NATIONAL BANK OF ROMANIA

Stress-testing the household sector – assessing the link between the banking sector and the real sector

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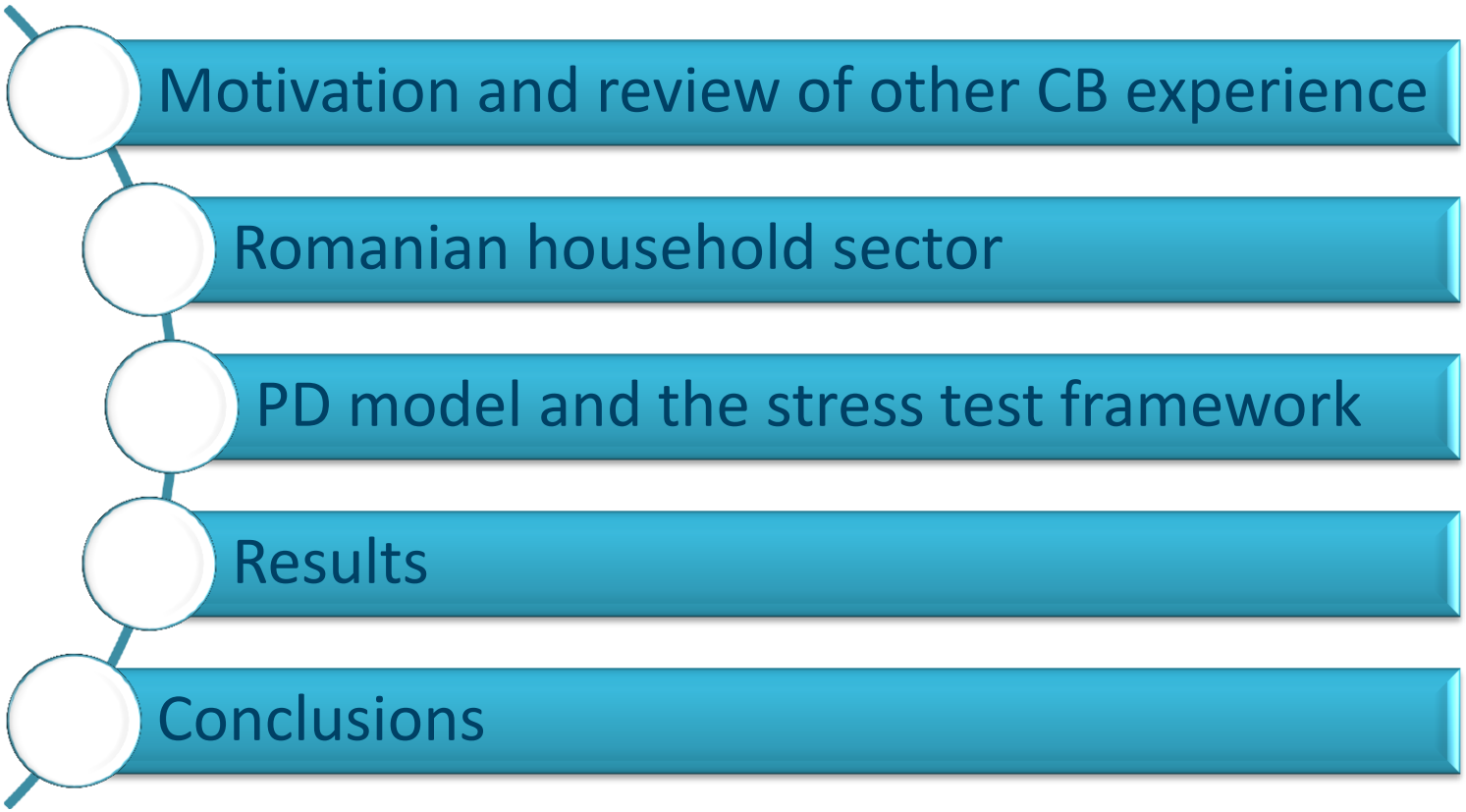
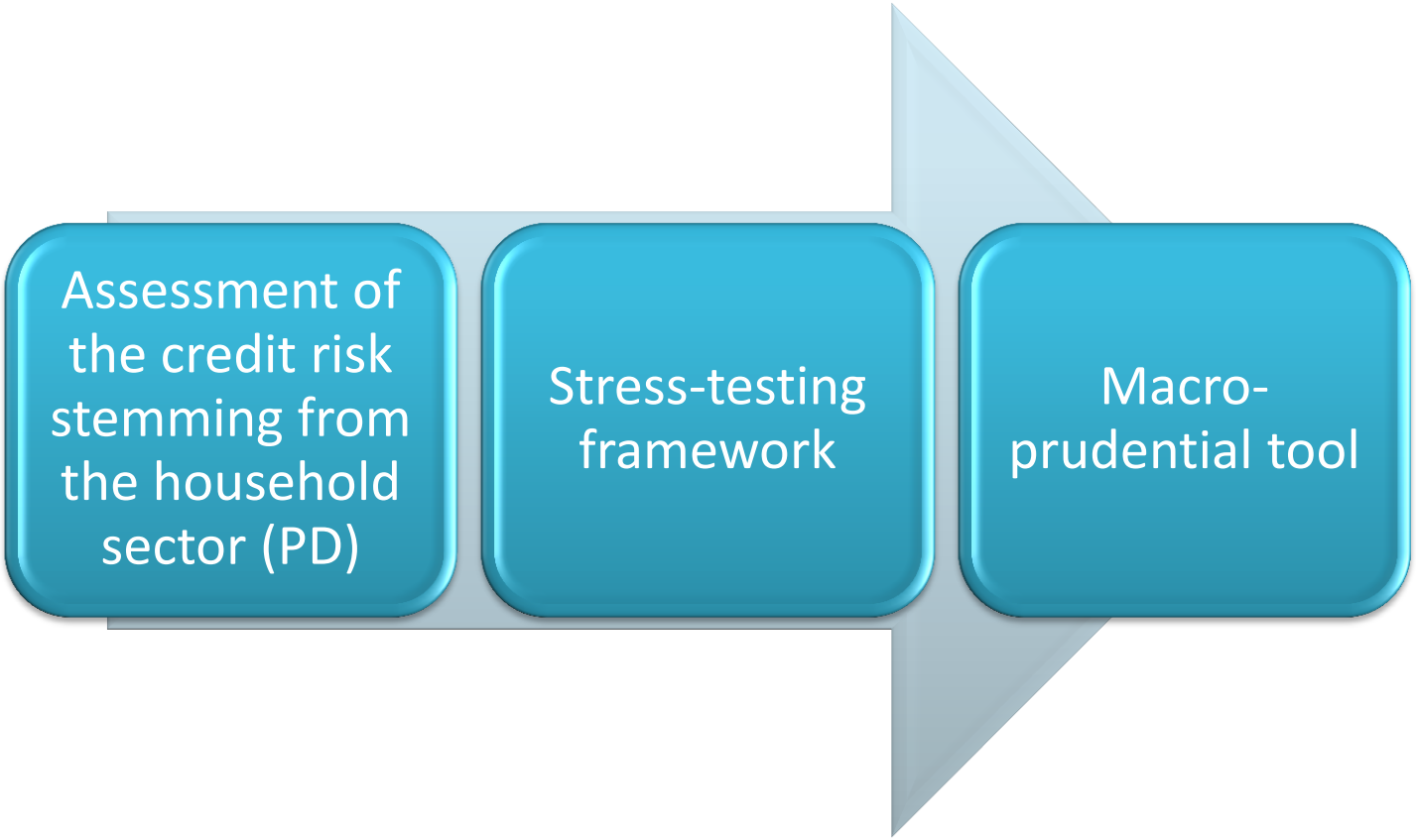
Note: The opinions expressed in this presentation are those of the authors and do not necessarily reflect the views of the National Bank of Romania

