14.02 Principles of Macroeconomics
Problem Set #3 - Answers

Due during Week # 8

1 PART I. True, False, Uncertain

1 **Workers like inflation since it raises their wages.**

False: Workers only care about real wages (W/P) and not about the nominal level of wages which presumably increases with inflation.

2 **Improvements in health that increase the elderly population tend to increase the unemployment rate.**

False: An increase in the amount of elderly in the population won't increase the labor force and the amount of people looking for jobs. The aging process would decrease the participation rate but need not imply an increase in the unemployment rate.

3 **If the government increases G without altering the supply of money, the amount of money demanded in equilibrium varies since both Y and i change.**

False: An increase in G tends to expand the level of output and then the Md(Y, i) shifts up in the financial market graph. Nevertheless, the amount on money demanded in equilibrium has to be equal to the supply of money, which did not change. To restore the equilibrium, the interest rate goes up compensating the positive effect of the higher income in the money demand. In equilibrium, the amount of money demanded is exactly equal to the fixed supply of money.

4 **A monetary contraction cannot affect the public budget since it is not a fiscal policy.**

False: A monetary contraction tends to increase the interest rate (it shifts the LM curve to the left). The demand for investment decreases and the equilibrium level of output is smaller. If part of the government revenues were collected with proportional income tax, the total amount of public revenues will decrease and the public budget will be affected.

5 **As in microeconomics, the AS curve is upward slopping because producers sell more goods when the price is high.**

False: The AS curve is upward sloping because a higher output level is equivalent to a lower unemployment rate. A lower unemployment rate gives the worker higher bargaining power in the wage setting process and the level of prices increases on wage (with the same simplifying assumptions used in the book, the level of prices is proportional to the wage).

2 PART II. IS-LM model

Suppose the population in the economy is divided into two groups. Although the two groups have equal amount of people, the richer one (Group A) gets 70% of total income and the poorer one (Group B) gets the remaining 30%. The economy is represented by the following equations.

$M^d = 5Y - 120r$
$M^s = 10000$
$I = 296 - 20i + 0.1Y$
$C_A = 120 + c_A(Y_A - T_A)$
$C_B = 60 + c_B(Y_B - T_B)$
$G = 500$

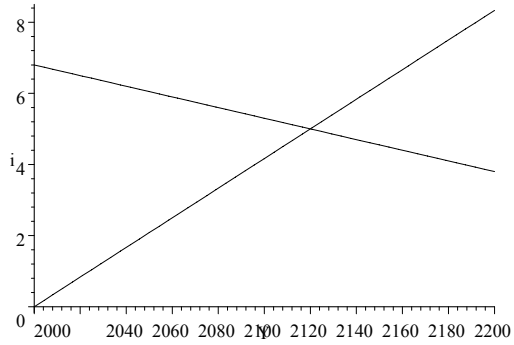
1. **Assuming $\mathbf{c}_A = \mathbf{c}_B = 0.6$ and $\mathbf{T}_A = \mathbf{T}_B = 200$, derive the IS and LM curve and find the equilibrium level of output and interest rate and compute the fiscal budget. Use graphs and math.**

The resulting consumption equations are:

$C_A = 120 + 0.6(0.7Y - 200)$
$C_B = 60 + 0.6(0.3Y - 200)$

Replacing in the equilibrium conditions $M^s = M^d$ and $Y = C_A + C_B + I + G$, the IS and LM curves can be derived:

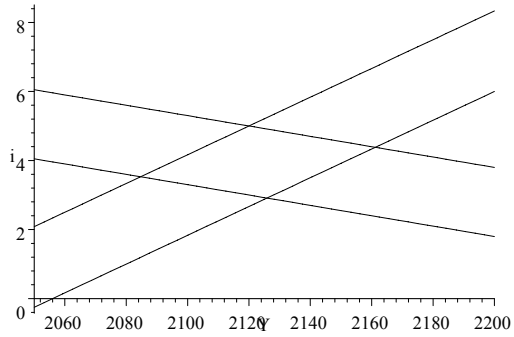
$LM : i = -\frac{250}{3} + \frac{1}{24}Y$
$IS : i = -.0\,15Y + 36.8$



Solution is : $\{i = 5.0, Y = 2120.0\}$
Finally, the fiscal deficit is $G - T_A - T_B = 100$.

