Banks' financial conditions and the transmission of monetary policy: a FAVAR approach[1]

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IJCB Spring Conference - Madrid - June 2010

[1] Opinions expressed are those of the authors only and do not necessarily reflect the views of the Banque de France.

The 2007-2009 financial crisis and the return of the credit channel

- "Credit view" of monetary policy transmission, as opposed to "expectations channel", back to the forefront, as in previous episodes of bank capital depletion and associated credit crunch (e.g. US 1991, Japan 1998-2000).
- In bad times, consensus that weak bank financial conditions impede the ability of monetary policy cuts to effectively limit the extent of credit and overall activity contraction.
- In normal times, the empirical relevance of the bank lending channel is still debated.

Motivation

- Empirical research on the bank lending channel so far has followed two types of strategies, both relatively inconclusive:

1. Microeconometric studies on bank balance sheet data (e.g. Kashyap and Stein, 1995, 2000). But difficult to infer anything about the macro consequences of identified bank level frictions (Ashcraft, 2006)

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2. Monetary VARs using agregate credit series (e.g. Bernanke and Blinder, 1992). But IRF of total credit to monetary shocks are often muted and non-significant.
   Possible compensation effects between components in bank loan portfolio (Den Haan et al., 2007), ... but limitations to the inclusion of a large number of more detailed credit series due to dimensionality issue in VAR.

This paper

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- Note that testing the importance of banks' financial conditions should be more relevant in a country with a (still) largely bank-based financial system like France.

This paper

- A FAVAR model of the French economy, along the lines of Bernanke, Boivin & Eliasz (BBE, 2005)
  - Better account of large set of information available to monetary policy-makers
  - Small VAR, but allows the computation of IRF for a large number of macro series
- Parallel to the *macro* factors, we extract a few bank-level or *micro* factors summarizing the dynamics of a panel of individual bank balance sheet ratios
- Combining *micro* and *macro* fators within a FAVAR models allows us to quantify whether the specific feedback of banks'financial conditions alters the transmission of monetary policy to key macro variables.

Related literature

- FAVAR studies: Gilchrist, Yankov & Zakrajsek (2009), Boivin, Gianonni & Stevanovic (2009): but focus on credit shocks and no use of bank-level information. Dave, Dressler & Zhang (2009): use disaggregated US bank data, but focus on differentiated response of various types of loans (as in Den Haan et al., 2007).

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- Financial institutions' health and macro: Adrian & Shin (2009): procyclical leverage of US investment banks; Peek, Rosengreen & Tootell (1999, 2003): bank health variable (share of assets under CAMEL 5 ratings) predicts activity, and matters for the FOMC's decisions on target rate .

Main results

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- Bank leverage and liquidity factors predict macroeconomic fluctuations. A potential scope for macro-prudential policy?
- But feedback from banks' financial condition does not alter significantly the transmission of monetary shocks to the French economy (above the information already contained in macro aggregates, including credit volumes and rates). Bad news for credit channel?

Description of the FAVAR: measurement equations

- Cf. methodology in Boivin and Gianonni (2007) on "Global forces and monetary policy effectiveness".
- Let X_t be a large vector of macroeconomic indicators, X_t^* a large vector of individual bank financial ratios (e.g. individual leverage).
- We assume that X_t (X_t^*) can be summarized by a small vector of factors C_t (C_t^*), such that:

$$X_t = \Lambda C_t + e_t \tag{1}$$

$$X_t^* = \Lambda^* C_t^* + e_t^* \tag{2}$$

where e_t and e_t^* are (mean-zero) series-specific components that may be serially correlated and (weakly) correlated across indicators within each block.

Description of the FAVAR: transition equation

- Dynamics are modeled as a structural VAR in the factors $\begin{bmatrix} C_t^* \\ C_t \end{bmatrix}$.
- We estimate this FAVAR in its reduced-form representation:

$$\begin{bmatrix} C_t^* \\ C_t \end{bmatrix} = \begin{bmatrix} \Psi_{11}(L) & \Psi_{12}(L) \\ \Psi_{21}(L) & \Psi_{22}(L) \end{bmatrix} \begin{bmatrix} C_{t-1}^* \\ C_{t-1} \end{bmatrix} + \begin{bmatrix} u_t^* \\ u_t \end{bmatrix} \quad (3)$$

where innovations u_t and u_t^* may be cross-correlated.

Extraction of the factors

- Macro factors C_t and micro factors C_t^* are extracted *separately* from X_t and X_t^* by PCA.
- We need the policy variable R_t (3-month money market rate) to appear among the macro factors:

$$C_t = \begin{bmatrix} F_t \\ R_t \end{bmatrix}$$

- To impose this constraint on C_t, we implement Boivin and Gianonni's (2007) iterative procedure and extract macro factors that are othogonal to R_t.

