Response to referee reports for

"News versus Sunspot Shocks in a New Keynesian Model" by Lilia Karnizova

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I would like to thank both referees for providing a positive feedback on this paper and highlighting its contributions. I would also like to expand upon the referees' comments regarding empirical identification of news and sunspot shocks in this note.

A simple New Keynesian model considered in the paper illustrates that dynamic responses of the model variables to news and sunspot shocks can be observationally equivalent in the region of indeterminacy. This result raises some questions about identification of unobservable shocks and creates additional challenges for empirical assessment of the relative importance of news and sunspot shocks.

1). The observational equivalence between news and sunspot shocks in the model arises due to the multiplicity of rational expectation solutions under indeterminacy. With multiple equilibria, the propagation of fundamental shocks (including news shocks) is influenced by arbitrary parameters. In the context of the New Keynesian model, the impulse response functions depend on the choice of a particular matrix M in the equation (7)-(8) of the manuscript.

Is there any guidance on the choice of the arbitrary parameters? Lubik and Schorfheide (2003, 2004) propose a benchmark, under which these parameters are chosen so that the impulse responses of the model variables to fundamental shocks are continuous on the boundary between the determinacy and indeterminacy regions. This benchmark is useful because the responses of fundamental shocks do not change drastically with small changes in the parameters governing indeterminacy. For example, in the New Keynesian model it is the elasticity of the interest rate response to inflation (ksi) that determines the uniqueness of the model solution. Further, Lubik and Schorfheide (2004) develop a procedure for estimating the model parameters that treats the regions of determinacy and indeterminacy symmetrically and lets the data decide which representation works better. The analysis of the New Keynesian model in the paper suggests that it may be difficult (if not impossible) to identify the model parameters related to news and sunspot shocks, if both types of shocks are included in the model simultaneously.

The identification problem concerning the parameters of sunspot shocks appears to be more general. As Referee 1 points out, "the sunspot shocks can be observationally equivalent not only to the unexpected policy shock, but also to the other fundamental shocks such as preference shocks and costs shocks if they are introduced to the model." Since econometric estimation of dynamic stochastic general equilibrium models is

gaining popularity, it would be desirable to establish some conditions under which the parameter identification can be achieved.

As a practical matter, one promising research avenue for evaluating the importance of news and sunspot shocks seems to follow the approach of Lubik and Schorfheide (2004) in trying several priors that assign different weights on the two effects of indeterminacy. The first effect refers to non-uniqueness of the propagation of fundamental shocks. The second effect relates to the presence of sunspot shocks. In any case, the estimation results for the models that admit both determinacy and indeterminacy must be interpreted with care. An excellent example of the interpretation is the last paragraph of the section C on page 209 in Lubik and Schorfheide (2004).

An alternative avenue may be to restrict the influence of news shocks into the region of parameter determinacy only. Then the relative importance of news and sunspot shocks could be judged in the context of a particular model by comparing a version of the model with news shocks in the determinacy region with a version of the model with sunspot shocks (and no news shocks) in the indeterminacy region.

2) Does the possibility to obtain qualitatively similar impacts on the observed variables imply that news and sunspot shocks are similar? I share the opinion of Referee 1 that is not the case.

A principal difference between news and sunspot shocks is their relation to the realized fundamental or structural shocks, such as a monetary policy shock considered in the paper. A news shock can be interpreted as an anticipated component of a particular fundamental shock. Thus, news shocks are correlated with future values of some fundamental shocks by definition. By contrast, sunspot shocks can be modelled as uncorrelated with any fundamental shocks. I conjecture that the difference between the two types of shocks could be exploited in empirical estimation of a reduced form structural VAR or a fully specified equilibrium model. A success of the approach would depend on the availability of the observed measure of a fundamental shock associated with news shocks.

3) I would like to thank Referee 1 for pointing out that the left-hand side of the equation (7) on page 6 of the manuscript should be [x(t), pi(t), R(t)]', rather than [Et x(t+1), Et pi(t+1)]'.

References

Lubik, T. and F. Schorfheide (2003): "Computing Sunspot Equilibria in Linear Rational Expectations Models." *Journal of Economic Dynamics and Control,* 28(2), 273-285.

Lubik, T. and F. Schorfheide (2004): "Testing for Indeterminacy: An Application to U.S, Monetary Policy." *American Economic Review,* 94(1), 190-217.