

Problem Set 2

Due July 16th at 2 pm

Problem sets submitted after class will not be graded.

Section I: GDP (25 points)

Consider the following quarterly data flow for the country of Citrustan:

Quantities are in millions of fruits

	Oranges		Lemons		Grapefruit	
	Quantity	Price	Quantity	Price	Quantity	Price
2015:Q2	500	1.1	200	0.7	600	2.1
2015:Q3	550	1.05	210	0.7	600	2.2
2015:Q4	250	1.2	90	0.9	340	3.2
2016:Q1	220	1.2	95	0.84	320	2.9
2016:Q2	520	1.1	210	0.72	640	2.15
2016:Q3	570	1.08	220	0.74	650	2.25

1. Calculate the quarterly nominal GDP for Citrustan in 2015:Q2 **(3 points)**

$$\text{NGDP}_{2015:Q2} = (500 \times 1.1) + (200 \times 0.7) + (600 \times 2.1) = \$1,950$$

2. Calculate the annualized nominal GDP for Citrustan for 2016:Q2 **(3 points)**

$$\text{NGDP}_{2016:Q2} = (520 \times 1.1) + (210 \times 0.72) + (640 \times 2.15) = \$2,099.2$$

$$\text{Annualized NGDP} = 4 \times \$2,099.2 = \$8,396.8$$

3. Using 2015:Q2 as the base year, calculate Citrustan's real quarterly GDP...

- a. For 2015:Q2 **(3 points)**

$$\text{Same as nominal since base year: } \text{RGDP}_{2015:Q2} = \text{NGDP}_{2015:Q2} = \$1,950$$

- b. For 2016:Q2 **(3 points)**

$$\text{RGDP}_{2016:Q2} = (520 \times 1.1) + (210 \times 0.7) + (640 \times 2.1) = \$2,063$$

- c. For 2015:Q4 **(3 points)**

$$\text{RGDP}_{2015:Q4} = (250 \times 1.1) + (90 \times 0.7) + (340 \times 2.1) = \$1,052$$

4. What is the annualized real GDP growth rate from (show work)

a. 2015:Q2 to 2016:Q2 (3 points)

It is already in annual terms so

$$\left[\left(\frac{\$2,063}{\$1,950} \right) - 1 \right] \times 100 = 5.79\%$$

b. 2015:Q2 to 2015:Q4 (3 points)

$$\left[\left(\frac{\$1,052}{\$1,950} \right)^{\frac{1}{0.5}} - 1 \right] \times 100 = -70.9\%$$

5. Economists often annualize growth rates to be able to compare rates of growth over different time periods. Why, in this particular case, might the annualized growth rate from 2015:Q2 to 2015:Q4 be misleading? (4 points)

Actual annual growth rate from 2015:Q2 to 2016:Q2 is 5.79%. However, annualizing 2-quarter data gives a prediction of -70.9%, which is misleading. In this special case might be due to *seasonal effects*. Since the production of orange, lemon and grapefruit decreases in winter, the growth rate from Q2 to Q4 is misleading when annualized.

Section II: Long Term Sustainable Growth (25 points)

A. Consider the following table:

GDP per capita (constant dollars)

	USA	China	India
1985	32,300	530	470
1995	38,680	1,220	650
2005	48,760	2,720	1,010
2015	51,490	6,420	1,810

1. Fill in the table below. (9 points)

Annualized growth rate (decade to decade)

	USA	China	India
85 to 95	1.8%	8.7%	3.3%
95 to 05	2.3%	8.3%	4.5%
05 to 15	0.55%	8.97%	6.0%

2. Output per person is close to output per hour. What do we call output per hour? **(3 points)**

Productivity or labor productivity

3. What are the three components that determine long run growth? **(3 points)**

Quantity of capital per hour worked

Training and education

Level of technology

4. Which of these three components likely explain the differential growth rates between USA, China and India over the past 30 years? **(2 points)**

Quantity of capital per hour worked

5. Suppose all the nations embrace strong growth as their goal and all three make intelligent decisions over the next 20 years. Which of the three nations is likely to witness the slowest GDP/capita growth and which is likely to achieve the fastest GDP/capita growth? **(4 points)**

USA will experience the slowest GDP/capita growth as it has already high levels of capital.

