Comments on

``Identifying Taylor Rules in Macro-Finance Models''

by Mikhail CHERNOV

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Patrick FEVE (TSE)

Summary of the paper (I)

- This paper significantly adds to the recent litterature (see Cochrane, 2011) about identification issues of the ``historical » Taylor rule parameters, i.e. a simple representation of the monetary policy that expresses the nominal interest rate (the policy variable) as a log-linear function of inflation, in a simple (forward-looking) DSGE model (under rational expecations).

- **<u>Main findings:</u>** the key monetary policy parameter (i.e. the parameter that links the short-run nominal interest rate to inflation) can be identified in some cases.

Summary of the paper (II)

- This is a important quantitative issue, because a lot of monetary policy prescriptions (in terms of aggregate (in)stability) deeply depend on the value of this monetary policy parameter (see Clarida, Gali and Gertler 2000, Lubik and Schorfheide, 2004). For example, less aggressive monetary policy can imply indeterminacy, and thus sunspot fluctuations.

- More generaly, this paper contributes to the analysis about the identification of DSGE models, i.e. any forward-looking model under rational expectations .

A simple illustration

- A simple model (univariate case, i.e. only inflation rate is observed by the econometrician). Two equations (Fisher eq. + Taylor type rule):

$$i_t = E_t \pi_{t+1}$$

$$i_t = \tau \pi_t + s_t \quad |\tau| > 1 \quad \text{and} \quad s_t = \rho s_{t-1} + \sigma_\epsilon \epsilon_t$$

- The forward looking solution (excluding explosive pathes)

$$\pi_t = -\frac{1}{\tau - \rho} s_t$$

Identification problem (I)

- The reduced form for inflation

$$\pi_t = \rho \pi_{t-1} - \frac{\sigma_\epsilon}{\tau - \rho} \epsilon_t$$

- 3 « structural » parameters, but only two parameters in the reduced form.
- To identify the monetary policy parameter, we need to fix the s.e. of the unknown shock.
- Any parameter that smooths shocks cannot be identified because this parameter and the volatility of shocks appear in a relative way in the reduced form.

Identification problem (II)

- <u>**Rmk:**</u> the identification problem is even more severe if we observe only the nominal interest rate. In this case, no parameter can be identified if shocks are serially uncorrelated! In the case of inflation (if shocks are serially uncorrelated), we need to fix one of the parameter.
- So, the selected variable matters a lot for identification!!!
- Well kown problem with forward looking models (no propagation mechanisms!) see the macro litterature, Hansen & Sargent in many contributions….

How to solve the identification problem?
(I) More shocks and more observable variables (in the paper)

- Let us consider a version of the model with two shocks that are assumed to be orthogonal (and serially uncorrelated):

$$i_t = E_t \pi_{t+1} + s_{1,t}$$

$$i_t = \tau \pi_t + s_{2,t} \quad |\tau| > 1 \quad \text{and} \quad s_{i,t} = \sigma_{\epsilon,i} \epsilon_{i,t}$$

- Both the nominal interest rate and the rate of inflation are observed by the econometrician.

The Identification problem is solved!

- In this case the covariance matrix of the rate of inflation and the nominal interest rate is given by:

$$\begin{pmatrix} \tau^{-2}(\sigma_1^2+\sigma_2^2) & \tau^{-1}\sigma_1^2 \\ \tau^{-1}\sigma_1^2 & \sigma_1^2 \end{pmatrix}$$

- The 3 parameters of interest are identified!
- Only one parameter (the monetary policy parameter) governs the transmission mechanism of the two shocks and cross equation restrictions on the two endogenous variables.
- But, we need to impose that the two shocks are orthogonal! A common assumption in the DSGE litterature, but restrictive!

How to solve the identification problem?
(II) News (or Expected) Shocks (not in the paper)

- We assume now that the shock to the monetary policy takes the form:

$$s_t = \sigma_\epsilon \epsilon_{t-q} \quad \text{with } q \geq 0$$

- This means that the « news » shock is expected q periods in advance, i.e. agents know today that a shock to the monetary policy will materialize in the next q periods (see Beaudry & Portier for TFP shocks and Leeper for fiscal shocks).
- Results can be easily extended to both unexpected and expected shocks to the monetary policy.

The Identification problem is again solved!

- The solution for inflation is given (see Feve, Matheron and Sahuc, 2009)

$$\pi_t = -\tau^{-1}\left(\tau^{-q}\sigma_\epsilon \sum_{i=0}^{q} \tau^i \epsilon_{t-i}\right)$$

- The solution takes a MA(q) representation.
- 2 parameters (the policy parameter and the s.e. of the shock).
- The model is not identified if q=0, but just-identified for q=1 and over-identified when q>1 (a specification test of the model can be then conducted!)
- **Rmk:** again, the choice of the observed variable matters. If we use the nominal interest rate instead of inflation, the model with « news shocks » on monetary policy is not identified when q=1, but identified when q>1.

Things can be even worse with the identification of the monetary policy parameters (not in the paper): an example

- Monetary policy inertia versus persistent shocks (the monetary policy alone)

$$i_t = \rho_i i_{t-1} + (1-\rho_i) i_t^{\star} + s_t$$

$$s_t = \rho_s s_{t-1} + \sigma_\epsilon \epsilon_t$$

$$i_t^{\star} = \bar{i}^{\star}$$

$$i_t = (\rho_i + \rho_s) i_{t-1} - \rho_i \rho_s i_{t-2} + \sigma_\epsilon \epsilon_t$$

- The reduced form

$$i_t = \beta_1 i_{t-1} + \beta_2 \rho_s i_{t-2} + u_t$$

Identification problem about the proper representation of the Taylor rule!

The two parameters of interest

$$\rho_i = \frac{\beta_1 \pm \sqrt{\beta_1^2 + 4\beta_2}}{2}$$

$$\rho_s = \beta_1 - \rho_i$$

$$\beta_1^2 + 4\beta_2 = (\rho_i - \rho_s)^2 \geq 0$$

$$\rho_i \;\; \text{large and} \rho_s \text{small}$$

$$\rho_i \;\; \text{small and} \rho_s \text{large}$$

- Two stories equally consistent with the data! (well known problem, see for example Sargent (1978)). To avoid this identification issue, consider the identification of this extended Taylor rule into a DSGE model (see Carrillo, Feve and Matheron, 2007)