



NATIONAL BANK OF ROMANIA

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# Stress-testing the non-financial companies sector - a macroprudential perspective

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

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# Agenda

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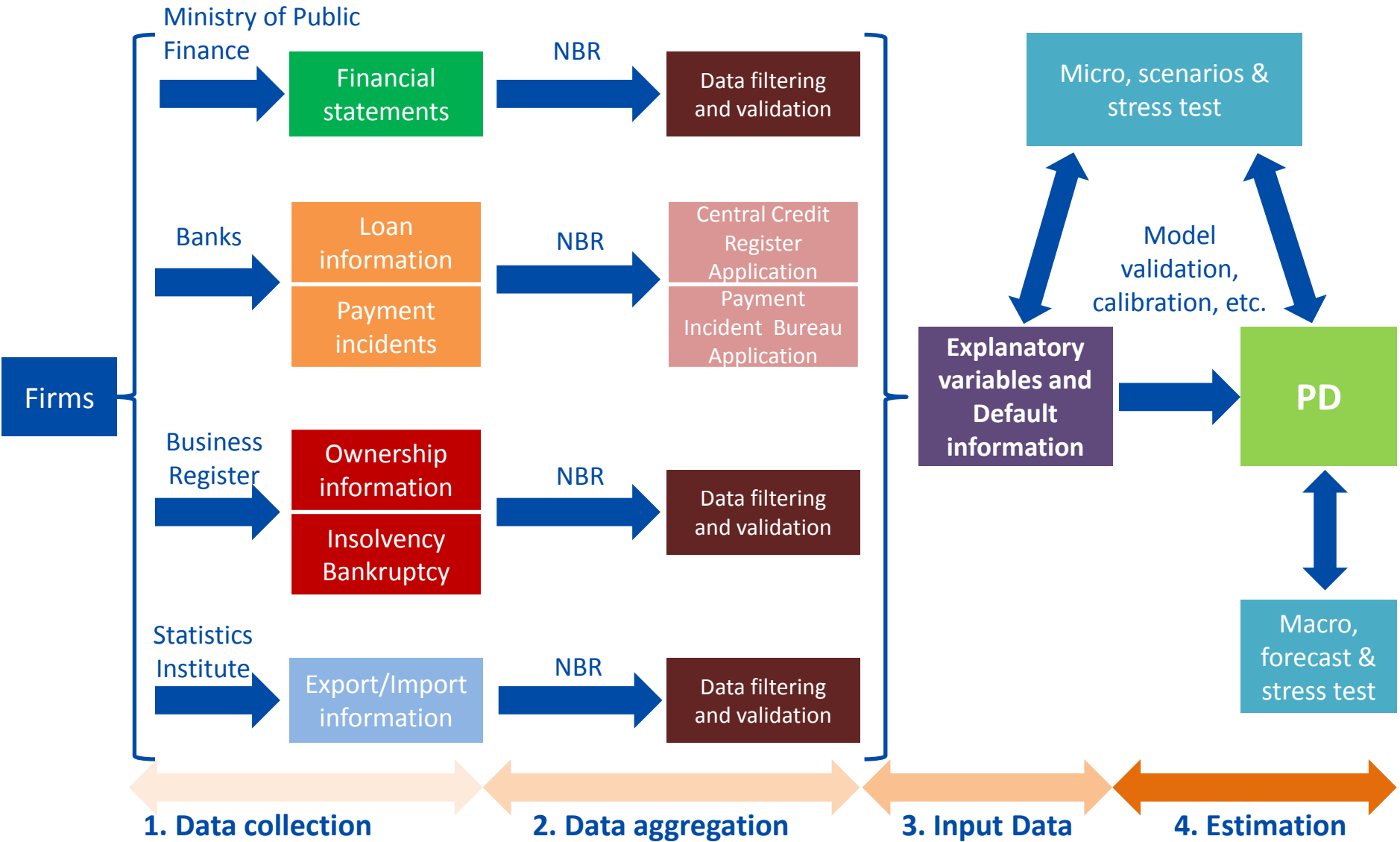
- Aims and usage of the framework
- Data
- Methodology & Results
- Conclusions & Future work

# Aims and usage of the framework

**Main objective**: assess the financial stability of the banking sector from non-financial companies' credit risk perspective

- estimates the probabilities of default for firms
- provides a stress-testing framework that investigates the impact of various scenarios both on firms' performance and on their probability of default (micro and macro shocks)

# Data



# Methodology

## PD model (1)

The current model<sup>1</sup> is estimated using a two-step approach:

- A *logit* model for the probability of default in the corporate sector, which quantifies the one-year ahead developments in the quality of banks' corporate loans (point-in-time microeconomic model)
- A macroeconomic module, which strives to capture the feedback effects from the macroeconomic stance into the banking sector, via the corporate sector channel