India will experience the fastest GDP/capita growth

The Chinese growth rate increases less, follows a stable pattern, indicates that they have enough capital, while Indian growth rate increases rapidly.

B. Consider the following table: (4 points)

1. Is the following table consistent with the economic growth model of Solow?

Country	Real GDP per capita 1960	Annual Growth in real GDP per capita, 1960 -2011
Taiwan	\$1,861	5.81%
Panama	2,120	3.50
Brazil	2,483	2.73
Costa Rica	4,920	1.42
Venezuela	7,015	0.91

Yes, because countries with lower real GDP per capita also display greater annual growth in real GDP per capita (they are catching up).

Section III (25 points)

Lola, in late 2016, has \$100 that she wants to save for two years. She decides she will investigate lending to the U.S. government, versus lending to different kinds of U.S. companies. She thinks inflation will average 1.5% over the next several years. She finds a page on Bloomberg¹ that provides the yields she can receive on various U.S. Treasury notes. She focuses on Treasury securities of duration 1-year and 2-years, about to be issued. These two securities appear on her Bloomberg screen:

U.S. T-Note, issue date 1/05/17, repayment date 01/05/18, price \$100, yield 1.0%

U.S. T-Note, issue date 1/05/17, repayment date 01/05/19, price \$100, yield 1.5%

Note: Remember that yield refers to the *annual* interest rate on the T-note.

1. What does Lola believe the ex-ante real yield is on the 2-year note? **(4 points)**

She thinks inflation is 1.5% so ex-ante yield will be $1.5\% - 1.5\% = 0\%$

2. Suppose inflation averages 2% over the next two years. What was the ex-post real yield on the 2-year note? **(4 points)**

$1.5\% - 2\% = -0.5\%$

3. What do market participants, on average, expect the 1-year yield will be in 2018? (Hint: Since there should not be any *arbitrage* opportunity between investing in a 1-year security twice and investing in a 2-year security once, market participants must expect both securities to have the same return over the same period of time.) **(5 points)**

$\$100 \times 1.01 \times (1 + y/100) = \$100 \times 1.015^2 \rightarrow y \approx 2\%$

4. If inflation turned out to be 3% in 2017, would you expect that the government would have to offer a higher or lower interest rate to borrow money for 1-year, in 2018? And if Lola bought the 2-year note, at a price of \$100, and went to sell it in 2018, would the payment she collected likely be higher or lower than \$100? Briefly explain. **(5 points)**

The government would have to offer a higher interest rate to compensate the loss of investors due to the higher inflation expectations.

She would have a payment that would be lower than \$100

¹ You may want to Google what a Bloomberg terminal is.

Lola now looks at a Bloomberg screen that provides information about the characteristics of a number of corporate bonds:

IBM note, issue date 1/05/17, repayment date 1/05/19, price \$100, yield 2.5%

SnorX note, issue date 1/05/17, repayment date 1/05/19, price \$100, yield 5.5%

5. Explain why SnorX must pay a higher rate than IBM, to borrow for 2 years and why both SnorX and IBM pay more than the government to borrow money over the same period. **(4 points)**

These are private (or risky) bonds whereas T-notes are risk-free. Thus, the private bonds should give higher yields than the government. IBM is less risky than SnorX, therefore SnorX would offer a higher rate.

6. Suppose a trade war erupts between China, Europe and the USA. Suppose further that this looks likely to badly hurt economies around the globe. **(3 points)**

- a. The price of the 2-year T-note likely (circle 1 answer)

Goes Up

Goes Down

- b. The price of the 2-year IBM note likely (circle 1 answer)

Goes Up

Goes Down

Goes Down a Lot

- c. The price of the 2-year SnorX note likely (circle 1 answer)

Goes Up

Goes Down

Goes Down a Lot

Section IV: Inflation (15 points)

Below is a table with the weights used by different items in the August 2017 CPI report.

Categories	Weights
Food	14%
Energy	7%
Core Goods (exc. Food and Energy)	19%
Core Services	36%
Owner's Equivalent Rent	24%

1. The index can be slow to add new goods, particularly technological advancements such as new smart phones or laptops. If the price of these goods tends to fall over time (relative to other goods), would tardiness in including them in the index tend to overstate or understate CPI inflation? **(3 points)**

Inflation would be overstated

2. Which of the above categories is most likely to be affected by imports of Chinese goods? If Chinese goods are becoming cheaper over time, how would that affect CPI inflation? **(4 points)**

Core goods. Core goods would get cheaper, so inflation would be lower.

