Lecture 21: Equilibrium responses to shocks in the NK model

ECON30009/90080 Macroeconomics

Semester 2, 2025

Last class

- Wrote down a simple 1 period NK model with sticky wages
- Nominal wage was perfectly sticky which implied that wages did not move to clear the labour market.
- Because households willing to supply any amounts of labour, firm's labour demand determined equilibrium labour used in production
- Firm's labour demand affected by the real wage. Variations in the real wage in turn depend on the price level when the nominal wage is sticky.

Last class

- We derived an AS and AD curve from the *optimizing* behavior of households and firms ("new" in New Keynesian refers to microfounded model as opposed to statistical relationship)
- AS curve affected by TFP, K and firm's labour demand
- AD curve affected by household demand which in turn is affected by demand for money balances and demand shock ϵ
- We showed what happens when TFP falls (AS curve shifts inward)
- and how expansionary monetary policy can stimulate demand and output via its impact on the price level and the real wage

Last class

- Different from the RBC model with money: monetary policy (and thus, money) is not neutral
- Notably, a key difference is there exists sticky prices (here sticky nominal wages) in NK model while all prices are perfectly flexible in RBC

Other shocks?

- A prediction of the RBC model is that variations in TFP are the driver of business cycles
- Other shocks in the RBC model cannot get co-movement right
- Can other shocks in the NK model give us the correct co-movement?

Demand shocks

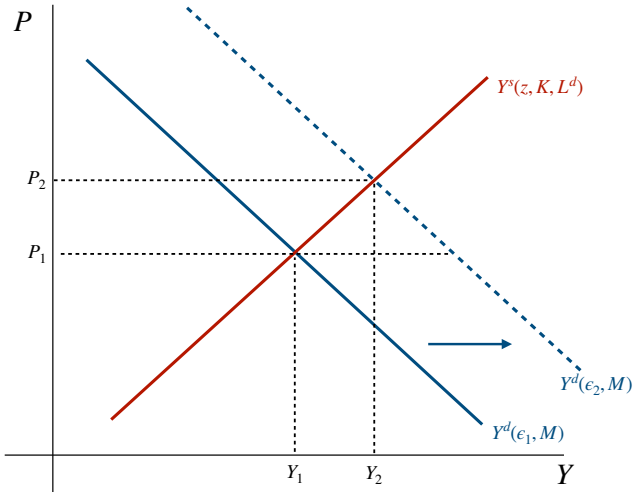
- A simple way to get a demand shock in our model is to increase the household's preference for consumption:

$$\max_{c,m} \epsilon \ln c + \gamma \ln m$$

- In particular, a rise in ϵ will raise the marginal utility the household gets from each additional unit of consumption, c

- We can ask how our economy would respond if households observed a positive demand shock, i.e., $\epsilon \uparrow$

Demand shocks



- Increase in demand for c leads to price level increase:

$$P = \frac{1}{z}\left[\frac{\epsilon M}{\gamma}\right]^{\alpha}\left[\frac{\overline{W}}{1-\alpha}\right]^{1-\alpha}$$

- Higher P lowers w $\Longrightarrow$ higher L^d.
- Output, consumption and total hours worked increase

Demand shocks

- In response to a demand shock, output consumption and total hours worked increase in the simple NK model.
- The demand shock causes the AD curve to move and raise prices
- What would be the stabilization policy the monetary authority can pursue if it wants to maintain price stability?

Stabilization

In equilibrium $M = M^s = \bar{M}$

- Reduce money supply to lower P

$$P = \frac{1}{z}\left[\frac{\epsilon M}{\gamma}\right]^{\alpha}\left[\frac{\overline{W}}{1-\alpha}\right]^{1-\alpha}$$

- Lower transfers to households $\Longrightarrow$ lower money balances and lower consumption demand

$$c = \frac{\epsilon}{\gamma}m = \frac{\epsilon}{\gamma}\frac{M}{P} = z\left(\frac{\epsilon M}{\gamma}\right)^{1-\alpha}\left[\frac{\overline{W}}{1-\alpha}\right]^{\alpha-1}$$

- Fall in P leads to higher real wage, L^d falls and output supplied falls (movement along AS curve).

What about a government spending shock?

Government spending shock

- Suppose government needs to spend an exogenous G amount of government spending. And suppose the government spending is wasteful
- But now let us assume that the government creates money to fund its spending G.
- This is a form of passive monetary policy. Here the monetary authority supplies money to accommodate the government's spending.

Government budget constraint

- Government spends exogenous G
- and creates money to finance G

$$PG = M^s$$

- Observe that the exogenous variable is G. M^s is now endogenous and dependent on the size of nominal government expenditure.
- Since money created used to completely finance government spending, there is no transfer to households in this case.

