Wolfgang Lemke:

An Affine Macro-Finance Term Structure Model for the Euro-Area

Discussion

by

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  - the estimation procedure
  - the goodness of fit
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- Why do bond traders also look beyond European fundamentals?
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The Model - Description

- Bond yields, y_t (n), n= 1,2,3,5,7,10 years, are affine functions of macro-economic state variables, X_t:

$$y_t^n = A_n + B_n' X_t$$

- The transition equation of the state vector is:

$$X_t = c + \mathcal{K} X_{t-1} + R\epsilon_t$$

$$X_t = (\pi_t, \pi_{t-1}, \pi_{t-2}, \pi_{t-3}, g_t, i_t, i_{t-1}, a_t, a_{t-1}, z_t, z_{t-1}, \nu_t)'$$

derived from a macro-economic model.

- Parameter Matrices A_n, B_n are functions of:
  – transition parameter matrix K, 12X12
  – Var-Cov matrix Σ, 5X5, of the 5 Macro-Module shocks,
  – and the price of risk,

$$\lambda_t = \lambda_0 + \lambda_1 X_t$$ λ: λ_0 is 1X5, λ_1 is 5X12 with 25 free parameters

The Model - Discussion

- First attempt to explain post 1998 EU-12 bond yields using fundamentals for EU-12

- <u>Unidirectional model</u>, from Macro- to Finance-Module, both conceptually and statistically

- Macro module not derived from agents' maximization problem, but well established in this literature. <u>Good care</u> is taken in explaining the equations and their relation to previous literature.

  ### *Suggestions:*
  - Obvious improvement: Make Phillips curve forward looking
  - Include credit growth as an additional variable in IS equation and the monetary policy rule (Trichet comments on <u>FT</u>)

- Only macro-state variables of the Macro-model are allowed to explain the bond yields.

  ### *Suggestion:*
  - Check robustness of this assumption: Include additional latent factors and explore the percentage of the variation in yields due to the macro-model and due to the latent factors as in Ang-Piazzesi.

Estimation

- Estimation in two stages:
  - First, Macro-Module with three observables ($\boldsymbol{\pi_t, g_t, i_t}$) and use of the Kalman Filter because of the existence of unobservable factors, $\boldsymbol{z_t, v_t}$. Full sample. Calibrate 5 of the 22 parameters in the model. Get estimates of series $\boldsymbol{z_t, v_t}$, plus parameter matrices $\boldsymbol{K, \Sigma}$ and use them in second stage.
  - Second, utilize the 6 bond yields of 1998-2006, plus the estimates from the first stage to estimate $\boldsymbol{h}$, plus vector $\boldsymbol{\lambda_0}$, setting matrix $\boldsymbol{\lambda_1} = 0$. Calibrate $\boldsymbol{\lambda_{0,\Pi}}$ $\boldsymbol{\lambda_{0,\alpha}}$ of the 5 $\boldsymbol{\lambda_0}$ parameters to zero.

- ***Suggestions*:**
  - Do the estimation in <u>one shot</u> because in the present set up, one assumes knowledge of the future in estimating the $\boldsymbol{\lambda_0}$ parameters.
  - Try to keep some $\boldsymbol{\lambda_1}$ parameters as non-zero, so as to allow more variability in the risk premia

The Model's Goodness of Fit

Paper uses two ways to assess "goodness of fit"

1. Compares imputed output gap with that generated by other methods, Figure 3.

2. Presents actual vs. model-implied yields (Figure 2). Yet, no benchmark → little information.

Suggestions:

- Compare model fit with naïve but unrestricted models:

   1. Compare model impulse responses to those from a naïve reduced VAR model of all the endogenous variables of the paper. How well do model impulse responses fit impulse responses of the reduced VAR? Are the deviations statistically significant?

   2. Do the second stage estimation of eq. (2.20): $y_t^n = A_n + B_n' X_t$ in a simpler way, by say a regression of y_t (n) on X_t or on a subset of X_t .

   3. Is there a reaction of macro variables to shocks in long term interest rates in an unrestricted reduced model? If yes, current approach requires a more extended model.

- Recall earlier suggestion to include latent factors

Impulse Responses

- Impulse response functions have intuitively correct sign.

- Verbal interpretation of bond yield reactions based entirely on the Expectations Hypothesis.

Suggestions:

- Does the Expectations Hypothesis hold?

  – Compute and plot the size of the risk premia, as in (2.23).

- Based on the model, what is the proportion of variability of the errors in forecasting long term interest rates attributed to variability in macro factors? Forecast Error Variance Decomposition

Practitioner's View

- Euro-Bond traders examine European Fundamentals, but examine US fundamentals as well. Can we afford to ignore them?

