Referee Report for AER 2014-0926
"Identifying Taylor Rules in Macro-Finance Models"

In a 2011 JPE paper, John Cochrane discussed several issues related to determinacy and identification in forward-looking New Keynesian models with Taylor rules. The present paper extends Cochrane's analysis of the issue of identification, and applies that analysis to a range of macro-finance models of increasing complexity. The authors make some strong claims about the requirements for identification of the Taylor rule coefficient in the model—in particular, the authors claim that either the monetary policy shock must be observed, or that restrictions must be placed on the monetary policy shock that enable it to be inferred, *even when the state vector itself is observed.*

It is this claim in particular that troubles me. I agree with the analysis in Cochrane's paper, but the authors of the present paper extend Cochrane's simple example and make a much stronger claim. While I have great respect for the authors and am generally a fan of their work, this claim just isn't true, unless I'm misunderstanding the details of what it is they're trying to claim.

Let's start with their version of Cochrane's example in Section 2.1. In this example, there is a Fisher equation,

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

and a Taylor rule,

$$i_t \;=\; \tau \pi_t + s_t, \tag{2}$$

with a monetary policy shock s_t. In Cochrane's original example, s_t is the state of the economy, and identification of the Taylor rule parameter τ requires the econometrician to observe s_t.

In the present paper, the authors extend Cochrane's simple example by making s_t a linear function of an economic state vector x_t,

$$s_t \;=\; d' x_t, \tag{3}$$

where x_t follows an exogenous first-order linear process,

$$x_{t+1} \;=\; A x_t + C w_{t+1}, \tag{4}$$

where A is stable and the shocks w_t are i.i.d.

The authors then make a stronger claim than Cochrane. They claim that identification of the Taylor rule parameter τ requires observing the monetary policy shock s_t, *even if x_t itself is observed.* See, for example, the last two paragraphs of Section 2.1, on pp. 4-5.

This claim is simply not true. From equation (2),

$$i_t \;=\; \tau \pi_t + d' x_t, \tag{5}$$

which implies

$$\tau \;=\; \frac{i_t}{\pi_t} - d' \frac{x_t}{\pi_t}\,. \tag{6}$$

Inflation π_t is a scalar, and the interest rate i_t and π_t are always assumed to be observed in Cochrane (2011) and the present paper. If i_t, π_t and x_t are observed, and $\dim(x_t) = n$, then in general I need just $n+1$ observations to perfectly identify τ and d. For example, I could run the regression

$$\frac{i_t}{\pi_t} = \tau + d' \frac{x_t}{\pi_t}, \tag{7}$$

and with $n+1$ distinct observations I would have perfect estimates of τ and d. Additional observations beyond the first $n+1$ would continue to perfectly confirm the estimated value of τ.

Notice that this solution directly contradicts the claims the authors make in the last two paragraphs of Section 2.1, on pp. 4-5. I can't see any good rationale for why the econometrician should be prevented from dividing equation (2) through by π_t and implementing my solution. Even if I admit that π_t could be exactly zero (a zero-probability event), then all I need is $n+1$ distinct observations for which $\pi_t \neq 0$ to identify τ.

At first, I thought that maybe this example was just too simple and my proposed solution wouldn't apply to the rest of the paper. But in fact, it works just fine. It works verbatim in Section 2.2 (the exponential-affine example). And it works in Section 3.1, the representative-agent model. If I divide the authors' equation (10) through by π_t, I get

$$\tau = \frac{i_t}{\pi_t} - \frac{r}{\pi_t} - d_2' \frac{x_t}{\pi_t},$$

so I can identify τ perfectly with just $n+1$ distinct (nonzero-inflation) observations.

Compare this result to the authors' discussion in the middle paragraph on p. 10. The authors' main claim is basically the same here and throughout the paper as it was in Sections 2.1 and 2.2, and thus my identification contradicts that main claim throughout the whole paper.

Note that this critique does not apply to Cochrane (2011), because he assumes that s_t is the economic state. In other words, Cochrane assumes that the state itself (x_t in this paper) is unobserved. In this case, dividing through by π_t doesn't help, because x_t is still unobserved and τ can no longer be backed out. But the authors have gone beyond Cochrane to make a much stronger claim, which in fact is too strong to be true.

Obviously, I can't recommend the paper to the AER with what appears to be a glaring oversight by the authors. Currently, I think the paper is fundamentally flawed and is not fixable. However, if the authors think that this mistake is fixable—or maybe that I've just misunderstood something very fundamental—then I'd be willing to consider a revision of the paper that clarified this issue and what it is exactly the authors are trying to show that isn't contradicted.