Extraction of the macro factors

- Starting from an initial estimate $F_t^{(0)}$ of F_t obtained as the first $K-1$ principal components of X_t, let us:

1. Regress X_t on $F_t^{(0)}$ and R_t, to obtain $\hat{\lambda}_R^{(0)}$.
2. Compute $\tilde{X}_t^{(0)} = X_t - \hat{\lambda}_R^{(0)} R_t$.
3. Estimate $F_t^{(1)}$ as the first $K-1$ principal components of $\tilde{X}_t^{(0)}$.
4. Back to 1.

Specification and estimation of the VAR

- Severe limitation due to small sample (64 quaterly observations)
- Choice of the number of factors based on statistical PCP2 and IC2 criteria (Bai & Ng, 2002), as well as empirical criteria (impact of additional factors on IRFs, as in BBE, 2005; Boivin and Gianonni, 2007; Boivin, Mojon & Gianonni, 2008)
- Lag selection appropriate according to the Schwarz information criterium.
- Preferred specification of the VAR in (3) includes 2 micro and 4 macro common components, with one lag.

Macro data

- A set of 60 French and 8 German macroeconomic quarterly variables over the period 1993:1 to 2009:1.
- Relatively short period of time, but strong presumption of a single monetary policy regime.
- French series cover: GDP and its components, prices, market and bank interest rates, credit aggregates, stock and housing prices...
- Inclusion of key German series motivated by French monetary policy being closely tied to Bundesbank rate decisions between 1993 and 1999. Cf. potential issue with break due to the introduction of the euro in 1999.

Bank-level data

- Initial database: bank balance sheets for all credit institutions operating in France (620 at sample end).
- Selection issue:
  - keeping enough banks to catch effects of dispersion in banks' conditions
  - discarding enough atypical small banks so that a few factors reflect macroeconomically meaningful information
- Selection of "banks", excluding specialized financial institutions, municipal credit banks, regional development institutions, banks operating in French overseas territories and Monaco, branches of foreign institutions, local savings banks of CNCE network, regional branches of mutual bank networks (double counting with national holding entity): leaves *105 banks present in 2009*.

Bank-level data (2)

- We then drop 21 very small banks as in first quartile of assets distribution (mean assets below EUR 400 mns).
- Balanced panel required for PCA: we keep only banks present over the whole period (no backward reconstruction of M&A): leaves 60 banks.
- Statistical breaks in financial ratios of interest: statistical correction of outliers on growth rates and reconstruction of corrected ratio series in levels (about 2% observations corrected). Deletion of 8 banks with more than 20% of outliers.
- Final sample of *52 banks* accounting for *70% of total domestic bank credit* in 2009:1.

Bank-level data: definition of financial ratios

- We are interested in three different ratios: liquidity of assets, total and credit leverage.
- For each type, we construct a separate database and estimate a specific FAVAR.
- Ratios are defined as:
  - LIQ = (cash + interbank assets + transaction securities + repos) / total assets
  - LEV1= total assets / tier 1 capital
  - LEV2 = customer loans / tier 1 capital

Bank-level data: stationarity issue

- (Break-corrected) individual bank ratios not always stationary on the sample period.
- Keeping stochastic trends in bank ratios can lead to inconsistent estimates of bank factors (Bai & Ng, 2005). PANIC approach inappropriate for mix of I(0) and I(1) series.
- We thus take the first difference of integrated ratio series (at the 95% level), leaving other series in levels
- All series (macro and micro) are centered and standardized before factor estimation.

Interpreting the factors

- First three macro factors (excluding R_t) highly correlated with business cycle, long term rates and inflation respectively.
- LIQ F1, LEV1 F2 and LEV2 F1 strongly correlated with business cycle macro factor and short term interest rate.
- Confirms intuition of comouvement between bank balance sheets and business cycle/market interest rates.
- May reflect active ALM policy or passive adjustment to demand for credit.

Analysis of comovements between factors

- We compute the R^2 of regressions of the macro variables in X_t on:

1. the four macro factors (including the short rate)
2. the first two micro factors from a given ratio dataset (e.g. LEV1)

Table: R2 for regressions of selected French macro indicators on various sets of macro and bank ratio factors (sample 1993:2 - 2009:1).

