Discussion of "Inflation Risk Premia in the US and Euro Area" by Peter Hördahl and Oreste Tristani

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What is the paper about?

- Determinants of break-even inflation (BE_π)

$$BE_\pi = \text{nom. rate} - \text{real rate}$$

- At maturity n

$$\begin{aligned} BE^n_{\pi,t} &= y^n_t - y^{*n}_t \\ &= \frac{1}{n} E_t \left[\pi_{t+1} + ... + \pi_{t+n}\right] + IRP^n_t \end{aligned}$$

where

$$\begin{aligned} \pi_t &\equiv \ln\left(P_t / P_{t-1}\right) \\ IRP &\equiv \text{infl. risk premium} \\ &\quad \text{compensates investors for bearing inflation risk} \end{aligned}$$

- Abstract from liquidity issues (see this morning)

Paper's objectives

- Estimate inflation risk premia in US and EA
  - Important to disentangle inflation expectations from inflation risk premium
  - Useful to interpret monetary policy, central bank credibility...
- Analyze macroeconomic determinants of inflation risk premia
  - Important to understand their dynamics

  $\Longrightarrow$ Requires model explaining joint behavior of macro variables, and (real and nominal) term structure

Authors' strategy

Combine:

- Macro model (explaining behavior of inflation π_t, output gap x_t, and short-term nominal rate r_t)
- No-arbitrage term-structure model (Ang-Piazzesi, 2003; HTV, 2006) to price bonds
  - use dynamics of short-term rate implied by macro model

Paper's findings

Inflation risk premium (IRP):

- relatively small, increasing with maturity in US and EA
  - $\simeq$ Durham (06), D'Amico et al. (08), Ravenna-Seppala (07), Pasaogullari-Tsonev (08)
    $\neq$ large IRP: Ang, Bekaert, Wei (06), Buraschi Jiltsov (05), Chernov-Mueller (08)
- varies with state of econ. (output gap and inflation)
  - low frequencies: broadly moves with output gap
  - higher frequencies: moves with in level of inflation
- responds positively to inflation shocks in US and EA
- responds positively to output shocks in US but negatively in EA.

Outline

1. Review of framework
2. A couple of issues (from a macro perspective, not specific to this paper)
   - Dynamics of market price of risk
   - Which inflation rate?
   - Estimated macro model
3. Conclusion

Review of framework

Macro model

- AS equation

$$\pi_t = \bar{\pi} + \mu_\pi \frac{1}{12} \sum_{i=1}^{12} E_t \left[\pi_{t+i}\right] + (1 - \mu_\pi) \sum_{i=1}^{2} \delta_{\pi,i} \pi_{t-i} + \delta_x x_t + \varepsilon_t^\pi$$

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$$x_t = \mu_x \frac{1}{12} \sum_{i=1}^{12} E_t \left[x_{t+i}\right] + (1 - \mu_x) \sum_{i=1}^{2} \zeta_{x,i} x_{t-i} - \zeta_r \left(r_t - E_t \left[\pi_{t+1}\right]\right) + \varepsilon_t^x$$

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- Policy rule

$$r_t = \bar{r} + (1 - \rho) \left\{\beta \left(E_t \left[\pi_{t+11}\right] - \pi_t^*\right) + \gamma x_t\right\} + \rho r_{t-1} + \eta_t$$

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  - place reasonable restrictions on law of motion of π, x, r
  - great advantage: forward looking! Monetary policy can affect economy through expectations
  - Caveat: all persistent deviations from policy rule interpreted as changes in inflation target π_t^*

Review of framework

Solution to macro model

- All variables depend on state vector

$$\begin{aligned} r_t &= \Delta' X_{1t} \\ & X_{1t} + M X_{1,t-1} + \Sigma \xi_{1,t} \end{aligned}$$

where state vector

$$X_{1,t} \equiv \left[x_{t-1}, x_{t-2}, x_{t-3}, \pi_{t-1}, \pi_{t-2}, \pi_{t-3}, r_{t-1}, \varepsilon_t^{\pi}, \varepsilon_t^{x}, \pi_t^{*}, \eta_t\right]'$$

