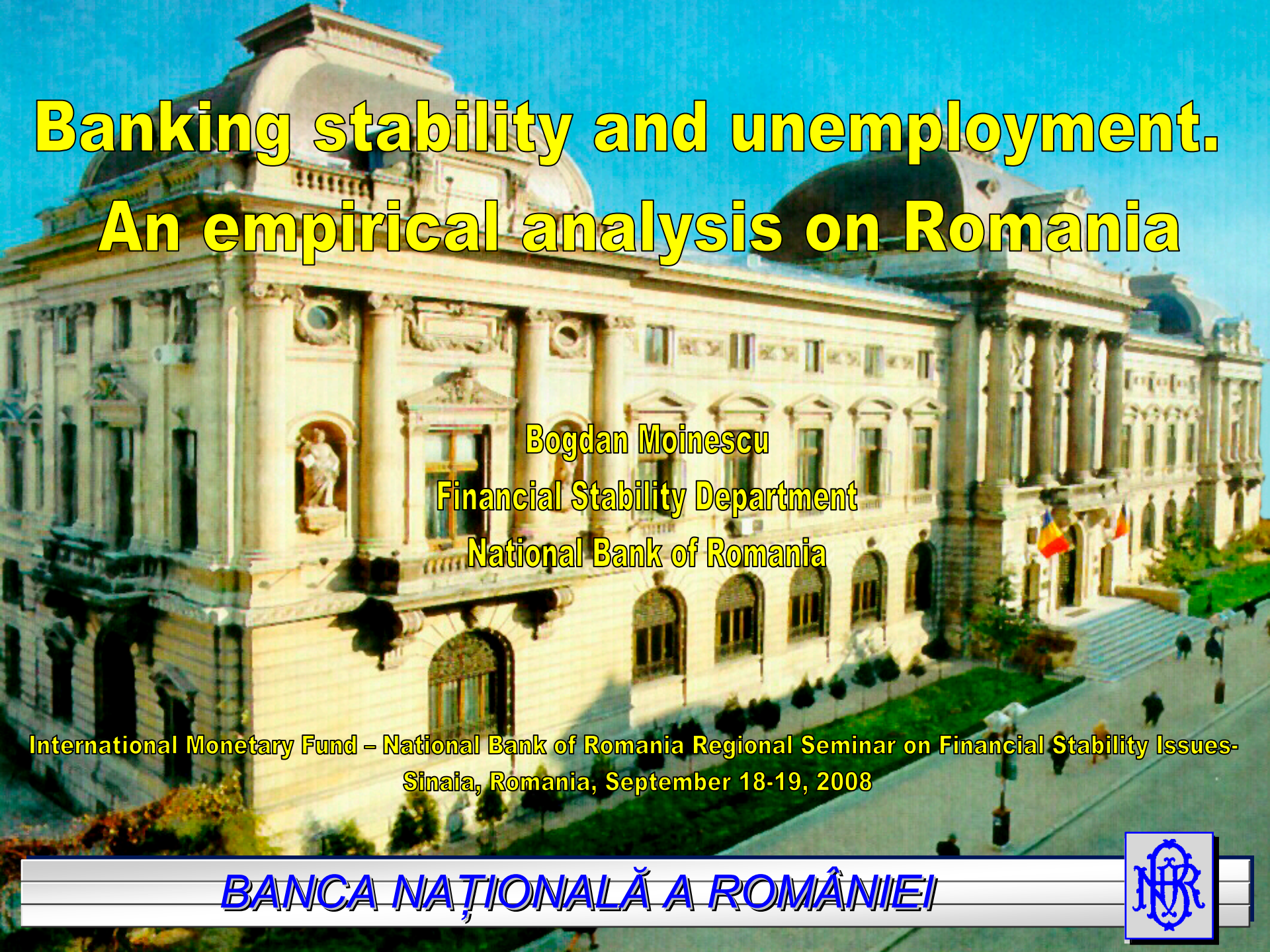

Banking stability and unemployment. An empirical analysis on Romania

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Outline

1. Literature review
2. Methodology
3. Data
4. Empirical analysis
5. Conclusions and future research work

1. Literature review

two main quantitative approaches to assess banking stability

- *NPLs prediction models*
  - Central banks (Austria, France, Germany…)
- *EWSs for banking crisis*
  - Cihack and Schaeck (2007)
  - Allen (2005)
  - Demirguc-Kunt and Detragiache (1998,2005)

