

In the quest of measuring financial cycle

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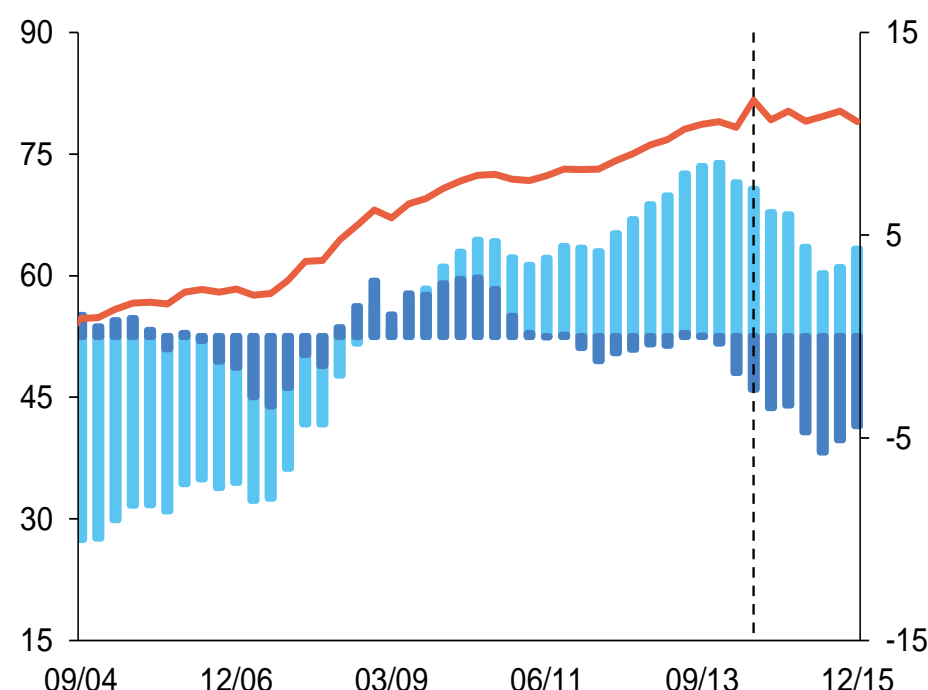
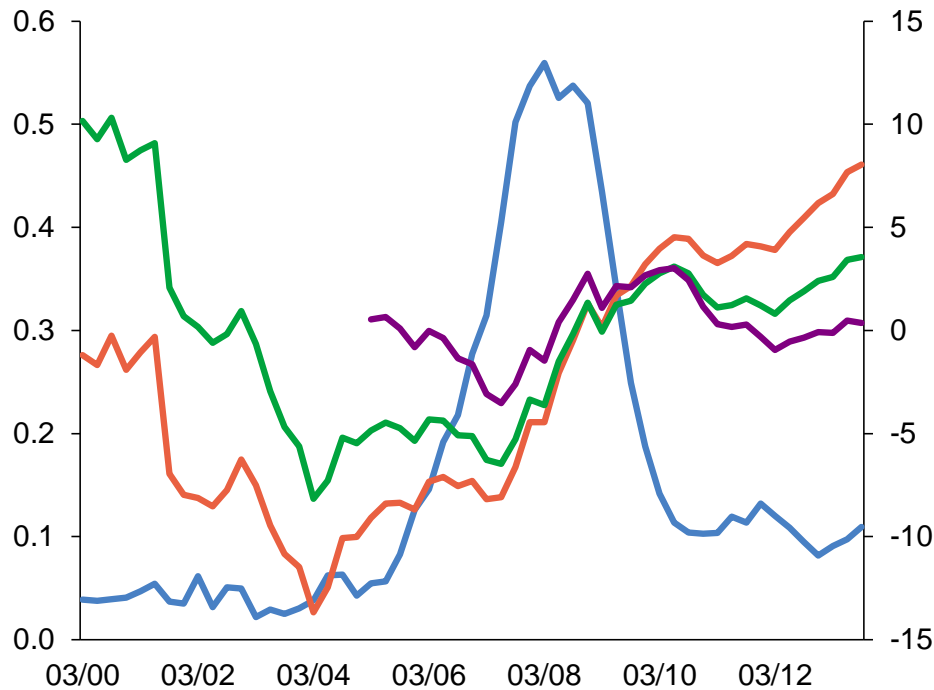
1. Motivation
2. Financial Cycle Indicator (FCI), Loan rating migrations
 - a) Background
 - b) Methodology
3. Results for the Czech Republic
4. Conclusions

- Financial crisis has brought great interest in financial fluctuations
 - their impact on the real economy
 - their role in financial stability and macroprudential policy
- In the paper, we chiefly focus on the latter
- Main goals
 - to get a better picture on where do we stand within the financial cycle (given a short data sample)
 - to monitor accumulation of systemic risks and support macroprudential decisions (CCyB buffer)
 - to facilitate communication between statisticians, policy makers and general public

- Measures of the financial cycle can be designed with respect to
 - Theoretical definition of the cycle
 - Statistical properties
- In our paper, we follow two distinct approaches towards the financial cycle measurement
 - FCI indicator (CISS-based and KISS-like indicator)
 - Rating migrations (complementary approach)

Measuring the financial cycle

- Is credit-to-GDP gap a useful measure?...not always!

