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Due in the discussion section next week.

**Problem 1 (Comparing Classical Model with Keynesian Model)**

In each empty box type “yes” if you agree with a statement, and “no” if you disagree with a statement.

Statement	Classical Model (Long-Run Model)	Keynesian Model (Short-Run Model)
Labor market clears -- the real wage is such that labor demand always equals labor supply		
When Fed lowers interest rates (monetary expansion), output increases and unemployment falls (price level does not change)		
There is cyclical unemployment		
There is frictional and structural unemployment		
Higher saving rate $s$ does not change current output		
Higher saving rate $s$ leads to a fall in current output		
Increased government spending $G$ and government deficit $G-T$ leads to higher current output, unemployment and higher level of interest rates		
Increased government spending $G$ and government deficit $G-T$ leads to higher current output, lower unemployment and higher level of interest rates		

**Problem 2 (The Big Picture Lesson)**

Circle the correct phrase:

In this course we studied two models: the long-run model and the short-run model. The ( **long-run / short-run** ) model was intended to capture the laws that govern the economy when enough time passes so that things fully adjust to changing conditions – therefore, the central assumption of this model was market clearing in all markets.

The ( **long-run / short-run** ) model, on the other hand, was intended to capture possible departures from this ( **short-run / long-run** ) equilibrium due to frictions in the ( **labor market / loanable funds market / goods market** ), that were assumed to preclude the ( **wage / price / interest rate** ) to flexibly adjust to market clearing outcome. Because of these frictions, the model instead assumed that firms can freely choose employment at the prevailing level of wages, and it assumed that there was always a pool of available unemployed workers around willing to accept jobs at this wage. The consequence of this assumption was that firms employ workers to meet the demand, and so spending drives income (production). As a result, ( **cyclical / frictional / structural** ) unemployment may appear in the ( **short-run / long-run** ), and the economy may slip into recession due to insufficient spending. Such effect can not possibly take place in the ( **long-run / short-run** ) model, as output is determined by full employment of available

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production resources, like labor and capital, and spending is always ( **insufficient / sufficient** ) to purchase all output by ( **Say's / Graham** ) Law.

One of the important implications of the short-run analysis is that ( **loanable funds / money** ) market turns out unimportant – as it is always in equilibrium for any arbitrary level of interest rates. In other words, the ( **loanable funds / money** ) market does not have any bite in determining the interest rate level, and consequently the importance of the ( **loanable funds / money** ) market is ( **elevated / deprecated**). In a sense, we could even say that the goods market determines income (output) and ( **loanable funds / money** ) market determines interest rate, and ( **loanable funds / money** ) market is redundant. Of course, this is only true to the first approximation because ( **interest rate / output** ) actually affects equilibrium in goods market through its effect on aggregate investment and ( **interest rate / output** ) affects equilibrium in money market through its effect on money demand – so the short-run equilibrium must be determined by solving simultaneously for the equilibrium in both goods market and ( **money / loanable funds** ) market. We have illustrated this process graphically by deriving goods market equilibrium line and money market equilibrium line. The short-run equilibrium could be found as the crossing-point of these two lines.

The above implications of the short-run model contrast sharply with the long-run model. Unlike in the short-run model, the ( **money / loanable funds** ) market is very important – as it determines the level of ( **nominal / real** ) interest rates in the economy and investment. In this case, on the other hand, ( **money market / loanable funds** ) market is almost redundant. Without much justification, we require that the money market aligns with the loanable funds market equilibrium, by choosing the price level properly. The price level is the only thing undetermined by the Classical Model without money market. The question how this equilibrium is reached, and how the price level adjusts to this equilibrium is not answered by the Classical model.

By having the short-run model, we can answer the above question. The short-run model suggests that when short-run equilibrium output  $Y$  is below the long-run equilibrium output  $Y^*$ , there additionally is ( **cyclical / frictional / structural** ) unemployment. As a result of unemployed workers being eager to take jobs, there is pressure on wages  $W$  to fall, and once this gradually happens, production costs falls. Because we think of firms as setting prices as a constant markup on the production cost, the price level  $P$  falls when the wages  $W$  fall. Consequently, money demand curve shifts down, and this shifts down the ( **Goods / Money** ) Market Equilibrium Line. The end result is that in the short-run equilibrium output increases. The adjustment process continues until the price level  $P$  falls enough so that in the short-run equilibrium output reaches its long-run level  $Y^*$ . To conclude, we can actually think of the short-run model as providing the missing link how the adjustment to the long-run equilibrium takes place – and how the price level eventually gets to play the critical role of restoring equilibrium. Additionally, we also learn why in the ( **long-run / short-run** ) it is loanable funds market rather than money market that becomes critical. This idea lead macroeconomists to unify both frameworks into one framework called ( **Keynesian / Classical / AD-AS** ) model.

