Problem Set 4

Problem sets submitted after 9 am will not be graded.

Section I (15 points)

Brazil's real GDP = 6 trillion Brazilian Real

U.S. real GDP = 20 trillion dollars

$1 buys 3 Brazilian Real

1 Big Mac costs $5 in the U.S.

1 Big Mac costs 10 Brazilian Real in Brazil

U.S. population in 2018: 320 million

Brazil population in 2018: 220 million

1. **(6 points)** One Wall Street analyst uses the data above to claim that per capita real GDP in the U.S. economy is about 7 times as large as per capita real GDP in Brazil. Reproduce his analysis.

U.S. GDP per capita = 20 trillion/ 320 million = USD 62.5 million

Brazil's GDP in USD = 6 trillion/ 3 = USD 2 trillion

Brazil's GDP per capita in USD = 2 trillion/ 220 million = USD 9.09 million

So, U.S. GDP per capita ≈ 7*(Brazil's GDP per capita in USD)

2. A different Wall Street analyst uses the data above to claim that the per capita real GDP in the U.S. is only about 5 times the size of per capita real GDP in Brazil.

    a. **(3 points)** What concept does she invoke to come to this conclusion?

        Purchasing power parity

    b. **(6 points)** Reproduce her analysis.

U.S. GDP per capita = 20 trillion/ 320 million = USD 62.5 million

Brazil's GDP in USD (PPP adjusted) = 6 trillion/ 2 = USD 3 trillion (where 2 comes from 10/5, the ratio of the cost of Big Macs in each country)

Brazil's GDP per capita in USD (PPP adjusted)= 3 trillion/ 220 million = USD 13.63 million

So, U.S. GDP per capita ≈ 5*(Brazil's GDP per capita in USD (PPP adjusted))

Section II (45 points)

Assume:
- In 2018:Q4 U.S. real GDP = $19.5 trillion and U.S. NX = $-0.5 trillion
- U.S. real GDP growth rate, without stimulus equals 2.5%:
  - 1.5% contribution from productivity, 1% from growth in the labor force.
- U.S. growth rate for domestic spending (real GDP-NX) is also 2.5% , if no stimulus is enacted.
- U = 5% and π = 2% in 2018:Q4 and U = 5% at end-of-year 2019, if there is no stimulus.
- U* = 5%.

Suppose Congress fails to deliver a tax cut, but quickly pivots and gets bipartisan support for a $200 billion increase in infrastructure spending. Assume the multiplier on domestic spending is 2 from the enacted fiscal policy changes. (In other words, for this analysis, assume the policy changes drive domestic demand: Y-NX). Assume the effects of the policy, enacted at the end of 2018, occur over the four quarters of 2019.

Optional: Filling in the table below may help you as you sort out the questions below.

	2018:Q4	2019:Q4	2019:Q4
		w/o stimulus	with stimulus
Y (Real GDP, $ trillions)	$19.5 tr	$20 tr	$(20 + 0.4) tr
NX (Net Exports, $ trillions)	−$0.5 tr	−$0.5 tr	−$0.5 tr
Y – NX (Domestic Demand, $ trillions)	$20 tr	$20.5 tr	$(20.5 + 0.4) tr

1. **(5 points)** If no policy is enacted, what is the level of domestic spending in 2019:Q4? Show your work.

Domestic spending in 2018:Q4 = Y – NX = $19.5 – (–$0.5) = $20 tr
Domestic spending in 2019:Q4 = $20 x 1.025 = $20.5 tr

2. **(5 points)** If the policy occurs, what is the level of domestic spending in 2019:Q4? What is the growth rate for domestic spending between 2018:Q4 and 2019:Q4? Show your work.

Stimulus effect of increase in G = $200 bn*2 = $400 bn
Total domestic spending with stimulus = $20.5 + $0.4 = $20.9 tr

Growth rate of domestic spending is [(20.9-20)/20] * 100 = 4.5%

3. Suppose the boom for USA spending, is not matched by an acceleration for spending in the rest of the world. Likewise, the boom lifts U.S. interest rates, but rest-of-world interest rates stay steady.

   a. **(5 points)** What do you think happen to the value of the dollar?

Capital inflows → Exchange rate appreciation (price of dollar in terms of foreign currency goes up)

   b. **(5 points)** Given the dollar's move and the different spending growth rates what do you think happens to U.S. exports and U.S imports? Briefly explain.

Exports decline because of expenditure switching effect (the price of US goods in terms of foreign goods has gone up).

Imports increase because of the enacted expansionary fiscal policy plan and because the price of foreign goods in dollar terms has gone down.

   c. **(5 points)** Given the dollar's move and the different spending rates, would you expect U.S. real GDP to grow at the same rate as U.S. real domestic demand? Briefly explain.

