

PROBLEM SET #4 Suggested Solutions

1. (2 point) Fiscal Policy

- a. (½ point) Explain why an increase in government spending (G) is supposed to have a larger effect on GDP & employment than an equal-sized decrease in taxes (TA).

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 (or decreased), the full amount of the change in G exactly equals the initial change in AD. So we have

$$\text{Initial } \Delta AD = \Delta G$$

And thus

$$\text{Total } \Delta GDP = \text{spending multiplier} * \text{initial } \Delta AD = \text{spending multiplier} * \Delta G$$

When taxes are decreased (or increased), the immediate impact of the change in taxes is a change in disposable income, YD. (Remember: $YD = Y + TR - TA$.) When disposable income changes, people who experience that change in disposable income will change 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

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

And thus

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

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.

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 \$128,400 in labor income, the higher your income, 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 (< ½ % 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 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.

- b. (½ point) Our clicker answers on October 24 indicated that, on average, we would change our consumption more in response to a change in income than we would to a change in taxes. Assuming we are an accurate reflection of the economy as a whole, how does that behavior impact your answer to part a?

If we in Econ 1 are a reflection of the population as a whole, then our clicker answers indicate that the effect of cutting taxes would be even smaller than predicted in part (a).

Our clicker answers implied that, on average, we respond more to a change in disposable income (ΔYD) due to a change in income (ΔY) than to a change in taxes (ΔTA). That is, our mpc associated with a change in income $>$ our mpc associated with a change in taxes.

$$mpc_{\Delta Y} > mpc_{\Delta TA}$$

When taxes are cut, the initial change in aggregate demand depends on our mpc associated with a change in taxes. In part (a), we assumed that mpc was the same as the mpc associated with a change in income. But if the mpc associated with a change in taxes is less than the mpc associated with a change in income, then our initial change in aggregate demand is even smaller than predicted in part (a).

For example, suppose we are comparing $\Delta G = +\$100$ billion per year with $\Delta TA = -\$100$ billion per year. Suppose the mpc is 0.3 and its value does not depend on why YD has changed. When our disposable income changes, we change our consumption by $0.3 * \Delta YD$. In part (a), these numbers suggest

Initial ΔAD due to $\Delta G = \Delta G = +\$100$ billion per year

Initial ΔAD due to $\Delta TA = 0.3 * (-\Delta TA) = 0.3 * (100) = +\30 billion per year

Based on our clicker answers, we don't spend 30 percent of a change in disposable income if the reason our YD went up was because of a tax change. Suppose our mpc associated with a change in taxes is 0.2. Our mpc associated with a change in income is still 0.3. In this case

Initial ΔAD due to $\Delta G = \Delta G = +\$100$ billion per year

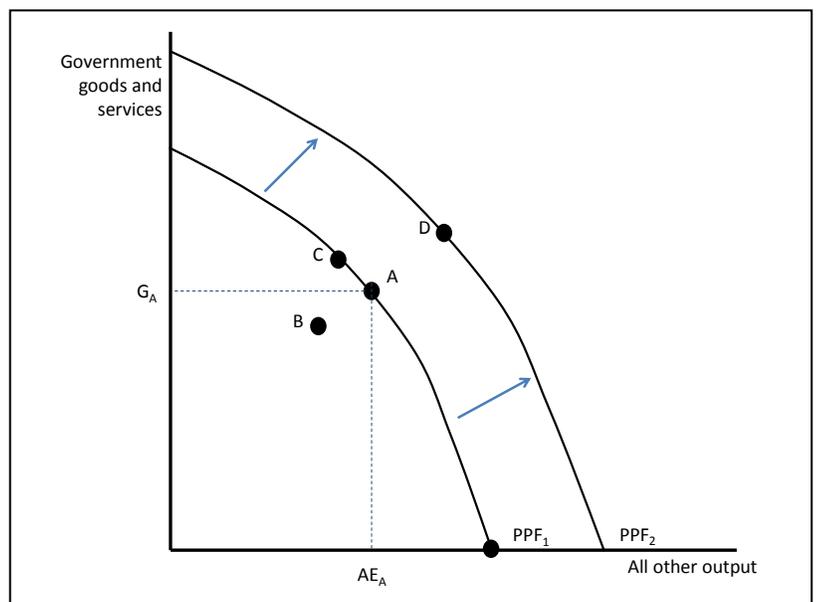
Initial ΔAD due to $\Delta TA = 0.2 * (-\Delta TA) = 0.2 * (100) = +\20 billion per year

The initial change in AD is even smaller than we had predicted in part (a).

Note that the multiplier is unaffected. The multiplier tells us the ratio of the total change in GDP (Y) to the initial change in AD . After the initial change in AD , every subsequent round of the multiplier process depends on how much of a change in income is spent on domestically produced goods and services. So the multiplier ($\Delta Y / \text{initial } \Delta AD$) is the same in part (a) as it is in part (b). The only effect is a change in the size of the initial ΔAD .

- c. (1 point) Use a PPF to discuss the difference between a [A] fiscal policy action that only increases aggregate demand, and [B] a fiscal policy action that both increases aggregate demand and increases productivity. Which type of fiscal policy action [A] or [B] would make the most sense when the economy is in a recession? Which type of fiscal policy action [A] or [B] would make the most sense when the economy is at full employment? Is the US economy currently in a recession?

A fiscal policy action (ΔG or ΔTR or ΔTA) will definitely affect aggregate demand. If the fiscal policy action also leads to an increase in productivity (e.g., through improvements in infrastructure or funding of education or research & development), then the one action will simultaneously increase aggregate demand and increase potential output. (If you had HS econ, you might have discussed this using the language of simultaneously increasing aggregate demand and increasing "aggregate supply.") An increase in potential output is depicted as a shift out of the PPF.