    – Dealing Rooms' expectations of future European long-term yields are based not only on the European future short-term rates, but also on a guess about the future <u>differences between US and European yields</u> of the same maturity.

    – If we are serious about exploring bond yields after 1998 in EMU, we <u>cannot ignore the outside world</u>. Is there evidence for this claim?

- The true question is:

    Does the paper's European Model incorporate whatever fundamental information on the US economy would potentially influence European yields? Or we need to include US fundamentals as well?

Market focuses on US-Euro differences in long-term yields

US-Germany spread in 10-year yields
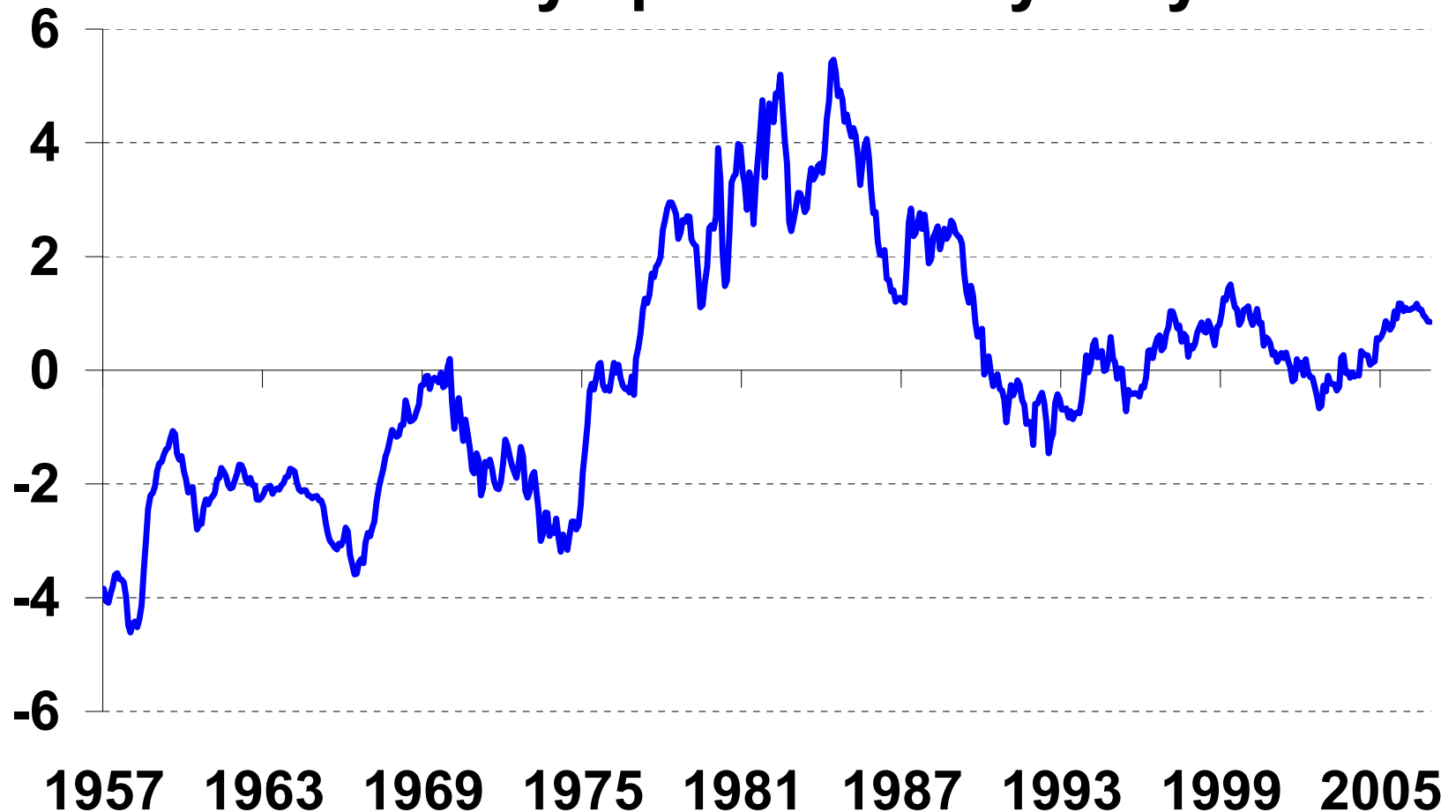
Globalization: Europe is not alone