- Remarks:
  - If habit in consumption: X_{1t} includes c_{t-1} or x_{t-1}
  - shocks = innovations to $\{\varepsilon_t^{\pi}, \varepsilon_t^{x}, \pi_t^{*}, \eta_t\}$
    - Do not include explicitly risk premium shocks, financial intermediation shocks....
  - Up to 1st order, no effect of volatility, risk premia on macro dynamics

Review of framework

Nominal and real term structure

- Assume asset pricing relation

$$p_t^n = E_t\left[m_{t+1} p_{t+1}^{n-1}\right]$$

where

  - p_t^n = price of $n-period$ nominal bond
  - m_t = nominal pricing kernel (stochastic disc. factor)

- Assume

$$\ln\left(m_{t+1}\right) = -r_t - \frac{1}{2}\lambda_t'\lambda_t - \lambda_t'\varsigma_{1t+1}$$

where market price of risk λ_t is a 4×1 vector

$$\lambda_t = \lambda_0 + \lambda_1 \begin{bmatrix} x_t \\ r_t \\ \pi_t \\ \pi_t^* \end{bmatrix}$$

- Real pricing kernel

$$\begin{aligned} \ln\left(m_{t+1}^*\right) &= \ln\left(m_{t+1}\right) + \pi_{t+1} \\ \pi_{t+1} &\equiv \ln\left(P_{t+1}/P_t\right) \end{aligned}$$

Issue #1: Market Price of Risk

- λ_t : HT assume effect of past variables occurs through x_t, r_t, π_t, π_t^*
  - Past variables do not separately affect λ_t
  - Inconsistent with assumptions underlying macro model $\Longrightarrow$ affects dynamics of inflation risk premium, inflation expectations, ...
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    - success in fitting both macro and asset pricing data

Issue #2: Which inflation rate?

- Inflation
  - in macro model
  - to compute nominal and real pricing kernels

  is (or should be)

