14.02 Principles of Macroeconomics

Problem Set # 2, Answers

Part I

1. **False**. The multiplier is $1/[1- c_1 (1- t)]$. The effect of an increase in autonomous spending is dampened because taxes respond proportionally to any increase in output.
2. **False**: A decrease in G shifts the IS to the left, Y↓ and i↓, so C↓ because income has decreased (assuming the income effect dominates the interest effect or no interest effect on consumption), but the effect on I is ambiguous (because, in general, we cannot assume similar assumption regarding the investment).
3. **False**: GDP will definitely increase, but interest rate change depends on the entity of the shifts and the slopes of the IS and LM.
4. **True**: the introduction of the ATMs reduces demand for money, which shifts the LM to the right, resulting in lower interest rate and higher GDP.
5. **True**: While an expansionary fiscal policy shifts the IS to the right, increases Y and the inflationary pressure, the Fed can sell T-bills through open market transactions, which reduces money supply, and in turn, shifts the LM to the left to off-set the increase in Y and the inflationary pressure. The result of the fiscal expansion, in this case, will be an increase in the interest rate.

Part II

1. c_0 is the minimum consumption for survival, which represents the sensitivity of the consumption w.r.t. the exogenous variables. c_1 is the marginal propensity to consume (MPC), which represents the sensitivity of the consumption w.r.t. the disposal income. Note, $c_1 (1 - t)$ is the slope of the consumption line in the space Y-C (goods market graph). c_2 is the sensitivity of the consumption w.r.t. the interest rate. c_3 is the sensitivity of the consumption w.r.t. the net wealth. $c_0 - c_1 T - c_2 + c_3 =$ is the intercept of the consumption line in the space Y-C (goods market graph). b_0 represents the sensitivity of the investment w.r.t. the exogenous variables. b_1 is the marginal propensity to invest, which represents the sensitivity of the investment w.r.t. the GDP (*not disposal income*). This is the slope of the investment line in the

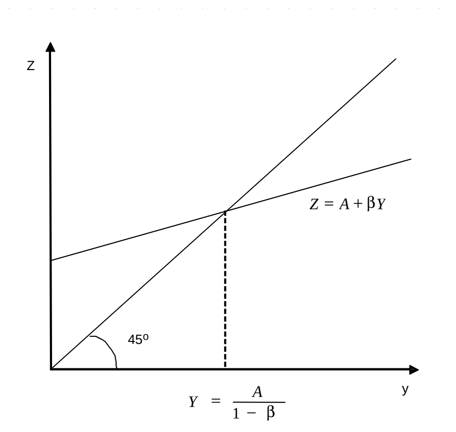
space Y-I (goods market graph). b_2 is the sensitivity of the investment w.r.t. the interest rate.

2. **Endogenous variables**: C, I, Y, and W (these all are determined endogenously according to their behavioral equation). **Exogenous variables**: G, T, t, B (determined by the government and we have no behavioral equation for them), and M (determined by the central bank and we have no behavioral equation for it).

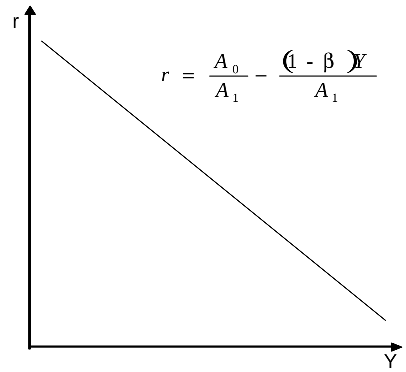
3. The equilibrium condition is Y = C + G + I. After substituting the behavioral and identity equations:

$$Y = \frac{\{[c_o + c_3(M+B) + b_0 + G - c_1 T] - [c_2 + b_2] r\}}{\{1-(1-t)c_1 - b_1\}} = \frac{A}{1-\beta} = \frac{A_0 - A_1 r}{1-\beta}$$

where A is autonomous spending and $1/(1-\beta)$ is the multiplier. We shall name A_0 the part of autonomous spending that does not depend on the interest rate and A_1 the part that does.

