Discussion to:
Constructing the Term Structure of Uncertainty from the Ragged Edge of SPF Forecasts

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Conference on Real-Time Data Analysis, Methods, and Applications

October 08, 2022

Summary of the Paper

'Constructing the Term Structure of Uncertainty...

- The paper focuses on the term structure of expectations of key macroeconomic aggregates and the surrounding uncertainty
  - by focusing primarily on the nowcast errors and forecast updates hidden in SPF based predictions,
  - by decomposing observed (and missing) predictions into a sequence of nowcast errors and updates with a term structure.
- Consider the decomposition

$$
\begin{aligned}
y_{t+h} - y_{t+h|t} &\equiv y_{t+h} - y_{t+h|t+h} + y_{t+h|t+h} - y_{t+h|t+h-1} \\
&+ y_{t+h|t+h-1} - y_{t+h|t+h-2} + \cdots \\
&- y_{t+h|t+1} + y_{t+h|t+1} - y_{t+h|t} \\
&= e_{t+h} + \sum_{i=1}^{h} \mu_{t+h|t+i}
\end{aligned}
$$

Summary of the Paper

'Constructing the Term Structure of Uncertainty...

- Transform this into a state-space model to extract the term structure of the expectations and uncertainty

$$Y_t = FY_{t-1} + \eta_t$$

where
$$\begin{aligned} \eta_t &= (e_{t-1}, \mu_{t|t}, \mu_{t+1|t}, \ldots, \mu_t^*)' \\ Y_t &= (y_{t-1}, y_{t|t}, y_{t+1|t}, \ldots, y_{t+H|t})' \end{aligned}$$

- The unobserved part of the Y_t is estimated in the state-space framework.
  These generate the full term structure of expectations.

- The measurements, which are raw SPF predictions, can be transformed into the desired form as

$$Z_t = C_t Y_{t-1}$$

where Z_t contains all available readings from the SPF and C_t is a known matrix of required transformation.

Summary of the Paper

'Constructing the Term Structure of Uncertainty...

- Once the term structure of forecast errors are identified, it can be elaborated in many ways
  - Martingale Difference Sequence (MDS):

$$\begin{aligned} \eta_t &\sim N(0, \lambda_t \Sigma) \\ \log \lambda_t &= \delta \log \lambda_{t-1} + v_t \end{aligned}$$

  - Non-MDS Generalization

$$\begin{aligned} \eta_t &= G\eta_{t-1} + \varepsilon_t \\ \varepsilon_t &\sim N(0, \lambda_t \Sigma) \\ \log \lambda_t &= \delta \log \lambda_{t-1} + v_t \end{aligned}$$

- λ_t**diag**(Σ) **is the key ingredient in the full term structure of uncertainty.**

Brief Summary of the Paper

'Constructing the Term Structure of Uncertainty...

- Tilt the final predictive distribution obtained from this model, using average density prediction provided by the SPF,
- Entropic tilting
  - Find such a density that is closest to the predictive density (in terms of entropy measure) obtained from the model,
  - and that has the moment conditions of the average density prediction provided by the SPF
  - A very clever use of SPF density predictions: Use full information provided by the density prediction: That is, use bin specific probabilities and the mean of the distribution.
  - Modify the model predictive distribution according to the information regarding the bins provided by the SPF density predictions.

Results

- Time variation in volatility
  - Great moderation is nicely captured,
  - Volatility is cyclical,
  - Volatility of the forecast updates at different horizons has much in common,
- Term structure of expectations
  - Fixed event forecasts are useful in forming long horizon expectations,

