Estimating Non-cyclical PDs: A Case Study from Bulgaria

Credit Scoring and Credit Control XIV

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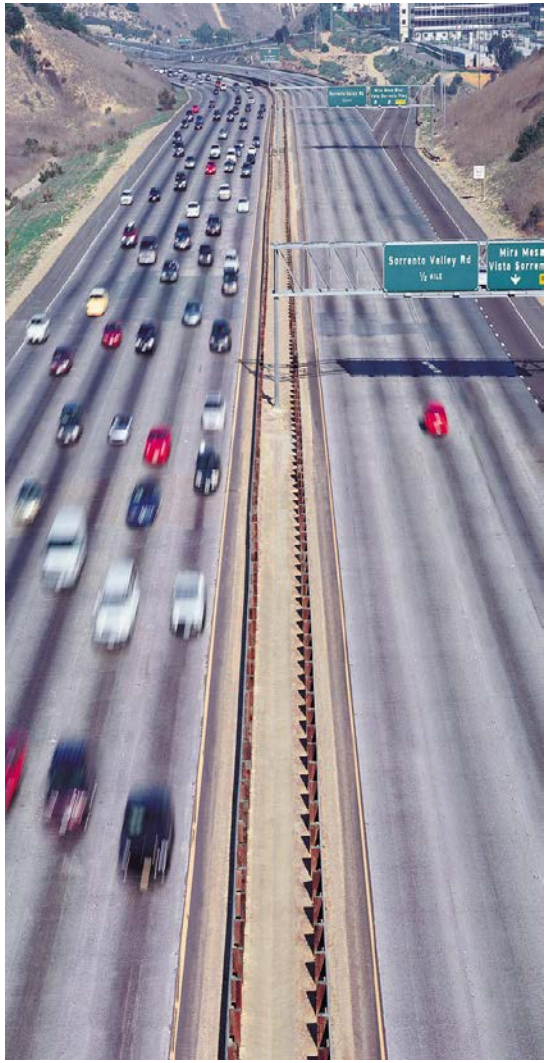
Summary



- Main goal:
  - Estimate non-cyclical PDs at pool and portfolio level
  - consistent with steady state macroeconomic conditions
- Why:
  - Know how current macroeconomic conditions affect credit indicators
  - Countercyclical buffers
  - Understand and contain cyclicality
- Approach:
  - Link between the macroeconomic conditions and performance and structure of accounts by pools
  - Set macroeconomic conditions to steady state values
- Application:
  - Consumer credit portfolio of a bank in Bulgaria

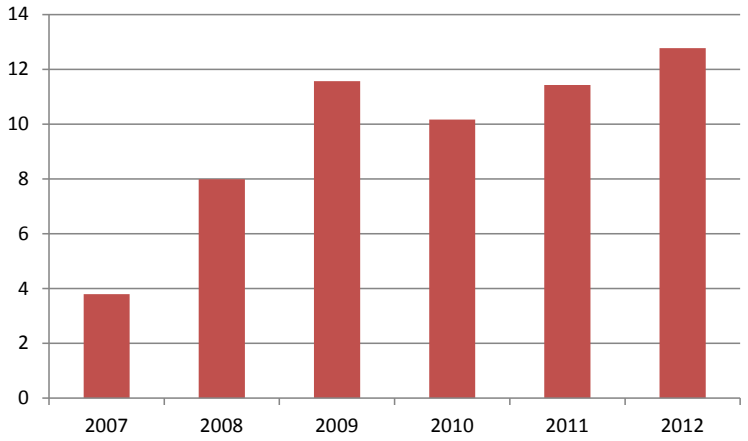
Agenda

- Background
- Model
- Econometric analysis
- Forecasts and scenarios
- Steady state
- Conclusion and considerations

