

**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 → nonlinear dynamics
- IRFs → allowed to be asymmetric, state-dependent, and size-dependent
- predictive distributions → 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 Bootstrap 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 is the MH proposal + 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/or 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 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.

Congratulations, nice paper!