ECON 33820 Advanced Macro Reading Group
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Optional Assignment: New Keynesian Models and FTPL
Due: As soon as possible, as long as necessary

Instructions
This is an optional assignment. You may work in small groups. You are advanced enough in your studies to know that this problem set is for your own benefit, and the only way to learn is to get your hands dirty. You may use any programming language that you wish, and you may work in either discrete or continuous time. You may solve the models below using any methods you like, including a package like Dynare. Please make sure that the units that you use for your figures are meaningful.

The purpose of this assignment is to understand the impact of a negative "demand" shock in New Keynesian models, under different assumptions about monetary and fiscal policy. I have enclosed the word "demand" in inverted commas because there is no such thing as a demand shock in a fully micro-founded model. So for the purpose of this assignment we will define a demand shock as a shock to a representative household's discount rate that makes it temporarily prefer to consume both goods and leisure in the future relative to the present, more so than it does in steady state. So, for example, in discrete time, you can assume that the household discount factor is given by

$$\beta_t = \beta e^{\xi_t}$$

with $\xi_t = 0$ in steady-state. We are interested in a shock that temporarily raises ξ_t above 0.

In the exercises that follow, I have purposely remained vague about the specific details of the model and I have left choices about parameterization up to you. You should use as simple a version of the model and as standard a parameterization as possible.

a) Start by constructing the simplest possible textbook representative agent New Keynesian model with sticky prices (you can use either Calvo or Rotemberg pricing). Assume that fiscal policy is passive and that monetary policy follows an active Taylor rule in which the nominal rate responds to inflation more than one-for-one. You can ignore the zero lower bound. Compute the impulse response of the economy to a discount rate shock.

b) Repeat the exercise above for different degrees of price stickiness, ranging from flexible prices to the limit as prices become fully rigid. For each level of price stickiness, summarize the impulse response as (i) the impact effect on output,

and (ii) the cumulative deviation of output from steady-state over the first T quarters for various values of T. Produce figures that shows how these summary measures of the output effect of the shock varies with the degree of price stickiness. Your figures should have the degree of price stickiness on the horizontal access and the output response on the vertical access. (HINT: when prices are flexible, the output response should be zero).

c) Add capital to your model. If you want some guidance on how to add capital to a simple New Keynesian model, a good paper to look at is Rupert and Sustek (2019). Make sure to include quadratic adjustment costs on capital, but other than that your model does not need any other bells and whistles. Note that the flex price version of your economy with zero capital adjustment costs is essentially a Real Business Cycle model (with the inconsequential addition of monopolistic competition). Repeat the exercises above for different levels of the capital adjustment cost (HINT: with an infinite adjustment cost, the economy's response to the discount rate shock should be essentially the same as in the version of the model without capital). You should be able to produce a nice figure that has the degree of price stickiness on the horizontal axis and a summary of the output response on the vertical axis, with a series of loci for different degrees of capital adjustment costs. If you have solved the model correctly, these figures should show the possibility of either negative or positive effects on output.

d) See if you can give some intuition for these figures, in particular what determines whether the discount rate shock leads to a boom or a recession and why. Re-run your code with alternative values for the responsiveness of monetary policy to inflation in the Taylor Rule. See if you can interpret these differences. You may find it useful to produce analogous figures for the impact and cumulative effects of inflation and the real interest rate in addition to output. Why do you think I asked you to focus on these two model parameters (degree of price stickiness, and size of capital adjustment costs)?

e) Repeat a)-d) under the FTPL. Specifically, assume an active rule for fiscal policy. A useful starting point might be to assume that government surpluses remain constant in response to the discount rate shock, either as a fraction of output or as a fraction of steady-state output, and to assume that the nominal interest rate is held fixed. See if you can provide some intuition for any differences in the effects of a discount rate shock between the versions of the model with active versus passive fiscal policy. How do your results change if you assume a Taylor rule for monetary policy (with a coefficient on inflation that responds less than one-for-one) rather than a nominal interest peg?

f) Based on your investigation what do you conclude about the effects of a "demand" shock in New Keynesian models, both in terms of inflation and output?

g) BONUS: How do the effects of a discount rate shock change if you assume an S-shaped surplus response as advocated by Cochrane (2021) ?

h) BONUS: How do the effects of a discount rate shock change if you introduce long-term debt with exponential maturity?