The Euro 10y – 2y spread responds negatively to either Euribor or Libor
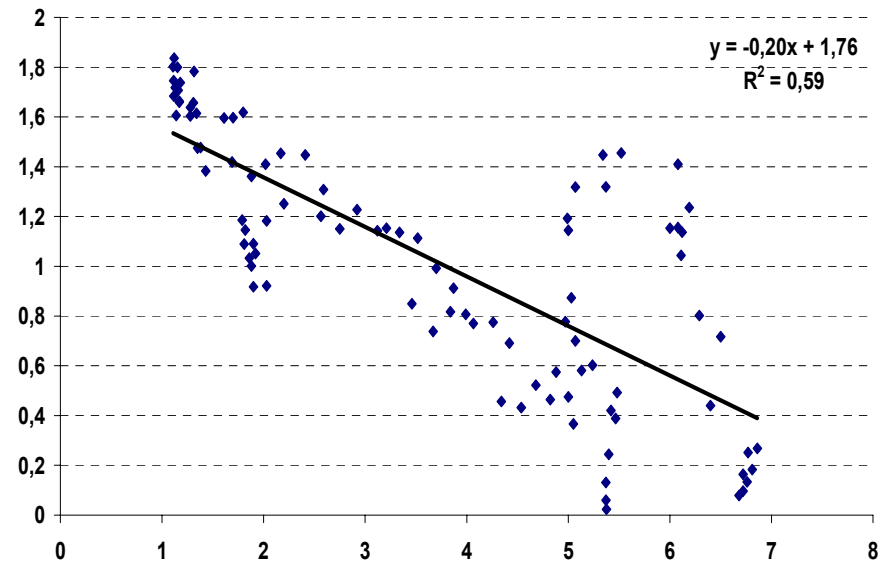
Response to Euribor

GERM: 10y-2y
x=euribor

$y = -0,39x + 2,23$
$R^2 = 0,48$

Response to Libor

GERM: 10y-2y
x=libor

$y = -0,20x + 1,76$
$R^2 = 0,59$
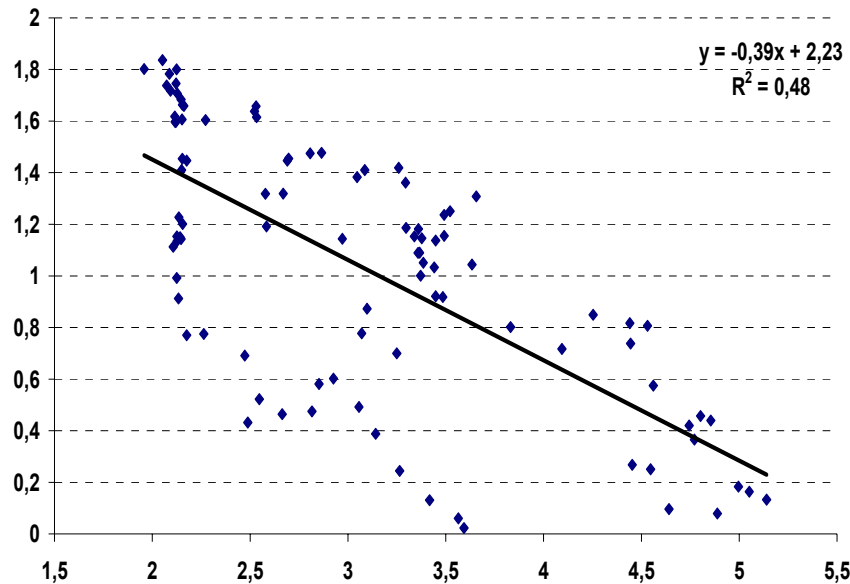
Spread = 2.2 – 0.39 Euribor
R-SQ = 0.48

