

Discussion of “Multivariate Bayesian Predictive Synthesis in Macroeconomic Forecasting”

by Xuguang Simon Sheng

American University

June 18, 2018

Summary of the Paper

- Build on McAlinn and West (2018, JoE) “Dynamic Bayesian predictive synthesis (BPS) in time series forecasting.”

Summary of the Paper

- Build on McAlinn and West (2018, JoE) “Dynamic Bayesian predictive synthesis (BPS) in time series forecasting.”
- Extend univariate BPS to the multivariate setting

Summary of the Paper

- Build on McAlinn and West (2018, JoE) “Dynamic Bayesian predictive synthesis (BPS) in time series forecasting.”
- Extend univariate BPS to the multivariate setting
- Propose a new BPS methodology for a specific subclass of the dynamic multivariate latent factor models

Summary of the Paper

- Build on McAlinn and West (2018, JoE) “Dynamic Bayesian predictive synthesis (BPS) in time series forecasting.”
- Extend univariate BPS to the multivariate setting
- Propose a new BPS methodology for a specific subclass of the dynamic multivariate latent factor models
- Advantages of the new method: evaluating and accounting for time-varying
 - forecast bias of point forecast;
 - mis-calibration of density forecasts;
 - interdependencies among agents over multiple series.

Summary of the Paper

- Build on McAlinn and West (2018, JoE) “Dynamic Bayesian predictive synthesis (BPS) in time series forecasting.”
- Extend univariate BPS to the multivariate setting
- Propose a new BPS methodology for a specific subclass of the dynamic multivariate latent factor models
- Advantages of the new method: evaluating and accounting for time-varying
 - forecast bias of point forecast;
 - mis-calibration of density forecasts;
 - interdependencies among agents over multiple series.
- Show encouraging empirical evidence on forecasting 6 macro variables using 5 VAR models

Summary of the Paper

- Build on McAlinn and West (2018, JoE) “Dynamic Bayesian predictive synthesis (BPS) in time series forecasting.”
- Extend univariate BPS to the multivariate setting
- Propose a new BPS methodology for a specific subclass of the dynamic multivariate latent factor models
- Advantages of the new method: evaluating and accounting for time-varying
 - forecast bias of point forecast;
 - mis-calibration of density forecasts;
 - interdependencies among agents over multiple series.
- Show encouraging empirical evidence on forecasting 6 macro variables using 5 VAR models
- Great paper!

Forecast Combination

- Bates and Granger (1969) have inspired extensive research on combining forecasts.

Forecast Combination

- Bates and Granger (1969) have inspired extensive research on combining forecasts.
- In his book (2012), forecaster Nate Silver urges readers to be “more foxy” by combining [lots of] information.

the signal and the noise and the noise and the noise and the noise and the noise why so many predictions fail – but some don't

nate silver noise

6/15/2018

2018 World Cup Predictions | FiveThirtyEight

FiveThirtyEight



2018 World Cup Predictions

Soccer Power Index (SPI) ratings and chances of advancing for every team, updating live.

[How this works](#) [Find out which team you should root for](#) [ESPN coverage](#)

Standings

Matches

TEAM	GROUP	TEAM RATING			KNOCKOUT STAGE CHANCES				
		SPI	OFF.	DEF.	MAKE ROUND OF 16	MAKE QUARTER-FINALS	MAKE SEM-FINALS	MAKE FINAL	WIN WORLD CUP
Uruguay 3 pts.	A	80.0	23	08	94%	36%	16%	6%	2%
Russia 3 pts.	A	72.3	20	08	92%	35%	15%	5%	2%
Egypt 0 pts.	A	61.4	18	09	12%	2%	<1%	<1%	<1%
Saudi Arabia 0 pts.	A	48.8	14	13	3%	<1%	<1%	<1%	<1%
Spain 0 pts.	B	91.3	32	05	87%	68%	46%	28%	17%
Portugal 0 pts.	B	83.5	24	05	70%	44%	24%	11%	5%

https://projects.fivethirtyeight.com/2018-world-cup-predictions/?ex_cid=promo

1/5

Combine Information or Combine Forecasts?

- Consider forecasting π . Each agent $i = 1, \dots, N$ faces two signals

Combine Information or Combine Forecasts?

- Consider forecasting π . Each agent $i = 1, \dots, N$ faces two signals
 - a public signal: $y = \pi + \eta$ with precision h , and a private signal: $z_i = \pi + \epsilon_i$, with precision s .

Combine Information or Combine Forecasts?

- Consider forecasting π . Each agent $i = 1, \dots, N$ faces two signals
 - a public signal: $y = \pi + \eta$ with precision h , and a private signal: $z_i = \pi + \epsilon_i$, with precision s .
 - Assuming normality, the precision of agent i 's forecast is $h + s$.