Outline of the presentation



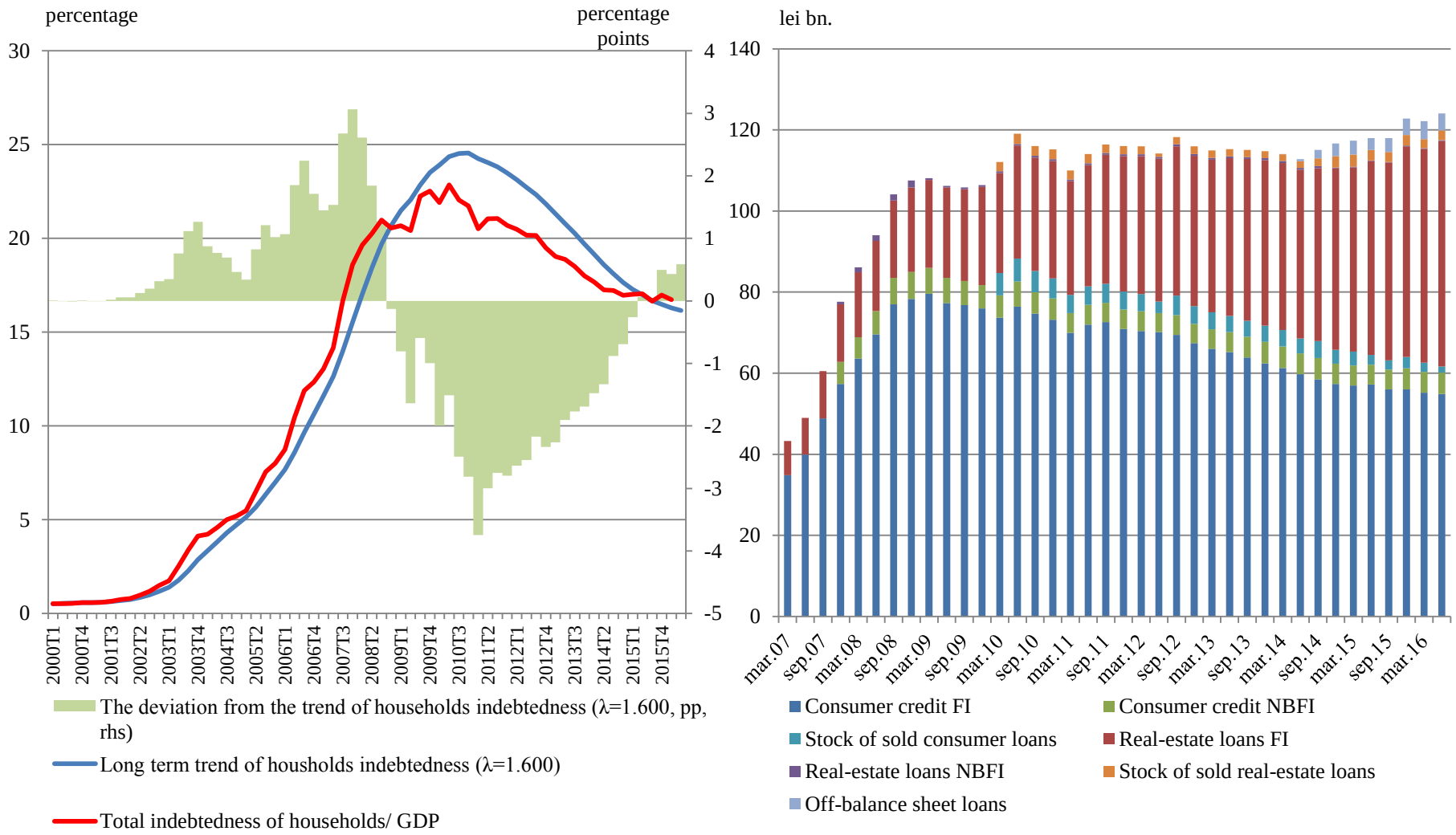
Motivation


Assessment of the credit risk stemming from the household sector (PD)
Stress-testing framework
Macro-prudential tool

