NATIONAL BANK OF ROMANIA

Stress-testing the household sector – an estimate of household probability of default using micro-data

Irina Mihai

Elena Banu

Radu Popa

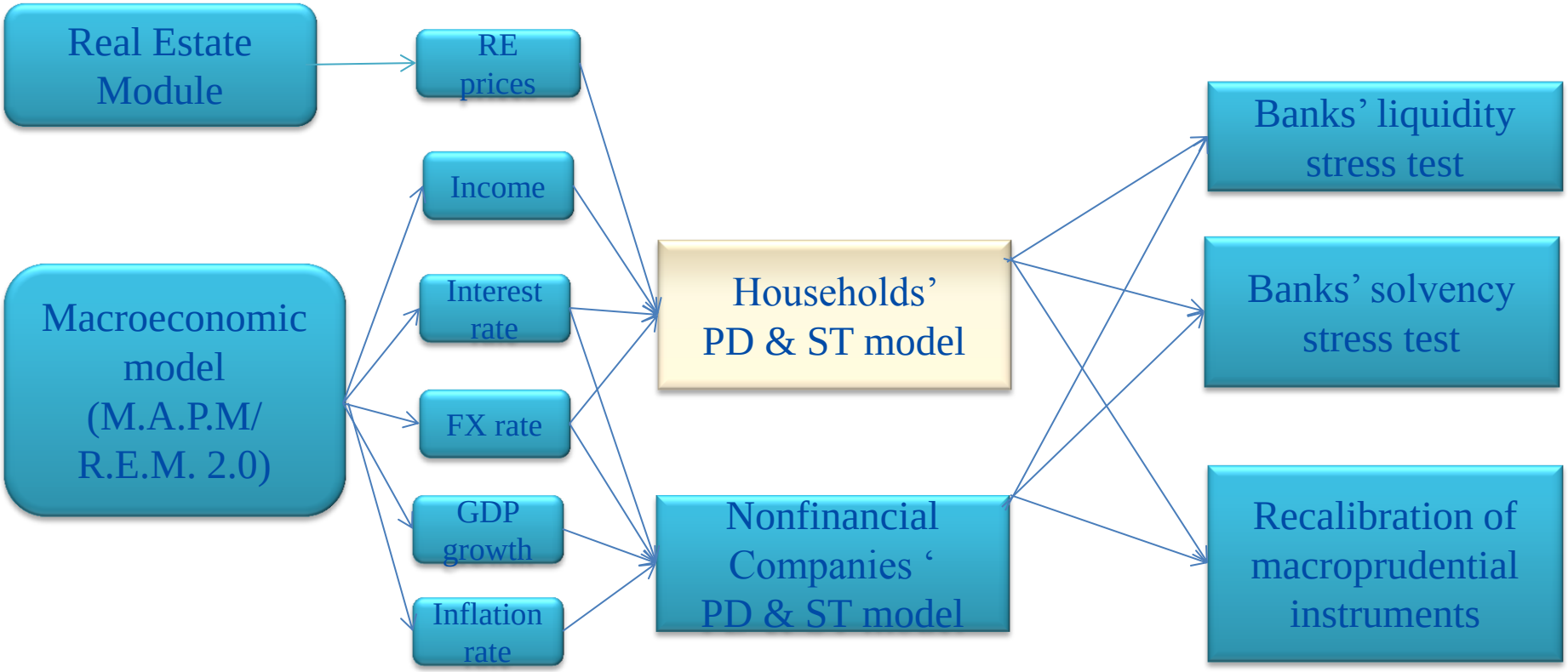
Florin Dragu

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

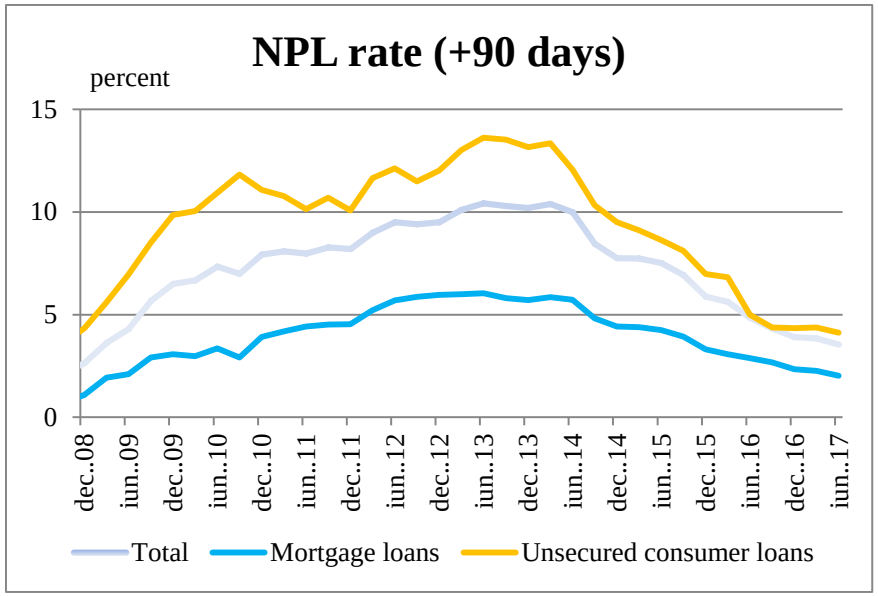
Outline of the presentation

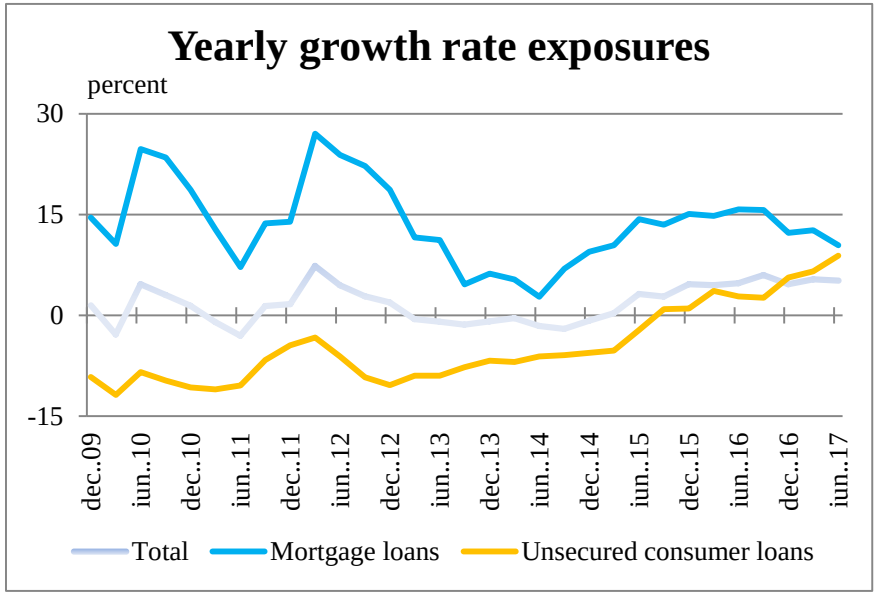
- Motivation
- Database and methodology
- Results
- Conclusions

Motivation