Combine Information or Combine Forecasts?

- Consider forecasting π . Each agent $i = 1, \dots, N$ faces two signals
 - a public signal: $y = \pi + \eta$ with precision h , and a private signal: $z_i = \pi + \epsilon_i$, with precision s .
 - Assuming normality, the precision of agent i 's forecast is $h + s$.
 - The precision of mean (or consensus) forecast is

$$\frac{(h + s)^2}{h + s/N} = h + s + \frac{(N - 1)s(h + s)}{Nh + s} = h + Ns - \frac{(N - 1)^2hs}{Nh + s}$$

Combine Information or Combine Forecasts?

- Consider forecasting π . Each agent $i = 1, \dots, N$ faces two signals
 - a public signal: $y = \pi + \eta$ with precision h , and a private signal: $z_i = \pi + \epsilon_i$, with precision s .
 - Assuming normality, the precision of agent i 's forecast is $h + s$.
 - The precision of mean (or consensus) forecast is

$$\frac{(h + s)^2}{h + s/N} = h + s + \frac{(N - 1)s(h + s)}{Nh + s} = h + Ns - \frac{(N - 1)^2hs}{Nh + s}$$

- The precision of the optimal forecast by combining all public and private information is $h + Ns$. See Kim, Lim and Shaw (2001).

Combine Information or Combine Forecasts?

- Consider forecasting π . Each agent $i = 1, \dots, N$ faces two signals
 - a public signal: $y = \pi + \eta$ with precision h , and a private signal: $z_i = \pi + \epsilon_i$, with precision s .
 - Assuming normality, the precision of agent i 's forecast is $h + s$.
 - The precision of mean (or consensus) forecast is

$$\frac{(h + s)^2}{h + s/N} = h + s + \frac{(N - 1)s(h + s)}{Nh + s} = h + Ns - \frac{(N - 1)^2hs}{Nh + s}$$

- The precision of the optimal forecast by combining all public and private information is $h + Ns$. See Kim, Lim and Shaw (2001).
- Implication 1: Mean forecast is more precise than individual forecast, since $h + s + \frac{(N-1)s(h+s)}{Nh+s} > h + s$.

Combine Information or Combine Forecasts?

- Consider forecasting π . Each agent $i = 1, \dots, N$ faces two signals
 - a public signal: $y = \pi + \eta$ with precision h , and a private signal: $z_i = \pi + \epsilon_i$, with precision s .
 - Assuming normality, the precision of agent i 's forecast is $h + s$.
 - The precision of mean (or consensus) forecast is

$$\frac{(h + s)^2}{h + s/N} = h + s + \frac{(N - 1)s(h + s)}{Nh + s} = h + Ns - \frac{(N - 1)^2hs}{Nh + s}$$

- The precision of the optimal forecast by combining all public and private information is $h + Ns$. See Kim, Lim and Shaw (2001).
- Implication 1: Mean forecast is more precise than individual forecast, since $h + s + \frac{(N-1)s(h+s)}{Nh+s} > h + s$.
- Implication 2: Mean forecast is less precise than the optimal forecast, since $h + Ns - \frac{(N-1)^2hs}{Nh+s} < h + Ns$.

Combine Information or Combine Forecasts?

- Consider forecasting π . Each agent $i = 1, \dots, N$ faces two signals
 - a public signal: $y = \pi + \eta$ with precision h , and a private signal: $z_i = \pi + \epsilon_i$, with precision s .
 - Assuming normality, the precision of agent i 's forecast is $h + s$.
 - The precision of mean (or consensus) forecast is

$$\frac{(h + s)^2}{h + s/N} = h + s + \frac{(N - 1)s(h + s)}{Nh + s} = h + Ns - \frac{(N - 1)^2hs}{Nh + s}$$

- The precision of the optimal forecast by combining all public and private information is $h + Ns$. See Kim, Lim and Shaw (2001).
- Implication 1: Mean forecast is more precise than individual forecast, since $h + s + \frac{(N-1)s(h+s)}{Nh+s} > h + s$.
- Implication 2: Mean forecast is less precise than the optimal forecast, since $h + Ns - \frac{(N-1)^2hs}{Nh+s} < h + Ns$.
- Related to the current paper, each agent i provides a density forecast $h_i(\pi)$. Given that these density forecasts are [highly] correlated, the policy maker should combine the information behind these forecasts.

Policy Maker's Loss Function

- Alan Greenspan pointed out that the monetary policy should be conducted in such a way that the associated uncertainty is minimized with respect to all scenarios.

