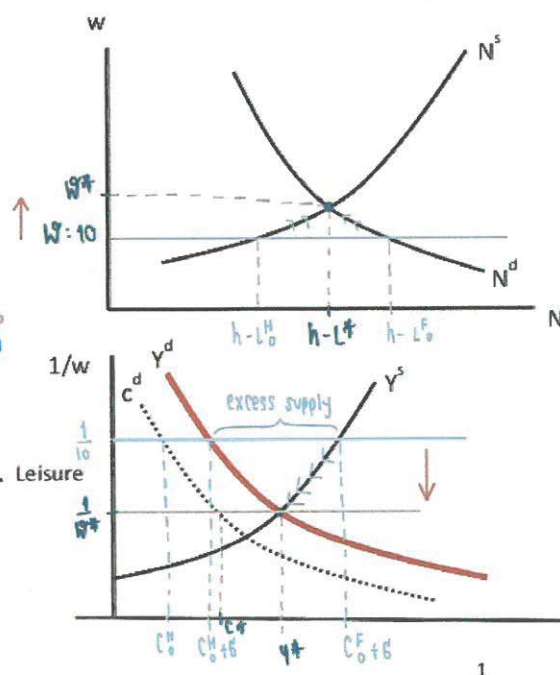
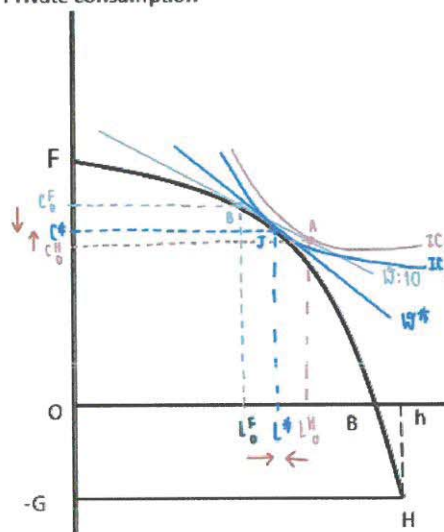


d. 1

competitive equilibrium.

Private consumption



The initial situation when wage equal to 10 is in disequilibrium. In labor market, there is excess demand for labor since firm demands for $h-L_0^h$ amount of labors while labor supply is only $h-L_0^h$. In goods market, price is too high because wage is lower than the equilibrium w^* . At price = $\frac{1}{10}$, there is excess supply of consumption goods as firm produces C_0^f while aggregate demand for "consumption goods from both household & government is $C_0^c + C_0^g$. ($C_0^c + C_0^g > C_0^c + C_0^f$).

Using Edgeworth box approach, the optimal consumption bundle of household is at point A on IC_0 where $MRS_{L,c}$ is equal to $w=10$. At point A, consumer's level of consumption is C_0^c with leisure L_0^h .

Given wage = 10, firm maximizes profit at point B where $MP_N = w=10 = MP_{L,c}$. Consumption & leisure is L_0^h & C_0^f . Even though both consumer & firm optimize their utility & profit, wage ($w=10$) is not the market clearing wage. And general equilibrium is not achieved since leisure of household is more than leisure of firm, in other word, households supply too few labors and work less than what firm wants while firm demand too many labors.

This results in household's lower level of consumption. To clear the excess, wage should be increasing such that the market is clear. Suppose wage is pushed up from 10 to w^* . Firm will hire less labors while households want to supply more labor, resulting in the equal amount of labor demand & supply of $h-L^*$.