Many economists believe that the above description is how the economy works – therefore many economists see an important role of the Fed and government to counteract ( **recessions / growth** ) that are driven by insufficient spending.

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In the long-run expansionary monetary policy is neutral– it only makes the ( **price / output** ) level higher and increases inflation, but has no effect on output. Higher inflation may lead to a higher spread between the nominal interest rate and the real interest rate – this true if inflation also boosts inflationary expectations (recall that nominal interest rate = real interest rate + expected inflation). However, ( **expansionary / contractionary** ) monetary policy, by its immediate effect on nominal interest rates through the money market – and thus also real interest rates due to sluggish price adjustment – may lead to an increase in the short-run investment spending and higher output. That is why during ( **expansions / recessions** ) the Fed tends to lower the interest rates – as it believes recessions are driven by insufficient spending.

Fiscal policy is a bit harder to implement. It takes longer to legislate a new tax code, or government expenditures (usually planned way ahead). So, in practice, it is not used as much used as monetary policy. However, it also has a positive effect on output in the short-run model, but may even have a negative effect on output in the long-run. In the long-run expansionary fiscal policy results in a fall in output due to crowding out of private investment. In the short-run model, however, ( **contractionary / expansionary** ) fiscal policy leads to an increase in output due to its positive effect on spending – in the short-run model spending drives output and income! This is one of the reasons why the government decided to enact a fiscal stimulus this year.

**Problem 3 (Short-Run Keynesian Model)**

You have the following data about the economy of *Keynesia*.

In this economy, labor market is slack and wages are sticky at the level  $W=10$ .

Firms price the goods they sell as a constant markup on the production cost, which is solely determined by the wage level. The price level is assumed to be 10% markup over the wage level, and thus  $P=11$ .

The following description of the economy has been provided to you.

Money Market

$$M^S = 22$$

$$M^D = 2P + 0.2Y - 100i$$

$$(P = 11, W = 10)$$

Goods Market

$$AE = C + I + G$$

$$C = (1 - 0.2)(Y - T)$$

$$I = 40 - 100i$$

$$G = 10$$

$$T = 0$$

In addition, **you know that** the economy has also 10 units of capital, labor supply is  $L=10$ , and the production function is given by  $Y = 14\sqrt{KL}$ .

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**Deriving and plotting GME Line:**

a. Recall that we can solve for the goods market equilibrium as follows:

$$Y = AE = C + I + G$$

$$Y = .8Y + 40 - 100i + 10$$

$$.1Y = 50 - 100i$$

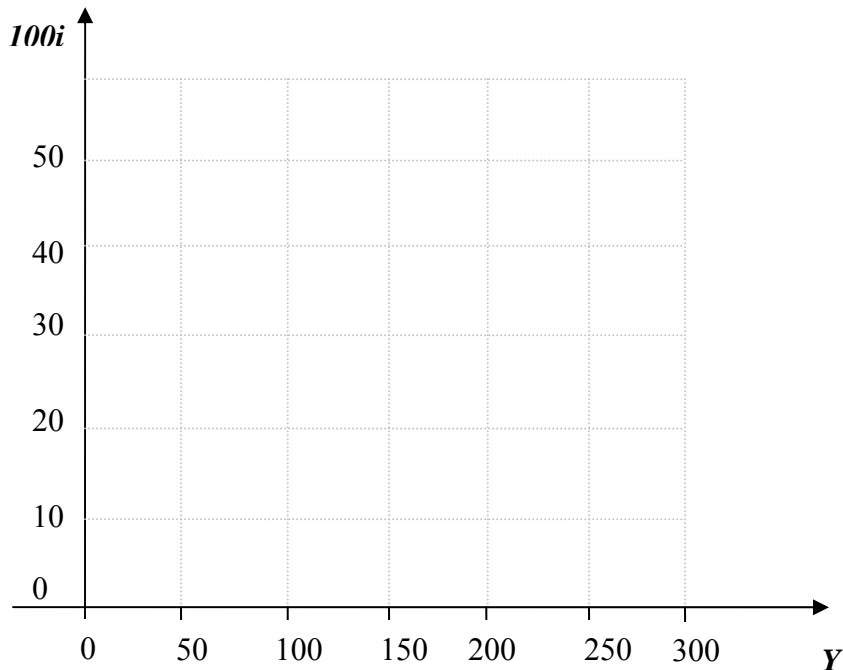
$$100i = 50 - 0.2Y$$

The equation above describes the GME line. Your task is to plot this line.