Policy Maker's Loss Function

- Alan Greenspan pointed out that the monetary policy should be conducted in such a way that the associated uncertainty is minimized with respect to all scenarios.
- When squared losses are used in forming expectations, the forecast by the i^{th} forecaster is given by $F_{it} = E(\pi_t | I_{it-h})$, and its associated uncertainty is defined as $E[\pi_t - E(\pi_t | I_{it-h}) | I_{it-h}]^2$.

Policy Maker's Loss Function

- Alan Greenspan pointed out that the monetary policy should be conducted in such a way that the associated uncertainty is minimized with respect to all scenarios.
- When squared losses are used in forming expectations, the forecast by the i^{th} forecaster is given by $F_{it} = E(\pi_t | I_{it-h})$, and its associated uncertainty is defined as $E[\pi_t - E(\pi_t | I_{it-h}) | I_{it-h}]^2$.
- Individual uncertainty of this form has been used by Jurado, Ludvigson and Ng (2015) to construct macro uncertainty.

Policy Maker's Loss Function

- Alan Greenspan pointed out that the monetary policy should be conducted in such a way that the associated uncertainty is minimized with respect to all scenarios.
- When squared losses are used in forming expectations, the forecast by the i^{th} forecaster is given by $F_{it} = E(\pi_t | I_{it-h})$, and its associated uncertainty is defined as $E[\pi_t - E(\pi_t | I_{it-h}) | I_{it-h}]^2$.
- Individual uncertainty of this form has been used by Jurado, Ludvigson and Ng (2015) to construct macro uncertainty.
- Given individual uncertainty, the policy maker's loss function can be formulated as

$$\min_{\omega_{i(t-h)}} \sum_{i=1}^n \omega_{i(t-h)} E[\pi_t - E(\pi_t | I_{it-h}) | I_{it-h}]^2.$$

Policy Maker's Loss Function

- Alan Greenspan pointed out that the monetary policy should be conducted in such a way that the associated uncertainty is minimized with respect to all scenarios.
- When squared losses are used in forming expectations, the forecast by the i^{th} forecaster is given by $F_{it} = E(\pi_t | I_{it-h})$, and its associated uncertainty is defined as $E[\pi_t - E(\pi_t | I_{it-h}) | I_{it-h}]^2$.
- Individual uncertainty of this form has been used by Jurado, Ludvigson and Ng (2015) to construct macro uncertainty.
- Given individual uncertainty, the policy maker's loss function can be formulated as

$$\min_{\omega_{i(t-h)}} \sum_{i=1}^n \omega_{i(t-h)} E[\pi_t - E(\pi_t | I_{it-h}) | I_{it-h}]^2.$$

- The key is to realize that the uncertainty faced by a policy maker in using the average forecast is the uncertainty associated with a typical forecaster of the panel; see, Lahiri, Peng and Sheng (2018).

Sources of Uncertainty

- Draper (1995) identifies three sources of uncertainty:
 - Scenario uncertainty: the inputs to the models
 - Model uncertainty: how to translate inputs into forecasts
 - Predictive uncertainty: conditional on the scenario and model

Sources of Uncertainty

- Draper (1995) identifies three sources of uncertainty:
 - Scenario uncertainty: the inputs to the models
 - Model uncertainty: how to translate inputs into forecasts
 - Predictive uncertainty: conditional on the scenario and model
- The current paper considers both model and predictive uncertainty.

Sources of Uncertainty

- Draper (1995) identifies three sources of uncertainty:
 - Scenario uncertainty: the inputs to the models
 - Model uncertainty: how to translate inputs into forecasts
 - Predictive uncertainty: conditional on the scenario and model
- The current paper considers both model and predictive uncertainty.
- Scenario uncertainty is important: a case study

Sources of Uncertainty

- Draper (1995) identifies three sources of uncertainty:
 - Scenario uncertainty: the inputs to the models
 - Model uncertainty: how to translate inputs into forecasts
 - Predictive uncertainty: conditional on the scenario and model
- The current paper considers both model and predictive uncertainty.
- Scenario uncertainty is important: a case study