If the economy is in a recession, it is operating at a point such as B which is inside the PPF. In that case, an increase in G that increases aggregate demand but has no effect on potential output can help move the economy to full employment (equivalently, to its PPF). Note that both G and “all other output” will increase – the increase in G is the initial change in aggregate demand and the increase in “all other output” are due to the rounds of the multiplier.

If the economy is already at full employment, it is operating at a point such as A which is on the PPF. In that case, an increase in G that only increases aggregate demand will not be beneficial. In the short run, an increase in G when we are at full employment could cause the economy to produce beyond the PPF but only for a short time. That is a situation which typically triggers inflation. For the explanation why, think of the Phillips curve: increased labor demand in times when unemployment is already low triggers increased wage inflation which triggers increased price inflation. In the long run, the increase in G when the economy is on its PPF will lead to crowding out (see#4): the increase in G will lead to higher interest rates which will lower interest-sensitive components of aggregate demand (investment & net exports, possibly consumption), moving us along a PPF. This is shown as the movement from point A to point C.

Therefore if the economy is already at full employment (that is, at a point like A), it makes more sense for fiscal policy to focus on actions that simultaneously increase AD and increase potential output. That means funding activities that improve total factor productivity (TFP), which shifts out the PPF. Examples include increases in infrastructure spending, increasing funding for education, and research & development spending. This would allow the economy to move from A to D.

The U.S. is not currently in a recession. Our unemployment rate is 3.7 percent, which is below the rate associated with full employment. We are on the PPF. US GDP equals potential GDP.

2. (2 points) Interest Rates

- a. Explain why prices of Treasury bills and interest rates on T-bills are inversely related.

A Treasury bill (T-bill) is an IOU from the US Treasury to whomever owns (“holds”) the IOU. It says the US Treasury will pay the owner some fixed amount of money on some particular date. For example, a one-year \$1,000 T-bill issued on 12/10/2018 would say “Payable to the bearer, \$1,000 on 12/10/2019.” The amount the T-bill will pay in the future is called its “face value.” The person who lends to the US Treasury (that is, the owner of the T-Bill) will pay less than the face value for that IOU.

For any loan, the language differs depending on whether you are the borrower or the lender. The borrower refers to the interest rate they pay to borrow. The lender refers to the exact same number as the rate of return they earn on lending.

We already know how to calculate rates of return. It’s the same definition we used when we talked about the investment spending decision rule.

$$\text{Rate of return} = \frac{\$ \text{ return}}{\text{initial outlay of funds}}$$

In the case of a T-bill, the \$ return is the difference between the amount we receive when the loan is repaid (the face value) and the amount we paid for the T-bill (the price of the T-Bill). The initial outlay of funds is what we paid in the first place, the price of the T-bill.

So, with some finesse you’ll learn either in a UGBA class or in Econ 136 for differences in time and compounding, for a T-bill

$$\text{Interest rate} = \text{Rate of return} = \frac{\$ \text{ return}}{\text{initial outlay of funds}} = \frac{\text{face value} - P \text{ of Tbill}}{P \text{ of Tbill}}$$

To show that the interest rate and the price are inversely related, you could use calculus. Take the derivative of the equation above with regard to “P of T-bill” and show that the derivative is negative. Calculus isn’t required in Econ 1 (but is part of 100A, 100B, and 136), so I won’t walk you through that analysis here.

Alternatively, you can use math logic to show that the interest rate and the price are inversely related. An increase in the price of the T-bill will decrease the value of the numerator and increase the value of the denominator, both of which decrease the overall fraction which is the interest rate.

Or, you can plug in actual numbers. Assume a FV of \$1,000, and a one-year term with no compounding (that’s the finesse we skip)

If P of T-bill is \$900, then interest rate = rate of return = $(1000 - 900) / 900 = 100/900 = 11.1$ percent

If instead P of T-bill rises to \$950, then interest rate = rate of return = $(1000-950) / 950 = 50/950 = 5.3$ percent

A higher price of a T-bill correlates to a lower rate of return (interest rate) on that very same T-bill.

- b. What is the federal funds rate (FFR)? Explain carefully how purchases or sales (tell us which one) of Treasuries by the Fed can ultimately lead to an increase in the FFR. Supplement your explanation with a graph.

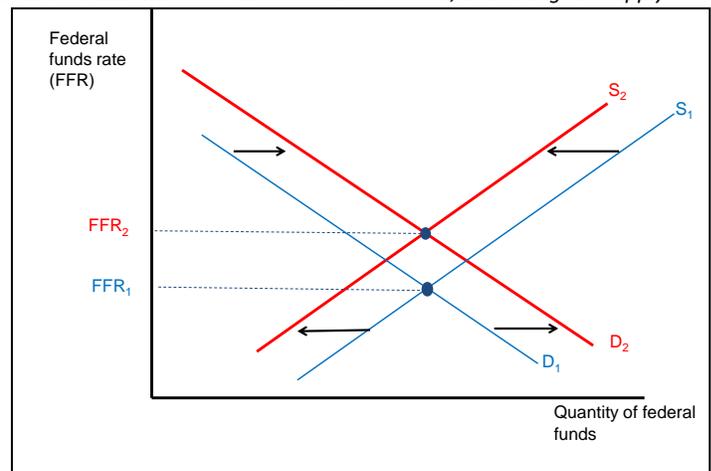
The Federal Funds rate is the interest rate banks pay for overnight borrowing of reserves. U.S. banks are required to maintain reserves equal to 10 percent of their total deposits. (See <http://www.federalreserve.gov/monetarypolicy/reservereq.htm>) Banks that are unable to meet their reserve requirement are allowed to borrow to increase their reserves. Before the financial crisis, the federal funds market was restricted to U.S. banks (and most of the rest of this answer assumes the market is still restricted to U.S. banks).