Given the appreciation of the dollar and the different spending rates, the NX deficit will likely rise. So, U.S. real GDP must be growing at a slower rate than U.S. real domestic demand.

4. **(5 points)** Suppose U.S. NX is -$0.8 trillion (i.e. trade deficit) in Q4:2019. What is the level and the growth rate for U.S. real GDP in Q4:2019?

Total U.S. real GDP after stimulus = $20.9 – $0.8 = $20.1 tr

Growth rate of U.S. real GDP = [(20.1 – 19.5)/19.5] * 100 = 3.07%

5. **(5 points)** One economist, Freddy, correctly forecast the new level for real GDP. He also predicted the unemployment rate would fall materially (say to 4%). What must he have assumed about labor productivity and labor force growth rates?

Freddy assumed that labor productivity and labor force participation rate grew slower (than 2.5%). By Okun's law this would lead to unemployment rate falling materially.
To see it mathematically,

3.07% = LTSG – 2 (4% - 5%)　→　LTSG = LFG + LPG = 1.07% < 2.5%

6. **(5 points)** A different economist, Betty, also correctly forecast the new level for real GDP. She, however, predicted the unemployment rate would remain at 5%. What must she have assumed about labor productivity and labor force growth rates?

Betty assumed that the labor force and labor productivity grew faster (than 2.5%).
By Okun's law, Betty must be predicting faster labor force and labor productivity growth in order for the change in GDP to be the same as Freddy despite no decrease in unemployment. To see it mathematically,
$$3.07\% = LTSG - 2\,(5\% - 5\%) \quad \rightarrow \quad LTSG = LFG + LPG = 3.07\% > 2.5\%$$

7. **(5 points)** Will the Fed tighten more if Freddy is right or Betty is right? Explain.

The FED will tighten more if Freddy turns out to be right. This follows because Freddy, by calculating a lower unemployment rate than Betty, is implicitly telling us that there is less slack in the economy and that therefore there may be stronger inflationary pressures appearing on "the horizon."

Section III (25 points)

Assume:
- The U.S. economy can grow at 2.8% per year.
- The Federal Reserve thinks the ideal inflation rate is 2%.
- The natural rate of unemployment is 4%.
- The Fed thinks r*, the real interest rate at which the economy neither speeds up nor slows down, is 2%.

1. **(4 points)** Jerome Powell assumed office as Chair of the Fed on February 2018. In 2020 Powell shocks the world and announces he will pursue a monetarist approach to conducting monetary policy. His approach to monetary policy comes from the quantity theory of money. At what rate will he aim to increase the money supply?

Recall the quantity equation: M*V = P*Y, so we have that $\Delta M\% + \Delta V\% = \Delta P\% + \Delta Y\%$. The quantity theory of money assumes that the velocity of money is constant ($\Delta V\% = 0$), thus $\Delta M\% = 2\% + 2.8\% = 4.8\%$.

2. **(3 points)** Although the Powell-led Fed successfully hits its target growth rate for money, by late 2019 inflation is running very hot. President Trump denounces this policy as a 'complete and utter disaster'. What false assumption made by Jerome Powell led to the policy not resulting in steady growth and inflation.

V is not constant, and it is actually highly unstable.

3. **(4 points)** President Trump now replaces Jerome with a 'tremendous guy' from Stanford whose monetary policy rule has helped guide central banks for many decades. Who is he? Write down his rule.

John B. Taylor.
The Taylor rule is: $ff = r^* + \pi + 0.5 \times (\pi - \pi^*) + (U^* - U)$

4. **(4 points)** Assume that at that point, unemployment is 3% and inflation is 5%. If the new chair follows his own rule, what will the fed funds rate be? Show your work.

   Applying the rule: $ff = 2\% + 5\% + 0.5 \times (5\% - 2\%) + (4\% - 3\%) = 9.5\%$

5. **(4 points)** After a year of this policy, inflation has been vanquished, falling below target, to 1%. Unemployment has risen to 8%. What fed funds rate does the rule now suggest? Show your work. Why is this a problem?

$$ff = 2\% + 1\% + 0.5(1\% - 2\%) + (4\% - 8\%) < 0$$

This is a problem because a nominal interest rate such as the fed funds rate cannot be negative. In this case, the FED is constrained by the "zero lower bound" of (nominal) interest rates.

6. **(6 points)** Use our expanded loanable funds model to demonstrate how the Fed could now move to QE, to continue to ease, despite the problem identified in question 5.

Let's say the Fed implements the QE in the corporate sector. The argument, however, can equivalently be made in the government sector.

There is a decrease in the corporations' demand of funds from HHs (this happens because the government is absorbing part of the total demand of funds through QE). This has the effect of shifting the demand curve to the left in the corporate loanable funds market.

