

EC2102 Macroeconomic Analysis I

Tutorial 7, Week 10, March 22-26, 2010

Question 1

- (a) y and x are positively correlated. See figure 1
- (b) y is a lagging variable w.r.t. x . See figure 2
- (c) x and y exhibit persistence.

Question 2

Depending on exactly how you count the recessions and booms, you get a different answer. Any answer that is coherent will be accepted.

Question 3

(a) Suppose that the economy was initially in equilibrium in time period 1: the labour market was clearing at a real wage of w_1^* , employment was at N_1^* ; the goods market was clearing at a real interest rate of r_1^* and real output of Y_1^* ; and the money market was clearing at a price level of P_1^* and the amount of money in the economy was M_1^* . (The government's budget constraint must thus be holding with equality.)

Now suppose that government expenditures increased temporarily by $\Delta G_1 > 0$. This implies that there is an increase in the present value of govt expenditures $\Rightarrow \nearrow$ in PV of taxes as well. This is because from the government's LBC:

$$\underbrace{G_1 + \frac{G_2}{1+r_1} + \dots}_{PV \text{ of expenditures}} = \underbrace{T_1 + \frac{T_2}{1+r_1} + \dots}_{PV \text{ of taxes, } \tau}$$

Hence,

$$\Delta G_1 = \Delta \tau$$

$\implies \Delta\omega^d = -\Delta\tau < 0$. This implies:

In the labour market, $N_1^s(r_1^*)$ curve shifts to the right to $\tilde{N}_1^s(r_1^*)$ (ω^d falls and consume less leisure which is a normal good, that is, work more). In the goods market, Y_1^s curve shifts to the right to \tilde{Y}_1^s because $N_1^s(r_1^*)$ shifted to the right. See Figure 3a. There are two effects on goods demanded. First, the government spends more:

$$\Delta G_1 > 0.$$

Second, as the consumer's lifetime disposable wealth has decreased, Y_1^d is affected by a change in consumption, implying that there is a direct decrease in C_1 , whose magnitude is:

$$\Delta C_1 = MPC\Delta\omega^d = -MPC\Delta G_1 < 0.$$

The overall change in Y_1^d , ΔY_1^d is such that

$$\begin{aligned}\Delta Y_1^d &= \left(\frac{1}{1 - MPC} \right) (\Delta G_1 + \Delta C_1) \\ &= \left(\frac{1}{1 - MPC} \right) (\Delta G_1 - MPC\Delta G_1) \\ &= \left(\frac{1}{1 - MPC} \right) \Delta G_1 (1 - MPC) \\ &= \Delta G_1.\end{aligned}$$

This means that Y_1^d changes by ΔG_1 , i.e., Y_1^d shifts out to the right to \tilde{Y}_1^d .

Unambiguously, equilibrium Y_1 increases. But it looks like equilibrium r_1 could increase or decrease.

As temporary change in G_1 , effect on lifetime wealth small, so N_1^S and hence Y_1^S don't change by much. And Y_1^d changes by ΔG_1 . Since change in lifetime wealth small, so effect on Y_1^d relatively large.

So Y_1^d shifts to the right by more than Y_1^S .

At the original equilibrium interest rate of r_1^* , output demand (point a on \tilde{Y}_1^d) exceeds output supply (point b on \tilde{Y}_1^s). Hence, goods market cannot be in equilibrium. To restore equilibrium, interest rate needs to rise because a rise in interest rate means that consumers want to save more, so they consume less today, C_1 falls (substitution effect of interest rate change dominates), and a rise in interest rate means that the rate of return on alternative asset to firms (bonds) increases, so I_1 falls. Hence, there is a movement along the \tilde{Y}_1^d curve upwards from point a .

At the same time, as interest rate rises, representative consumer works more, since the price of leisure today is more expensive relative to the price of leisure tomorrow and this substitution effect dominates, so $\tilde{N}_1^S(r_1^*)$ starts to shift to the right, and thus causes a movement up along the \tilde{Y}_1^S curve from point b .