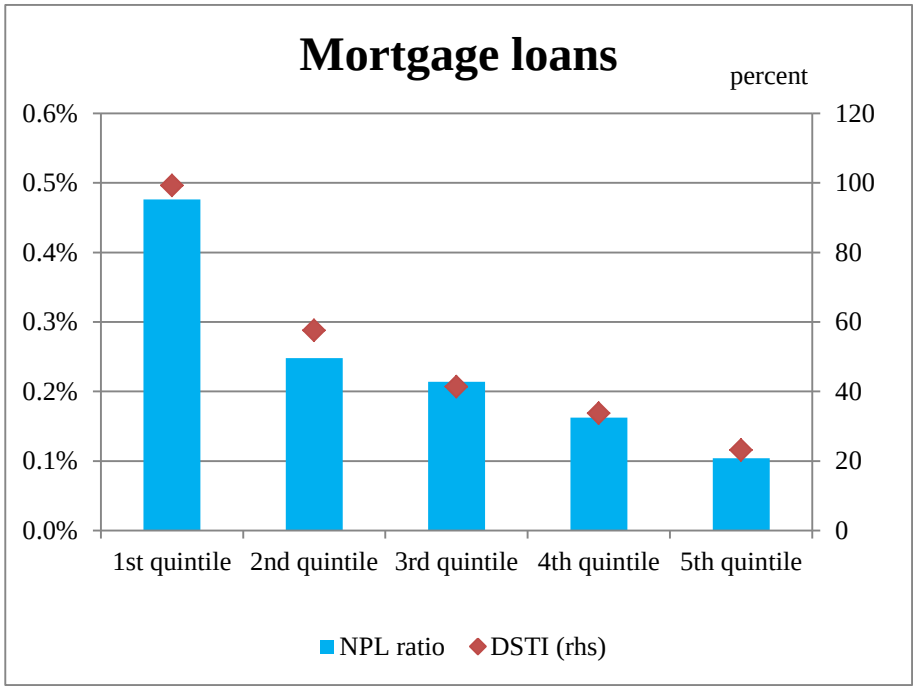

Real Estate Module
RE prices
Income
Interest rate
FX rate
GDP growth
Inflation rate
Macroeconomic model (M.A.P.M/ R.E.M. 2.0)
Households' PD & ST model
Nonfinancial Companies ' PD & ST model
Banks' liquidity stress test
Banks' solvency stress test
Recalibration of macroprudential instruments

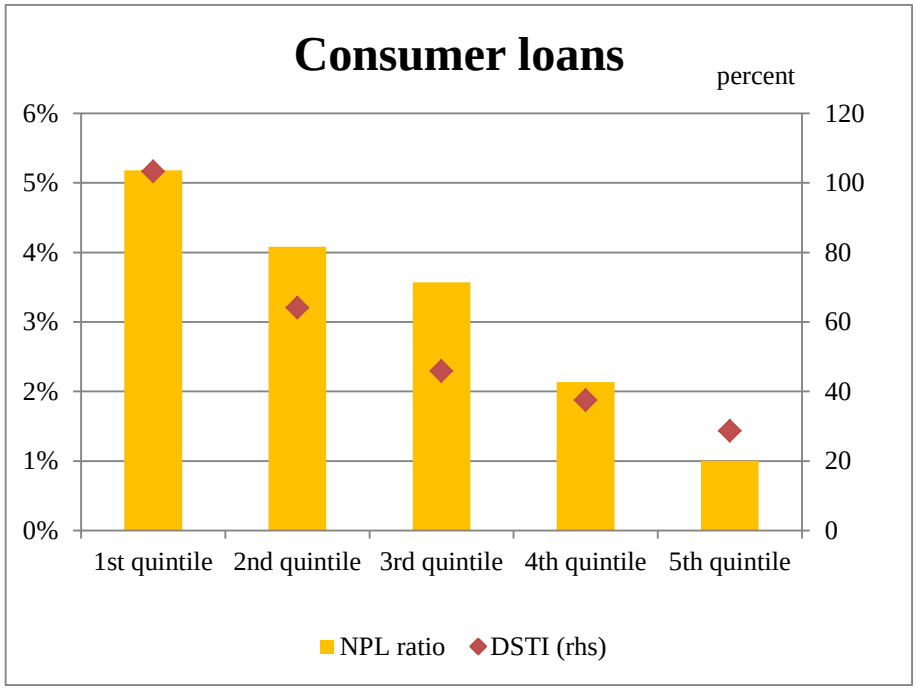
Decreasing rate of non-performing loans, but increasing credit growth…





