p2}), F_3(DR^{p3}), F_4(DR^{p4}), F_5(DR^{p5}), F_6(DR^{p6}))$$

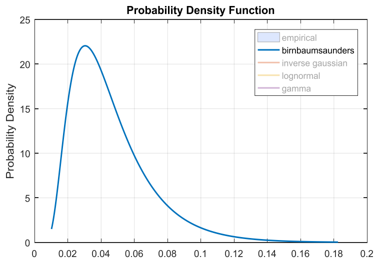
by Sklar theorem

$$= \boldsymbol{C}(F_1^{-1}(u_1), F_2^{-1}(u_2), F_3^{-1}(u_3), F_4^{-1}(u_4), F_5^{-1}(u_5), F_6^{-1}(u_6))$$

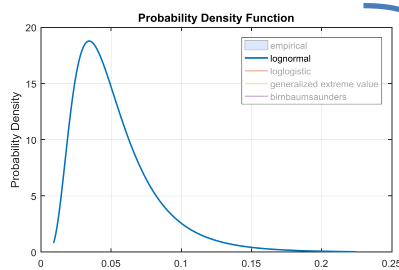
where the probabilities u_i=$F_i(DR^{pi})$ such that $DR^{pi} = F_i^{-1}(u_i)$, i=1..6

- What functional form for the copula?
  - elliptical copula function – Gaussian and Student copula (with several specifications)

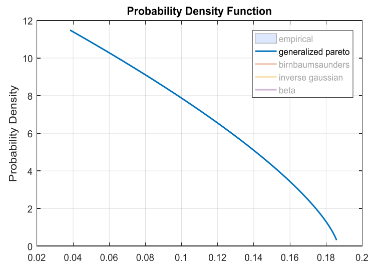
Step 5. Monte Carlo Simulation of Default Rates from the Joint Default Rate Distribution



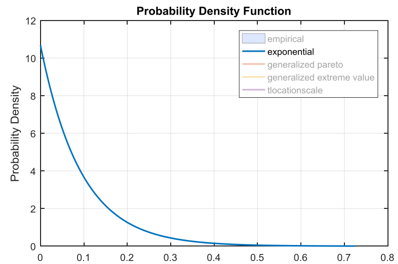
Fitted distribution for mortgage backed loans