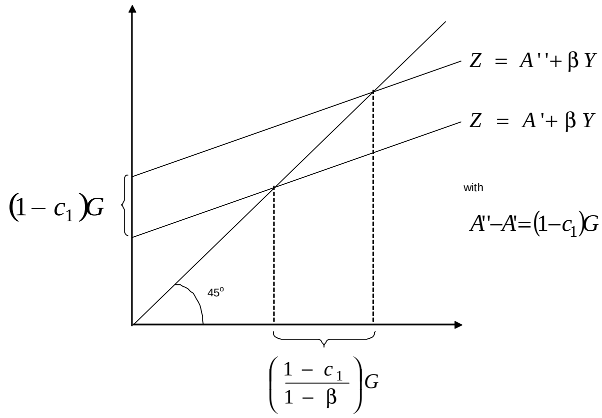


4. The IS curve will, in this case, be a negative slope straight line on the r-Y space. The intercept of the r axis is A_0/A_1 and the slope of r with respect to Y is $-(1-\beta)/A_1$. Representing the IS with the inverse axes is mathematically correct but is not the way the IS curve is usually represented in economics.



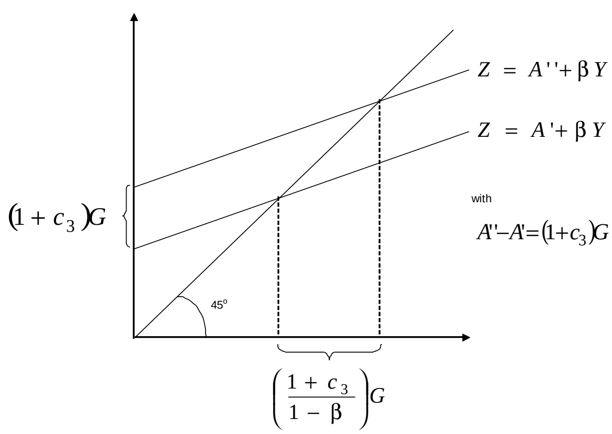
5. The larger is the interest sensitivity of investment (b_2) and of consumption (c_2), and the larger is the income sensitivity of investment (b_1) and of consumption (c_1), the flatter is the IS, thus a small change of r has a large impact on I and C, and therefore on Y. The IS curve is a representation of equilibrium in the goods market. When income expands for some reason, interest rates must fall so that there is a demand for goods that meets this new supply. If the demand for goods (either from investment or consumption) is very sensitive to the interest rate, a small fall in the interest rate will be enough to equilibrate the goods market. If the multiplier is very large, and the expansion of output generates a big demand by itself, a small fall in the interest rate will be needed to expand the demand towards equilibrium.

6. An expansion of government spending and per capita taxes expands equilibrium output. This is the balanced budget multiplier result that comes from the fact that the private propensity to consume is smaller than one. The government is taking income away from the individuals and spending it, but private individuals were not going to spend it completely. Since equilibrium output increases so will consumption. The budget deficit will decrease. We have assumed that government spending and per capita taxes will cancel but since income increases so will the amount of income tax (tY) increase.



7. An expansion of government spending financed with domestic bonds will increase equilibrium output. The demand for goods and services expands for two reasons. First, because of the expansion in government purchases. Second, because of increased private spending caused by the public's perception that the additional bonds issued by the government are a contribution to private sector wealth. Consumption will increase and the budget deficit can increase or decrease depending on the parameters. In fact the change in the budget deficit will be equal to:

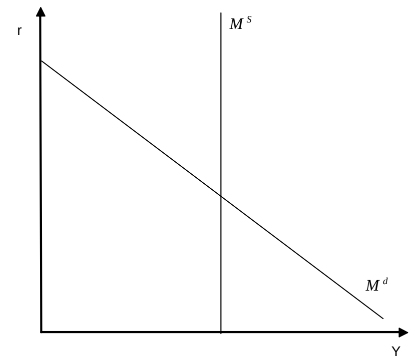
$$\Delta BD = \underbrace{t\left(\frac{1+c_3}{1-\beta}\right)G}_{t\Delta Y} - G$$