…large asymmetries indebtedness between income quintiles





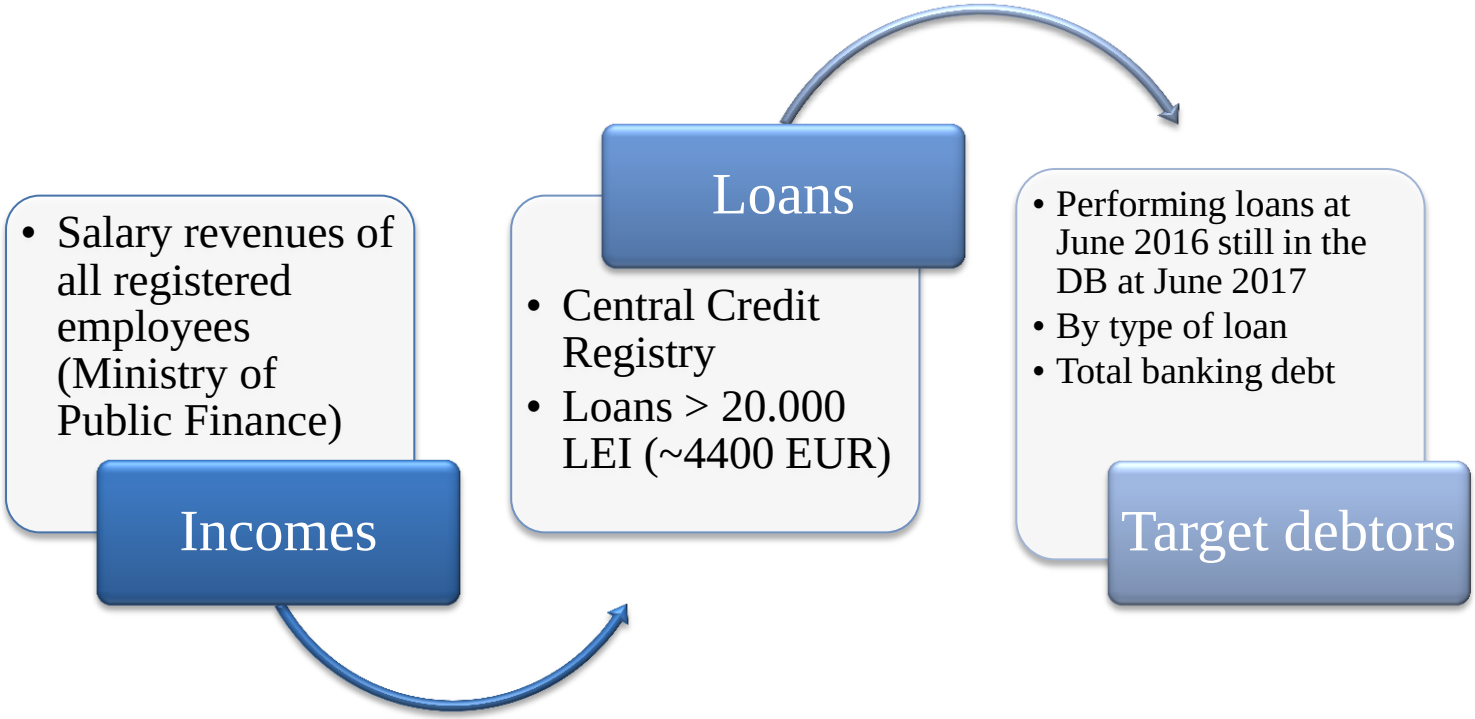
Database and methodology

- **Debtor in default** = debtor who has at least one loan that is 90 days past-due; this definition takes into account debtor – level contagion;
- **Mortgage-backed loans (MB)** = housing loans or other real estate investment loans, including First Home loans;
- **Unsecured consumer loans** (**CONS**) = consumer loans without real-estate collateral
- Logit model by type of loan and considering a debtor's total banking debt

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

- Conduct a bootstrap with a proportion of 20:80 of defaulted to non-defaulted debtors
- Data: Point in Time – June 2016 with a 12-month forecast window

Database and methodology



Database and methodology - selection of target loans

Step 1 (June 2016)

- Identification and elimination from the main DB of:
  - Restructured and refinanced loans
  - Conversions from FX to RON
  - "Unlikely to pay" loans
  - Non performing loans
  - Residual maturity <= 12 months

Step 2 (June 2016)

- Identification of sub-populations by type of loan at June 2016
  - **MB loans – 334 051, out of which 16 342 belong to debtors with at least 2 MB loans**
  - **CONS loans – 479 644 , out of which 65 687 belong to debtors with at least 2 CONS loans**

Step 3 (June 2017)

- Identification of loans in each sub-population still in the DB at June 2017 and had registered income :
  - **MB loans – 291 055 out of which 62 922 had no data regarding income => 228 133 loans**
  - **CONS loans – 254 849 out of which 44 509 had no data regarding income => 174 475 loans**

Step 4 (June 2017)

- Identification of newly defaulted and non defaulted loans in the two sets:
  - **MB loans – 445 defaulted loans, 227 688 non defaulted loans**
  - **CONS loans – 4029 defaulted loans, 170 446 non defaulted loans**

Step 5 (forecast June 2018)

- Use forecasted values for GDP growth and Euro Real Effective Exchange Rate
- Calibrate model based on King and Zeng (2001) - adjustment to intercept only

