

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

Marc Giannoni

Columbia Business School, NBER, CEPR

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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

$$\begin{aligned} BE_{\pi,t}^n &= y_t^n - y_t^{*n} \\ &= \frac{1}{n} E_t [\pi_{t+1} + \dots + \pi_{t+n}] + IRP_t^n \end{aligned}$$

where

$$\pi_t \equiv \ln(P_t/P_{t-1})$$

$$IRP \equiv \text{infl. risk premium}$$

compensates investors for bearing inflation risk

- 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

⇒ 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

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

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- Intertemporal IS equation

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

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

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- 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

$$r_t = \Delta' X_{1t} \\ X_{1t} + MX_{1,t-1} + \Sigma \zeta_{1,t}$$

where state vector

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

- 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

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

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

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

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
⇒ affects dynamics of inflation risk premium, inflation expectations,
- Alternative: Model-consistent market price of risk

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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)

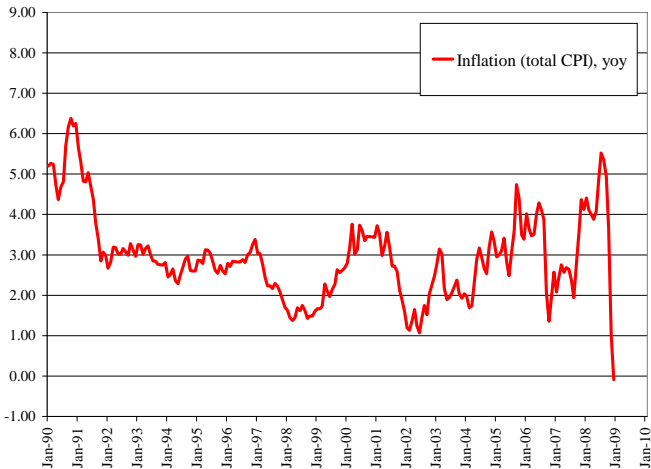
$$\pi_t = \ln(P_t/P_{t-1})$$

- However, in estimation assume

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

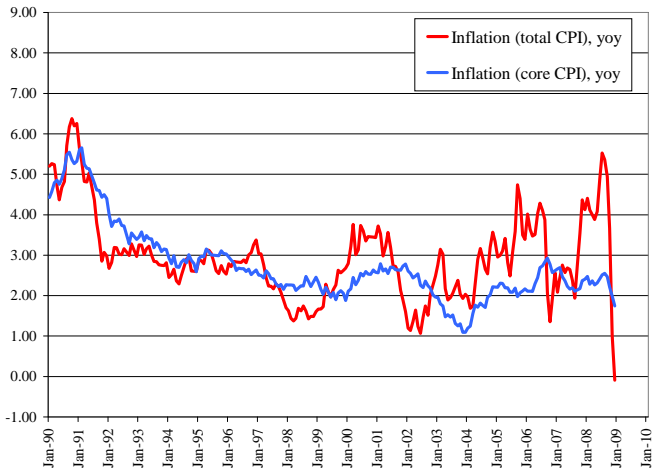
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US inflation: CPI, y-o-y



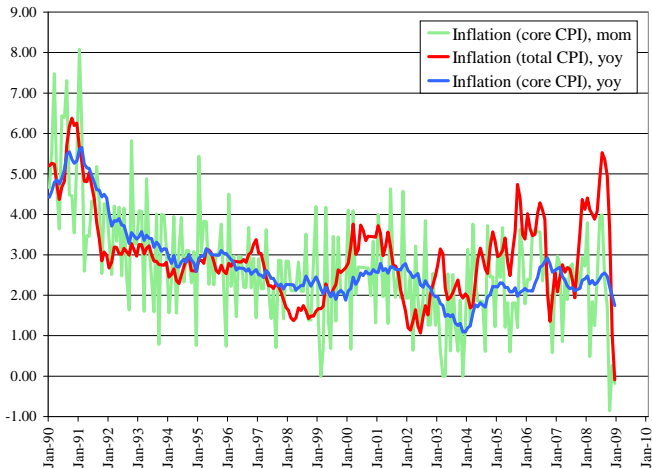
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US inflation: CPI or Core CPI (y-o-y)



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)

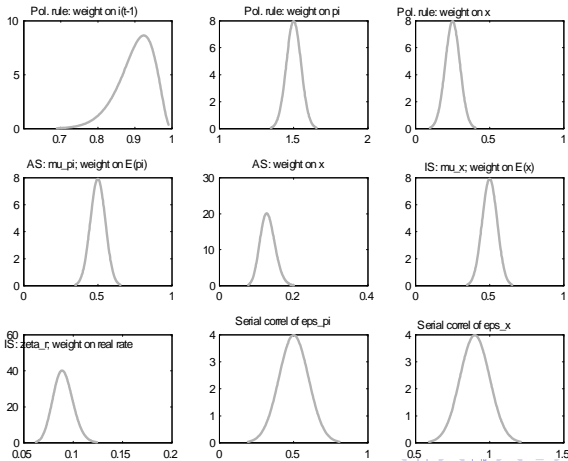
$$\begin{bmatrix} \pi_{1t}^{obs} \\ \vdots \\ \pi_{mt}^{obs} \end{bmatrix} = \Lambda \pi_t + \begin{bmatrix} e_{1t} \\ \vdots \\ e_{mt} \end{bmatrix}$$

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

⇒ likely to affect results

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