

Priors for the long run

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What does the paper do?

- Shows that BVARs with 'standard' priors (MN + sum-of-coefficients) attribute too large fraction of low frequency behavior of time series to deterministic component.
- This may result in bad long horizon forecasts.
- Introduces a new prior ('prior for the long run' or 'PLR') that treats linear combinations of variables that are a-priori likely to be stationary different from linear combinations that are probably non-stationary.
- Empirical application to US data shows that PLR yields more accurate long run forecasts.

- Neat paper. Identifies a problem. Proposes a solution. Shows that the solution works.
- Highlights that policy makers are not only interested in the very short run (large BVARs, factor models) but in the medium to long run forecasts as well.
- PLR can be implemented using dummy observations → easy to add to existing code.
- But is PLR user-friendly?

Implausible forecasting power initial observation (Sims, 2000)

$$y_t = c + \rho y_{t-1} + \epsilon_t, \quad c = 0, \quad \rho = 1$$
$$D\hat{C}_t = \frac{\hat{c}}{1 - \hat{\rho}} + \hat{\rho}^{t-1} \left(y_0 - \frac{\hat{c}}{1 - \hat{\rho}} \right)$$



$$y_t = c + B_1 y_{t-1} \dots + B_p y_{t-p} + \epsilon_t$$
$$\Delta y_t = c + \Lambda H y_{t-1} + \Gamma_1 \Delta y_{t-1} \dots + \Gamma_{p-1} \Delta y_{t-p+1} + \epsilon_t$$

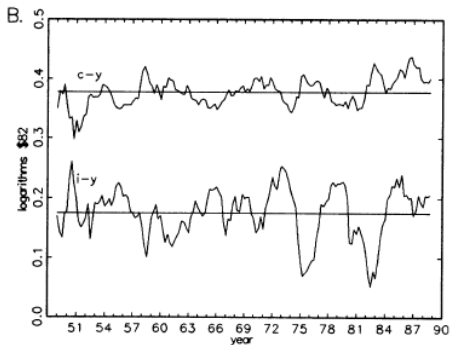
- Rows of H select linear combinations of y_t that are a-priori likely to be stationary (cointegration) or non-stationary.
- Robust insights of economic theory:
 - Great ratios / balanced growth
 - Stationary real interest rate

Three points regarding user-friendliness

- 1 What are robust insights of economic theory?
- 2 What if stationary combinations are misspecified?
- 3 What if number of variables becomes large?

Point 1: Robust evidence on stationarity of 'great ratios' ?

- Issue: where can PLR-user find “robust insights of economic theory” in order to specify H matrix? (PM: BVAR-user usually just wants to make a forecast)
- King, Plosser, Stock & Watson (1991): “the estimated cointegrating vector is broadly consistent with the balanced-growth prediction.”



Point 1: Robust evidence on stationarity of 'great ratios' ?

- Whelan (2003): "Over the long run, nominal spending on investment and consumption have tended to grow at the same rate. But the higher share of durable goods in investment and the declining relative price of these goods together imply that real investment tends to grow faster than real consumption."

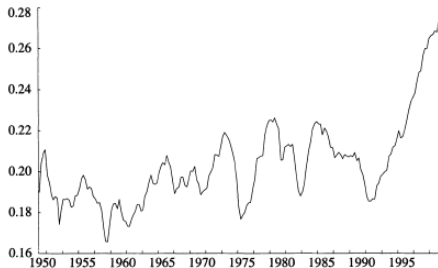
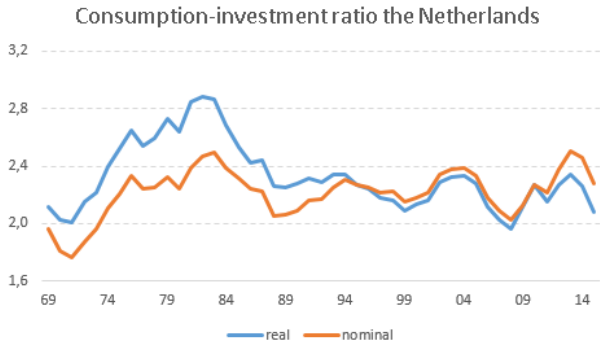


FIG. 1. Ratio of real private fixed investment to real consumption.

Point 1: Robust evidence on stationarity of 'great ratios' ?

- Lafourcade & de Wind (2012): "Our data therefore displays the same stochastic particularities for these variables as US data, that is, a balanced-growth path in nominal terms for private domestic absorption."



Point 2: What if a-priori assumed stationary combinations are in fact non-stationary (or vice versa)?

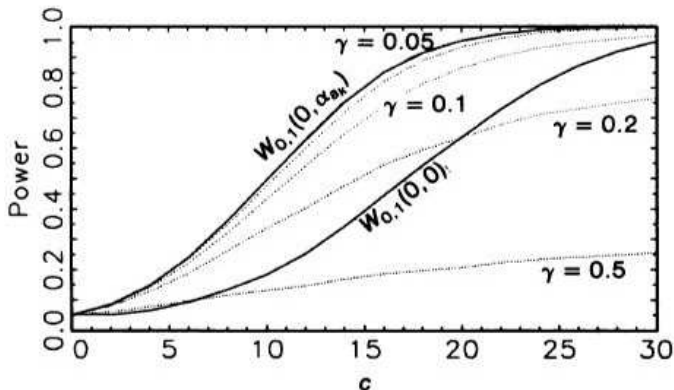
- Issue: what if economic theory does not give clear guidance regarding relevant long run parameter values?
- How robust is the method against mis-specification of the stationary and non-stationary linear combinations of the time series?
- PLR is flexible: if $H_{i \cdot} y_t$ is non-stationary, prior on Λ_i automatically becomes more tightly centered around zero.