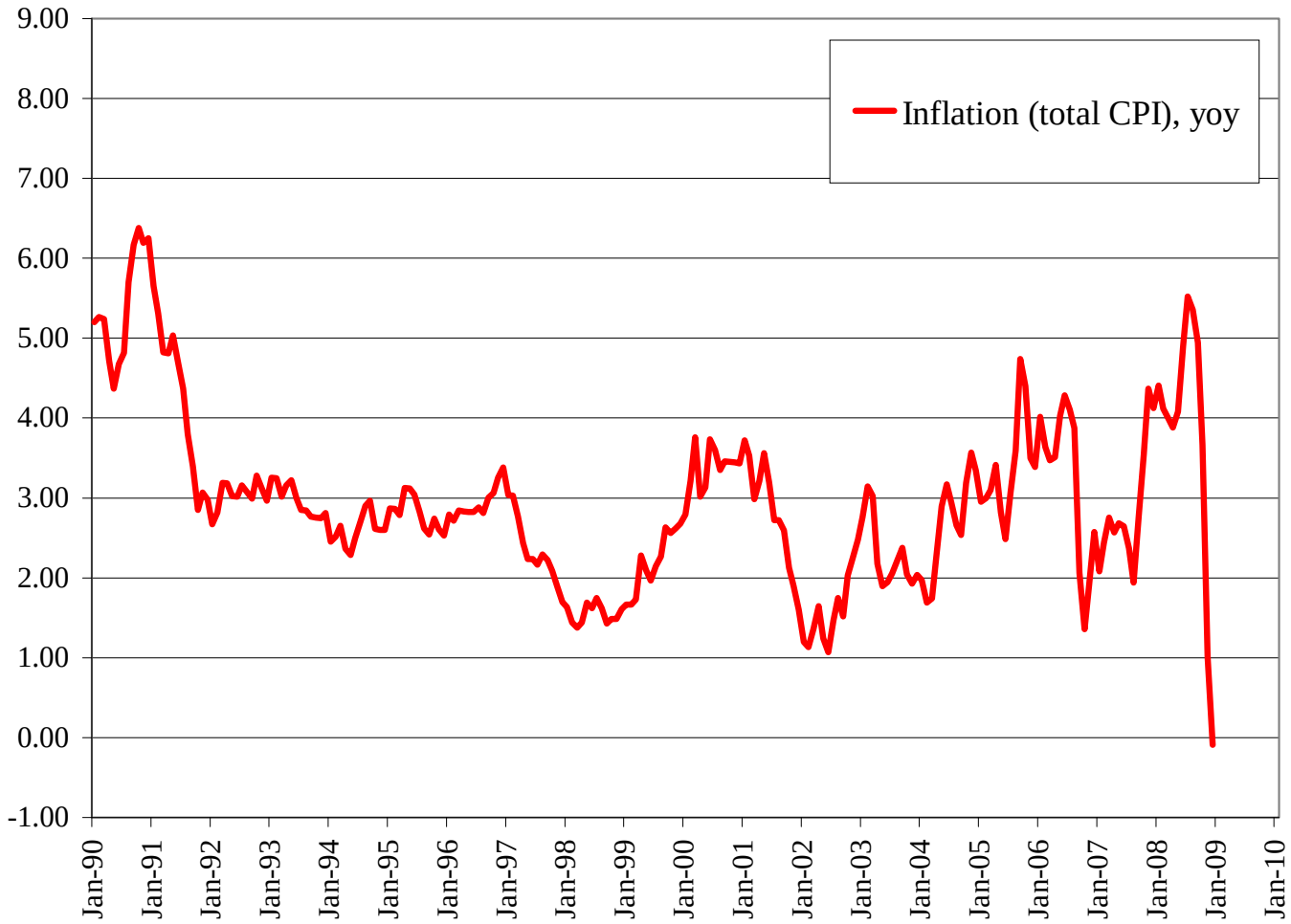
$$\pi_t = \ln\left(P_t / P_{t-1}\right)$$

- However, in estimation assume

$$\pi_t^{obs} = \ln\left(P_t / P_{t-12}\right)$$

Issue #2: Which inflation rate?