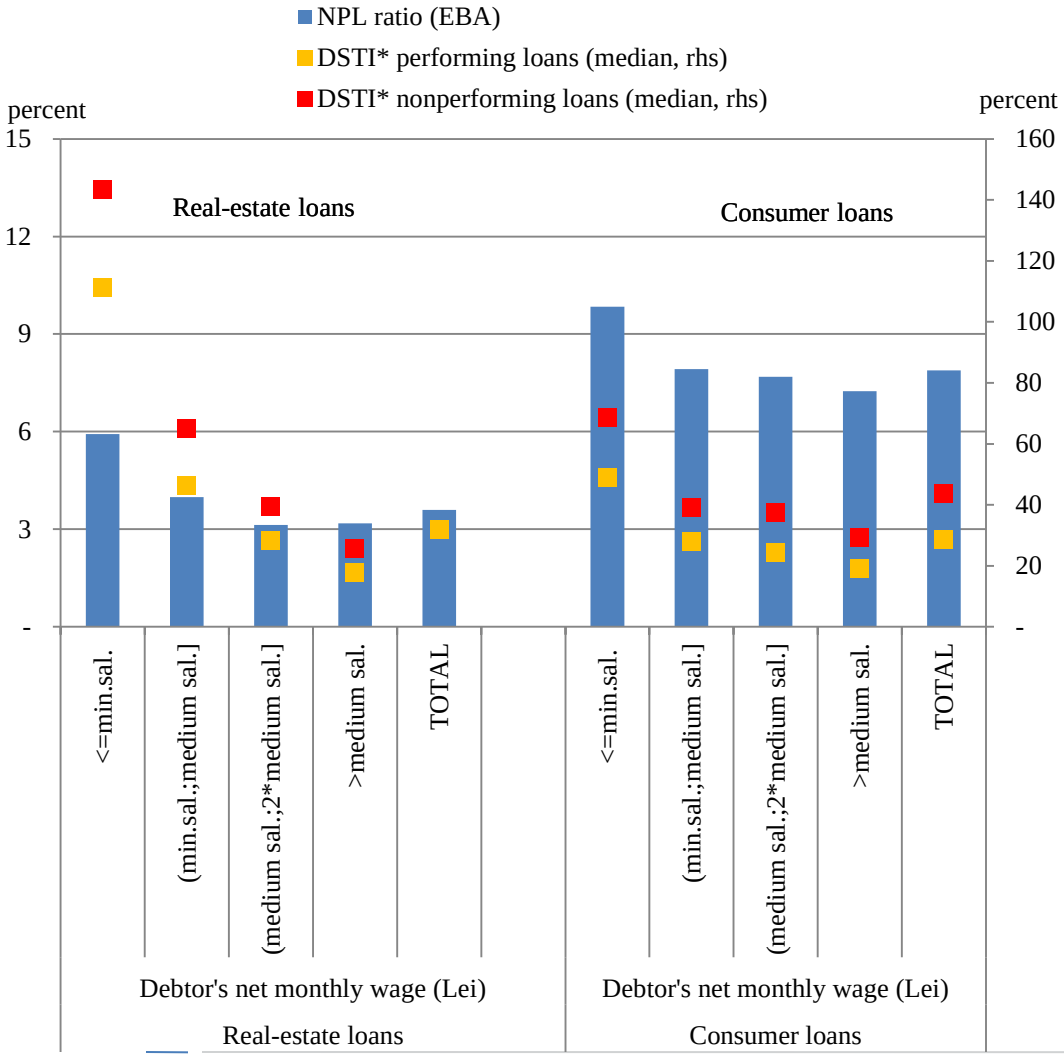
Review of European Central Banks' experience

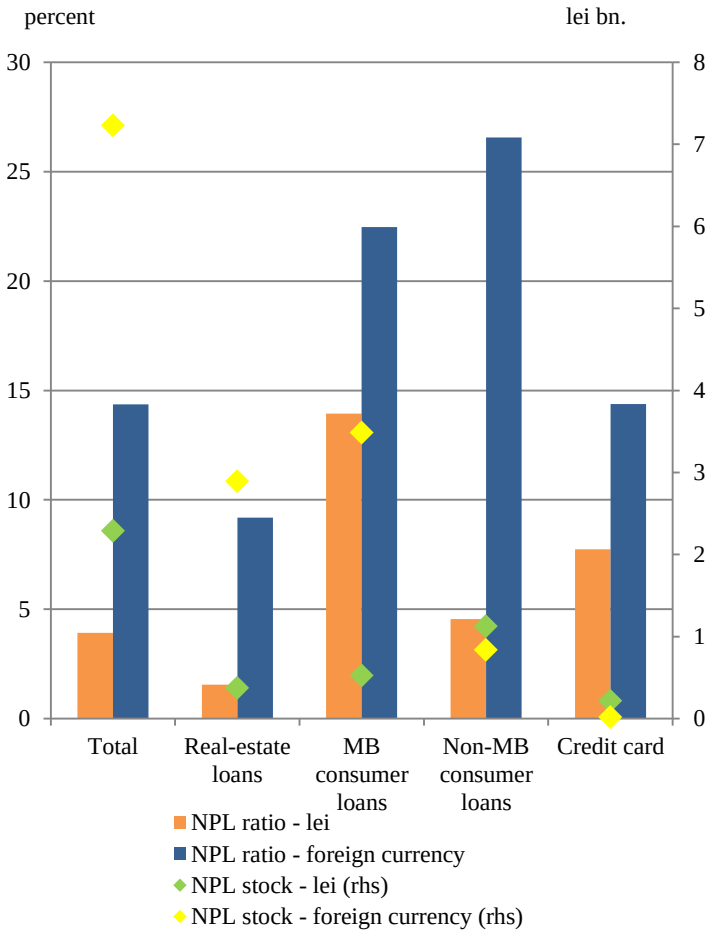
Authors	Country	Year	Data sources	Sample used	Dependent variable	Methodology
Johansson & Persson	Sweden	2006	- HEK survey (SNIS)	- indebted households distributed on income cuintiles	Financial margin = f(income, debt service, necessary running costs)	Sensitivity analysis
Herrala & Kauko	Finland	2007	- Finnish survey data on income distribution	- indebted households in the survey	Household distress = f(disposable income, debt, wealth, consumption)	Sensitivity analysis
Albacete & Fessler	Austria	2010	OeNB's Household Survey on Housing Wealth 2008; EU Statistics on Income and Living Conditions (EU-SILC) 2008; Austrian Consumption Survey 2004/05	- households holding housing debt	Financial margin = f(disposable income, basic consumption, debt service)	Sensitivity analysis
Hlaváč & al.	Czech Republic	2013	- Household Budget Survey 2011 (HBS); EU - SILC 2011	- households in the HBS sample	Financial margin = f(net monthly income, essential monthly expenditure, monthly instalments)	Sensitivity analysis
Costa	Portugal	2012	- Household Finance and Consumption Survey 2011 (HFCS)	- households in the HFCS sample for Portugal	Probability of default (default = late or missed payments on loans in the twelve months prior to the HFCS)	Logit