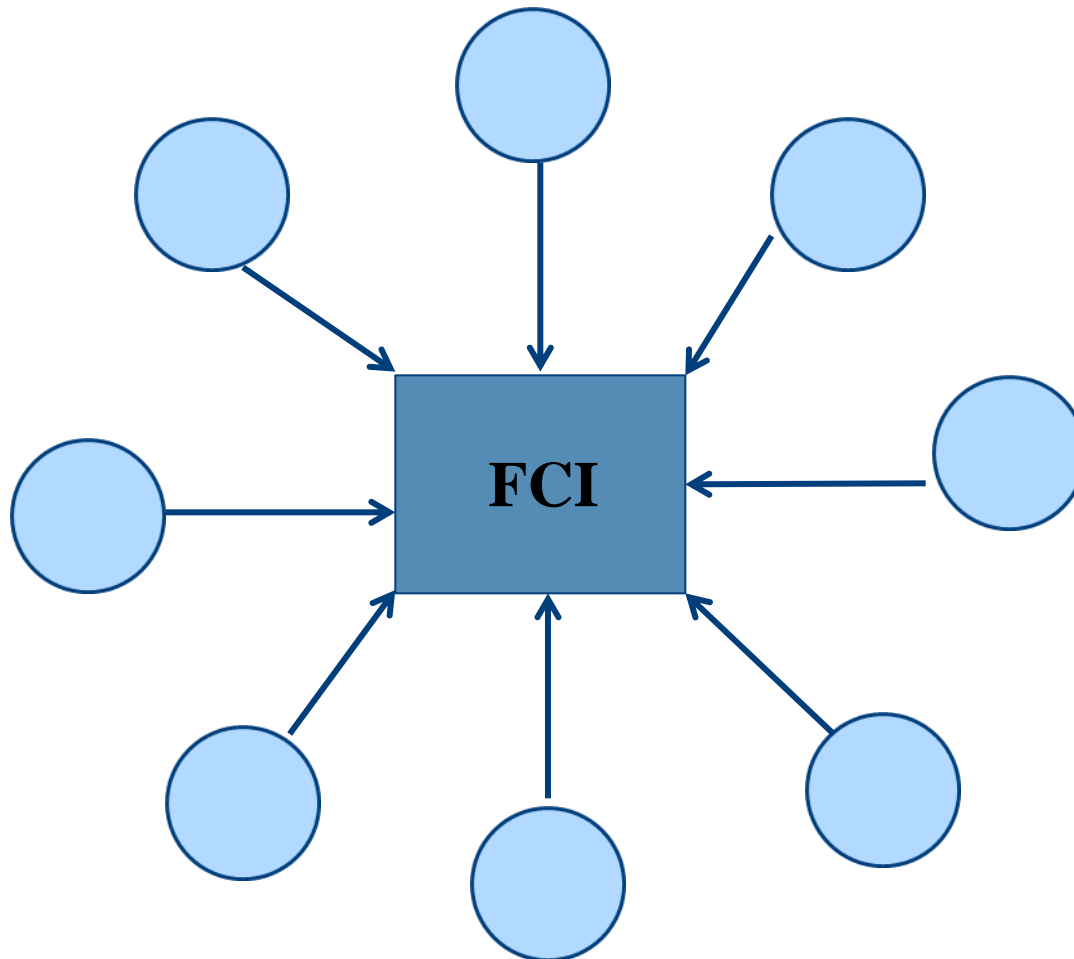


— IFC
 — Credit-to-GDP: start 1995, rhs axis
 — Credit-to-GDP: start 2000, rhs axis
 — Credit-to-GDP 2: start 2005, rhs axis

■ Credit-to-GDP: start 1995, rhs axis
 ■ Credit-to-GDP: start 2004, rhs axis
 — Credit to GDP

- Definition of the Financial cycle: “... swings in market participants’ attitudes to financial risks, where the swings reflect changes in risk perceptions and value and the reinforcing interactions between them.”
 - Optimism = risk-accumulation phase
 - Under-pessimism = (post) risk-materialization phase
- These swings manifest themselves through various indicators characterizing the behavior of market participants
 - FCI indicator should capture the overall (general) tendency
 - FCI indicator should issue a stronger signal about risk accumulation of risks if more indicators point in that direction

- Selection of indicators (based on the expert judgement but reflects existing literature and data availability/quality)
 - New Credit (separately for NFC and HH)
 - Property prices
 - Debt sustainability indicators (separately for NFC and HH)
 - Credit Conditions (credit supply side, NFC and HH)
 - General market sentiment – asset prices
 - Current account deficit (external imbalances)
- All time-series (indicators) are transformed into interval (0,1) to ensure their mutual comparability (kernel estimate of the CDF was used)