	Macro	LIQ	LEV1	LEV2
All France data Xt	0.56	0.24	0.15	0.17
Selected FR indicators				
Short interest rate	1.00	0.68	0.56	0.69
IPI	0.87	0.83	0.62	0.71
Housing prices	0.62	0.32	0.22	0.33
Total loans	0.56	0.28	0.14	0.16
Housing loans	0.70	0.57	0.43	0.48
Inv. corporate loans	0.60	0.49	0.25	0.33
France 10y yield	0.80	0.70	0.60	0.64
Int. rate C and I loans	0.89	0.71	0.62	0.78
Int. rate invt. loans	0.95	0.82	0.69	0.83
Int. rate housing loans	0.91	0.85	0.75	0.79

Do bank ratio factors predict macro fluctuations?

- Granger-causality tests of the joint significance of bank-level factors of type j within each micro-macro FAVAR. Equivalent to testing whether $\Psi_{21}(L) = 0$ in equation (3) with $L = 1$ here.
  - Does matter for insuring that the $\Psi_{ij}(1)$ coefficients are indeed identified (cf. Reichlin vs Boivin & Gianonni, 2008).
- Tests conducted over whole and pre-crisis sample.

Table: Granger causality tests of joint causality of banl-level factors in alternative FAVARs.

	LIQ	LEV1	LEV2
All sample (1993:2009)			
F1	0.92	0.00	0.00
F2	0.00	0.15	0.08
F3	0.50	0.89	0.86
Interest rate	0.73	0.00	0.00
Before 2007-2009 crisis			
F1	0.02	0.06	0.06
F2	0.00	0.01	0.00
F3	0.21	0.02	0.05
Interest rate	0.21	0.00	0.01

Implications for monetary policy transmission

- Does the endogenous reaction of banks (active AL management) amplify the response of credit and macro variables to unexpected monetary policy shocks? Looking for credit supply effects...
- If yes, a FAVAR ignoring changes in banks' balance sheet structure would be potentially mispecified.
- We investigate this issue comparing IRF obtained from our FAVAR framework under alternative specifications:
  - $\Psi_{21}(L) = 0$ (equivalent to FAVAR limited to macro factors only)
  - $\Psi_{21}(L)$ left unrestricted
- Note: Cholesky identification with interest rate ordered last.

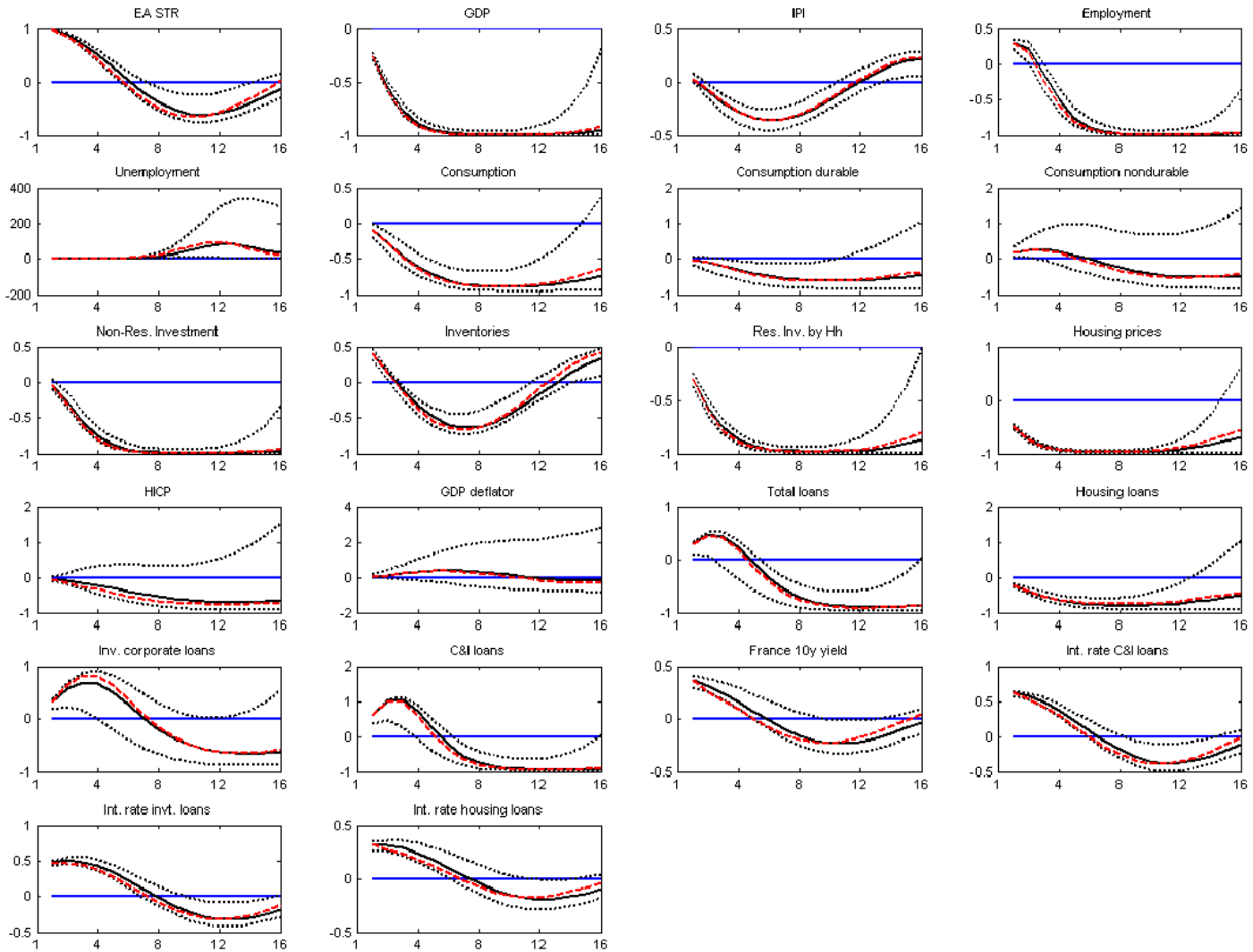
The case against a structural break in 1999