US inflation: CPI, y-o-y



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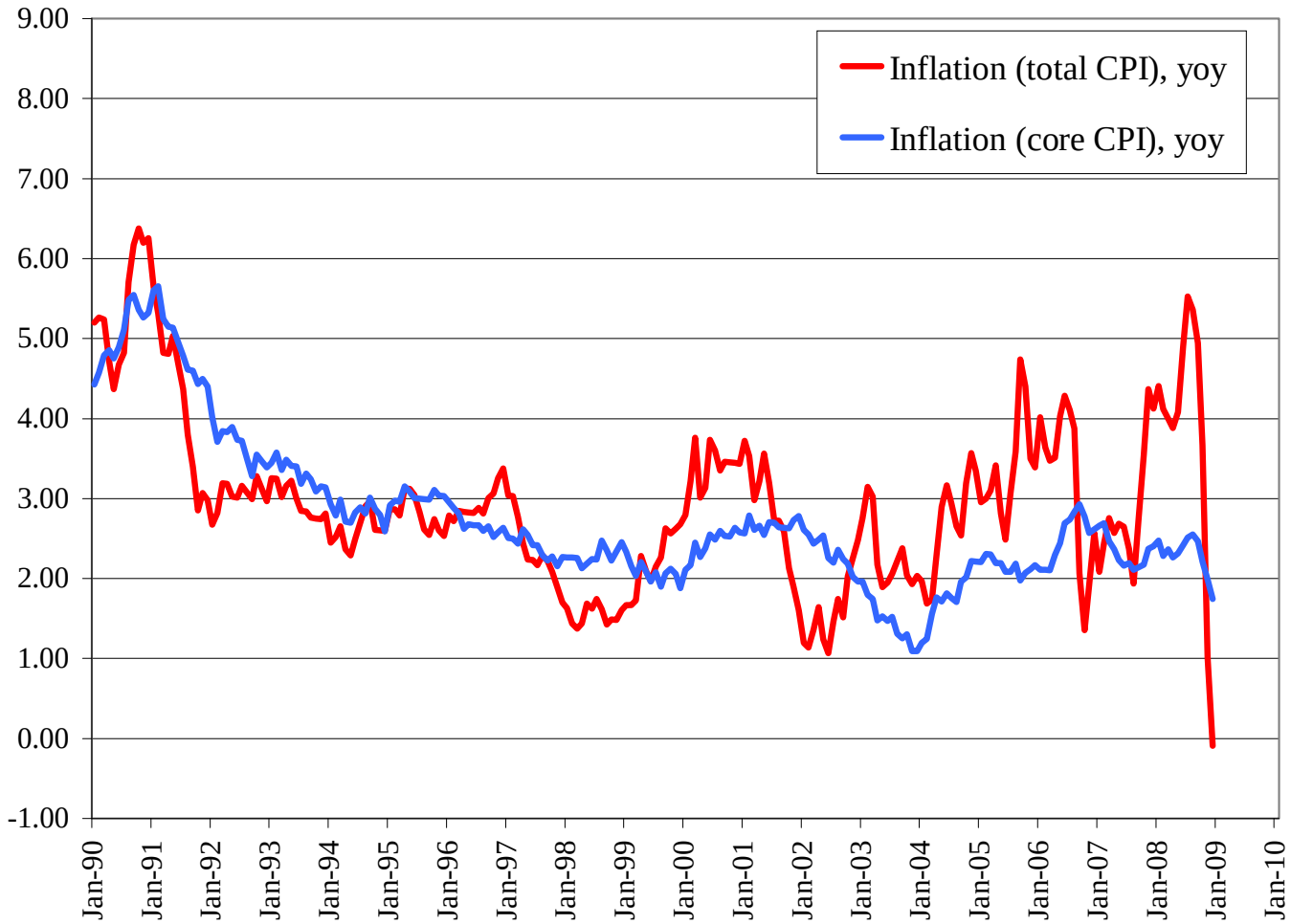
