A model of the euro-area yield curve with discrete policy rates
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Methodology

- **Model**
  - Arbitrage-free term structure model
  - Discrete policy rates, rich specification of EONIA spread
  - Solve for arbitrage-free OIS yields analytically
- **Estimation**
  - Daily (!) euro area data since 1999
  - State space model: Chen-Scott-type inversion and Kitagawa-Hamilton filter used for ML estimation
- **Applications**
  - Quantifying effect of forward guidance
  - Quantifying forward premia
  - Identifying monetary policy and liquidity regimes

Assessment and discussion

- **Overall assessment**
  - Mainly methodological paper
  - Careful analysis, smart details – at modelling and estimation front
  - Wide scope of applications
  - Clearly written, good to read
  - Should be sharper on value-added and difference vis-a-vis benchmark term structure models
  - Strengthen interpretation of results from policy perspective
- **Discussion**
  - Classification of the model in the 'zoo' of term structure models
  - Specific questions on method and results
  - Comment on policy applications

Going beyond Gaussian affine term structure models as standard central bank workhorses

Genuine TSM	Gaussian affine TSM	Renne (2012)
One-period rate i	"Risk-free" rate	Eonia rate
i=f(factors)	Sum of K latent factors, ex post similar to level, slope, curvature	Sum of discrete monetary policy rate and 3 components making up EONIA spread
Law of motion for factors	Gaussian homoscedastic VAR	Discrete and continuous-valued factors, non-normal shocks, Markov-switching dynamics
$P(n) = E^Q(\exp[\text{sum of current and future } i])$	General pricing equation	
$y(n) = -1/n \log(P(n)) = g_n(\text{factors})$	Yields affine in factors	Yields affine in regime variable and continuous state variable
	Yields and d(yields) Gaussian	Non-Gaussian yield distribution (how exactly?)
	Negative yields possible	Negative yields excluded

A paper on ‘ relative pricing’

- **‘Finance approach’, no macro, see Cochrane (2001):**
  - *“Term structure models used in finance amount to regressions of interest rates on lagged interest rates …*
  - *… Macroeconomists also run regressions of interest rates on a wide variety of variables, including […] inflation, output, unemployment, exchange rates, […]*
  - *Someone, it would seem, is missing important right hand variables”*
- **Maybe clarify, at least expositionally:**
  - How can we talk about monetary policy (“tightening”, “easing”,…) without relating to macro conditions?
  - How does the model learn/know/predict monetary policy regimes: all macro info priced in yields?

Questions on method and results (1)

- **Yields used for estimation:**
  - All yields in table (1m, 3m, 6m, 1m, 2y, 4y) used for estimation?
  - Why not go beyond 4y tenor?
- **Persistence of regimes**
  - Regime of 'normal' vs. excess liquidity condition is fairly persistent – both under physical and under risk-neutral measure: P(exc|exc) = 0.9999.
  - Estimate hitting an imposed bound? Reliable estimate?
  - Implied expected staying time?
  - Relevant? Example: Forward premia should (inter alia) depend on difference in persistence of that regime under P and Q measure

Questions on method and results (2)

- **Size of unconditional variance of s_t capped in estimation**
  - Paper is transparent on that approach – good!
  - But …
    - Is the imposed bound binding?
    - Would unconstrained estimates of $\mathbf{s_t}$ completely wipe out other components in long-term bond pricing?
    - Is there (almost) an identification issue behind it?
- **Fit of the model**
  - Model allows skewed and fat tails: how well are data features matched (first differences!)?
  - How well does model fit 'cross-sectionally out ouf sample'?: Check implied yield curve and yield series for > 4-year maturity

Can the model's richness be better exploited?

- **What can the model reveal what others (ATSM) cannot?**
  - Results qualitatively and/or quantitatively different from ATSM?
  - Does the model allow for other/additional interpretation?
- **Example: forward guidance**
  - CB keeps target rate constant for certain number of periods
  - Paper finds: statistically downward impact on yield curve ...
  - ... which is *"far larger when the current target rate is low"*
  - Is the latter effect surprising?
    - Qualitatively? - No: basic one-factor model with expectations hypothesis gives same result *(**illustrate on next slide**)*
    - Quantitatively? – Need to compare to other models, and should trace what model features drive the effect

Illustration: forward guidance impact

- **One-factor model**
  - $i_t = \mu + \alpha (i_{t-1} - \mu) + e_t$
  - Note that $E_t(i_{t+1}) = \mu + \alpha (i_t - \mu)$
  - Pure expectations hypothesis holds:
    $y_t(n) = 1/n \, E_t(i_t + i_{t+1} + \ldots + i_{t+n-1})$
- **Effect of forward guidance**
  - 1-period short rate, 2-period represents long rate:
  - $y_t(1) = i_t$, $y_t(2) = 1/2 \, E_t(i_t + i_{t+1}) = 1/2 \, [(1+ \alpha) i_t + (1- \alpha) \mu]$
  - CB commits to keep i_{t+1} at current short rate i_t => $y^*_t(2) = i_t$
  - How much would long yield be lower due to forward guidance:
    $S = y^*_t(2) - y_t(2) = 1/2 \, (1- \alpha)(i_t - \mu)$
  - For $i_t < \mu$, $S < 0$. **The lower i_t, the stronger the effect of forward guidance.**

Summary and outlook

- **Heavy-weight contribution to term structure literature**
- **Hammer in search of a nail – think of further applications:**
  - Other forms of forward guidance
  - Interest rate gradualism
- **Convince readers (even) better**
  - what purpose all the bells and whistles serve ...
  - ... and what a simpler model cannot achieve in terms of
    - forecasting
    - nowcasting (which regime prevails currently)
    - counterfactuals
    - pricing of other instruments