- How to deal with the changeover from the Bank of France to the ECB in 1999?
- Any change in monetary policy regime regarding notably the reaction to French business cycle fluctuations?
- We provide informal and formal evidence against the case of a break in 1999.

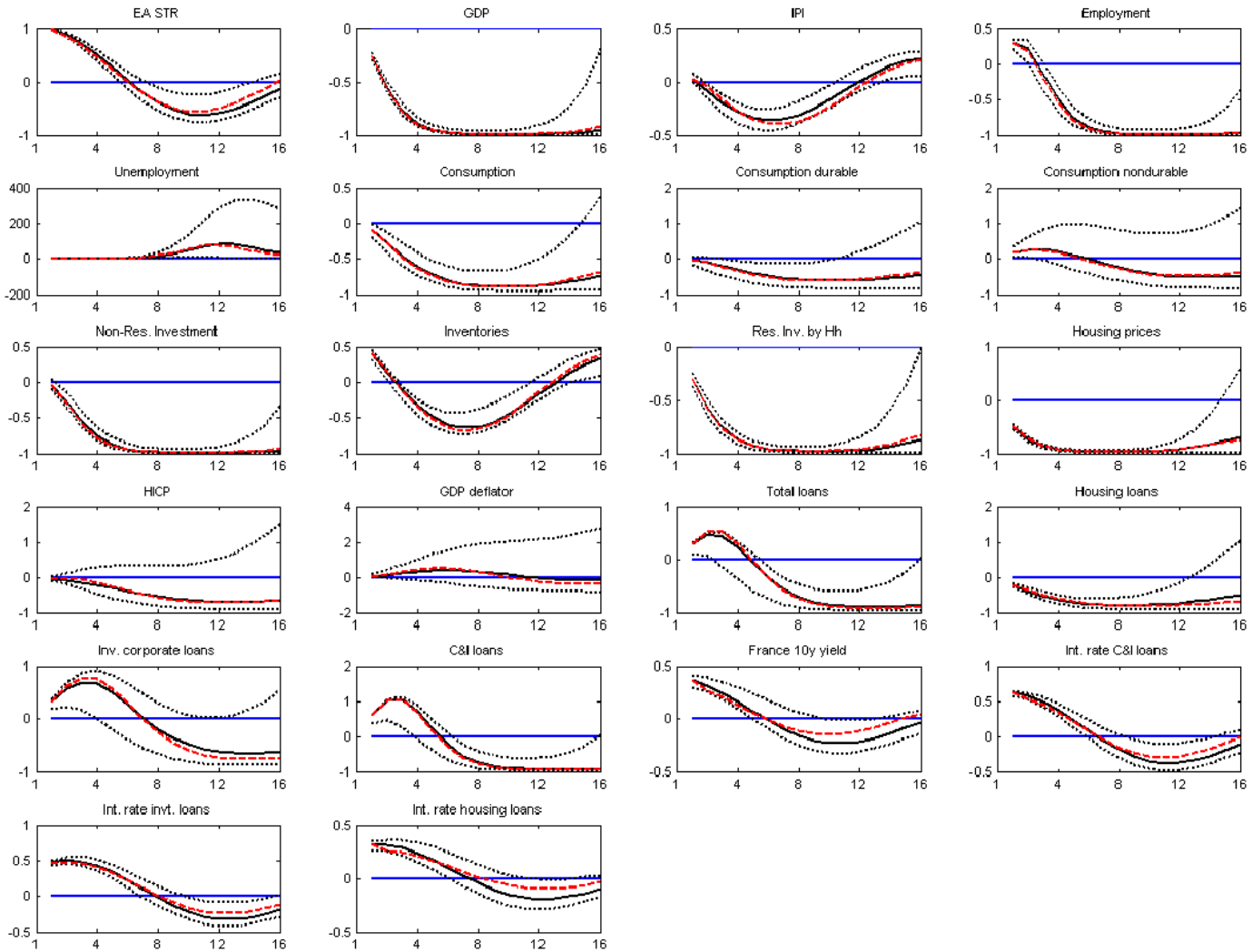
The case against a structural break in 1999