The level and structure of HH sector indebtedness has evolved in line with the financial cycle…



…with risk stemming especially from lending to lower income quintiles and in foreign currency



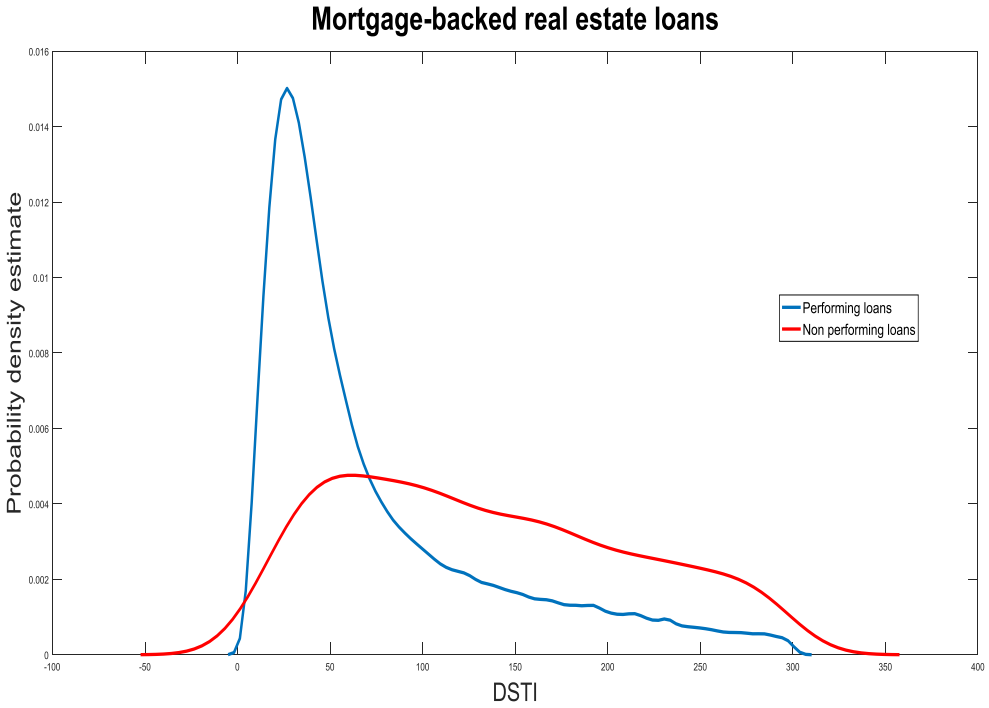


Methodology

- Logit model by type of loan and considering a debtor's total banking debt

$$PD = \frac{\exp(\alpha + X\beta)}{1 + \exp(\alpha + X\beta)}$$

- Calibration for the low-default portfolio (mortgage): bootstrap (10.000 iterations) and King correction (adjustment to intercept only, King & Zeng (2001))
- Data: Point in Time – June 2015 with a 12-month forecast window
- Source: Credit Risk Registry - contains loans larger than 20.000 lei

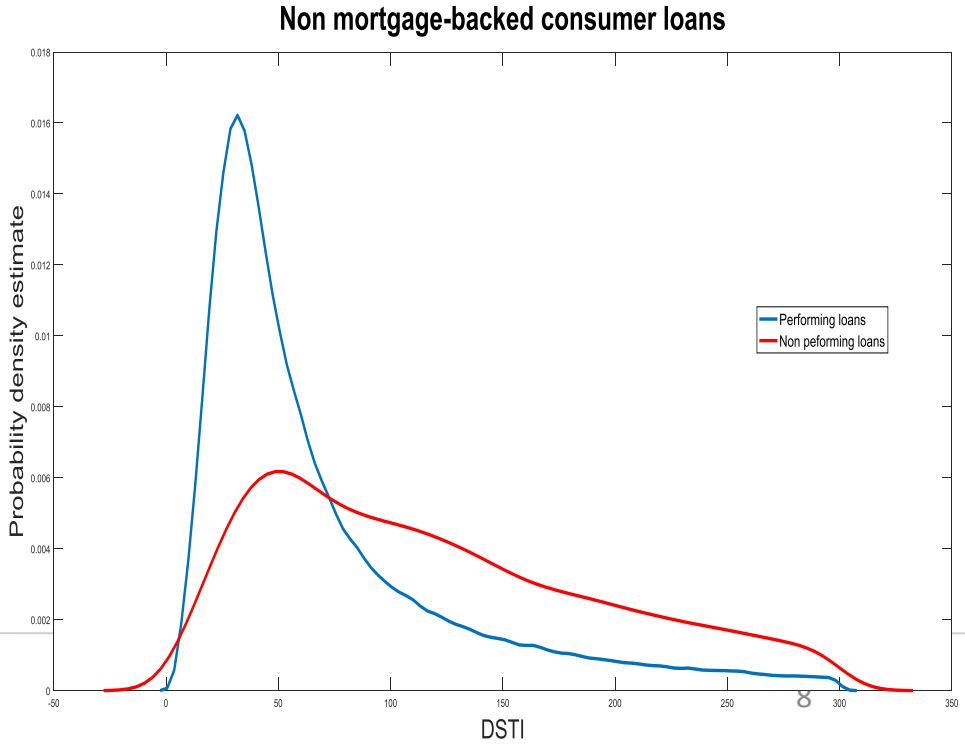


Mortgage-backed real estate loans:

- 237.230 debtors
- Average historic default rate: 1.02%

Non mortgage-backed consumer loans:

- 256.885 debtors
- Average historic default rate: 3.05%



Results – mortgage-backed real estate loans

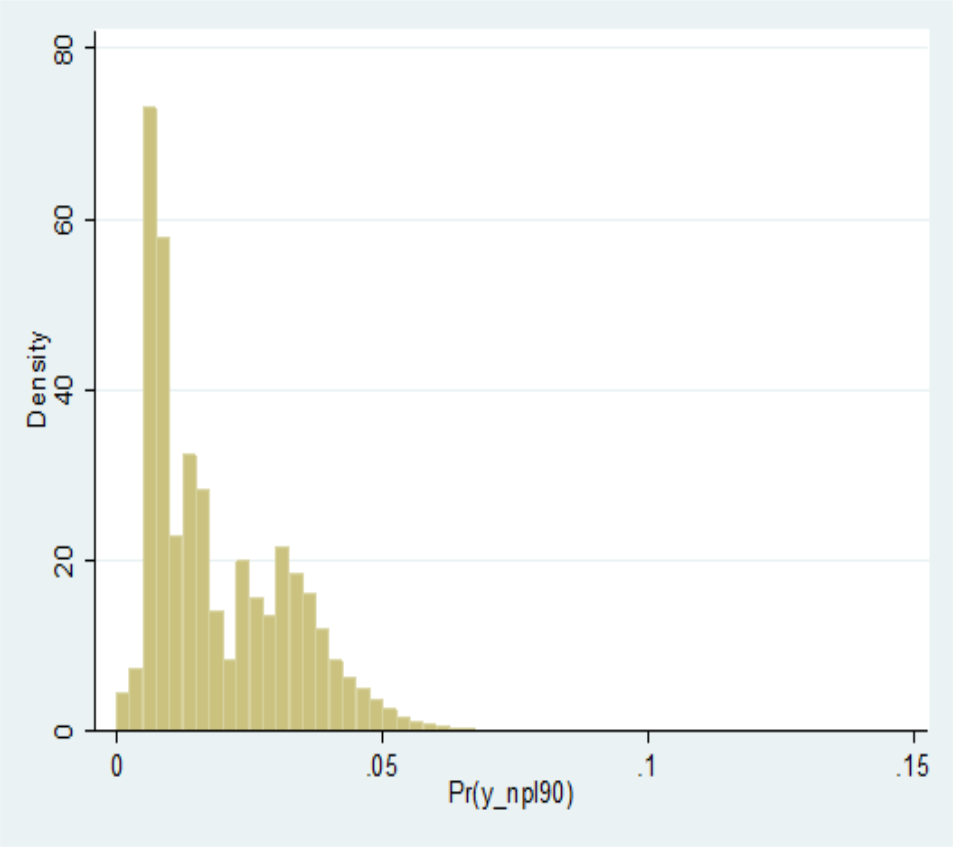
	(1)	(2)	(3)	(4)
Other credit in distress	-0.157 (0.96)	0.096 (0.98)	-0.037 (0.99)	0.254 (0.94)
EUR denominated loan	0.335** (0.03)	0.440** (0.01)	0.290* (0.06)	0.403** (0.02)
Other foreign denominated loan	1.488*** (0.00)	1.670*** (0.00)	0.988*** (0.00)	1.118*** (0.00)
Interest rate at origination (%)	0.153*** (0.00)	0.133** (0.01)	0.132*** (0.00)	0.122** (0.03)
Remaining maturity (months)	0.003*** (0.00)	0.003*** (0.01)	0.001 (0.10)	0.002 (0.13)
Income quintile 1	-0.316 (0.26)	0.120 (0.70)	-0.309 (0.26)	0.102 (0.75)
Income quintile 2	-0.405* (0.08)	0.106 (0.69)	-0.407* (0.08)	0.104 (0.69)
Income quintile 4	-1.130*** (0.00)	-0.526** (0.01)	-1.108*** (0.00)	-0.483** (0.02)
Income quintile 5	-1.651*** (0.00)	-1.102*** (0.00)	-1.747*** (0.00)	-1.215*** (0.00)
Prima Casa Loan	-1.717*** (0.00)	-1.732*** (0.00)	-1.829*** (0.00)	-1.808*** (0.00)
Loan granted during 2007-2008	-0.107 (0.66)	-0.292 (0.30)	-0.073 (0.77)	-0.272 (0.35)
Age (years)	0.147* (0.08)	0.076 (0.43)	0.113 (0.18)	0.038 (0.70)
Change is the Real Estate prices (%)	-0.007** (0.04)	-0.009** (0.04)	-0.004 (0.36)	-0.007 (0.14)
DSTI (%)		0.007*** (0.00)		0.007*** (0.00)
LTV (%)			0.007*** (0.00)	0.005*** (0.01)
No. of obs.	Bootstrapped sample	Bootstrapped sample	Bootstrapped sample	Bootstrapped sample
Log Likelihood	-799.077	-613.018	-759.534	-588.922
R2	0.263	0.273	0.262	0.267
ROC	0.829	0.835	0.828	0.831
Linktest	-1.767	-0.852	-1.474	-0.565

