Economics 314 Spring 2019
Project #5 Assignment Due: 9am, Wednesday, March 13

Partner assignments

Shisham Adhikari	Matt Wan
Sean Allen	Ben Thomas
Jackson Anderson	William Ren
Tom Davies	Evian Oosthuizen
Frank Gaunt	Max Nobel
Robert Irvin	Lirui Jiao
Sam Williams-Baron	Alex Zhang
Jonathan Li	

1. A Simple *IS/LM* Model

Consider the following linear version of the *IS/LM* model:

$$Y = C + I + G \tag{1}$$

$$C = c_0 + c_1\left(Y - T\right) + \varepsilon_C \tag{2}$$

$$T = t_0 + t_1 Y + \varepsilon_T \tag{3}$$

$$I = i_0 + i_1 r + \varepsilon_I \tag{4}$$

$$m - p = m_0 + m_1 Y + m_2\left(r + \pi^e\right) + \varepsilon_m \tag{5}$$

The variables *m* and *p* are in logs to preserve linearity of the model. The other variables are levels. Lower-case letters with subscripts are coefficients that are assumed to be constant. The ε terms are shocks to the various equations of the model. *G, m, p,* and π^e are exogenous.

a. For each of the slope coefficients (coefficients that do not have a subscript of zero), tell whether it is positive or negative and explain why. (Some coefficients must be less than one, so indicate that as well.)

b. Why is there no shock term in equation (1)?

c. Find the equation for the *IS* curve. What is its slope? Can we determine the sign of the slope? How (if at all) does each of the exogenous variables and shocks affect the *IS* curve?

d. Find the equation for the *LM* curve. What is its slope? Can we determine the sign of the slope? How (if at all) does each of the exogenous variables and shocks affect the *LM* curve?

e. Solve the model for Y, C, I, T, and r in terms of the exogenous variables and shocks. Find an expression for the effect of each exogenous variable and shock on the equilibrium values of Y and r and, if possible, determine its sign.

f. Find the equation for the aggregate-demand curve in this model. How (if at all) is the AD curve affected by each of the exogenous variables and shocks?

g. The "zero-lower bound" constraint on nominal interest rates means that the demand curve for money must flatten as i approaches zero. If money demand as a function of the interest rate were perfectly flat (with the interest rate on the vertical axis), what would be the limiting value of m_2? What would happen to the slopes of the *IS*, *LM*, and/or AD curves as a result? What would happen to the effects on Y of monetary policy (changes in m) and fiscal policy (changes in G or ε_T)?

2. A Simple Sticky-Wage Model of Aggregate Supply

Suppose that production in this economy is given by the production function

$$y = \alpha k + (1-\alpha) l + \varepsilon_y. \tag{6}$$

The lower-case letters are again logs, so this is a Cobb-Douglas function with α being the usual constant parameter, but with a logarithmic shock ε_y attached. The capital stock is assumed to be fixed in the short run.

a. What is the marginal product of labor? (Be careful here, because MPL is $\frac{\partial Y}{\partial L}$, not $\frac{\partial y}{\partial l}$.)

b. Suppose that firms set the level of employment so that the marginal product of labor equals the real wage, $\frac{W}{P}$. Show the equilibrium condition (and solve it for L or l if you can).

c. If we assume that nominal wages are perfectly sticky, so W is exogenous, derive the equilibrium relationship between y and P: the short-run aggregate-supply curve. Is the slope of the SRAS curve positive, negative, zero, or infinite?

d. What variables and shocks affect the SRAS curve and in which direction? In particular, what effect would a productivity shock (ε_y) and a change in the nominal wage (W) have on the SRAS?

e. Suppose that a shock to aggregate demand causes P to increase. What would be the effect on W/P and on Y? Are real wages procyclical or countercyclical in this model?

3. Monetary policy targeting in *IS/LM* model. Suppose that the *IS* curve is given by

$$\begin{aligned} &Y = \alpha_0 + \alpha_Y \left(Y - T\right) - \alpha_r r + G + \varepsilon, \\ &\alpha_0 > 0, \quad 0 < \alpha_Y < 1, \quad \alpha_r > 0, \end{aligned} \tag{7}$$

where ε is a random expenditure shock with a mean value of 0. Money demand is given by

$$\begin{aligned} &m^d - p = \beta_0 + \beta_Y Y - \beta_r r + \eta, \\ &\beta_0 > 0, \quad \beta_Y > 0, \quad \beta_r > 0. \end{aligned} \tag{8}$$

The term η is a random shock to money demand with a mean value of 0 and m and p are the logs of money and prices. We assume that the expected rate of inflation is zero here.

We know that central banks can choose either money-supply targets or interest-rate targets. We often think of the central bank choosing these targets based on current values of important variables such as Y and π. However, central banks cannot usually observe Y and π immediately. In fact, it is sometimes as much as a year lag before reliable data on GDP and prices become available. In the interim, the central bank must choose its "operating rule" without any guidance from Y and π, either a fixed money-supply rule $m^s = \bar{m}$ or a fixed interest-rate rule $r = \bar{r}$.

a. Suppose that the central bank chooses a money-supply rule. Solve the model and find $\partial Y/\partial \varepsilon$ (the effects of an expenditure shock on output) and $\partial Y/\partial \eta$ (the effects of a money-demand shock on output).

b. Now suppose that the central bank follows an interest-rate rule. Solve the model under the interest-rate rule and calculate the effects on output of each kind of shock.

c. Which policy rule is more effective at stabilizing output when expenditure shocks occur? Which rule is better at stabilizing output in the face of money-demand shocks? Show the corresponding result using *IS* and *LM* curves.

d. Money demand has been unstable in recent decades, due in part to rapid technological innovation in the financial-services sector. Most central banks now follow interest-rate rules. Based on your analysis above, would they be better off with a money-supply rule?