Equilibrium in the goods market is restored when equilibrium r_1 has risen sufficiently so that goods demanded equals good supplied at point c , where the equilibrium r_1 has risen from r_1^* to \tilde{r}_1^* , and equilibrium output increases from Y_1^* to \tilde{Y}_1^* ; and in the labour market, $\tilde{N}_1^S(r_1^*)$ has shifted to the right to $\tilde{N}_1^S(\tilde{r}_1^*)$, where labour supplied equals labour demanded at the new wage rate which has fallen from w_1^* to \tilde{w}_1^* , and N_1 has risen from N_1^* to \tilde{N}_1^* . There is a “**crowding out**” effect of G_1 increase on C_1 and I_1 . For C_1 , it falls due to \searrow in ω^d , falls due to \nearrow in equilibrium r_1 from r_1^* to \tilde{r}_1^* , so overall: $C_1 \searrow$. You can see this by the fact that the overall change in output demanded from Y_1^* to \tilde{Y}_1^* is less than ΔG_1 , so $C_1 \searrow$. - I_1 falls due to \nearrow in r_1 . Less investment now means lower production capacity in the future.

In the money market, a rise in the real rate of interest causes a fall in money demand, whereas a rise in current income leads to a rise in money demand. It is not clear which effect dominates. If the former effect dominates, then overall money demand has fallen from $M_1^d = P_1 L(Y_1^*, r_1^*)$ to $\tilde{M}_1^d = P_1 L(\tilde{Y}_1^*, \tilde{r}_1^*)$ (see figure: question 3(a) money market (a)), and the price level thus rises from P_1^* to \tilde{P}_1^* . But if the current income effect dominates the interest rate effect, then money demand rises from $M_1^d = P_1 L(Y_1^*, r_1^*)$ to $\tilde{M}_1^d = P_1 L(\tilde{Y}_1^*, \tilde{r}_1^*)$ and the price level falls from P_1^* to \tilde{P}_1^* (see figure: question 3(a) money market (b)).

(b) Suppose that the economy was initially in equilibrium in time period 1: the labour market was clearing at a real wage of w_1^* , employment was at N_1^* ; the goods market was clearing at a real interest rate of r_1^* and real output of Y_1^* ; and the money market was clearing at a price level of P_1^* and the amount of money in the economy was M_1^* .

Now suppose that government expenditures has permanently increased by ΔG , that is $\Delta G_1 = \Delta G_2 = \Delta G_t = \Delta G > 0$ for all t , which means that PV of govt expenditures $\nearrow \implies$ PV of taxes \nearrow as well since

$$\Delta G_1 + \frac{\Delta G_2}{1+r_1} + \frac{\Delta G_3}{(1+r_1)(1+r_2)} \dots = \Delta \tau$$

$$\implies \Delta \omega^d = -\Delta \tau < 0.$$

This implies that in the labour market, N_1^s curve shifts to the right from $N_1^s(r_1^*)$ to $\tilde{N}_1^s(r_1^*)$ (because $\omega^d \searrow$)

In the goods market, Y_1^S shifts to the right to \tilde{Y}_1^S because $N_1^s(r_1^*)$ shifted to $\tilde{N}_1^s(r_1^*)$. As for the change in goods demanded today, there are three effects. First, a direct increase through from government of ΔG_1 . Second, we know that the PV of taxes \nearrow by $\Delta\tau$. Because consumer's lifetime disposable wealth has decreased, Y_1^d is affected by a change in consumption: $\Delta\omega^d = -\Delta\tau = -\left(\Delta G_1 + \frac{\Delta G_2}{1+r_1} + \dots\right) < 0$,

$$\Delta C_1 = MPC\Delta\omega^d = -MPC\left(\Delta G_1 + \frac{\Delta G_2}{1+r_1} + \dots\right) < 0.$$

Third, there is an increase in future real income of

$$\Delta Y = \frac{\Delta Y_2}{1+r_1} + \frac{\Delta Y_3}{(1+r_1)(1+r_2)} + \dots$$

