Econ 702
Spring 2020
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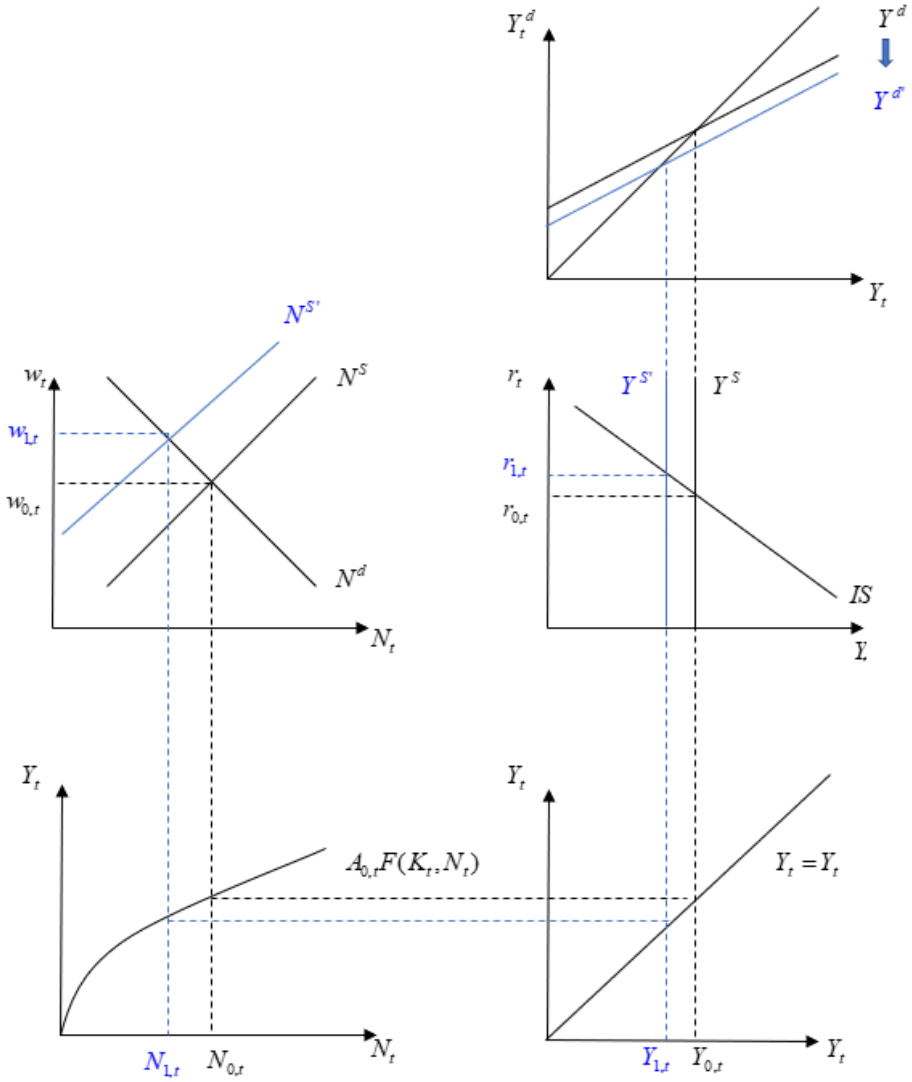
Answers To Homework 7

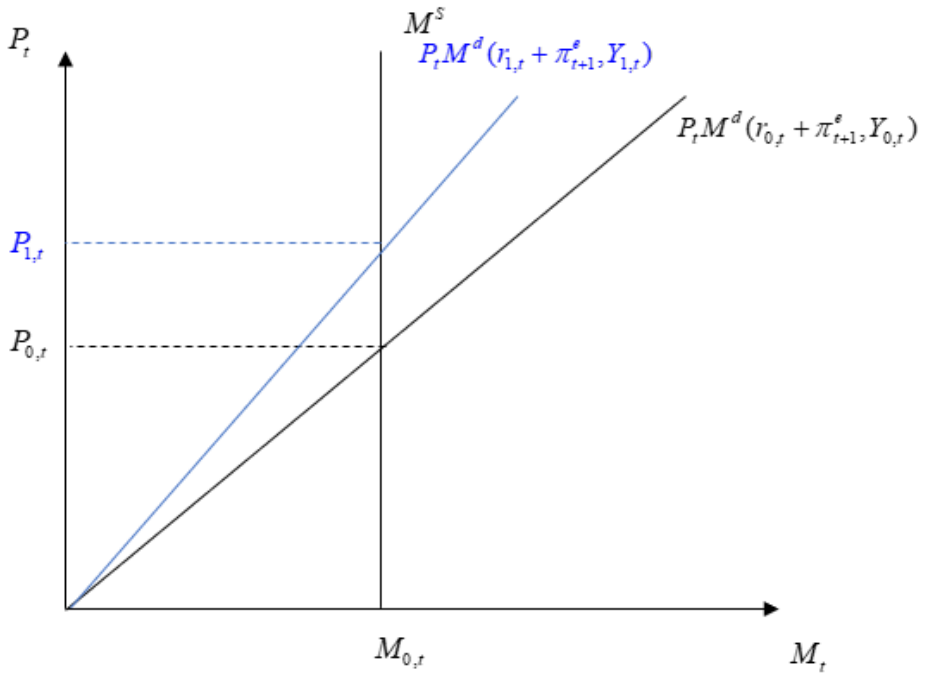
Do problems 2, 4 and 5 at the end of chapter 18 from Garin, Lester and Sims. Here they are:

2. Consider the basic Neoclassical model. Suppose that there is an increase in θ_t.

   (a) Graphically analyze this change and describe how each endogenous variable changes.
   Answer:



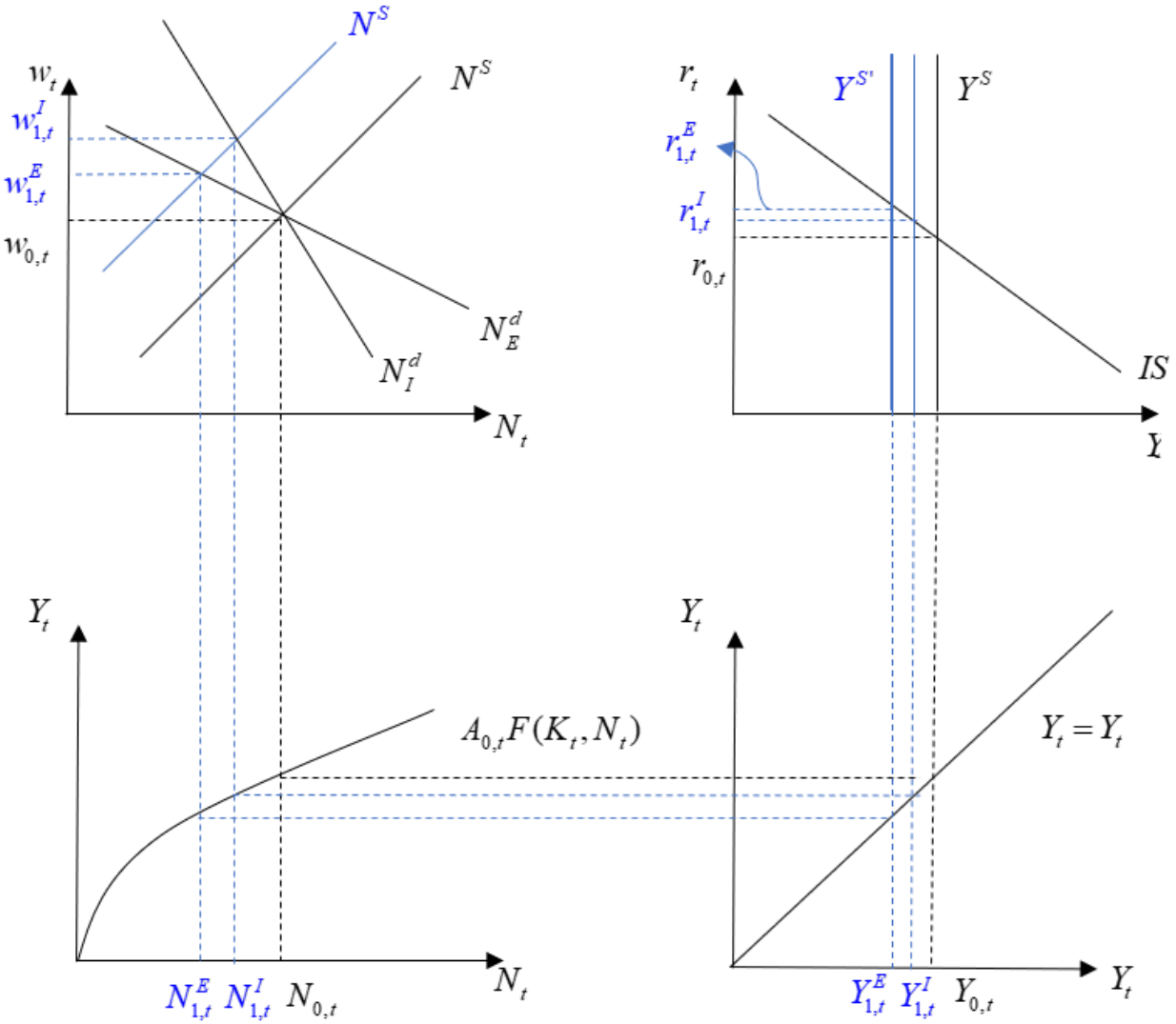
An increase in θ_t shifts the labor supply to the left. This results in a low level of N_t and a higher level of w_t, which are denoted by $N_{1,t}$ $w_{1,t}$. Due to the decrease in N_t, output also falls to $Y_{1,t}$. Since the output supply is independent to r_t, the vertical Y^S curve shifts to $Y^{S'}$. Since there is no direct effect on the IS curve due to the change of θ_t, the leftward shift of the Y^S curve means that r_t must rise to $r_{1,t}$. This higher real interest rate induces the household to consume less and the firm to invest less.