large variety of factors leading to bank distress …

- ***Macroeconomic variables*** (GDP growth, real interest rate, real exchange rate, inflation, credit growth)
- ***Microeconomic variables*** **(**FSIs: CAR, tier 1 to assets ratio**,** nonperforming loans to assets ratio, ROE, net profit to income, operational costs to assets)
- ***Institutional variables*** (deposit insurance schemes, financial liberalization, regulation)

2. Methodology

banking stability: definition and instruments

- ***Banking stability***: the status of the banking system in which credit institutions, specific markets and infrastructure are adequately performing their role within the economy, even in the case of extreme, but plausible events
- ***Proxy*** for baking stability:
  - Quality of assets (weight of net overdue and doubtful claims in total assets)
  - General index for measuring the downside risk in the banking sector (rating downgrade probability)

two main transmission channels of unemployment over banking stability

- ***NPL effect***
  - An increase in the unemployment rate will cause a contraction of the reimbursing capacity of households, triggering an increase in the default rate
- ***Demand for new loans effect***
  - An increase in the unemployment rate might produce a material reduction of demand for new loans, which could lead to a significant deterioration of the ratio between the bearing interest assets and bearing interest liabilities

standard model design

- ***NPL model***

$$NPL_{i,t} = \alpha + FE_i + f(FSI_{i,lag(t)}, Macro_{lag(t)})$$

- ***Rating downgrade model***

$$DP_{i,t} = \frac{1}{1 + e^{-[a + f(Micro_{i,t-1}, Macro_{t-1})]}}$$

3. Data

exhaustive sample of commercial banks, Romanian legal persons

- ***Panel features***
  - 31 credit institutions
  - 8.5 years of data (Dec. 1999 – Jun. 2008)
  - monthly observations
- ***Explanatory variables***
  - Microprudential data
  - Macroeconomic control variables
- ***Lags considered: up to one year***

preliminary empirical analysis

(NPL prediction model)

Explanatory variables (NPL model)	Expected sign	Empirical result
Microprudential data		
Tier 1 Capital to Assets Ratio	-	-
Gross Loans to Assets Ratio	+	+
Gross Loans Growth Rate (monthly, quarterly, annually)	+	-
Market Share (gross loans)	-	-
Staff Costs to Total Cost Ratio	-	N
Cost to Income Ratio	+	-
Net Margin Rate	+	N
Macroeconomic data		
Unemployment rate	+	+
Industrial production (monthly change)	-	- (weak, 2 lags)
Industrial production in manufacturing (monthly change)	-	- (weak, 2 lags)
Gross wage, total economy (quarterly change)	-	-
Net wage, total economy (monthly change)	-	- (weak)
Lending interest rate for non-bank clients	+	N
Consumer price index (monthly change)	+	N
RON/EUR exchange rate (monthly change)	+	+

preliminary empirical analysis

(Rating downgrade model)

Explanatory variables (Rating downgrade model)	Expected sign	Empirical result
Microprudential data		
Tier 1 Capital to Assets Ratio	-	N
Gross Loans to Assets Ratio	+	N
CAAMPL Rating	-	-
Market Share (gross loans)	-	-
Staff Costs to Total Cost Ratio	-	-
Net Overdue and Doubtful Claims to Net Assets Ratio	+	+
Cost to Income Ratio	+	+
Net Margin Rate	-	-
Macroeconomic data		
Unemployment rate	+	+
Industrial production	-	- (weak)
Gross wage, total economy	-	N
Lending interest rate for non-bank clients	-	-
RON/EUR exchange rate	+	N

4. Empirical analysis

reasonable predictive power,

according to panel estimation standards (*NPL model*)