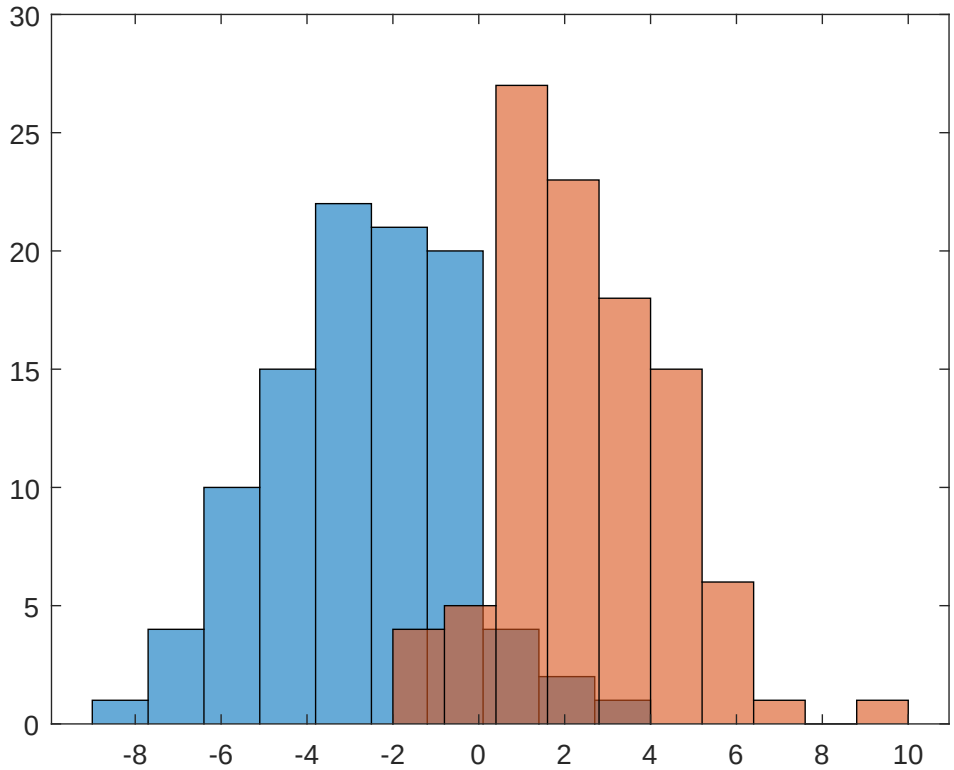
Results - II

- Term structure of uncertainty
  - The availability of annual forecasts at long horizons appears to help narrow the estimated forecast uncertainty.
  - Forecast uncertainty tends to rise with the forecast horizon and after a threshold it tends to stabilize.
- Tilting using SPF density predictions
  - Seems to add little in terms of predictive gains beyond stochastic volatility,
  - Leads to changes in the term structure of uncertainty.

Comments - 1

- The model uses averages of individual SPF predictions, which might lead to loss of some potential information due to multi-modality.
- The parts that have relatively little weight in individual histograms might have relatively more weight in the average histogram.

