Referee Report *American Economic Review*

Identifying Taylor Rules in Macro-Finance Models

By

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This paper examines identification of the parameters in simple interest rates rules like the Taylor rule. The authors argue that it may be hard to achieve identification of key policy rule parameters (like the response coefficient for inflation) because it is hard to tell from interest rate and inflation data only if policy is responding to inflation or something else. The first case the authors give when identification of the policy rule cannot be achieved is the well-known example of Cochrane (2011). The extremely simple Cochrane model consists of the Fisher equation,

(1) i(t)=pie(t+1),

and the simple interest rate rule,

(2) i(t)=tau*pie(t)+s(t),

where s(t) is an exogenous driver. In this model, the authors show that identification of the coefficient for inflation in the policy rule (tau) cannot be achieved because the econometrician cannot separate out the effects on the interest rate of inflation (i.e. the Taylor rule coefficient) and the monetary policy shock (which is the sole driver of economic fluctuations in the model). However, when s(t), or the parameters driving its process can be observed, tau is identified.

The authors then turn to more general examples, many of them macro-finance style models, and discuss the conditions under which identification can be achieved, and when it fails. The main takeaway is that identification depends on how stringent assumptions about the nature of the policy shock one is willing to do, and that reasonable researchers can and will have different opinions about this.

Overall, I think is an interesting and generally well drafted paper which it makes its key points crisply. However, as you can tell from my comments below, I am not at convinced that the problems you raise have some substantive relevance in practice. In this sense, I am thinking about your paper as highlighting features of identification of Taylor style rules in forward-looking models that I do not believe are particularly relevant in empirically realistic models.

Comments

As I understand it, the fundamental reason why identification fails according to your analysis is that there is a strong correlation between the policy shock and the regressor. In the simple Cochrane example, the policy shock is the sole driver of fluctuations in inflation, and unless you observe this shock directly or estimate the reduced form using the Kalman filter and i(t) and pie(t) as observables, identification fails. When s(t) follows an simple AR(1) process,

(3) s(t) = rho*s(t-1)+eps_s(t),

OLS estimation of (2) provides a limit estimate of tau equal to rho (the persistence of exogenous policy shock). So the bias can be quite large. However, this is a model in which, (a) all the variation in inflation and interest rates are due to the policy shock, and (b) the direct effects from policy to the regressor (inflation) is immediate.

If we took the opposite position, namely the recursiveness assumption commonly imposed in structural VARs (e.g. Christiano, Eichenbaum and Evans, 1999 and Angeloni, Kashyap, Mojon and Terlizzese, JMCB, 2003) when studying the transmission of policy shocks, there are no problems with identification as this assumption imposes orthogonality between the regressors (output gap and inflation) and the error term. However, even well-fitting DSGE models which does not impose this constraint (for instance the Smets and Wouters (2007, AER) model, in which all quantities and prices can respond freely to policy shocks, finds that the contemporaneous impact of policy on inflation and the output gap are fairly modest. Moreover, most empirical DSGE and SVAR models (like in the recent paper by Gertler and Karadi, 2013, forthcoming in AEJM) imply that monetary policy shocks account for only a small portion of fluctuations in inflation and the output gap. This means that even if the recursiveness assumption is invalid, most of the variation in inflation and output would be driven to other exogenous forces, and hence the biases in the Taylor rule regression would be much smaller compared to the case when all fluctuations in output and inflation are caused by policy shocks.

To exemplify this, I simulated a very large sample (10^5 obs) for the simple Cochrance model in the paper (eqs. 1 and 2 above), assuming tau=1.5, rho=.9 and that std(eps_s(t))=1. Using these simulated data to estimate the Taylor rule gives plim tau = 0.9. However, replacing the simple Fisher equation (1) with the following "reduced form IS-Phillips curve"

(1')   pie(t)=beta*pie(t+1)-alpha*i(t)+v (t),

and using betta=0.99 and alpha=.1 and that v(t)= v(t-1)+eps_p(t) and assuming std(eps_p)=std(eps_s)=1, I obtain plim tau = 1.47, which is below but very close to the true value of 1.5. The identification problem is thus strongly mitigated in a more realistic model where simultaneity between the regressors (in this simple example inflation) and the policy shock is mitigated due to the smaller role of policy shocks and smaller direct impact of the policy rate on inflation.

For the reasons stated above, I believe that a weakness in the paper is that you never consider the quantitative significance of the identification problem you pose in more realistic models with more shocks. This is something that has to change if the paper is going to make a substantive point and merit publication in a top general interest journal.

Moreover, to make a substantive point, I also think you need to address that estimation of Taylor rules on quarterly and monthly data gives pretty similar results. Arguably monetary policy cannot have very large effects on aggregate quantities and prices within a month, so Taylor rules estimated on higher-frequency data should be identified, and the fact that monthly and quarterly data produces similar estimation speaks against problems with identification.

Finally, I also found the introduction not very clear on the problem addressed in the paper and was lacking references to previous work on identification in macroeconomic models, like Canova and Sala (2008, JME), and papers that have estimated Taylor rules in practice, like CGG (QJE, 2001). This made it very hard to understand the connection to previous theoretical and empirical work in the area.