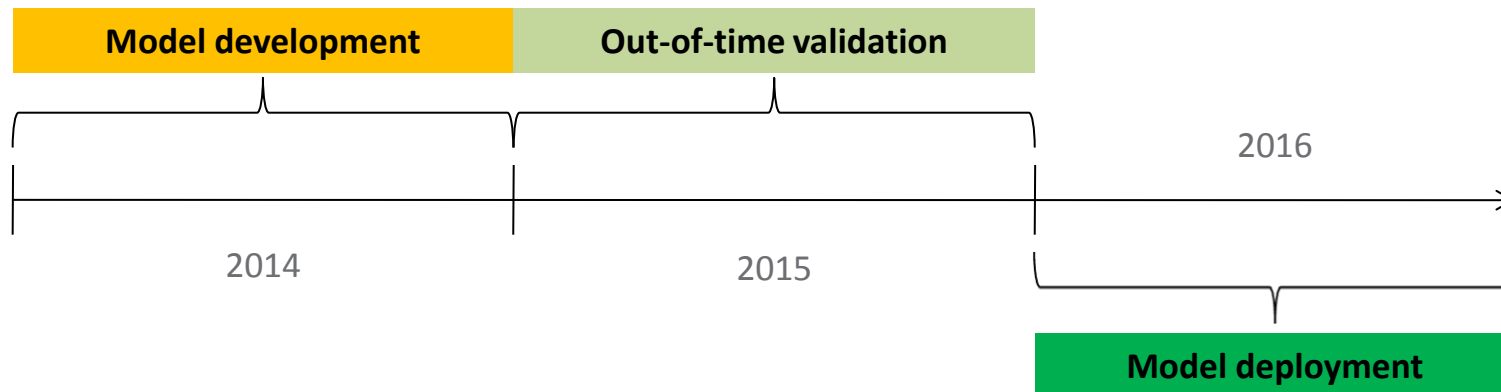
[1] Further details can be found in Costeiu and Neagu (2013), <https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1592.pdf>

# Methodology

## PD model (2)

*Logit* methodology, using as explanatory variables financial ratios derived from firms' financial statements

$$\left\{ \begin{array}{l} y_i = \begin{cases} 1 \leftrightarrow \text{default} \\ 0 \leftrightarrow \text{otherwise} \end{cases} \\ y_i^* = x_i \beta + \varepsilon_i \end{array} \right. \implies P(y_i = 1) = F(x_i \beta) = \frac{1}{1 + e^{-x_i \beta}}$$



# Methodology

## Macro module (1)

The macroeconomic module is used:

- as input in the calibration phase of the PD model
- to forecast the default rate

Model specification:

- *time interval*: Q1 2001 – Q2 2016
- *dependent variable*: quarterly registered default rate
- *independent variables*: GDP growth, real effective exchange rate, CORE1 annual inflation, the interest rate spread (domestic loans interest rate vs. 3m EURIBOR)

# Methodology

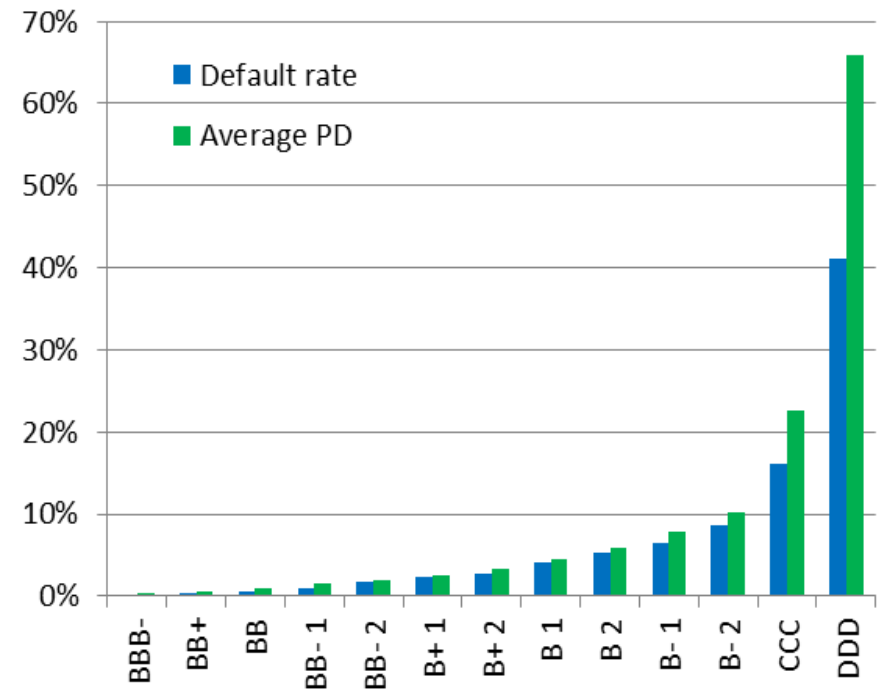
## Macro module (2)

