

PROBLEM SET #4 Suggested Solutions

This is important: Because you can use your clicker points to replace lost PS points and thus bring your total to 40/40 for PS, some of you didn't need very many points on PS4 to reach 40/40.

Therefore your GSI may not have graded every question.

For instance, if you had earned 27/30 on PS1+PS2+PS3 and had 10/10 clicker points, you only needed 3 points on PS4 to bring your total to the max of 40/40.

Check with your GSI. They will be able to tell you which questions they read & which they didn't.

It's therefore important that you read the solutions.

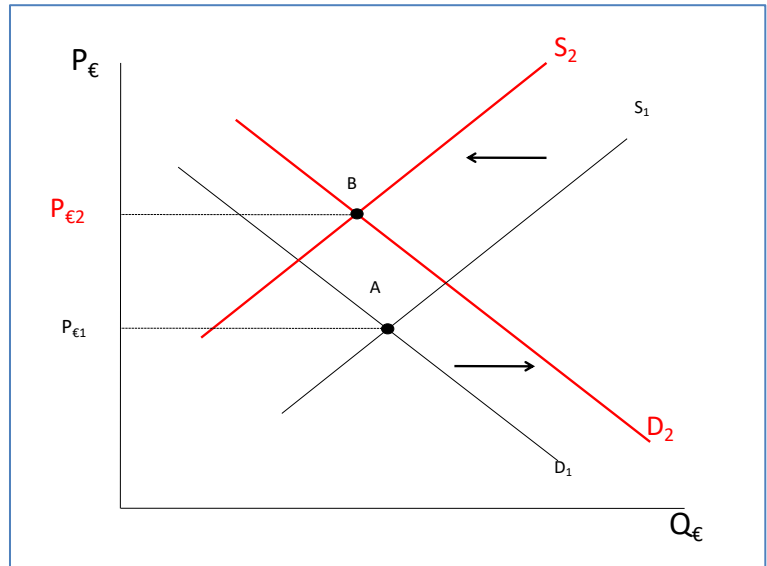
1. (1.5 points) Exchange Rates

Assume a floating exchange rate system. For each event below, draw a graph depicting the effect of the activity on the market indicated in the prompt. Label everything clearly. Predict the effect noted in the prompt. Briefly (one or two sentences) explain your graph.

- A. (Dollars and Euros, from the perspective of the US, $P_{\text{€}}$ on vertical axis) The Federal Reserve – but no other central bank – decides to decrease interest rates. Predict effect on \$ price of 1 € and whether \$ rises or falls relative to €.

Here we are looking at the market in which dollars are exchanged for euros (and thus, simultaneously, euros are exchanged for dollars). The demand curve for euros represents holders of U.S. dollars seeking to exchange them for euros. The supply curve for euros represents holders of euros seeking to exchange them for U.S. dollars.

An asset is something you own that has value. A physical or tangible asset is something that you can touch. It exists in a physical sense. A piece of land or items of jewelry are examples of physical assets. A financial asset is something you own that has value, but it is intangible; there is no physical, existing asset that you can touch. The financial asset has value because it represents a claim on money in the future. A bond is an I.O.U. "signed" by a government agency or a corporation in exchange for money. It's essentially a loan document that can be easily resold. A stock gives you ownership of (a very small part of) a business, entitling you to a claim on future earnings of the company. There are lots of other financial assets but, for our purposes, we can focus just on bonds and stocks.



Financial assets are bought and sold constantly. They are issued by businesses and government agencies in particular countries, but except in rare cases can be bought and sold by anyone anywhere in the world.

For understanding the connection between interest rates & exchange rates, it's important to put yourself in the shoes of people with a lot of wealth (wealth-holders) – not borrowers. The interest rate paid on an asset is the rate of return earned by the people who own that asset. People with wealth want to earn the best rate of return (given risk) possible. If interest rates rise, that is beneficial to wealth-holders because now they will earn a higher rate of return.

A decrease in US interest rates (but no change in interest rates in the rest of the world) means that the rate of return on American assets has decreased relative to the rate of return on foreign assets. Flip that idea over: the rate of return on foreign financial assets has increased relative to the rate of return on US financial assets. Wealth-holders will move some of their wealth into foreign financial assets (raising demand for foreign financial assets) and out of American financial assets (decreasing demand for US financial assets).