Method: Pooled EGLS (Cross-section weights)
Sample: 2001M01 2007M06
Included observations: 78
Cross-sections included: 31
Total pool (unbalanced) observations: 2290

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.051401	0.016181	3.176548	0.0015
B_NPL_ASSETS_P?(-1)	0.611114	0.021646	28.23195	0.0000
B_TIER1_ASSETS_P?(-12)	-0.000642	0.000170	-3.777618	0.0002
B_LOANS_ASSETS_P?(-3)	0.000582	0.000178	3.267804	0.0011
M_DS1(-1)	0.003188	0.118550	2.689474	0.0072
M_DWG3	-0.000994	0.000317	-3.137469	0.0017
M_UR(-12)	0.007730	0.143938	5.370538	0.0000

Weighted Statistics

R-squared	0.718058	Mean dependent var	0.720784
Adjusted R-squared	0.713553	S.D. dependent var	0.739645
S.E. of regression	0.424307	Sum squared resid	405.6227
F-statistic	159.3890	Durbin-Watson stat	2.131413
Prob(F-statistic)	0.000000		

NPL ratio is relatively inelastic on short term to labor market shocks

- Consistently significant and positive relationship between the unemployment rate (1y lag) and the NPL ratio, but
  - Rather low impact in the case of a sharp increase
- The quarterly growth rate of the gross wage in the economy robustly indicates an inverse relationship between the household's income and the NPL ratio, but
  - Rather low impact in the case of a material change

fixed effects – a proxy for the quality of individual credit risk management techniques

Bank	Fixed Effect	M	Bank	Fixed Effect	M	Bank	Fixed Effect	M
B1	-0.1166	2.0	B11	-0.0854	2.7	B21	-0.0816	2.8
B2	-0.0853	2.0	B12	-0.1211	2.0	B22	0.2183	5.0
B3	0.0701	2.9	B13	-0.0816	2.2	B23	-0.0797	2.9
B4	-0.0310	2.7	B14	-0.0998	2.7	B24	-0.0738	3.0
B5	-0.0193	2.9	B15	0.1013	3.3	B25	-0.0359	2.2
B6	-0.0291	3.8	B16	0.0557	4.3	B26	0.1357	2.9
B7	0.0485	2.0	B17	0.0201	2.9	B27	0.1892	3.6
B8	0.0126	2.1	B18	0.0835	3.5	B28	0.0607	3.7
B9	-0.0464	2.9	B19	-0.0936	2.0	B29	0.1921	2.9
B10	0.0013	3.0	B20	0.0725	3.0	B30	-0.0800	2.1
						B31	-0.1283	2.0

- the positive values for fixed effects reflect poorer then average credit risk management skills
- significant correlation between the level of fixed effects and supervisors' rating on management quality (65.93%)

good econometric performance,

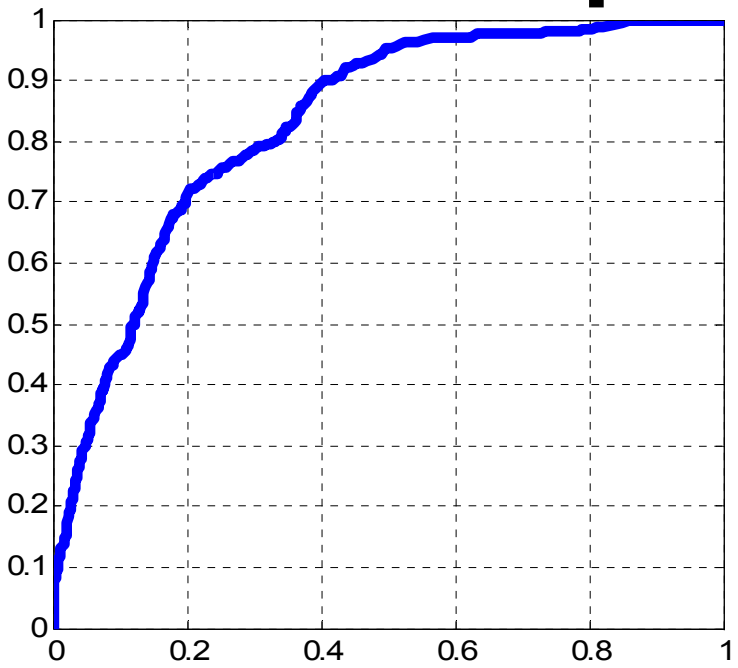
according to *logit* estimation standards (*Dg model*)