Spread = 1.8 – 0.20 Libor
R-SQ = 0.59

Strong correlation in yield spreads after 1998

**Correlations
1998-2006: ρ = 0.76**

— US yield spread (10y-2y)   — Germany yield spread (10y-2y)
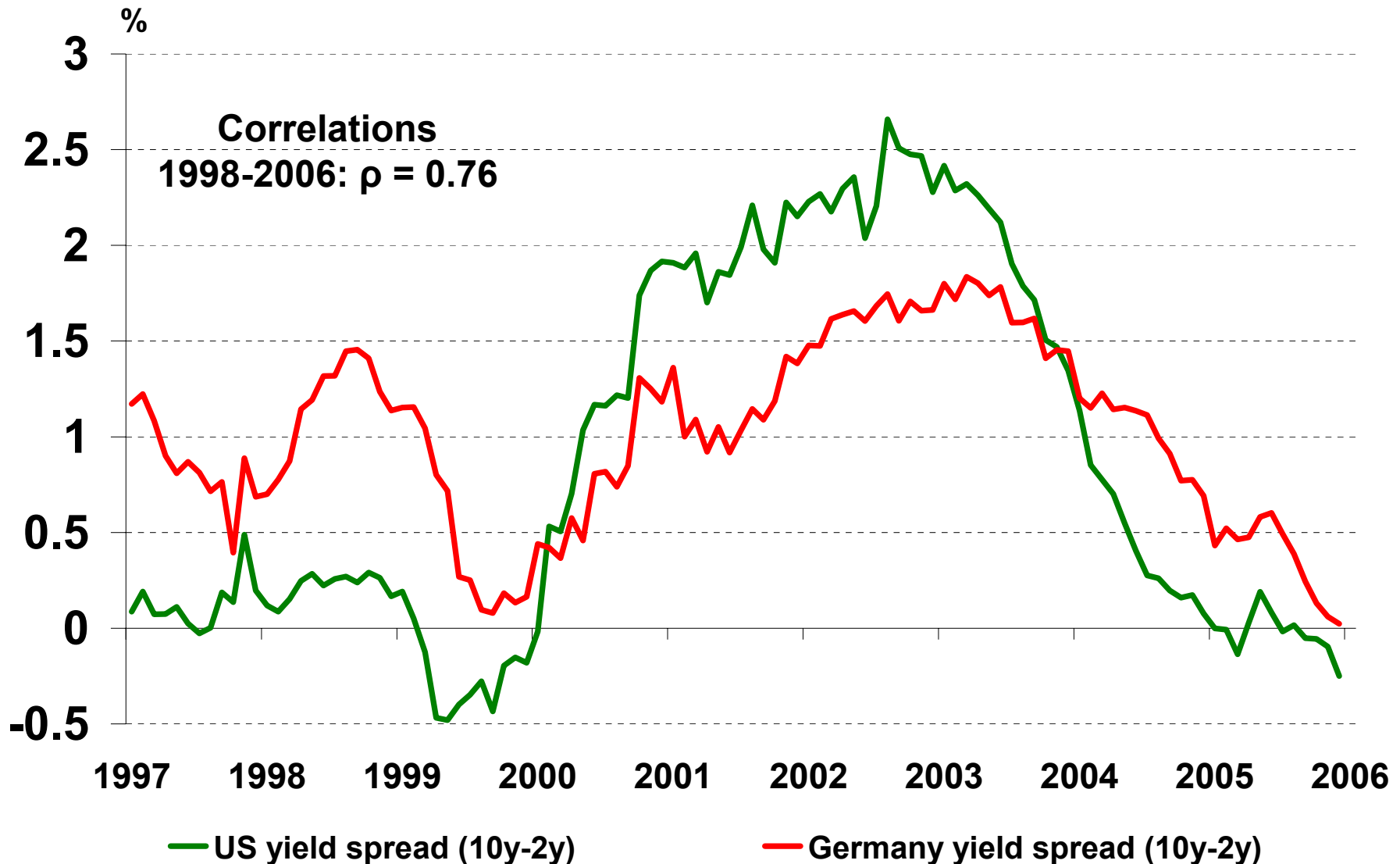
Decoupling during German Unification and preparation for EMU entrance (1989-1997)

This is a topic for future research

Positive correlation breaks during 91M6 –96M7
Corr. more positive after the break than before