The fall in demand for U.S. financial assets will cause two changes in this foreign exchange market. First, some American people, businesses, banks, and government agencies will reallocate their wealth, buying fewer U.S. financial assets and more European financial assets. That is, those who hold U.S. dollars would prefer to buy more foreign financial assets and fewer U.S. financial assets. This will increase the demand for euros because there are more people seeking to convert their U.S. dollars into euros in order to buy European financial assets. On the graph this is shown by shifting D_1 to D_2 .

At the same time, some European people, businesses, banks, and government agencies will make the exact same shift in their wealth

portfolios: buying fewer U.S. financial assets and more European financial assets. That is, those abroad will no longer want to buy as many U.S. financial assets because the U.S. assets have a relatively lower rate of return. This will decrease the supply of euros because fewer people are seeking to convert their euros into U.S. dollars in order to buy U.S. securities. On the graph this is shown by shifting S_1 to S_2 .

The shifts in the demand and supply for euros cause the dollar price of one euro to increase from $P_{\epsilon 1}$ to $P_{\epsilon 2}$. Therefore, the net result is that the U.S. dollar depreciates (becomes weaker, falls in value compared to the euro), while the euro appreciates (becomes stronger, rises in value compared to the U.S. dollar).

Notice that it is unclear whether quantity will rise or fall. However, unlike the markets for goods and services, we do not really care about changes in the quantity for foreign currency. The most important thing to pay attention to is the price.

- B. (Pounds and Euros, from the perspective of Britain, P_{\pounds} on vertical axis) The possibility (likelihood?) of Britain exiting from the European Union ("Brexit") leads many Europeans to decide that holding their wealth in British assets is a bad idea. They sell their British stocks and bonds and put the proceeds into money market funds denominated in Euros. Predict effect on \pounds price of 1 \pounds and whether \pounds rises or falls relative to \pounds .

We'll be generous in how we mark this question because there were a couple of different interpretations, based on whether you categorize Brits as Europeans. (That turns out to be a political question, which was not the intent at all.)

The strict interpretation of the prompt: People who were holding British stocks and bonds sell their British assets (which gives them pounds) and put the funds into money market funds denominated in euros (which requires them to exchange the pounds for euros). That would be shown as an increase in the demand for euros. An increase in demand increases price, making the pound price of a euro higher, depreciating the pound relative to the euro.

An alternative interpretation of the prompt: Europeans (people who hold euros) want to buy fewer British stocks and bonds in the future, lowering the supply of euros offered in exchange for pounds. Same effect: pound price of the euro rises, making the pound weaker relative to the euro.

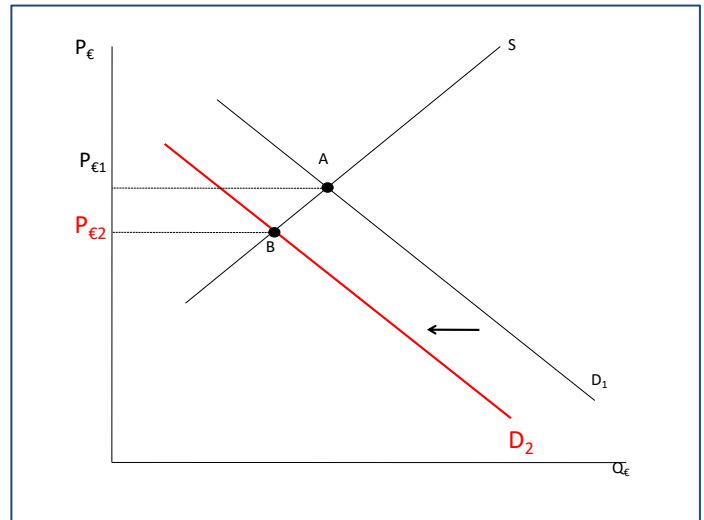
A third interpretation of the prompt combines both of those interpretations, giving you both a rise in demand and a drop in supply of euros.

All interpretations lead to the same result: an increase in the pound price of the euro, depreciating (weakening) the pound relative to the euro.

Graph is the same as in a, or is just one of those shifts shown in a, depending on which interpretation you went with.

- C. (Dollars and Chinese Yuan (RMB), from the perspective of the US, PRMB on vertical axis) The surprising announcement by Trump of additional tariffs on goods manufactured in China leads many to expect trade from China to the US to fall. Predict effect on US\$ price of 1 RMB and whether US\$ rises or falls relative to RMB.