Overall,

$$\begin{aligned} \Delta Y_1^d &= \left(\frac{1}{1-MPC}\right) \Delta G_1 \\ &\quad - \left(\frac{1}{1-MPC}\right) \left[MPC \left(\Delta G_1 + \frac{\Delta G_2}{1+r_1} + \frac{\Delta G_3}{(1+r_1)(1+r_2)} + \dots \right) \right] \\ &\quad + \left(\frac{1}{1-MPC}\right) \left[MPC \left(\frac{\Delta Y_2}{1+r_1} + \frac{\Delta Y_3}{(1+r_1)(1+r_2)} + \dots \right) \right] \\ &= \Delta G_1 + \left(\frac{MPC}{1-MPC}\right) \left[\frac{\Delta Y_2 - \Delta G_2}{1+r_1} + \frac{\Delta Y_3 - \Delta G_3}{(1+r_1)(1+r_2)} + \dots \right] \end{aligned}$$

Let us conjecture that $\Delta Y_t = \Delta G_t$ every period from $t \geq 2$. That is, in all future periods, each of those periods' income would increase by the same amount as government spending. If this is so, then

$$\Delta Y_1^d = \Delta G_1 = \Delta G.$$

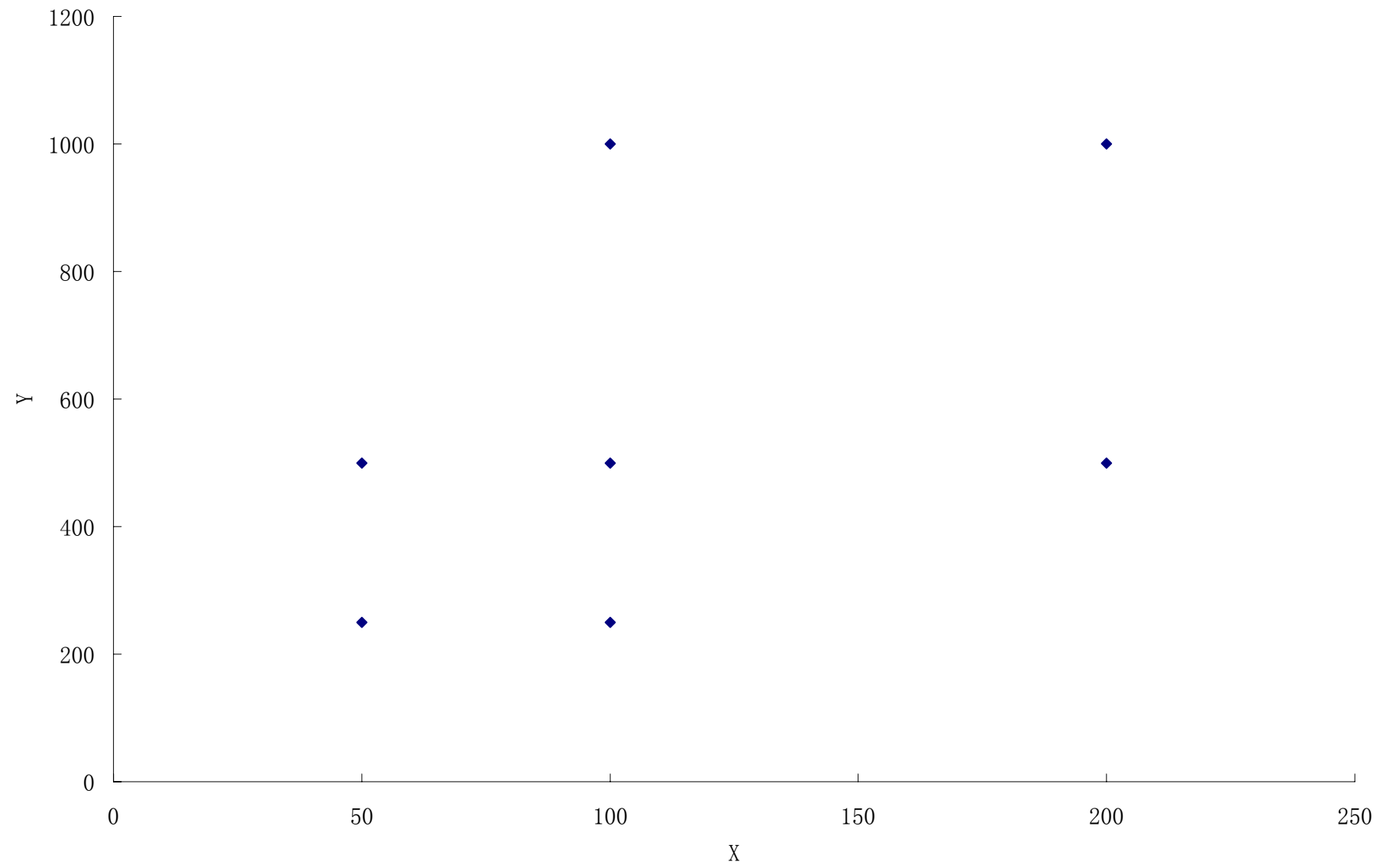
Since Y_1^d shifted to the right to \tilde{Y}_1^d , and Y_1^S shifts to the right to \tilde{Y}_1^S , real output today must have increased, though it appears that r_1 may rise or not. However, r_1 does not change, because the change in government expenditures is permanent, so consumption every period is affected in the same way, and hence, there is no incentive to change savings to smooth consumption over time, implying no change in credit market. Hence, r_1 remains unchanged, and $\Delta Y_1 = \Delta Y_1^d = \Delta G$. Since there is no change in