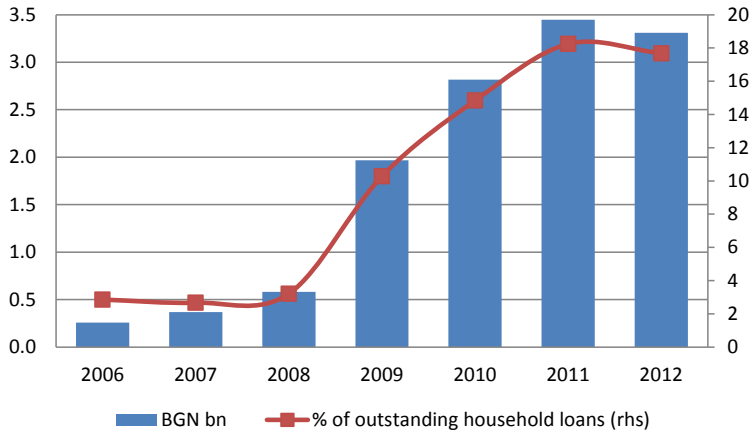
The empirical case

- Retail portfolio of a bank in Bulgaria
- Monthly data on all open accounts including performance
- Distribution by PD pools
  - based on the age of the accounts and default history - customers' time with the bank, events of restructuring and months in delinquency
  - bank's methodology and is constant throughout time
- Regional dimension
- 2007-2012 - quarterly

Portfolio's default rate (%, annual average)

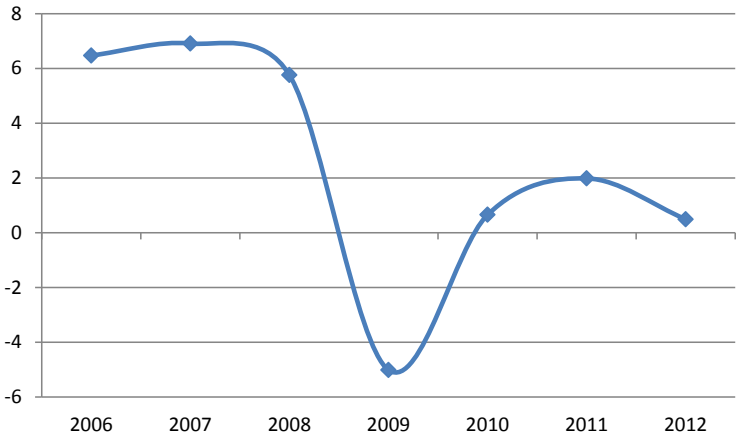


Bad and restructured loans

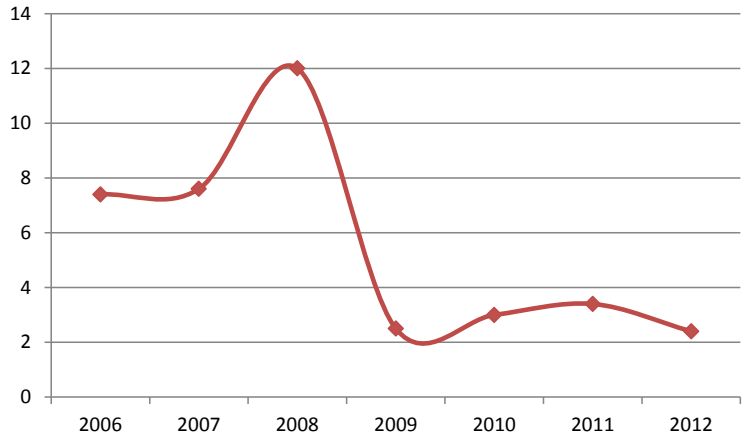


The empirical case

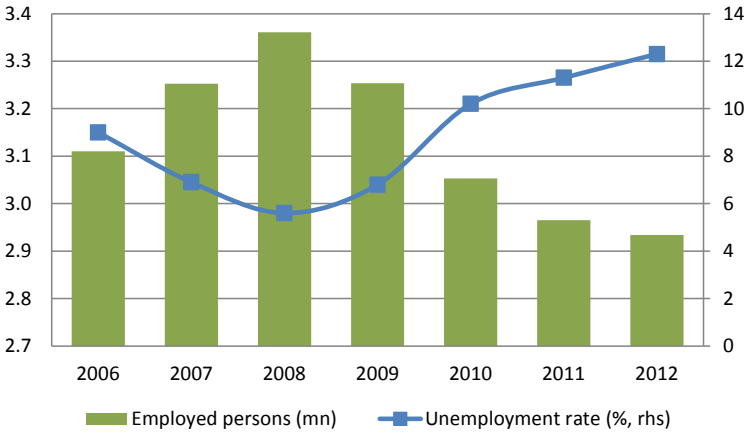
Real GDP growth (% yoy)