The imposition of tariffs on Chinese goods lowers US demand for Chinese goods. Fewer dollars are offered in exchange for Chinese yuan because there is less trade. The demand for the yuan falls, lowering the price of the yuan. Fewer dollars per yuan (more RMB per dollar) means the dollar is stronger (has risen, appreciated) relative to the yuan.



2. (1 point) Open Economy Multiplier.

Explain why the spending multiplier is larger when the marginal propensity to import is smaller. Your explanation should rely on economic behavior, not (simply) math. That is, include the equation if you like, but if your explanation is only about the math, you get 0 points.

The spending multiplier tells us how much total income (and output) change when there's an initial change in aggregate demand. An explanation is usually easier if you choose a direction of change – increase or decrease – rather than keeping it as general as “change.” Let me choose to describe the process starting from an initial increase in AD.

Suppose there were no imports. Our description of the multiplier process would read like this: An initial increase in aggregate demand (for instance, an increase in investment spending) means companies will want to hire more workers. Because of their new jobs, these workers are going to receive more income. They will save some of this new income, and the rest they will spend on goods and services. The companies that produce the goods and services that the workers buy will, in turn, hire more workers in order to increase production of their products, and these workers end up having more income. This leads to even more consumption, and the rounds of output, income, spending continue. The total increase in income and output is larger than the initial increase in aggregate demand.

But that description omits the role for imports. Not everything that we buy is produced domestically, and it is only purchases of domestically produced goods and services that generate income for workers in our economy. So we need to modify that description in order to take into account imports.

If imports increase when income increases (for example, when $IM = 600 + 0.2Y$, and so $mpm > 0$), then some of the added consumption is spent on imports. Only a portion of the gains in consumption will be added to domestic GDP. In each multiplier round, the additional spending for domestically produced goods and services will be the difference between the change in consumption and the change in imports.

Our description of the multiplier process when some of our spending is for imports: An initial increase in aggregate demand (for instance, an increase in investment spending) means companies will want to hire more workers. Because of their new jobs, these workers are going to receive more income. They will save some of this new income, and the rest they will spend on goods and services. Some of their spending is for domestically produced goods & services; some is for internationally produced goods & services (IM). The companies that produce the goods and services that the workers buy will, in turn, hire more workers in order to increase production of their products, and these workers end up having more income. The spending for domestically produced goods & services therefore generates production, jobs, and income in the domestic economy. This increase in income in the domestic economy leads to even more consumption (some of which is for domestically produced goods and services and some of which is for internationally produced goods & services), and the domestic economy's rounds of output, income, spending continue. The total increase in income and output in the domestic economy is larger than the initial increase in aggregate demand.

As the share of our spending that goes to imports decreases (mpm gets smaller), a larger share of any round of spending will be for domestically produced goods & services. More spending will circulate in the domestic economy when the mpm is smaller, making the total change in income and output larger when the mpm is smaller. Thus the multiplier – the ratio of the total change in income and output to the initial change in aggregate demand – will be larger when the mpm is smaller, that is, when the share of our spending that is for imports is smaller.

FYI: The amount spent on imports doesn't just disappear. The amount we spend on imports generates GDP and jobs in other countries.

3. (1 point) Fiscal Policy.

Explain why an increase in government spending (G , government purchases of goods and services) of \$100 billion per year has a larger effect on GDP than does a cut in taxes of \$100 billion per year. Be sure you identify the key assumption in your analysis. (Write "Key Assumption: " before that sentence.)

The total effect on GDP depends upon the initial change in aggregate demand because the total change in GDP equals the spending multiplier times that initial change in AD. So we need to focus on the size of the initial change in AD. Remember: $AD = C + I + G + EX - IM$. So our focus is on the size of the initial change in one or more of those 5 components of AD.