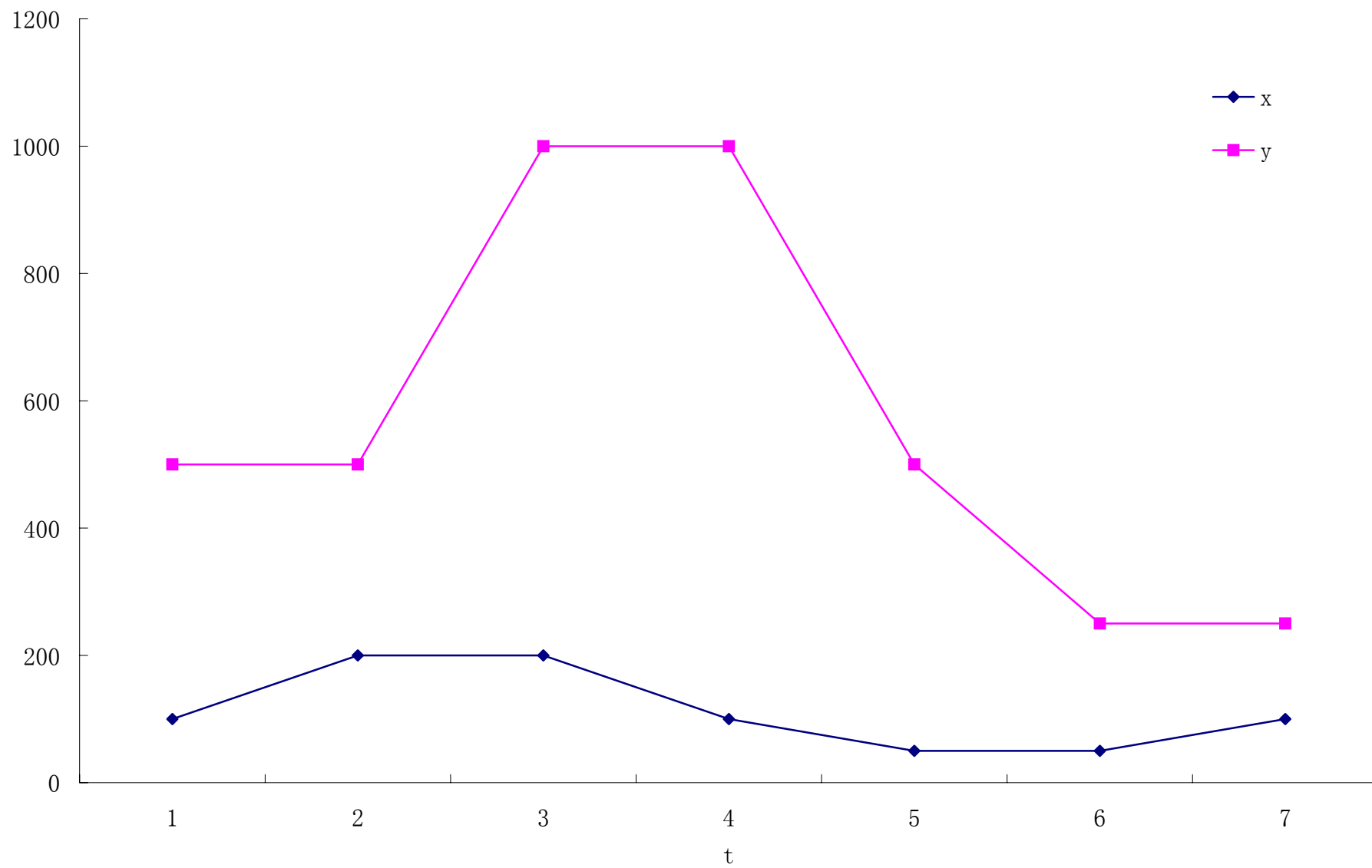
investment, no change in future capital stock. Hence, nothing in the future has changed except that for all future periods only government expenditures change, so it must be that in all future periods $\Delta Y_t = \Delta G_t$, which proves the conjecture.