Results – non mortgage-backed consumer loans

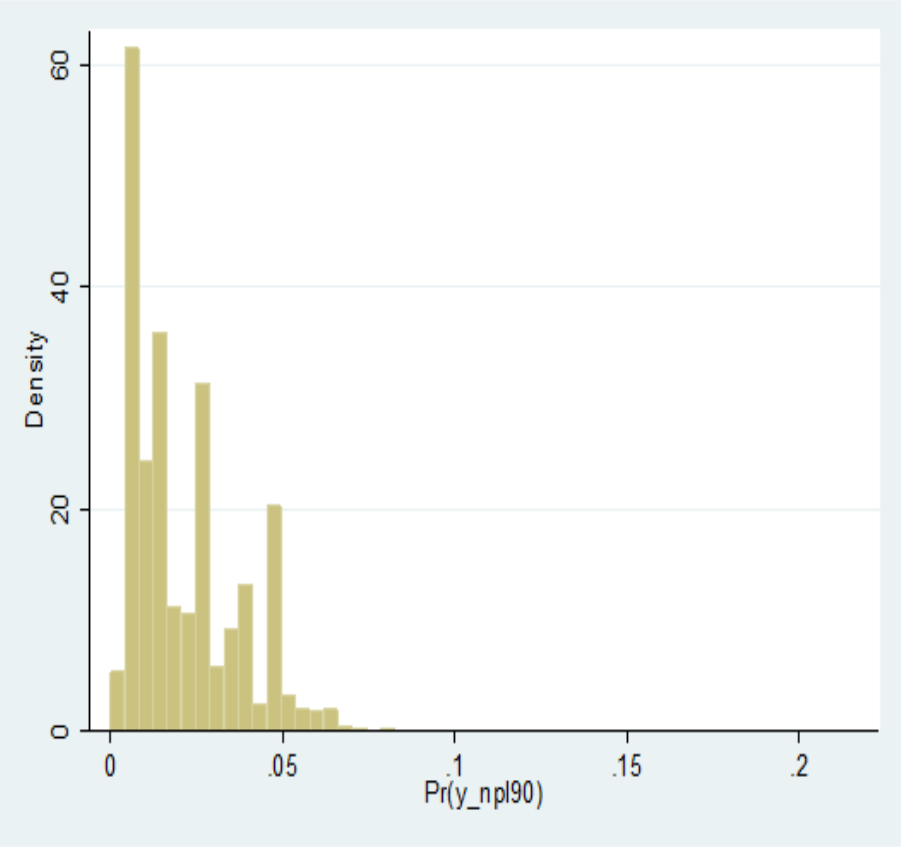
	(1)	(2)	(3)	(4)
Has a mortgage backed loan	**-0.430*** (0.00)**	**-0.473*** (0.00)**	**-0.291* (0.08)**	**-0.421*** (0.00)**
EUR denominated loan	-0.046 (0.52)	-0.033 (0.70)	-0.087 (0.41)	-0.089 (0.21)
Other foreign denominated loan	**0.529*** (0.00)**	**0.416** (0.01)**	**0.477** (0.01)**	**0.527*** (0.00)**
Income quintile 1	**-0.421*** (0.00)**	**-0.322*** (0.00)**	**-0.226*** (0.00)**	-0.027 (0.66)
Income quintile 2	0.008 (0.88)	**0.105* (0.08)**	0.015 (0.81)	**0.401*** (0.00)**
Income quintile 4	**-0.916*** (0.00)**	**-0.726*** (0.00)**	**-0.752*** (0.00)**	**-0.524*** (0.00)**
Income quintile 5	**-1.651*** (0.00)**	**-1.408*** (0.00)**	**-1.410*** (0.00)**	**-1.255*** (0.00)**
Remaining maturity (months)	**-0.005*** (0.00)**	**-0.004*** (0.00)**	**-0.005*** (0.00)**	**-0.004*** (0.00)**
Interest rate at origination (%)	**0.040*** (0.00)**	**0.053*** (0.00)**	**0.084*** (0.00)**	**0.049*** (0.00)**
Number of banks	**0.276*** (0.00)**	**0.253*** (0.00)**	**0.290*** (0.00)**	**0.280*** (0.00)**
DSTI (includes all types of income,%)		**0.002*** (0.00)**		
DSTI (%)			**0.004*** (0.00)**	
Unemployment status				**0.594*** (0.00)**
No. of obs.	209117	184624	158238	209117
Log Likelihood	-20868.443	-16964.453	-13498.224	-20787.307
R2	0.047	0.046	0.057	0.051
ROC	0.686	0.690	0.710	0.696
Linktest	-0.267	-1.557	0.642	-0.617