The Federal Funds rate is determined in the market by changes in the supply of and demand for federal funds. The difference between a bank's total reserves and its required reserves are the bank's "excess reserves." Banks that have excess reserves will lend reserves to other banks; that is the supply of federal funds. Banks whose total reserves are less than required will borrow reserves from other banks; that is the demand for federal funds. Like any market, the market for federal funds will clear at an equilibrium price where the supply of federal funds meets the demand for federal funds. This equilibrium price is called the "Federal Funds rate."

The Fed is able to manipulate this market by increasing or decreasing the amount of reserves in the banking system. Increasing the amount of reserves means that fewer banks will need to borrow in order to meet their reserve requirement, which will decrease the demand for federal funds. More reserves in the system also means that more banks will have excess reserves to lend, increasing the supply of federal funds. The net effect is that the federal funds rate will fall.

Alternatively, if the Fed decreases the amount of reserves, more banks will need to borrow in order to meet their reserve requirements, increasing the demand for federal funds. At the same time, fewer banks will have excess reserves to lend, decreasing the supply of federal funds. The increase in demand & decrease in supply have the same effect: both serve to increase the price of federal funds, that is, the federal funds rate.

If the Fed wants to increase the FFR, they therefore need to decrease the amount of reserves in the banking system. They do so by selling Treasury bills to banks and the public. Payment to the Fed for these T-bills lowers the amount of reserves in the banks. Fewer reserves in the banking system leads to a higher FFR.



What's new since the financial crisis? The Federal Reserve now allows institutions other than U.S. banks to participate in the federal funds market. See <https://www.clevelandfed.org/newsroom-and-events/publications/economic-commentary/2017-economic-commentaries/ec-201707-the-federal-funds-market-since-the-financial-crisis.aspx>. In particular, the Federal Home Loan Banks (FHLBs, see <https://www.investopedia.com/terms/f/fhfb.asp>) and government-sponsored enterprises (GSEs) such as Fannie Mae and Freddie Mac are allowed to make loans in the federal funds market. These changes affect who is in the market, but do not change the role of federal funds for banks (covering reserve requirements) nor how a market price responds to changes in demand or supply.

c. What is "IOER"? What is "FOMO"? What is an advantage to the Fed using the IOER rather than FOMO as its policy tactic?

IOER is the interest rate paid on excess reserves. (<https://www.federalreserve.gov/monetarypolicy/reqresbalances.htm>) As of 2008, the Federal Reserve pays interest to banks based on the bank's balance in its reserve account.

FOMO is federal open market operations. (See <https://www.federalreserve.gov/monetarypolicy/openmarket.htm>) It refers to the buying and selling of Treasuries (bills, notes, and bonds) by the Federal Reserve in order to achieve its interest rate target.

When the Fed relied only on FOMO to achieve its FFR target, the Fed had to have a very good prediction of how banks in the federal funds market would respond to a change in reserves. Would a \$10 million decrease in reserves cause the FFR to go up by 0.03 percent, 0.04 percent, or something else? The people who work "the Desk" at the New York Fed had a reasonably good model that related the amount of reserves to changes in the FFR. But as any economist can tell you, the ability of a model to make accurate predictions is best when nothing unusual is happening. When unusual events occur, the model may make wildly wrong predictions. We saw this lesson play out starting in August 2007 when the actual FFR diverged repeatedly from the target FFR, and sometimes by a substantial amount.

The initial thought for the IOER was that it would create a floor for the FFR. If only U.S. banks are participating in the federal funds market, then IOER operates as a price floor for the FFR. A bank with excess reserves could hold onto those excess reserves and be paid the IOER. Or it could lend the excess reserves to another bank and be paid the FFR. The IOER is guaranteed and risk-free. No economically rational bank officer would lend to another bank at a rate below the IOER. So the IOER should operate as a floor.

Or so they thought. Once the regulatory changes went into effect allowing institutions other than US commercial banks to participate in the federal funds market, things changed a bit. The primary lenders in the federal funds markets are now the GSEs and FHLBs who also have reserve accounts at the Fed. But the GSE and FHLBs are not eligible to receive the IOER. So they are willing to lend in the federal funds market at a rate below IOER. That means the FFR has been slightly below the IOER. The Fed has adapted to all of these changes by specifying a range for its FFR target (currently, 2.0-2.25 percent) but a value for the IOER (currently 2.20 percent).

In the words of the Cleveland Fed (<https://www.clevelandfed.org/newsroom-and-events/publications/economic-commentary/2017-economic-commentaries/ec-201707-the-federal-funds-market-since-the-financial-crisis.aspx>):

Interest Paid on Reserves

The Fed began paying interest of 25 basis points on excess reserve balances in December 2008, increasing the rate to 50 basis points in December 2015. At first blush, this would seem to give the federal funds rate a floor, a rate below which it would not go. The expectation was that an institution that wished to lend in the federal funds market and earn interest could always hold its reserves with the Federal Reserve (effectively “lending” to the Fed) and earn IOER, which would remove the incentive to accept a rate lower than that in the federal funds market. However, the effective federal funds rate has been consistently lower than the IOER rate since its inception (figure 3). The reason for this is that there are institutions that have reserve accounts at the Fed and participate in the federal funds market but that are not eligible for IOER. Primarily, these institutions are the GSEs Fannie Mae, Freddie Mac, and the FHLBs. These institutions are willing to accept a rate in the federal funds market that is lower than the IOER rate, and this drives the effective federal funds rate below the IOER rate.

