

# Learning about Banks' Net Worth and the Slow Recovery after the Financial Crisis

Josef Hollmayr

(Deutsche Bundesbank)

and

Michael Kühl

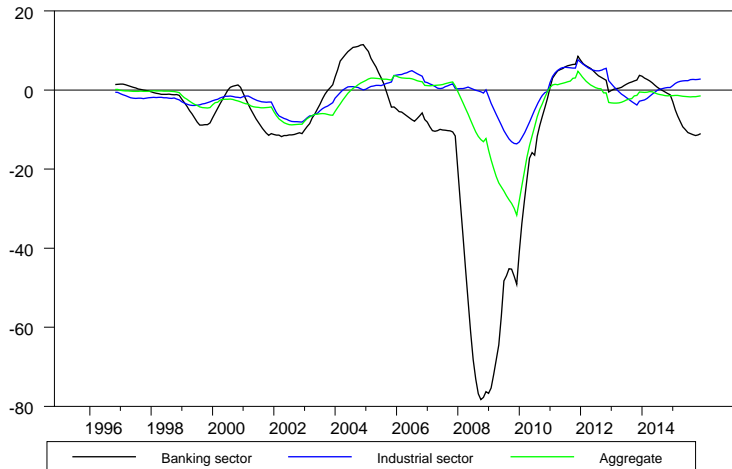
(Deutsche Bundesbank)

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# Motivation

- ▶ Expectation errors regarding the profit situation in different sectors (expected profits proxied by expectations about earnings per share)



# What is the paper about?

- How is information processing regarding the banking sector in the USA before/during/after the financial crisis?
- Are there consequences of information processing in the banking sector on the real economy?
- ↳ more specifically: what role for the slow recovery?

# What is the paper about?

- How is information processing regarding the banking sector in the USA before/during/after the financial crisis?
- Are there consequences of information processing in the banking sector on the real economy?
- ↪ more specifically: what role for the slow recovery?

## 1. Examine information processing wrt. the US financial sector

- ▶ Investigation of expectation formation.
- ▶ Test for two types of information rigidities (known from expectations about inflation).
- ▶ Showing degree of information rigidities over time.

## 2. Relate this to the economic performance after the crisis (and offer an explanation for the slow recovery)

# Main results

- ▶ Expectations about banks' profits are heavily biased during the financial crisis.
- ▶ Information processing is not stable over time.
- ▶ Information rigidities relevant: but noisy information (since the crisis).
- ▶ Market participants seem to exhibit a learning behavior about banks' profits.
- ▶ Incorporating this kind of learning into a macro-finance model yields...
- ▶ ... substantial differences between full information rational expectations and learning.
- ▶ ... which results for example in a slower recovery.

# Data

We measure/proxy a change in net worth of banks by earnings per share (EPS).

Data:

- ▶ Earning reports from professional analysts forecasts (I/B/E/S).
- ▶ Expected EPS originate from survey on banks in *S&P* 500.
- ▶ Using aggregated data for sectors.
- ▶ Monthly Data 1995M1 - 2015M12.

# (Un)biasedness of expectations

**Question:** Are expectations biased during the crisis?

1. Expectations are unbiased if there is a systematic one-to-one relationship between the expected value in n-periods and the realizations of the n-th period

$$EPS_t^h = \alpha + \beta E_{t-n} (EPS_t^h) + \epsilon_t,$$

2. Unbiasedness requires the restriction  $\alpha = 0$  and  $\beta = 1$  to hold.

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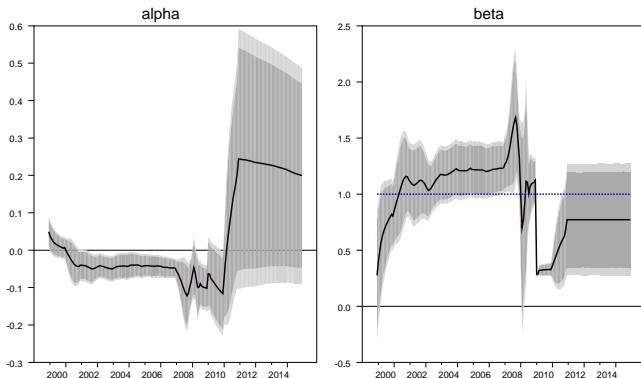
2. Unbiasedness requires the restriction  $\alpha = 0$  and  $\beta = 1$  to hold.



