

PROBLEM SET #3 Suggested Solutions

1. (1 point) Unemployment Equilibrium

What does it mean for the economy to be in an “unemployment equilibrium”?

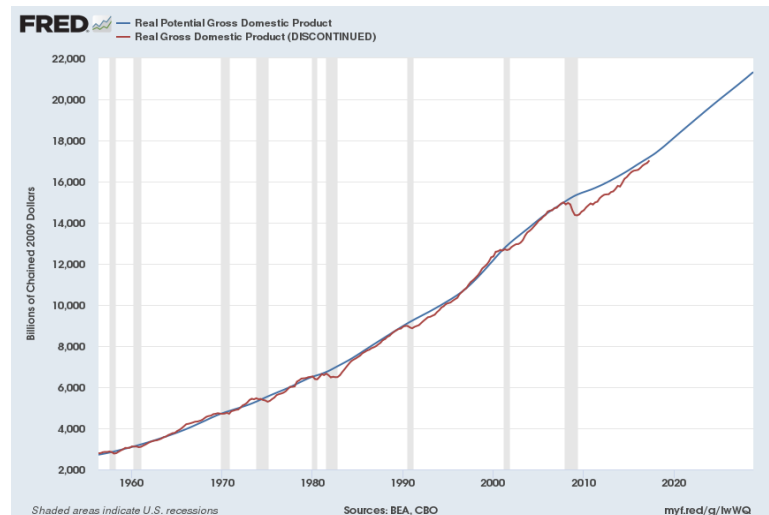
The economy is in an “unemployment equilibrium” when it is in macroeconomic equilibrium (that is, $Y = AD$) but the resulting equilibrium level of output is below the full-employment level of output ($Y_E < Y_{FE}$). When $Y_E < Y_{FE}$, there is an unemployment problem.

Remember that when Keynes was first writing in the 1930s, the dominant model of unemployment came from a micro model of the labor market. Assuming that the entire economy can be described as one labor market (a bad assumption, but stick with me here), then if there is an unemployment problem, that must be because the quantity of labor supplied (workers) is greater than the quantity of labor demanded (employers). That is, under the bad assumption that we can describe the entire economy as one labor market, unemployment means the labor market is in disequilibrium. That is, before Keynes, the common belief was that unemployment was prima facie evidence of disequilibrium. Which is to say, before Keynes, based on bad assumptions, unemployment and equilibrium could not occur simultaneously.

Keynes threw that idea on its head. In *The General Theory of Employment, Interest, and Money* (a rough slog at times, but everyone interested in macro should read it at some point in their lives) he proposed a revolutionary new way of understanding the macroeconomy. One of the key take-aways of what Keynes wrote is that unemployment and equilibrium most definitely can occur simultaneously. Equilibrium is defined as the macroeconomy producing an amount of output (actual real GDP) that is equal to the desired amount of spending ($AD = C + I + G + EX - IM$). Period. If there is a relatively low level of AD, then that equilibrium can occur at a level of real GDP that is less than the potential real GDP the economy could produce if the economy was at full employment.

Remember this graph? The blue (smooth) line shows the amount of output (real GDP) that the US economy could produce if it was utilizing all of its resources. That is, the blue line is Y_{FE} – the full employment level of output, the amount of output that would be produced if the economy was at full employment. The red (squiggly) line shows the amount of output (real GDP) that the economy is producing in each quarter. That is, the red line is Y_E .

When actual output < potential output, (that is, when actual GDP < potential GDP; that is, when $Y_E < Y_{FE}$; that is, when the red line is below the blue line), the economy is in an unemployment equilibrium.



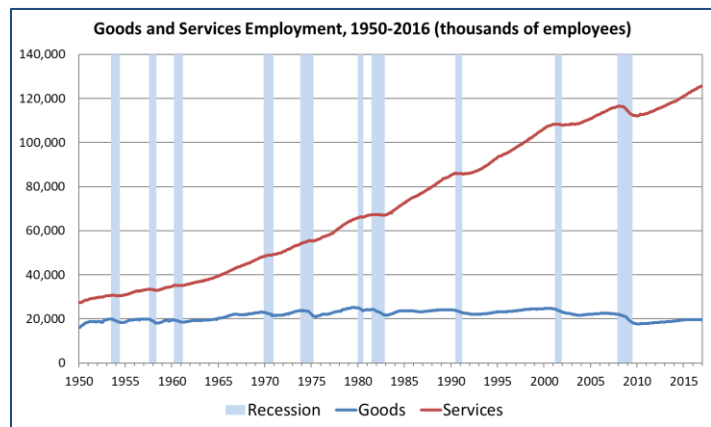
Notice that I assumed that the actual level of real GDP (the squiggly red line) was always in equilibrium. I do this for two reasons, both related to the fact that being out of equilibrium means that inventories are unexpectedly increasing or decreasing (see p. 93 of the macro book). [1] Services cannot be inventoried and therefore production of services is always in equilibrium. Over 60% of US output is services, which means over 60% of the macroeconomy is always in macro equilibrium. [2] The instances when the goods market is out of equilibrium are infrequent and fleeting. They are interesting in and of themselves as those instances of being out of macro equilibrium are often indicators that we are surprisingly at a turning point in the economy. But those moments are rare. And so we assume with little if any impact on our stories that the macroeconomy is always in equilibrium.