Results – predictive probabilities

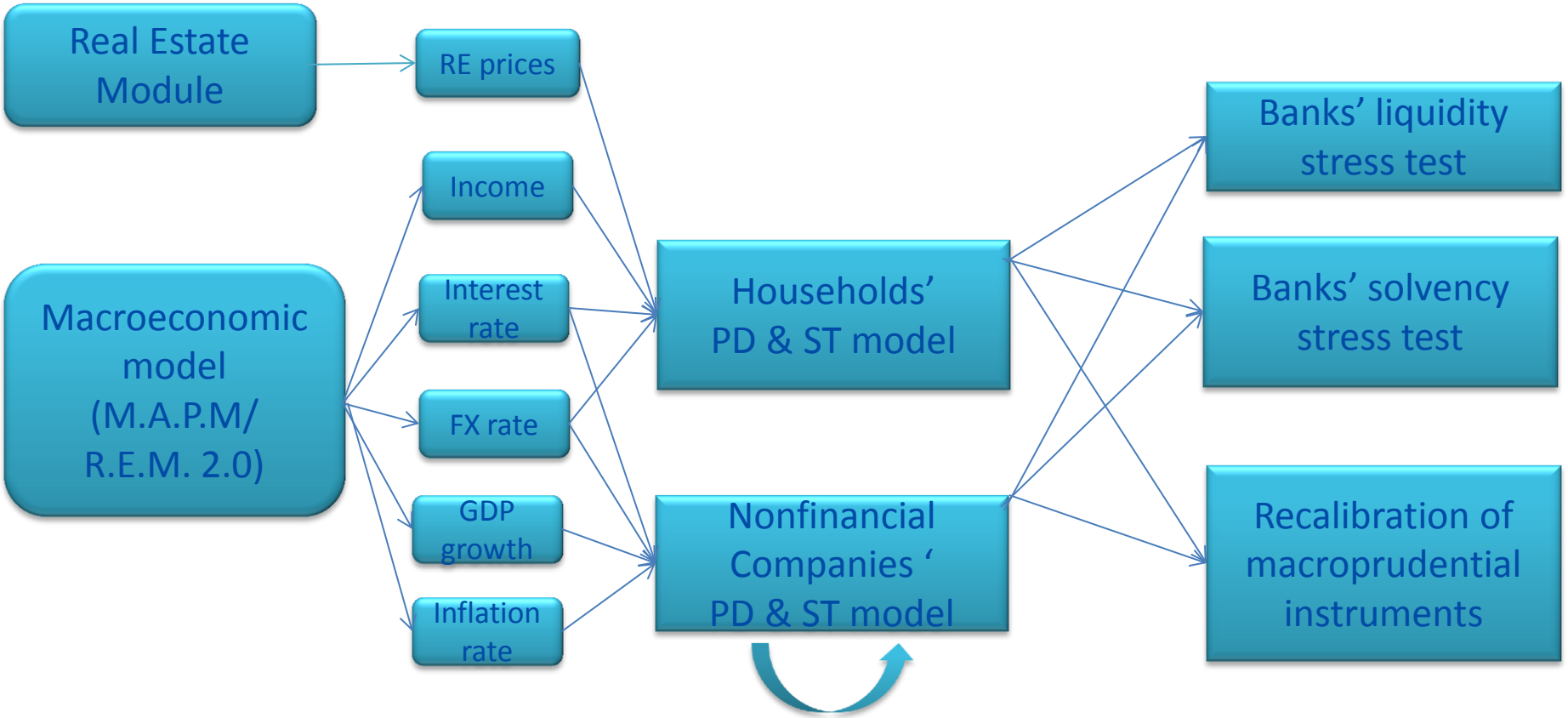
Mortgage-backed real estate loans



Non mortgage-backed consumer loans



Part of an integrated stress testing framework



Stress test model - Households

I. Indebtedness channel: exchange rate, interest rate and income shocks

$$DSTI_{i,t} = 100 * \frac{Loan_{i,t} * Interest\ rate\ factor_{i,t}}{Income_{i,t}}$$

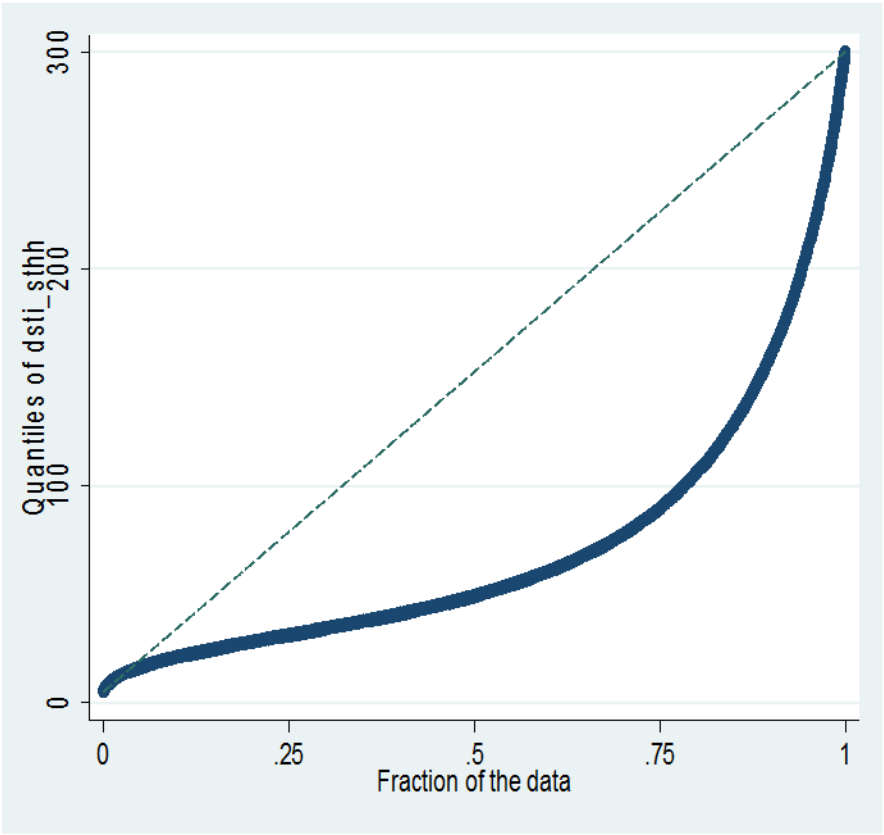
$$DSTI^{+}{}_{i,t} = \frac{(1+\delta_{FX}) * Interest\ rate\ factor^{+}{}_{i,t}}{(1-\delta_{Income}) * Interest\ rate\ factor_{i,t}} * DSTI_{i,t}$$