Database and methodology - variables

Debtor level

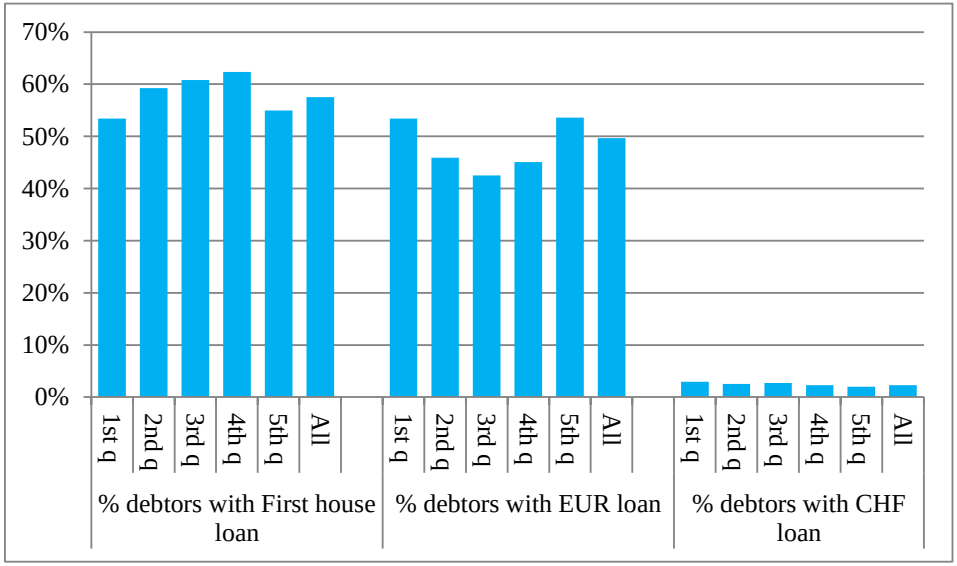
- Income (quintiles)
- Age
- Ratio of total banking debt service to income (DSTI*)

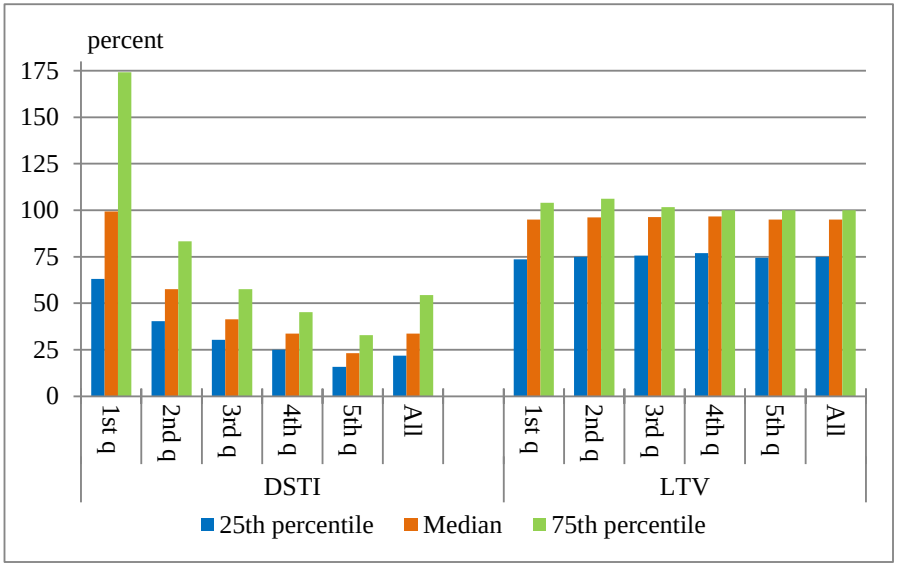
Loan level

- Residual maturity
- Annual interest rate (at origination)
- Bank (dummy)
- EUR (dummy)
- CHF (dummy)
- First Home loan (dummy)
- LTV
- Other MB loan (dummy)