2. (2 points total) Unemployment and inflation

- a. Based on the work you did for section exercises #11 and #13, write a paragraph that describes the current **unemployment** situation in the United States. Be sure you place today's situation in some sort of context, be that historical or global.
- b. Based on the work you did for section exercises #11 and #13, write a paragraph that describes the current **inflation** situation in the United States. Be sure you place today's situation in some sort of context, be that historical or global.

Your paragraphs will vary. One point of this question is that you should have knowledge of the current unemployment and inflation situations in the U.S. Whether your context for understanding today is America's past or some other country's present – that's up to you.

You should know that unemployment in the US is currently below 4 percent. Whether you know that it was 3.8 in May, 4.0 in June, 3.9 in July, 3.9 in August, 3.7 in September, and <we'll find out on November 2> in October . . . that level of detail is not important. But you should know that it's around/just below 4 percent. You should know that 4 percent is very low by US historical standards (see the graphs from 10/10 and 10/17 lectures). You should know that the incidence of unemployment varies by demographic characteristics – by race, by gender, by marital status, by educational attainment, and more. You should have some knowledge of what some of that variation is (which variation you want to focus on is up to you). You should know that the vast majority of jobs in the US are in the service industry (Did I show you that graph? If not, here it is. About 20 million jobs in the US are in the goods-producing sector, and that number has not really changed over the last 65 years. All job growth in the US since 1950 has been in the service-providing sector, which now provides nearly 130 million US jobs.)



On inflation, similarly, you should have some knowledge of the current inflation situation. You should know that the inflation rate as measured with the CPI-U is around 2-3 percent. Whether you know that it was 2.7% in May, 2.8% in June, 2.9% in July, 2.7% in August, 2.3% in September, and <we'll find out on November 8> in October . . . that level of detail is less important. But you should know it's between 2 and 3 percent. You should know that the Core CPI (excluding food & energy) is also around 2 percent, and is much more stable than the CPI that includes food & energy. You should know that the inflation rate varies depending upon what sector of the economy we're looking at but that most of the volatility is confined to the food and energy sectors. You should know that the US experienced very high inflation in the 1970s and early 1980s, but that the core inflation rate has more or less been in the 0-4 percent range (and more or less "about 2 percent") for about 3 decades (for most of you that would mean "for your entire life"). You might know that the US experienced deflation in 2009, a shocking and unpleasant experience for people like me whose wages were cut. But these days, it is more important to know that "around 2 percent" is what inflation has been for quite some time, and that whether inflation is starting to rise is not immediately obvious from the numbers you looked at for section exercises 11 and 13.

3. (1 point total) Investment

Decreased construction spending – a component of investment – led the way into the 2007-2009 recession. Explain why a drop in housing prices caused a drop in investment in housing construction. Include the concept of "expected rate of return" in your answer.

In general, a profit maximizing business compares the expected rate of return on an investment project – purchase of machinery or construction of a building – with the relevant interest rate. The expected rate of return takes into account the expected revenue and expected costs (other than interest costs) of buying & using the capital. The difference (expected profit) divided by the price of the capital equals the expected rate of return. (There are far more complicated – and accurate

– ways to calculate the expected rate of return, but this approach is sufficient for you to understand what is at play in the investment decision-making process.)

- If the expected rate of return is greater than the relevant interest rate, then the business will increase profit by undertaking the project.
- If the expected rate of return is less than the relevant interest rate, then the business will decrease profit by undertaking the project.

The relevant interest rate depends upon the financing for the project. A business that is borrowing to fund investment (external finance) will compare the interest rate it needs to pay to borrow with the expected rate of return on the project. A business that is using its retained earnings (internal finance) will compare the interest rate it was earning on its retained earnings with the expected rate of return on the project.

