Professor Christiano
311, Spring 2000

Notes for Answers to First Midterm

1. (20)

   (a) Let the jump in consumption be denoted Δc_0. Initially, planned spending exceeds actual output by Δc_0. This excess of spending over production produces an unintended increase in inventories. Producers respond by expanding production and employment. Here is one scenario: They respond by expanding output and income by Δc_0. This results in a further increase in planned spending by $c_1 \Delta c_0$. So now planned spending exceeds production by $c_1 \Delta c_0$. Suppose firms respond to this by expanding production by another $c_1 \Delta c_0$. This then produces a further rise in planned spending by $c_1^2 \Delta c_0$. Firms respond by raising production by this amount, and the process continues in this way. The total rise in Y is the sum of all the individual jumps: $\Delta c_0 + c_1 \Delta c_0 + c_1^2 \Delta c_0 + ... = \Delta c_0/(1 - c_1)$. What happens to saving is this. Initially, saving falls by Δc_0. The initial rise in income of Δc_0 creates an increase in saving of $(1 - c_1)\Delta c_0$. The next rise in income of $c_1 \Delta c_0$ produces a rise in saving of $(1 - c_1)c_1 \Delta c_0$, and the next rise in income of $c_1^2 \Delta c_0$ produces another rise in saving of $(1 - c_1)c_1^2 \Delta c_0$, and so on. The net effect on saving is the sum of the initial drop, plus all the subsequent jumps. Adding up the subsequent jumps, we get $(1 - c_1)\Delta c_0 + (1 - c_1)c_1 \Delta c_0 + \; ... \; = (1 - c_1)\Delta c_0/(1 - c_1) = \Delta c_0$. This exactly offsets the initial fall in saving, so the overall effect on saving of the fall in the savings function is nill.

   (b) The rise in equilibrium output is greater than the jump in c_0 because firms' decisions to increase output and employment results in further increases in planned spending, beyond the initial jump in Δc_0 i.e. the multiplier mechanism is at work.

   (c) Equilibrium in the goods market is $Y = Z(Y)$, where Z is aggregate planned spending. Subtracting T and C from both sides, we get, $S = I + G - T$. That is, planned saving must equal planned investment plus the government deficit in equilibrium. Now the level of planned investment, G,and T are here assumed to be exogenous and fixed. This is why the level of planned saving cannot change in equilibrium with the rise in c_0.

(d) This is so because of the definition of actual investment. We assume that actual consumption equals planned consumption, actual government spending equals planned government spending, by assumption. Actual investment, I^a, is equal to planned investment, I^p, plus unplanned inventory accumulation, I^u. Unplanned inventory accumulation corresponds to the difference between actual output and planned spending:

$$I^u = Y - C^p - I^p - G^p.$$

Putting all this together, we find that actual consumption plus actual investment plus actual government spending is:

$$\begin{aligned} C^a + I^a + G^a &= C^p + (I^p + I^u) + G^p \\ &= C^p + (I^p + [Y - C^p - I^p - G^p]) + G^p = Y, \end{aligned}$$

always. That is, I^u is *defined* as the quantity of investment, such that when you add it to planned investment, actual spending equals actual output.

2. (25)

(a) Firm managers must finance investment projects by borrowing from someone else: equity holders (through retained earnings), banks, or by issuing bonds. In each case, the person or persons providing funds have other things they could potentially do with their money. We assume those other things earn the market interest rate, i. So, when interest rates are high, only the projects that promise to generate a strong return will be financed and when interest rates are low, both the good and not-so-good projects will be financed. This is the rationale for the downward-sloped investment demand curve.

(b) The curve is downward sloping because, if you reduce the rate of interest, this shifts the planned spending curve up. This results in a higher equilibrium level of Y, as can be seen from the goods market equilibrium condition:

$$Y = Z(Y) = c_0 + c_1 \left(Y - \bar{T} \right) + \bar{G} + \bar{I} - bi.$$

Points above the IS curve are points where i is too high to be on the IS curve. With i high, planned spending is below actual output. At points below the IS curve, planned spending exceeds actual output and income, because planned spending is high at points like this.

(c) To figure out the effect on the slope, start at a point on the IS curve. Drop the rate of interest by y. Let the distance to the right that output increases to get to the new equilibrium be called x. The slope of the IS curve is y/x ('the rise over the run'). Now, the larger is b, the more a given drop in the rate of the interest shifts the Z curve up.

3. (25)

(a) If you increase government spending by $\triangle \overline{S}$, the resulting effect on equilibrium output is $\triangle Y = m \triangle \overline{S}$, where $m = \frac{1}{1-c_1}$. By decreasing taxes by the same amount you would obtain an increase in output equal to $\triangle Y = c_1 m \triangle \overline{S}$. Since the marginal propensity to consume, c_1, is smaller than one, increasing $\overline{G}$ would stimulate equilibrium output more that a decrease in $\overline{T}$ by the same amount. Put differently, since the public spending $(\frac{1}{1-c_1})$ multiplier is bigger than the lump-sum taxes multiplier $(\frac{c_1}{1-c_1})$, changing the first delivers a better outcome.

(b) The total effect on output of the two changes in fiscal policy is given by $\triangle Y = m \triangle \overline{G} - c_1 m \triangle \overline{T} = \frac{(1-c_1)\triangle \overline{G}}{1-c_1} = \triangle \overline{G}$. The increase in output resulting from a higher public spending is only partly offset by the increase in lump-sum taxes. The net effect is positive because the public spending multiplier is bigger than the lump-sum taxes one.

4. (25)

(a) The LM is the combination of output (Y) and interest rates (i) such that there is equilibrium in the money market. The money demand in this question is given by

$$M^d = P(Y + \bar{L} - L_1 i)$$

Setting money demand equal to money supply, and solving for i, obtains:

$$i = \frac{\bar{L}}{L_1} - \frac{1}{L_1}\frac{M^s}{P} + \frac{Y}{L_1}.$$

This is the LM curve.

(b) Suppose L_1 is very large, which means that the money demand is very responsive to the interest rate. Suppose the money market is in equilibrium and Y increases. We know that the interest rate has to increase in order to eliminate the excess money demand resulting from a higher output. But, given the assumption of the high responsiveness of money demand to i, i has to increase just a little in order to reestablish equilibrium in the money market. Hence, the LM becomes flatter, i.e. for the same increase in Y, the interest has to increase by less to reestablish equilibrium on the money market.

(c) Suppose we have a very flat money demand curve. Say that we increased M^s. Then, given Y, the interest rate will not fall by much in order to increase the money demand so as to reestablish equilibrium in the money market. Hence, the LM shifts right by very little after the increase in M^s. In the extreme case of a completely flat money demand curve, the LM curve won't shift at all. Hence, monetary policy becomes less effective as we increase the response of money demand to the interest rate.