2 **The government wants to reduce the fiscal deficit, but it is worried about the negative consequences such a policy might have on the level of output. What combination of monetary and fiscal policies would you recommend to decrease the deficit without provoking a recession? Explain graphically and give the intuition.**

A fiscal contraction (increase in taxes or decrease in government consumption) reduces the fiscal deficit but has negative effects on the level of output (shift IS curve down). To mitigate the negative effect on output, the fiscal contraction can be implemented together with a monetary expansion (shift LM curve to the right). The monetary expansion promote investment through lower interest rates. Eventually, the increase in investment can compensate the decrease in the public expenditure (or increase in taxes).



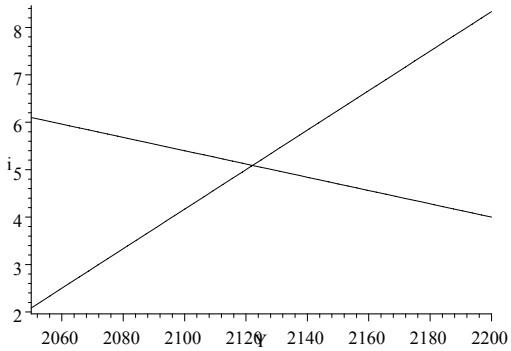
3 **Assume now $c_A = 0.4$ and $c_B = 0.8$. Derive the IS and LM curve and find the equilibrium level of output and interest rate. Use graphs and math.**

There is a miscomputation in the above question. With $c_A = 0.4$ and $c_B = 0.8$ the exercise leads to a negative interest rate. In this case

$C_A = 120 + 0.4(0.7Y - 200)$
$C_B = 60 + 0.8(0.3Y - 200)$

Replacing in the equilibrium conditions $M^s = M^d$ and $Y = C_A + C_B + I + G$, the IS and LM curves can be derived:
$LM : i = -\frac{250}{3} + \frac{1}{24}Y$
$IS : i = -.019Y + 36.8$ '
Solution is: $\{i = -0.82418, Y = 1980\}$

The right intuition of the excercise can be obtained using $\mathbf{c}_A = 0.5$ and $\mathbf{c}_B = 0.9$. In this case:
The resulting consumption equations are:
$C_A = 120 + 0.5(0.7Y - 200)$
$C_B = 60 + 0.9(0.3Y - 200)$
Replacing in the equilibrium conditions $M^s = M^d$ and $Y = C_A + C_B + I + G$, the IS and LM curves can be derived:
$LM : i = -\frac{250}{3} + \frac{1}{24}Y$
$IS : i = -.0\,14Y + 34.\,8$



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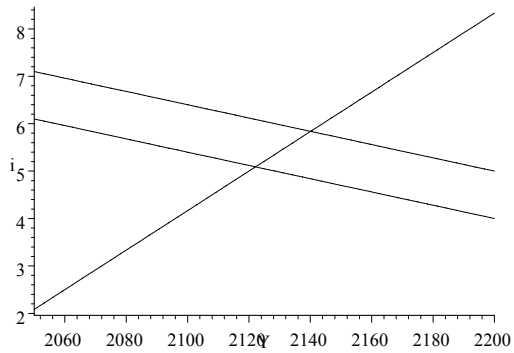
Solution is : $\{i = 5, Y = 2122\}$

4 **Explain the effect on output, interest rate, demand of money, amount of money and investment of a public transfer to Group B financed by an increase in the tax leveraged to Group A.**

The policy includes taxing the Group A to finance the transfer to Group B. Notice that a transfer is a negative tax. Then: $\Delta T_A = -\Delta T_B > 0$. Since the propensity to consume is higher within the Group B, the autonomous spending increases in $(0.8 - 0.4)\Delta T_A$ -using the marginal propensity to consume $\mathbf{c}_A = \mathbf{0.5}$ **and** $\mathbf{c}_B = \mathbf{0.9}$, the autonomous spending increases in $(0.9 - 0.5)\Delta T_A$-. So the IS curve shifts up and both the interest rate and level of income are higher in equilibrium.

In extension: the increase in autonomous spending causes an increase in output, the demand of money tends to increase but since the supply of money

is fixed, the interest rate has to go up in order to reestablish the equilibrium in the money market. The overall effect on investment is ambiguous (higher output tends to increase it but higher interest rate tends to decrease it).