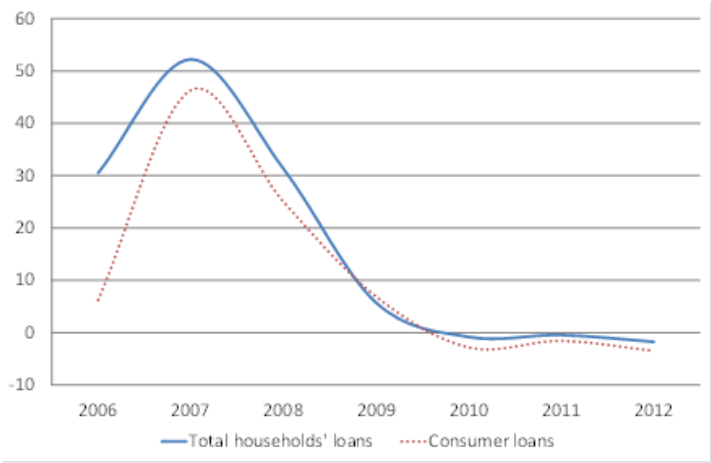
HCPI inflation (annual average, %)



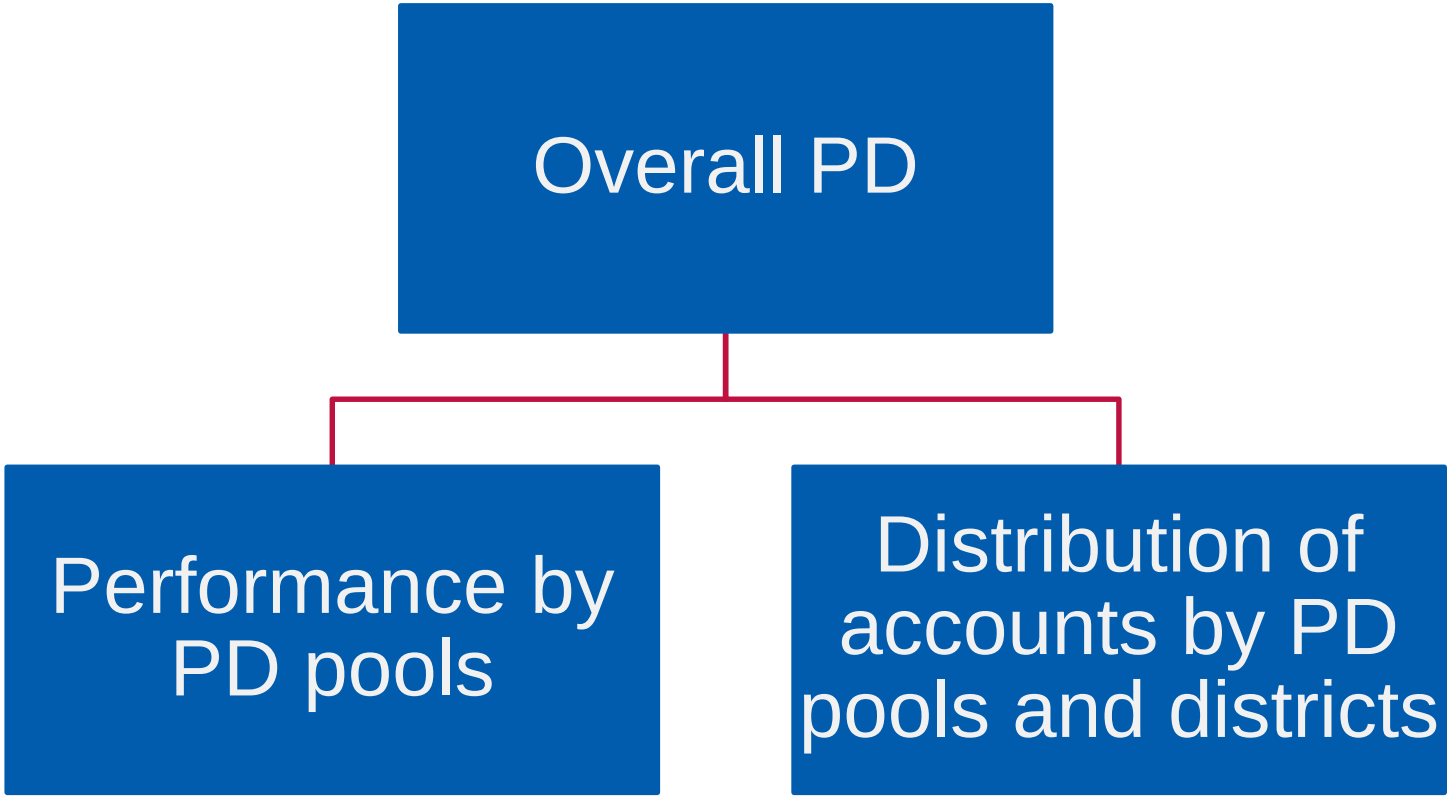
Labour market dynamics



Loans to households (% yoy)



The model



The model
PD by pools

- Logit relationship following Wilson (1997)

$$PD_{j,t} = \frac{1}{1 + \exp(y_{j,t})}$$

- $y_{j,t}$ *is an index of macroeconomic variables* X

$$y_{j,t} = \beta_{j,0} + \beta_{j,1} X_{1,t} + \beta_{j,2} X_{2,t} + \cdots + \beta_{j,n} X_{n,t}$$

$$OR_{j,t} = \frac{1 - PD_{j,t}}{PD_{j,t}}$$

- Error correction form to capture long-term and short-term dynamics

$$\Delta \ln(OR_{j,t}) = \Delta y_{j,t} - \gamma\left(\ln(OR_{j,t-1}) - y_{j,t-1}\right)$$

- γ – speed of error correction

The model
Structure by district and pool

$$\Delta \ln(DP_{i,j,t}) = \delta \Delta \ln(D_{i,t}) + \vartheta \Delta Z_{i,t} - \rho\,(\ln(DP_{i,j,t-1}) - \delta \ln(D_{i,t-1}) - \vartheta Z_{i,t-1})$$

- Error correction form
- $DP_{i,j,t}$ is the number of accounts of district *i*, PD pool *j*
- $D_{i,t}$ is the number of accounts by district
- $Z_{i,t}$ is an index of macroeconomic variables, related to each district
- ρ is the speed of error correction, such that $\rho \in (0,1)$

The model
Overall PD

- Structure by pools:

$$share_{j,t} = \frac{\sum_i DP_{i,j,t}}{\sum_i D_{i,t}}$$

- PD of the portfolio:

$$PD_t = \sum_j PD_{j,t}\, share_{j,t}$$

Econometric analysis

- Set of macroeconomic variables
- Lags
- Estimate the model equations

Econometric analysis

$$Default\ rate\ by\ pool\ (t) = f\begin{pmatrix} default\ rate\ by\ pool\ (t-1) \\ gdp\ growth(t) \\ wages\ (t, t-1) \\ interest\ rate\ (t) \end{pmatrix}$$

$$Share\ of\ accounts\ by\ pool\ and\ districrt\ (t) = f\begin{pmatrix} Share\ of\ accounts\ by\ pool\ and\ district\ (t-1) \\ gdp\ growth(t, t-4) \\ unemployment\ rate\ (t, t-4) \end{pmatrix}$$

