Learning the Macro-Dynamics of U.S. Treasury Yields

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Rigorous modeling of learning about price dynamics is hard

Past and future market participants also learn; need to account for learning dynamics in setting prices

Reduced-form term structure model bypasses much of this difficulty

Paper argues model-based forecasts are (mostly) similar to median professional survey forecast

… but model-based forecasts can do better if macro info is incorporated

Models and professionals differ in implied dynamics of expected excess returns to long-term bonds
Learning (in the model)

- Dynamics

  (Simplified version)

  Assume reduced-form yield dynamics through $t$, including learning about macro dynamics, prices that depend on expectations of future learning, are approximated by a first-order, low-dimension VAR estimated at $t$

- Fit $n$ yields to VAR through $t$ to get params

- Yields on other bonds determined by restricted interpolation
No-arbitrage restrictions

- Paper finds that no-arb curve-fitting function varies little over the sample
- Can think of learning as continually updating estimates of the VAR, don’t worry about interaction between learning and no-arb restrictions – very nice empirical result
Blue Chip versus model-based forecasts

Paper’s conclusions

- Similar forecasts when model uses recursive least-squares estimation
- Models are more accurate when
  - They downweight older observations
  - They incorporate macro data in the VAR

My interpretation of the same evidence

- Blue Chip, model-based forecasts differ substantially
- Model-based are more accurate because of known features of survey forecasts
Blue Chip, JSZ model forecasts

Overview
Methodology
Forecast comparison

One quarter ahead

Four quarters ahead
## Root mean squared forecast differences and errors

Basis points, annualized yields

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<th>Diff/Error</th>
<th>Method</th>
<th>Horizon</th>
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<th>5 yr</th>
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Decomposing forecast errors

\[ \text{survey forecast error}_t = \text{JSZ forecast error}_t - \left( \text{survey forecast}_t - \text{JSZ forecast}_t \right) \]

\[ \text{RMSE}_{BC}^2 = \text{RMSE}_{JSZ}^2 + \text{RMSD}_{BC,JSZ}^2 - 2\bar{\Pi}(\text{JSZ error, forecast diff}) \]

Five-year yield, one and four quarters ahead (normalize by LHS)

\[ 1 = 0.755 + 0.210 + 0.035; \quad 1 = 0.872 + 0.125 + 0.002 \]

Replace JSZ with JPS

\[ 1 = 0.699 + 0.274 + 0.027; \quad 1 = 0.725 + 0.335 - 0.060 \]
Survey bias 1: Slow adjustment

- Coibion and Gorodnichenko: mean forecasts from surveys are sluggish (informational rigidities?)

- Serial correlations of monthly changes in forecasts of ten-year yield
  - Blue Chip: 0.32 (one-Q-ahead), 0.35 (four-Q-ahead)
  - JSZ model: 0.02 (one-Q-ahead), 0.00 (four-Q-ahead)
  - JPS model: 0.07 (one-Q-ahead), 0.08 (four-Q-ahead)
Survey bias 2: Excess persistence

- Piazzesi/Salomao/Schneider (Trend and cycle in bond premia): survey forecasts imply much higher persistence of slope than models imply

\[ \hat{E}_t(\text{slope}_{t+4\text{ quarters}}) = a + b \text{slope}_t + e_t \]

- Point estimates of \( b \): Blue Chip, 0.82; JSZ model, 0.71; JPS model, 0.70
- Replace LHS with realized slope: \( b = 0.56 \)
Forecasting the slope of the term structure

- Black line: actual slope
- Blue line: Blue Chip 4-Q-ahead forecast of slope
- Red line: JSZ model 4-Q-ahead forecast of slope
The slope and expected excess returns

- Models: Steep slope implies high, transitory expected excess returns to long-maturity bonds

- Blue Chip: Steep slow implies moderately high, long-lived expected excess returns to long-maturity bonds
Conclusions

- Result that no-arb pricing function varies little over the long sample is surprising and useful

- Comparison with Blue Chip survey forecasts is too sympathetic to the survey forecasts