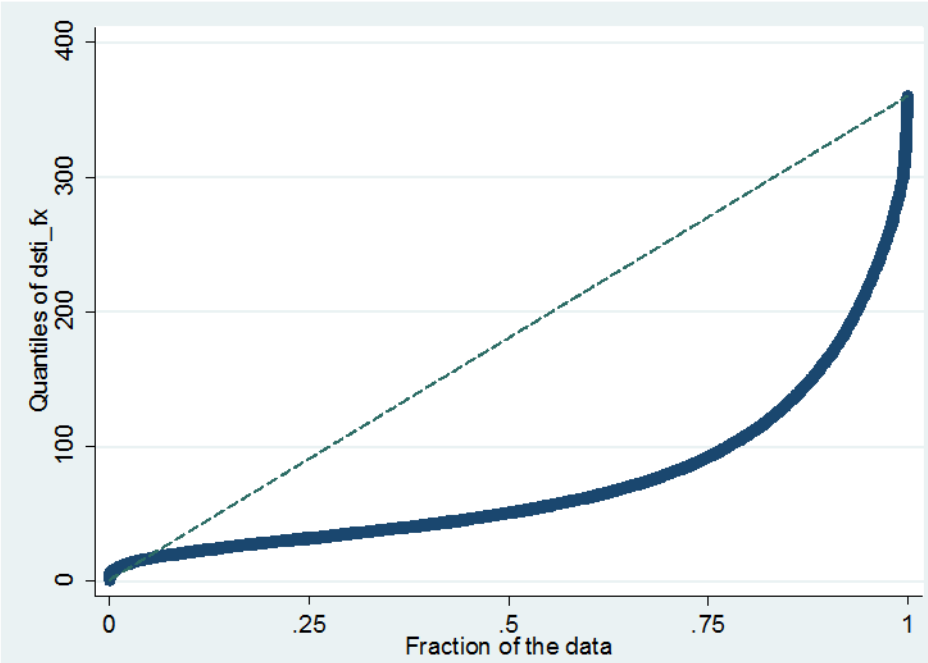
II. Wealth channel: RE price shock

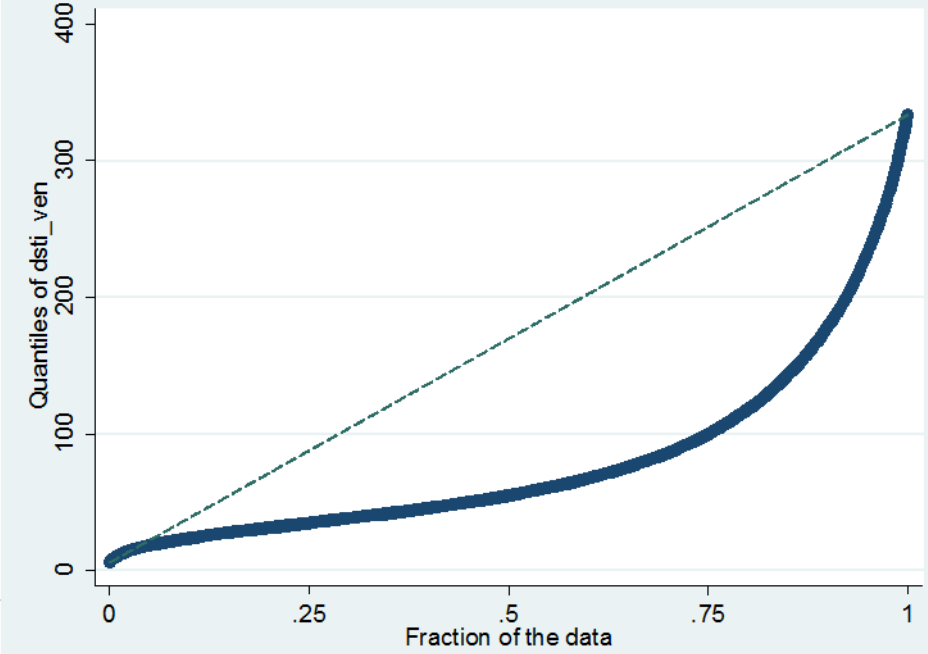
$$LTV_{i,t} = 100 * \frac{Loan_{i,t}}{Value_{i,t}}$$

$$LTV^{+}{}_{i,t} = \frac{1}{(1-\delta_{RE\ price})} * LTV_{i,t}$$

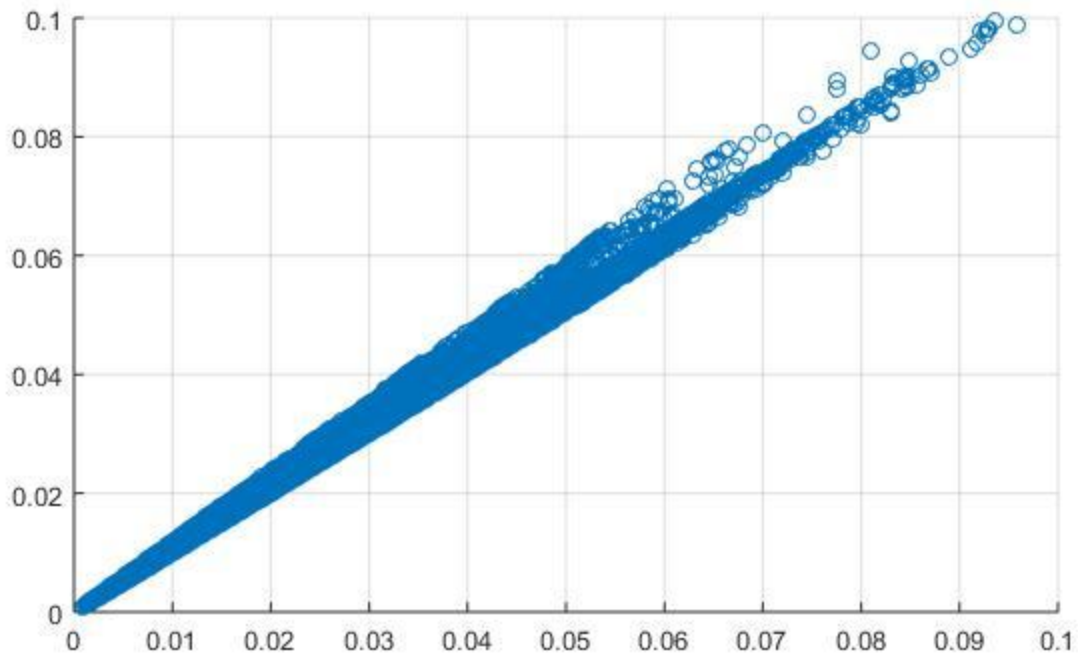
Results – stress test







Results – stress test



Conclusions

- For the MB RE loans:
  - **PD** ⇧ for debtors with loans in foreign currency (euro or exotic), as well as for those who have had a higher interest rate at origination or have higher DSTI and/or LTV values;
  - **PD** ⇩ in the case of a shift to higher income quintiles or of a Prima Casa loan;
- For the NMB Consumer loans:
  - **PD** ⇧ for those debtors who have loans in other currency than euro, who shift to a lower income quintile, as well as for those who have loans at two or more banks;
  - **PD** ⇩ for those debtors who also have a MB real estate loan, who shift to higher income quintiles or have larger residual maturities. The change in unemployment is also a relevant macroeconomic variable for the decrease of the PD.

Thank you!

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