Database and methodology – descriptive statistics

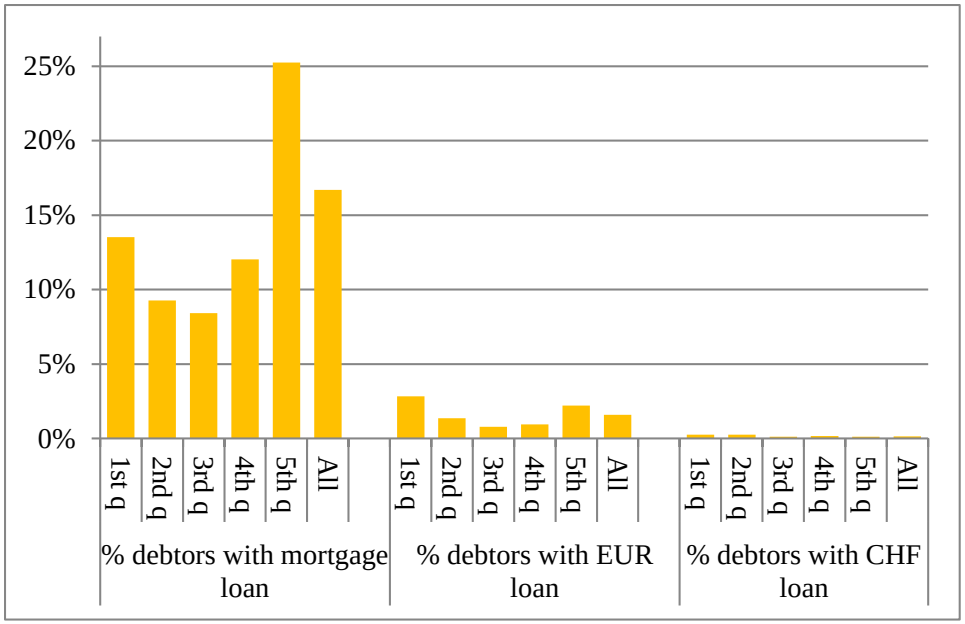
Mortgage backed loans

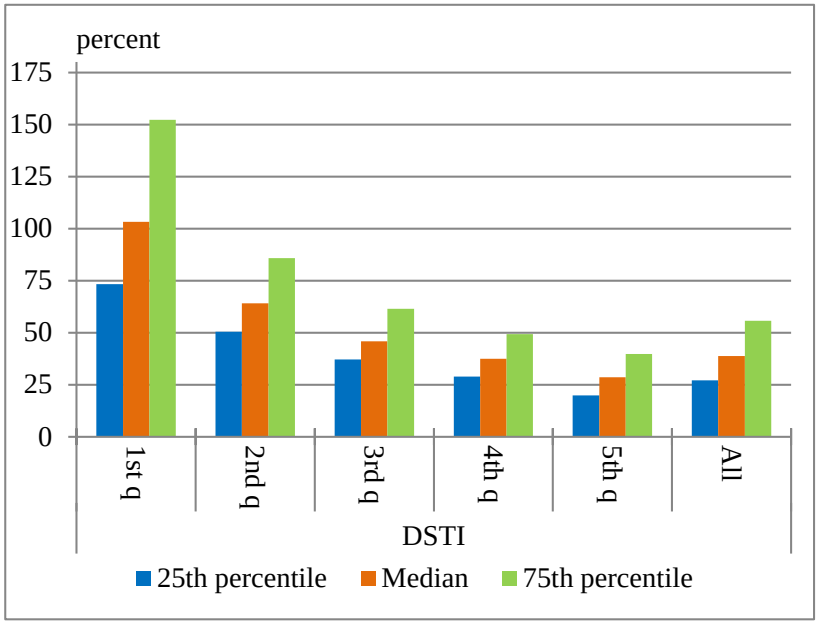




Database and methodology – descriptive statistics

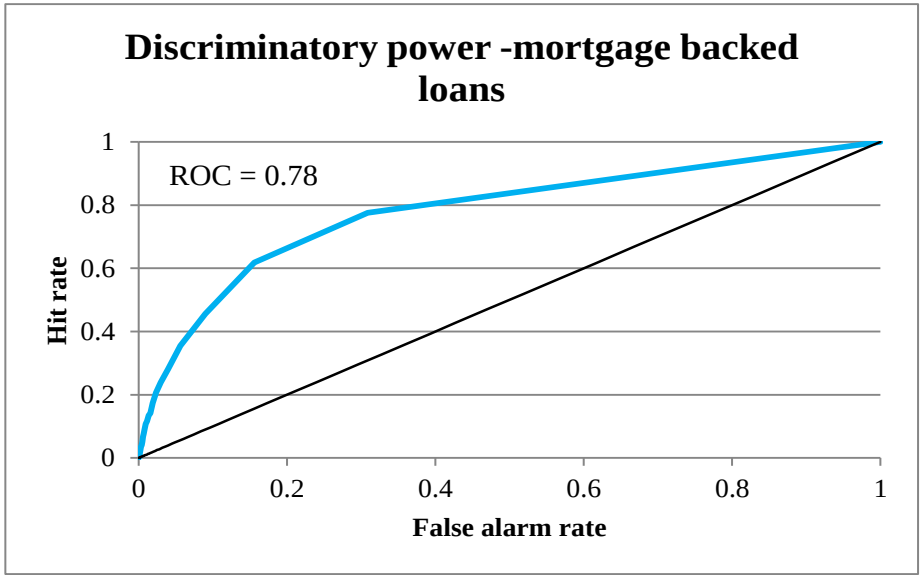
Unsecured Consumer loans





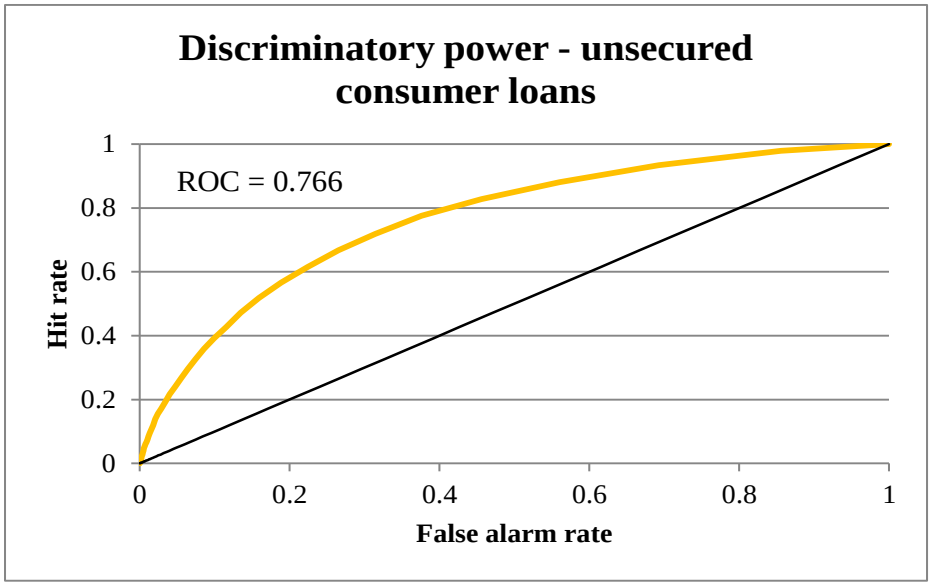
Results – mortgage backed loans

Coefficient		t-stat	Marginal effect at means
Age	0.01	1.61	0.01%
Residual maturity	0.003	6.65	0.002%
Interest rate	0.13	3.28	0.08%
EUR	0.45	5.70	0.27%
CHF	1.63	7.47	2.07%
First house	-1.68	-17.24	-0.91%
Quintile 1	0.23	1.98	0.31%
Quintile 2	0.08	0.58	0.06%
Quintile 4	-0.05	-0.45	-0.03%
Quintile 5	-0.58	-4.60	-0.24%
DTI	0.01	7.98	0.03%
LTV	0.00	1.86	0.02%