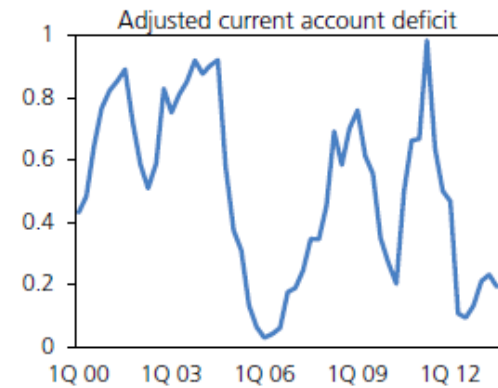
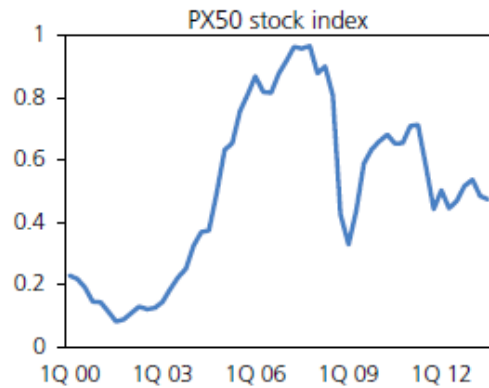
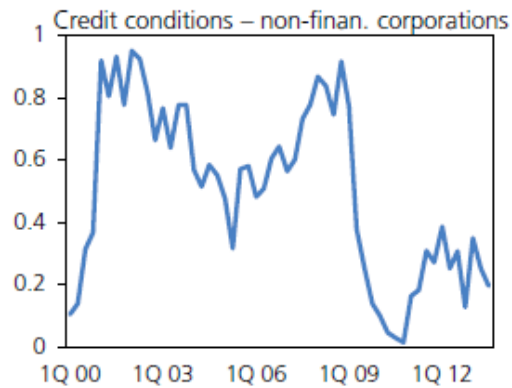
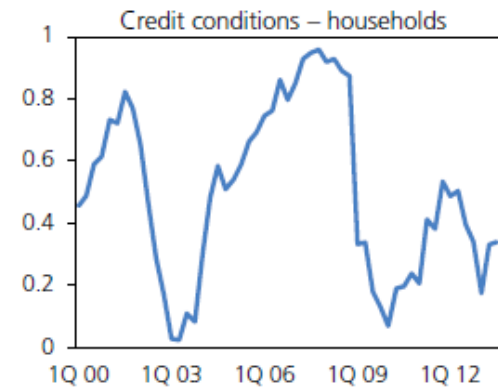
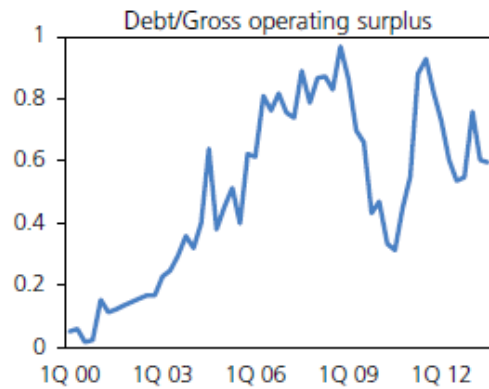
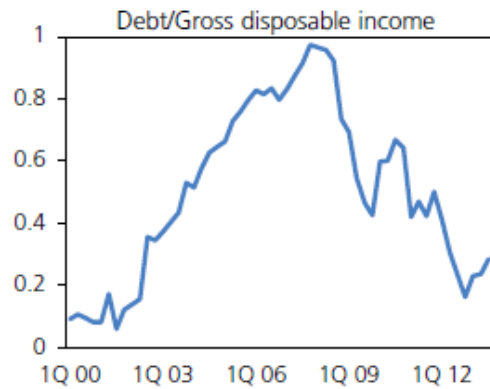
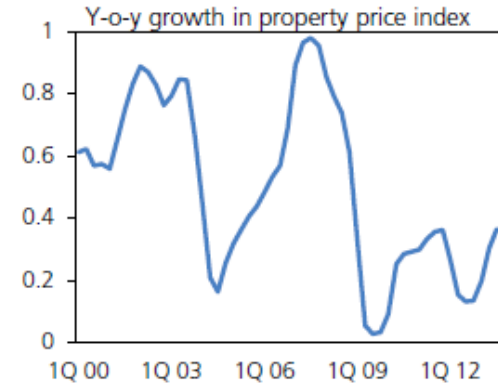
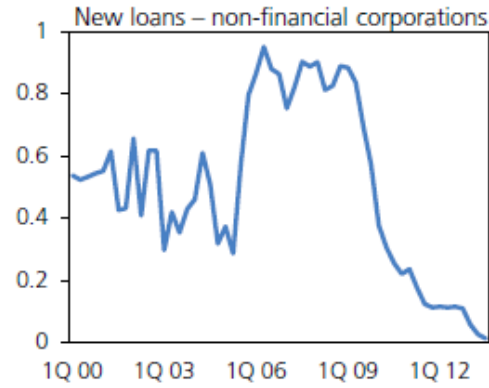
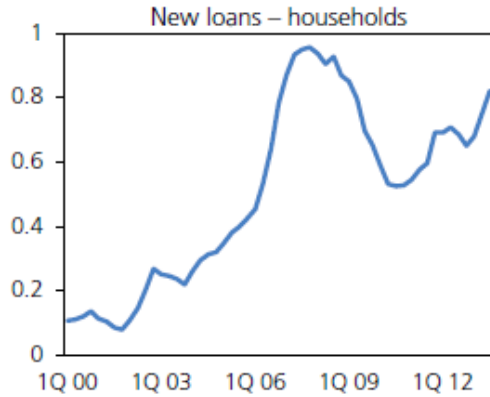
- Why not a factor model?
 - Factor model is hardly a „KISS“ solution
 - Short time series available
 - Is a factor model in line with the proposed definition of the financial cycle? (does it capture the „reinforcement“ element)
 - Potential lack of association with the intended outcome
 - Idiosyncratic shocks vs. macroprudential (in)action