5 **Explain the effect on output and interest rate of a more equal distribution of income**

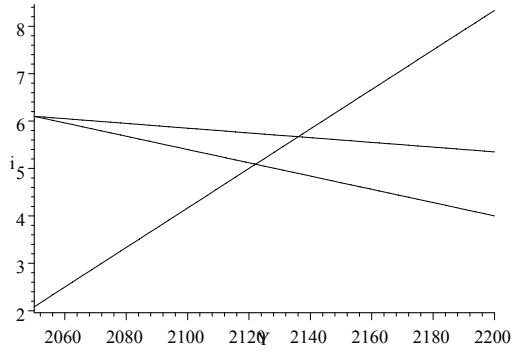
In this case, the slope of the total consumption with respect to income increases: $\Delta C = \Delta C_A + \Delta C_B = 0.4\Delta Y_A + 0.8 \cdot \Delta Y_B = -0.4 \cdot \Delta sh \cdot Y + 0.8 \cdot \Delta sh \cdot Y = 0.4 \cdot \Delta sh \cdot Y$

(Using the marginal propensities to consume $\mathbf{c_A = 0.5}$ **and** $\mathbf{c_B = 0.9}$, the same answer is obtained:

$\Delta C = \Delta C_A + \Delta C_B = 0.5\Delta Y_A + 0.9 \cdot \Delta Y_B = -0.5 \cdot \Delta sh \cdot Y + 0.9 \cdot \Delta sh \cdot Y = 0.4 \cdot \Delta sh \cdot Y$)

where Δsh is the change in income share.

An increase in the multiplier results in a flatter IS curve, a higher level of output and a higher level of interest rate.



3 PART III. Labor Market

In a far away country, the total population is 1000 people (all of them non institutional civilian people), 564 are working and 36 are looking for a job.

1. **What is the size of the labor force? What are the participation rate and unemployment rate?**

   labor force (L) =employment (N) + unemployment (U) = 564 +36 = 600

   participation rate = labor force (L)/non institutional civilian people = (600/1000)=0.60

   unemployment rate (u) = unemployment (U)/labor force (L)=(36/600)=0.06

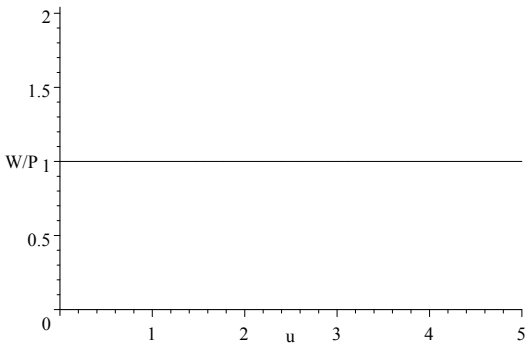
   In this economy, the labor productivity is 2. And the wage setting process is described by

   $W/P^e = Z - 200u$**. Where Z is the unemployment insurance provided by the government and u is the unemployment rate.**

2. **What is the Price Setting equation for a mark-up level** $\mu = 1$**.**

   $Y = 2N$ so $P = \frac{(1+\mu)}{2}W = W$

   $PS : W/P = 1$



3. **For** $Pe = P$**, what is the natural unemployment rate, natural level of employment and natural level of output if** $Z = 10$**? Show it graphically and mathematically.**

   $WS : W/P = 10 - 200u$
   $PS : W/P = 1$

The WS equation is downward sloping because the higher unemployment rate, the weaker the workers' bargaining power. The introduction of labor unions affects that negative relation reducing the slope of the WS equation. Nevertheless, the equilibrium real wage is still 1. So, a higher natural unemployment rate is needed to compensate the higher bargaining power and restore the equilibrium.

Finally, recognize that prices may turn out to be different from what it was expected.

7. **Given the Price Setting equation and the Wage Setting equation, derive an equation for P as a function of Pe, Y and L. What happens with the AS curve when the wage setting process looses sensitivity with respect to the unemployment rate?**

   $WS : W = P^e(10 - 200u)$
   $PS : W = P$

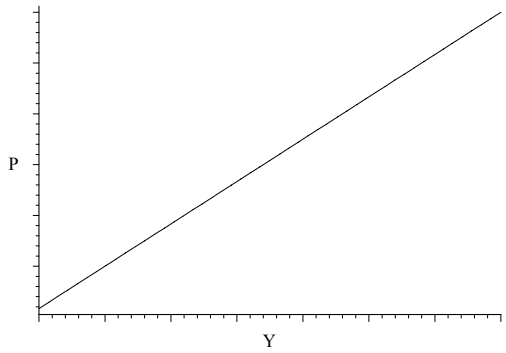
   replacing

   $P = P^e(10 - 200u)$

   $u = \frac{L-N}{L}$

   $Y = 2N \rightarrow N = Y/2$

   Finally: $P = P^e(10 - 200(\frac{L-Y/2}{L})) = P^e(-190 + 100\frac{Y}{L})$



If the WS equation looses sensitivity with respect to the unemployment rate, then the slope of the AS curve is flatter. The less the real wages respond to an increase in unemployment, the less the wages increase with employment and output. Since the wages are proportional to the level of prices, the less the wages respond to output, the flatter is AS.