When government spending is increased, the full amount of the change in G exactly equals the initial change in AD. So we have
Initial $\Delta AD = \Delta G = \$100$ billion/year

And thus

$$\text{Total } \Delta GDP = \text{spending multiplier} * \text{initial } \Delta AD = \text{spending multiplier} * \Delta G = \text{spending multiplier} * \$100 \text{ billion/year}$$

When taxes are decreased, the immediate impact of the change in taxes is an increase in disposable income, YD . (Remember: $YD = Y + TR - TA$.) When disposable income increase, people who experience that change in disposable income will increase their consumption spending. The size of the change in consumption spending depends upon the mpc : how much of that change in disposable income generated by the change in taxes will be reflected in a change in consumption spending. (Remember: $mpc = \Delta C / \Delta YD$.) So we have

$$\text{Initial } \Delta AD = \Delta C = mpc * \Delta YD = mpc * (-\Delta TA) = mpc * \$100 \text{ billion/year}$$

And thus

$$\text{Total } \Delta GDP = \text{spending multiplier} * \text{initial } \Delta AD = \text{spending multiplier} * mpc * (-\Delta TA) = \text{spending multiplier} * mpc * \$100 \text{ bn/year}$$

If the mpc is less than 1 ($mpc < 1$), and if the changes in TA and G are the same size ($-\Delta TA = \Delta G$), then the total ΔGDP will be smaller when taxes are changed than when government spending is changed.

KEY ASSUMPTION: The key assumption is that people spend only some proportion and not 100% of the tax cut. If 100% of the tax cut is spent in the first round, then there is no difference in the effect of an increase in G and a cut in TA .

Sometimes it helps to think concretely about examples of government spending (G) and taxes (TA). Government spending is a government agency's purchase of goods or services. Taxes are paid to the government by people or businesses.

Examples of government spending include

- all defense (military) expenditures including paying troops and officers, buying weapons and other equipment, purchasing meals and other supplies for those in the military and so on
- transportation expenditures including building or repairing or maintaining federal highways and bridges, airports, rail lines, and so on, and paying salaries of people who work for federal transportation agencies.
 - FYI: a lot of federal transportation expenditures are grants given to the states, who then hire the workers or contractors. So the CalTrans workers maintaining I-80 or I-5 are working on a federal highway but are not federal employees. They are state employees paid with dollars the CA government received from the federal government to finance federal highway maintenance and repair.
- "Interior" department spending, which includes the National Parks, so salaries of rangers and others who work for Yosemite National Park, plus equipment and supplies to keep the parks operating
- And much more!

Examples of taxes collected by the federal government, in order by how much revenue is collected (most to least), include

- Income taxes (represent ~50% of federal tax revenue), a percent of the income we earn, where the taxable income includes labor income, capital income, and transfer payments. The higher your income, the larger the % of income paid in taxes.
- Payroll taxes (~1/3 of federal tax revenue, more commonly called "Social Security and Medicare taxes"). A percent of the labor income we earn. Because we only pay Social Security taxes on the first \$132,900 in labor income, the higher your income above that threshold, the lower the % of income paid in taxes.
- Corporate income taxes (<10% of federal tax revenue), a percent of the profit of corporations.
- Excise taxes (~3% of federal tax revenue) and tariffs (~1% of federal tax revenue), a percent of the price of taxed items.
- Estate taxes (< 1/2 % of federal tax revenue), a percent of wealth a person leaves to others (excluding charitable donations made from the estate). Applies only if someone has wealth > \$11.4 million when they die.

For instance, if government spending for highway and bridge construction increases by \$100 billion, the entire \$100 billion represents increased output (highways and bridges) and increased income for the people who are employed to construct those highways and bridges. But if income taxes decrease by \$100 billion, less than \$100 billion will be spent by workers on consumer goods and services and so less than \$100 billion will generate increased output (consumer goods and services) and increased income for the people who are employed to produce and sell those consumer goods and services.

4. (1 point) Interest rates and net exports.

Explain why a decrease in interest rates in the U.S., all else constant (*ceteris paribus*) leads to an increase in net exports.

(note that the first part of this explanation is exactly what you did for #1a above, the link between interest rates and exchange rates) A decrease in US interest rates (and implicitly no change in interest rates in the rest of the world) means that the rate of return on American assets has fallen relative to the rate of return on foreign assets. Flip that idea over: the rate of return on foreign financial assets has increased relative to the rate of return on US financial assets. Wealth-holders will move some of their wealth into foreign financial assets (raising demand for foreign financial assets) and out of American financial assets (decreasing demand for US financial assets).

The fall in demand for U.S. financial assets will cause two changes in this foreign exchange market. First, some American people, businesses, banks, and government agencies will reallocate their wealth, buying fewer U.S. financial assets and more foreign financial assets. This will increase the demand for foreign currency.