**2 years rolling correlation between
US and Germany's yield spread (10y-2y)**

1980-1997: ρ = 0.07
1998-2006: ρ = 0.76

— US yield spread (10y-2y)   — Germany yield spread (10y-2y)
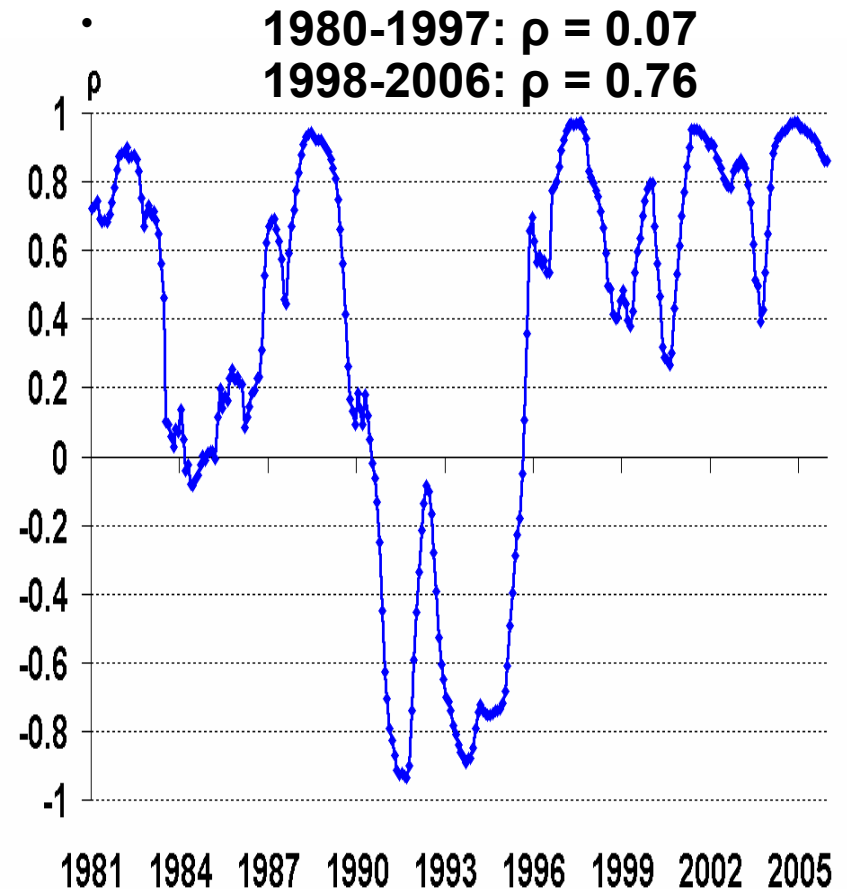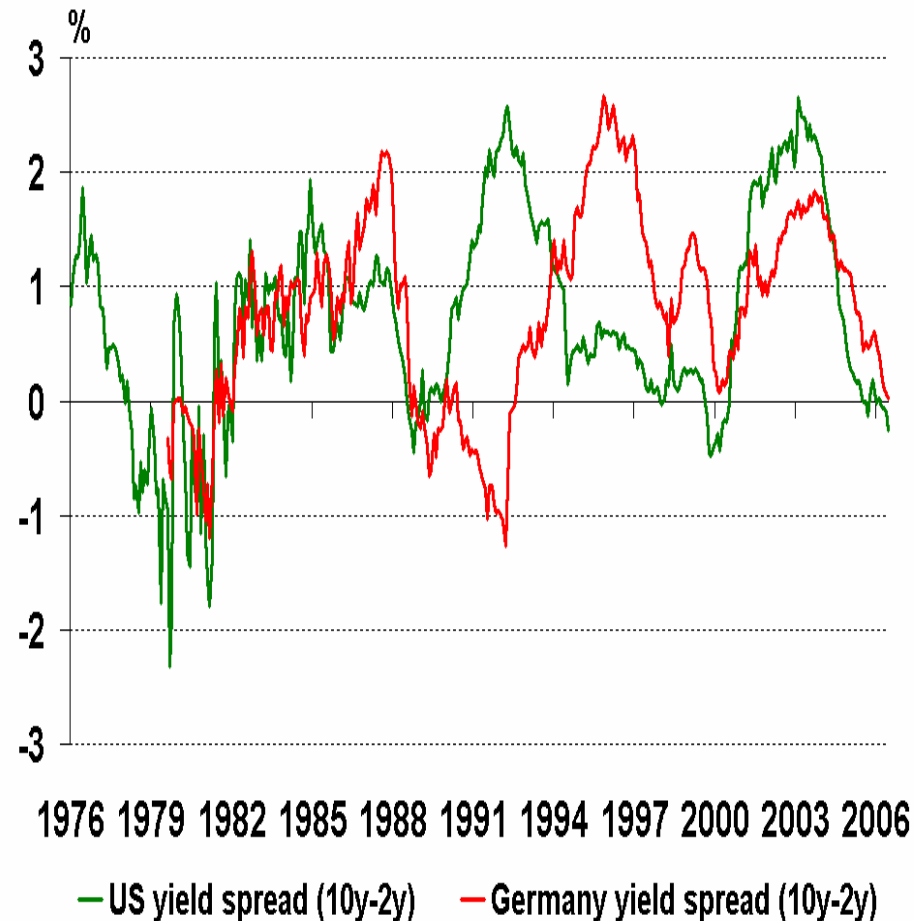
Does the outside world matter in Euro-Area bond pricing?

