

Paper discussion  
State-Dependent Macroeconomic Policy Effects:  
A Varying-Coefficient VAR

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Advanced analytics:  
new methods and applications for macroeconomic policy  
21-22 July 2022, Bank of England

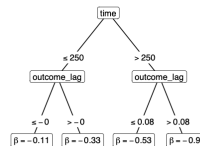
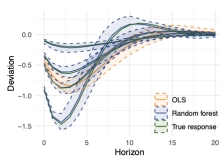
# Recap on key methods

Macroeconomic Random Forest

MACRO  
RANDOM  
FOREST

R v4.0.5 python v3 MRF v1.0.0 Maintained? yes

(c) Endogenous and exogenous change



# Key methods

- Varying Coefficient VAR

$$y_t = \beta_t \varepsilon_t^{PolicyShock} + x_t^T \gamma_t + u_t$$

where  $x_t$  is the control vector.

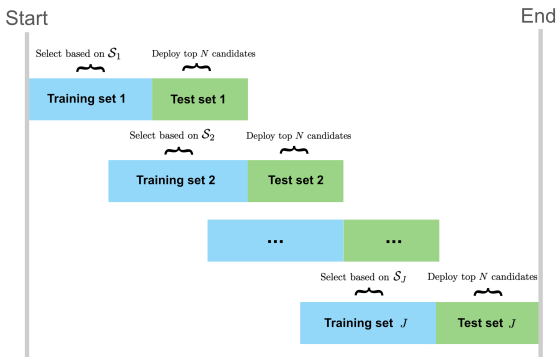
- Policy coefficient modelling:  $\beta_t$  as a tree function of economic inputs.
- Standard Random Forest algorithm (Buergin and Ritschard 2017) <sup>1</sup>
- Obtained state-dependent Impulse Response Function for policy analysis

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<sup>1</sup>Buergin, R. A. & Ritschard, G. (2017). Coefficient-wise tree-based varying coefficient regression with vcpart. *Journal of Statistical Software*, 80(6), 1–33.

# Estimating time-varying relationships

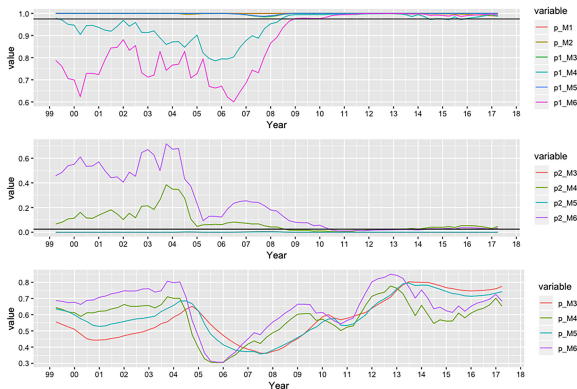
Consider adaptive methods of model determination or ensembling, such as Yang and Lucas (2022)<sup>2</sup>



<sup>2</sup>Yang, P. R. & Lucas, R.(2022). DMS, AE, DAA: methods and applications of adaptive time series model selection, ensemble, and financial evaluation. arXiv:2110.11156v3.

# Interpreting time-varying relationships

## Example: adaptive methods on yield curve <sup>3</sup>



<sup>3</sup>Yang, P. R. (2020). Using the yield curve to forecast economic growth. Journal of Forecasting, 39: 1057– 1080. <https://doi.org/10.1002/for.2676>

# Robust estimation and user-algorithm interactions

- In this paper:

$$(\hat{C}_m, \hat{\beta}_m)_{m \in [M]} = \arg \min_{(C_m, \beta_m)_{m \in [M]}} \sum_{t \in [T]} (y_t - \hat{y}_t((C_m, \beta_m)_{m \in [M]}))^2$$

- More generic loss function suitable for time series modelling and forecasting (Yang and Lucas 2022):

$$\ell(\lambda, p) := \sum_{\tau=t-v+1}^t \lambda^{t-\tau} |\hat{y}_{\tau|\tau-k} - y_{\tau}|^p$$

- Various change-point literature

# Conclusion

- ① Innovative use of tree method for macroeconomic policy analysis.
- ② Further time-series statistical engagements:
  - Robust estimation and change-points
  - Adaptive methods and associated interpretations