Since π^e_{t+1} is taken to be exogenous, a higher real interest rate translates into a higher nominal interest rate. Lower output and higher interest rate lead to an decrease in money demand. Thus, the money demand curve shifts to the left, which makes the equilibrium price go up to $P_{1,t}$.

(b) Now, draw out two versions of the model, one in which labor demand is relatively elastic (i.e. sensitive to the real wage)., and one in which labor demand is relatively inelastic (i.e. relatively insensitive to the real wage). Comment on how the magnitudes of the changes in Y_t, r_t, w_t and N_t depend on how sensitive labor demand is to the real wage.

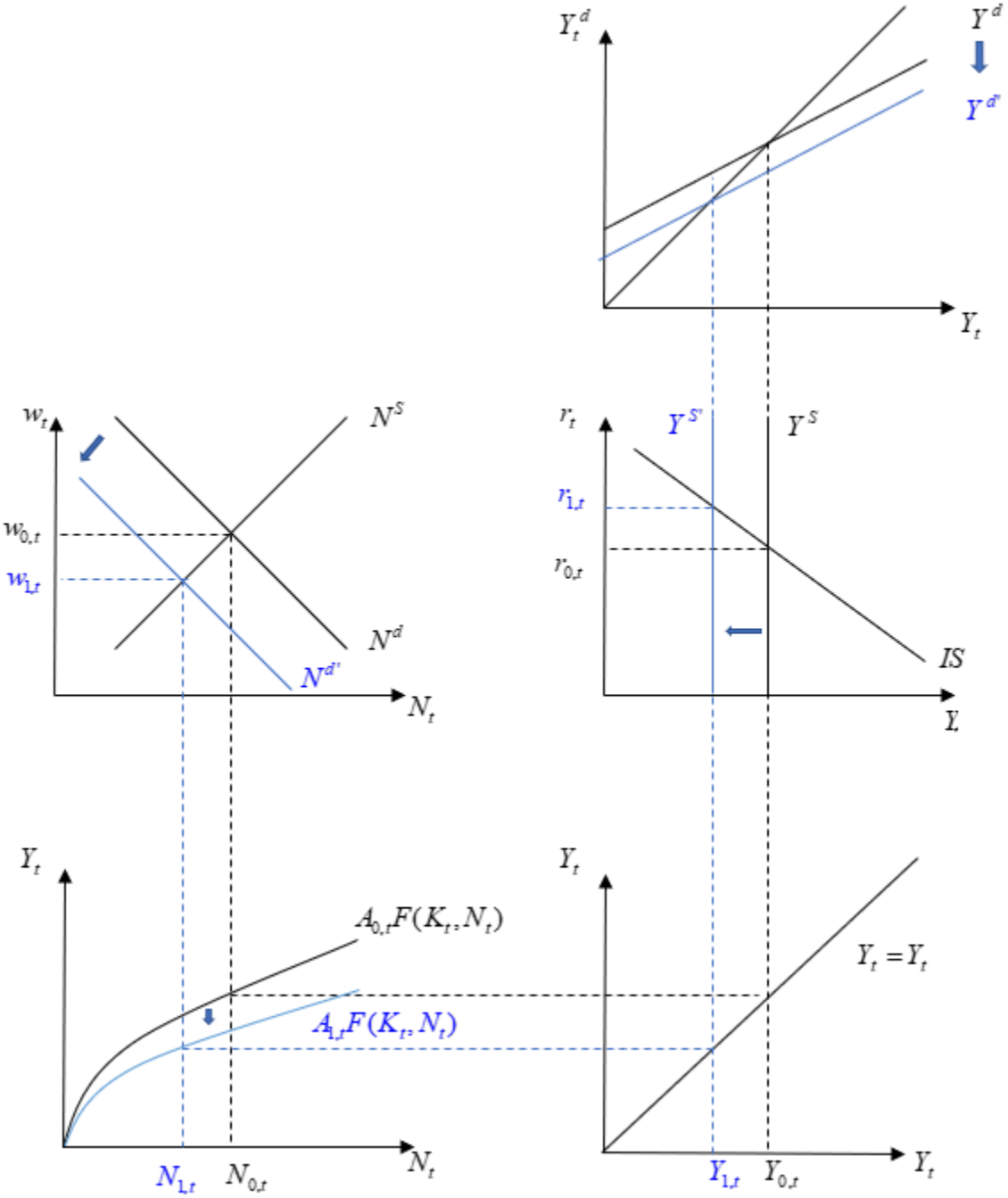
Answer:



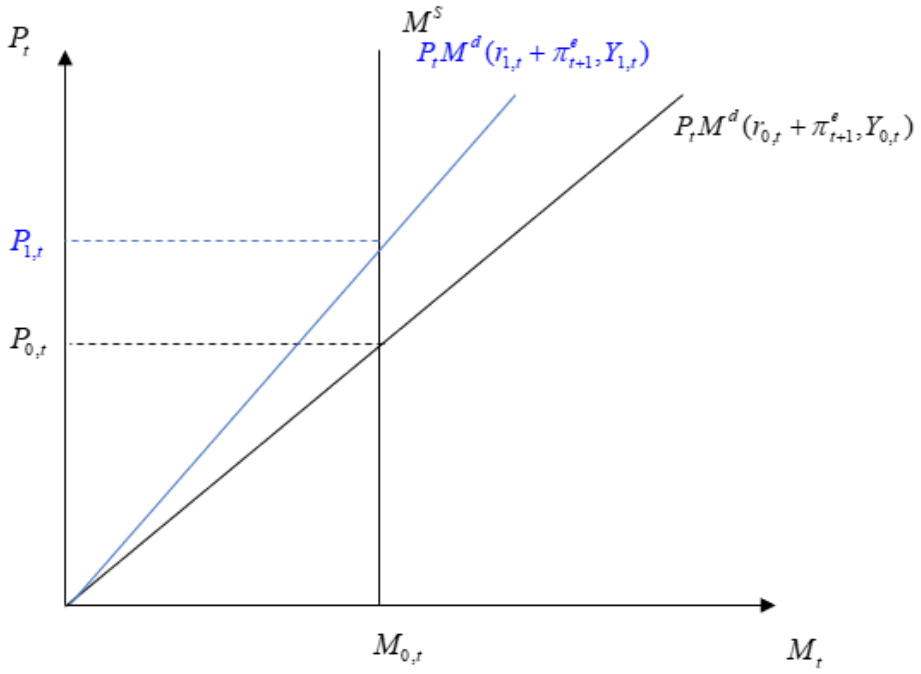
Consider two cases with elastic labor demand (N_E^d in the graph) and inelastic labor demand (N_I^d in the graph). Then let $Y_{1,t}^I, r_{1,t}^I, w_{1,t}^I, N_{1,t}^I$ be the variables when the labor demand is inelastic and $Y_{1,t}^E, r_{1,t}^E, w_{1,t}^E, N_{1,t}^E$ be the variables when the labor demand is elastic. As we can see in the graph, when the labor demand is inelastic, the wage changes more but the labor, output and real interest rate change less compared to the elastic labor demand case.

4. Consider the basic neoclassical model. Suppose that there is a reduction in A_t. In which direction will P_t move? Will it change more or less if money demand is less sensitive to Y_t?

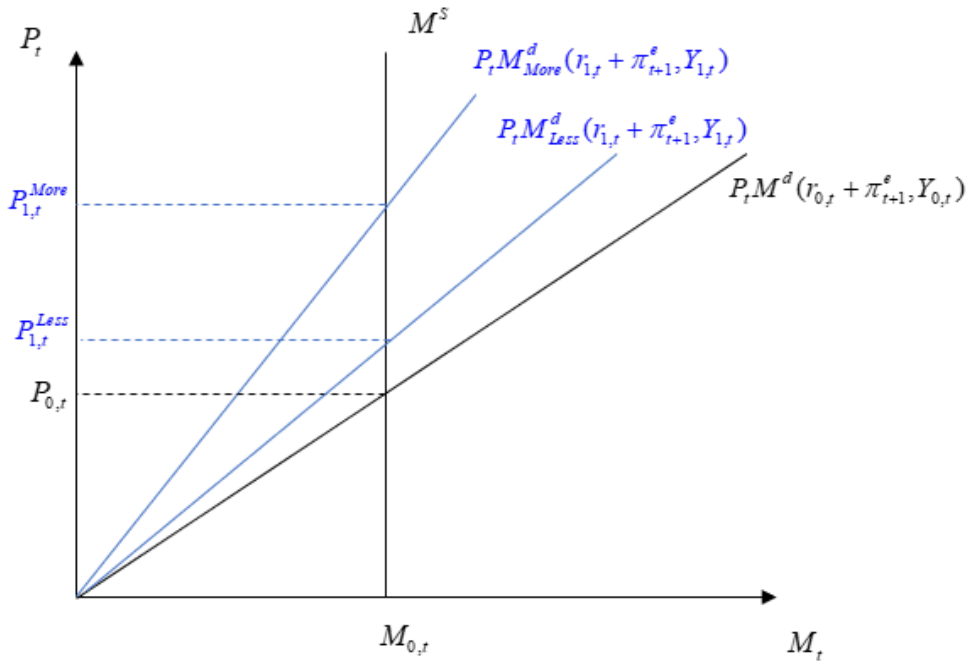
Answer:



As we can see above diagrams, a decrease in A_t makes output go down and real interest rate go up. Since π^e_{t+1} is taken to be exogenous, a higher real interest rate translates into a higher nominal interest rate. Lower output and higher interest rate lead to a decrease in money demand. Thus, the money demand curve shifts to the left, which makes the equilibrium price go up to $P_{1,t}$



If money demand is less sensitive to Y_t, the money demand curve shifts to the left relatively less. Thus, price also responds less as we can see in the following diagram.



