NATIONAL BANK OF ROMANIA

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Probability of default - a new qualitative perspective

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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

Agenda

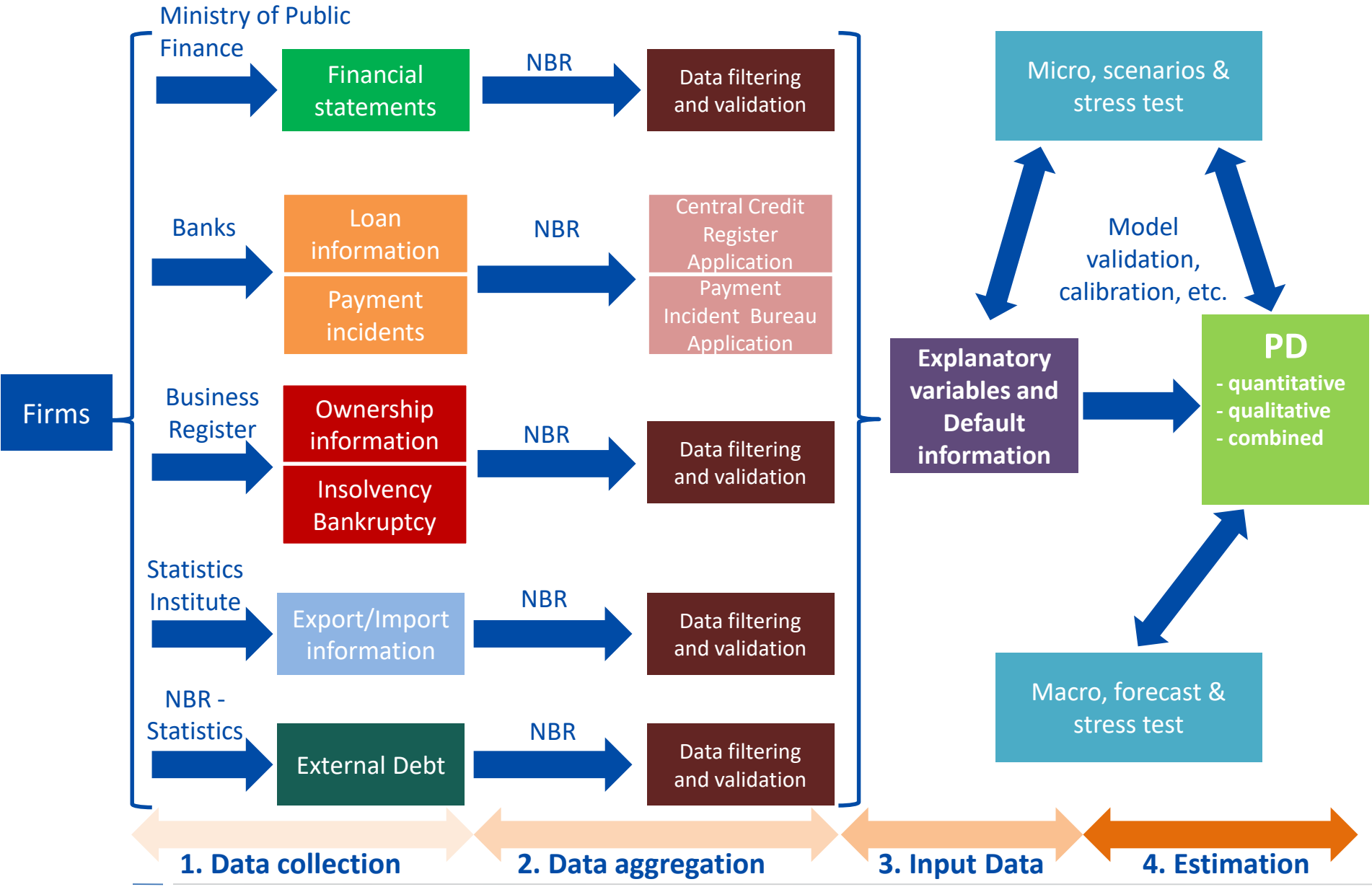
- Aims and usage of the framework
- Qualitative PD module

Aims and usage of the framework

Main objective: assess the financial stability of the banking sector from a credit risk perspective.

