Discussion on: Financial and Macroeconomic Data Through the Lens of a Nonlinear Dynamic Factor Model

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Framework and Contribution

Goal: study the role of exogenous shocks and internal propagation in driving the fluctuations of macro and/or financial data

Model: nonlinear dynamic factor model

Contributions:

- state and measurement equations $\rightarrow$ nonlinear dynamics
- IRFs $\rightarrow$ allowed to be asymmetric, state-dependent, and size-dependent
- predictive distributions $\rightarrow$ account for time-varying volatility and asymmetric tail risks

Applications:

- US Shadow rate during ELB period;
- US Credit Cycle across 4 macro-sectors.

Section 1

Comments: question/issue (**Q**), hint/suggestion (**H**)

- **Q**: sometimes a bit too vague (e.g., "*IRFs are different*")
  H: clarify the sentence(s); suggest an interpretation; provide an example
- **Q**: IRFs: which one(s) of these features are not captured by more standard models?
  H: make a comparison w.r.t. the literature; highlight what is new
- **Q**: the model specification is stated too concisely, focusing on its implications
  H: provide few more details on it
- **Q**: literature on Bayesian DFM?
- **Q**: what is meant by "*predictive densities with time-varying volatility and asymmetric tail risk are key properties of the macro data*"?
- **Q**: footnote 1: $\Psi(L)$ not defined.

Section 2

- **Q**: Model: what are the differences w.r.t. Kim et al. (2008) and Andreasen et al. (2017)?
  H: Is it the same approximation, but applied to a different model?
- **Q**: Section 2.3 should be clarified...
  H: specify the nonlinear measurement equation or make a precise cross-reference; provide narrative examples for the multiplicative case; ...

H: Clarify the size of y_t and f_t in Eq.(2)

H: what about using a shrinkage prior on the coefficient $h_x x$ to perform data-driven selection of (non)linear factor dynamics?

Section 2 – Estimation

- **Q**: Motivation for preferring one algorithm over the other?
  H: Suggest some guidelines. Also, a simulation study may help to make this statement and to convince the reader.
- **Q**: Metropolis-Hastings with Boostrap filter. I believe the following elements deserve a clarification:
  - why 50 draws per block per each iteration instead of 1?
  - computation of $S_{i,1}$
  - decay of the scaling parameters
  - why are both $S_{i,1}$ and $S_{i,2}$ needed?
  - how is inference made on the latent states $\{f_t\}_t$?
- **Q**: Particle Gibbs: why not an adequate prior on h_x to impose stationarity?
  H: Since Gibbs is used, it would be simple to specify. For instance, one could use a truncated Normal or transformed Beta.
- **Q**: Apdx B: which are the burn-in and thinning values? Have the authors performed some convergence diagnostic checks?

H: What about using a shrinkage prior on the coefficient h_{xx} to perform data-driven selection of (non)linear factor dynamics?

Section 3

- **Q**: What is the difference between IRF in Eq. (21) and Generalized IRF?
- **Q**: Example of IRF:
  - More details about the DGP?
  - What is the purpose of the example?
  - What is the motivation for this example?

  H: in some macro/financial application one may expect more persistence IRF to a negative shock...
- **Q**: Figure 3: what is an explanation for the "overshooting" at horizon 2,3?
- **Q**: Figure 4: the deviation from the the Normal seems quite small. Moreover, how does the skewness depend on parameters?

  H: Try to re-run the simulation with other values of h_{xx}.
- **Q**: How are the shortfall and longrise defined? Are they some quantiles of...which distribution?
- **Q**: Multivariate state: how many factors are manageable? What challenges are there for $q > 1$ factors?

  H: Computationally, the algorithms will require substantial changes or just take longer?

Section 4 – Shadow rate

- **Q**: Estimation:
  - why that many particles?
  - high ACF for which parameter?
  - what it the MH propsoal + acc. rate?
- **Q**: Did the authors encounter any numerical issue in computing the marginal likelihood? Did they use the output of the particle filter?
- **Q**: Figure 7: the (point) estimates are similar. In the nonlinear model, during the gray area, is the CI suggesting the factor is not significantly different from 0?

  H: What about plotting the two filtered estimates together and/ore report their correlation?
- **Q**: Figure 8: could it be better explained? Specifically:
  - 3-month: nonlinear under-estimates; linear over-estimates, but seems to have higher correlation.
  - 10-year: nonlinear seems to have high correlation in ELB; linear not.
  - What are Wu and Xia (2016) doing? Why do their model it seem better?

Section 4 – Credit Cycle

- **Q**: Seems a descriptive analysis showing the main implications of the model. Specifically, I found it hard to understand:
  - What is the goal?
  - Which model is best?
- **Q**: Estimation:
  - Why a different algorithm is used? Was the previous performing worse or too computational intensive?
  - Why so large burn-in and thinning?
  - What is the computational time?
- **Q**: Figure 10: is the blue line corresponding to a linear DFM or does it have a nonlinear measurement equation?
- **Q**: Figure 10: what is the practical implication? The difference between the two cases seems tiny...

  H: Apply a model selection criterion to choose the "best" model.
- **Q**: Figure 11-12: both seem rather symmetric (wrt +/- shocks)...
- **Q**: I was unable to find the results of the "two historical episodes in which the model estimates large shocks: 1980:Q2 and 2008:Q2".

Other Questions & Hints

- What about forecasting?
- Few typos
- **H**: Highlight the advantages of the proposed model by strengthening the application to Credit Cycle or consider a different one.
- **H**: Change the style of the horizontal line at 0 to avoid ambiguity with the other curves.

Conclusion

Congratulations, nice paper!