Household

- household problem is standard, only difference from Lecture 20 is budget constraint has no transfer

$$\max_{c,m} \epsilon \ln c + \gamma \ln m$$

s.t.

$$c + m = Ra + \frac{\overline{W}}{P}\ell + \pi$$

- Optimality conditions:

optimal trade-off between c and m: $\quad \frac{\epsilon}{c} = \frac{\gamma}{m}$

and household budget constraint

Firm's problem

- Firm's problem is standard.
- Nominal wage is fixed and households willing to supply any amounts of labour as demanded since no disutility from working.
- So labour demand determines labour used in equilibrium:

$$L^d = \left[\frac{P\left(1-\alpha\right) z K^{\alpha}}{\overline{W}} \right]^{1/\alpha}$$

Equilibrium

- Suppose $N = 1$ and $K = Na = 1$

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- Lower real wages lead to higher labour demand

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- More labour used in production leads to output supplied increasing

Equilibrium

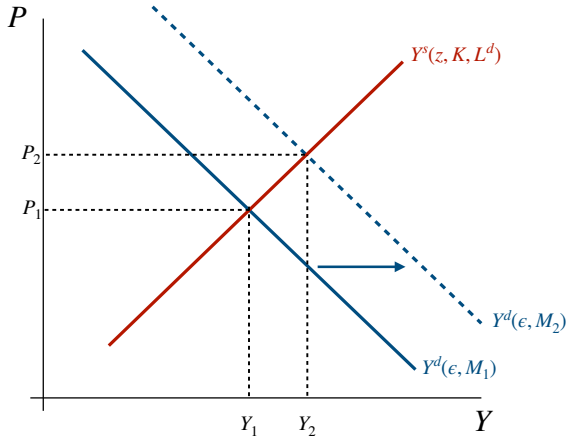
- Despite fall in real wage rate, consumption increases as firm employs higher amounts of labour

Equilibrium

- Despite fall in real wage rate, consumption increases as firm employs higher amounts of labour
- Income overall higher as more labour used in production ($\ell \uparrow$) and real return to capital, R, higher (complements)

$$c = \frac{\epsilon M}{\gamma P} = \frac{\epsilon}{\gamma} G$$

Government spending shock



- Positive government spending shock shifts out AD curve
- Passive monetary policy to support rise in government spending

In response to positive G shock

- The static NK model with perfectly sticky nominal wages predicts:
  - Output increases and price level rises
  - Total labour used in production increases

Wrapping up: an overview

- Start of this course: looked at history of macro
- Out of Great Depression, macro started as a separate field of inquiry in economics
- Idea that govt should intervene to manage fluctuations in economic activity

Wrapping up: an overview

- But how to manage fluctuations not straightforward
- Are coefficients estimated from statistic relationships "structural parameters"? Do these estimated parameters not change even when policy changes?
- Push towards micro-founding macro

Wrapping up: an overview

- 1st half of the course: a micro-founded model of the economy in the long-run
- Could look at how households and firms respond to changes in policy in the long run and whether market economy outcomes were pareto optimal
- No one size fits all: in OLG model, type of fiscal policy and how its financed mattered for outcomes!

Wrapping up: an overview

- 2nd half of the course: using our micro-founded model to explain business cycle and responses to policy
- Adapt the model that looked at drivers of long run growth to examine fluctuations in the short run
- RBC model finds that indeed variations in TFP can explain fluctuations in economic activity over the short-run
- ... but only variations in TFP

Wrapping up: an overview

- From lens of RBC model: just because something fluctuates doesn't mean should intervene to prevent its fluctuation (plain vanilla RBC model says market economy is pareto efficient)

- .. which suggests we should think carefully about what friction exists in the economy that we want to address

Wrapping up: an overview

- In class, we looked at two types of frictions:
  - search frictions $\implies$ search model of unemployment
  - sticky prices (in particular sticky nominal wages) $\implies$ inflation
- Both models suggest there is a role for stabilization policy

Wrapping up: an overview

- So where do we go from here?
- Model assumptions mattered a lot for the predictions and implications of the model
- How do we use micro-foundations to study the macro-economy?

Wrapping up: an overview

- Model-centric vs. **problem-centric**
- Writing down a highly realistic model with every single feature of the economy incorporated makes it a very complicated model
- Problem is that in equilibrium, things can interact to amplify, mitigate or cancel out (e.g., think about government spending and how in some cases it can crowd out consumption)
- With too many features in a model, very hard to identify what's driving the outcome
- Other end of spectrum: writing too a simple a model ends up not being useful or policy-relevant

Wrapping up: an overview

- Problem-centric approach: requires us to think carefully about the trade-offs we want to examine
- Careful modeling of the question we want answered. Simplifying assumptions on everything else.
- But that also means recognizing that a model written to answer a particular type of question, is not always appropriate to answer a question it wasn't designed to address

Final takeaways

- Even if you don't go down the path of writing down your own models
- You should be able to apply a critical lens to models introduced to you
- And to understand why a model gave a particular prediction

Final exam

- Final is cumulative (you need to know how to solve the household problem, the firm's problem, government budget constraints and for equilibrium)
- Emphasis on material from social security onwards (Lecture 10 onwards)
- Format:
  - ECON30009: 5 short answer questions (30%), 2 long answer questions (70%)
  - ECON90080: 7 short answer questions (28%), 3 long answer questions (72%)
- Practice final online: we will go over short answer and 1 long answer on Thursday
- Tutorial: go over 2nd long answer question

Otherwise, thanks! You've been a great class!