- estimates the probabilities of default for the non-financial companies
- provides a stress-testing framework that investigates the impact of various scenarios on the probability of default of non-financial companies
- macroprudential tool to assess if the banking sector is adequately equipped to deal with micro and macro shocks (evaluate banks‘ level of provisions and capital requirements, sectorial distribution of risks, etc)

Aims and usage of the framework



Qualitative PD module

Methodology (1)

Approach: Logit model using a backward selection method

Step I

- Estimate initial models (100) on random samples of 50:50 defaulting to non-defaulting companies
- Eliminate variables based on minimum significance and likelihood ratio tests

Step II

- Select variables to enter final model based on frequency of explanatory variables and model specification

Step III

- Re-estimate model with selected explanatory variables on random samples of 50:50 defaulting to non-defaulting companies
- Derive model parameters as the mean of coefficients' distribution
- Adjust intercept to account for real default structure

Qualitative PD module

Methodology (2)

As explanatory variables we use two types of indicators:

1. **Grades-based indicators**

- firm's market position (in 2-digits NACE groups)
- competition intensity (using sectorial Herfindahl-Hirschman indexes)
- firm's track record in the NFC sector
- shareholders' support
- sector riskiness (based on info from NBR's Bank lending survey and historical NPL data)
- share of arrears in total debt

Qualitative PD module

Methodology (3)

2. Dummy variables

- companies that grow more than the entire NFC sector
- firms more dependent on the business cycle (grow more in boom, decrease more in the contraction phase)
- sector degree of development (identifying firms with technology- and knowledge-intensive activities)
- companies exposed to FX risk (i.e. have foreign-currency denominated loans or external debt)
- firms with export/import activities
- form of ownership (domestic privately-owned, foreign privately-owned, state-owned)
- identifying atypical situations (negative equity, no employees, no sales)
- firms with payment incidents

=> In total, the qualitative module relies on approximately 30 indicators

Qualitative PD module

Methodology (4)

Examples on how we construct grades-based indicators:

- **Competition intensity**
  - compute Herfindahl-Hirschman Index at 3-digits NACE group
  - classify sectors based on US DOJ competition thresholds
  - assign grades from 1-3 to each firm based on the sector they belong (1 - high competition, 2 - moderate competition, 3 - low competition)
- **Shareholders' support**
  - identify firms with debt to shareholders or to affiliated companies
  - assign grades from 1-4 to each firm based on the share of debt to stockholders in total debt (1 - first quartile, 2 - second quartile …) => the larger the share, the better the grade

Qualitative PD module

Results (1)

Logit model for 1 year default horizon using data for **2016** (dev. sample) and **2017** (validation)

- number of observations in the development sample: **69,026** out of which **2,278** defaults
- number of observations in the bootstrapping exercise: **4,556** out of which **2,278** defaults
- number of observations in the validation sample: **71,250** out of which **2,184** defaults