For a construction project, the expected rate of return compares the expected net \$ gain from the project with the financed cost of the project. Builders will typically take out construction loans to cover the cost of labor & materials. Suppose someone is building a house and the labor & materials costs total \$200,000. If the house then sells for \$280,000, the rate of return is $\$80,000/\$200,000 = 0.40 = 40\%$ (wow!). If the price of houses falls and the house can sell for only \$220,000 rather than \$300,000, the rate of return is $\$20,000/\$200,000 = 0.10 = 10\%$. So a drop in the price of houses means a drop in the rate of return for construction companies.

Now we turn to planning because the decision here is whether a housing construction project should begin. If expectations of future housing prices are based on what is happening today to housing prices – a habit economists call “myopic expectations” – then a drop in housing prices today means an expected drop in housing prices in the future, which lowers expected rates of return on housing projects that would have been begun today and finished/sold 3-9 months from now.

As the expected rate of return falls, fewer potential projects are profitable at existing interest rates and thus fewer projects will be undertaken. In this case, fewer houses will be built because of the decline in the expected rate of return. Less money will be spent on housing construction, lowering that component of investment spending.

4. (1 point total) Categorizing Spending

For each activity below, indicate to its right whether the activity would be recorded as investment spending, purchase of an intermediate good, or something else. Give a brief (one phrase) explanation of your answer.

- Your sister, a California resident, buys a new refrigerator to use in her catering business. *Your sister runs a business and is buying a piece of equipment that will be used over and over to produce her final product, catered meals. This is investment spending.*
- Your sister pays for electricity to run the new refrigerator. *Each kilowatt hour of electricity cannot be re-used. It is used up in the process of chilling the air in the refrigerator. Today's kwh doesn't chill food tomorrow, only today. Tomorrow she has to buy more kwh. This is an intermediate good.*
- The Econ Department at UC Berkeley buys a new refrigerator for faculty & staff to use. *The Econ department is not a business. The Econ department at UCB is at a state school, so any of its spending is part of government spending. So this is “something else.”*
- Your sister hires contractors to build a commercial kitchen for her catering business. *Construction spending is part of investment spending whether it is residential (housing, apartments) or non-residential (for example, a commercial kitchen for a catering business).*
- Do your answers to parts (a) - (d) depend upon whether the goods are produced in the United States or abroad? Why? *No. The answers to (a) – (d) would be the same. If the product in question was produced abroad, it would be categorized additionally as imports (IM), but that wouldn't change the initial answer given in (a)-(d) above.*

5. (2 points total) Equilibrium Output

Suppose the following equations describe a simple economy. All amounts are **billions of \$ per quarter**.

Consumption: $C = 100 + 0.80YD$
 Investment: $I = 500$
 Government: $G = 300$
 Exports: $EX = 450$
 Imports: $IM = 350$

Transfer Payments to the Public: $TR = 800$
 Tax Payments to the Government: $TA = 1,300$

a. What is the value of equilibrium income in this economy? Be sure to include the units in your answer. Attach your work or no credit.

Step 1: Simplify the consumption function using the equation $YD = Y + TR - TA$.

$$C = 100 + 0.8YD$$

$$C = 100 + 0.8(Y + TR - TA)$$

$$C = 100 + 0.8(Y + 800 - 1,300)$$

$$C = 100 + 0.8(Y - 500)$$

$$C = 100 + 0.8Y - 400$$

$$C = -300 + 0.8Y$$

Step 2: Simplify $C + I + G + EX - IM$ in the equilibrium equation.

In equilibrium, $Y = AD$ where $AD = C + I + G + EX - IM$

$$Y = -300 + 0.8Y + 500 + 300 + 450 - 350$$

$$Y = 600 + 0.8Y$$

Step 3: Solve for Y.