- d. What is a yield curve? 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 second “premium” to compensate the lender for the risk their estimates may be wrong (called the “risk premium”). The idea is that someone could buy a 30-year bond today, which matures in 2048, 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 premium for doing so (the term+ risk premium) sufficiently compensated them for the risk of tying up their funds long-term.

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 their 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.

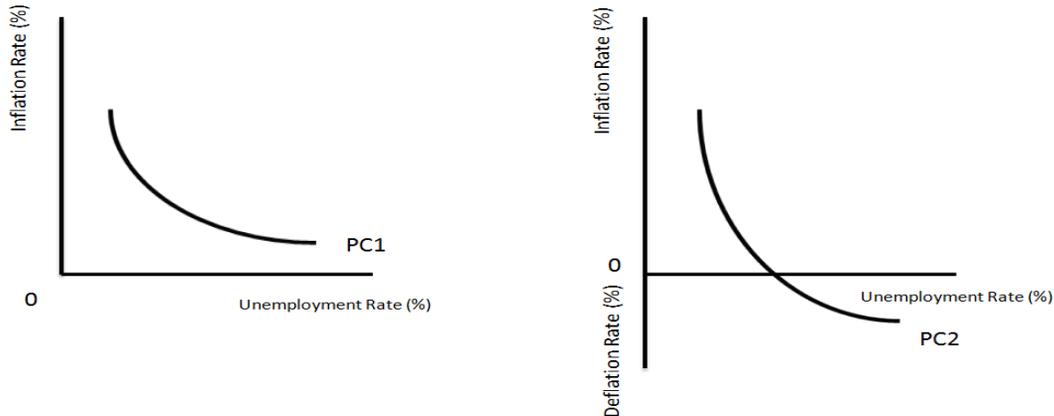
For consumption spending, to the extent that interest rates affect durable goods purchases, those will be medium term loans (3 or 5 or 7 year car loans, for instance)

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

3. Phillips Curve (2 points)

- a. In the graph at the right, draw and label a Phillips curve. In the space below, explain why a change in the unemployment rate leads to a change in the inflation rate.

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 – 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.



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.

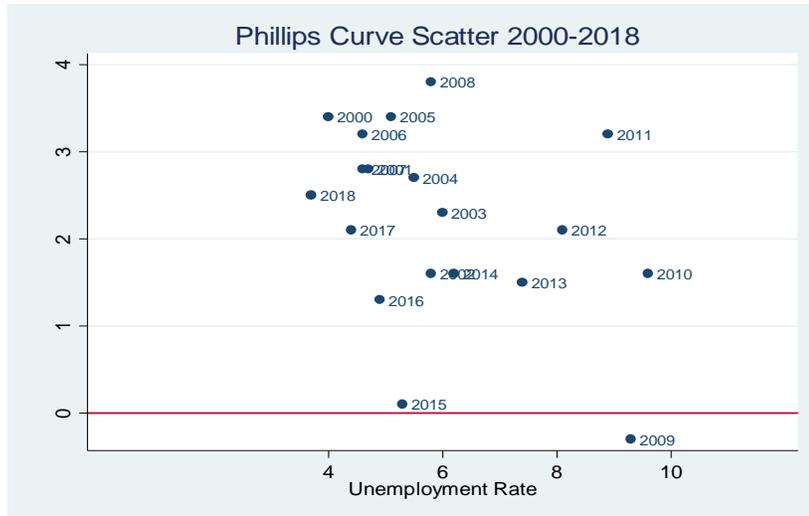
Conversely, the higher the unemployment rate is, the lower the inflation rate. A higher unemployment rate means that there are lots of workers looking for work. Existing workers do not have much bargaining power because employers can replace them with someone searching for a job. So workers must be content with relatively low wage increases or, in very bad times such as 2008-09, wage cuts. Employers wanting to hire additional workers will be able to do so without raising wages much, if at all. So costs of production won't rise by much, and thus output prices won't rise by much. The inflation rate will be low. If wage cuts are prevalent, it is possible to experience deflation (negative inflation).

- b. The members of the Fed's FOMC use the Phillips curve concept in their thinking about monetary policy actions. They recognize that the Phillips curve can shift. Read the 3 articles below (links are live in the version of the PS on the course website). Then discuss these questions: Why do recent data (2010 to 2018) make it seem the Phillips curve is now flat? What factors could have shifted the Phillips curve over the last 8 years? Why should we expect the flatness of the Phillips curve is temporary and not permanent?

<http://economics21.org/commentary/fed-phillips-curve-caroline-baum-11-04-2015>

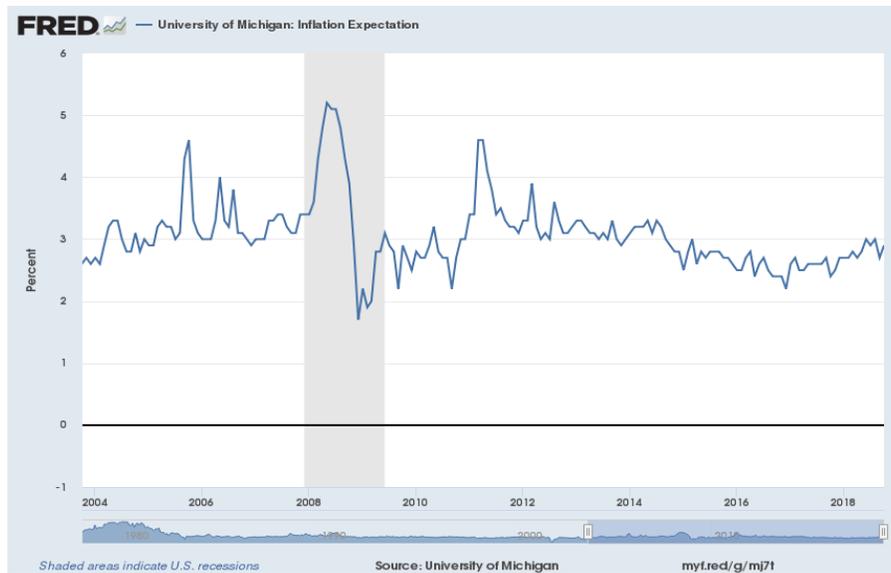
<http://www.nytimes.com/2015/10/25/upshot/the-57-year-old-chart-that-is-dividing-the-fed.html>