**Calibration:** Based on King and Zeng (2001) - Adjustment to intercept only

$$\log\left(\frac{PD}{1-PD}\right) = \alpha + X\beta + \log\left(\frac{\pi_d}{1-\pi_d} / \frac{p}{1-p}\right)$$

where:

- PD is the calculated probability of default
- $\pi_d$  is the default rate at which we calibrate the PD
- p is the average unadjusted computed probability of default for the forecast sample
- X is the explanatory variables vector



Source: MPF, NBR calculations



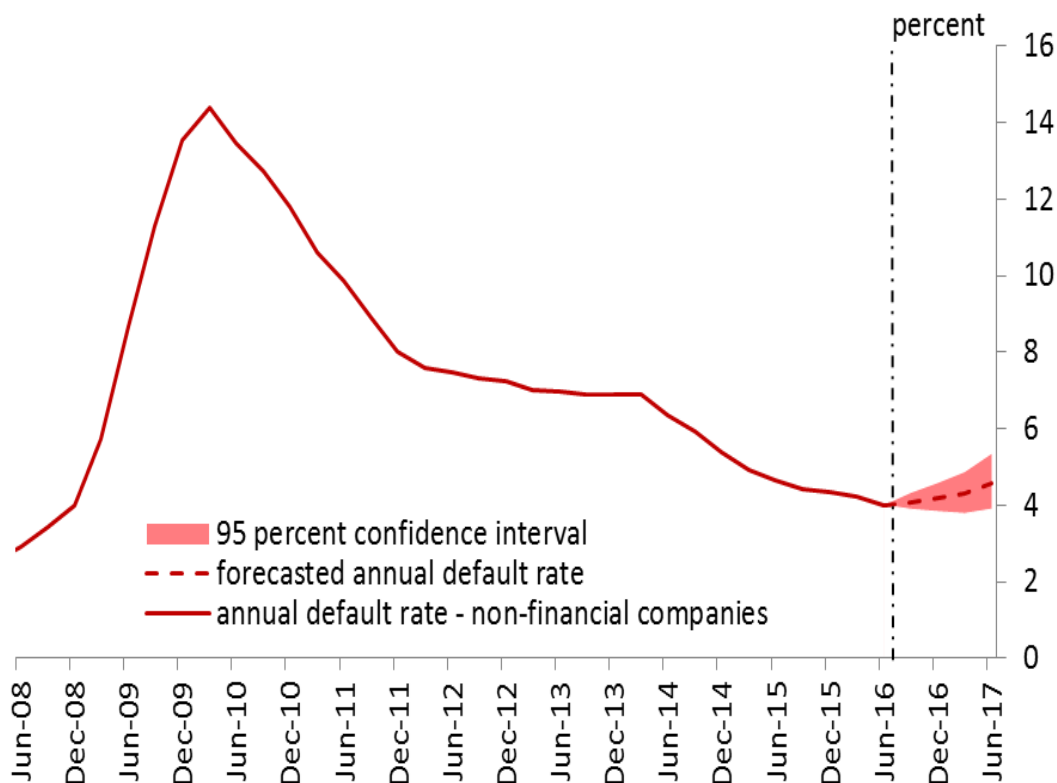
# Results

## Macro module

### Baseline scenario:

	2016	2017
Effective EU economic growth (%)	1.67	1.59
Annual inflation rate in the euro area (%)	0.24	1.40
3M EURIBOR interest rate (% per annum)	-0.28	-0.40
EUR/USD exchange rate	1.11	1.09

