Should Central Banks Worry About Nonlinearities of their Large-Scale Macroeconomic Models?

By Lepetyuk, Maliar, and Maliar
November 3, 2017
Santa Clara

Discussion by Zheng Liu
Federal Reserve Bank of San Francisco

The views expressed herein do not necessarily reflect the views of the Federal Reserve Bank of San Francisco or the Federal Reserve System.
Is linearizing DSGE models a sin?

• DSGE models often solved/estimated by linearization

• But nonlinearity can be important:
  – ZLB
  – Credit constraints
  – Uncertainty

• How bad are linear approximations? Do they mislead policy inferences?
• Considers a “baby version” of ToTEM with ZLB, a DSGE model by Bank of Canada.
  – Model still large (49 eq, 21 state variables)
• Compare 3 different solution methods
  1. Linearization (with ELB, use OccBin/IRIS)
  2. Second-order approx. around SS (ELB ignored)
  3. Global solution with CGA (with ELB)
• Surprising finding: very little difference b/n linearization and global solution
  – ZLB dynamics are similar
  – Transition dynamics to a higher inflation target also similar (if started from appropriate SS)
• Model may be complicated but still “close to linear”: price/wage dispersions not very important quantitatively
• Shocks are small: near-SS dynamics (appropriate for Canada, but not for EMEs)
• Rep household: risk sharing mitigates/eliminates uncertainty
• ZLB: infrequently observed, small “spillover” to aggregate dynamics
Hammer looking for a nail?

To a man with a hammer, everything looks like a nail.
Some suggestions (nails)

• The baby ToTEM still too complicated
  – Can similar point be made in a medium-scale DSGE model (Smets-Wouters, 2007)?
• DSGE models with uncertainty shocks (e.g., Basu-Bundick, 2017; Leduc-Liu, 2016)
  – Linear perturbation inappropriate
  – Neither is 2\textsuperscript{nd}-order approx.
  – Can use global solution to evaluate accuracy of the standard 3\textsuperscript{rd}-order local approx.
• Apply global solution to policy evaluations:
  – Uncertainty and high-order effects important for welfare
Broader applications of global solution

• A few more nails:


  2. Financial/banking crisis models (Brunnermeire-Sannikov, 2014; Gertler-Kiyotaki, 2015)
     • Can CGA deal with bank runs and multiple equilibria?

  3. Heterogeneous agent models (Kaplan, et al. 2017)
     • Distributional consequences of macro policy?
Conclusion

• Well written paper on a specific subject: accuracy of linear approx. in a large-scale DSGE model

• Global solution approach can have much broader applications, where nonlinearity is inherent
  – Optimal policy
  – Discrete choices (sovereign default)
  – Financial crisis and multiple equilibria
  – Distributional issues