<https://www.stlouisfed.org/on-the-economy/2015/september/phillips-curve-unemployment-down-inflation-low>

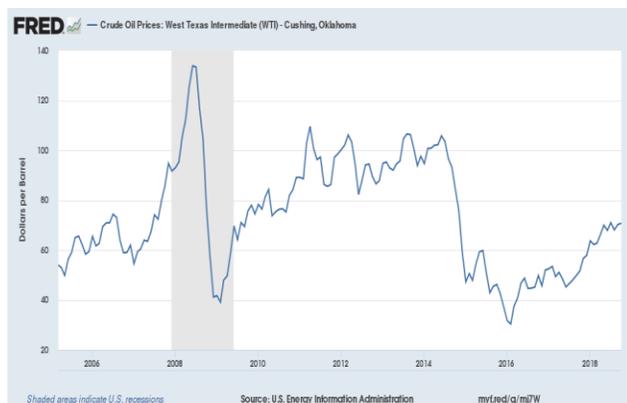


The scatter plot of the Phillips curve data for 2000-2018 is shown to the left. It's very hard to see a downward sloping trade-off between unemployment and inflation in the 2010-2016 data. Instead it seems the Phillips curve was mostly flat (ignoring the 2015 observation for a minute). Looking at the 2015-2018 data in isolation, though, it appears the traditional tradeoff between unemployment & inflation has reappeared. There are two possible explanations for what happened 2010-2016: shifts of the Phillips curve, and a general flattening of the Phillips curve.

Shifts of the Phillips curve in general could be due to changes in inflationary expectations, changes in commodity prices, and changes in labor productivity growth.

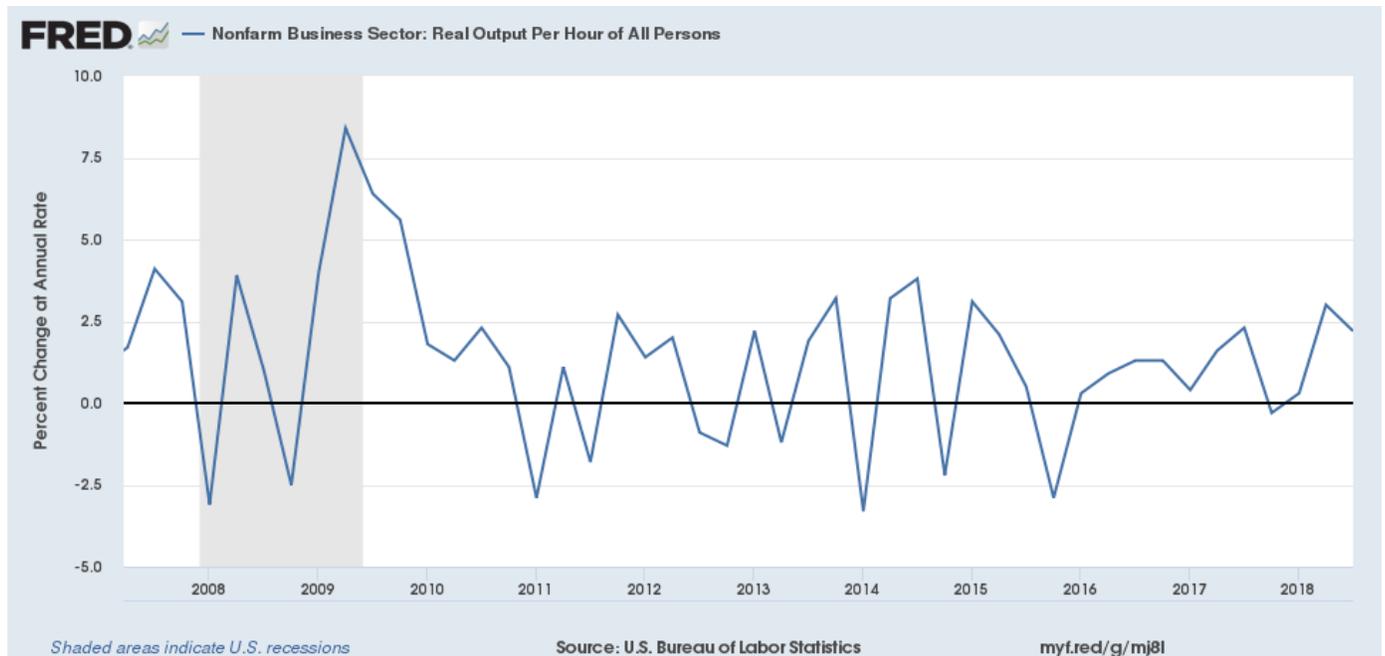


[1] Inflationary expectations. A decrease in inflationary expectations would shift the Phillips curve down (equivalently, to the left), and shifts left of the Phillips curve could account for the 2010-16 pattern seen in the scatter plot. But it's hard to see a steady year-over-year decrease in inflationary expectations between 2010 and 2016. The plot at the left shows the expected inflation rate, based on the University of Michigan Survey of Consumers. If we focus on just 2011 to 2016, we might see a slightly downward trend in the expected inflation rate. But what seems to particularly jump out is the spike in inflationary expectations in 2011 which seems to line up with the one-year jump up in the tradeoff between 2010 and 2011. The rest of the period, inflationary expectations are pretty darn constant at about 3 percent. So it's hard to argue the Phillips curve has shifted due to changes in inflationary expectations.