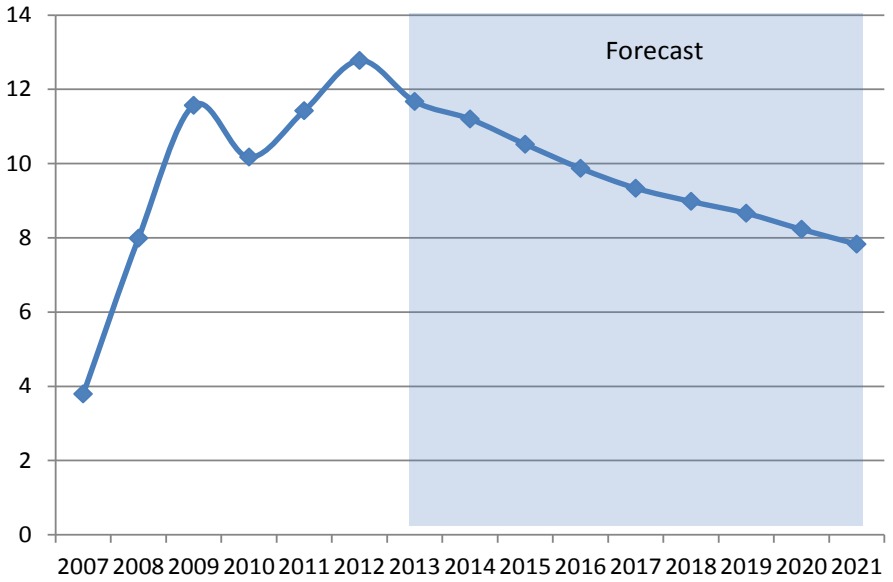
Econometric analysis

- Different speed and magnitude to changes in the macroeconomic conditions
- Good pools - strong positive relationship with economic growth and favourable labour market conditions
- Weaker pools - negative relationship with economic growth and a positive relationship with the unemployment rate

Baseline forecast

- Experian macroeconomic projection up to 2021
  - Economic upturn
  - Very modest recovery in 2010-14
  - 13% unemployment in 2013
  - Slow improvement in 2015-2017
  - 3.1% growth by 2021
  - Unemployment rate fall to 8%
- Unchanged structure by district

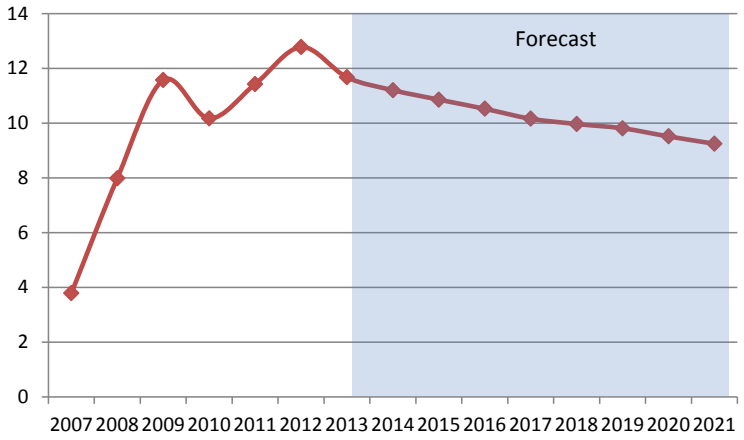
Portfolio's default rate (%, annual average)

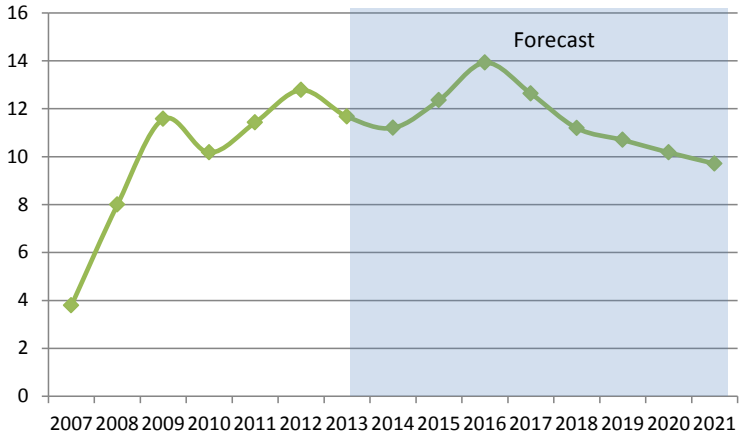


Forecasts and Scenarios

- Scenario 1
  - Positive but slower growth
  - 1% annual average growth in 2013-2021.
  - more modest wage growth and reduction in the unemployment rate compared to baseline.
- Scenario 2
  - Recession in 2015-2016
  - Corresponding hike in the unemployment rate
  - Reduction in average wages
  - Slow rebound in 2017 and then baseline growth is resumed