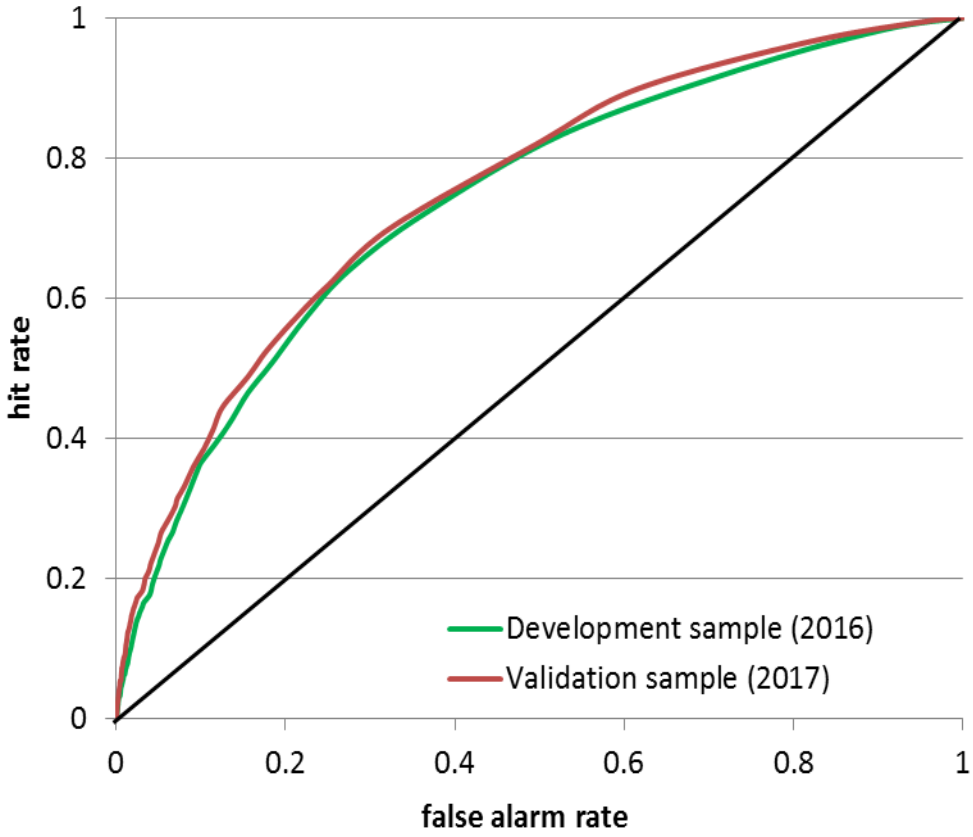
Variables	Coefficient	Standard error	p-value
Payment incidents (dummy)***	2.078	0.0689	0.000
Value added (dummy)***	-0.488	0.0568	0.000
Atypical situation (dummy)***	0.753	0.0572	0.000
Arrears (grades)***	-0.244	0.0262	0.000
Market position (grades)***	-0.168	0.0212	0.000
FX risk (dummy)***	0.159	0.0516	0.002
Trade (dummy)***	-0.285	0.0659	0.000
Shareholders' support (grades)***	-0.123	0.0244	0.000
Intercept	-1.777	0.126	0.000

***** p<0.01, ** p<0.05, * p<0.1**

Qualitative PD module

Results (2)