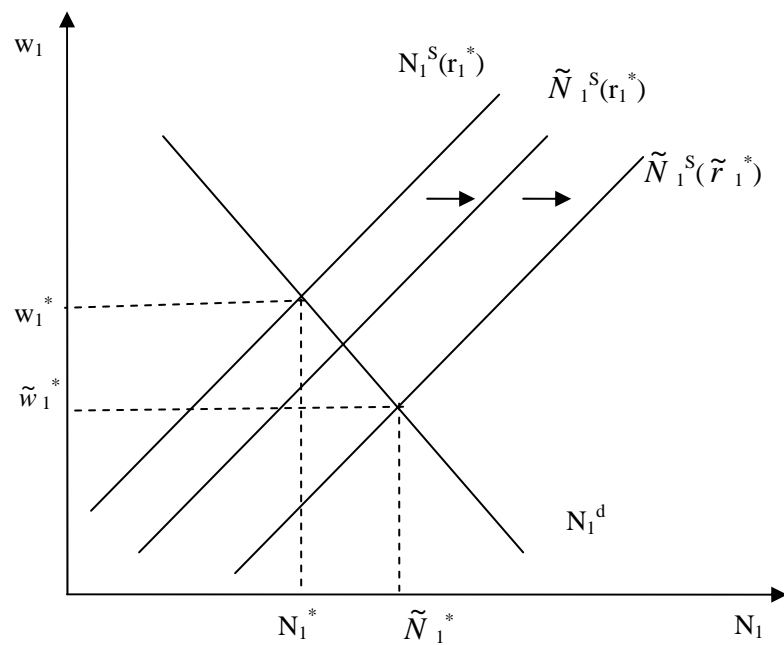
In equilibrium: a permanent \nearrow in government expenditures leads to: real current output \nearrow , real interest rate is unchanged, consumption is unchanged, investment is unchanged, real current wage rate has \downarrow , and current employment \nearrow . And since $\Delta G_t = \Delta G > 0$, i.e., all future periods only government expenditures change, it must be that in all future periods $\Delta Y_t = \Delta G_t$, which proves the conjecture.

So here, no crowding out effect. C_1 and I_1 remain unchanged. The entire cost of permanent change in government expenditures has resulted in a decrease in leisure, where the representative consumer worked harder to support higher government spending. See Figure 3b.