5. Consider the basic Neoclassical model. Graphically analyze the effects of:

(a) An increase in G_{t+1}.

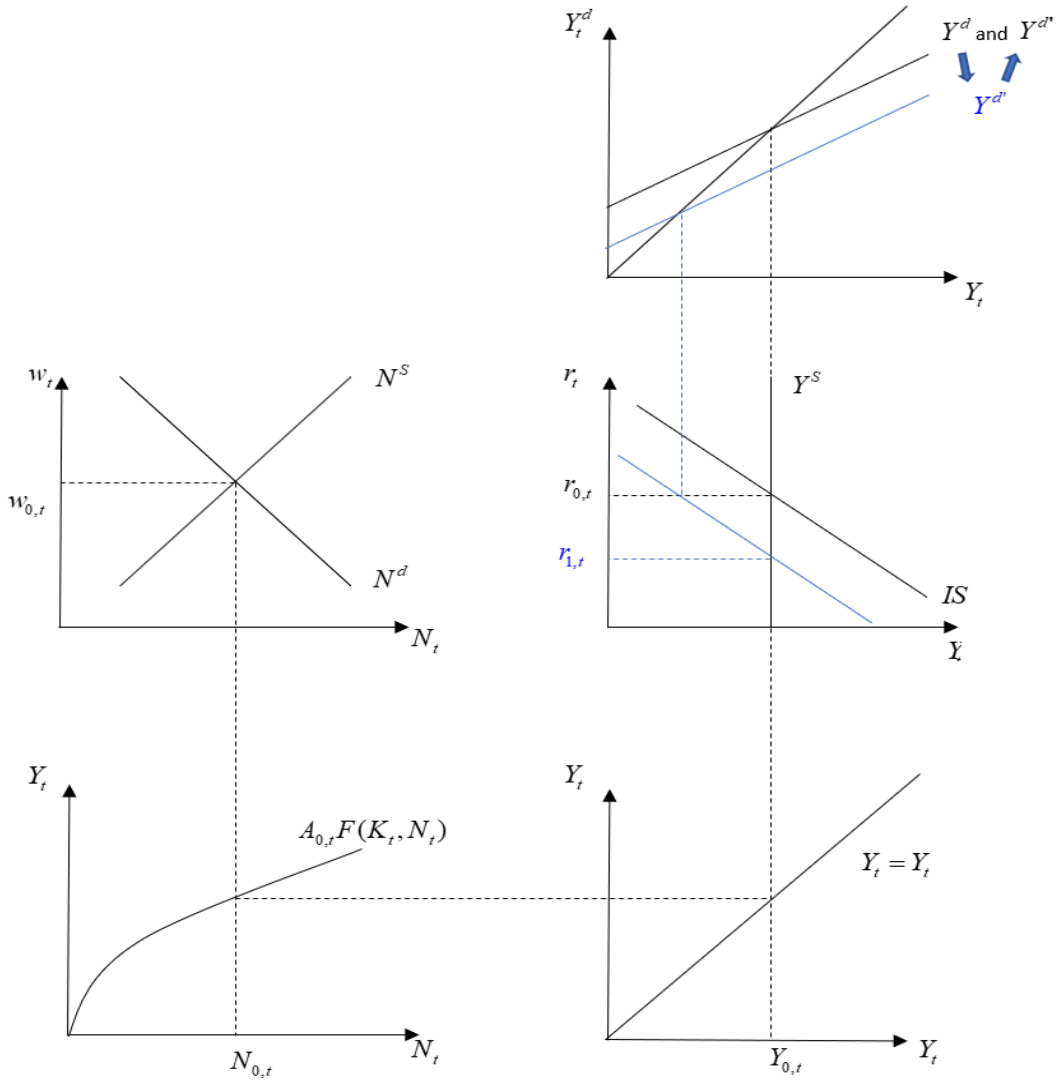
(b) An increase in A_{t+1}.

(c) A permanent increase in productivity (i.e. A_t and A_{t+1} increase by the same amount).

In each case, clearly describe how each endogenous variable changes.

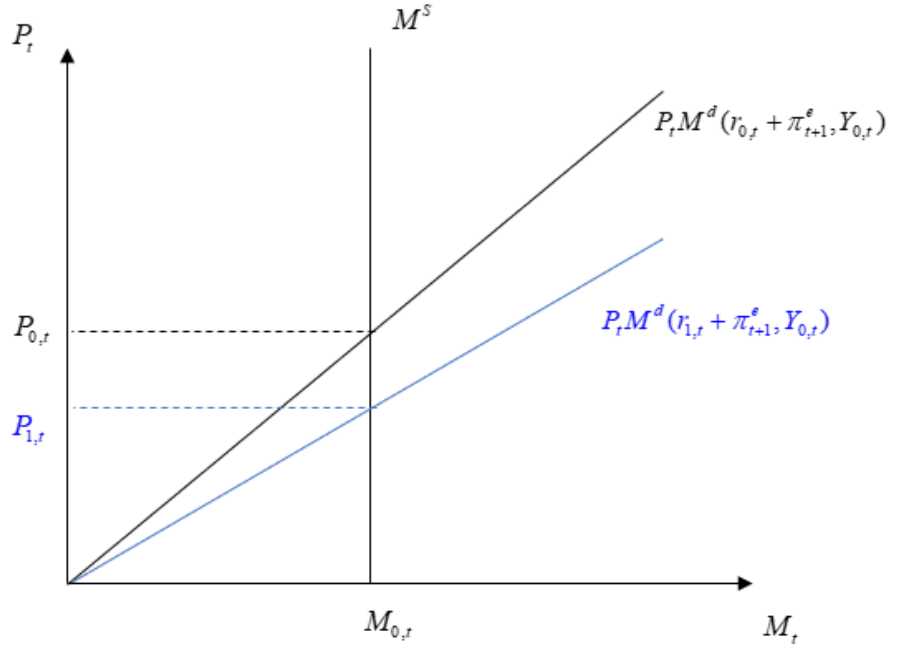
Answer:

(a)



The change of G_{t+1} directly affects the demand side. There is only direct effect on current demand since current consumption is decreasing in G_{t+1}, i.e. $C^d(Y_t - G_t, Y_{t+1} - G_{t+1}, r_t)$ (There is no change in Y_{t+1} since an increase in G_{t+1} is like an increase in current government spending from the perspective of period t+1 and we know an increase in G_t doesn't affect to the current output Y_t in equilibrium). The fall in consumption makes autonomous desired expenditure go down. This shifts the expenditure line down to $Y^{d'}$ from the original Y^d and causes the IS curve to shift inward. However, there is no shift in current output supply curve. Thus, in equilibrium, Y_t doesn't change but the real interest rate goes down to $r_{1,t}$, which makes consumption and investment go up, counteracting the initial negative effects. This shifts the expenditure line up to

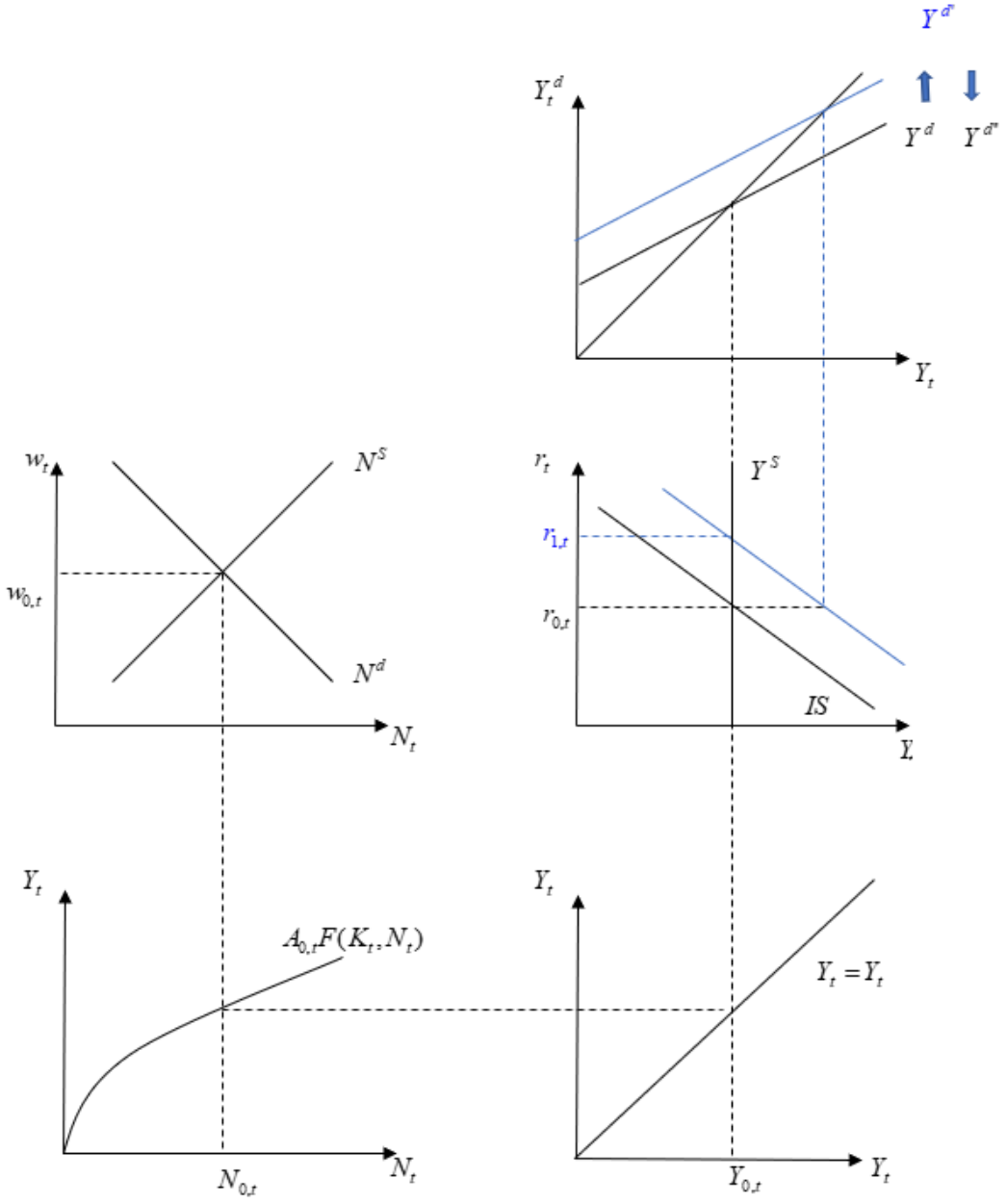
$Y^{d''}$ from $Y^{d'}$. Since the investment increases and the total output doesn't change, the net effect of the increase in G_{t+1} on consumption is negative. There is no change in the labor market.