1. From 1993 on, (independent) French monetary policy was closely tied to the German one and so to German economic conditions. To catch this, inclusion of German macro aggregates in our macro dataset.
2. France + Germany = 50% of euro area GDP; French business cycle is highly correlated to the euro area average.
3. Transmission of MP shocks to the French and German economies unaffected by the launch of the euro (Boivin et al., 2008)
4. Formal statistical test of parameter stability (with bootstrapped p-values) does not reject the null of no break in 1999.

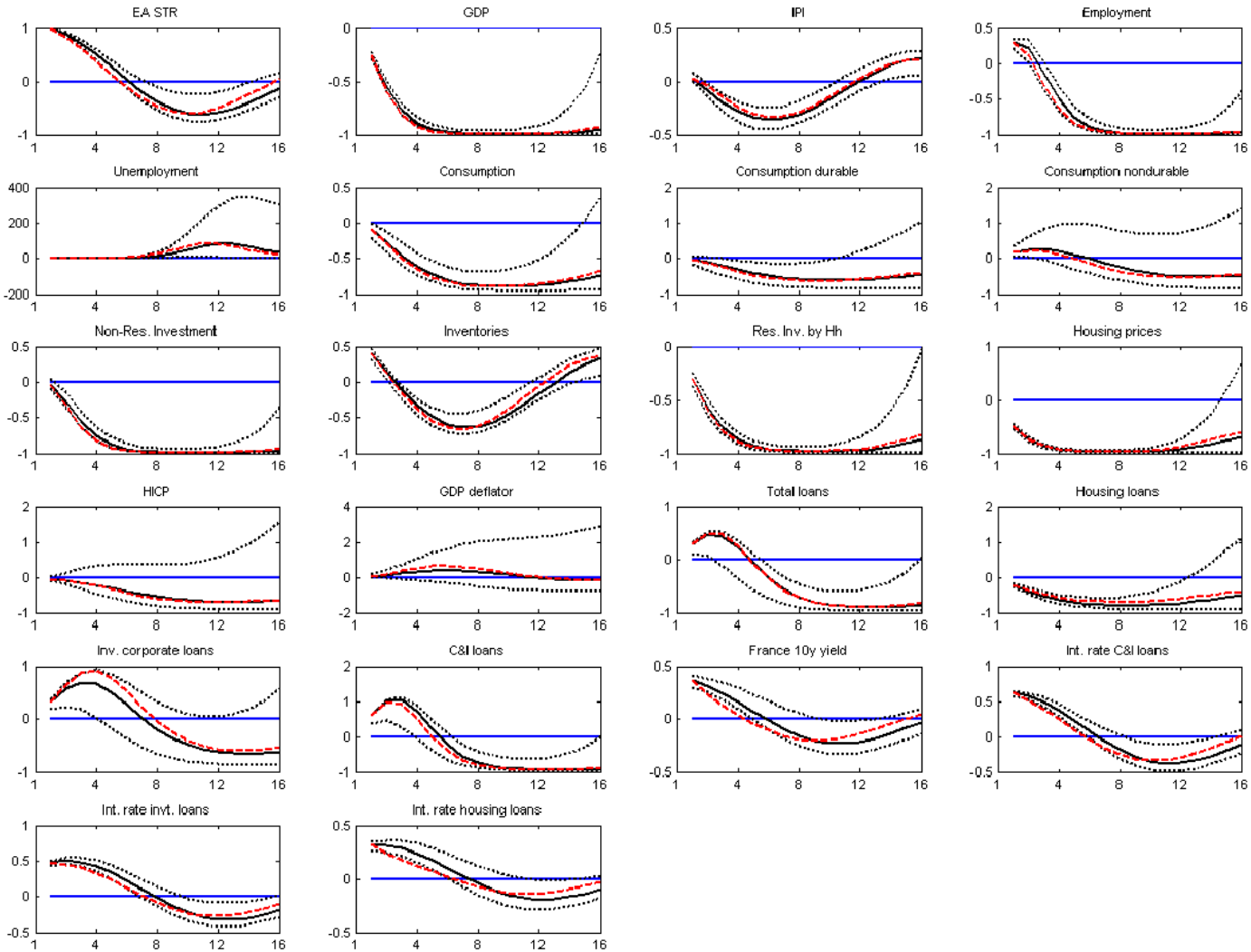
IRF to a monetary shock: macro / macro + LIQ factors



IRF to a monetary shock: macro / macro + LEV1 factors



IRF to a monetary shock: macro / macro + LEV2 factors



Discussion

- Individual IRF for main macro variables have expected shape in the purely macro FAVAR.
- No price puzzle, weak response of consumption, strong response of investment.
- Temporary positive response of C&I loans and inventories.
- IRF not altered significantly when the model is augmented with bank-level factors, be it liquidity of leverage factors.