Source: NBR, Inflation Report, August 2016

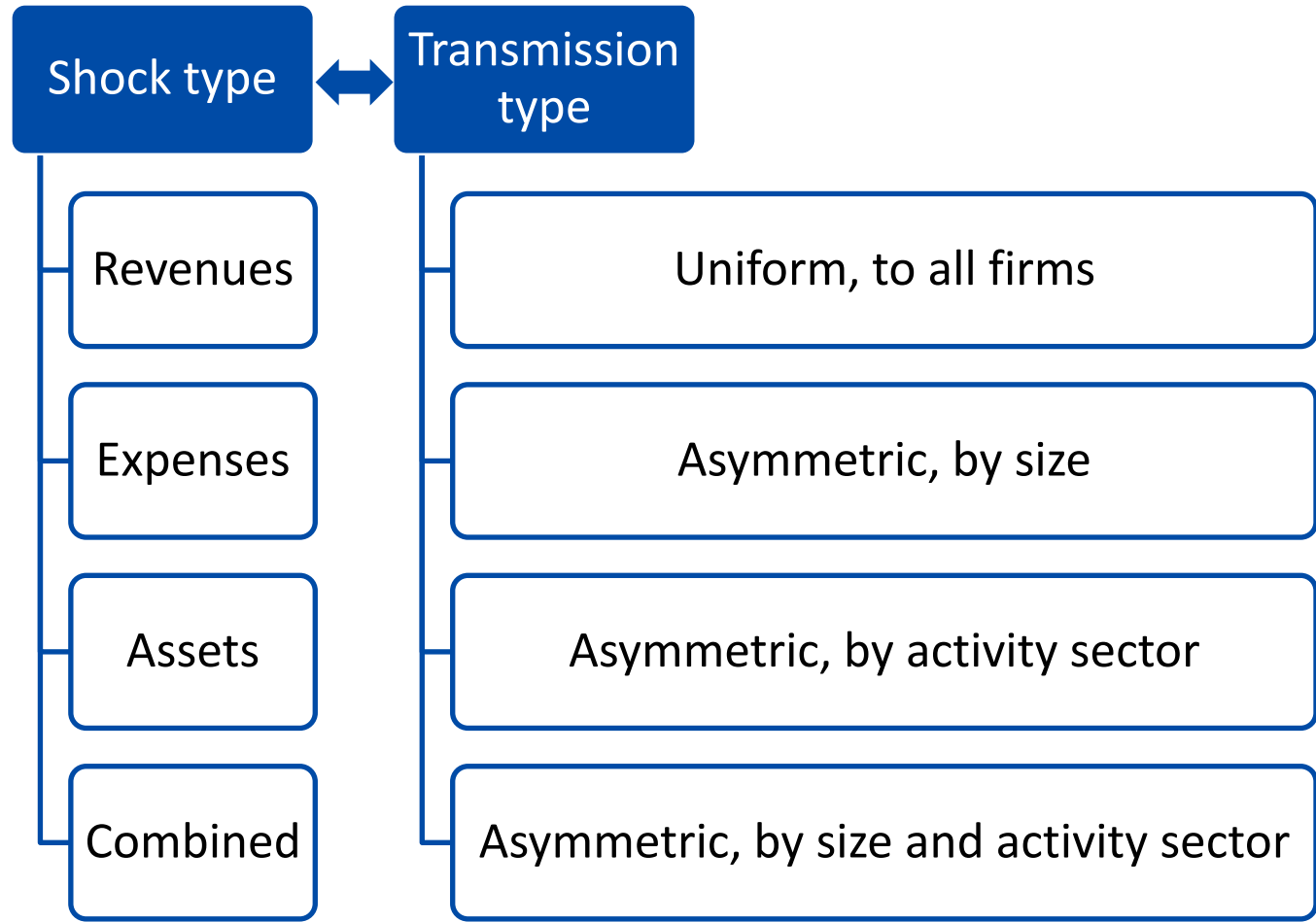


Source: NBR calculations