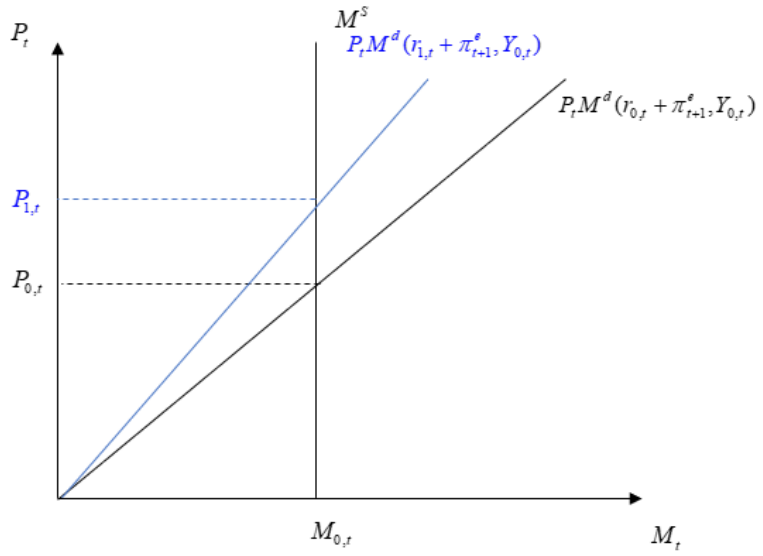
Since π^e_{t+1} is taken to be exogenous, a lower real interest rate translates into a lower nominal interest rate. Lower interest rate lead to an increase in money demand. Thus, the money demand curve shifts to the right, which makes the equilibrium price go down to $P_{1,t}$.

(b)

The change of A_{t+1} directly affects the demand side. There is a direct effect and indirect effect on current demand. First, higher A_{t+1} makes the firm want to do more investment. Furthermore, higher A_{t+1} makes next period output increase since an increase in A_{t+1} is like an increase in current A_t from the perspective of period t+1. The increase in investment and consumption raise autonomous desired expenditure in period t. This shifts the expenditure line up to $Y^{d'}$ from the original line Y^d and causes the IS curve to shift outward. However, there is no shift in current output supply curve. Thus, in equilibrium, Y_t doesn't change but the real interest rate goes up to $r_{1,t}$, which makes consumption and investment decrease, counteracting the positive effect of A_{t+1}. This makes the expenditure line do down to $Y^{d''}$ from $Y^{d'}$. It is ambiguous as to what happens to C_t and I_t. Since government spending is exogenous and Y_t is fixed, we know $C_t + I_t$ must be unchanged. The labor market doesn't change.