At the same time, some non-US people, businesses, banks, and government agencies will make the exact same shift in their wealth portfolios: buying fewer U.S. financial assets and more foreign financial assets. This will decrease the supply of foreign currency because fewer people are seeking to convert their foreign currency into U.S. dollars because they are buying fewer U.S. financial assets.

The shifts in the demand for and supply of foreign currency cause the dollar price of one unit of foreign currency to increase, which means that the U.S. dollar depreciates (becomes weaker, falls in value compared to the foreign currency), while the foreign currency appreciates (becomes stronger, rises in value compared to the U.S. dollar).

When foreign currency is more expensive (more dollars per unit of foreign currency), that raises the US-dollar cost of imports into the United States, which leads to a decrease in imports (IM). At the same time, the exact same rise in the price of foreign currency (more dollars per unit of foreign currency) lowers the foreign-currency cost of exports from the US, leading to a rise in US exports (EX).

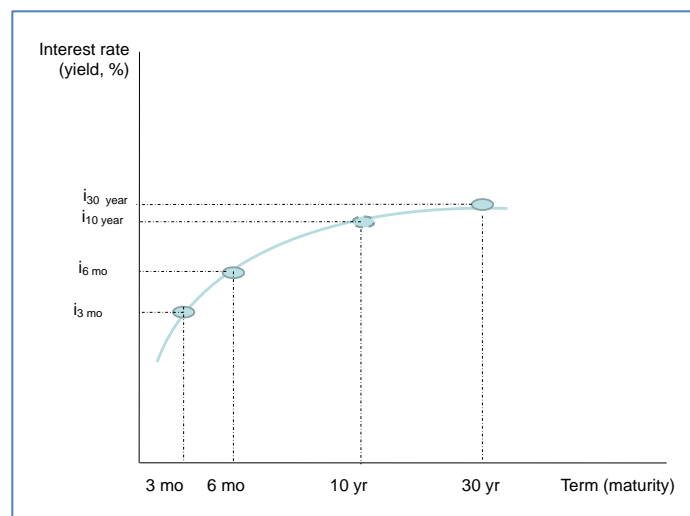
Net exports is the difference ($NX = EX - IM$) and since EX are rising (increasing NX) and IM are falling (increasing NX), there is an increase in NX.

5. (1 point) Yield Curve.

A. Using the axes at the right, draw a yield curve. (Note that in the textbook, page 226, the yield curve is missing labels on the horizontal axis. It should show 3 months, 1 year, 5 years, 10 years, etc.)

B. Which “end” of the yield curve does the Fed have the most control over? Which “end” of the yield curve has the most influence on aggregate demand? Discuss.

The yield curve shows, for any particular day, the interest rates on financial assets of different maturities. A normal yield curve shows higher long-term interest rates than short-term interest rates. An inverted yield curve has higher short-term interest rates than long-term interest rates. The terms (maturities) shown are usually 1-month, 3-month, 6-month, 12-month, 3-year, 5-year, 10-year, 20-year, and sometimes 30-year.



Long-term interest rates should be the average of future and expected short-term rates plus a “premium” to compensate the lender for tying up their funds for a long time (called the “term premium”) plus a premium because expectations are not known with certainty (called the “risk premium”). The idea is that someone could buy a 30-year bond today, which matures in 2049, or they could buy a series of 1-year bonds, buying one every year and rolling over the full amount that they have earned into each new bond. Someone would buy a long-term bond if the premia for doing so (the term and risk premia) sufficiently compensated them for tying up their funds long-term and taking the risk that their hunches may be wrong for what short-term rates will be in the future.

*Suppose you expect short-term rates to be 0.5 percent for 2019-2023, and then to be 3 percent for 2024-2049. The average of those current and future short-term rates would be $1/30 * (5 * 0.5 + 25 * 3) = 2.58$. If everyone shared the same expectations, then a long-term rate for a 30 year bond would then be something greater than 2.58, to allow for the term and risk premia.*

On the other hand, suppose short-term rates today were 10 percent, but were expected to fall to 3 percent by 2021. Then the average of those current and future short-term rates would be $\frac{1}{30} * (2 * 10 + 28 * 3) = 3.47$. Even allowing for a term premium, the long-term rate would be lower than the current short-term rate.