8. The equilibrium condition in the money market is that the money supply is equal to the money demand. It is given in equation (5). By using equations (3)

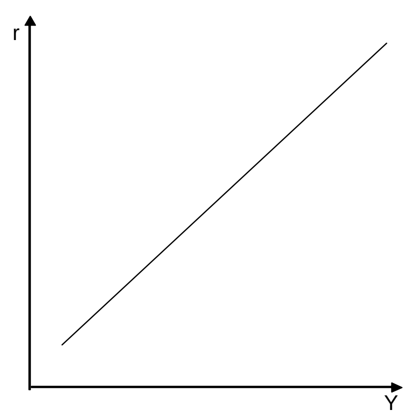
and (4) in equation (5), we can solve that equilibrium in the money market is described by:

$$r = \frac{m_0 + m_3 B - (1 - m_3) M^S}{m_2} + \frac{m_1}{m_2} Y$$



9. Parameters m_1 , m_2 , *and* m_3 are the income, interest, and net wealth sensitivity of the money demand, reciprocally.

10. The equation in answer (6) shows that the LM curve has a positive slope, given by m_1/ m_2



11. The larger is the income sensitivity of the money demand, the steeper is the LM, the larger is the interest sensitivity of the money demand the flatter is the LM. Again, we must remember that the LM curve is an equilibrium condition for the money market. Also remember that money supply always meets demand in this particular model. If income increases for some exogenous reason, this will increase the demand for money. Interest rates must rise to make money demand contract back to equilibrium. If money demand is very

sensitive to interest rates, the required increase will be very small. If money demand is very sensitive to income, the required increase will be larger than otherwise.

12. By substituting the value of r from the money market equilibrium condition in the equilibrium Y from the good market, we get:

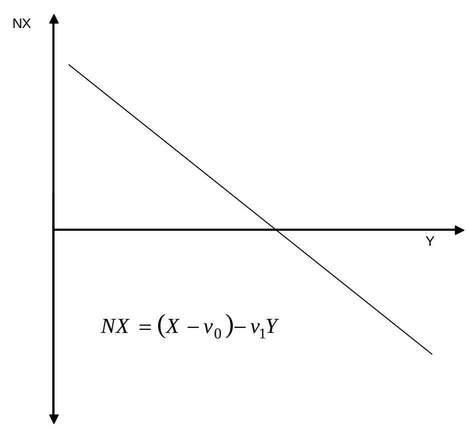
$$Y = \frac{\left\{[c_o + c_3 (M+B) + b_0 + G - c_1 T] - [c_2 + b_2]\left(\frac{m_0 + m_3 B - (1-m_3)M}{m_2} + \frac{m_1}{m_2}Y\right)\right\}}{\{1 - (1-t)c_1 - b_1\}}$$

and solving for Y we get

$$Y^* = \frac{\left\{[c_o + c_3 (M+B) + b_0 + G - c_1 T] - \left(\frac{[c_2 + b_2][m_0 + m_3 B - (1-m_3)M]}{m_2}\right)\right\}}{\{1 - (1-t)c_1 - b_1]\} + \left(\frac{[c_2 + b_2]m_1}{m_2}\right)}$$

13. Now, part of imports are determined endogenously. The parameter that describes the sensitivity of imports to output is v_1. There is a component of imports that continues to be exogenous and is described by v_1 which is the marginal propensity to import.

14. The NX slope has a negative slope since higher levels of income increase the amount of imports while exports are fixed.



15. As far as the slope of the IS is concerned ß decreases from $\beta = (1-t)c_1 + b_1$ to $\beta = (1-t)c_1 + b_1 - v_1$. This means that the multiplier decreases. The reason is that now part of the effect of expanded demand ends up expanding the demand for foreign goods and hence increasing imports.