**Econ 3020 Fall, 2022**

**Problem Set 3 (100 pts)** **Name: 1) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_email address: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Due Friday, October 21, 2022**

**by 6 pm Eastern time via Gradescope 2) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ email address:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**3)\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_email address:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**4) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ email address:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**5) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ email address:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Directions:** Answer questions 1-6 below from Ch 6, 3, and 4 (graded). Questions 7 & 8 from Ch 7 are ungraded practice for the test. You can submit questions 7&8 if you wish the TA to check, or you can wait to go over it at the review session for the test. Show all work and label carefully. For the graphs, draw them out and take a *clear* photo or scan and upload the image into the doc. You will need to type in your math work under each section, or you can handwrite that portion and photo/scan each part (part a, b, c…) or page and upload.

You will be working in your group of 4. You will turn in one completed set for your group, but should work on this ahead and fill out your own personal copy as well, and everyone should check the finalized copy. You may use your notes, book, and the lecture recordings. At discussion (or outside of discussion via Zoom), your group should finalize the one version you will submit to the TA.

If anyone is ill or quarantining from Covid, please set up a Zoom meeting (non-ill/quarantine can still come to discussion, but can also Zoom while in discussion with the absent person). One person from each group can create a page in Collab, and can then coordinate a Zoom meeting. You may ask your TA questions during discussion.

All of your names and email addresses should be in the document so the TA can record your grades. Please upload your document onto Gradescope on your TA’s Collab page. List your group number above, and all of your names & email addresses.

**1. (Ch 6) (23 pts) Solow Growth Model**

Assume that the per-worker production function is yt = 42kt0.3, in dollars per worker. The saving rates is 17.5%, the depreciation rate is 10%, and the labor force growth rate is 1.25%.

a. (2) Calculate the capital-labor ratio steady state for this economy (round at end of calculations to nearest 2 decimals).

sy = dk

0.175\*42\*k^0.3 = 0.1125k

k = 391.79 capital/labor

b. (2) Calculate the steady state output per worker for this economy (round at end of calculations to nearest 2 decimals using (a) from above).

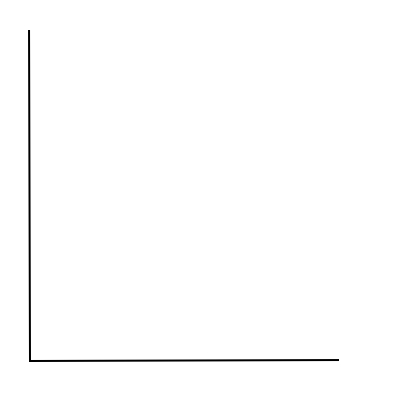
y = 42\*k^0.3 = 251.86 dollar/worker

c. (4) Calculate the consumption per worker and investment per worker at the steady state (nearest 2 decimals).

c = (1-s)\*y = 82.5%\*y = 207.79 dollar/worker

i = sy = 17.5%\*y = 44.08 dollar/worker

d. (7.5) Show the Solow Growth Model graphically given your answers to (a-c) above.



e. (7.5) Suppose that the capital-labor ratio was initially at $325/worker. Calculate *i* and *break-even i* (round answer to nearest 2 decimals). Show this graphically in (d), and explain how the economy would move to the steady state.

i = sy = 17.5%\*42\*325^0.3 = 41.67 dollar/worker

break even investment = (d + n)\*k = 11.25%\*325 = 36.56 dollar/worker

the economy will decrease the current investment level with depreciation rate and dilution rate combined higher than the savings rate to converge to the balanced growth path (the steady state).

**2. (Ch. 3) (9 pts) Bonds.**

**a. (2)** A 3 year bond with a $1000 face value is issued October 6, 2021. If the interest rate October 6, 2021 is 0.55%, what will the coupon be?

Coupon value = i\*face value = $5.5

b. (2) A 2 year bond with a $1000 face value and a coupon of $42.30 is issued on October 6, 2022. What is the current market interest rate?

i = coupon/face value = 42.3/1000 = 4.23%

c. (5) On October 6, 2022, you are trying to decide whether to purchase the 3-year bond, which has 2 remaining years to maturity, or the 2 year bond (from above). Assume that the first coupon payment has been made for the 3 year bond.

i. (2) What would you be willing to pay for the 2 year bond?

PDV = 42.3/1.0423 + 42.3/1.0423^2 + 1000/1.0423^2 = $1000

ii.(2) What would you be willing to pay for the 3 year bond with 2 years left so that you are indifferent between the 2 year and the 3 year bond (to 2 decimals)? Assume that the first coupon payment has been made for the 3 year bond.

PDV = 5.5/1.0423 + 5.5/1.0423^2 + 1000/1.0423^2 = $930.82

iii. (0.5) What happened to the interest rate from 2021 to 2022?

The interest rate rises dramatically.

iv. (0.5) What happened to the price of the existing 3 year bond as the interest rate changed?