# Methodology

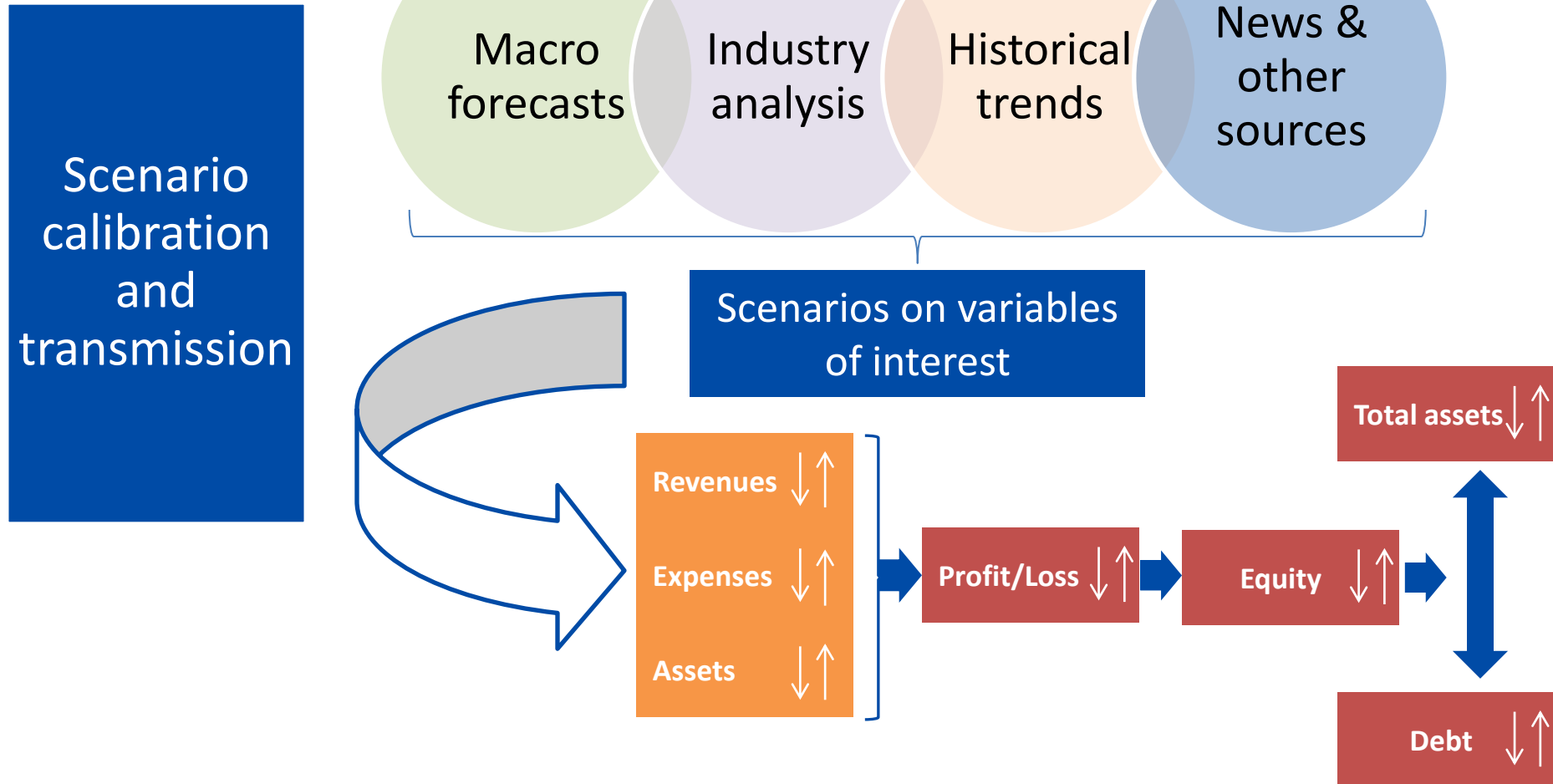
## Micro, stress-test module (1)