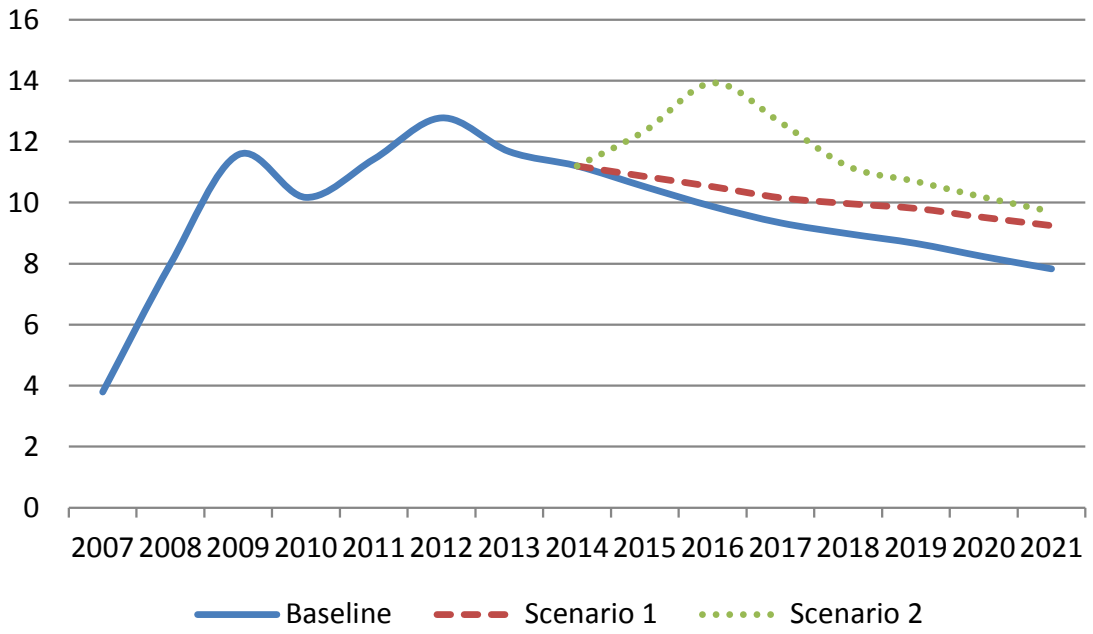
Portfolio's default rate (%, annual average)





Forecasts and Scenarios

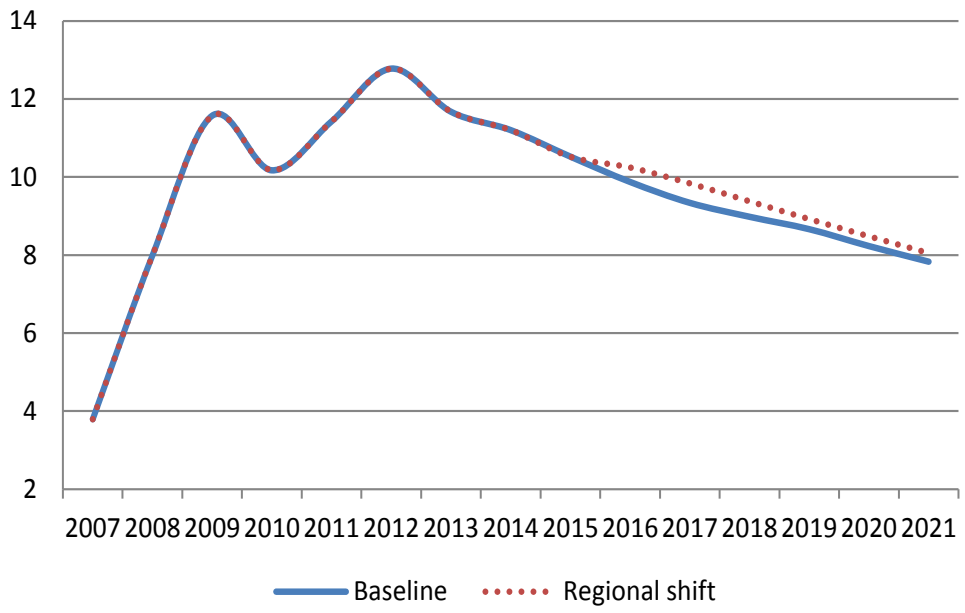
Baseline and scenario forecasts of the portfolio's PD (%)