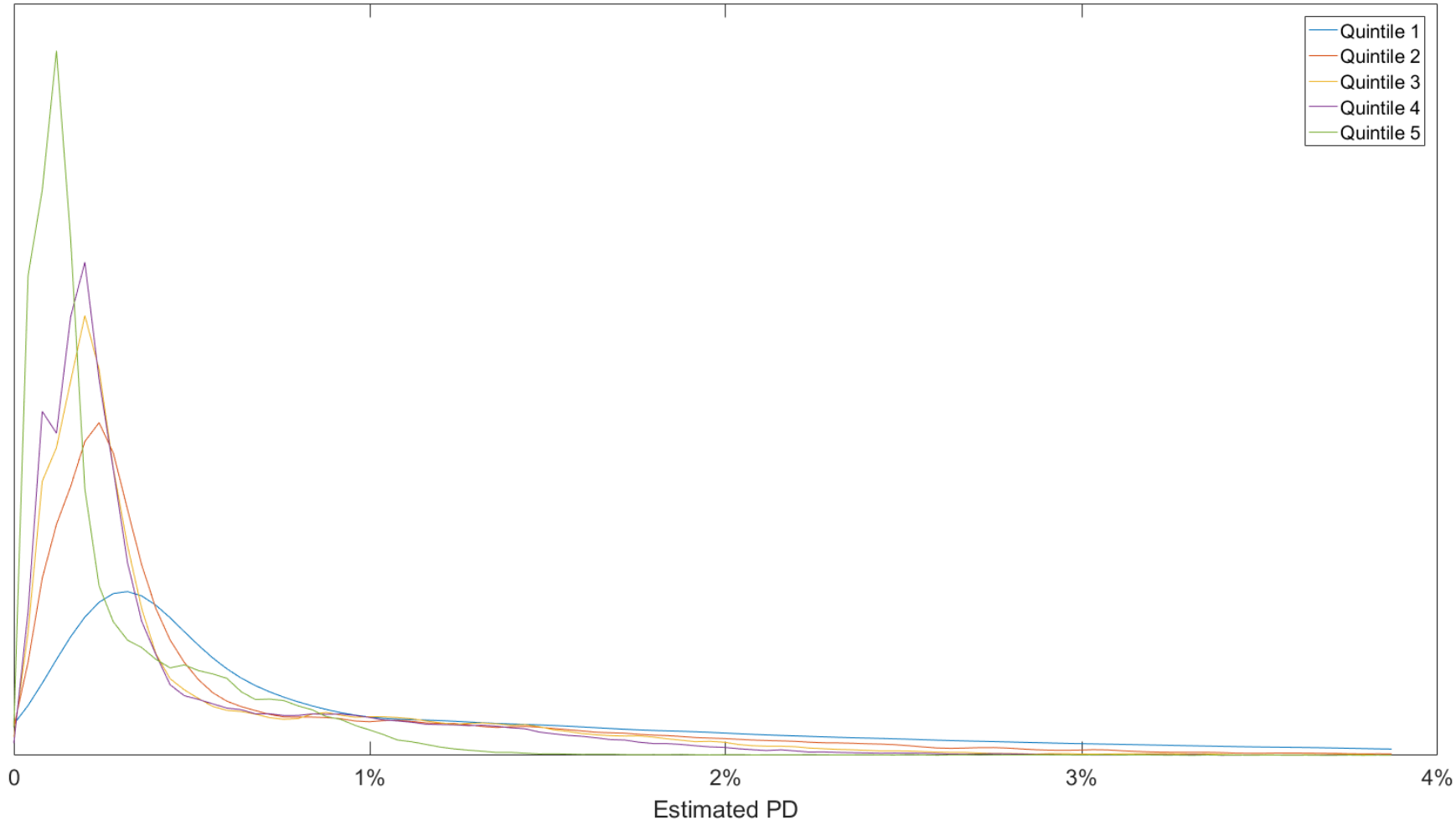


Results – unsecured consumer loans

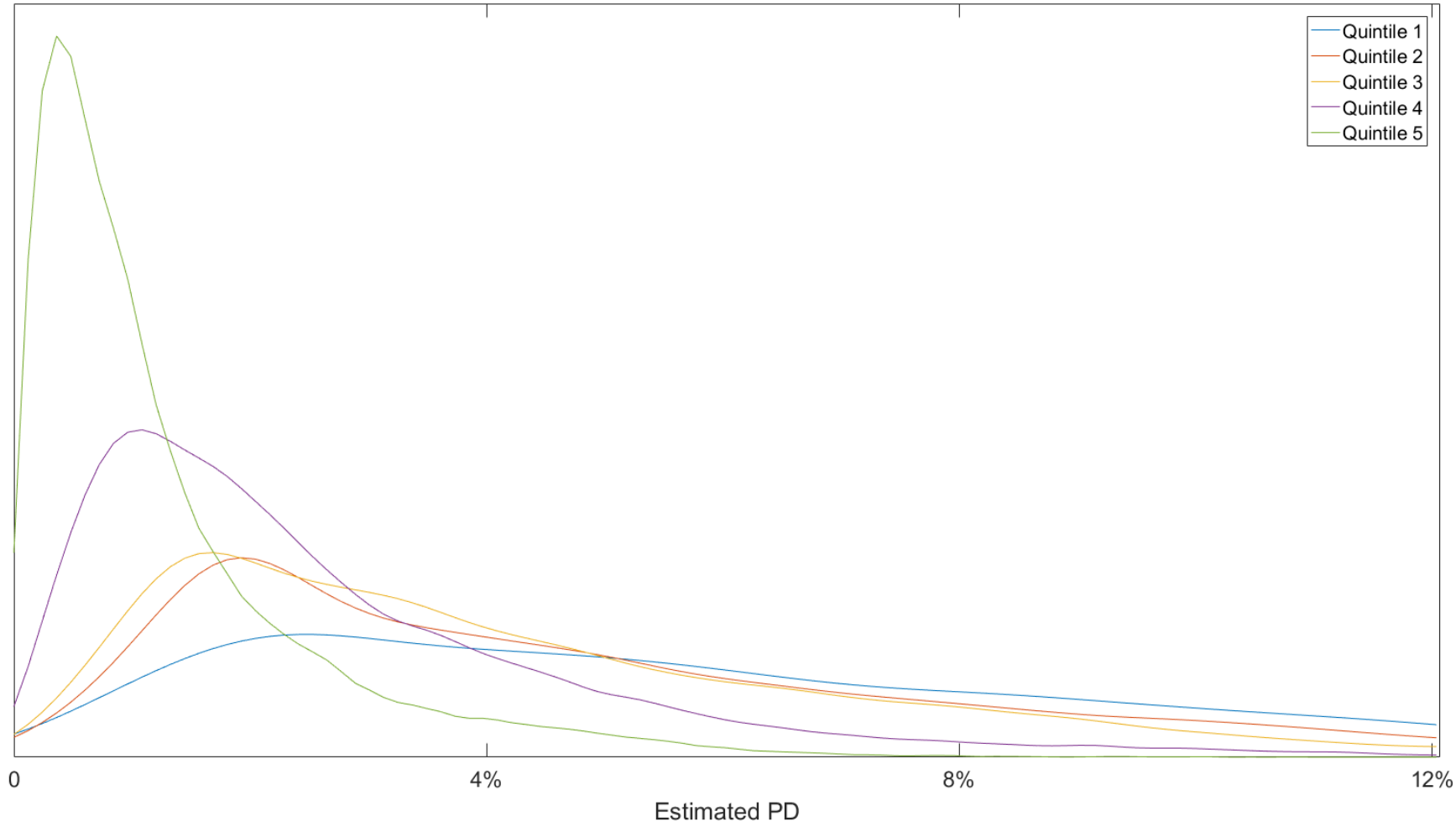
Coefficient		t-stat	Marginal effect at means
Age	-0.04	-46.33	-0.12%
Residual maturity	0.02	15.37	0.04%
Interest rate	0.14	28.61	0.41%
EUR	0.00	0.04	0.01%
CHF	0.87	2.66	3.47%