- Composite index follows CISS methodology...

$$IFC_t = (w \circ i_t)' C_t (w \circ i_t)$$

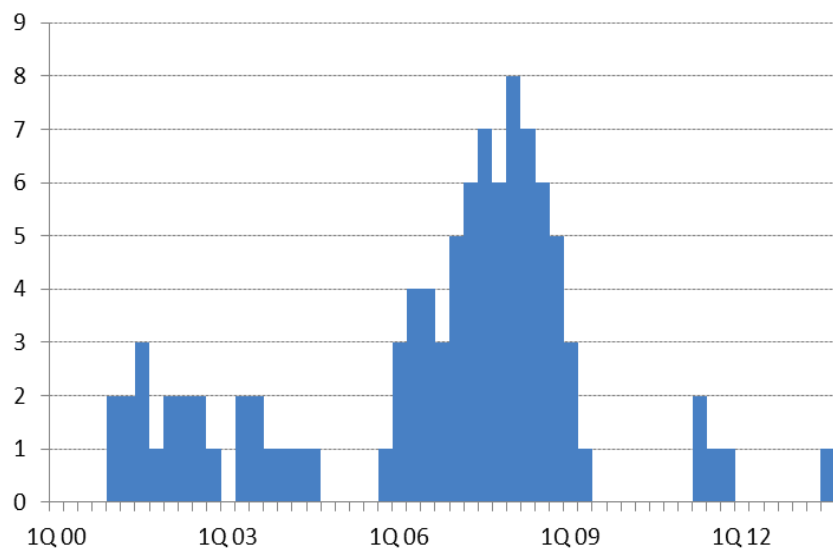
- Time-varying correlations, C_t , are estimated using EWMA method (decay factor set to 0.94)
- (Constrained) weights were estimated using Monte Carlo sampling to obtain the best model fit (MSE) with respect to future credit losses.

Methodology



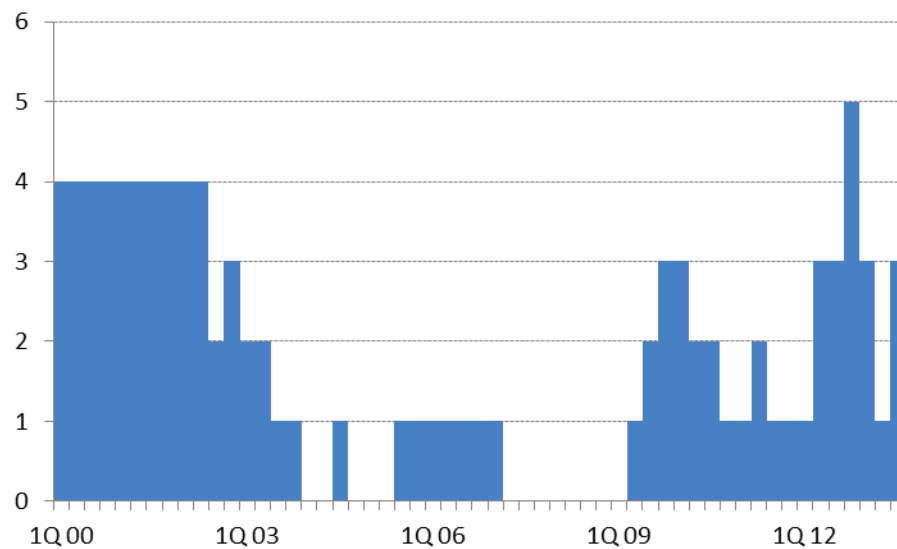
Expansion

(nr. of indicators above 80th quantile)