# (Un)biasedness over Time? Recursive OLS

We estimate recursively by adding one additional observation:

$$\frac{EPS_t^h - EPS_{t-n}^h}{EPS_{t-n}^h} = \alpha + \beta \frac{E_{t-n}(EPS_t^h) - EPS_{t-n}^h}{EPS_{t-n}^h} + \epsilon_t^*$$

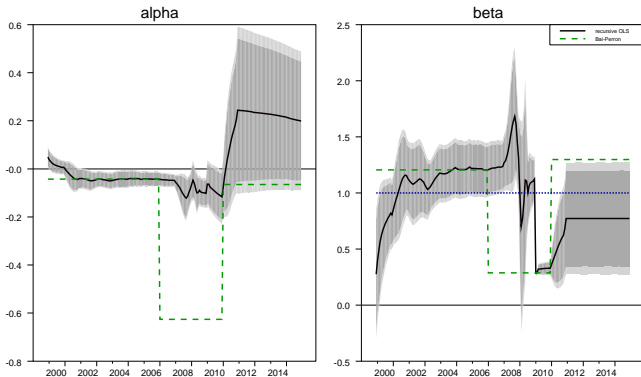


▶ Table

# (Un)biasedness over Time? Bai-Perron structural breaks

We allow for  $m$  (endogenous) breaks and run the regression (Bai-Perron):

$$\frac{EPS_t^h - EPS_{t-n}^h}{EPS_{t-n}^h} = \sum_{i=1}^m \left[ \alpha_i + \beta_i \frac{E_{t-n} (EPS_t^h) - EPS_{t-n}^h}{EPS_{t-n}^h} \right] I_i + \epsilon_t^*$$

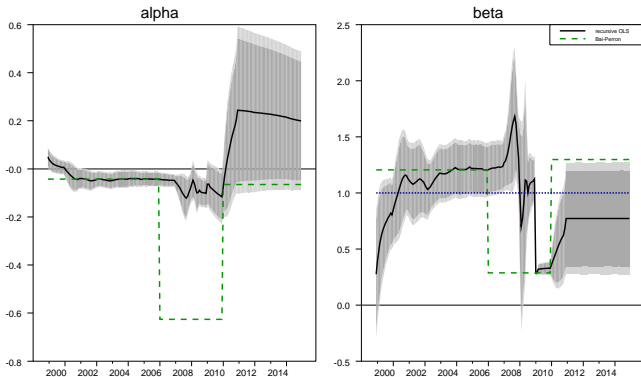


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**Conclusion:** Expectations about bank profits heavily biased during the crisis!

# Information rigidities?

**Question:** Are there information rigidities at work?

1. Show whether expectation error ( $exp.err_t = EPS_t^{12M} - E_{t-12}(EPS_t^{12M})$ ) reacts on structural shocks  $shock_{t-i}^k$

- ▶ Estimate for every shock  $k$

$$exp.err_t = c + \sum_{i=0}^p \delta_i shock_{t-i}^k + \sum_{j=1}^q \zeta_j exp.err_{t-j} + e_t \quad (1)$$

and

- ▶ look whether expectation error reacts systematically on past realisation of shocks starting from  $t - 13$  because from  $t - 1$  to  $t - 12$  simply “news”.

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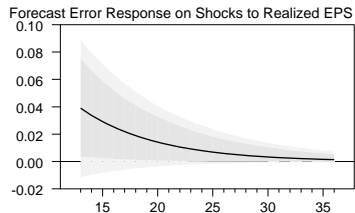
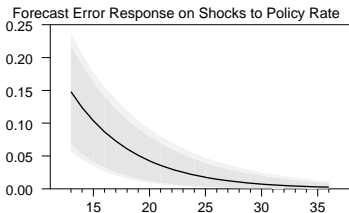
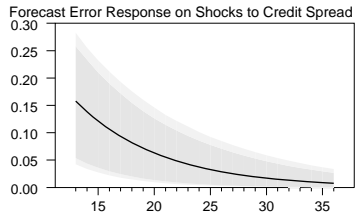
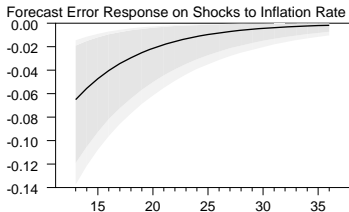
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- ▶ look whether expectation error reacts systematically on past realisation of shocks starting from  $t - 13$  because from  $t - 1$  to  $t - 12$  simply “news”.
2. Take structural shocks:
    - ▶ we estimate a VAR with industrial production, inflation, fed funds rate, unempl. rate, bank share prices, share prices, credit spread, realized EPS.
    - ▶ construct structural shocks with Choleski decomposition (but do not put too much emphasize on interpretation of shocks)