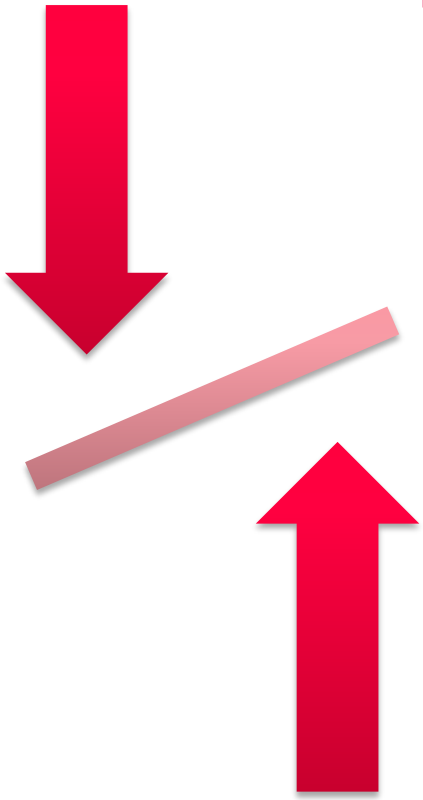
Regional strategy scenario

- In 2015 double the share of accounts in the North-west districts to 10%
- Unchanged district structure afterwards
- Baseline macroeconomic forecast

Portfolio's default rate (%, annual average)

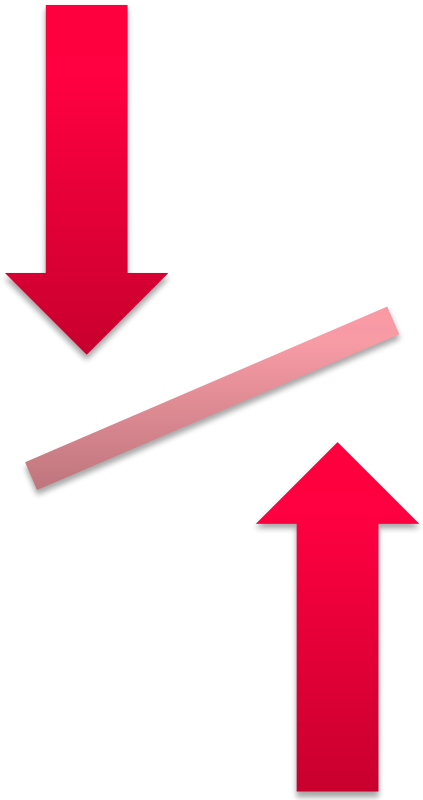


Steady state



- Macroeconomic steady state
  - In the steady state the economy operates at its sustainable, non-inflationary capacity, stepping up by its potential rate of growth.
  - Potential growth is determined by the physical, human capital and total factor productivity; related to demographic, institutional and technological developments
  - The unemployment rate that characterizes the long-term equilibrium labour market is NAWRU.
  - Real macroeconomic variables drive the long-term development
  - Nominal variables converge to stable values