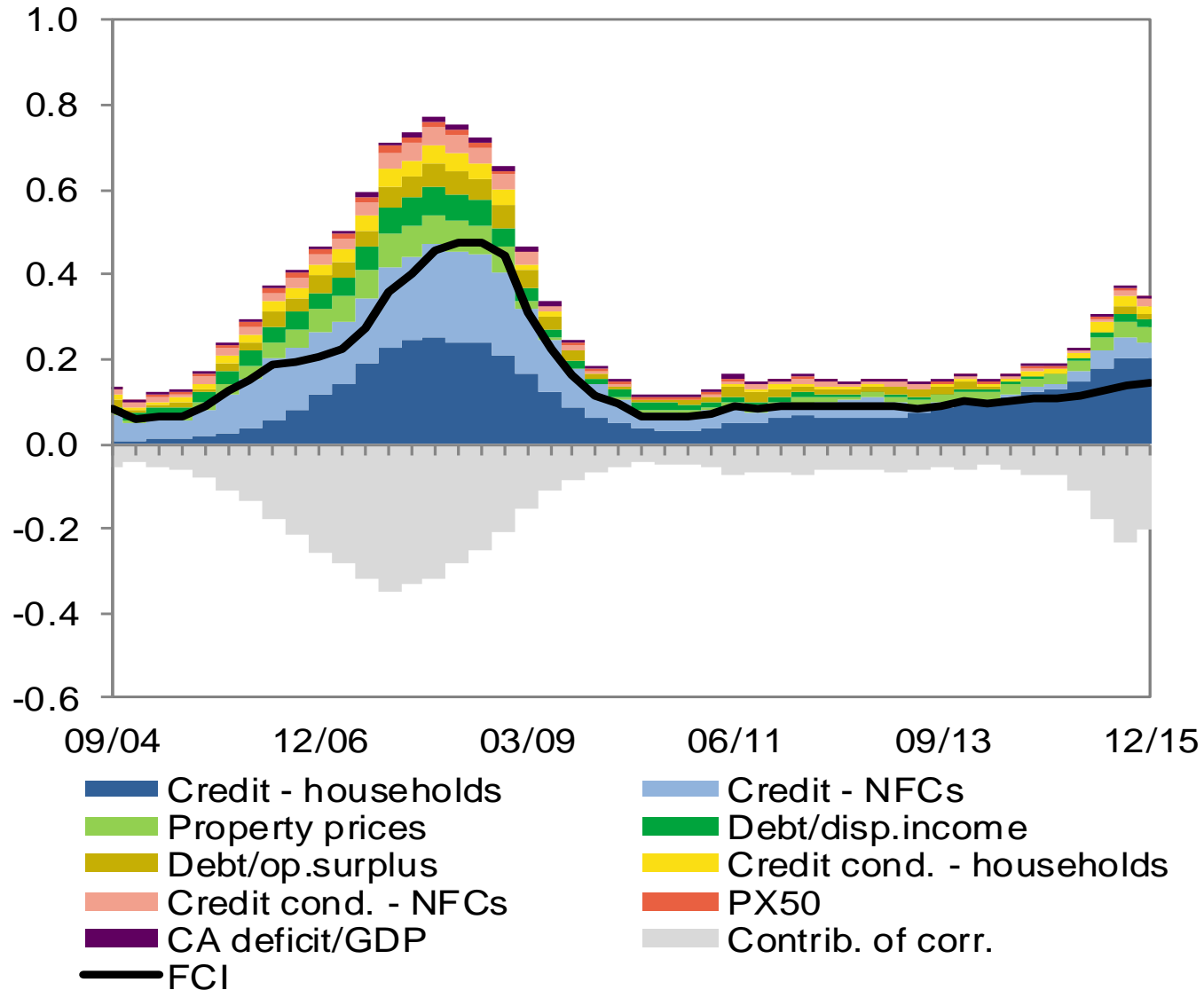


Recession

(nr. of indicators below 15th quantile)



The FCI and its decomposition (0 minimum, 1 maximum)



FCI subindicators: year-on-year changes



Modelling financial cycle with dynamic factor models

- Link between credit migration and economic cycle well documented
 - credit risk management and structural models of credit risk (Koopman et al. 2005, Figlewski et al. 2011, Fei et al. 2012)
 - studies with focus on macroprudential policy (Marcussi and Quagliariello 2009)
- The relationship between credit migration and financial/credit cycle less clear
 - Koopman et al. (2008) and Koopman et al. (2009) use dynamic factor models and interpret factors as „credit cycle“
 - similarly, Bruche and Aguado (2003) use the same interpretation in their unobserved Markov chain model of default rate and LGD

- We employ a dynamic hierarchical factor model by Moench et al. 2013
 - Allows for a unified treatment of factor dynamics at a global and rating-specific level

$$z_{ij,t} - \bar{z}_{ij} = \alpha_{ij} G_{i,t} + \varepsilon_{ij,t},$$

$$G_{i,t} = \beta_i F_t + \varepsilon_{G_{i,t}},$$

$$F_t = \gamma_F F_{t-1} + \varepsilon_{F_t}$$

$$\varepsilon_{F_t} = \gamma_{e_F} \varepsilon_{F_{t-1}} + \epsilon_{e_{F_t}}, \quad \epsilon_{e_{F_t}} \sim N(0, \delta_{e_F}^2)$$

$$\varepsilon_{G_{i,t}} = \gamma_{e_{G_i}} \varepsilon_{G_{i,t-1}} + \epsilon_{e_{G_{i,t}}}, \quad \epsilon_{e_{G_{i,t}}} \sim N(0, \delta_{e_{G_i}}^2) \quad i = 1, \dots, 5$$

$$\varepsilon_{ij,t} = \gamma_{e_{ij}} \varepsilon_{ij,t-1} + \epsilon_{e_{ij,t}}, \quad \epsilon_{e_{ij,t}} \sim N(0, \delta_{e_{ij}}^2) \quad j = 1, \dots, 4$$

- Estimated via Markov Chain Monte Carlo methods (MCMC) and the generalized Carter and Kohn (1994) algorithm