The price of the existing 3 year bond would fall if the interest rate rises, and it would rise if the interest rate falls.

**3. (Ch 3) (18 pts) Interest Rates.**

On September 30, 2022, the following interest rate on bonds with differing times to maturity was observed. Assume that the expectations theory is correct, so that there is no term premium for a two or three-year bond.

|  |  |
| --- | --- |
| **Years to Maturity**  **(on September 30, 2022)** | **Interest Rate** |
| 1 | 4.05% |
| 2 | 4.22% |
| 3 | 4.25% |

a. (2 pts) Use the information above to calculate the expected interest rate on a one-year bond one year from now.

i(one year from now) = 4.22%\*2-4.05% = 4.39%

b. (2 pts) Use the information above to calculate the expected interest rate on a one year bond two years from now.

i (two year from now) = 4.25%\*3 – 4.05% - 4.39% = 4.31%

c.(4 pts) i. (2 pt) The year before, on September 30, 2021, the rates on 1, 2, and 3 year bonds were 0.09%, 0.28%, and 0.53%. Why were interest rates so low in 2021? (Hint: See article posted in Collab/Resources/Readings/Part II: USA Today – “Fed Signals Interest Rates…”

ii. (2) Why do you think interest rates are higher in 2022 than in 2021? (Hint: See <https://www.federalreserve.gov/newsevents/pressreleases/monetary20220921a.htm>)

The United States is experiencing an elevated inflation rate in 2022, especially higher food and energy prices. Additionally, the Russian war against Ukraine is putting extra upward pressure on the inflation rate. Thus, the fed needs to increase the interest rate to stop this surge and hold the inflation rate back to normal at 2%.

d. (10 pts) Go to <https://home.treasury.gov/resource-center/data-chart-center/interest-rates/TextView?type=daily_treasury_yield_curve&field_tdr_date_value=2020>. Fill in the information in the table below for that date.(1 pt each)

|  |  |
| --- | --- |
| **Years to Maturity**  **(on \_January 22, 2020)** | **Interest Rate** |
| 1 | 1.55% |
| 2 | 1.53% |
| 3 | 1.52% |

(2) What might the yield curve be predicting? What news might the market have been reacting too? (Hint: see <https://www.who.int/news-room/detail/29-06-2020-covidtimeline>). Was the prediction correct?

Now go to <https://home.treasury.gov/resource-center/data-chart-center/interest-rates/TextView?type=daily_treasury_yield_curve&field_tdr_date_value=2022> to get the most recent yield curve information. (1 pt each)

|  |  |
| --- | --- |
| **Years to Maturity (on October 14, 2022)** | **Interest Rate** |
| **1** | **4.5%** |
| **5** | **4.25%** |
| **10** | **4%** |

(2) What might the yield curve be predicting?

**4. (Ch. 3)** **(18.5 pts) Money Market.**

**a. (5.5 pts) Money Market**

Go to <https://home.treasury.gov/resource-center/data-chart-center/interest-rates/TextView?type=daily_treasury_yield_curve&field_tdr_date_value=2020> and select the time period “2020,” get the interest rate on a 3 month Treasury Bill for January 6, 2020, (note these are given in %). Go to <https://fred.stlouisfed.org/series/WM1NS> and get the M1 money stock for January 6, 2020 (hint, modify the dates to between 2019 and 2022 to get a blown up graph). Show the data on the graph below for the M1 money market, and label this equilibrium point “**A.**” Label your graph carefully.

i:

M1:

Shape, square

Description automatically generated

**b. (8 pts) Fed response to Covid Shutdown**

**i. (5 pts)**

(1 pt) Go to [www.bea.gov](http://www.bea.gov) and in Interactive Data, GDP & Personal Income, go to Table 1.1.1 Percent Change From Preceding Period in Real Gross Domestic Product to get the 2020 Quarter 2 percentage change in Real GDP.

Q2 %∆Real GDP: -29.9%

(4 pts) Explain how this change in real GDP would affect the money market (assume *all else constant*), and show graphically above. Label the new equilibrium in June (end of Quarter 2), 2020 as point “**B**” (use generic label i2).

The dramatic decrease in real GDP would shift the money demand curve to the left since people have less income and thus decrease the consumption, causing less M1 money in the market.

**ii. (3 pts)** Explain how the market moves from equilibrium point “**A**” to equilibrium “**B** .

After the demand curve shifts to the left, at point A, quantity of money demanded is less than the quantity of money supplied, which indicates that households are holding too much money on hands. As a result, households will invest extra money to buy financial products, which drives the demand of bills up. Since the demand curve for bills is downward sloping, the price of bills increases as the demand curve shifts to the right. As the price of the bill is inversely related to the interest rate, this change in the demand of bills will cause the interest rate to decrease, shifting the equilibrium point to point B.

**c. (5)** **Fed response.**

(i) (4 pts) Now go back go to <https://fred.stlouisfed.org/series/WM1NS> and get the M1 money stock for June 29, 2020.