Discriminatory power

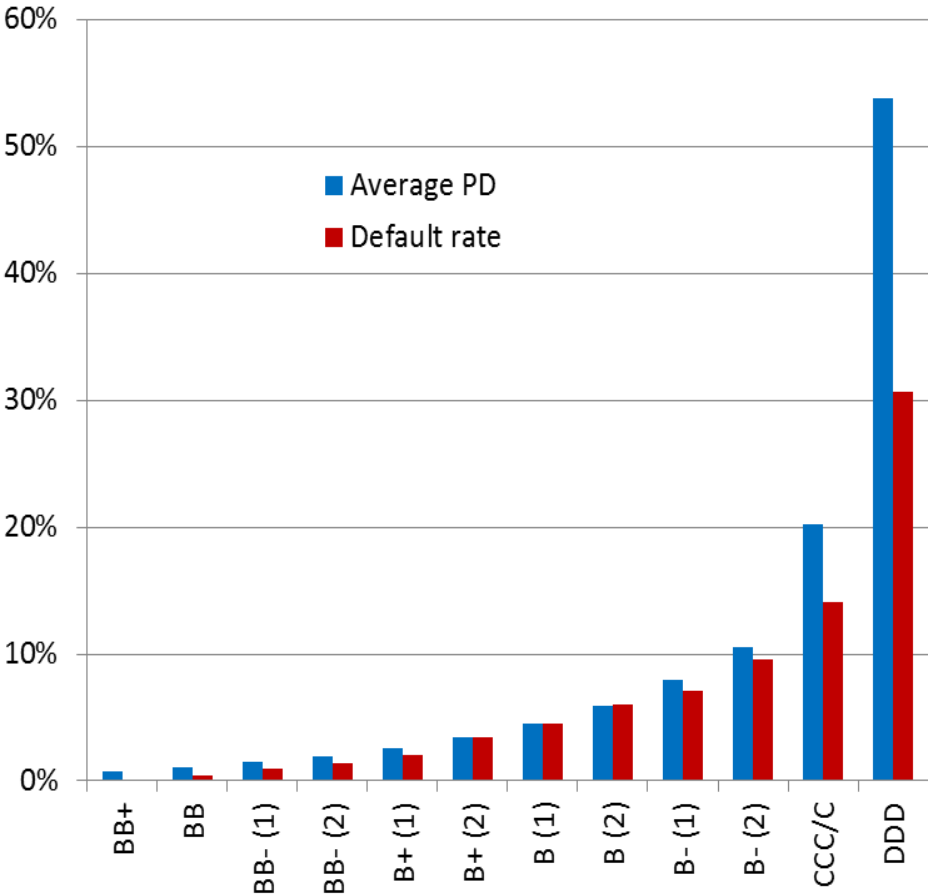


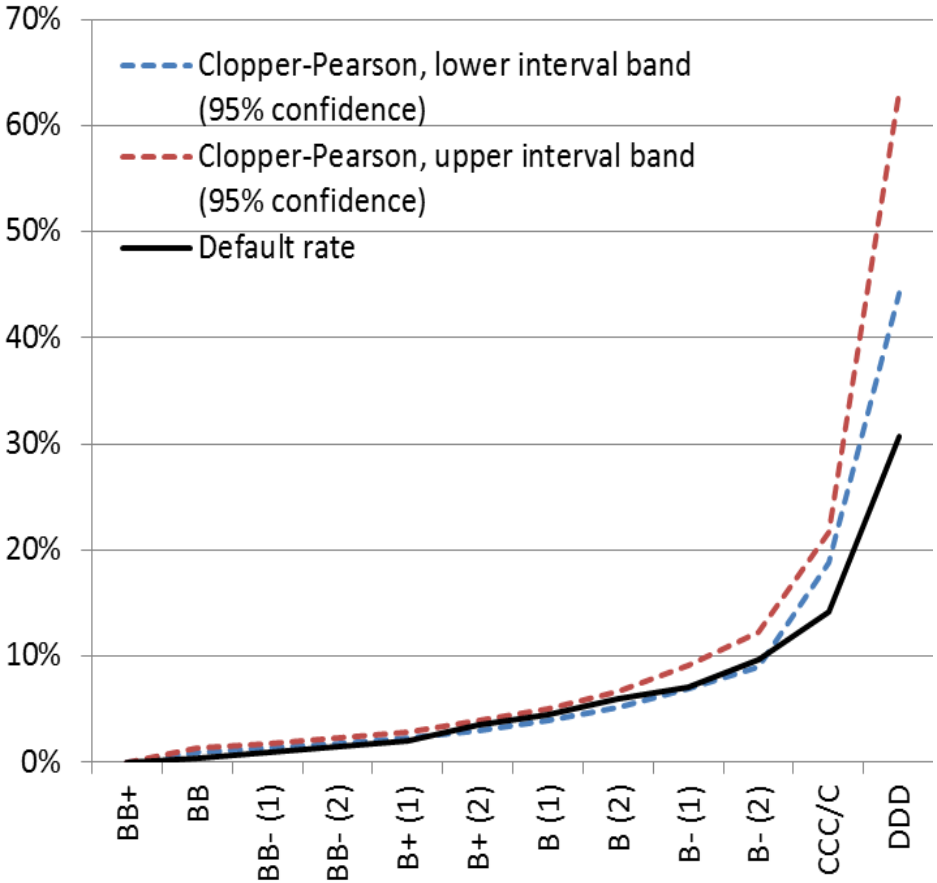
- Development sample - ROC: 73.7%
- Validation sample - ROC: 75.1%

Qualitative PD module

Results (3)