The Fed has the most influence over the left or short-term end of the yield curve. They determine the IOER, influence the FFR (overnight), and intervene in short-term Treasury markets as part of FOMO.

Interest rates matter to aggregate demand through their influence on Investment, Net Exports, and possibly also consumption spending. For investment spending financed externally, the borrower typically tries to match up the expected length of the investment good with the term of the loan. Buying a machine that will last 5 years? Go for a loan of no more than 5 years. Buying a machine expected to last 1 year? Get a loan with term under one year. Building loans are typically 30 years (home mortgages) or sometimes more (some commercial buildings). So for investment, the relevant interest rate is long-term and possibly medium-term (3-5 years).

For net export spending, interest rates matter because they are the rate of return on financial wealth. Financial assets will be of various terms – short, medium, and long – within a balanced portfolio. So interest rates at both “ends” of the yield curve are relevant for net exports.

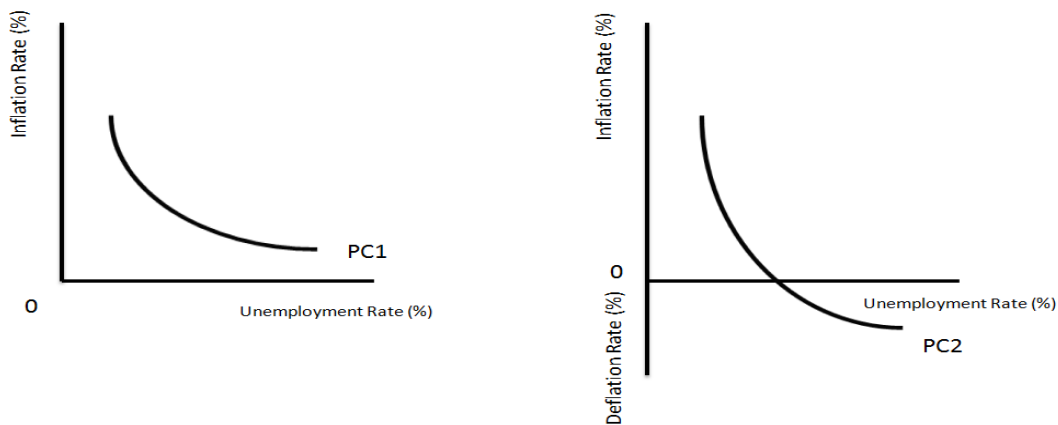
For consumption spending, to the extent that interest rates affect durable goods purchases and to the extent that Fed policy changes consumer loan rates, those will be medium term loans (3 or 5 or 7 year car loans, for instance)

So, generally: the Fed affects the short-term rates but aggregate demand responds to primarily medium- and long-term rates.

6. (1.5 point) Phillips Curve

A. At the right, draw a typical Phillips Curve.

The Phillips Curve shows the tradeoffs between the inflation rate and the unemployment rate, holding constant (1) inflationary expectations, (2) supply shocks that affect the cost of inputs, and (3) labor productivity growth. You could draw either type of Phillips Curve shown below, PC1 or PC2. The difference between the two is that for PC2 there are some rates of unemployment for which the economy would experience negative rates of inflation: deflation.



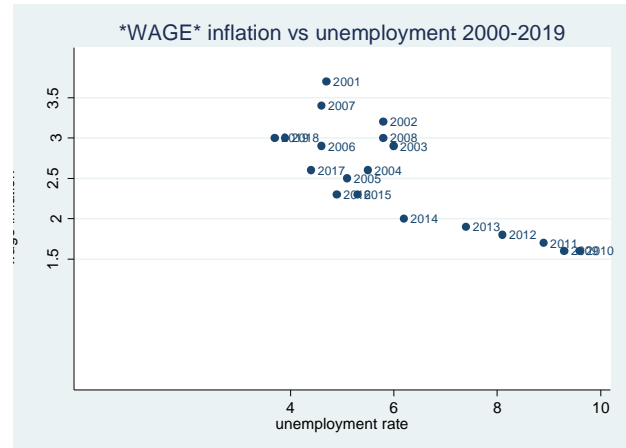
B. (1 point) Why is a decrease in the unemployment rate expected to lead to an increase in the inflation rate? What is one possible reason the recent data show no (or very little) increase in the inflation rate despite the fall in the unemployment rate?

