Identifiability of An and Schorfheide (2007)

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The An and Schorfheide (2007) model is a prototypical DSGE model and consists of a representative household purchasing a basket of differentiated goods using a Dixit-Stiglitz type aggregator and supplying homogeneous labor services. The differentiated goods are supplied by monopolistically competitive firms using only labor services within a linear production function. Each firm sets prices according to the Rotemberg pricing assumption such that changing prices entails a real cost in terms of goods. The Rotemberg price adjustment function of the j-th intermediate firm is

$$ac_t(j) = \frac{\phi}{2}\left(\frac{P_t(j)}{P_{t-1}(j)} - \Gamma_{t,t-1}\right)^2 y_t(j)$$

where in the baseline specification we have full, $\Gamma_{t,t-1} = \pi$, indexation. Labor productivity, A_t, is the driving force of the economy and evolves according to a unit root process, i.e. $\log(A_t/A_{t-1}) = \log(\gamma) + \log(z_t)$, where γ denotes the steady state growth rate. Hence, $y_t = Y_t/A_t$ denotes detrended output and $c_t = C_t/A_t$ detrended consumption. The monetary authority follows a Taylor rule for the nominal interest rate R_t and real government spending G_t is assumed to evolve stochastically as a ratio of output $g_t := (1 - G_t/Y_t)^{-1}$. Uncertainty is introduced via random fluctuations in productivity growth, government spending and a monetary policy shock. The model is given in `AnSchorfheide.mod`.
The mod file considers three specifications of the monetary policy rule:

$$\begin{aligned}
R_t^*/R &= (\pi_t/\pi^*)^{\psi_\pi}(y_t/y_t^*)^{\psi_y} && \text{(flex-price)}\\
R_t^*/R &= (\pi_t/\pi^*)^{\psi_\pi}(y_t/y)^{\psi_y} && \text{(steady state)}\\
R_t^*/R &= (\pi_t/\pi^*)^{\psi_\pi}(z_t \cdot y_t/y_{t-1})^{\psi_y} && \text{(growth)}
\end{aligned}$$

where $y_t^* = (1-\nu)^{\frac{1}{\tau}} g_t$ is the output under flexible prices ($\phi = 0$) but with the monopoly power distortion intact.

Exercises

(a) Consider the baseline model with the flex-price monetary policy rule.

- Show that the model lacks theoretical identification at the calibrated parameter set.
- Try to solve the obvious identification failures.
- Does an approximation to the second-order yield additional restrictions to also solve the non-obvious lack of identification?

(b) Change the monetary policy rule. How does this affect identification of parameters?

(c) Reconsider the baseline model with the flex-price Taylor rule. Add a preference shock, ζ_t, to the utility function that shifts the discount factor in the intertemporal optimization problem of the household without changing the intratemporal labor supply decision. Therefore, the Lagrange multiplier corresponding to marginal utility is given by $\lambda_t = \zeta_t c_t^{-\tau}$. How does this affect the identification of the model?

(d) Reconsider the baseline model with the flex-price Taylor rule. Modern DSGE models introduce a partial, $\Gamma_{t,t-1} = \pi_t^{\iota^p} \pi^{1-\iota^p}$, indexation scheme. How does this affect identification of parameters?

(e) Choose an identified model of your choice and discuss which parameters are strongly and which are weakly identified. To this end, you might want to use either the indicators based on the Hessian or the Bayesian Learning Rate indicator of Koop, Pesaran and Smith (2013).

Cheating

Ivashchenko and Mutschler (2020) - The effect of observables, functional specifications, model features and shock on linearized DSGE models, Economic Modelling, 88, https://doi.org/10.1016/j.econmod.2019.09.039.