Calibration quality - 2018

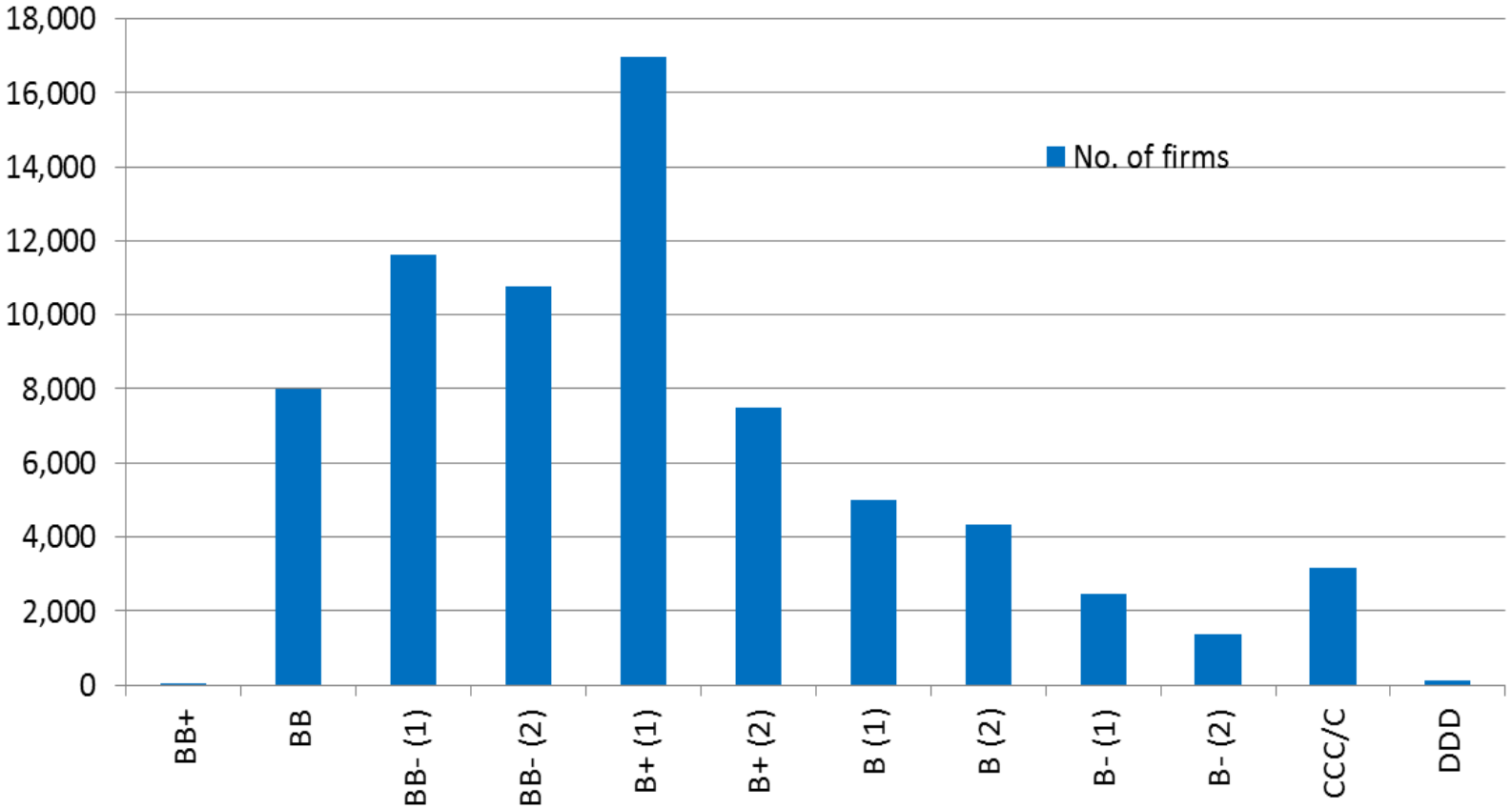




Qualitative PD module

Results (4)