Other mortgage loan	-1.51	-43.99	-2.52%
Quintile 1	0.13	2.93	0.75%
Quintile 2	0.15	4.18	0.67%
Quintile 4	-0.46	-16.25	-1.48%
Quintile 5	-1.05	-36.97	-2.24%
DTI	0.004	10.65	0.12%



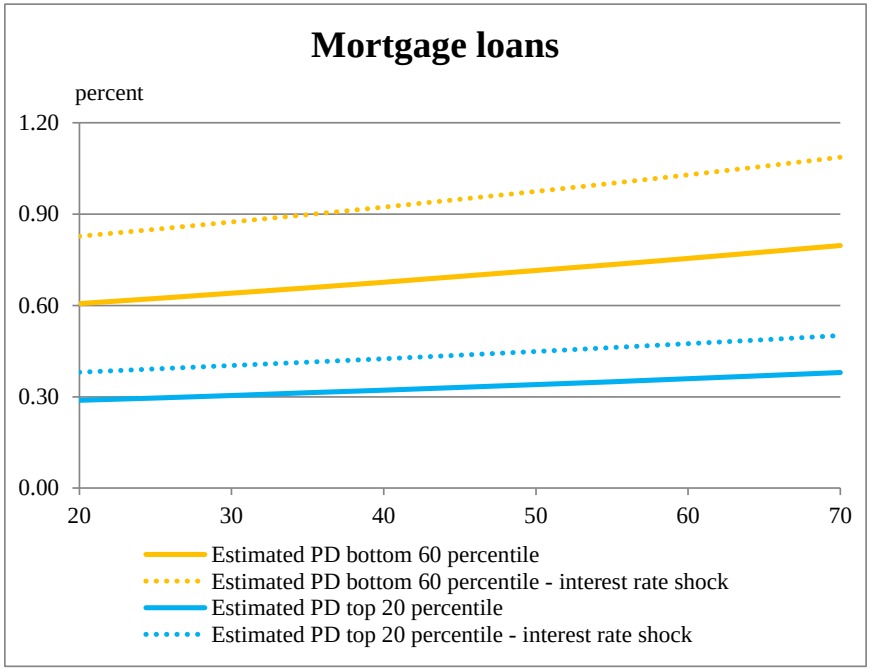
Results – predictive probabilities for mortgage backed loans