- Model is estimated on a transformed migration matrix of corporate loans (Credit Bureau Data)
- Ratings correspond to the official credit risk categorization of loans by CNB
- Data span 2002m1-2014m3 at monthly frequency

- The average transition rates over 2002m1-2014m3

	Standard	Watch	Substandard	Doubtful	Loss
Standard	0.993	0.005	0.001	0.000	0.000
Watch	0.061	0.907	0.022	0.002	0.001
Substandard	0.019	0.025	0.911	0.031	0.007
Doubtful	0.009	0.005	0.024	0.893	0.062
Loss	0.001	0.000	0.001	0.001	0.997

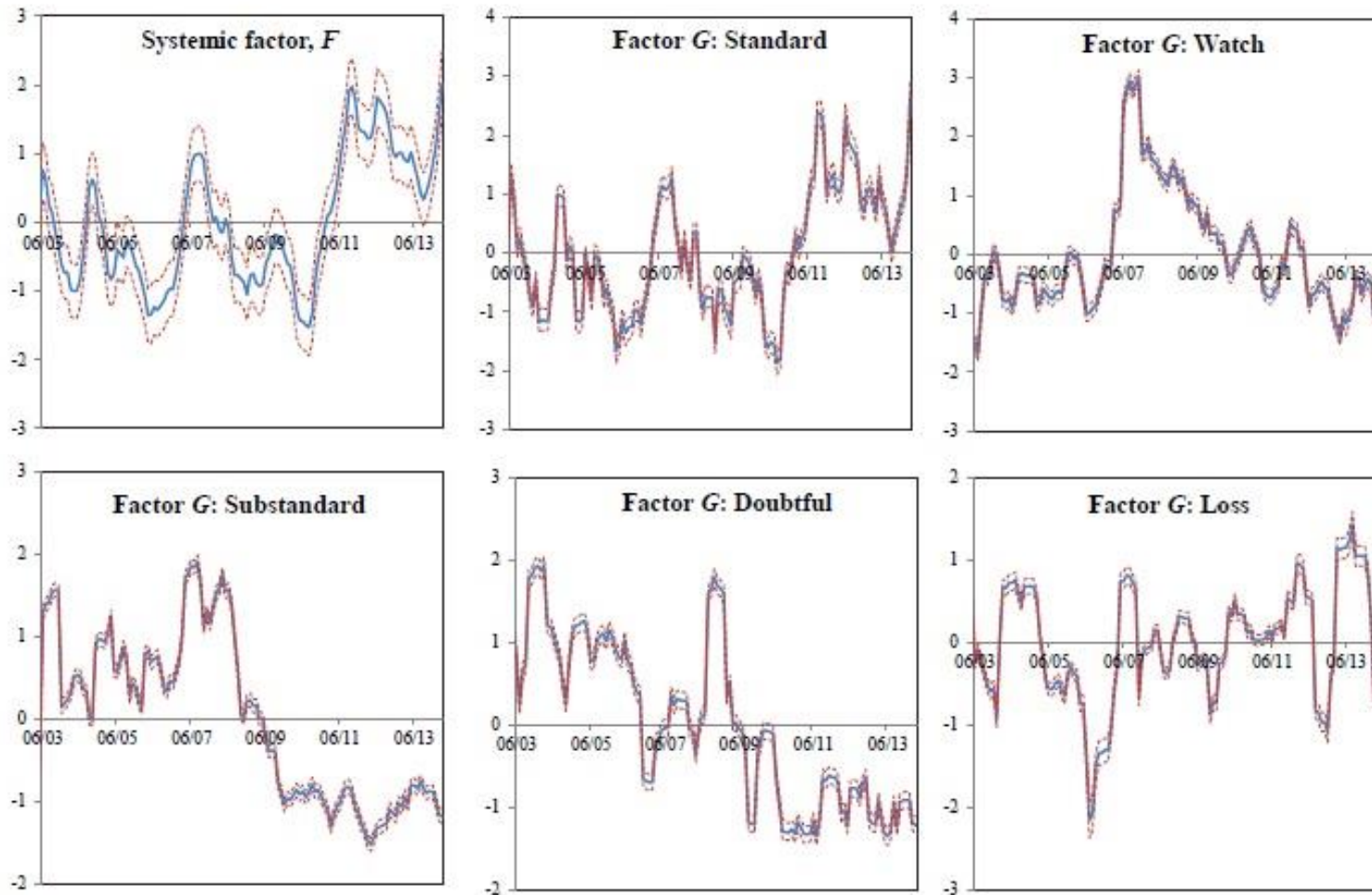
- Rates transformed as in a single-factor model by Wei (2003)