Rating distribution - 2018



Combined PD

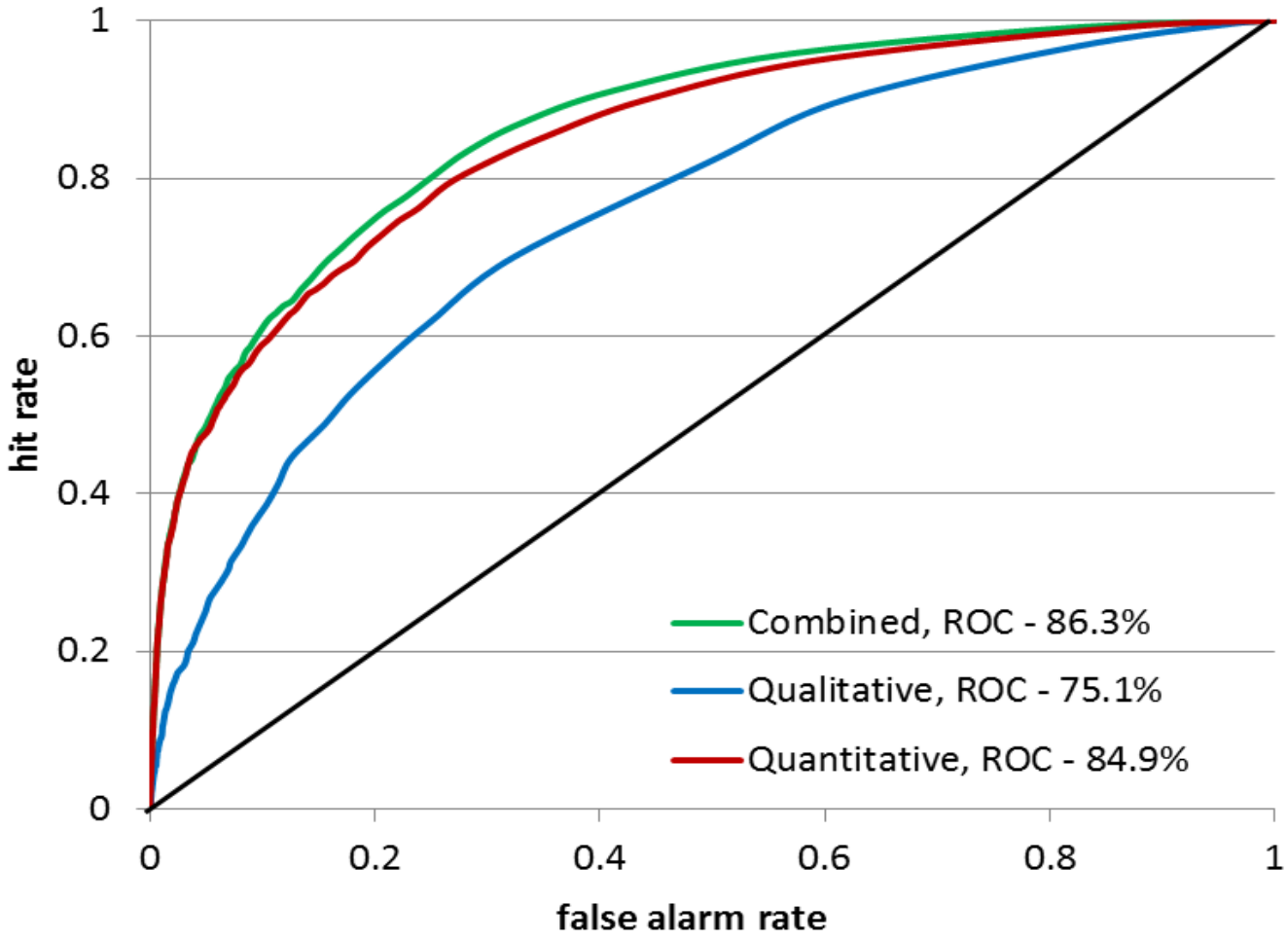
The final PD is obtained by using the following weighting scheme:

- 70% - the quantitative module [1]
- 30% - the qualitative module

[1] Details on the quantitative module can be found in Costeiu and Neagu (2013)
https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1592.pdf