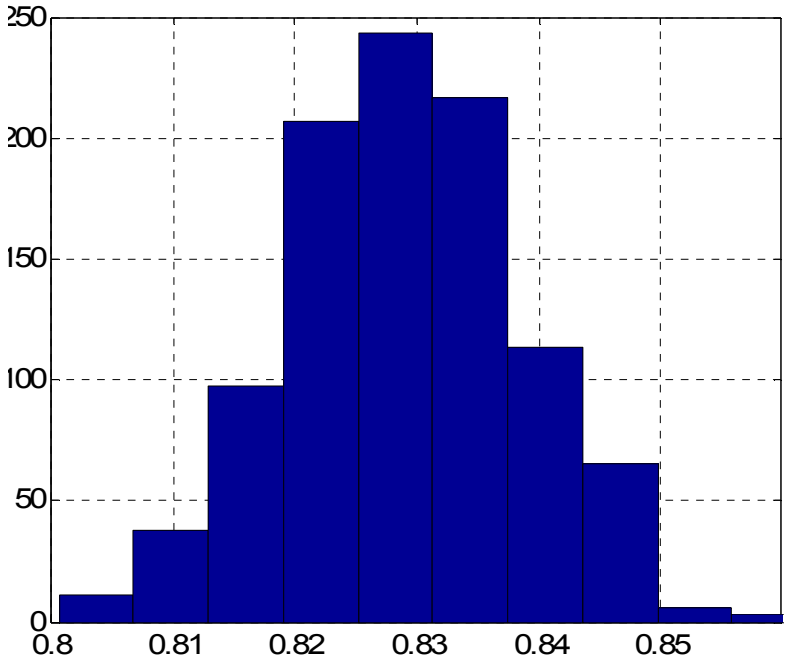
Method: ML - Binary Logit (Quadratic hill climbing)
Included observations: 2335
Convergence achieved after 6 iterations

Variable	Coefficient	Std. Error	z-Statistic	Prob.
B_RATING	-2.385779	0.177884	-13.41197	0.0000
B_MKW_LOANS	-48.69318	7.369840	-6.607088	0.0000
B _NPL_ ASSETS_RATIO	25.31090	6.835512	3.702853	0.0002
B_STAFFC_TCOSTS_RATIO	-2.993111	1.009588	-2.964685	0.0030
M_UR	26.37972	5.750699	4.587220	0.0000
M_IR	-4.080934	1.005499	-4.058616	0.0000
C	3.796026	0.523364	7.253127	0.0000

McFadden R-squared	0.249576	Mean dependent var	0.149036
S.D. dependent var	0.356201	S.E. of regression	0.312144
Akaike info criterion	0.637903	Sum squared resid	226.8260
Schwarz criterion	0.655158	Log likelihood	-737.7522
Hannan-Quinn criter.	0.644190	Restr. log likelihood	-983.1144
LR statistic	490.7243	Avg. log likelihood	-0.315954
Prob(LR statistic)	0.000000		