Figure: Example with generated data



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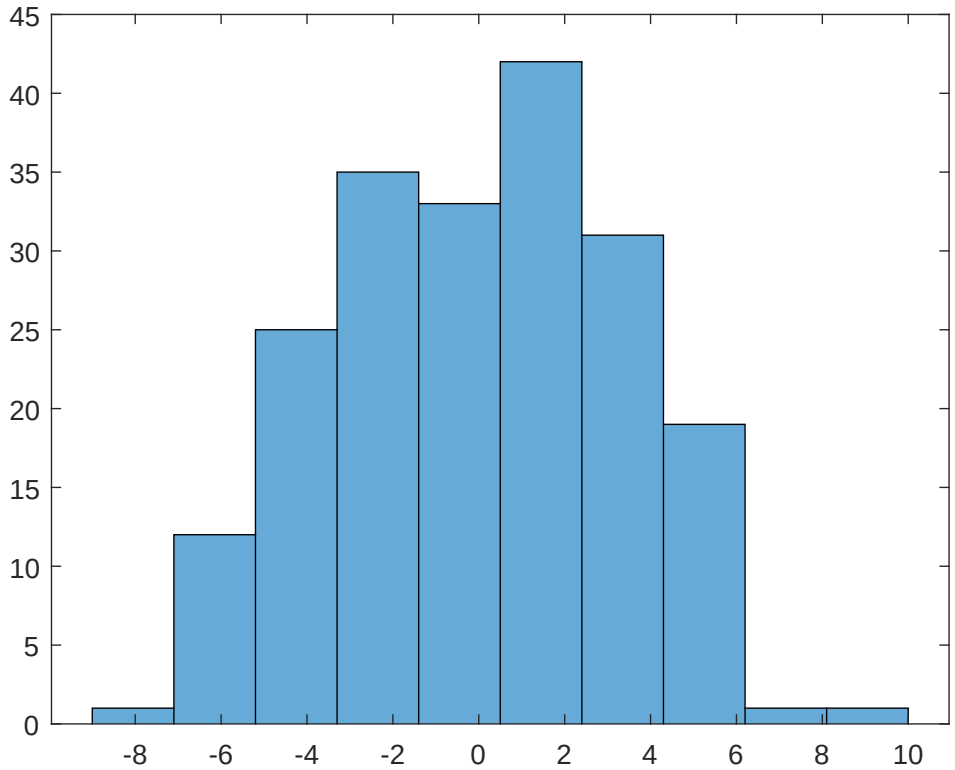
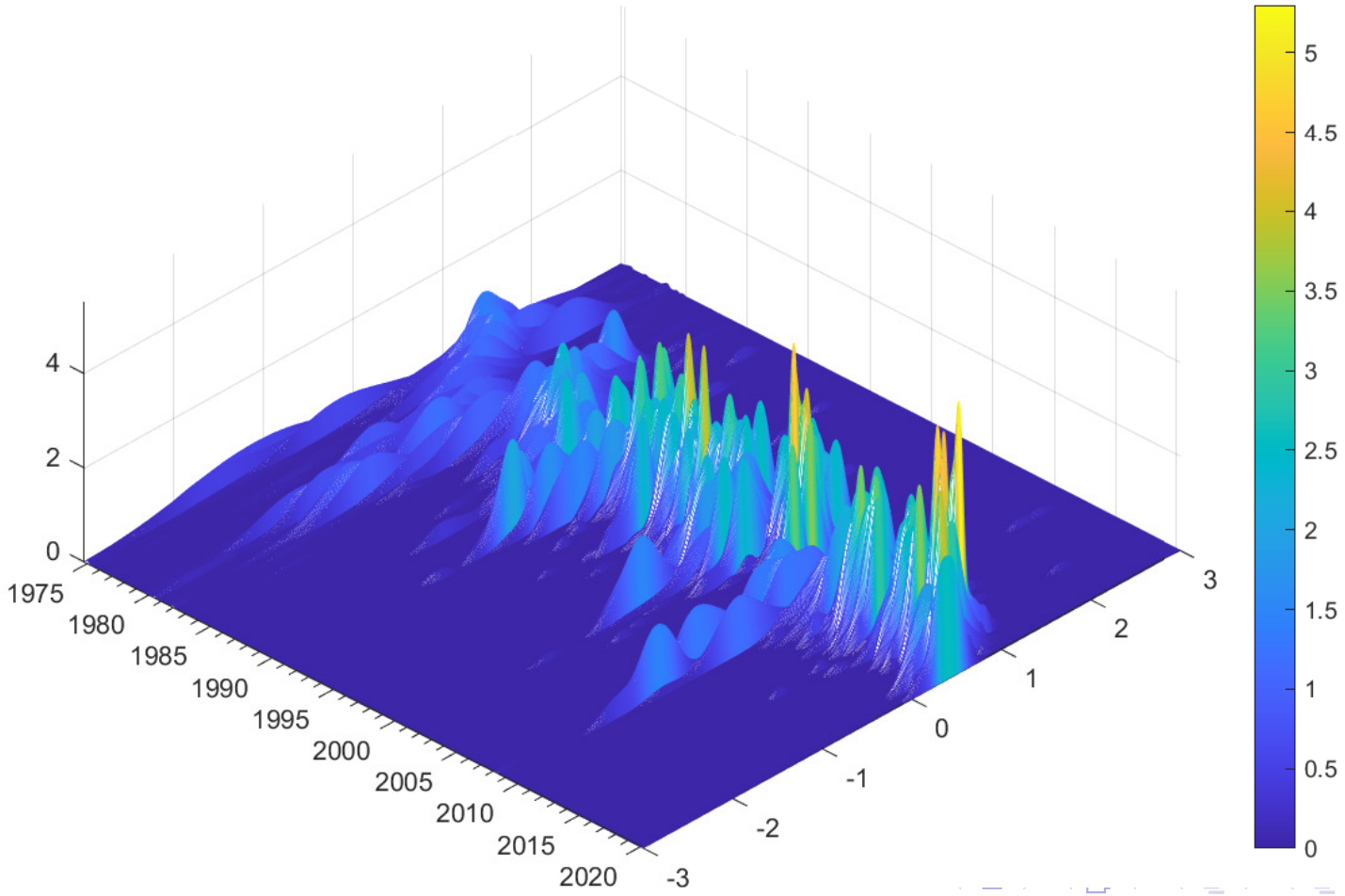


Comments - 1

- Perhaps one might use the distribution implied by the SPF point forecasts.

Figure: The distribution of the SPF based point nowcast of RGDP growth 1975-2019



Comments - 1b

- Closely related, there might also be a lot noise in these probabilities attached to some bins

Figure: The difference between means of SPF point and density predictions

Comments - 2

- Tilting could be extended to include the SPF density predictions' implied variance,
- The idea of tilting using the moments conditions derived from information in the bins can be extended to include either
  - the second moment of the average SPF predictive density,
  - the average of the second moment from individual predictive densities.