So, first fill out the table below, and then using this data carefully plot the graph below.

*Your answer:*

Output $Y$	$100i$
0	
50	
100	
150	
200	
250	



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**Deriving and plotting MME Line:**

**b.** Recall that we can solve for the money market equilibrium as follows:

$$M^S = M^D \text{ (plug in for } P=11)$$

$$22 = 22 + 0.2Y - 100i$$

$$0 = 0.2Y - 100i$$

$$100i = 0.2Y$$

The equation above describes the MME line. Your task is to plot this line and include it on the previous diagram.

*Your answer:*

So, first fill out the table below, and then include this plot in the diagram above.

Output $Y$	$100i$
0	
50	
100	
150	
200	
250	

From the graph – approximately answer what the S-R equilibrium output  $Y$  is.....

**c.** Calculate both S-R equilibrium output  $Y$  and interest rate by solving the system of equations (GME + MME):

*Your answer:*.....

*(Your answer must align with the one you gave above!)*

**d.** Using the production function, information about the level of capital and labor supply (see above) calculate unemployment rate in this economy.

*Your answer:*.....

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**Passing from the Short-run to the Long-run...**

Since the economy of *Keynesia* is in a recession (there is positive cyclical unemployment you calculated in d above), two things may happen at this point:

1. The economy might gradually recover as high cyclical unemployment rate will drive wages  $W$  down, and thus the price level (given here by  $P=1.1W$ ).
2. Alternatively, government or Fed can actively try to speed up the process and apply expansionary fiscal policy (increase of  $G$  or fall in  $T$ ) or monetary policy (increase in money supply  $M^s$ ), respectively.

In the remaining part of the exercise you will be guided to show all of this.

**Case 1 Economy adjusts by itself:**

e. Suppose the wage level falls to 9. Calculate short-run equilibrium. Is it enough to bring the economy back to its long-run level?

*Your answer:*

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**f.** The economy needs to recover by itself. Calculate the wage level at which this is the case. (Note that here you are asked to calculate equilibrium of a Classical Model, determine long-run level of output using labor market clearing, capital and production function, then use loanable funds market to find interest rate and plug in to money market to find the price level. Finally given price level find from the money market, use  $P=1.1W$  to calculate wage level.)

*Your answer:*

**g.** Take the wage level from point f above and redo calculation as in point e to show that it is a short-run equilibrium.

*Your answer:*

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**Case 2a Monetary intervention:**

**h.** By how much the Fed would have to increase money supply to bring the economy back to the long-run equilibrium. Would the price level be different from what you calculated in point f?

(HINT: Start with long-run output level  $Y=140$ , find supporting interest rate that makes goods market to be in equilibrium exactly at this level of out, then work with this interest rate to find supporting money supply so that money market is in equilibrium.)

*Your answer:*

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**Case 2b Fiscal intervention:**

**i.** By how much the government would have to increase  $G$  to bring the economy back to the long-run equilibrium? Would the price level be different from what you calculated in point f?

(HINT: Find supporting interest rate that makes goods market to be in equilibrium exactly at the current price level and current level of money supply. Then, plugging in this interest rate, the long-run level of output  $Y=140$ , into goods market equilibrium condition find  $G$ .)

*Your answer:*

**Bonus question (no credit)**

**j.** Using GME/MME diagram, illustrate graphically what you did in points g, h and i.

*Final remark: This homework covers almost all calculations you might be asked to do with the short-run model. However, note that you had many hints all the way through. In order for your to succeed in the exam you need to be able to do it all without any hint. Note that it is not really very hard, but without enough practice can easily become very confusing – especially when you work under pressure of time. My advice is: practice, practice, practice...and think what you are doing so that it is not all mechanical!*