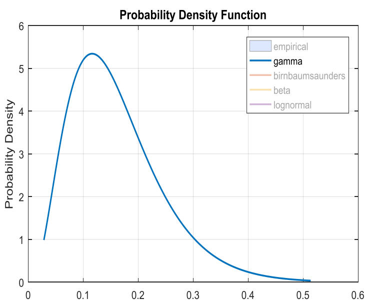
Fitted distribution for Revolving Loans



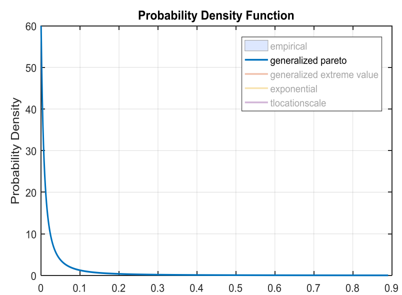
Fitted distribution for other HH loans



Fitted distribution for Corporate and large SMEs portfolio



Fitted distribution for medium and small SMEs portfolio



Fitted distribution for other non-financial companies portfolio

- **Correlation**
- **Multivariate copula functional form**

$$F(DR^{p1}, DR^{p2}, DR^{p3}, DR^{p4}, DR^{p5}, DR^{p6})$$

$$DR_1(dr^{p1}, dr^{p2}, dr^{p3}, dr^{p4}, dr^{p5}, dr^{p6})$$

$$DR_2(dr^{p1}, dr^{p2}, dr^{p3}, dr^{p4}, dr^{p5}, dr^{p6})$$

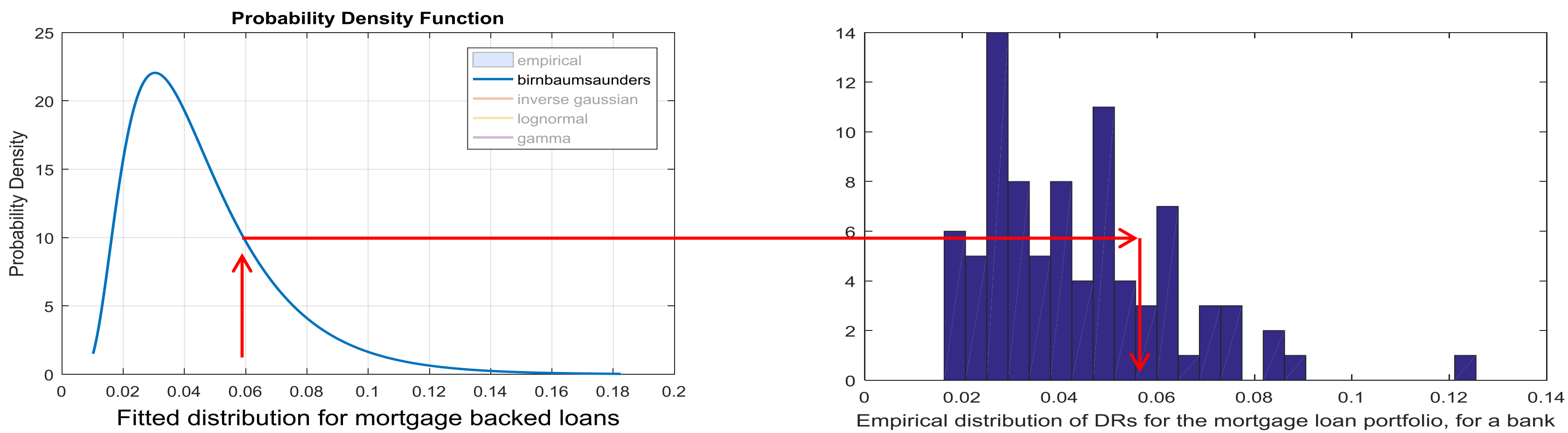
$$DR_n(dr^{p1}, dr^{p2}, dr^{p3}, dr^{p4}, dr^{p5}, dr^{p6})$$

Step 6. Default rates on Bank Level, Using the Joint Default Rates Computed on System Level

Based on the previous step, apply the simulated quantiles at system level on the empirical distributions obtained on bank level for each portfolio and each simulation (DR_{1-n})

E.g. $DR_i(dr^{p1}, dr^{p2}, dr^{p3}, dr^{p4}, dr^{p5}, dr^{p6})$

For the first portfolio (p1)



dr^{p1} on system level

dr^{p1} on bank level

Step 7. Calibration of the Average Default Rates on Portfolio Level

- Reflecting the different quality of debtors according to their prudential classification
- For each bank and each simulation (1-n) get the default rate specific to each portfolio.

$$DR_i(dr^{p1}, dr^{p2}, dr^{p3}, dr^{p4}, dr^{p5}, dr^{p6})$$

- Possible to further look within each portfolio, at the classification of debtors from the prudential perspective. (i.e. take an average transition matrix)

	Default rate
Standard	2.8%
Watch	6.8%
Substandard	19.4%
Doubtful	31.4%
Loss	67.5%