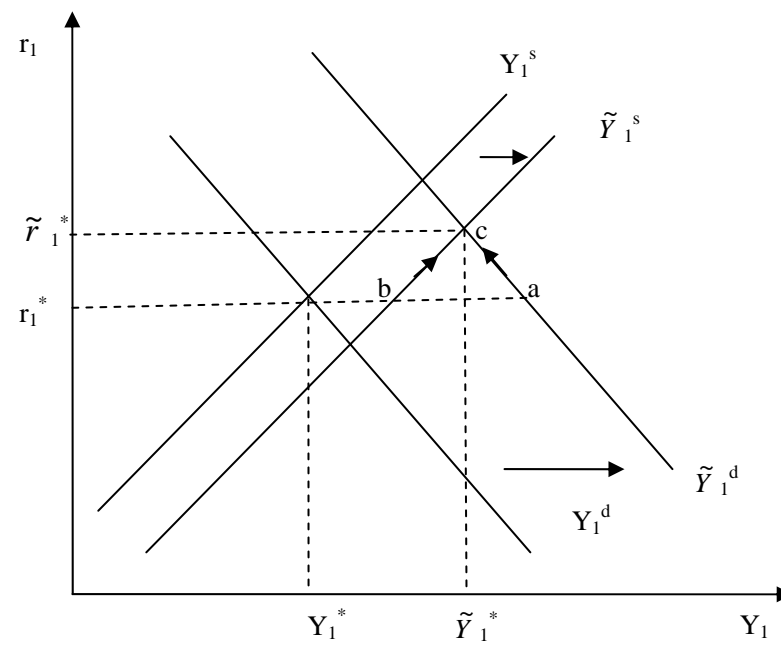
In the money market, a rise in current income will lead to a rise in money demanded from $M_1^d = P_1 L(Y_1^*, r_1^*)$ to $\widetilde{M}_1^d = P_1 L(\widetilde{Y}_1^*, \widetilde{r}_1^*)$. Hence, the price level has fallen from P_1^* to \widetilde{P}_1^* .



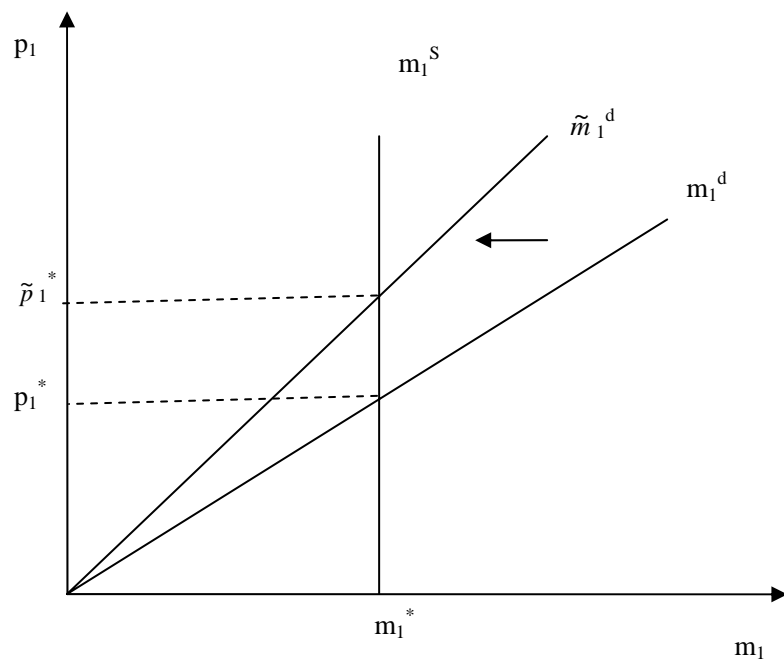




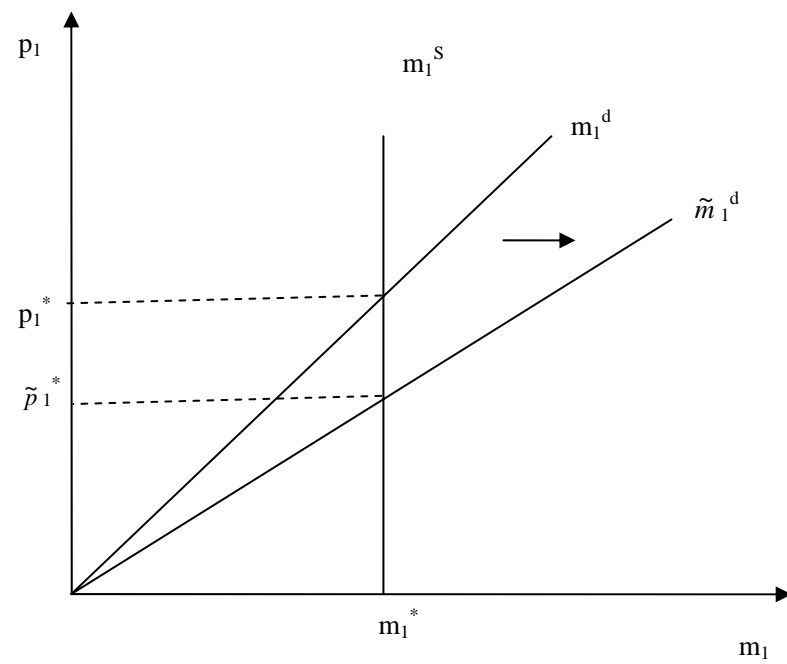
Question 3(a) Labor market



Question 3(a) Goods market



Question 3(a) Money market (a)