[2] Commodity prices are definitely a good candidate for explaining leftward (downward) shifts of the Phillips curve. Remember though that it is changes in commodity prices (oil, corn, maybe soy) due to changes in supply or in worldwide demand that shift the Phillips curve. Changes in commodity prices due to changes in U.S. domestic demand are just a reason for moving along a Phillips curve, not a shift of the Phillips curve.

Crude oil prices fell consistently from July 2014 to April 2016 (percent change < 0). Falling prices reflect either increasing supply or decreasing demand. Demand was not decreasing during that period; it was a time of economic growth. The drop in crude oil price must be due to increasing supply (largely through the spread of fracking). So this is something that will shift the Phillips curve down (to the left).



[3] Labor productivity growth also does not seem to explain a shift to the left (down) in the Phillips curve. The growth rate of labor productivity (output per worker, or output per worker-hour) would need to jump up in order for the Phillips curve to shift down (left), but as seen above, there is little movement in labor productivity growth since the immediate aftermath of the downturn.

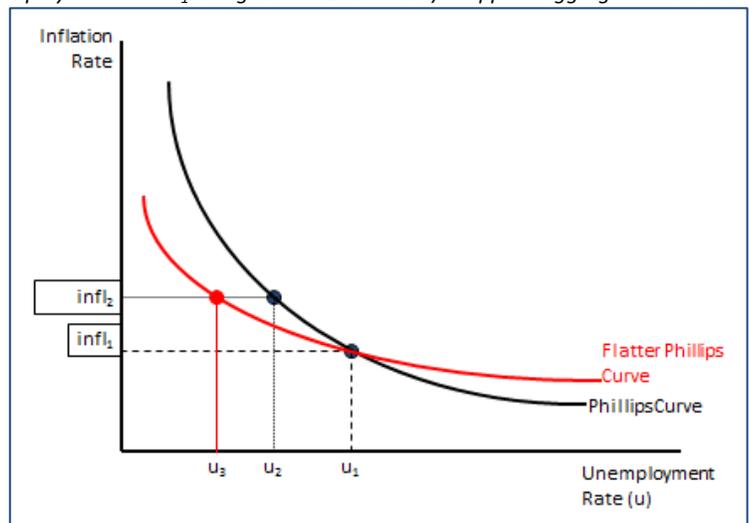
Note that any of those three factors would also explain a lowering of the “natural rate of unemployment” which is often defined as the lowest rate of unemployment consistent with a stable inflation rate.

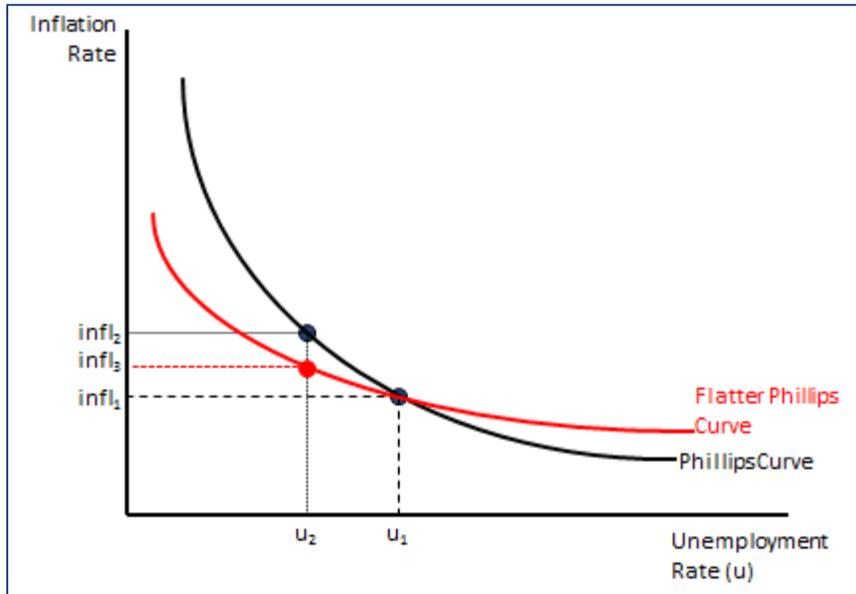
So the absence of a tradeoff 2010-2016 could be due to the fall in commodity prices shown in the oil price graph above, shifting the Phillips curve to the left. But it’s not a terribly strong candidate. Instead, we need to think about the determinants of the slope of the Phillips curve.

To think about the slope of the Phillips curve we go back to the story of why there is a downward slope in the first place. We will underline the parts of the story that might matter. The slope is about how the inflation rate changes when there is a change in the unemployment rate. Start from a given rate of unemployment (choose any unemployment rate u_1 along the horizontal axis). Suppose aggregate demand (AD) increases causing an increase in real GDP and therefore an increase in employment. Assuming no change in the labor force, the rise in employment will lower the unemployment rate. As more workers are hired, there will be upward pressure on wages. As wages increase, it becomes more expensive for firms to produce output (a shift up of the marginal cost curve), and so firms will increase prices, which increases the inflation rate.

Now let’s take each of those three underlined phrases – each representing an implicit assumption in the story that links unemployment rates and inflation rates – and explore how it might be related to a flattening of the Phillips curve slope.