3. The CPI tracks rent prices more closely than housing prices. In the Great Recession, home prices fell by about 20 percent, but rents actually increased in that period. Would inflation have been lower or higher during the recession if it had tracked home prices rather than rent? **(4 points)**

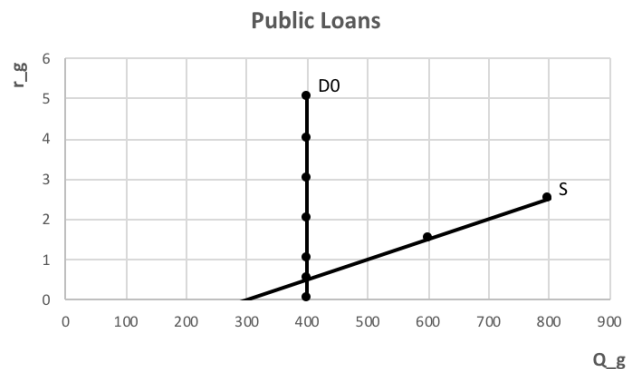
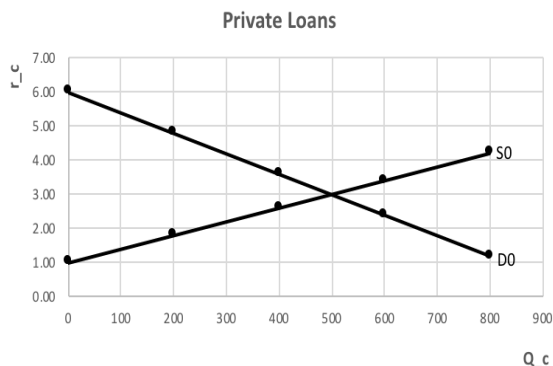
Inflation would have fallen even more in the Great Recession if it had tracked house prices.

4. Suppose oil prices fall by 20% due to higher supply of oil shale. In contrast, during the same time, core service prices increase by 20%. Would overall CPI inflation increase or decrease? **(4 points)**

Inflation would increase since core services are a larger component in the CPI.

Section V (30 points)

The charts below depict lending and borrowing for the U.S. economy in late 2016:



1. Label the curves and identify, on the graph, the equilibrium real corporate borrowing rate and the equilibrium quantity of lending to U.S. corporations. Likewise, identify the equilibrium quantity of borrowing by the U.S. government and the equilibrium interest rate that households receive. **(4 points)**

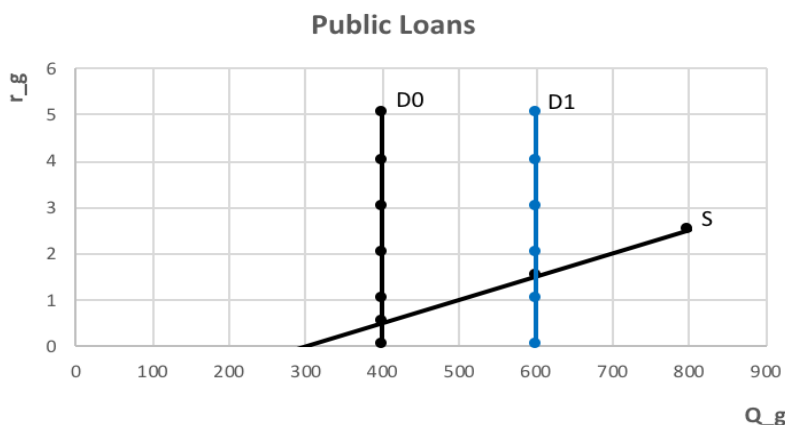
Equilibrium for corporates is (500, 3%)
Equilibrium for government is (400, 0.5%)

2. What is the spread between the two equilibrium borrowing rates? **(2 points)**

Spread = 3% - 0.5% = 2.5%

Suppose the government enacts a very large increase in government spending, with small tax increases on the wealthy. The U.S. government, in 2017, needs to borrow 50% more than they did in 2016. In 2016, inflation is 1.5%. In 2017, inflation is 2%.