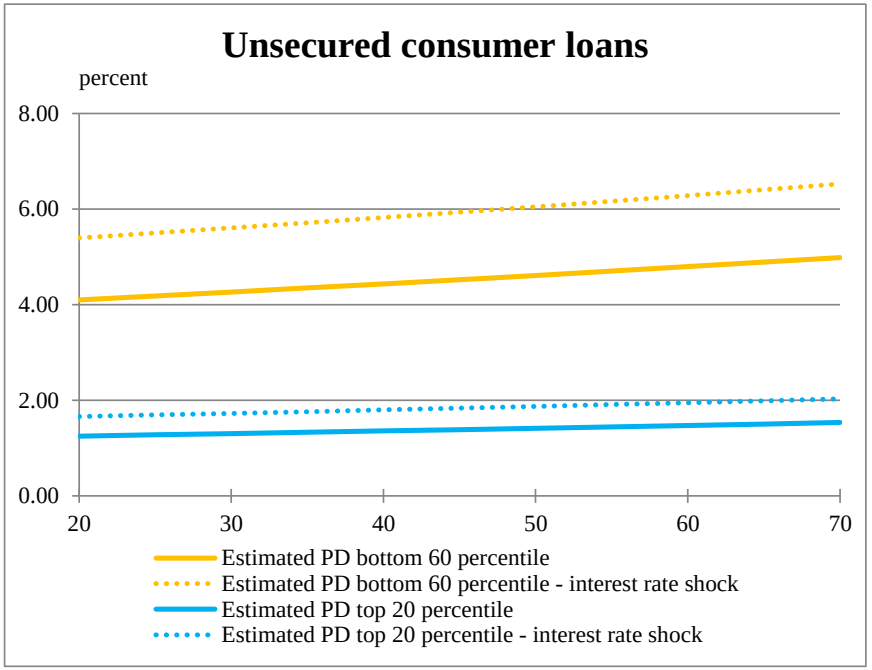


Results – predictive probabilities for unsecured consumer loans



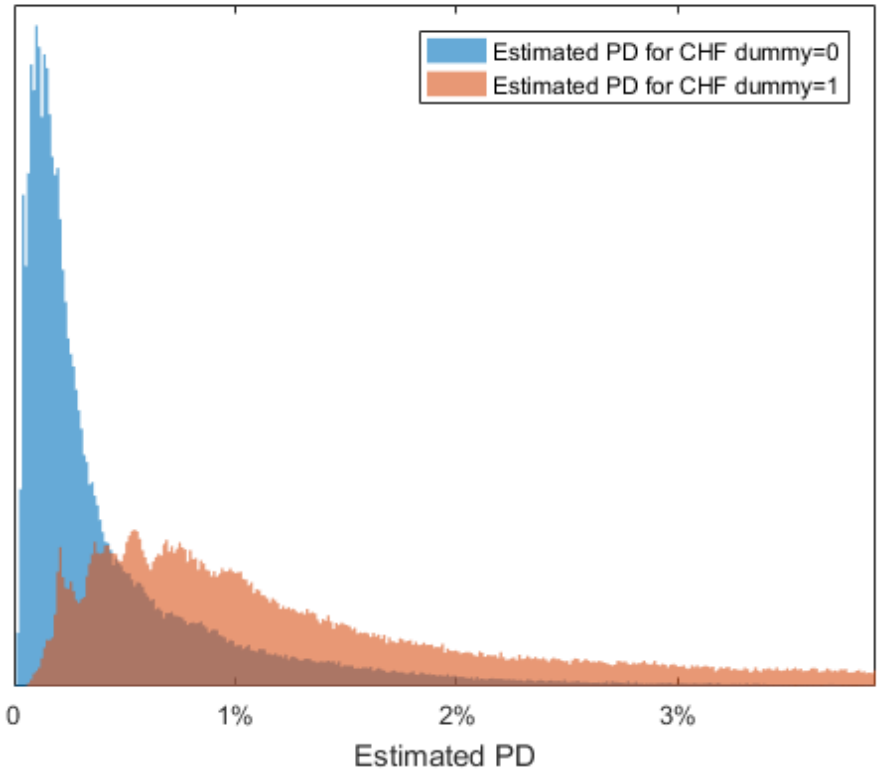
Results – DSTI and interest rate shock



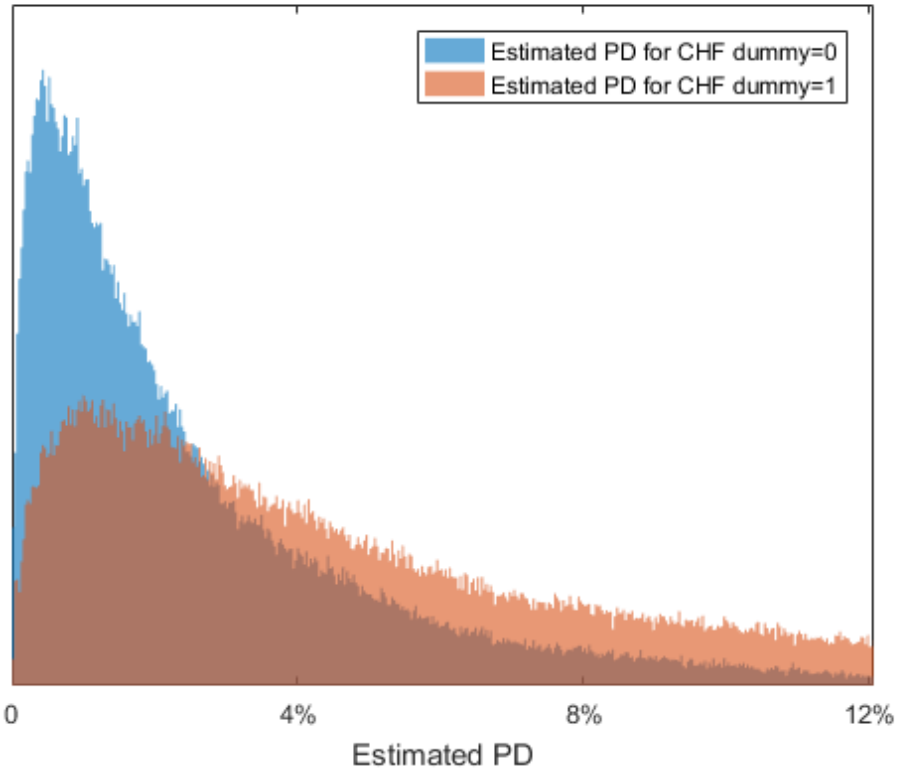


Results – impact CHF

Mortgage backed loans



Unsecured Consumer loans



Conclusions

- **Income quintiles** play important role determining PD for consumer loans
- For mortgage loans, only **lowest** and **highest income** quintiles have significantly different PD's
- **CHF** loans are significantly riskier for both consumer and mortgage loans, while **Euro** loans only have an impact on mortgage loans
- **DSTI** has an important effect on both types of loans, especially relevant for debtors in lower income quintiles
- **Interest rate shock** affects disproportionately lower income debtors through higher DSTI

Directions for future research

- Develop panel estimates for multiple years to increase robustness
- Improve stress test scenario and calculate impact on bank solvency
- Integrate in calibration of macroprudential instruments

Thank you!

radu.popa@bnro.ro