“Assuming no change in the labor force.” We know the labor force participation rate has been falling since 2000. If the labor force participation rate is falling at the same time that employment is rising, then the unemployment rate will fall more rapidly than would usually be the case for the same size of increase in employment. In the graph at the bottom of the previous page, instead of falling from u_1 to u_2 , the unemployment rate would fall all the way to u_3 . But the rest of the story (higher wages, higher prices) is unaffected, so the effect on inflation would be unaffected: inflation would rise from $infl_1$ to $infl_2$. The result: a flatter Phillips curve.





“... there will be upward pressure on wages”
 If workers have reduced power in their bargains with employers (perhaps through a decrease in union power, perhaps through other forces), then for the same size increase in employment and decrease in unemployment, there will be a smaller increase in wages. For a smaller increase in wages, we would see a smaller increase in prices and thus a lower inflation rate. When unemployment decreases from u_1 to u_2 , the inflation rate would rise only as high as $infl_3$ not all the way to $infl_2$. The result: a flatter Phillips curve.

“... firms will increase prices.” The ability of firms to increase prices when they experience an increase in costs depends in part on how competitive the market in which they operate is. A firm with market power has a greater ability to pass cost increases on to its customers, as we saw with the micro models comparing monopoly, monopolistic competition, and perfect competition. Global competition lowers market power of firms, lowering their ability to pass cost increases on to customers. Internet competition and ability to price compare may do the same thing. For the same size increase in employment and decrease in unemployment, and thus the same size increase in wages, with more competition we would see a smaller increase in prices and thus a lower inflation rate. The graph above depicts this situation. When unemployment decreases from u_1 to u_2 , the inflation rate would rise only as high as $infl_3$ not all the way to $infl_2$. The result: a flatter Phillips curve.

This December 2015 article is particularly relevant: : <http://www.nytimes.com/2015/12/03/upshot/wages-up-prices-low-shake-shacks-food-for-thought-for-fed.html>

To summarize, we have several candidates for explaining why the Phillips tradeoff over 2010-2016 looks more flat than downward sloped:

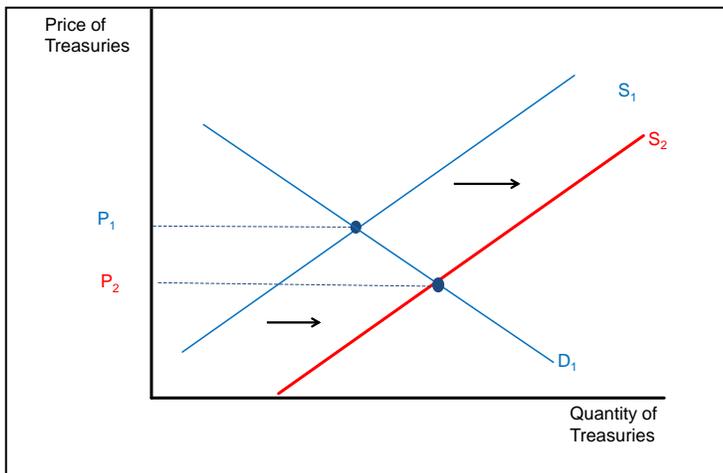
- Falls in oil prices would shift the Phillips curve down (equivalently, left) making the scatter plot of points appear flatter. (But when oil prices rise again, the Phillips curve would shift back up (right)).
- Falls in labor force participation rates can flatten the Phillips curve, making for a less pronounced tradeoff. If the labor force participation rate stabilizes, then the Phillips curve will become steeper again
- Falls in worker bargaining power can flatten the Phillips curve, making for a less pronounced tradeoff. If labor regains power in the economy, then the Phillips curve will become steeper again
- Increased global or internet competition can flatten the Phillips curve, making for a less pronounced tradeoff. If firms acquire increased market power, then the Phillips curve will become steeper again

4. (1 point) Crowding Out

a. When the government budget deficit increases, all else constant, what is the effect on interest rates? Explain your logic. Draw a graph that illustrates your answer.

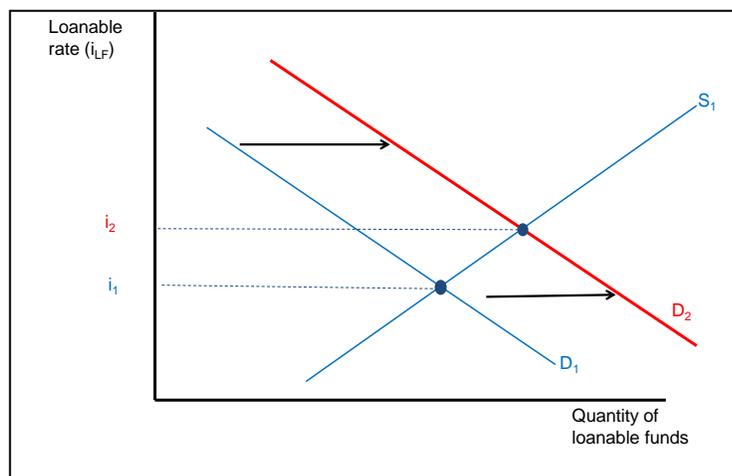
The government budget deficit ($BD = G + TR - TA$) represents outlays ($G+TR$) by the government that cannot be paid out of current tax revenues (TA) and therefore tells us how much the government must borrow. For instance, the US federal government’s deficit was \$784 billion for fiscal year 2018 (10/1/17-9/30/18), or 3.9 percent of nominal GDP. It is projected to be \$972 billion for FY2019 (4.6% of GDP). See <https://www.cbo.gov/publication/53919>

An increase in the budget deficit therefore means more borrowing by the federal government. We can see the effect on interest rates either by looking at the market for Treasuries or at the more general market for loanable funds.