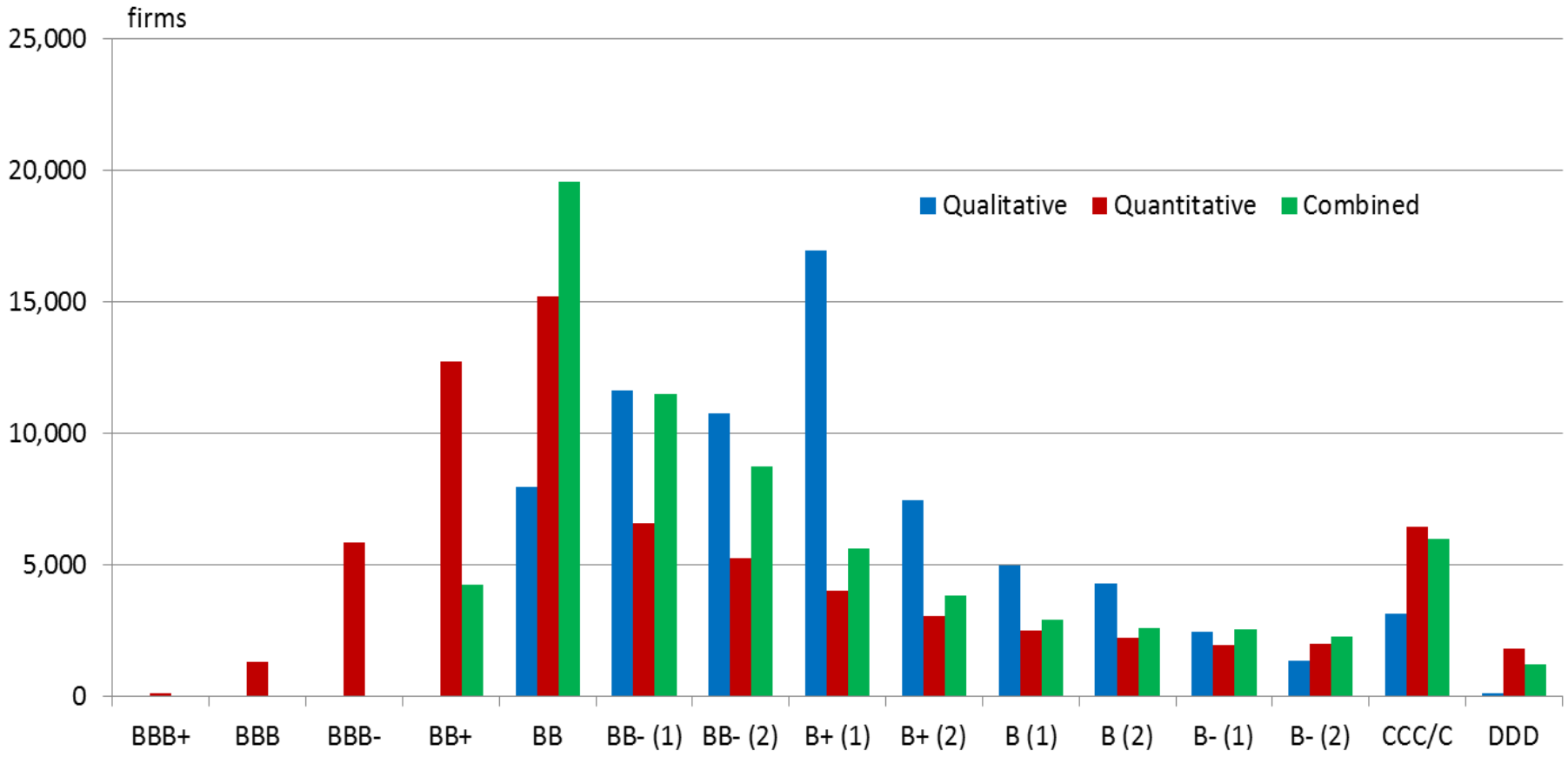
Combined PD

Discriminatory power - 2018



Combined PD

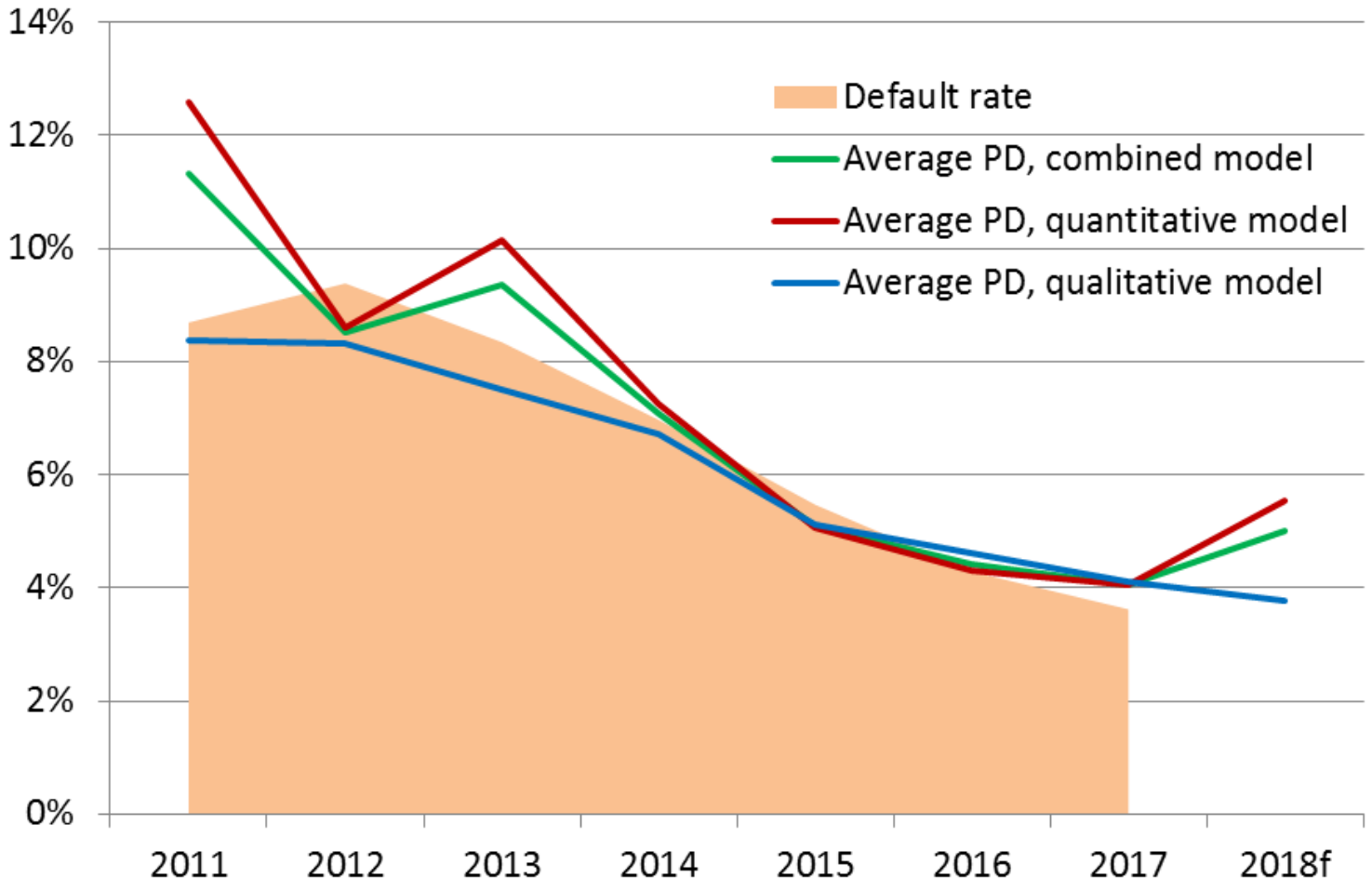
Rating distribution - 2018



=> objective: a more granular class allocation

Combined PD

Historical evolution



Conclusions

- using the qualitative module together with the quantitative module improves the overall performance of the corporate credit risk model
- in an environment characterized by elevated indebtedness levels and given that NPL still remain a vulnerability, both in Romania and the EU, an adequate risk monitoring framework remains paramount

Thank you!