$$z_{ij,t} = \Phi^{-1}\left(\sum_{k=1}^j p_{ik,t}\right).$$

- The resulting transformed migration matrix

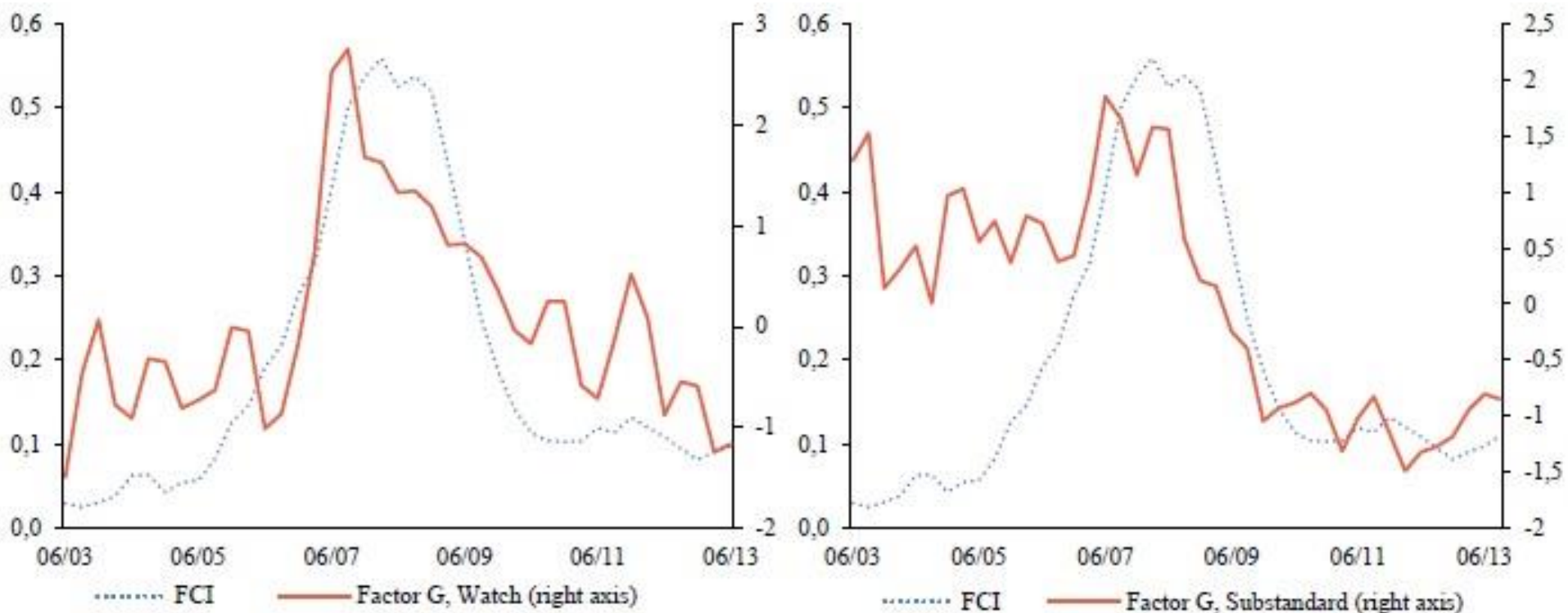
$$\begin{pmatrix} z_{1,2,t} - \bar{z}_{1,2} & z_{1,3,t} - \bar{z}_{1,3} & \cdots & z_{1,5,t} - \bar{z}_{1,5} \\ \vdots & \ddots & & \vdots \\ \vdots & & \ddots & \vdots \\ z_{5,2,t} - \bar{z}_{5,2} & z_{5,3,t} - \bar{z}_{5,3} & \cdots & z_{5,5,t} - \bar{z}_{5,5} \end{pmatrix}$$

- Estimated systemic and rating-specific factors



Note: Red dashed lines: 5th and 95th quantile, blue line: mean

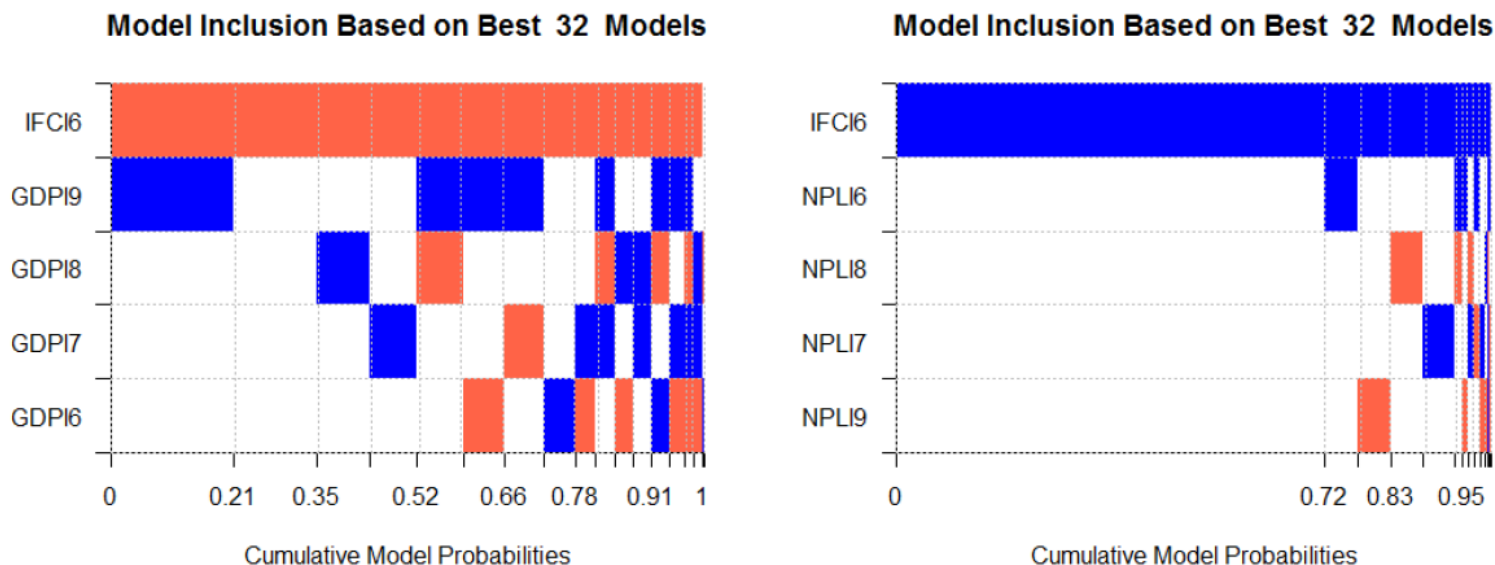
- Factor for Watch and Substandard loans vs. FCI