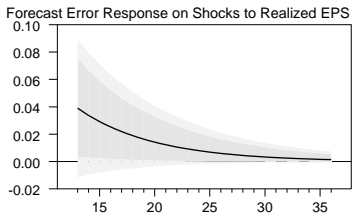
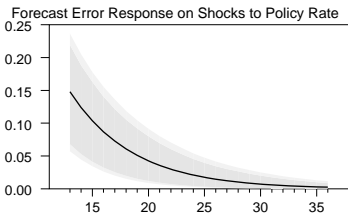
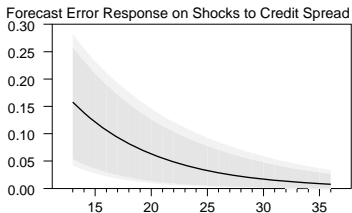
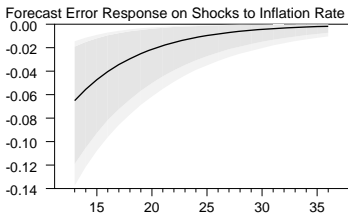
following Coibion/Gorodnichenko (*JPE* 2012)

# Information rigidities?



▶ Pre Crisis

# Information rigidities?



▶ Pre Crisis

**Conclusion:** Evidence in favor of information rigidities.

# Forms of information rigidities

1. Sticky Information models (eg Mankiw/Reis, *QJE* 2002)
  - ▶ Not all agents have the same information set because agents can only adjust their information sets occasionally.
  - ▶ Agents update their information sets infrequently.
  - ▶ Only a part of agents updates information at a given time.
2. Noisy Information models (eg Sims, *JME* 2003; Woodford, 2003; Mackowiak/Wiederholt, *AER* 2009).
  - ▶ Agents cannot discover the actual information set because they are only able to observe/use a subset.
  - ▶ All agents update constantly but observe only noisy signals about the true state.



# Sticky or noisy Information?

**Question:** What type of information rigidity prevails in the economy?

1. Take the structural shocks from before and
2. Test whether forecast dispersion among analysts (measured as standard deviation of the survey  $\sigma_t^{E_t(EPSt+12M)}$ ) reacts systematically on shocks.

$$\sigma_t^{E_t(EPSt+12M)} = c^\sigma + \sum_{i=0}^p \delta_i^\sigma |shock_{t-i}^k| + \sum_{i=j}^q \varsigma_i^\sigma \sigma_{t-j}^{E_t(EPSt+12M)} + e_t^\sigma$$

3. Results:  $\delta_i^\sigma$  are insignificant, i.e. dispersion does not react on news!

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3. Results:  $\delta_i^\sigma$  are insignificant, i.e. dispersion does not react on news!

**Conclusion:** Standard deviation of survey forecasters not driven by fundamental shocks, i.e. indicating noisy information.

# Is there learning about bank equity related variables?

**Question:** Are bank equity related variables exposed to learning schemes?

- ▶ Kalman Filter

$$E_t EPS_t = E_{t-1} EPS_t + K_t (EPS_t - E_{t-1} EPS_t)$$

or

$$(EPS_{t+h} - E_t EPS_{t+h}) = \frac{1 - K_t}{K_t} (E_t EPS_{t+h} - E_{t-1} EPS_{t+h}) + error_{t+h,t}$$

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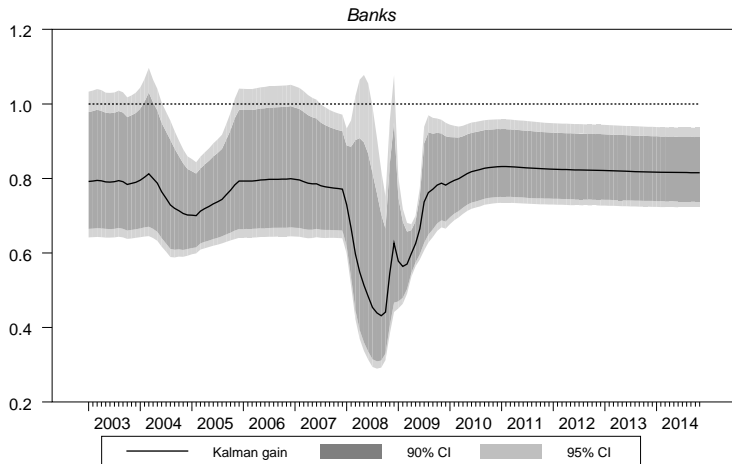
⇒ We estimate

$$(EPS_{t+h} - E_t EPS_{t+h}) = \beta_t (E_t EPS_{t+h} - E_{t-1} EPS_{t+h}) + error_{t+h,t},$$

whereas  $K_t = 1/(1 + \beta_t)$ .

following Coibion/Gorodnichenko (*AER* 2015)

# TVP Kalman gain



▶ Industrials

▶ TVP comp



# Model

**Question:** What are the macroeconomic consequences of imperfect information about bank equity?

## 1. Workhorse NK-Model with banking sector: Gertler/Karadi (JME 2011)

### ▶ Real side:

Standard assumptions on the real side of the economy (households, sticky price firms, capital producers).