Steady state



- PD
  - PD in each pool converges to a non-cyclical level

$$PD_{j,t} = PD_{j,t-1} = PD_j^*$$
$$OR_{j,t} = OR_{j,t-1} = OR_j^*$$

  - depends only on the steady state macroeconomic variables:

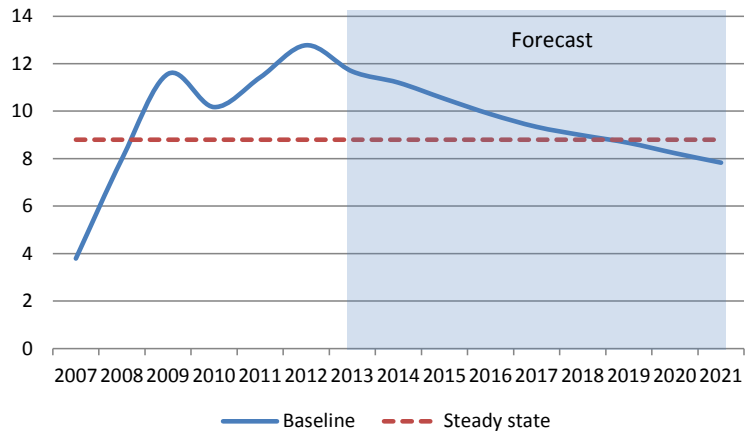
$$-\gamma \ln\left(OR_j^*\right) = \Delta y_j{}^* + \gamma y_j{}^*$$

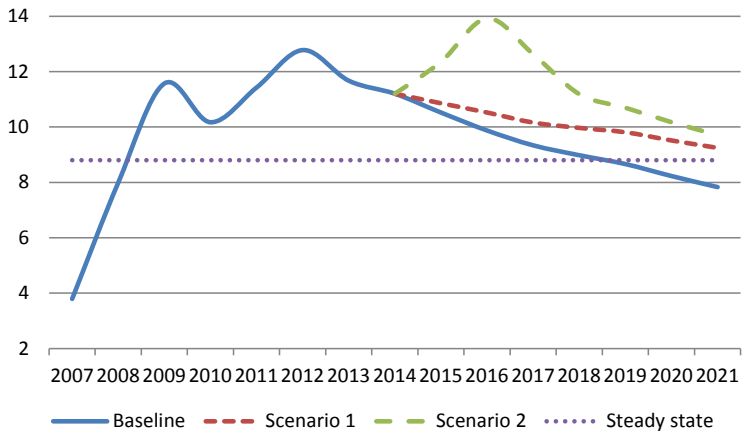
- Structure
  - share by district remains constant
  - depends only on the steady state macroeconomic variables in each district:

$$DP_{i,j}^* = \vartheta \Delta Z_i{}^* + \rho \vartheta Z_i^*$$

Steady state

- Steady state macroeconomic estimates:
  - European Commission, ECFIN AMECO database





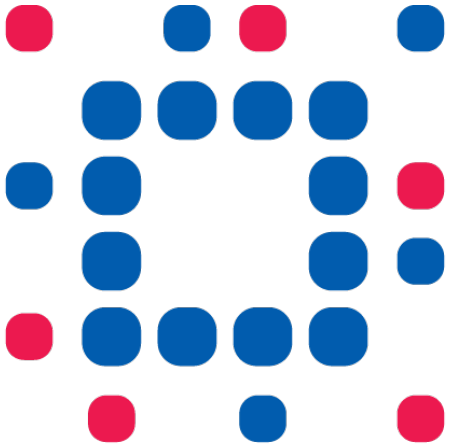
Conclusion

- Non-linear procyclical relationship between macroeconomic conditions and credit risk
- Procyclicality is propagated by the relation of economic growth and labour market variables to
  - the distribution of accounts by PD pools
  - the performance by pools
- Time series modelling of the PD
- Non-cyclical PDs estimation in line with potential economic conditions of the economy
- The concept of economic growth can be easily extended to determining the cyclical position of the financial sector

Considerations

- Extension to LGD, expected loss estimates
- International portfolios
- Consistent potential growth estimates
- Fast growing economies
- Other factors

Time for Questions



Experian

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