**Homework #6: Real Rigidities and the New Keynesian Model**

ECON 6313

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Program the New Keynesian Model outlined in the notes on "Real Rigidities and the New Keynesian Model" into the "King and Watson" software. In your program, set capital's share of output, $\alpha$, to 0.33, the discount factor, $\beta$, to 0.99, the habit persistence in consumption parameter, $b$, to 0.7, the steady-state level of labor, $n^*$, to 0.2, and the labor elasticity parameter, $\zeta$, to 1/3. In addition, calibrate the investment adjustment cost parameter, $\kappa$, to 2.5, the capital depreciation rate, $\delta$, to 0.025, the price elasticity of demand, $\epsilon_P$, to 6, and the probability firms cannot optimally adjust their price, $\eta_p$, to 0.75. Assume the steady-state values of technology, the price level, and the inflation rate, $Z^*$, $P^*$, and $\pi^*$, respectively, are all equal to 1. Finally, set the persistence of the technology and monetary policy shocks, $\rho_Z$ and $\rho_M$, to 0.92 and 0.50, respectively, and the standard deviation of both shocks, $\sigma_Z$ and $\sigma_M$, to 1. For each problem, generate on a single page the impulse response functions (20 periods) for output, consumption, investment, labor, the inflation rate, and the nominal interest rate (six separate subplots) to a positive 1-standard deviation technology shock. Repeat this process for a 1-standard deviation money growth rate shock. Thus, your finished assignment should include your answers to the questions, 12 pages of impulse response functions (properly label each page), and a copy of your Matlab code for the baseline model.

1. Using the baseline calibration outlined above, generate the impulse response functions for the six variables to both a technology shock and a money growth rate shock. Provide a briefly explanation why labor moves in the opposite direction of output after a technology shock. Briefly discuss whether the nominal interest rate's response to a positive money growth rate shock is consistent with the typical money demand and money supply model (i.e., the money demand/money supply graph taught to undergraduates).

2. Repeat the numerical exercise in (1) except now assume there is no habit persistence in consumption, $b = 0$. Which two of the six impulse responses change the most after a technology shock when $b = 0$? How does the impulse response function of the nominal interest rate change after a money growth shock when $b = 0$. Is this new impulse response function consistent with your explanation in (1)?

3. Generate the impulse response functions in (1) using the baseline calibration but assuming there are no investment adjustment costs, $\kappa = 0$. How does the peak investment response and the persistence of investment's response (is investment higher/lower, more/less persistent, in the later periods) differ after both shocks when $\kappa = 0$? Provide a brief economic explanation why consumption's response to a money growth shock is so much different when $\kappa = 0$?

4. Redo the impulse responses functions from (1) except assume there are no real rigidities in the model ($b = 0$ and $\kappa = 0$). When comparing the impulse response functions after a technology shock to those responses in (3), which variable's response changes the most and why? Do any of the other responses to a technology shock exhibit noticeable

changes? Provide a briefly economic explanation why inflation's response to a money growth rate shock is different with real rigidities ($b = 0.7$ and $\kappa = 2.5$) then without real rigidities ($b = 0$ and $\kappa = 0$).

5. Now examine the impulse response functions in a model with real rigidities but hardly any nominal rigidities. (The model will not solve as written without a very small amount of price stickiness.) That is, repeat (1) except set $\eta_p = 0.01$. Is the response of output to the technology and money growth rate shocks consistent with its response in the money-in-the-utility-function model (without nominal rigidities) we discussed in class? Briefly explain. [Hint: Pay close attention to the values on the y-axis.]

6. Lastly, consider a model without real rigidities and hardly any nominal rigidities. Specifically, recalculate (1) but assume ($b = 0$, $\kappa = 0$, and $\eta_p = 0.01$). When comparing these impulse response functions with those in (5), do the presence of real rigidities impact the responses to the technology and money growth shocks when there are hardly any nominal rigidities? Briefly explain.