Scenario calibration and transmission



# Methodology

## Micro, stress-test module (2)



# Methodology

## Micro, stress-test module (3)

### Motivation

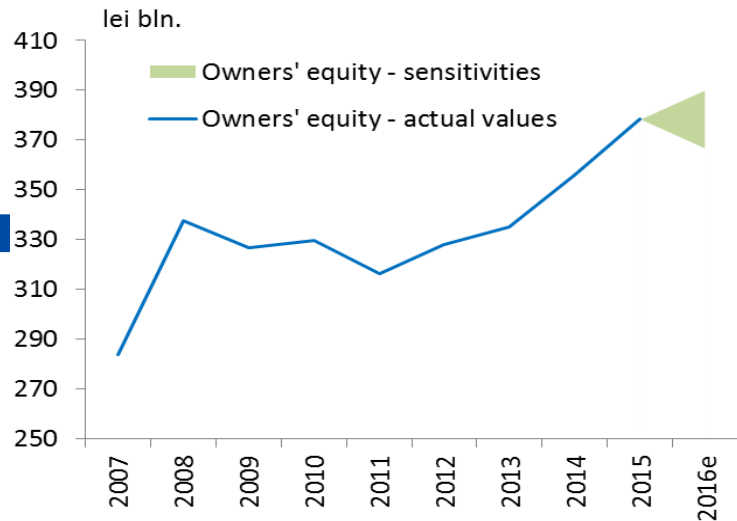
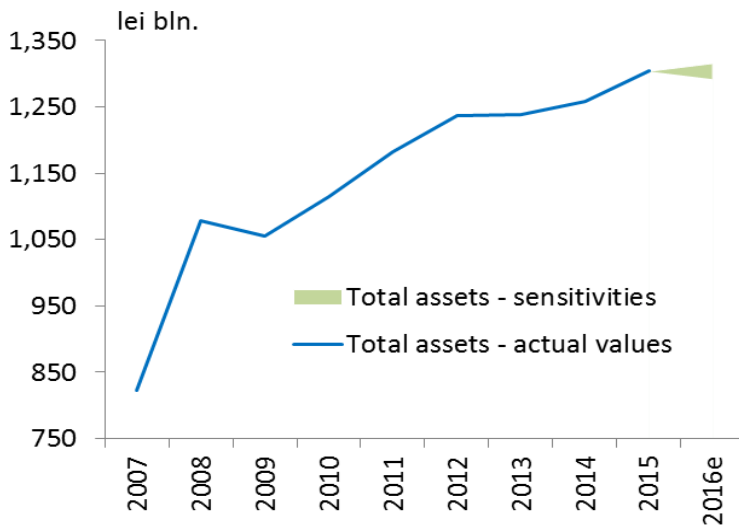
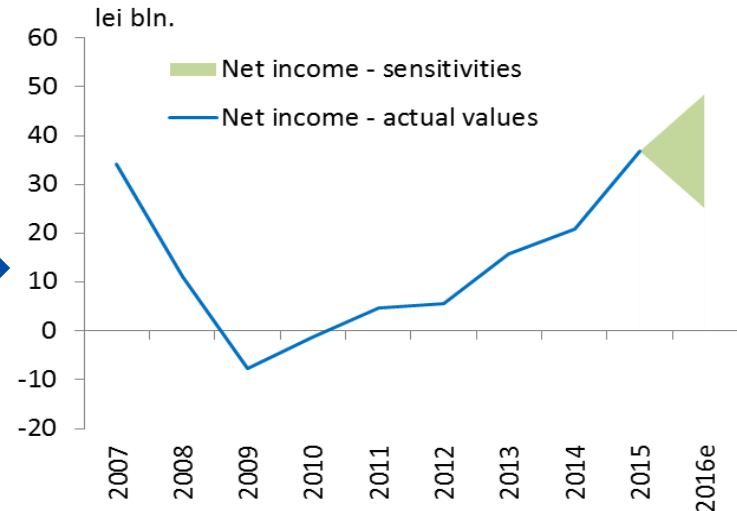
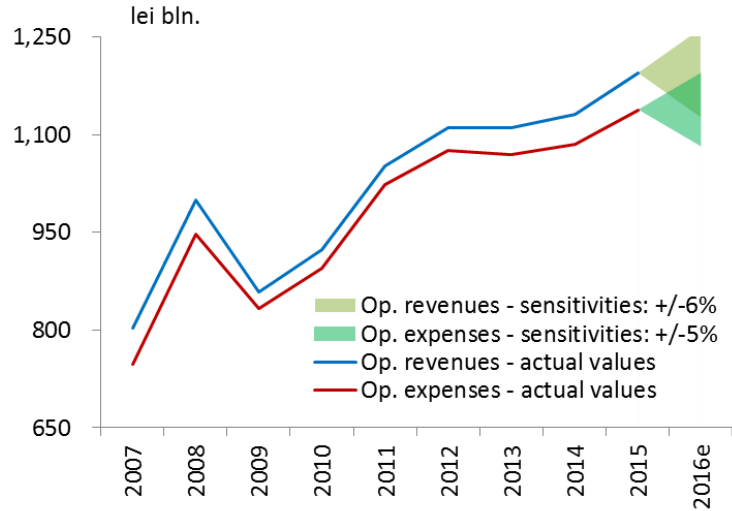
	2015/2014		2009/2008	
	Total sales	Total operating expenses	Total sales	Total operating expenses
<b>Total companies</b>	6.0%	4.9%	-13.2%	-12.0%
	<i>By size</i>		<i>By size</i>	
	Total sales	Total operating expenses	Total sales	Total operating expenses
<b>Large corporates</b>	4.8%	5.2%	-13.6%	-13.1%
<b>SMEs</b>	7.0%	4.6%	-12.8%	-11.2%
	<i>By sector</i>		<i>By sector</i>	
	Total sales	Total operating expenses	Total sales	Total operating expenses
<b>Agriculture</b>	-3.4%	0.1%	3.9%	2.0%
<b>Mining</b>	-14.5%	-7.1%	-21.5%	-20.9%
<b>Manufacturing</b>	3.0%	1.1%	-17.0%	-16.4%
<b>Utilities</b>	5.7%	6.3%	-5.6%	-6.0%
<b>Construction</b>	11.3%	5.4%	-22.6%	-23.3%
<b>Trade</b>	7.5%	6.3%	-11.8%	-10.1%
<b>Services</b>	10.7%	10.7%	-10.5%	-6.9%
<b>Real estate</b>	6.1%	-2.5%	1.2%	-8.0%