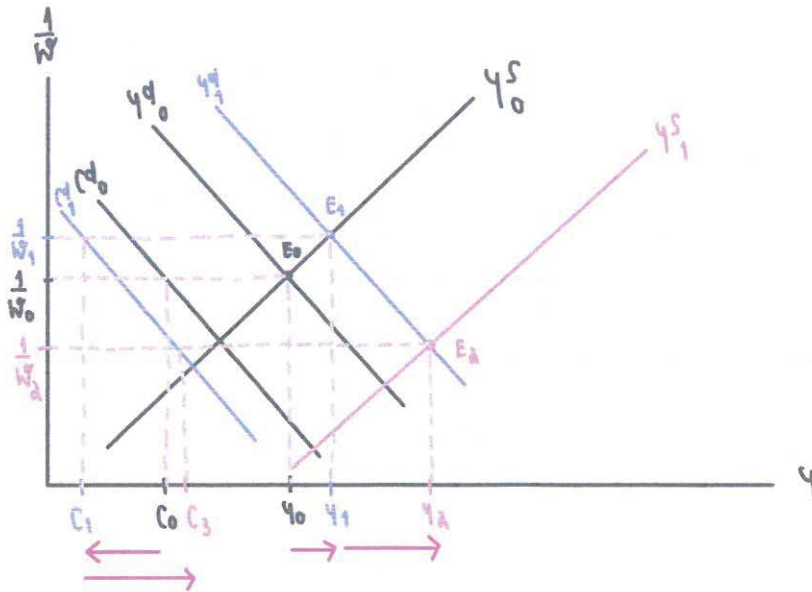
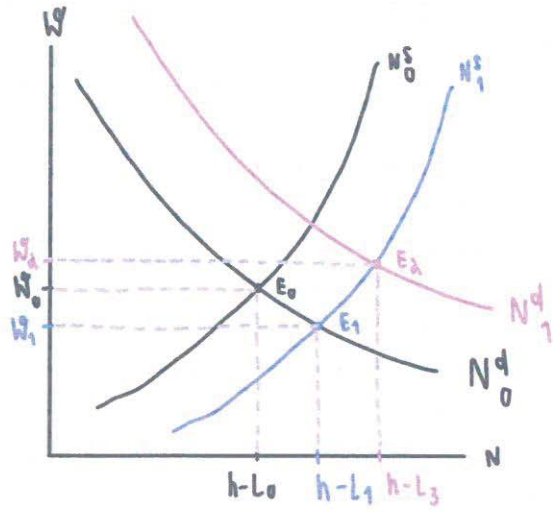
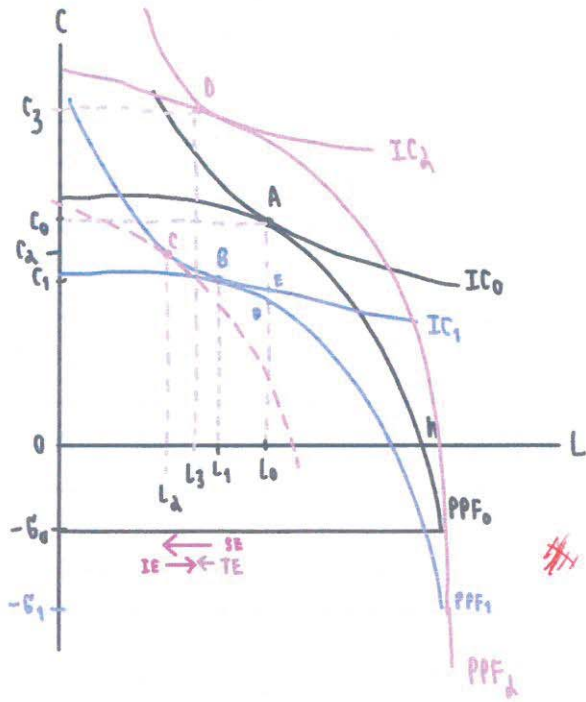
An increase in wage causes the price of consumption goods to fall from $\frac{1}{10}$ to $\frac{1}{w^*}$. With lower price level & higher wage, firm will cut down production and supply less of $\frac{1}{w^*}$ consumption goods. That is, aggregate supply falls from Y_0 to Y^* . On the other hand, households will increase their consumption from C_0^c to C^* , resulting in aggregate demand for consumption goods at $Y^* = C^* + C_0^g$.

In Edgeworth box diagram, a rise in wage causes the wage line to rotate up. Firm is willing to produce at point J where $MP_N = w^* = MP_{L,c}$ to maximize its profit. It will increase leisure hour from L_0^h to L^* and reduce consumption from C_0^f to C^* . For households, higher wage makes consumer move from IC_0 to IC_1 . Consumer reduces the leisure hour from L_0^h to L^* because an increase in wage means higher opportunity cost of taking leisure. Therefore, consumer will work more and increase its private consumption from C_0^c to C^* . Consumer's optimal level of utility is at point J where $w^* = MRS_{L,c}$.

After the wage adjustment, demand is equal to supply in both labor & goods market, indicating the market clearing situation under competitive equilibrium.

3. *Q18 1*

Assume stronger substitution effect.



Initial situation is when both labor & goods market are in equilibrium. Firm maximizes profit at point A, similar to consumer's utility maximization at point A. Private consumption is c_0 with leisure L_0 and working hour of $h - L_0$. Equilibrium wage is w_0 with price level $\frac{1}{w_0}$ given that government spending is G_0 & tax is t_0 .

Suppose government increases its spending from G_0 to G_1 and increase tax from t_0 to t_1 .

An increase in government spending leads to a downward shift of PPF curve from PPF_0 to PPF_1 by the size of a rise in tax. If consumer choose to work at the same level, he/she will lower the consumption to point D. If consumer wants to mitigate the impact of tax by working harder, leisure will fall while consumption rise a little from point D to point B. In this case, we assume that consumer is rational & will choose the optimal bundle B. That is, an increase in government spending causes worker to reduce both consumption & leisure from c_0 to c_1 & L_0 to L_1 . N^S will shift to the right from N^S_0 to N^S_1 . Wage reduce from w_0 to w_1 , resulting in a higher price level $\frac{1}{w_1}$. Consumption demand shift to the left while y^d shifts to the right.

However, since the increase in government spending can raise the level of technology and productivity, PPF will shift upward due to higher marginal product of labor. To determine what happen when the 2 effects combine, we will consider 2 cases when substitution effect is equal to income effect and case of stronger substitution effect. Note that we assume that the impact of productivity is higher than the changes in government spending. An increase in level of technology means higher marginal product of labor. PPF curve rotates upward from PPF_1 to PPF_2 . As MP_L increases, firm's demand for labor increases as well. N^d shifts from N^d_0 to N^d_1 with rising real wage from w_1 to w_2 . With higher wage rate, worker will work less due to substitution effect since price of taking leisure is higher. This substitution effect is from point B to C. Income effect is from C to D where higher income allows worker to take more leisure from L_1 to L_2 . Consumption rises from c_1 to c_2 . With more labor hired by firm, aggregate supply increases as well, capturing by the right shift of y^s to y^s_1 . Output increases from y_1 to y_2 . The higher wage w_2 indicates lower price level $\frac{1}{w_2}$. In this case, private consumption rises from c_1 to c_2 after the technological improvement. Therefore, the household welfare increases when government spending can raise level of technology.

For the case when substitution effect & income effect are equal, the analysis is mostly similar to the case discussed above, except that labor supply & leisure will remain the same while consumption rises.