- VAR with 2 lags over 1998:12-2006:11 of
  - German 10-year minus 2-year yield
  - 3-month Euribor
  - US 10-year minus 2-year yield
  - 3-month Libor
- Then, add to the VAR
  - Euro-Area growth in Industrial Production
  - Euro-Area inflation
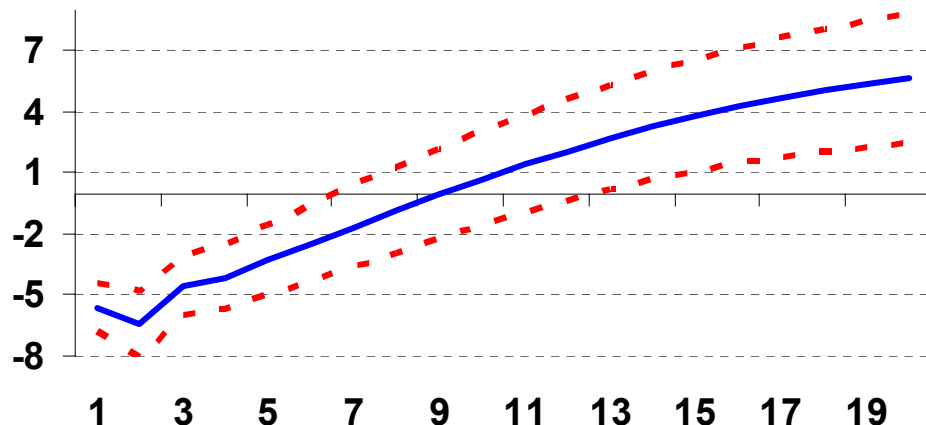