Source: MPF, NBR calculations

Scenario calibration and transmission

# Results

## Micro, stress-test module (1)



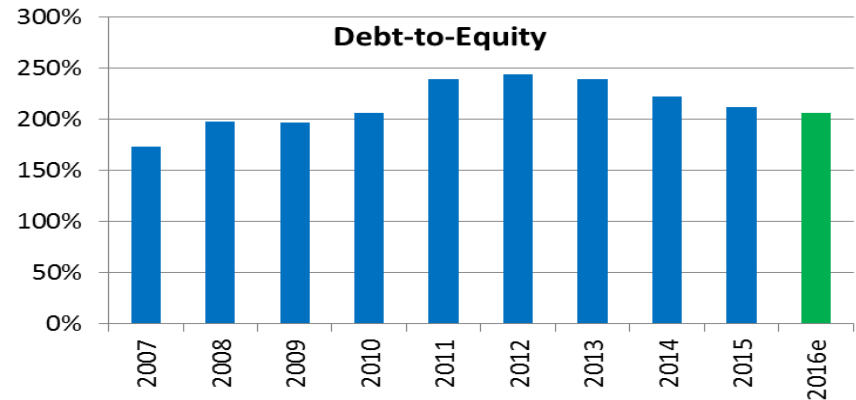
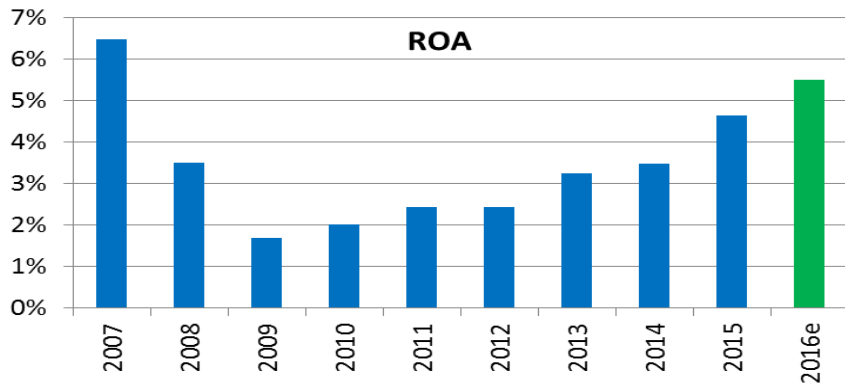
# Results

## Micro, stress-test module (2)

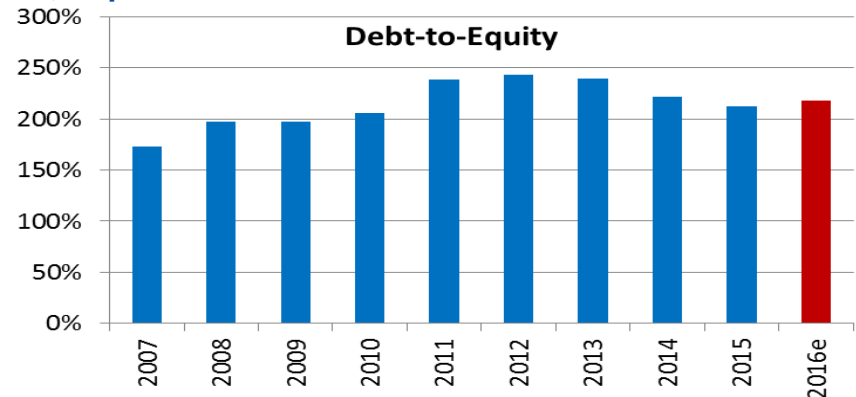
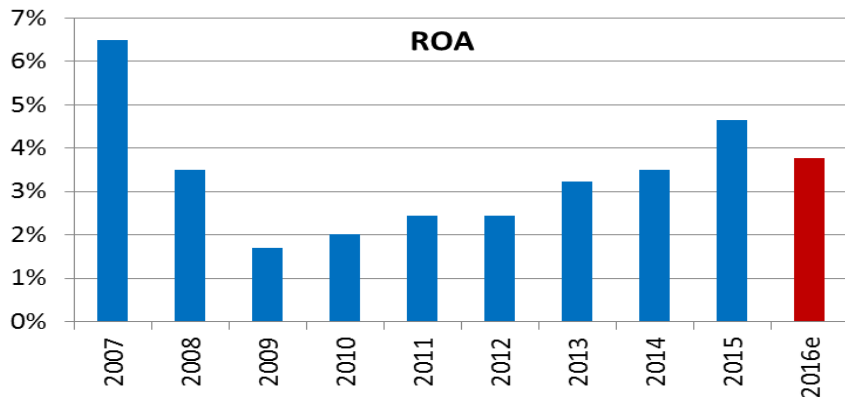
Two-fold use:

1. scenario analysis and stress-test firms' main financial indicators...