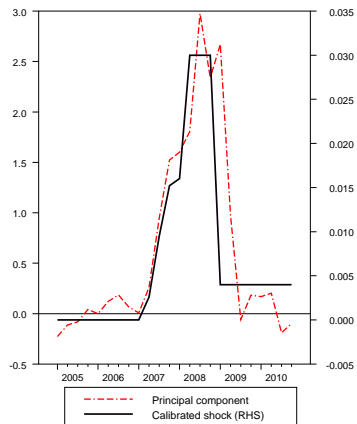
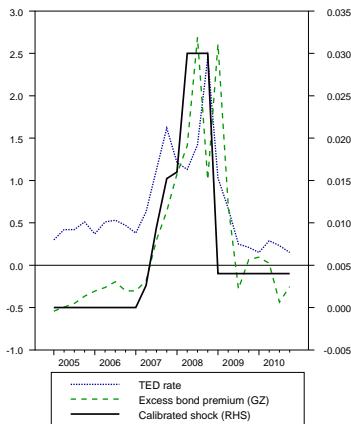
### ▶ Financial side: ▶ Model

Bankers optimize the franchise value of the bank subject to a *incentive-compatible constraint*

## 2. Simulation design:

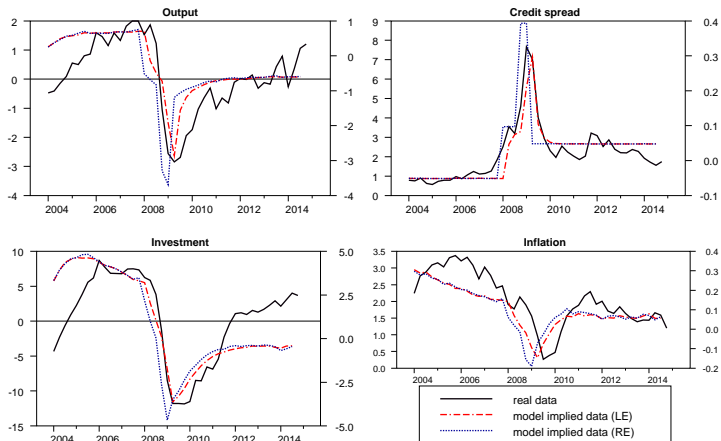
- ▶ We introduce an exogenous process that captures innovations on equity with non-zero mean.
- ▶ Anticipated utility and Kalman filter learning calibrated on the basis of estimation before.
- ▶ We assume that agents are only uncertain about the steady state value of net worth inefficiency from the beginning of the crisis.
- ▶ Randomly drawing for TFP shock, MP shock, capital quality shock, equity shock given steady state process.
- ▶ 500 simulations for the last 12 years.

# Crisis scenario





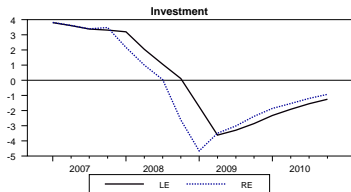
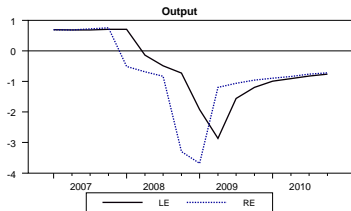
# Trying to match the data



## Observations:

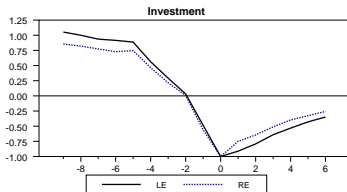
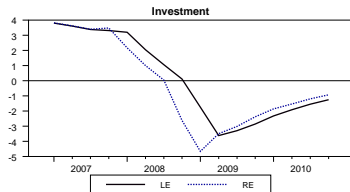
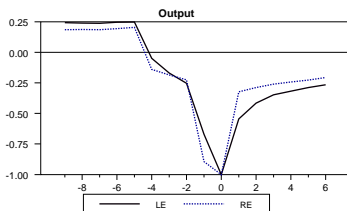
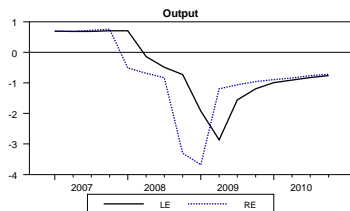
- ▶ FIRE: faster downturn and deeper recession.
- ▶ LE: Slower downturn and slightly slower recovery.

# Slow recovery



comparison in absolute terms

# Slow recovery



comparison in absolute terms

comparison relative to trough

**Conclusion:** Learning produces slower recovery after trough!

# Conclusion

We have shown that:

1. Expectations about banks' profits were biased particularly during the financial crisis
2. Evidence in favor of information rigidities wrt the evaluation of banks' profit situation since the crisis.
3. Evidence in favor of a learning scheme about banks' profits during the crisis.
4. Calibrated learning mechanism embedded into a DNK banking model produces asymmetries during the recovery, i.e. slower recovery.

Thanks for your attention!