Assignment #5*

Econ 102: Introductory Macroeconomics

Due May 5, 2010

Directions: Turn in the homework to your TA's box before lecture. Please legibly write your name, TA name, and section number on the front of the homework. Write your name as it appears on your ID. Late homework is not be accepted. Please show your work in a readable and organized way. Good luck!

1 Keynesian Models

1.1 Aggregate Expenditure (AE) Model, Analytical

Consider a closed economy with consumption function

$$C = \bar{C} + MPC[Y - (T - TR)] \tag{1}$$

where I is planned investment, $\bar{C}$ is autonomous consumption, MPC is the marginal propensity to consume, Y is output, T is taxes levied on households by government, and TR is the level of transfers from government to households. Use your knowledge of the aggregate expenditure model (goods market) to answer the following questions.

1.1.1 Are there any restrictions on the possible values of $\bar{C}$ and MPC? If so, list them and briefly explain why these restrictions are imposed.

1.1.2 Write out the aggregate expenditure equation $AE(Y)$. Is it linear in Y? If so, list the slope and y-intercept terms. Draw a graph of $AE(Y)$ versus Y.

*Kelly; UW-Madison; spring 2010.

1.1.3 **Write equilibrium output level Y^* as a function of T, TR, MPC, $\bar{C}$, I, and G.** ***(hint: write down the equilibrium condition for AE model, i.e.** $AE(Y^*) = Y^*$**, and solve for** Y^* **algebraically)***

1.1.4 **Define tax multiplier $M_T \equiv \frac{\Delta Y^*}{\Delta T}$ and government expenditure multiplier $M_G \equiv \frac{\Delta Y^*}{\Delta G}$ (in calculus terms, $M_T = \frac{\partial Y^*}{\partial T}$ and $M_G = \frac{\partial Y^*}{\partial G}$). Given your expression for Y^* from the previous part, write M_T and M_G, the fiscal policy multipliers, in terms of constants. Which multiplier is larger in magnitude?** ***(hint: the fiscal policy multipliers are the coefficients on the** T **and** G **terms in the equation for equilibrium output** Y^* **that you derived previously)***

1.1.5 **Briefly explain how the aggregate expenditure model reaches equilibrium (Y^*, C^*) from any nonzero initial level of output Y_0.** ***(hint: you answer should talk about how firms respond to unexpected changes in inventories under three cases:** $Y_0 < Y^*$, $Y_0 = Y^*$**, and** $Y_0 > Y^*$**; stating the goal of the firm may help)***

1.1.6 **From this part forward, assume the following:** $\bar{C} = 175$, $MPC = \frac{4}{5}$, $I = 200$, $G = T - TR = 250$. **If** $Y = 2000$**, what is planned aggregate expenditure? Given your answer, would you expect equilibrium output level** Y^* **to be higher or lower than** $Y = 2000$**?**

1.1.7 **What is the equilibrium level of output** Y^***? Is it consistent with your guess in the previous part?**

1.1.8 **Now, suppose that** G **is reduced to** 200 **units with** T **unchanged. What is the new equilibrium output level? Calculate** $\frac{\Delta Y}{\Delta G}$**. Is your result consistent with the government expenditure multiplier** M_G **computed in part (1.1.4)?**

1.1.9 **Now, suppose that** T **is reduced by** 20 **units with** $G = 250$ **and** TR **unchanged. What is the new equilibrium output level? Calculate** $\frac{\Delta Y}{\Delta T}$**. Is your result consistent with the tax multiplier** M_T **computed in part (1.1.4)?**

1.2 Aggregate Expenditure Model, Computational

Let's add an explicit dimension of time to the aggregate expenditure model. Here, subscript t stands for time, so all variables are now indexed by t. $\bar{C}$ and MPC are still treated as constants; they don't vary over time. Consider a closed economy. Implement the following AE model in Excel.

Aggregate expenditure:

$$AE_t = C_t + I_t + G_t \tag{2}$$

Output:

$$Y_{t+1} = C_t + I_t + G_t \tag{3}$$

Consumption:

$$C_t = \bar{C} + MPC[Y_t - (T_t - TR_t)] \tag{4}$$

Investment:

$$I_t = 0.15Y_t \tag{5}$$

Government expenditure:

$$G_t = 0.2(Y_t - TR_t) \tag{6}$$

Taxes:

$$T_t = 0.25I_t \tag{7}$$

Transfers:

$$TR_t = 0.1(I_t - T_t) \tag{8}$$

Initial conditions (at time $t = 0$):

$$Y_0 = 200$$

Constants:

$$\bar{C} = 20$$

$$MPC = 0.65$$

You should have the following columns in your Excel file: t, Y_t, C_t, I_t, G_t, T_t, and TR_t. Each row in the Excel file should be some t (year). The first row of your Excel file should label the columns. **<u>You do not have to print out your tables, only your graphs (when asked to do so).</u>**
(extended hint: "Manually enter the initial conditions into the second row ($t = 0$), then write Excel formulas for consumption, investment, government spending, taxes, and transfers. Enter the formula for output next period ($t = 1$) in the third row. Notice the timing: output at time $t+1$ depends on variables from time t, the previous year. Copy your formulas for C_t, I_t, G_t, T_t, and TR_t from the second row to the third. Finally, copy your formulas for all variables from the third row down until the model runs for 500 periods (until $t = 500$).")