$$Y = 600 + 0.8Y$$

$$Y - 0.8Y = 600 + 0.8Y - 0.8Y$$

$$0.2Y = 600$$

Divide both sides by 0.2

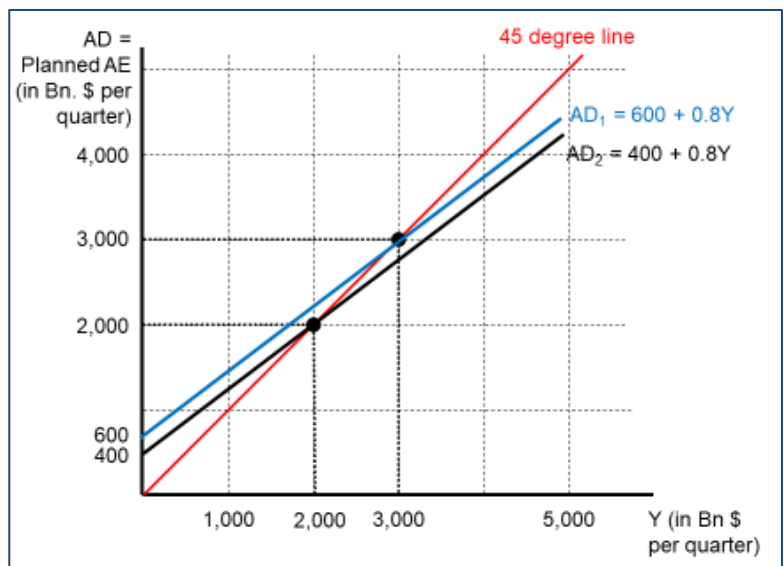
$$Y = 600 / 0.2 \text{ (UGH decimals... get rid of them by multiplying numerator \& denominator by 10)} = 6,000 / 2 = 3,000$$

Step 4: UNITS!!!

Look back up to the prompt and find the units.
 In equilibrium, output is 3,000 billion \$ per quarter.

b. Carefully graph planned Aggregate Expenditure (aggregate demand) as a function of income (Y). Label your axes to show what is being measured in billions of \$ on each axis. Show the equilibrium level of output and income in your graph.

The graph is at the right. It includes the second AD line from part c as well. The AD line shifts down by \$200 billion per quarter (the initial change in AD), resulting in a total change in Y of \$1,000 billion per quarter.



c. Housing prices drop, reducing household wealth. Millions of families can no longer obtain credit through home equity lines of credit (HELOC). Without HELOCs, households cannot spend as much money on consumer goods & services. These wealth and credit effects cause consumption to drop by \$200 billion. Graph the new planned Aggregate Expenditure as a function of income (Y). Show the new equilibrium level of annual output and income in

your graph.

Calculate the new equilibrium level of output and income and write the value in the box at the right. Attach your work or no points.

Consumption drops by \$200 billion per quarter, which means the new consumption function is $C = [\text{original } C \text{ function}] - 200 = 100 + 0.8YD - 200 = -100 + 0.8YD$.

The steps for solving for the new equilibrium output are the same.

Step 1: simplify the C function: $C = -100 + 0.8*(Y + 800 - 500) = -500 + 0.8Y$

Step 2: simplify the AD expression: $Y = -500 + 0.8Y + 500 + 300 + 450 - 350 = 400 + 0.8Y$

Step 3: solve for equilibrium Y: $0.2Y = 400$, so $Y = 400/0.2 = 4000/2 = 2000$

Step 4: find the units and write them down: **In equilibrium, output now equals \$2000 billion per quarter.**

d. What is the value of the investment spending multiplier ($\Delta Y/\Delta I$) for this economy? Attach your work or no points.

The easiest way to calculate the value of the multiplier for this problem is to remember the definition of the multiplier and substitute in the relevant values.

$$\text{Multiplier} = \frac{\text{total } \Delta Y}{\text{initial } \Delta \text{ spending}} = \frac{2000 \text{ bn } \$ \text{ per quarter} - 3000 \text{ bn } \$ \text{ per quarter}}{-200 \text{ bn } \$ \text{ per quarter}} = \frac{-1000 \text{ bn } \$ \text{ per quarter}}{-200 \text{ bn } \$ \text{ per quarter}} = 5$$

The other way to calculate the value of the multiplier is to know which formula for the multiplier is the right one to use in this instance. Knowing which formula is the right one to use requires figuring out which of C, I, G, EX, IM, TR, and TA depend upon Y. Looking at the equations in the prompt, only C changes when Y changes. Thus we want the formula for the multiplier that includes the $\frac{\Delta C}{\Delta YD} = \text{mpc}$. That is the formula $\frac{1}{1-\text{mpc}}$. Here the $\text{mpc} = 0.8$ (the mpc is the slope of the consumption function), so the multiplier $= \frac{1}{1-0.8} = \frac{1}{0.2} = 5$.

You should understand why this sentence is true: Knowing which formula is the right one to use requires figuring out which of C, I, G, EX, IM, TR, and TA depend upon Y.

You should not memorize the various formulas for the multiplier.

6. (2 points total) Multiplier

a. Your friend, who is not taking Economics and therefore doesn't know economic language, doesn't understand why an initial \$400 billion annual decrease in construction spending makes income fall by more than \$400 billion per year. Tell your friend why an initial change in planned aggregate expenditure results in a much larger change in equilibrium income.