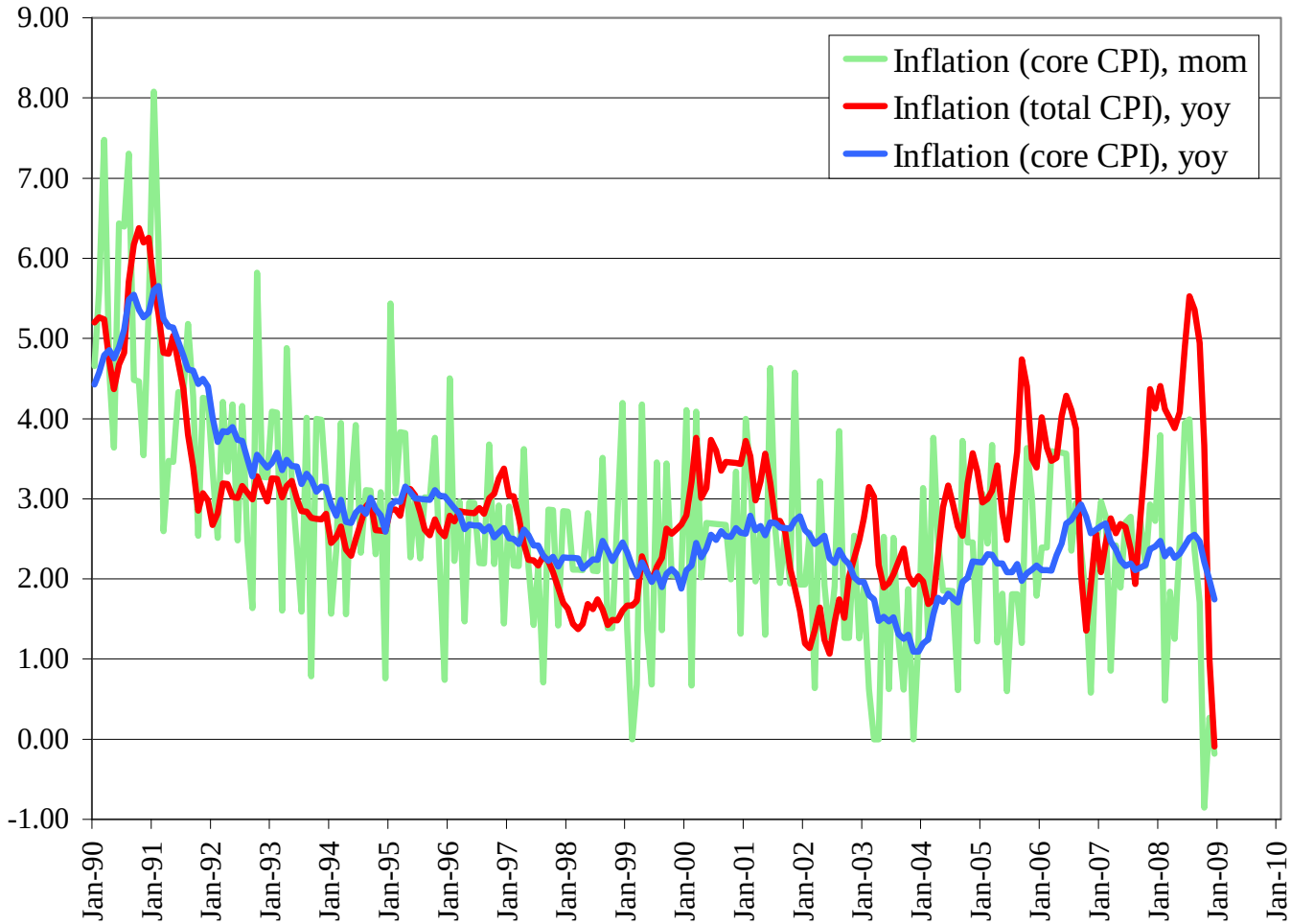
US inflation: CPI or Core CPI (y-o-y)