Discussion (2)

- We do not conclude against the credit channel (as e.g. Ramey, 1993), since credit aggregates contribute here to the macro factors. Besides, we cannot identify fluctuations in bank factors as pure "credit supply" effects.
- We find that banks' financial conditions do not matter much for monetary transmission (in normal times). Aggregate credit, money and interest rate variables are sufficient indicators in this respect.
- The bank lending channel may be active in France (cf. Angeloni et al., 2003), but no evidence in support of a strong channel.

Planned extensions

- Impact of bank factors for the response of the economy to real shocks?
- Response of macro variables to bank-level shocks? (more then in the spirit of Gilchrist et al., 2010, or Lown and Morgan, 2006).

Table: Descriptive statistics (2009Q1).

	Mean	Median	SD	Min	Max
Assets (billions of euros)	99.5	5.4	255	0.3	1390
% of total bank assets	1.3	0.1	3.4	0.0	18.6
Loans (billions of euros)	27.1	1.9	62.9	0.0	334
% of total bank loans	1.4	0.1	3.1	0.0	16.6
Liquidity (LIQ)	0.22	0.29	0.23	0.01	0.99
Broad leverage (LEV1)	20.5	29.1	26.1	1.18	124.7
Narrow leverage (LEV2)	8.0	11.6	11.23	0.18	50.52