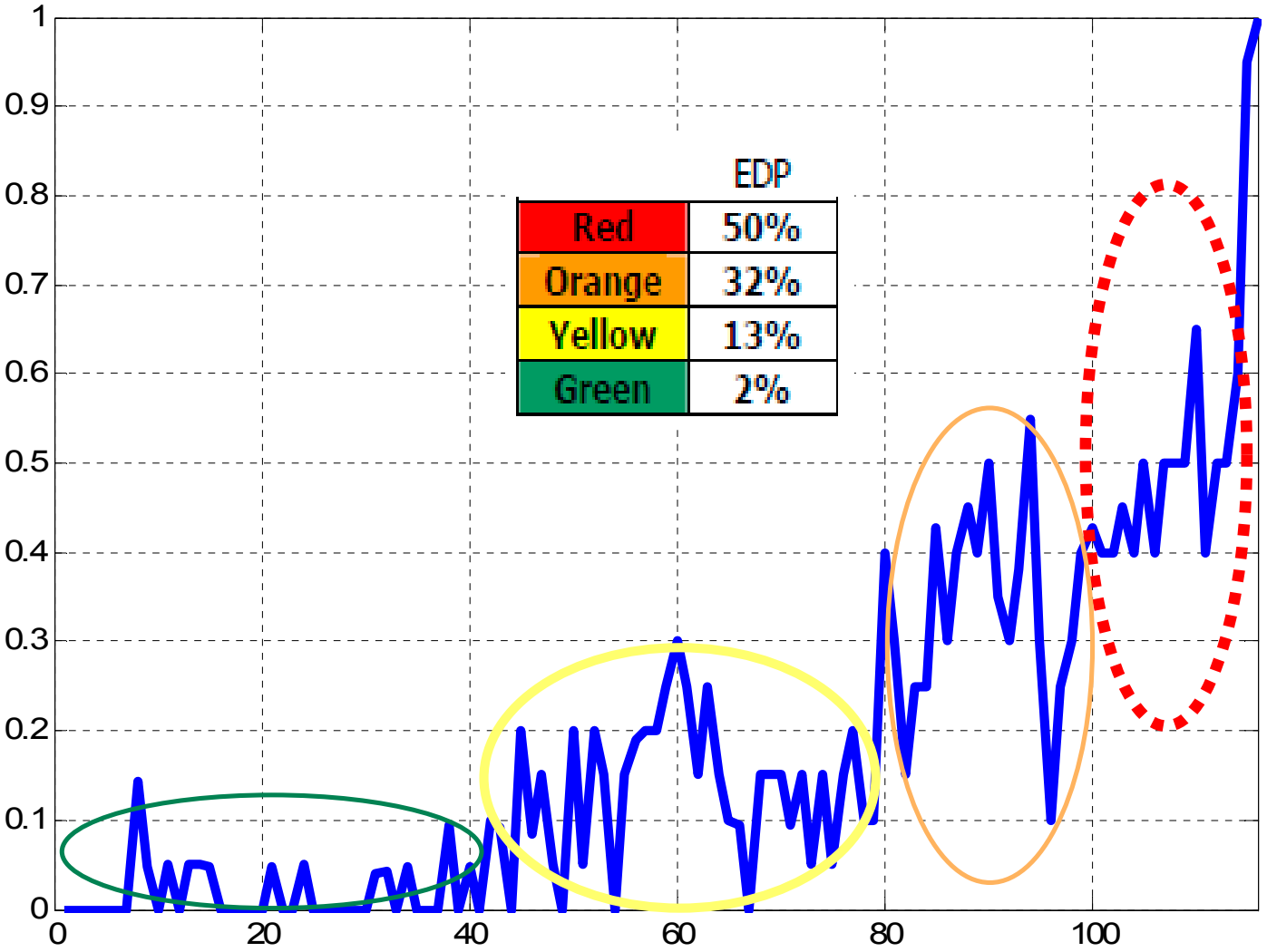
high and robust discriminatory power …





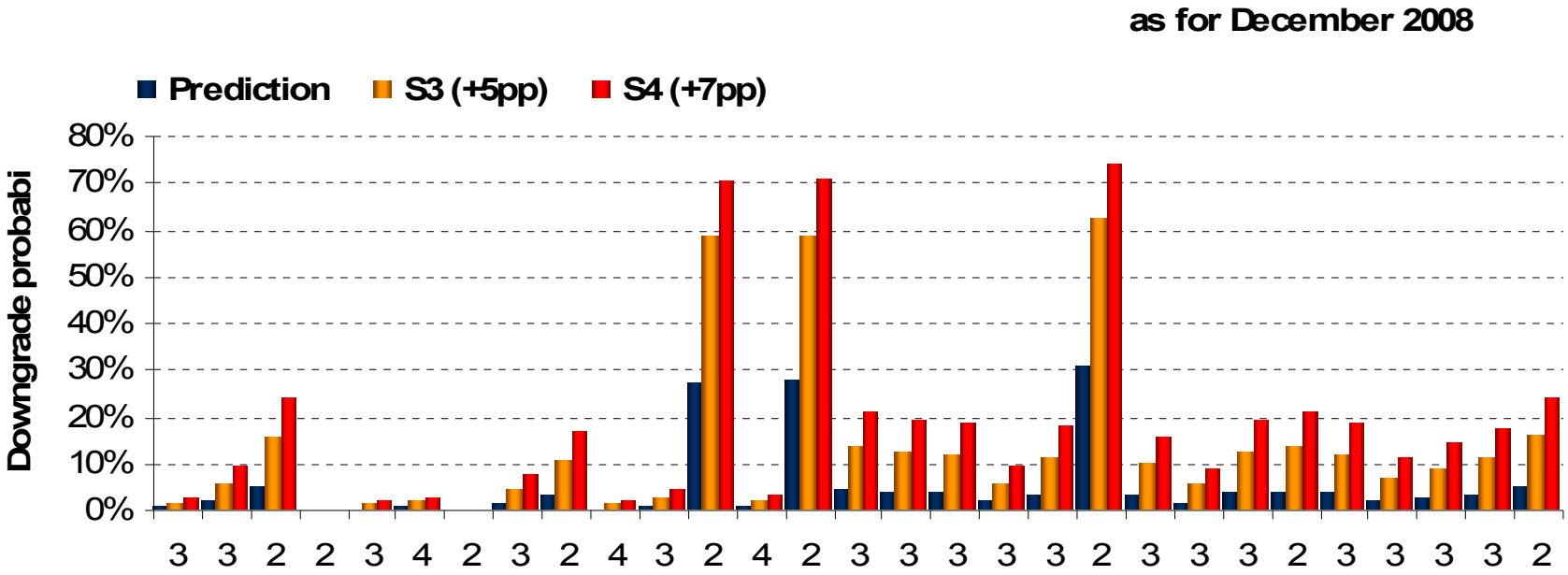
- AUROC in sample: 84.4%
- AUROC out of sample: 83.8%
- Reasonable level of model stability (*bootstrap approach*)

four classes of risk (traffic light approach)



sensitivity analysis

- Scenario 1: **1** pp increase in unemployment rate
- Scenario 2: **3** pp increase in unemployment rate
- Scenario 3: **5** pp increase in unemployment rate
- Scenario 4: **7** pp increase in unemployment rate



performance migration in stress events

	Prediction	S1 (+1pp)	S2 (+3pp)	S3 (+5pp)	S4 (+7pp)
GREEN	86.60%	79.82%	69.98%	61.27%	58.41%
YELLOW	10.74%	17.52%	27.36%	36.07%	28.19%
ORANGE	2.66%	1.74%	0.00%	0.00%	10.74%
RED	0.00%	0.92%	2.66%	2.66%	2.66%

- Even in the worst case scenario, the largest share of the banking system would still find itself on green light
- Only 2.66 percent of the banking system assets would have a high probability of downgrade (all these banks are rated 2)

Conclusions

- The unemployment rate seems to be the most significant macroeconomic variable for explaining system-wide short term movements in the performance of the Romanian credit institutions
- Econometric evidence suggests that the main transmission channel of unemployment over banking stability is the demand for new loans effect, while the effect over NPLs is rather low
- The performance of the Romanian credit institutions could decrease significantly in the context of a severe unemployment rate increase towards the levels recorded in early 2000s', but without systemic implications on short term

Future research work

- Test the predictive power of unemployment rate on other indicators used in the assessment of asset quality, such as gross overdue and doubtful loans to total loans ratio
- Test the statistical significance of the unemployment rate on the default rates of consumer loans
- Enlarge the set of candidate explanatory variables (both micro and macro) for a more refined empirical research on the risk drivers of bank distress in Romania

Thank you for your attention !