Since the real rate of return in the corporate loanable funds market falls, HHs' supply in the government bonds market increases (outward shift of the supply curve), which reduces the equilibrium interest rate for the government.

The final objective, which is to lower the ("long term") equilibrium real corporate rate is achieved despite having the T-Bill nominal rate (a short rate) already pushed to its lower bound (notice that the equilibrium real rate of return in the T-bill market is in fact equal to $-\pi$).
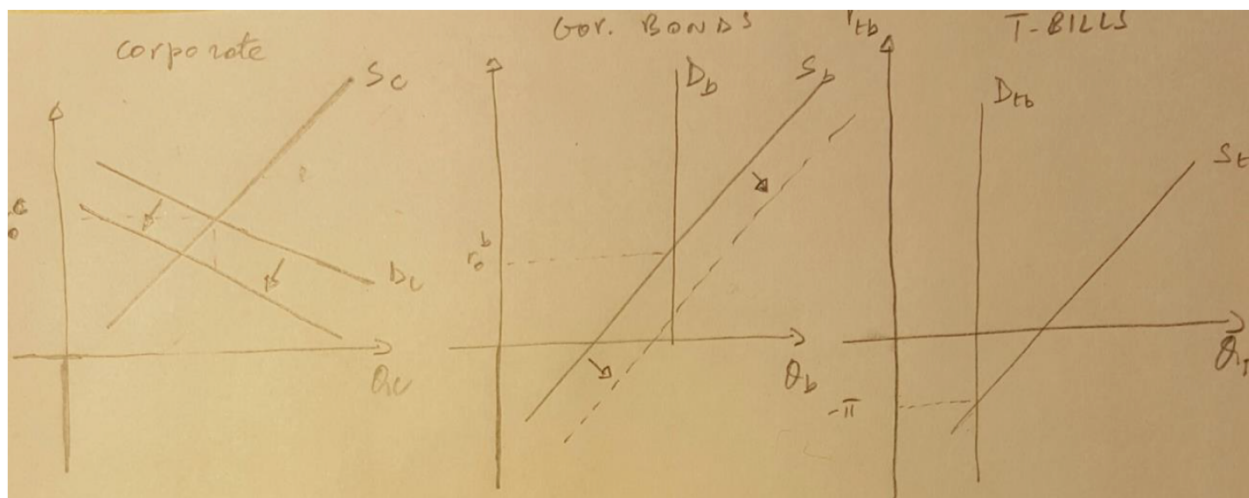
The issue with implementing the QE in the corporate sector is that the Fed will have to choose which corporate bonds to buy and will therefore be affecting decisions about which firms get funds and which do not.

If the Fed implements QE in the government sector, the diagrams will look like below.
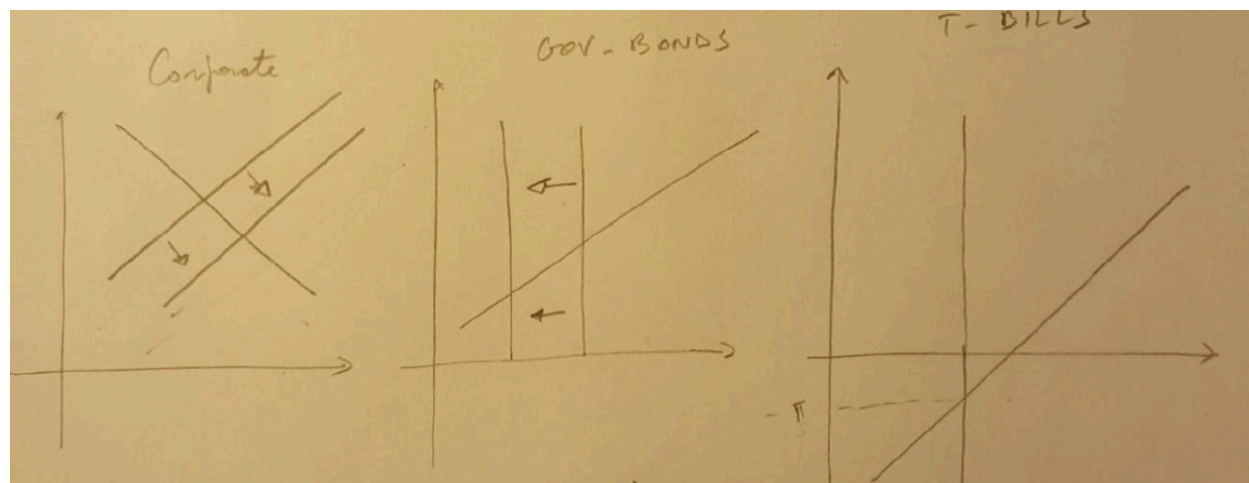
Section IV (20 points, 4 points each)

Suppose that $\alpha = 1.4$, $U^* = 5\%$, $U_t = 5\%$, and $\pi^e = 2\%$.