**Scenario 1: Revenues +6%, Expenses +5%**



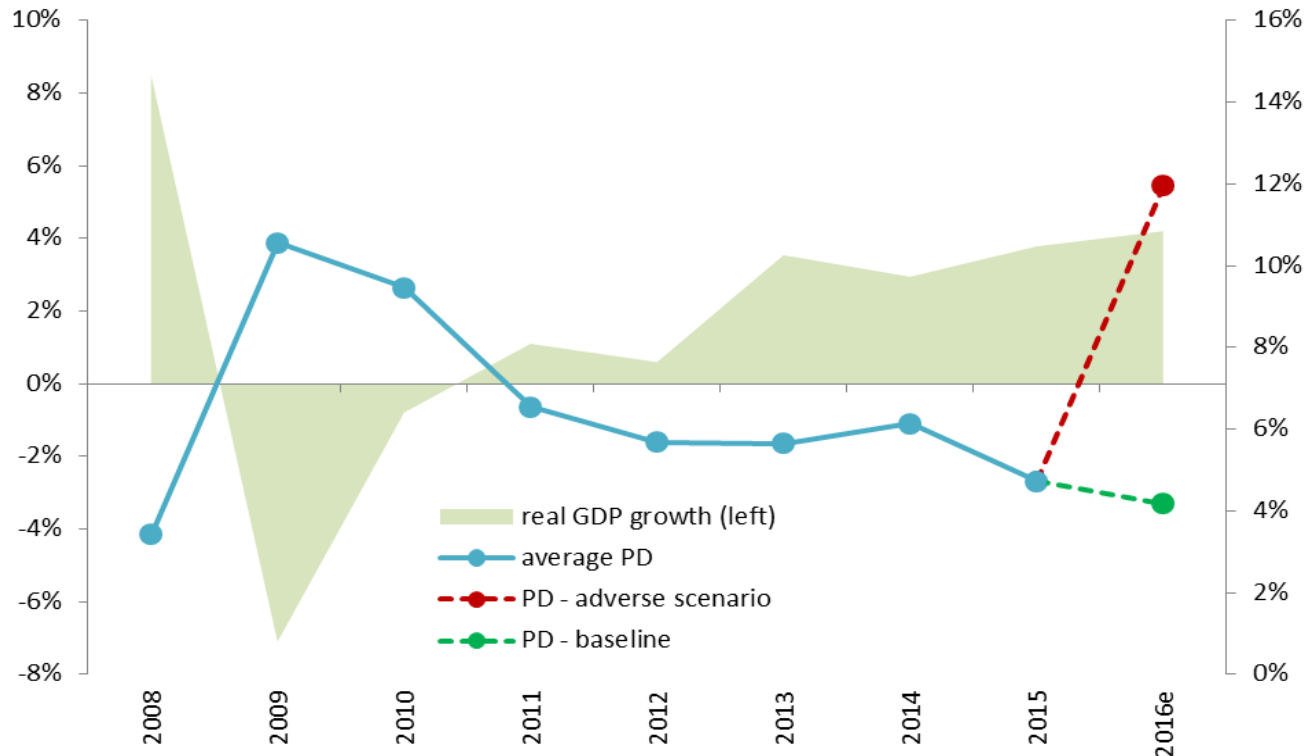
**Scenario 2: Revenues -6%, Expenses -5%**



# Results

## Micro, stress-test module (3)

- ...but it can also be employed as an input for PD estimation under various scenarios



Source: European Commission, MPF, NBR calculations

# Results

## Micro, stress-test module (4)

### Transition matrix - adverse scenario

<i>Rating class</i>	BBB-	BB+	BB	BB- (1)	BB- (2)	B+ (1)	B+ (2)	B (1)	B (2)	B- (1)	B- (2)	CCC	DDD
BBB-	0%	24%	73%	3%									
BB+		0%	47%	42%	8%	2%							
BB			0%	18%	45%	28%	6%	2%					
BB- (1)				0%	3%	41%	41%	10%	2%	1%	0%	1%	
BB- (2)					1%	7%	38%	36%	12%	3%	1%	1%	1%
B+ (1)						3%	11%	31%	31%	14%	5%	4%	1%
B+ (2)						1%	5%	16%	25%	25%	13%	11%	3%
B (1)							1%	7%	20%	22%	21%	23%	5%
B (2)								1%	7%	16%	21%	44%	10%
B- (1)									1%	6%	12%	58%	22%
B- (2)										1%	5%	65%	29%
CCC											1%	41%	58%
DDD													100%

Source: MPF, NBR calculations



# Future work

- Implementing the CRR art. 178 default definition
- Developing sectoral PD models
- New calibration methods
- Further strengthen the stress-testing module with Value-at-Risk & Expected Shortfall models
- Through-the-cycle estimation/calibration



Thank you!

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