1.2.1 Translate the AE model formulas above into Excel formulas in a spreadsheet, and then run the model for $t = 0, 1, \ldots, 500$.

1.2.2 **Graph Y_t, C_t, I_t, and G_t versus t (time) in a single graph, if possible. Print your graph(s) out. What trends do you observe?**

1.2.3 **Based on your answer to the previous part, which statement is correct: (1) $Y_0 < Y^*$; (2) $Y_0 = Y^*$; (3) $Y_0 > Y^*$?**

1.2.4 **Graph T_t, TR_t, and $S_{public,t} = T_t - G_t - TR_t$ versus t (time) in a single graph, if possible. Print your graph(s) out. What trends do you observe? Describe the government budget balance over time.**

1.2.5 **Graph $S_{public,t}$, $S_{private,t} = Y_t - (T_t - TR_t) - C_t$, and $NS_t = Y_t - C_t - G_t$ versus t (time) in a single graph, if possible. Print your graph(s) out. What trends do you observe? Describe household saving behavior over time.**

1.2.6 **Define the household savings rate as $s_t = \frac{S_{private,t}}{Y_t}(100)$ and the national savings rate as $s'_t = \frac{NS_t}{Y_t}(100)$. Graph s_t and s'_t versus t in a single graph, if possible. Print your graph(s) out. What trends do you observe?**

1.3 Mechanics of the Aggregate Expenditure Model

1.3.1 **Assume an aggregate expenditure function of form $AE(Y) = a + bY$, where $a > 0$ and $0 < b < 1$. Draw a graph of the aggregate expenditure model that includes the $45°$ line and the aggregate expenditure function in AE versus Y space. Your graph should be labeled clearly and completely.**

1.3.2 **Assume that initial output level Y_0 is less than the equilibrium level of output Y^* ($Y_0 < Y^*$). Also, let's say that the full employment level of output Y_{FE}, associated with the natural (full employment) level of unemployment, is such that $Y^* < Y_{FE}$. Reproduce your graph in the previous part, adding vertical lines denoting Y_0 and Y_{FE}.**

1.3.3 **Briefly describe how the economy transitions from initial output Y_0 to equilibrium output Y^*. Your answer should talk about how the following economic variables are affected: (1) the level of employment; (2) the level of inventories; (3) unexpected changes in inventories; and (4) the level of output.**

1.3.4 **The government wants to attain the full employment level of output, Y_{FE}, in the short-run by adjusting the level of government expenditure G. Based on your diagram from part (1.3.2), how should the government change G to achieve its goal? On your graph, show the effects of an appropriate change in G. Label ΔG and ΔY as a result of the new fiscal policy. What is the new level of output?**

1.3.5 **Based on your answer to the previous part, which statement is correct: (1) $\Delta Y < \Delta G$; (2) $\Delta Y = \Delta G$; (3) $\Delta Y > \Delta G$? What is the government spending multiplier $M_G = \frac{\Delta Y}{\Delta G}$ in this case?**

1.3.6 **When the government implements its new fiscal policy, what happens to the economy in terms of unexpected changes in inventories and output? What if businesses anticipate the government's change in fiscal policy?**

2 AD / AS Model

2.1 Aggregate Demand / Aggregate Supply Model

Consider the AD / AS model with a horizontal SRAS curve and a vertical LRAS curve. The Federal Reserve implements monetary policy by adjusting the money supply (M).
Long-run aggregate supply curve (vertical):

$$Y_{LR} = 500 \tag{9}$$

Short-run aggregate supply curve (horizontal):

$$P_{SR} = 6 \tag{10}$$

Aggregate demand curve:

$$Y = \frac{4M}{P} \tag{11}$$

Money supply:

$$M = 750 \tag{12}$$

2.1.1 If the economy is initially in long-run equilibrium, what are the values of P^*_{LR} and Y^*_{LR}?

2.1.2 Now suppose a supply shock moves the short-run aggregate supply curve to $P_{SR} = 4$ (still horizontal). What is the new short-run equilibrium (P^*_{SR}, Y^*_{SR})?

2.1.3 If the aggregate demand and long-run aggregate supply curves are unchanged, what is the new long-run equilibrium (P^*_{LR}, Y^*_{LR}) after the supply shock?

2.1.4 **Suppose that after the supply shock, the Federal Reserve wants to hold output at its long-run level. What level of the money supply M' would be required to achieve this in the short-run?**

2.1.5 **From this part forward, consider the generic aggregate demand - aggregate supply model with three curves: AD, SRAS, and LRAS. Assume that the economy starts in long-run equilibrium. Additionally, assume that the short-run aggregate supply curve is horizontal in P versus Y space. In a carefully-labeled graph with these three curves, diagram the effect (both short-run and long-run) of an increase in expected future corporate profits. Your graph should identify two equilibrium points, short-run equilibrium (P^*_{SR}, Y^*_{SR}) and long-run equilibrium (P^*_{LR}, Y^*_{LR}). Briefly describe how the economy transitions from short-run to long-run equilibrium. Draw arrows along the transition path.**

2.1.6 **Now assume that the short-run aggregate supply curve is upward-sloping in P versus Y space, but not vertical, with a slope near one. Continue to assume that the economy starts in long-run equilibrium. Repeat (2.1.5), but diagram the effect of an unexpected increase in the price of oil.**