

14.02 Principles of Macroeconomics

Problem Set #2(Answers)

2/26/97

1) a) The multiplier $= 1/(1 - c_1) = 1/(1 - .9) = 10$. The equilibrium level of output (Y) $= [1/(1 - c_1) * [c_0 + I + G - c_1T]] = 10 * [300 + 200 + 2,000 - (.9)1,000] = 16,000$.

b) (Private) Saving function (S) $= Y - T - C = Y - T - [c_0 + c_1(Y - T)] = -c_0 + (1 - c_1) * (Y - T)$. Substitute value for each variable, we get $S = 1,200$. Alternatively, we could have used the fact that in equilibrium, investment must be equal to total saving. $[I = S + (T - G)]$ Then, $S = I - (T - G) = 200 - (1,000 - 2,000) = 1,200$.

c) Now, $c_0 = 200$. Then, equilibrium output will decrease by $10 * 100 = 1,000$. Therefore, the new equilibrium output will be 15,000. The attempt on the part of consumers to increase saving by reducing consumption will result in, at least in the short run, decline in demand, and thus output level. In this case, lower autonomous portion of consumption by 100 will lead to output reduction of 1,000 through the multiplier effect.

d) In ZZ-Y Keynesian cross graph, increase in saving (or, decrease in c_0) will shift ZZ (demand) schedule downward (parallel to the old), and the new equilibrium level will be where the new ZZ schedule intersects with the 45 degree line.

e) At the new equilibrium output level $Y = 15,000$, private saving $S = -200 + (.1)(15,000 - 1,000) = 1,200$. In equilibrium, investment must equal total saving. Since neither investment nor public saving has changed in this case, private saving must remain unchanged as well. This is again an example of "paradox of saving" we saw in class. Decrease in income as a result of decline in consumption will offset any increase in saving through lower c_0 , leaving private saving at the same level.

2) a) Increase in I leads to higher autonomous expenditure, higher output, while has no effect on the slope of ZZ and the multiplier.

b) Decrease in c_1 leads to higher autonomous expenditure ($-c_1T$), lower slope for ZZ, smaller multiplier, and lower equilibrium output. You can check by taking derivatives of the output equation to see that the reduction in demand due to lower fraction of income being consumed would dominate an increase in autonomous expenditure due to ($-c_1T$) term. Therefore, at the new equilibrium, output will be lower.

c) Reduction in welfare payment is equivalent as increase in T in our model. Thus, we will have smaller autonomous expenditure, and lower output, while there is no change in either slope or multiplier.

d) Increase in G leads to higher autonomous expenditure, higher output with no change in slope of ZZ, and multiplier.

3) Investment would not decline by \$1 million. Instead, private saving would rise by \$1 million, leaving investment unchanged. The increase in G raises Y by $\$1/(1 - c_1)$ million, and private saving by $(1 - c_1)$ times the change in $Y (= (1 - c_1) * [1/(1 - c_1)])$, which amounts to exactly \$1 million.

4) a) The new expression is :

$$Y = [1/(1 - c_1(1 - t_1))][c_0 + I_{bar} + G - c_1t_0].$$

b) The new autonomous expenditure multiplier is smaller than the old, because each dollar of additional income induces additional spending equal to $c_1(1 - t_1)$, rather than c_1 ,

as was previously the case. Thus any change in autonomous expenditure would have its effect on equilibrium GDP dampened in the presence of income taxes. For example, in case of decrease in investment level, the smaller multiplier would lead to a smaller reduction in output. So, the output loss would not be so severe.

c) The deficit D is given by $D = G - T$, which is now:

$$D = G - t_0 - t_1[1/(1 - c_1(1 - t_1))][c_0 + Ibar + G - c_1t_0],$$

which increases with $c_0 + Ibar$, so to keep the deficit constant, G would have to move in the same direction as $c_0 + Ibar$, or T in the opposite direction. Such policies would tend to magnify movements in Y . For example, due to decline in consumer confidence, c_0 goes down. As a result, output level will decrease, causing the economy to slow down. Note that tax revenue collected by government would decline as well since it depends on income level. To comply with the Balance Budget Amendment, which requires $G = T$, the government would have to reduce G , thus exacerbating the slowdown of the economy, even though the right policy for this case might be to increase G to stimulate the economy.

5) a) False. To calculate equilibrium output, all we need is to first estimate the value of marginal propensity to consume, which will give us the multiplier term. Then we can obtain the new equilibrium output by multiplying change in autonomous expenditure by the multiplier term. On the other hand, if you want to find not only new output level but also its adjustment process, using simulation method would likely save considerable amount of time and effort, especially with a long and complicated lagged adjustment equation.

b) False. In recession, demand would likely to be lower than production, assumed, in a dynamic model, to be set in advance before the unexpected low demand is actually realized. This will result in positive inventory investment (defined as production minus sales) during period of recession.

6) a) MPC in model $A = .25 + .15 = .40$ MPC in model $B = .20 + .15 + .05 = .40$

b) Given that MPC for both models are .40, the multiplier terms for both models are $1/(1 - .40) = 1.666\dots$

c) The economy described by model B will have slower adjustment process to any demand shocks than the economy described by A. The slower adjustment of consumption to disposable income implies a slower effect of income on demand, and thus back on output. This timing difference is very important to the effectiveness of any economic policy. Knowing the accurate description of adjustment process will enable the policy maker to design an effective set of economic policy, one which succeeds in reaching not only its intended output level, but also its intended timing.

7) The final effect on GDP would have been smaller, because only 39 percent of the tax cut would eventually have been spent. In the simulation example, increase in G by \$1 billion led to an increase in autonomous expenditure of 1 billion. Thus, the equilibrium output increased by \$1.64 billion (\$1 billion times $1/(1-.39)$). On the other hand, reduction in T by 1 billion would result in an increase of autonomous expenditure by only \$.39 billion. The eventual equilibrium output would have been higher by only $.39 * \$1.64$ billion = \$0.64 billion. The adjustment would also have been more gradual, since the full impact of the tax reduction on consumption takes three periods to materialize, in contrast to the increase in government spending, which has its full effect on sales in the first period.