The idea behind the downward sloping Phillips curve has to do with worker’s bargaining power. If the unemployment rate is low, employees have more bargaining power and can demand higher wages or threaten to leave for another employer. Firms will need to pay a higher wage to attract new employees (or to make sure their existing employees don’t quit). Firms will charge higher prices to make up for the higher wages they now need to pay workers. This leads to a higher inflation rate. Thus a low level of unemployment is correlated with a higher inflation rate.

You can think about this bargaining power issue either from the perspective of existing workers for particular firms, or from the perspective of new workers hired by a firm. Existing workers have more bargaining power if unemployment is low because they have lots of alternative employment opportunities. To keep these workers, the firms will have to agree to pay higher wages to prevent the workers from going to another firm that pays them more. If firms pay higher wages, they will have to increase prices to pay for their higher costs.

From the perspective of new workers being hired by expanding firms, we get the same result. The lower the unemployment rate, the tighter are labor markets. Employers wanting to hire additional workers will often need to entice workers away from their existing jobs. To do this, firms bid up wages, pushing up the costs of production, which ultimately push up the prices of output. The inflation rate will be high.

Why has recent data shown very little or no increase in inflation despite the fall in the unemployment rate? In theory, one possibility is that the relationship between unemployment and wage inflation has broken down, and the other possibility is that the relationship between wage inflation and price inflation has broken down. However, as seen in class and included at the right, the relationship between unemployment and wage inflation has not broken down – there is still a downward sloping (tradeoff) relationship between unemployment and wage inflation.



So that leaves us with the relationship between wage inflation and price inflation. Why are firms not passing along higher wage increases by increasing prices? Several possibilities come to mind:

- Increases in labor productivity along with higher wages means that the cost of production per unit of output hasn't increased much (but this explanation is inconsistent with the data on labor productivity growth, which hasn't shown a steady increase as wage inflation has increased)
- Firms face competitive pressures especially from international competitors and don't pass along cost increases because of a fear of losing market share. If this were correct, we would expect to see a decrease in profits for firms facing increased competitive pressure. (Data on corporate profits may not capture what we want to see here because those data will be dominated by big corporations – Apple, Microsoft, General Electric – that have market power and few international competitors.)
- The data on price inflation have become flawed and are not adequately capturing what's really happening with price inflation. (This one is hard to investigate empirically because it's saying that our empirical measures are wrong, making it hard to offer empirical evidence.)

You may have thought of yet another explanation. What matters is that you used good economic logic in your explanation.

7. (3 points) Essay

Go to the website for the Federal Reserve, then to the FOMC - meeting calendars & statements page at <http://www.federalreserve.gov/monetarypolicy/fomccalendars.htm>. Then look at the statement the FOMC issued after its October 29-30, 2019 meeting.

Write a 1 to 2 page paper in which you do the following:

- Choose two different sentences in the statement that you understand today that you probably wouldn't have understood in August. For each, first quote the sentence, then explain what the sentence means using the concepts and language we have learned this semester. One paragraph for each sentence and explanation. It'll probably look nice if you offset the quoted sentence with italics or a bullet or something like that.
- Choose one different sentence in the statement that you still don't understand today. Quote the sentence, then identify which (part of) the sentence you don't understand. If you can make a guess at the sentence's meaning, share your guess.
- In recent years, the Fed has sought to explain clearly what they are doing and why. In your fourth and final paragraph, discuss to what extent you think a little bit of economics education (say, a 1-semester course in micro & macro) is necessary for someone to be able to understand the Fed's statements.

Remember that in economics (as in life), the conclusions you come to will depend in part on the assumptions you make. So be sure you make the relevant assumptions explicit. Don't invoke wildly unrealistic assumptions; the assumptions you make should be reasonable.

There are many ways you could have gone with this essay, so we can't provide you with "this is what you should have written."

Guidelines:

a. Did you follow the specifications? One-page essay? Max of 400 words? 1" margins? Double-spaced? 10 or 11 or 12 pt font? Your name and date & word count in the top right corner? Your essay stapled at the back of your problem set? Attached your "works cited" list (either at the end of page 1 or on a separate page)? Submitted both via bCourses & in hard copy?

If so, you remained eligible for full credit. If not, you lost 1 point right off the top.

b. Did you address the prompt? If so, then you remained eligible for full credit. If not, well, that was silly wasn't it? If you didn't address the prompt, you lost point(s) for not addressing the prompt.