

Anindya Banerjee

Structural analysis using factor augmented VARs and three-pass regression filters

Abstract:

The paper proposes a new approach to sign-restriction-based identification of structural shocks in factor augmented vector autoregression (FAVAR) models. We work with a new method of estimating factors called the three-pass regression filter (3PRF) proposed by Kelly and Pruitt (2015), calculated in closed form and conveniently represented as a set of ordinary least squares regressions. Sign restrictions are imposed on the responses of industrial production (IP) and consumer price index (CPI) in the first twelve months following a monetary policy (MP) shock. Each of the N variables in our United States dataset is used individually as a proxy for the 3PRF factors and for each of these proxies, up to 7 factors are extracted and used in a Bernanke, Boivin and Elias (2005) (BBE) type FAVAR model. In all, thirteen variables in the dataset, when used as proxies individually, are seen to satisfy the sign restrictions for IP and CPI. In addition two further variables/proxies satisfy the sign restrictions in combination. Fifteen FAVAR models are therefore estimated and the corresponding impulse responses of the variables are assessed in a BBE-type model to an identified MP shock.

Out of the models satisfying the sign restrictions we attempt, using various criteria, to obtain the one that is most representative. For such a representative model, we observe that the impulse responses of all other variables, upon which no sign restrictions are imposed, make a lot of sense and are in accord with economic intuition. Moreover, the adjustment of prices seems to be much faster (and without permanent effect on the price level) than in BBE or similar studies.

A further step of our analysis computes the mean 3PRF response with impulse responses based on one to 7 factors estimated from standard principal component analysis (PCA). We find that the responses of IP are quite similar. The first PCA factor explains about 70% of IP variability (7 factors explain about 90%), as do two 3 PRF factors. Stark differences emerge when looking at the responses of CPI. Only if the FAVAR contains the first PCA factor and the federal funds rate (FFR) is a price puzzle absent. With 2 PCA factors or more, significant price puzzles emerge. However since the first PCA factor appears to capture no CPI variability while the second captures 70% of variability, adding this second (needed) factor leads to the price puzzles. Looking through 3PRF lenses we argue that it is the relevance of information, not the overall quantity that matters. Thus, at first sight, it emerges that adding more information which may be irrelevant leads to biased responses and erroneous

identification of shocks. This last finding has resonance in similar work undertaken by Boivin and Ng (2006) albeit in the context of forecasting.