Safety, Liquidity, and the Natural Rate of Interest
by Marco Del Negro, Domenico Giannone,
Marc P. Giannoni, Andrea Tambalotti

Jing Cynthia Wu
Chicago Booth & NBER
Comment 1: Decomposing long term yield into expectation and term premium

This is one core question in the term structure literature

\[ y_t^n = \bar{y}_t^n + tp_t^n \]

where

\[ \bar{y}_t^n = \frac{1}{n} E_t [r_t + r_{t+1} + \ldots r_{t+n-1}] \]

Expectation \( \bar{y}_t^n \) is the trend.
Comment 1: Expectation

The short rate

\[ r_t = \delta_0 + \delta'_1 X_t \]

Dynamics for factors

\[ X_{t+1} = \mu + \rho X_t + \Sigma \varepsilon_{t+1}, \quad \varepsilon_{t+1} \sim N(0, I) \]

Pricing equation

\[ P_{nt} = \mathbb{E}_t[\exp(-m_{t+1})P_{n-1,t+1}] \]

\[ y_{nt} = -\frac{1}{n} \log(P_{nt}) \]

Expectations

\[ E_t[r_{t+n}] = \delta_0 + \delta'_1 E_t[X_{t+n}] \]
Comment 1: Bias correction

- Estimation: OLS for VAR. Highest eigenvalue of $\rho$: 0.95.
- However, the persistence is underestimated.


![Graph showing the relationship between $\hat{\rho}_{OLS}$ and $\rho_{OLS}$ with median and mean values.]
Comment 1: Downward trend in expectation

black: five-by-five-year forward rate
Red: OLS
blue: Bauer, Rudebusch, and Wu (2012, 2014) bias corrected
Comment 2: How negative can nominal rates be?
Comment 2: How negative can nominal rates be?

Nominal $r^*$ was as negative as -5%.

Is it plausible?

- We do not observe negative interest rates in the US.
- The SNB’s deposit rate is at record low of -75 basis points. But that’s still far away from -5%.
- The negative interest rates in Europe were due to interventions by central banks, but $r^*$ is in the counterfactual world where there is no central bank.

Frictions that potentially allow a negative nominal rate

- take physical currency out of circulation
  - highly unlikely
- storage cost
  - there is a limit
Comment 2: What causes implausibly negative nominal rate?

Lack of proper treatment for ZLB
  ➤ In the reduced form: discard short rate after 2008 Q3

Consequences
  ➤ internal inconsistency
    ➤ remove short rate and its ZLB
    ➤ forward looking agents factor the ZLB in the future into yields at longer maturities.
    ➤ the same lower bound should constrain the nominal trend and $r^*$.  
  ➤ less information leads to less accurate estimation
Comment 2: Shadow rate – a treatment for ZLB

Black (1995)

\[ r_t = \max(s_t, r), \]

- Allow the model to be internally consistent
  - short rate, trend on nominal rates, and expectations in longer rates are subject to the same lower bound.
- Does not allow nominal rates to be (too) negative.
Comment 2: Shadow rate – a treatment for ZLB

Wu and Zhang (2016)

- DSGE linear in $s_t$
- $r_t = \max(s_t, r)$
- A negative $s_t$ accommodates unconventional monetary policy

Potential consolidating negative nominal rates by relabeling $r_t$ as $s_t$

- $s^* + E_t\pi_{t+1} < 0$
- $r^* + E_t\pi_{t+1} > 0$
- A downward trend in $s^*$ instead of $r^*$ at the ZLB.
Comment 2: Shadow rate – a treatment for ZLB

Puzzle remaining: what happened in the 1970s?
Main result: a trend in convenience yield from late 1990s explains the decline in $\bar{r}$. 
Comment 3: No trend in the data

- No trend is present in the data
- Spread jumps up during the Great Recession
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- Spreads jump up during the Great Recession
Comment 4: Model dependent results

- For the first 70% of the sample, the correlation is 0.37
- The difference was 0.8% at the beginning
- Different cyclical behaviors
For the first 70% of the sample, the correlation is -0.57
The difference was 4.8% at the largest
Comment 4: Model dependent results

- $r^*$ is much more volatile than the other two series
- There is hardly a common pattern across the three
Comment 4: Should the natural rate of interest be more volatile than observed rates?

The variance of $r^*$ is 3 times the variance of $r$. 
Conclusion

Overall, this is a very interesting, timely, and well written paper!

- Comment 1: downward trend in expectation.
- Comment 2: is very negative nominal $r^*$ a shadow rate?
- Comment 3: there isn’t a trend in convenience yield in the data.
- Comment 4: model dependent results.