Avoiding pitfalls in using structural VARs to estimate economic models ☆

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Abstract

Structural Vector Autoregressions with a differenced specification of hours (DSVAR) suggest that productivity shocks identified using long-run restrictions lead to a persistent and significant decline in hours worked. Economists have interpreted this evidence as showing that standard business cycle models in which a positive technology shock leads to a rise in hours are inconsistent with the data. In this paper we argue that such a conclusion is unwarranted because model's data and actual data are not treated symmetrically. To illustrate this problem, we estimate and test a flexible-price DSGE model with non-stationary hours using Indirect Inference on impulse responses of hours and output after technology and non-technology shocks. We find that, once augmented with a moderate amount of real frictions, the model can mimic well impulse responses obtained from a DSVAR on actual data. Using this model as a data generating process, we show that our estimation method is less subject to bias than a method that would directly compare theoretical responses with responses from the DSVAR.
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0. Introduction

This paper combines dynamic stochastic general equilibrium (DSGE) models and Structural Vector Autoregressions (SVARs) to characterize the joint dynamics of hours worked and labor productivity.

The literature on the subject is currently burgeoning. In a provocative paper, Galí (1999) argues that the response of hours to a technology shock is persistently and significantly negative in the US as well as in other G7 countries (see also Galí, 2004 regarding the euro area). This claim is based on SVARs of the growth rates of labor productivity and hours with long-run restrictions. The negative response of hours is interpreted as invalidating a whole class of business cycle models, namely technology-driven flexible price ones (Galí and Rabanal, 2004 and Francis and Ramey, 2005). These SVARs results and their interpretation have raised major controversies. On the one hand, Christiano et al. (2004) provide evidence in favor of a level-stationary specification of hours worked (LSVAR), as opposed to the difference-stationary (or DSVAR) specification in Galí (1999).[1] On the other hand, Erceg et al. (2005) and Chari et al. (2005) use DSGE models estimated on US data as Data Generating Processes (DGP) to evaluate the identification of technology shocks provided by DSVARs. Chari et al. (2005) show that a DSVAR model leads to a negative response of hours under a business cycle model in which hours respond positively. They conclude that SVARs with long-run restrictions are not useful guides for developing business cycle theories.[2]

The contribution of the present paper is twofold. First, we develop a DSGE model with non-stationary hours. In contrast to related studies, our model is in close conformity with the DSVAR specification advocated by Galí (1999): hours being non-stationary, the DSVAR is the correct specification to investigate. The model also embeds time non-separability in leisure choices. We select the parameters of the model so that a DSVAR estimated on simulated data from the model would mimic a DSVAR estimated on actual data. More precisely, the method used in this paper picks the parameters that minimize the discrepancy between the simulated Impulse Response Functions (IRFs)—those from the DSVAR estimated on model's data—and the empirical IRFs—those from the DSVAR estimated on actual data. While our model is technology-driven, features flexible prices and displays a positive response of hours to a technology shock, it can generate simulated IRFs that look like the Galí (1999) finding. This calls into question the conclusions reached by Galí (1999) and Francis and Ramey (2005).

Second, we illustrate the merits of our approach through a comparison with a popular alternative methodology used by Rotemberg and Woodford (1997), Christiano et al. (2005a), and Altig et al. (2005), among others. This alternative methodology selects parameter values so that the theoretical IRFs are as close as possible to the empirical IRFs obtained from a DSVAR. We work through an example and show that this methodology delivers severely biased estimates of the model's structural parameters, and underperforms the method we suggest.

The methodology used in this paper is close in spirit to Sims's (1989) general principle, subsequently adopted by Cogley and Nason (1995): treating models and data symmetrically. With such an approach, the IRFs from the DSVAR are given no a priori structural interpretation. They are just moments from the data, and the DSVAR is similar to a filter.[3] However, these moments

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[1] With their LSVAR specification, Christiano et al. (2004) show that hours increase after a permanent technology shock.

[2] See also Cooley and Dwyer (1998) criticism of SVARs.

[3] The DSVAR plays the role of the *auxiliary model* in Gouriéroux et al. (1993).