- Mock up exercise to explore some properties of the financial cycle measure (what the measure can say about the future developments of a target variable on the top of its own history)

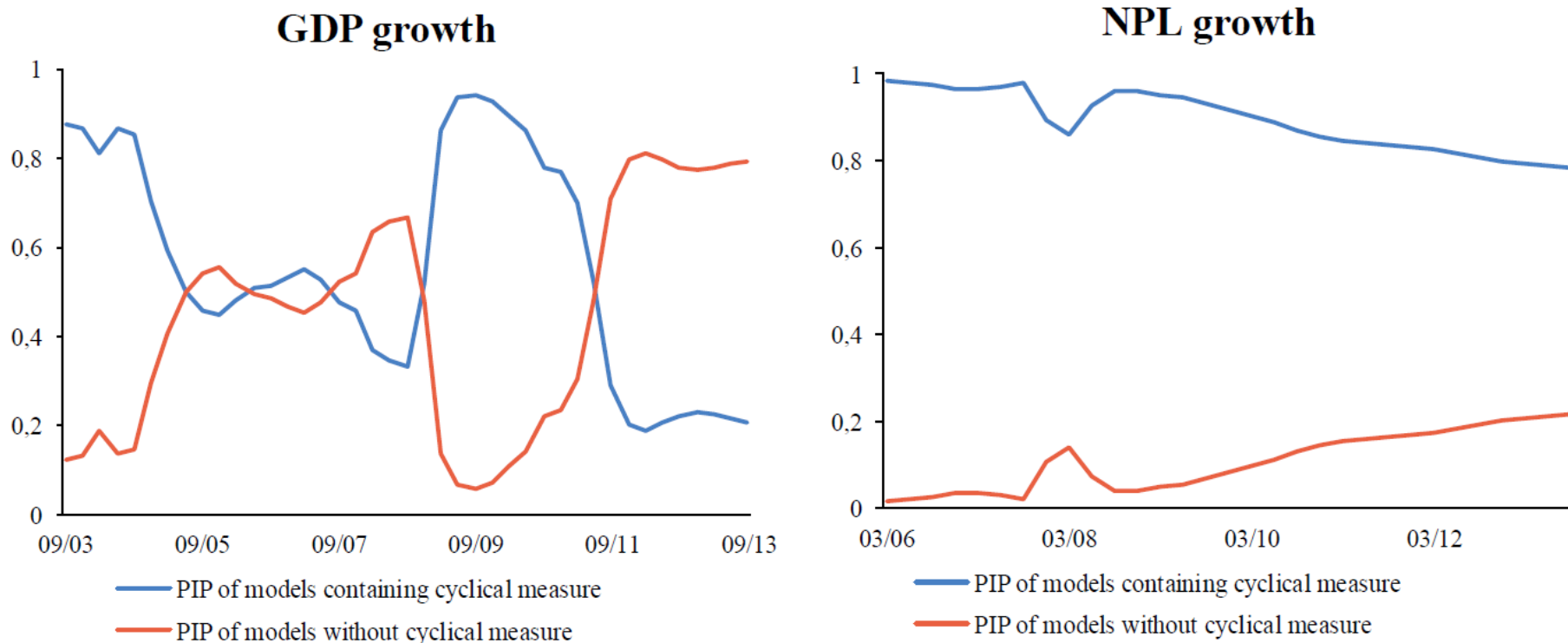
$$q_{t+h} = \beta c_t + \delta X_t + \varepsilon_t,$$

Figure 7: Cumulative posterior model probabilities for NPL and GDP growth



- Same exercise within the time-varying framework...

Figure 8: Time-varying posterior inclusion probabilities for the FCI



- Assessment of the current position in the financial cycle has become important in the context of macroprudential policy
- In general, our measures proved to be a useful tool with promising signaling properties of the future events (in particular credit risk materialization related to excessive credit growth).
 - Our measures are closer to economic intuition than the traditional credit-to-GDP gap measure
- Our analysis seems to confirm earlier literature claiming that there is a non-linear relationship between real economy and developments in financial sector (relationship seems to strengthen around the tipping point of the cycle).

Q & A Session

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