  in order to match the macro-factors of the model
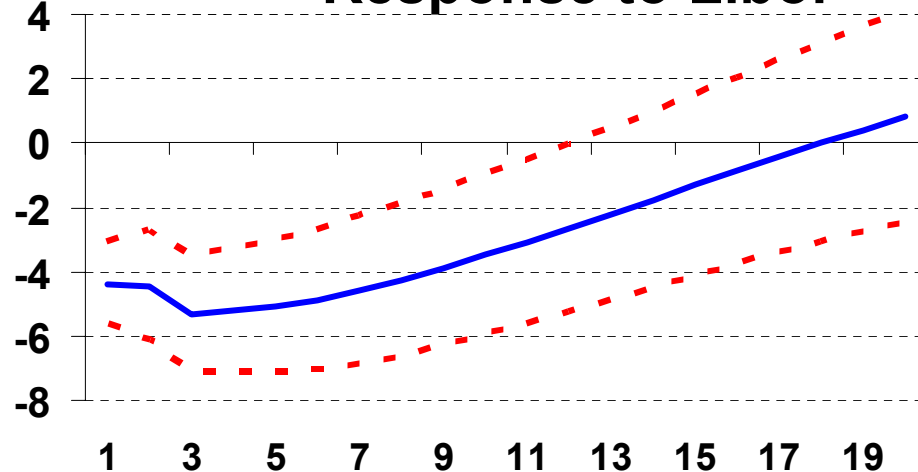
Impulse response of German 10y–2y spread
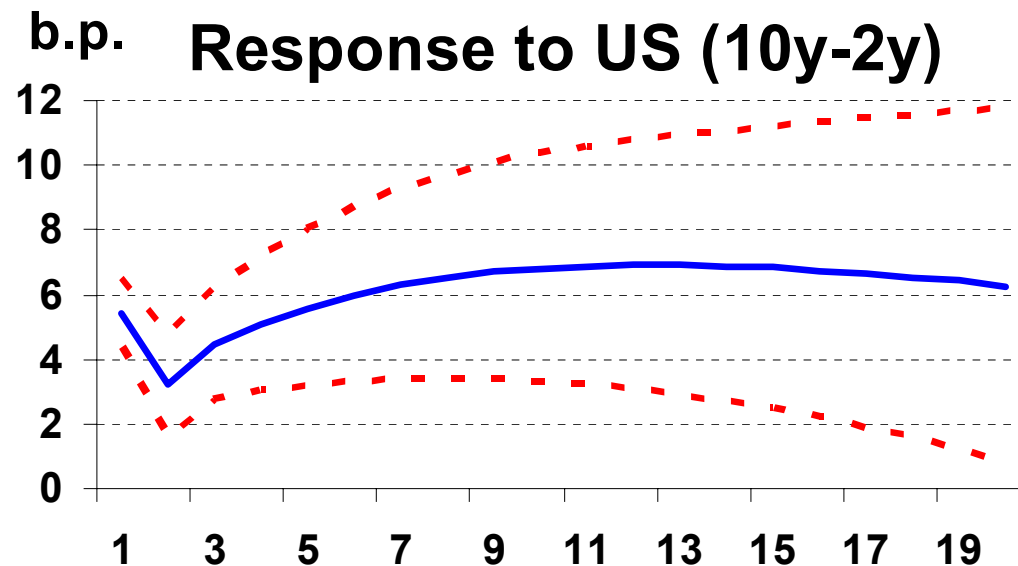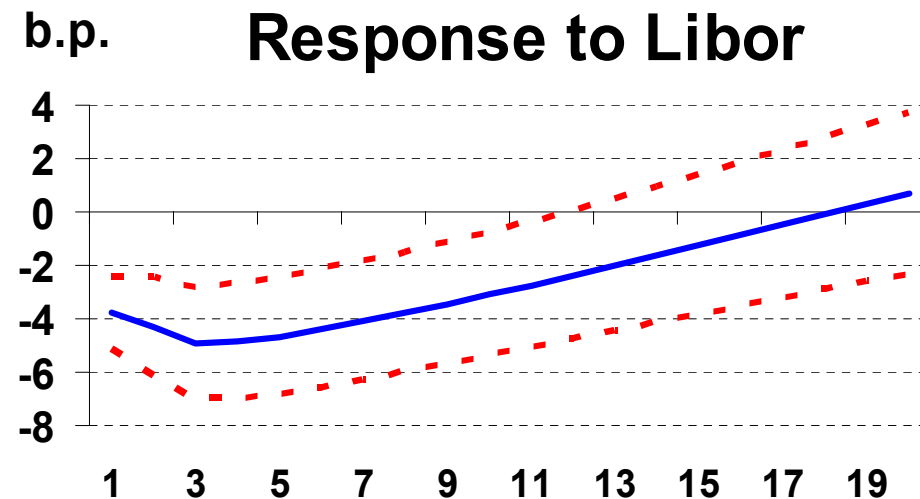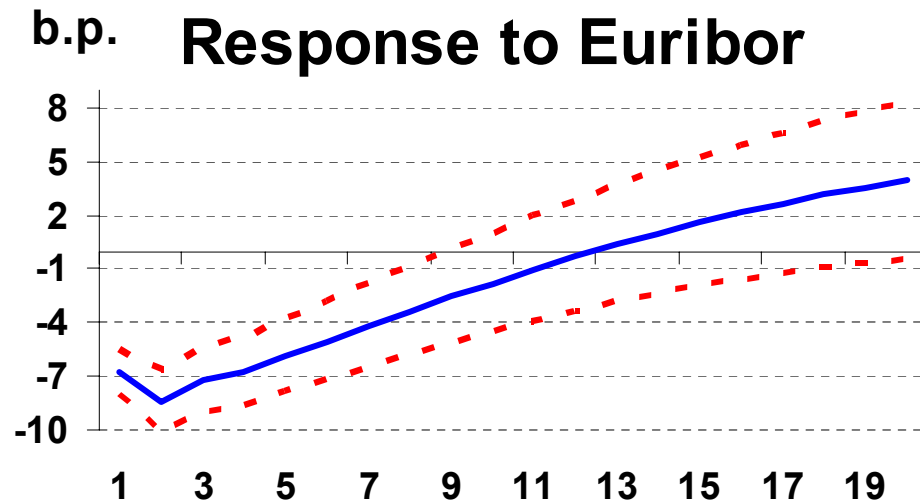
VAR(2): German 10y-2y, Euribor, US 10y-2y, Libor