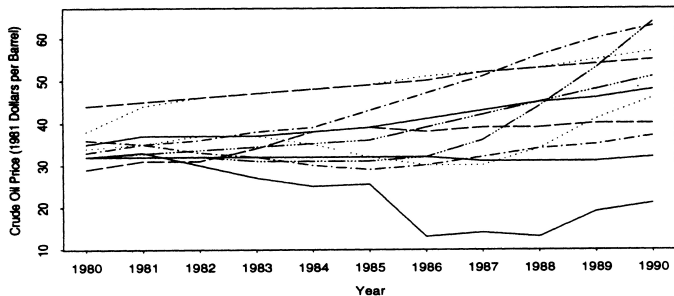
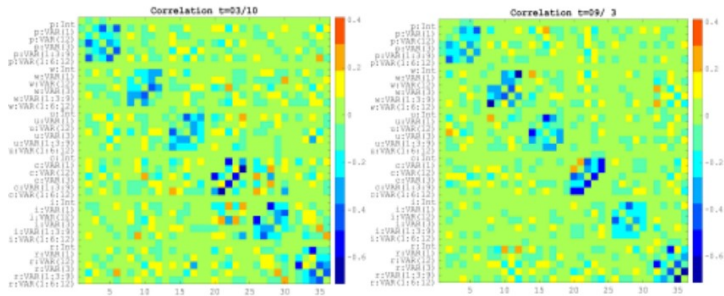


Fig. 1. Forecasts of the price of oil by each of the 10 EMF models under the reference scenario, 1980-90: the lower full curve is the actual price

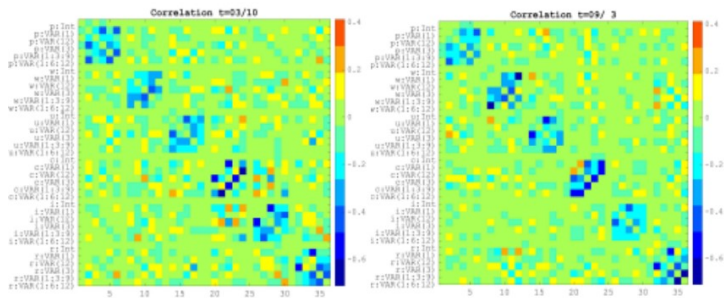
Measuring Interdependence across Agents/Variables

- Comparing estimates of interdependence of 2003 vs. 2009



Measuring Interdependence across Agents/Variables

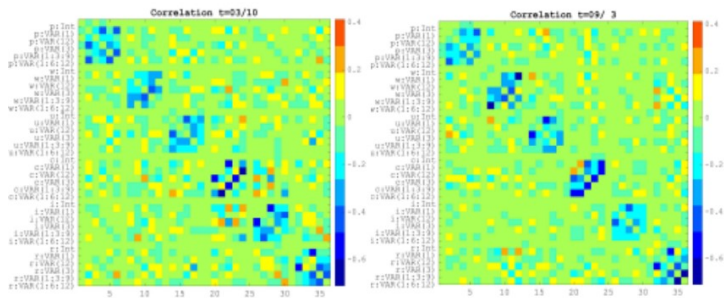
- Comparing estimates of interdependence of 2003 vs. 2009



- Hard to see any systematic difference between the two graphs.

Measuring Interdependence across Agents/Variables

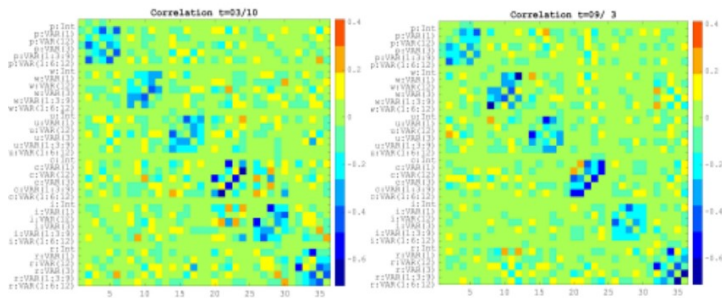
- Comparing estimates of interdependence of 2003 vs. 2009



- Hard to see any systematic difference between the two graphs.
- Propose some summary statistics, e.g. dependence between agent i and j for the same variable; between variables for the same agent.

Measuring Interdependence across Agents/Variables

- Comparing estimates of interdependence of 2003 vs. 2009



- Hard to see any systematic difference between the two graphs.
- Propose some summary statistics, e.g. dependence between agent i and j for the same variable; between variables for the same agent.
- Explore the connection between changes in the interdependence pattern and regime changes in the economy.

Minor Comments on Empirical Study

- Use real-time dataset, e.g. considering large revisions in consumption

Minor Comments on Empirical Study

- Use real-time dataset, e.g. considering large revisions in consumption
- Consider the random walk model as the benchmark; see Faust and Wright (2013) that in forecasting inflation, ridiculously simple forecasts are hard to beat.

Minor Comments on Empirical Study

- Use real-time dataset, e.g. considering large revisions in consumption
- Consider the random walk model as the benchmark; see Faust and Wright (2013) that in forecasting inflation, ridiculously simple forecasts are hard to beat.
- Compare the BPS forecasts with those of experts; see Ang, Bekaert and Wei (2007) that survey inflation forecasts are generally more accurate than model-based forecasts.