1. Write down the equation for the Phillips Curve. What is current inflation π_t equal to?

$$\pi_t = \pi^e + \alpha(U^* - U_t)$$

$$\pi_t = 2\% + 1.4(5\% - 5\%) = 2\%$$

2. If the unemployment rate doubles, what does the equation predict will be the value of inflation, all else equal?

$$\pi_t = 2\% + 1.4(5\% - 10\%) = -5\%$$

3. In the Great Recession, the unemployment rate indeed doubled. Compared to actual inflation, did our calibration for the Phillips curve over or underpredict inflation?

Underpredict inflation

4. Some economists disagree about the value of α in the Phillips curve. Would a lower or higher α help the Phillips curve fit the data better?

Lower alpha.
Inflation would be less responsive to changes in the unemployment gap $(U^* - U_t)$.

5. Does a lower α imply lower or higher credibility in the central bank for determining inflation?

Lower alpha would imply higher credibility in the central bank's ability to set the inflation rate equal to its expected value. At $\alpha = 0$, we have $\pi_t = \pi^e$.

Section V (15 points)

1. Suppose New Zealand discovers a giant diamond mine. The U.S. demand for these diamonds causes the New Zealand trade surplus with the U.S. to soar.

   a. **(2 points)** What happens to the U.S. demand for the NZD—New Zealand's currency?

      Increases

   b. **(3 points)** What happens to the value of the NZD versus the U.S. dollar, if all other things remain the same?

      Appreciates

   c. **(5 points)** Draw two charts (one for the market for NZD, one for the market for U.S dollars) depicting the shifts in supply and demand, before and after the surge in the trade surplus.

   Demand curve for NZD shifts right (in the NZD market), driving up the equilibrium exchange rate for U.S. dollars per NZD. Also, the supply curve for dollars shifts right (in the U.S. dollar market), driving down the exchange rate for NZD per dollar.

Market for NZD

Market for $
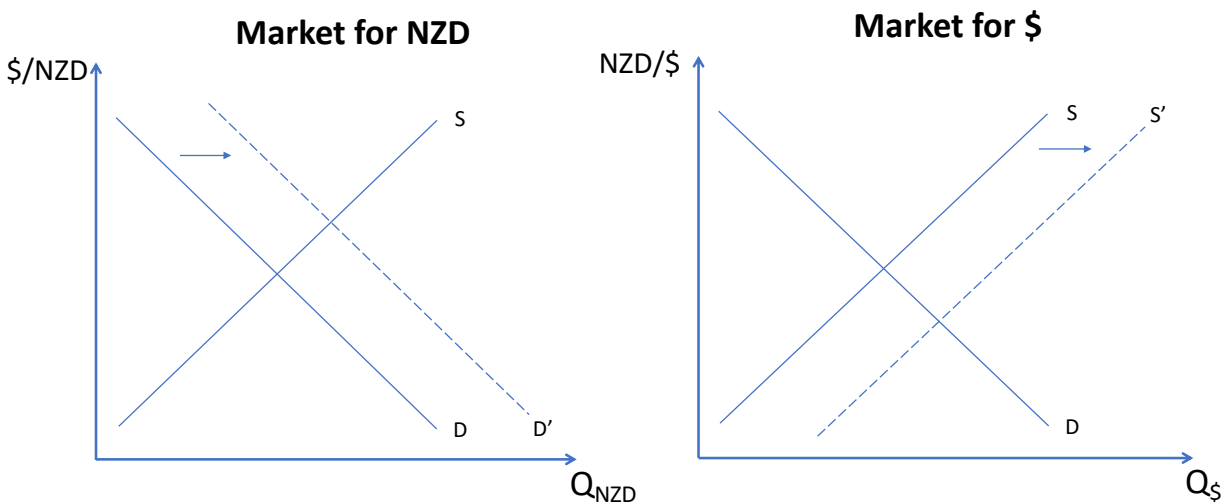
2. **(5 points)** Suppose the central bank of New Zealand wants to prevent a change in the exchange rate. Reproduce your graphs above and add in the action that the central bank of New Zealand could take in order to prevent a change in the exchange rate.

The central bank of New Zealand could buy some of the dollars in the market in exchange for domestic currency (NZD); in doing so the central bank can influence the overall supply of NZD

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(which goes up) and the demand of dollars (which goes up). The charts below show the central bank intervention to restore the initial exchange rate.

Market for NZD

$/NZD

S   S'

D   D'

Q_NZD

Market for $

NZD/$

S   S'

D   D'

Q_$