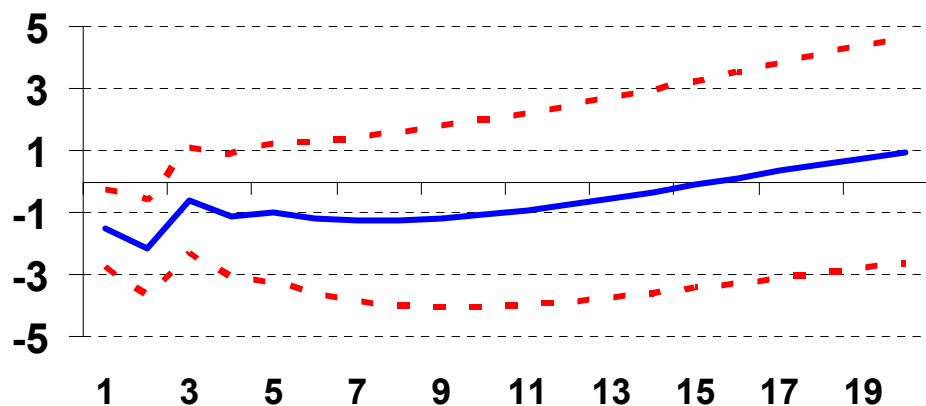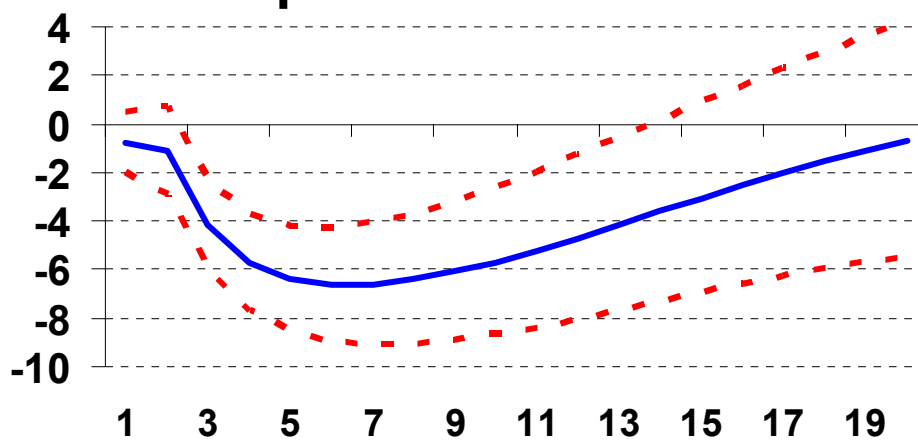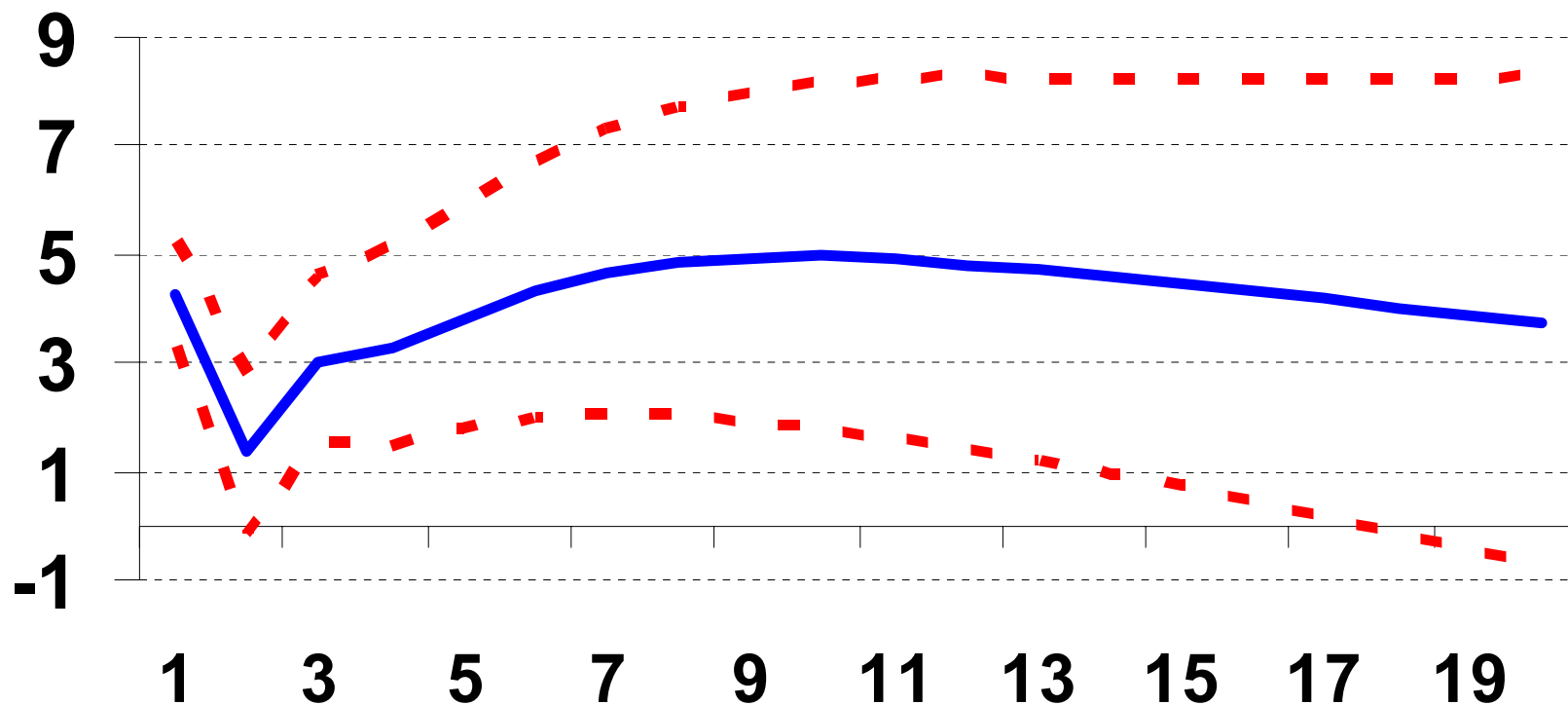# Impulse response of German 10y – 2y spread

VAR(2): German 10y-2y, Euribor, US 10y-2y,
Libor, EU-12 Growth in Ind. Pr., EU-12 inflation

Impulse response of German 10y – 2y spread

b.p. **Response to US (10y-2y)**

VAR(2): German 10y-2y, Euribor, US 10y-2y,
Libor, EU-12 Growth in Ind. Pr., EU-12 inflation

Conclusions

- Very interesting attempt to connect EU-12 bond yields with the EU-12 macro-economy

- Questions to be explored:
  - How much of the variation in yields do macro fundamentals explain?
  - Can the macro model be improved?
  - How well does the model fit the bond yields relative to naïve but unrestricted alternatives?
  - Can we characterize the EU-12 bond yield deviations from the EH?
  - Does the outside world matter in EU-12 bond pricing? And if so, can we model the influence through fundamentals?