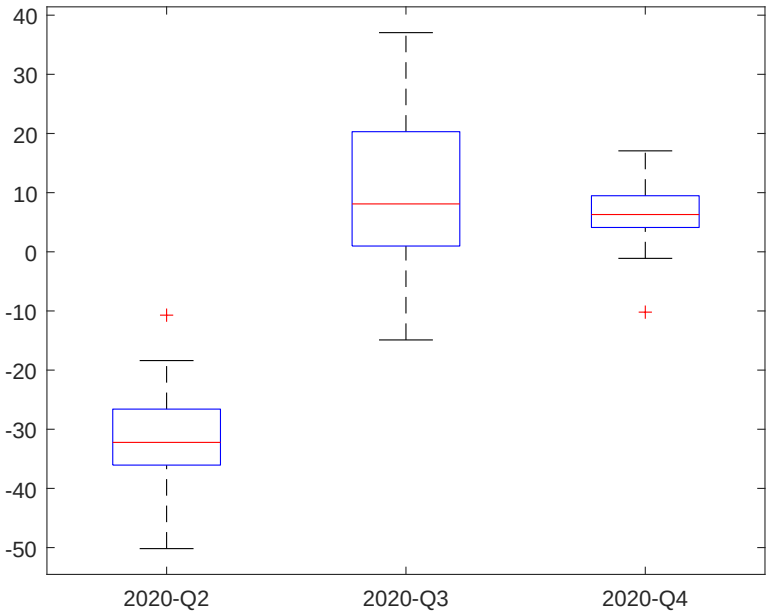
$$\bar{g} \equiv (\bar{p}_t', \bar{m}_t', , \bar{v}_t')'$$

- This might be especially appealing for the second and third quarters of 2020 when the uncertainty had peaked.
- Given that the model involves time variation in volatility the second moments of the predictive density might bear valuable information.

Comments - 3

- Disagreement (cross sectional variation) vs. uncertainty

Figure: Distribution of SPF point predictions in 2020-Q2 survey

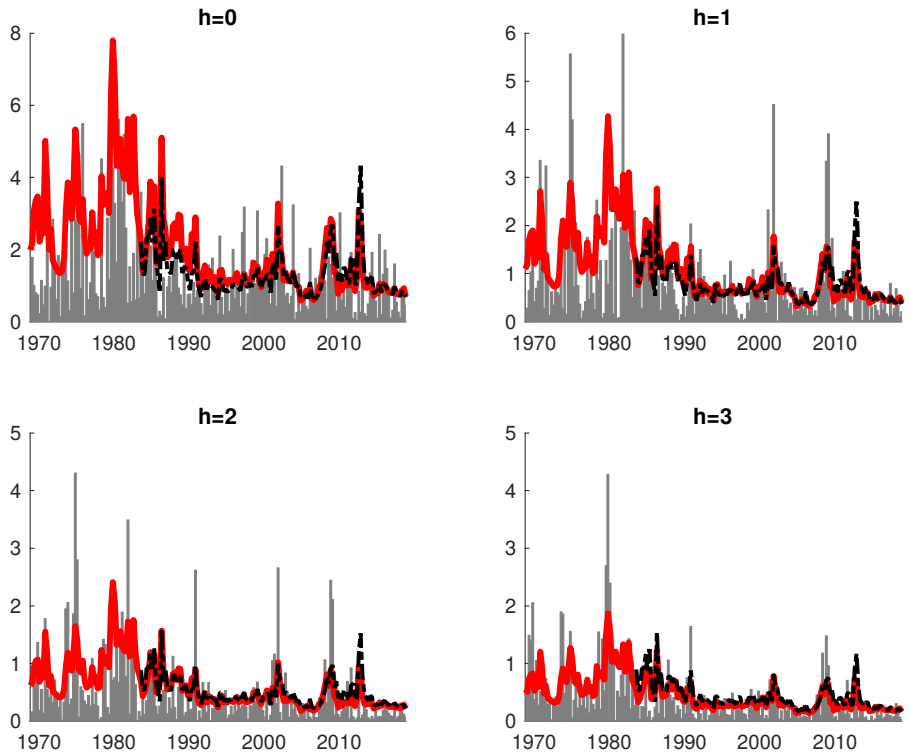


- While disagreement often has downward sloping term structure it might provide valuable information at times of large shocks, specifically for the nowcast uncertainty.

Comments - 4

- There could be more emphasis on the term structure of uncertainty through modelling of forecast updates volatility.

Figure: Stochastic volatility estimates for GDP growth forecast updates, observed part of η_t



Comments - 4

- There could be more emphasis on the term structure of uncertainty through modelling of forecast updates volatility.
- The average shape of forecast updates' term structure seems to be downward sloping but the shape itself could be time varying, i.e.,
  - the degree of the slope might be changing, during 2020-Q2, for example.
- In its current form, $\lambda_t \text{diag}(\Sigma)$ only has the common 'level' and the slope is fixed in the variation of the diagonal elements of the covariance matrix.
- Consider the term structure of sovereign bonds for example, why not a second factor for the slope.