Question 3(a) Money market (b)

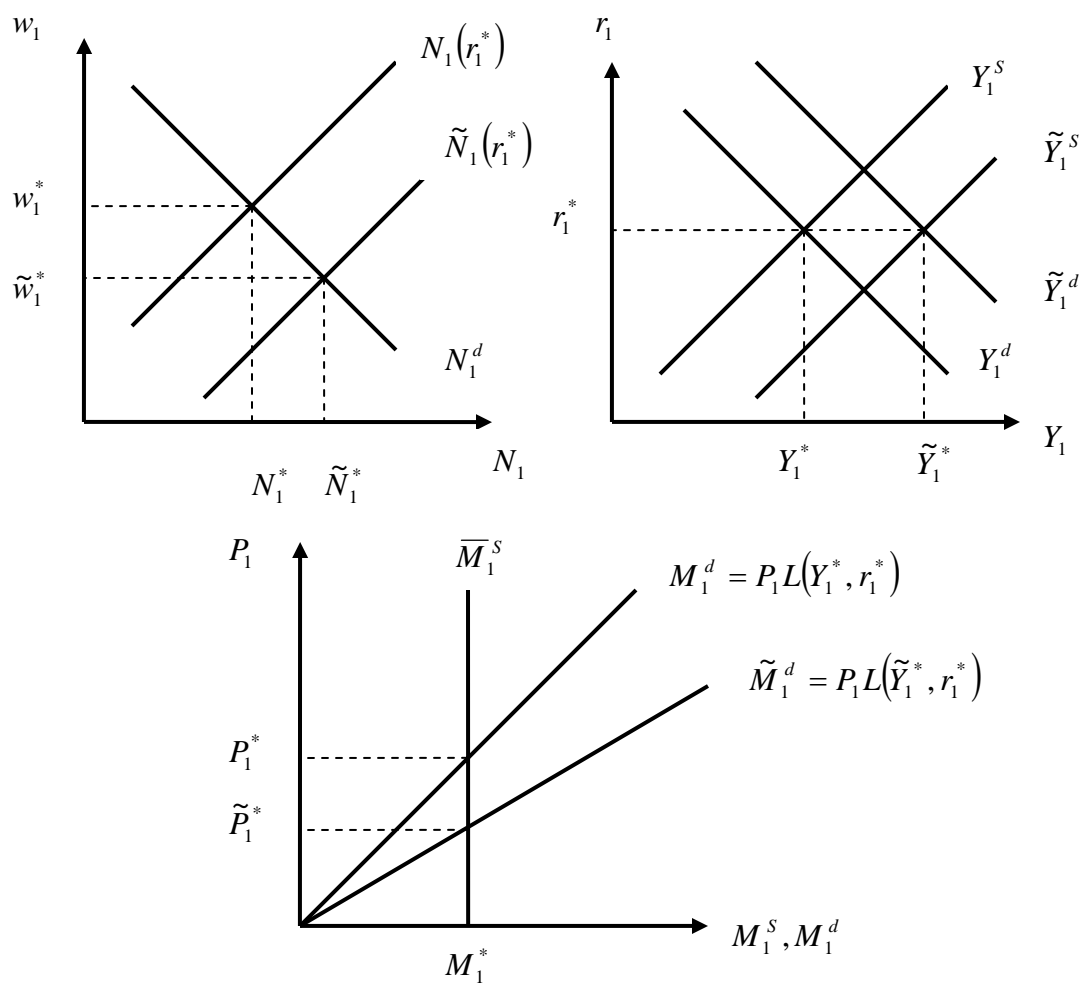


Figure 3b