3. In the government quadrant, adjust the picture to represent the change in government policy. Identify the new equilibrium interest rate and the new equilibrium level of lending to the government. **(4 points)**

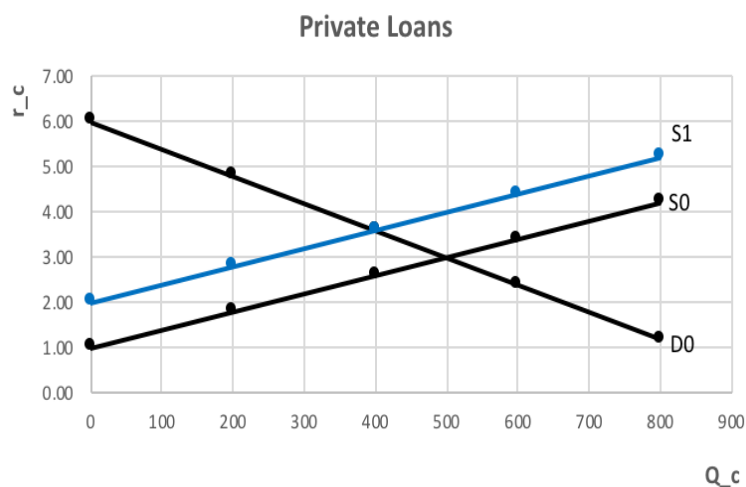


New equilibrium is (600, 1.5%)

4. We now have a new equilibrium in loanable funds market for the government. Suppose that in the short-run, the available sources of loanable funds are fixed in the economy, how will that affect the loanable funds market for corporations? **(5 points)**

The demand curve D0 in the public loans market shifted to D1 so households will be willing to lend more to the government. Thus, the supply curve in the private loans market will shift to the left. Households will be lending less money to corporations and more money to the government.

5. Draw the change you expect to see in the corporate loanable funds market. **(4 points)**

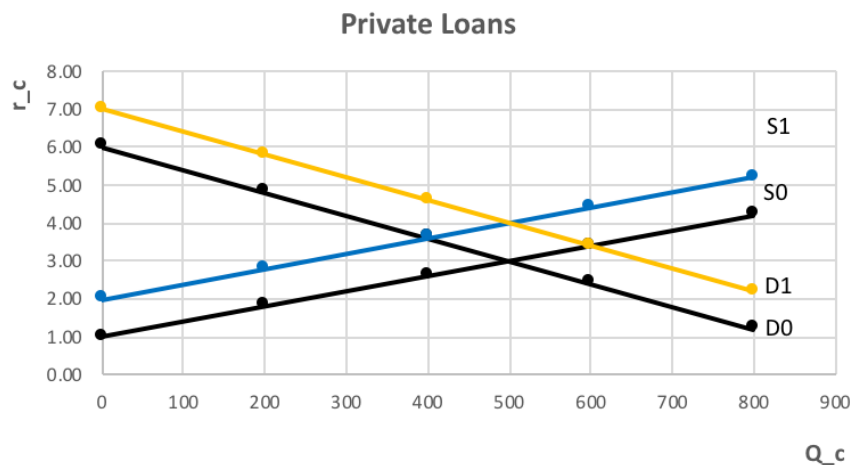


6. If nothing else changes, will corporations be investing and borrowing more or less? What do economists call this change in private investment, in reaction to a change in government borrowing? **(5 points)**

Corporations will be borrowing less if nothing else changes. Economists label this change as the crowding out effect.

7. Suppose increased government spending bolsters corporation's confidence. Suppose businesses sense a stronger recovery from low growth rate, because of the increase in government spending. Suppose this lifts corporate spirits and companies ramp up investment, so that their investment and borrowing are higher in 2017, than they were in 2016. Draw the necessary additional shift, so that your chart depicts both effects. **(4 points)**

Demand of private companies would shift to the right as they want to make more investment and thus they need to borrow more.



8. Suppose you looked on a Bloomberg screen in 2016 and again in 2017. What would the interest rate be that the government paid, to borrow money from households in 2016 and 2017? **(4 points)**

$$\text{In 2016: } i = \pi + r = 1.5\% + 0.5\% = 2\%$$

$$\text{In 2017: } i = \pi + r = 2\% + 1.5\% = 3.5\%$$