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Identifying News Shocks from SVARs

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ABSTRACT

This paper investigates the reliability of SVARs in identifying the dynamic effects of news shocks. Using a simple but insightful model with a non-fundamental representation, we show analytically under which conditions SVARs are likely to be successful at identifying news shocks. We find that the dynamic responses to news shocks identified using a short-run restriction are biased. However, this bias is smaller if news shocks account for most of the variability of the endogenous variable and the economy exhibits strong forward-looking behavior. Our simulation experiments confirm this finding and further suggest that the number of lags in the VAR and the anticipation horizon are key ingredients for the success of the VAR setup.

1. Introduction

This paper contributes to the expanding literature on the empirical relevance of anticipated shocks called news shocks. Using a structural vector error correction model for total factor productivity (TFP) and stock prices, Beaudry and Portier (2005, 2006) suggest an identification procedure that allows for the uncovering of anticipated shocks. They find that innovations in the growth rate of TFP are largely anticipated and that these news shocks on TFP account for more than half of the forecast error variance of consumption, output and hours. In a similar framework, Beaudry and Lucke (2009) provide a complete assessment of the leading forces of aggregate fluctuations and show that news shocks turn out to be the main drivers of the business cycle.[1]

The objective of this paper is to answer to the following question: Under which conditions are Structural Vector AutoRegressions (SVARs) successful at identifying news shocks and their dynamic effects? Two arguments motivate this question. First, SVARs are widely used as tools for the validation and estimation of DSGE models. Accordingly, failures of SVARs to provide reliable results transmit into erroneous model selection and policy prescriptions (see Christiano et al. (2006); Chari et al. (2008)). Second, identifying news shocks in the SVAR setup is a tedious task.[2] The presence of news shocks in the economy

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[1] A large part of the business cycle literature tackles the issue of news shocks using Dynamic Stochastic General Equilibrium (DSGE) models (e.g. Davis (2007); Fujiwara and Shintani (2008); Schmitt-Grohé and Uribe (2008); Khan and Tsoukalas (2009)). Schmitt-Grohé and Uribe (2008) show that standard RBC models augmented with real rigidities (habit formation in consumption and leisure, investment adjustment costs and variable capacity utilization) generate news driven business cycles and that anticipated shocks explain more than two thirds of the predicted aggregate fluctuations.

[2] See Beaudry and Portier (2005); Beaudry and Portier (2006); Beaudry and Lucke (2009); Barsky and Sims (2011); Sims (2012) for the estimation of news TFP shocks from SVARs. Also see Ramey (2011); Mertens and Ravn (2011) for quantitative investigations into the usefulness of SVARs for the identification of tax shocks.

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may induce a non-fundamental time series representation of the data (see Fève and Matheron (2009); Leeper and Walker (2009)). Such non-fundamentalness jeopardizes the identification of structural shocks from past and current data because these data cannot reveal the current and past shocks, an assumption taken as given in the VAR analysis.[3]

To identify and understand the implications of news shocks, we use a SVAR setup with two observable variables under the solution of a simple linear forward-looking model with rational expectations. The first observable variable admits several interpretations and may be viewed as the growth rate of TFP (as in Beaudry and Portier, 2006), fiscal policy (see Leeper and Walker, 2009), dividend growth rate or any stochastic forcing variable that can be subjected to news shocks. The second observable variable represents an endogenous decision variable that heavily depends on the anticipated and unexpected shocks in a forward-looking fashion. We consider the structural model to be the Data Generating Process (DGP). In spite of its simplicity, the structural model's analytical tractability allows us to understand the implications of news shocks in a SVAR framework. Following Beaudry and Portier (2005), we identify the news shock using a short-run restriction (see Sims, 1980). More formally, the news shock is identified as the orthogonal shock (on impact) to the first observable.[4]

Our results are the following. First, we find that the estimated Impulse Response Functions (IRFs) are biased, especially when the news shock contains a long anticipation horizon. Second, the bias is much smaller when the fraction of fluctuations in the economy driven by news shocks is substantial and the VAR model is estimated using a sufficient number of lags. Indeed, estimating a VAR model with a number of lags smaller than the length of news implies a lag truncation-bias. Third, when the model displays a strong forward-looking behavior, the bias decreases by more. These findings are both obtained from analytical results and simulation experiments.

The paper is organized as follows. In the first section, we expound our reference setup and discuss non-fundamentalness issues. The second section reports the identification strategy and the resulting estimated dynamic responses. The third section assesses the reliability of SVARs using different simulation experiments. The last section concludes.

2. The Setup

We use a simple model as the DGP and investigate under which conditions VAR models admit a non-fundamental representation.

2.1. The model

The model economy takes the following form[5]

$$y_t = aE_t y_{t+1} + bE_t \Delta x_{t+1}, \tag{1}$$

$$\Delta x_t = \sigma_\varepsilon \varepsilon_{t-q} + \sigma_u u_t \quad \sigma_\varepsilon,\ \sigma_u > 0, \tag{2}$$

where y_t denotes a single endogenous variable and x_t is a single exogenous variable, specified in first-difference. E_t denotes the expectation operator conditional on the information set in period t, *i.e.* when agents must take their decisions about y_t. The parameters a and b in the behavioral Eq. (1) are assumed to be non-zero. For simplicity, we normalize b to unity.[6] Eq. (1) naturally emerges from any optimization problem in stochastic equilibrium models. Typically, Eqs. (1) and (2) define the log-linear equilibrium conditions for an asset-pricing model, where y_t denotes the log of the price-dividend ratio and Δx_t the growth rate of exogenous dividends. Eq. (2) is the backbone of our analysis. It states that, at any point in time t, private agents observe the two components of Δx_t: an anticipated component observed $q \geqslant 1$ periods in advance, ε_{t-q} and an unanticipated component, u_t. Furthermore, these shocks are assumed to be serially uncorrelated with zero mean and unit variance and mutually uncorrelated at all leads and lags.

Excluding sunspots (*i.e.* we impose $|a| < 1$) and bubbles (*i.e.* we restrict the solution to satisfy $\lim_{T\to\infty} E_t a^T y_{t+T} = 0$) and using the process (2), we obtain the solution (or reduced form) for y_t

$$y_t = \sigma_\varepsilon \sum_{i=0}^{q-1} a^{q-1-i} \varepsilon_{t-i} \tag{3}$$

Eqs. (2) and (3) represent the DGP. We assume that the variables Δx_t and y_t are observed by the econometrician but she cannot distinguish between the two shocks driving Δx_t. This observability problem is made more pernicious by the fact that the econometrician faces two permanent shocks.[7] In a more compact way our DGP can be written as

[3] See the references in Leeper and Walker (2009) about non-fundamentalness issues in rational expectation econometrics.

[4] In our setup, we show that a short-run restriction yields reliable results. We recognize that in a more complicated framework, a simple short-run restriction may not be valid and other identification strategies might have to be implemented in a VAR setup. Barsky and Sims (2011) identify news shocks as those explaining the overwhelming fluctuations in TFP. Mertens and Ravn (2009) propose an augmented fiscal SVAR estimator which is robust to the presence of anticipation effects.

[5] We have also investigated another model economy of the form $y_t = aE_t y_{t+1} + b\Delta x_t$. Our quantitative findings are almost identical. The results are available from the authors upon request.

[6] Our main findings are unaffected by this normalization. The results are also available from the authors upon request.

[7] Notice that we follow the empirical strategy adopted by Beaudry and Portier (2005, 2006) by assuming that the variable subject to news shocks is observed, together with y_t. In their paper, the observed forcing variable x_t is the log of TFP and y_t is defined as the excess return on stock prices.