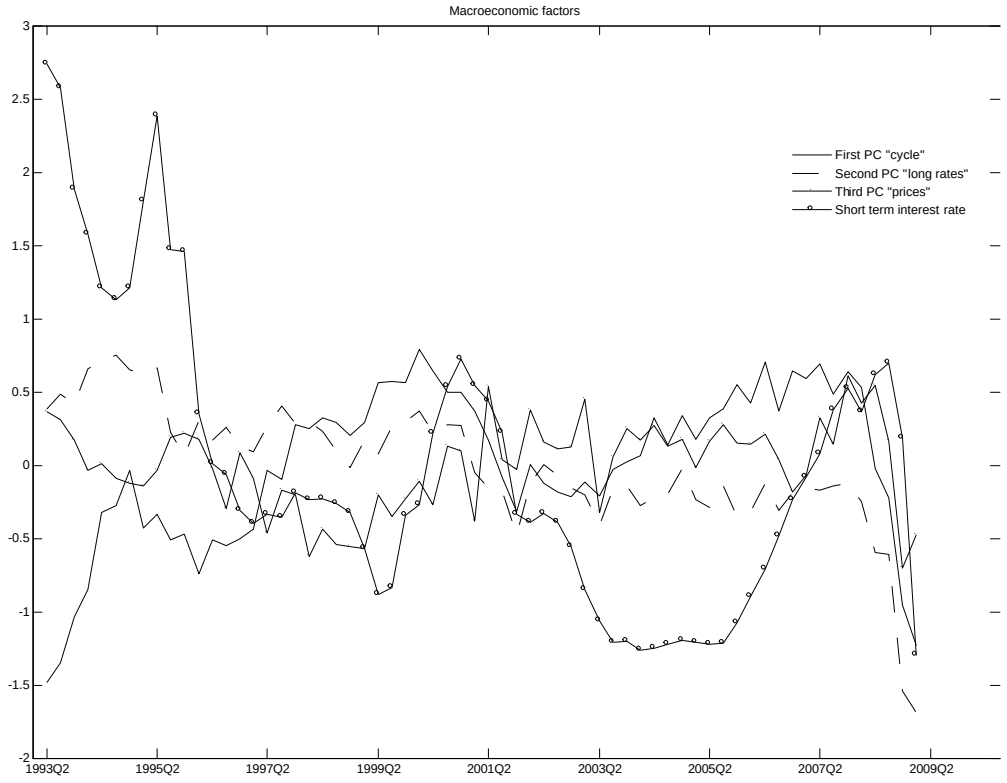


Figure: Macro factors

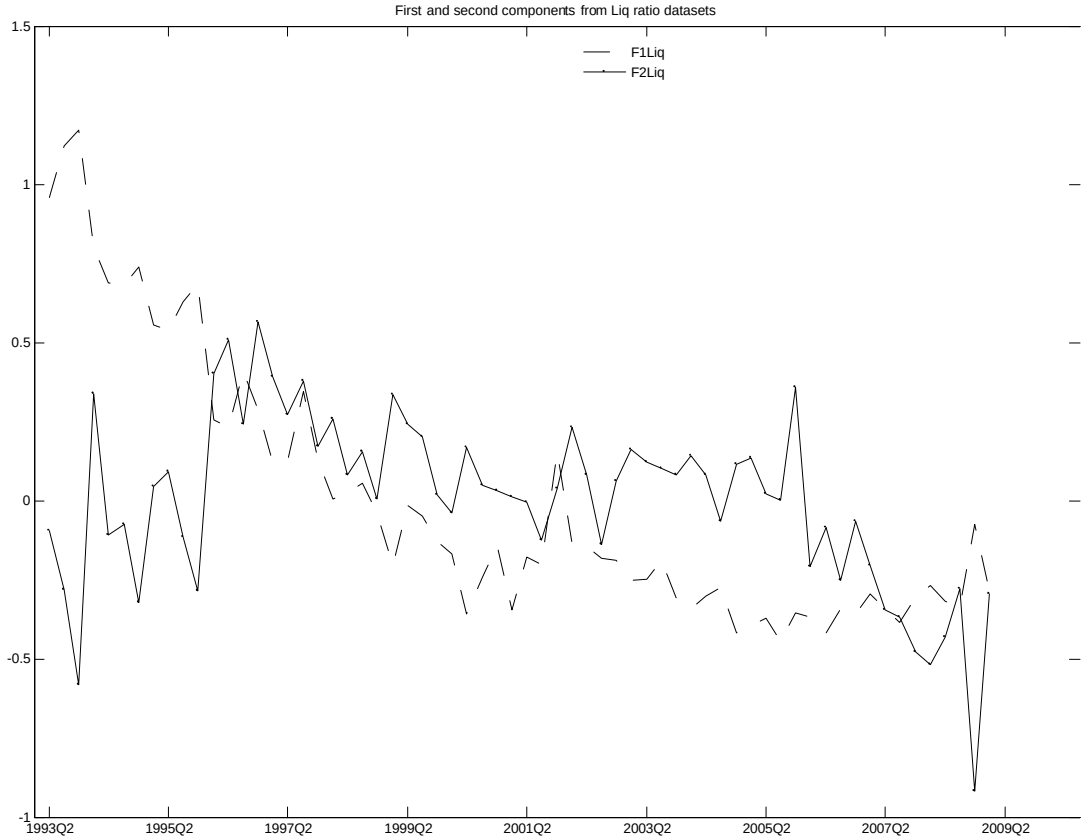


Figure: Bank factors: LIQ