Issue #2: Which inflation rate?

US inflation: Empirically convenient or model consistent?
CPI (y-o-y) or Core CPI (m-o-m)



Issue #2: Which inflation rate?

- m-o-m inflation measure:
  - noisy; poorly predicts future inflation [AR(6): $\rho(1) < 0.2$]
  - yet concept consistent with model
- y-o-y inflation measure:
  - smoother; predicts future inflation well [AR(6): $\rho(1) > 0.9$]
  - but inconsistent with model
- Alternative: filter noise explicitly!
  - Measurement error (as is done here)
  - Estimate latent inflation using multiple indicators (Boivin-Giannoni, 2006)

$$\begin{bmatrix} \pi_{1t}^{obs} \\ \vdots \\ \pi_{mt}^{obs} \end{bmatrix} = \Lambda \pi_t + \begin{bmatrix} e_{1t} \\ \vdots \\ e_{mt} \end{bmatrix}$$

Issue # 3: "Estimated" model parameters

- Estimated parameters of macro model: "model seems empirically plausible, with estimated macro parameters broadly with the range of estimates which can be found in the literature" (p. 17)

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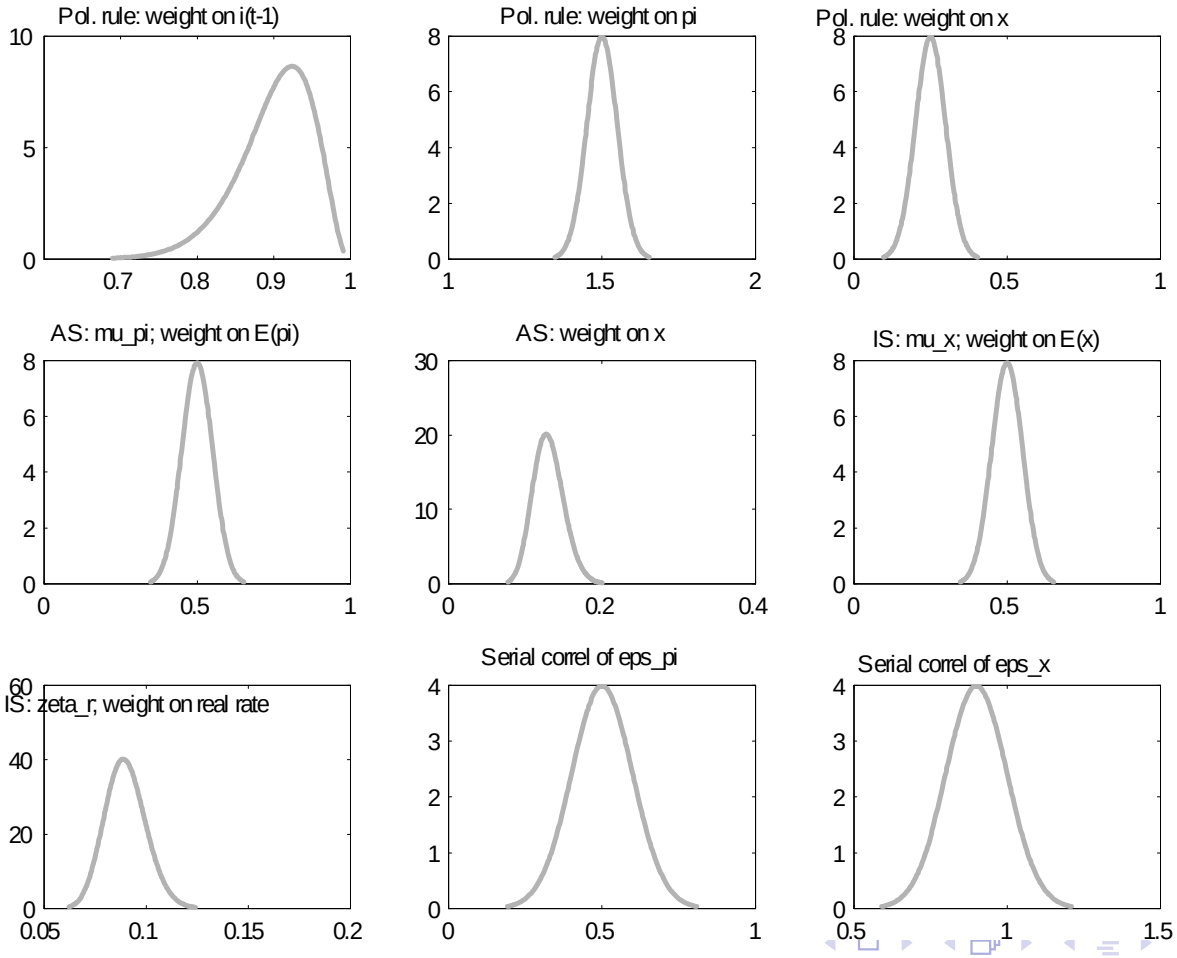
- Yes, but priors probably play a big role: very tight!



Conclusion

- Very nice paper, well done!
- Useful and promising to combine macro model with no-arbitrage term-structure
  - Particularly desirable: forward-looking elements of macro model
  - Monetary policy can have a significant effect on agents' expectations
  - Nowadays believed to be a key (main (?)) channel through which monetary policy affects economy

Conclusion

- A few reservations
  - stochastic discount factor inconsistent with macro dynamics
  - inflation: very different in model and empirical setup
  - tight priors

  $\Longrightarrow$ likely to affect results

- Future research: models with significant effect of volatility, risk premia on macro variables