$$\text{vec}(\Lambda) | H, \Sigma \sim N \left(0, \text{diag} \left(\left[\frac{\phi_1^2}{(H_{1 \cdot} \bar{y}_0)^2}, \dots, \frac{\phi_n^2}{(H_{n \cdot} \bar{y}_0)^2} \right] \right) \otimes \Sigma \right)$$

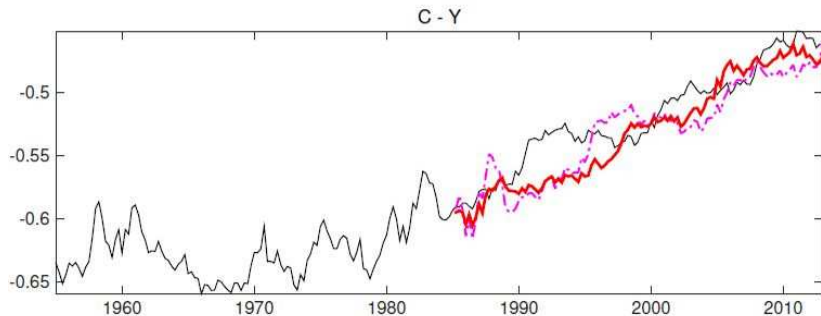
- Non-stationarity can be due to 2 reasons: (1) there is no stationary linear combination at all, (2) there is a stationary linear combination, but the true loadings are different from the assumed loadings.
- Example: money demand equation, $m - p = \beta_1 y + \beta_2 r$, $\beta_1 = 1??$, $\beta_2 = -0.05??$

Horvath-Watson versus Johansen

- Horvath & Watson (1995): testing for cointegration assuming some of the cointegrating vectors are known a priori.
- Johansen (1991): testing for cointegration without knowledge of the cointegrating vectors.
- Conclusion: H-W test for cointegration more powerful than Johansen if a priori imposed cointegrating vector is 'sufficiently close' to true vector.

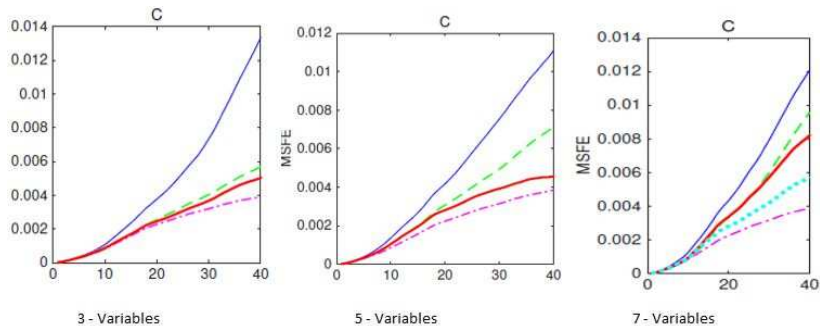


Consumption-to-GDP ratio sufficiently stationary?



- Replace common stochastic trend for C and Y with separate stochastic trend for C (two-sector growth model)?
- Monte Carlo experiments may shed light on sensitivity to misspecification of stationary combinations.

Consumption-to-GDP ratio sufficiently stationary?



- Imposing stationarity of consumption-to-GDP ratio does not seem to result in better long run forecasts of consumption.

Point 3: How to choose H in large BVAR?

- Large BVARs generally have good forecasting properties, also for euro area inflation (Giannone et al. IJF 2014).

Table 2
Variables in the database.

| Variable | Frequency | Transformation |
|---|-----------|----------------|
| Unprocessed food prices (7%) | Monthly | Log-levels |
| Processed food prices (12%) | Monthly | Log-levels |
| Non-energy industrial good prices (28.5%) | Monthly | Log-levels |
| Energy prices (11%) | Monthly | Log-levels |
| Services prices (41.5%) | Monthly | Log-levels |
| Oil price (euros) | Monthly | Log-levels |
| Non-energy commodity prices (euros) | Monthly | Log-levels |
| Food commodity prices (euros) | Monthly | Log-levels |
| Producer Price Index (PPI) consumer goods | Monthly | Log-levels |
| Real GDP | Quarterly | Log-levels |
| Compensation per employee | Quarterly | Log-levels |
| Unit labour costs | Quarterly | Log-levels |
| Nominal effective exchange rate | Monthly | Log-levels |
| US Dollar/Euro exchange rate | Monthly | Log-levels |

Point 3: How to choose H in large BVAR

$$H(\text{sum - of - coefficients}) = \begin{pmatrix} 1 & 0 & \cdot & \cdot & \cdot & 0 \\ 0 & 1 & 0 & \cdot & \cdot & 0 \\ \cdot & & \cdot & & & \\ \cdot & & & & & \\ 0 & & & & & 1 \end{pmatrix}$$
$$H(\text{PLR}) = \begin{pmatrix} * & * & \cdot & \cdot & \cdot & * \\ * & * & * & \cdot & \cdot & * \\ \cdot & & \cdot & & & \\ \cdot & & & & & \\ * & & & & & * \end{pmatrix}$$

- Is it possible to 'savely' introduce stationary combinations of variables one-by-one as long as forecasting performance (or in-sample model odds-ratio) improves (like Johansen's trace and λ -max statistics can be used to determine the cointegrating rank)?

- Very interesting paper...
- ... but could benefit from a “practioners guide”.
- Question: do we need a BVAR model to generate long term inflation forecasts if CB can credibly achieve its goal?