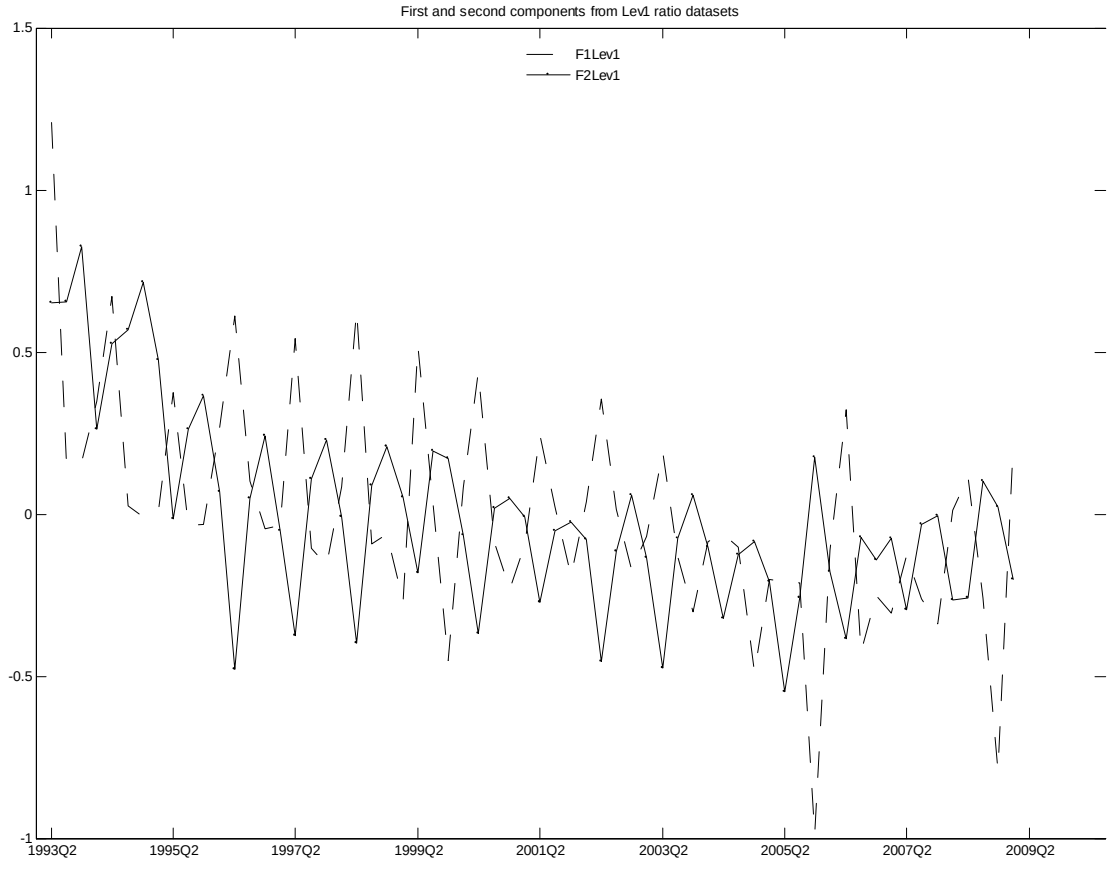


Figure: Bank factors: LEV1

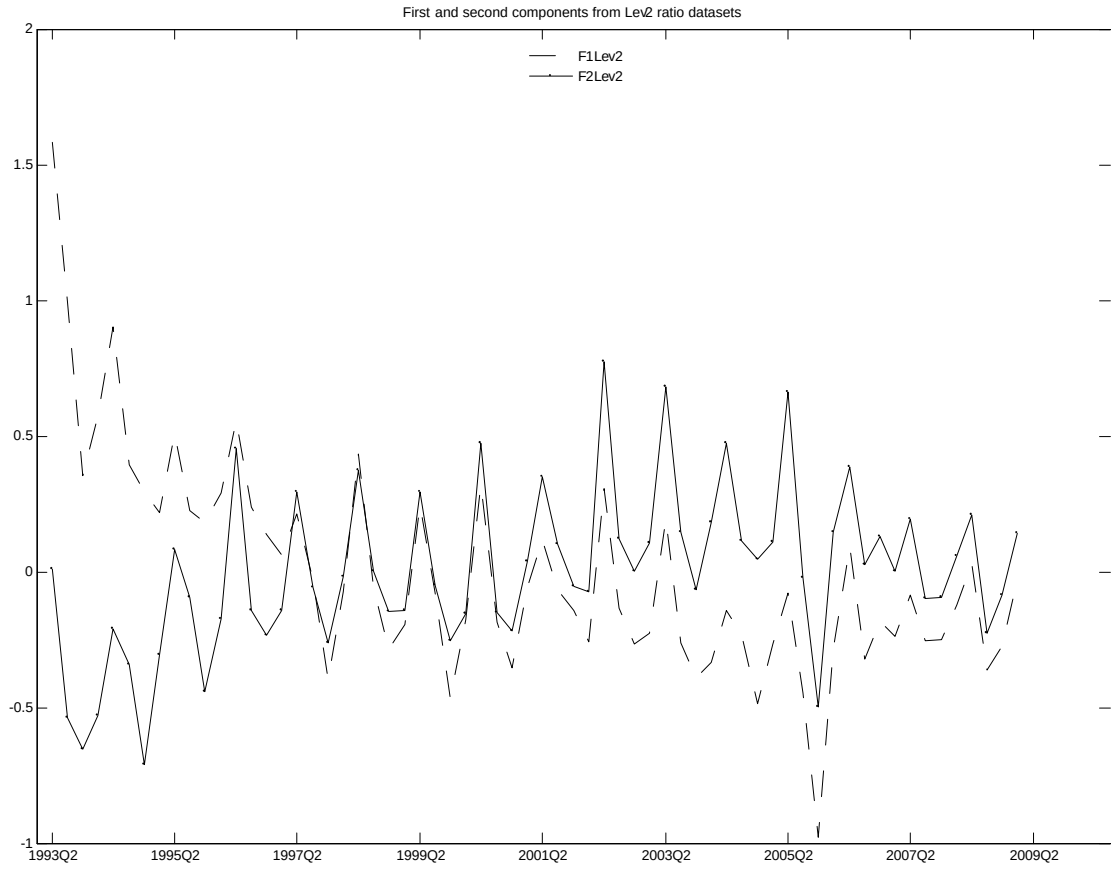


Figure: Bank factors: LEV2