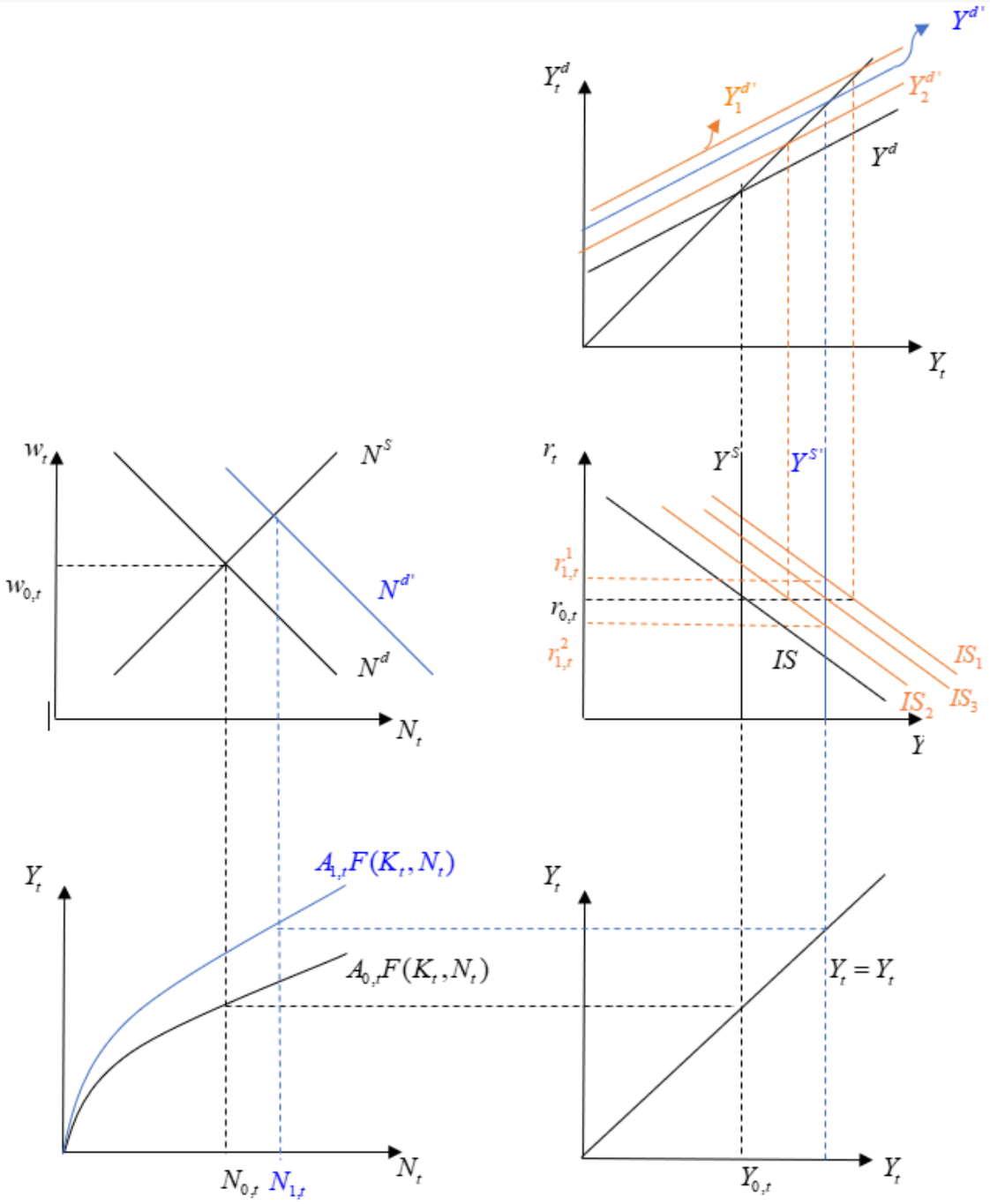


Since π_{t+1}^e is taken to be exogenous, a higher real interest rate translates into a higher nominal interest rate. Higher interest rate lead to a decrease in money demand. Thus, the money demand curve shifts to the left, which makes the equilibrium price go up to $P_{1,t}$.



(c)

An increase in A_t shifts the labor demand curve to the right so that the equilibrium labor N_t and wage w_t go up. In addition, the higher level of A_t shifts the production up. Thus, the output supply moves to $Y^{S'}$ from Y^S. As we seen in part (b), the increase in A_{t+1} shifts IS curve to the right. Thus, the output Y_t increases. Depending on the relative magnitude of the change of output supply $Y^{S'}$ and IS curve, the real interest rate might increase, decrease or not change. First, if the change of autonomous expenditure is larger than the change of output supply (the case with the expenditure curve $Y_1^{d'}$ and IS curve IS_1), the real interest will increase to $r_{1,t}^1$. Due to the increase in real interest rate, consumption and investment decrease, counteracting the positive effect of A_{t+1}. This makes the expenditure line go down to $Y^{d'}$ from $Y_1^{d'}$. It is ambiguous as to what happens to C_t and I_t. Since government spending is exogenous and Y_t increases, we know $C_t + I_t$ must increase. On the other hand, if the change of autonomous expenditure is smaller than the change of output supply (the case with the expenditure curve $Y_2^{d'}$ and IS curve IS_2), the real interest will fall to $r_{1,t}^2$. Due to the decrease in real interest rate, consumption and investment go up. This makes the expenditure line go further up to $Y^{d'}$ from $Y_2^{d'}$. C_t and I_t increase unambiguously in this case. Lastly, if the change of autonomous expenditure is exactly same as the change of output supply (the case with the expenditure curve $Y^{d'}$ and IS curve IS_3), there is no change in real interest rate. C_t and I_t increase unambiguously.



The effect on money market also depends on the relative magnitude of the change of output supply and the IS curve. As we have seen above, if the change of autonomous expenditure is larger than the change of output supply, the real interest will increase to $r_{1,t}^1$ and output also goes up. Since π_{t+1}^e is taken to be exogenous, a higher real interest rate translates into a higher

nominal interest rate. Higher output and higher interest rate lead to an ambiguous effect on money demand and the price $P_{1,t}$.

However, if the change of autonomous expenditure is smaller than (or equal to) the change of output supply, the real interest rate will fall to $r^2_{1,t}$ (or same as $r_{0,t}$). Higher output and lower interest rate (or same interest rate) lead to a positive effect on money demand. Thus, the money demand curve shifts to the right, which makes the equilibrium price go down to $P_{1,t}$. The effect would be larger when the real interest rate decreases.