Market for Treasuries. Treasuries – Treasury securities (bills, notes, and bonds) – are IOUs from the federal government, their promise to repay the loan at some date in the future. The government needs to issue additional Treasuries in order to borrow more, increasing the supply of Treasuries. Increased supply will decrease the price. A lower price of Treasuries correlates to a higher interest rate paid by the government (see #2a).

Market for Loanable Funds. Loanable funds – money lent to borrowers – are the \$\$ lent by lenders to borrowers. Here, we ignore the differences between types of loans and assume homogeneity of borrowers and of lenders. (It’s an abstraction, a simplification, a way of thinking about something very complex in a relatively simple way.) The supply of loanable funds represents the behavior of lenders who are willing to loan funds (money). The demand for loanable funds represents the behavior of borrowers who want to borrow funds (money). The equilibrium of supply and demand is the price of loanable funds, the price of loans, which is the interest rate. When the government borrows more, that increases the demand for loanable funds. Increased demand will increase the price of loanable funds, which is the interest rate.



- b. The effect you described in part a leads to “crowding out” – when increased government deficits cause higher interest rates which in turn cause decreases in investment and net exports. Identify and explain a circumstance under which an increase in government borrowing would not lead to higher interest rates.

“Crowding out” is a two-word phrase for this longer statement: when increased government deficits cause higher interest rates which in turn cause decreases in investment and net exports.

There are (at least?) two circumstances under which increased government borrowing won’t lead to an increase in interest rates.

[1] Suppose the demand for Treasuries is perfectly price elastic. People are willing to buy whatever quantity of Treasury securities (notes, bills, and bonds) the government makes available at the prevailing price. If there is a horizontal demand for Treasuries, then the price of Treasuries won’t fall when the Supply of Treasuries increases, so interest rates won’t increase, so there will be no crowding out.

[2] Suppose there is a simultaneous shift in the demand for Treasuries. When the government increases its borrowing by issuing new Treasuries, the demand for Treasuries increases by the same amount. In that case, the price will not change so interest rates won’t change and there will be no crowding out.

Equivalent to [1] is a perfectly elastic supply of loanable funds.

Equivalent to [2] is a simultaneous shift of the supply of loanable funds.

For instance, in an economy in which the central bank is not independent of the fiscal authorities (in the US case, if the Fed was not independent of Congress), then the central bank could be compelled to purchase any additional IOUs issued by the fiscal authorities. In that case, there would be no crowding out as a result of the increased government borrowing. But boy oh boy would there be other problems! If the government was able to borrow unlimited amounts without having to pay market interest rates, then (back to #1c) the

government would be able to conduct expansionary fiscal policy at full employment that could push the economy beyond the PPF in the short run. That would move the economy up the Phillips curve (see #3a), leading to increased demand for labor, higher wages, and thus higher prices (a higher rate of price inflation than would have been the case in the absence of the expansionary fiscal policy . . . remember the counterfactual). That is, when the fiscal authorities take control of the central bank, there is a risk of rampant inflation. This is why the Federal Reserve is independent of Congress, and it's why the federal government is required by law to initially sell Treasuries "to the public" which means to anyone other than the Fed. By law, the Fed can buy Treasuries in the secondary market – that is, from someone who bought it initially from the US government – but cannot lend directly to the government.

5. Essay. (3 points total)

In many states in the U.S., high school students are required to take an economics course in order to graduate high school. Many of those courses suffer from an effort to cover way too much material. Students leave the course having seen so much that they are unable to remember anything. Moreover, in many economics principles courses, the concepts are rarely tied to any real world applications and so students leave the course unable to take anything they've learned and apply it outside of the classroom. Therefore there is a movement in the US to focus on economic literacy: teach a handful of concepts in a way that makes them "stick" so that students can remember and, more importantly, apply the concepts in the months and years after the course ends.

Make a list of the top three economic concepts that you think should be taught in a HS economics class and defend why you chose those three concepts. Remember the goal: students should be able to remember the concepts after the course ends, and should be able to apply the concepts in real world contexts. Which three concepts would you choose, and why?

Your essay must be your own work. To present anyone else's work as your own is theft of intellectual property: plagiarism. That means you must use quote marks " " around any words you quote exactly from any source (and then provide the source for the quote). It also means that if you get ideas from anyone else, or if you paraphrase someone else, you must again give them credit for their ideas. To do otherwise is plagiarism: the theft of intellectual property, a violation of the Code of Student Conduct and one of the worst offenses in academe. If you have questions about whether or not you've properly cited your sources, please talk with your GSI, the Head GSI, or Prof. Olney. "Your own work" also means that essays crafted jointly on piazza or otherwise are not acceptable. That too is plagiarism. As is reusing an essay you wrote for another class; your work for each class must be original.

The usual comments apply. Follow the specs and you're good; don't follow the specs and you lose a point. Address the prompt and you're good; don't address the prompt and you don't get full credit.

Here are some of the answers from a random selection of Fall 2017 essays

- *Supply & demand, GDP, loss/risk aversion*
- *Supply & demand, externalities, business cycles*
- *Opportunity costs, externalities, fiscal & monetary policy*
- *Supply & demand, interest rates, counterfactuals*
- *Supply and demand, inflation, fiscal policy*
- *Supply & demand, unemployment & recessions, macro policy*
- *Supply & demand, opportunity cost, diminishing marginal utility*
- *Supply & demand, exchange rates, profit maximization*
- *Opportunity cost, externalities, market failure*
- *Supply and demand, C+I+G+NX, multiplier*
- *Counterfactual, multiplier, externalities*
- *Supply & demand, opportunity cost, interest rates*
- *Supply & demand, spending multiplier, money creation*
- *Opportunity costs, moral hazard, supply & demand*
- *Supply & demand, production possibilities frontier, market failures*