Discussion

Macroeconomic forecasting in times of crisis

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(Time-series) Forecasting = use historical patterns to predict future

Introduction

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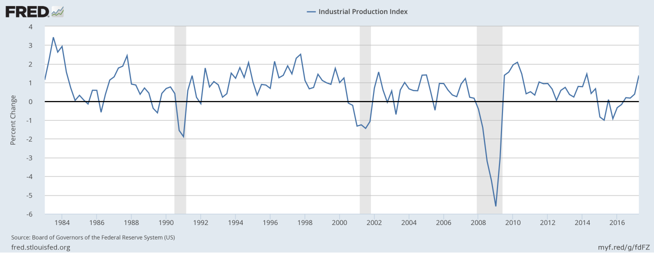

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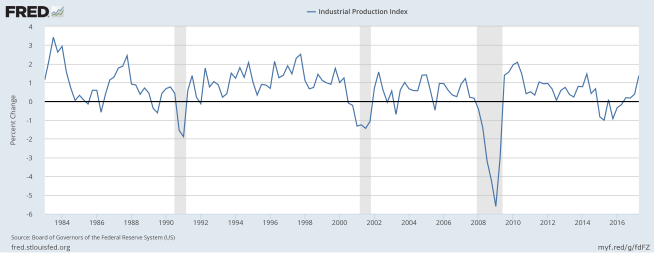


- Solution: use (crisis) patterns to forecast during crisis?

Contribution

- How to define and find the patterns and how to use them?
- Match the current time series with the ”most equal‘ pattern in history.
  - Cut the data into blocks of length k.
  - Compare the current block with all blocks via distance function:

$$dist = \sum_{i=1}^{k} w(i)(y_{T-k+i} - y_i)^2$$

  - Only the closest blocks provide information for the forecast.
- Assume the match:
  - Current data block: $B^C = y_{T-k}, ..., y_{T-1}, y_T$
  - Best match data block: $B^1 = y_1, ..., y_{k-1}, y_k$
- To forecast y_{T+1} we use information contained in y_{k+1} (and B^1).

Framework

- Completely non-parametric approach: $\hat{y}_{T+1} = y_{k+1}$
- In the paper semi-parametric approach:

$$\hat{y}_{T+1} = (y_{k+1} - \hat{y}_{k+1,ARIMA}) + \hat{y}_{T+1,ARIMA}$$

  - $\hat{y}_{T+1,ARIMA}$: parametric ARIMA forecast.
  - $(y_{k+1} - \hat{y}_{k+1,ARIMA})$: correction for forecast error made by ARMA model in "'similar"' period.

- Match with m similar periods:

$$\hat{y}_{T+1} = \frac{1}{m}\sum_{i}^{m}(y_{l(i)+1} - \hat{y}_{l(i)+1,ARIMA}) + \hat{y}_{T+1,ARIMA}$$

- Machine learning step: estimate two parameters, k and m.
- Select k and m by minimizing out-of-sample forecast error.

Multivariate matching

- Other variables may provide ''pattern" information.
- Reinhart and Rogoff (2014): Financial crisis $\Rightarrow$ protracted and halting nature of the recovery
- Compare multivariate block, including financial variables:

$$dist = \sum_{i=1}^{k} w(i)((x_{T-k+i} - x_i)^2 + (z_{T-k+i} - z_i)^2)$$

- Financial variables provide important information to identify patterns.

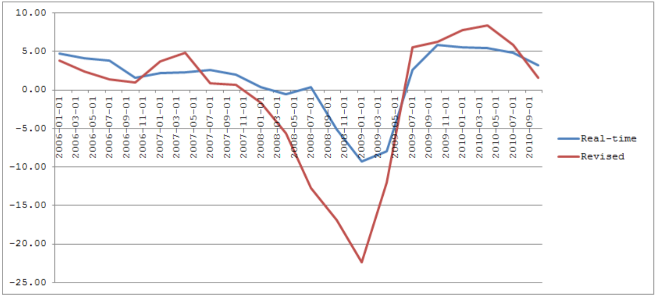
Comments: Machine learning

- What is the computational burden to estimate two parameters?
- In principle one could estimate more parameters:
  - The weights for additional series.
  - The weights for different blocks.
  - The weighting function for lags.
  - The weight on parametric vs. non-parametric forecast:

$$\hat{y}_{T+1} = w\, y_{k+1} + (1-w)\, \hat{y}_{T+1,ARIMA}$$

Comments: Real-time vs. revised series

- Forecasting evaluation done with last vintage (revised data).
- Real-Time estimate of Industrial production (SPF) growth vs. revised estimate:



- In Real-Time harder to capture changing patterns!
- Leading variables (financial variables) could be potentially even more useful.

Comments: density forecast

- Can this methodology be used also to produce density forecasts?
- Given that multiple blocks are matched this seems natural:

$$\hat{y}_{T+1,i} = \left(y_{l(i)+1} - \hat{y}_{l(i)+1,ARIMA}\right) + \hat{y}_{T+1,ARIMA}$$