\+

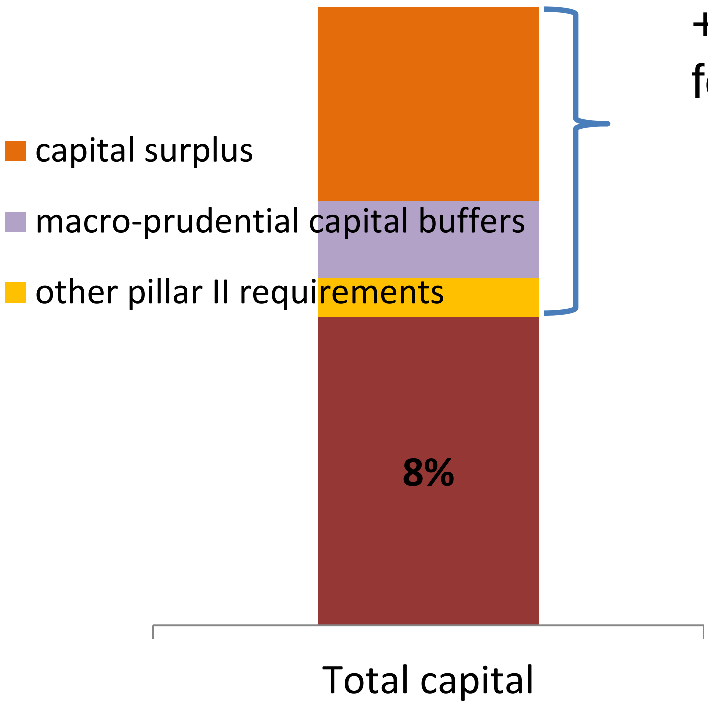
Exposure level for each rating class

Provision coverage ratio as proxy for LGD

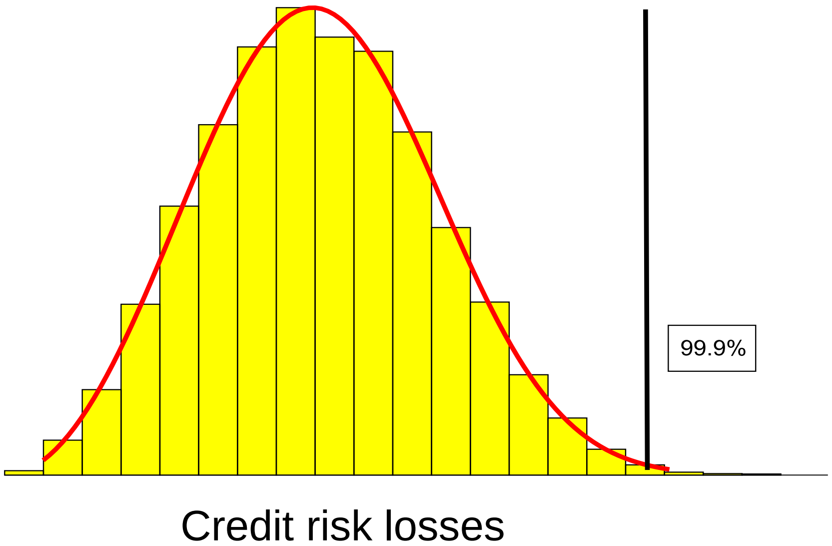
- Compute the loss for the bank at simulation i as being

$$loss_i = \sum_{6\,portfolios} DR * LGD * Exp$$

Step 8. Wrapping up – Bank Level



+ operational profit
for the period



$\boldsymbol{Deficit_i}$ = MIN (0, Total capital + operational profit for the period – 8%* REA – $\boldsymbol{Loss_i}$)

not accounting for the scenarios where the loss is greater than a pre-specified threshold of the loss distribution (e.g. 99,9)

Step 9. Rank Institutions

- Compute the average deficit of banks across scenarios
- Rank institutions according to their relative average deficits

$$\frac{average\ deficit_{bank\ i}}{\sum_i average\ deficit_{bank\ i}}$$

III. Further improvements and developments of the model

- Investigating modules to
  - Model concentration risk (work in progress)
- Future possible extensions
  - Developing a time-dependent (conditional) model

III. Further improvements and developments of the model

- Investigating modules to
  - Model concentration risk:
  - Takes into account the difference between “real” portfolios and highly granular ones, adjusting for Pillar 1 undifferentiated capital requirements
  - Aims at increasing the capital requirement depending on the difference between unexpected loss estimates at a given threshold and credit risk regulatory (Pillar 1) capital requirements

IV. Conclusions and Policy Implications

- Model a relative risk ranking of credit institutions based on credit risk, with size adjustments

- Possible use the model results as an additional indicator to determine the contributions of individual banks to the deposit guarantee schemes, as part of the EBA methodology.

Thank you!