Your goal here is to explain this without using economic jargon, so that someone who isn't taking Econ 1 could understand. Essentially, you want to describe for them the process we watched unfold in class on Wednesday October 24.

When people spend less money buying goods and services, fewer goods and services are produced. When businesses produce and sell less output, they need fewer workers. People either lose their jobs completely or get their hours cut. Either way, workers have less income. And when people have less income, they spend less money buying goods and services.

In this case, we start with a drop in construction spending. People employed in construction – builders, plumbers, contractors, electricians, and more – lose their jobs or have their hours cut. Their income falls. As a result, they cut back their own spending on goods and services. Maybe they'll go out to eat less often, or go shopping for clothes and stuff at Target less often. Their cutback in spending is felt particularly by retail workers and retail business owners, and eventually by the producers of the goods sold at stores like Target. Those workers who lost income will now reduce their own spending, triggering another round of decreased production, layoffs and lost income.

This is a continuous cycle. It is called the “multiplier effect.” The size of the effect will depend on what share of any change in income typically ends up back in the economy as spending. If someone’s income goes up by \$1,000 a month, how much of that gets spent on newly produced goods and services? In an economy in which people spend a lot of any change in its income (instead of saving it), there will be big multiplier effects in response to an initial change in expenditure.

*Notice that the multiplier process works as the economy contracts **and** when the economy expands. If someone’s income is cut by \$1,000 a month, how much will they reduce their spending? There are only two ways to avoid having to cut spending by the full \$1,000 a month: using previously accumulated assets (spending your own wealth, such as savings account balances or other financial accounts), or acquiring new liabilities (borrowing from family and friends, using your credit cards, and so on). If people cut their spending a lot when their income falls, the multiplier effect will be quite large. If people are able to nearly sustain their spending despite a cut in income, the multiplier effect will be small.*

In this question, we looked at the impact of an initial drop in spending of \$400 billion per year. Ultimately, income falls by more than \$400 billion per year. The multiplier process makes the decline worse.

b. In which case would the annual drop in GDP following the yearly drop in housing construction be greater:

- [case 1] Consumers have access to credit
- [case 2] Consumers do not have access to credit

Explain. Your explanation should include the concept “marginal propensity to consume.”

How much consumption drops when income drops depends on whether workers are able to spend something other than their disposable income when they buy goods and services. If your paycheck drops by \$1,000 per month and you don’t want to cut your spending by \$1,000 per month, you’ve got only two choices: draw down your assets that you’ve accumulated by saving in the past (take money out of your savings account, sell off a savings bond, sell some stock, sell your car), or accumulate liabilities by accessing credit (charge things on your credit card to pay off later, take out a home equity loan, borrow from a sympathetic relative, go to a pawn shop).

If you can’t access credit, you will have to cut your spending by a larger amount. The mpc is the cut in spending divided by the cut in disposable income. Therefore, without access to credit, the mpc is larger, so the multiplier is larger, and the drop in GDP is larger.

7. (1 point total) Categorizing Expenditures

For each activity below, indicate in the box to its right where the activity would be recorded on the expenditure side of U.S. GDP accounting. Give a brief (one phrase) explanation of your answer. The choices are “C” (consumption), “I” (investment), “G” (government spending), “EX” (exports), “IM” (imports), and “not recorded”.

a. A fire at the Chevron refinery in Richmond, CA causes \$150 million in damage

This is not recorded. There has been no output produced, no employment generated. It’s a bad situation, but any natural or environmental disaster has no direct effect on GDP.

b. The City of Richmond hires local toxic-clean-up crews to remove toxins from city-owned playgrounds following the Chevron refinery fire

The City of Richmond is a government agency, so its spending is part of government spending. Now the effect of the environmental damage is starting to impact GDP – not through the damage itself, but through the cleanup efforts.

c. Restaurant owners in Richmond pay local toxic-clean-up crews to remove toxins from their outdoor seating

The restaurant owners sell meals. Cleaning outdoor seating, buying napkins, washing windows – all of these are purchases of intermediate goods and therefore are not recorded on the expenditure side of GDP accounting. When you buy a meal at the restaurant, part of what you pay for the meal will cover the costs of cleaning up after the toxic spill.

d. Restaurant owners in Richmond purchase new outdoor seating that was manufactured in England

The outdoor seating is used over and over to produce restaurant meals. It is therefore investment spending. Because the seating was manufactured outside the US, it is also imports.