Also go to <https://m.treasury.gov/resource-center/data-chart-center/interest-rates/Pages/TextView.aspx?data=yieldYear&year=2022> and get the interest rate on a 3 month Treasury Bill for June 29, 2020 (note these are given in %). Show these on the graph above and label this new equilibrium point “**C.** “

M1 Money Stock 6.29.2020: 16615 billions of dollars

3-month Treasury interest rate 6.29.2020: 1.78%

(ii) (1) What did the Fed do in response to the economy shutting down for Covid? (Hint: see the Fed’s June 10, 2020 FOMC Announcement <https://www.federalreserve.gov/newsevents/pressreleases/monetary20200610a.htm> about the Fed’s response to Covid shutdown.

The fed continuously monitored the economy and gathered information for future goals. The fed decreased the interest rate aiming to boost the economy during COVID times as a monetary policy response. The fed also increased its holdings of Treasury securities and agency residential and commercial mortgage-backed securities as open market operations to increase the money supply. Also, the Open Market Desk offered large-scale overnight and term repurchase agreement operations.

**5. (Ch 4) (21.5 pts) Loanable Funds.**

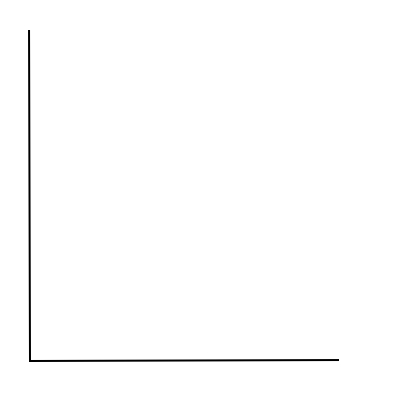
**a. (17.5 pts).** Go to [www.bea.gov](http://www.bea.gov). Under Interactive Data, go to GDP & Personal Income, Table 5.1 Saving and Investment by Sector, and fill in the table below. (1 pt each, 6 pts total)

|  |  |  |
| --- | --- | --- |
|  | 2022, Quarter 1 | 2022, Quarter 2 |
| Net Private Saving |  |  |
| Net Government Saving |  |  |
| **Net Saving** |  |  |

Now go to <https://home.treasury.gov/resource-center/data-chart-center/interest-rates/TextView?type=daily_treasury_real_long_term&field_tdr_date_value=2022> to get the Treasury Daily Long-term Real Interest Rate. Get the rate for March 31, 2022 (end of Quarter 1) and June 30, 2022 (end of Quarter 2). (1 pt each, 2 pts total)

|  |  |
| --- | --- |
| **Date** | **Long Term Real Interest Rate** |
| March 31, 2022 |  |
| June 30, 2022 |  |

Assume all else is constant. Show graphically and explain how the change in net savings will affect the loanable funds model. Label the old equilibrium “**A**” and the new equilibrium “**B**.” **Label your graph carefully.** (9.5 pts)



**b. (4 pts)** Now go to <https://fred.stlouisfed.org/series/HSN1F> and get the number of New One Family Houses Sold for March, 2022 and June, 2022. ( 1 pt each, 2 total)

|  |  |
| --- | --- |
| **Date** | **New One Family Houses Sold** |
| March, 2022 |  |
| June, 2022 |  |

(2 pts) What was the effect of change in the long-term real interest rate on the quantity of new One Family Houses Sold? How would this affect the loanable funds model?

**6. (10 pts)** **(Ch. 3) Leverage**. The average price of a new single-family home sold in April, 2022 was $562,400.[[1]](#footnote-1) Suppose two families each purchased a house for this amount. Family A puts 20% down and borrows the remaining amount, while family B only puts 5% down and borrows the remaining amount. Due to rising interest rates, suppose that the price of houses falls by 5% over the following year.

a. (4) Calculate the return for each family.

**Family A:**

**Family B:**

(b) (2) Which family has the lowest return (greatest loss)? Which was more highly leveraged?

(c) (4) Suppose each family had paid down $5,000 of the loan at the end of the year. What is the equity that each family has in the house? Explain whether the families “above water” or “underwater.”

**Family A:**

**Family B:**

**\*7. (Ch 7) (Practice - ungraded) Velocity.** Collect the following data.

A. For M1 Money Stock, go to [M1 Money Stock (M1SL) | FRED | St. Louis Fed (stlouisfed.org)](https://fred.stlouisfed.org/series/M1SL).

B. For reported M1 Velocity, go to [Velocity of M1 Money Stock (M1V) | FRED | St. Louis Fed (stlouisfed.org)](https://fred.stlouisfed.org/series/M1V).

C. For GDP Deflator, go to [www.bea.gov](http://www.bea.gov) and use Table 1.1.9

D. For Real GDP, go to [www.bea.gov](http://www.bea.gov) and use Table 1.1.6.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Year** | **M1**  **(use average of October to December to get 4th Quarter)** | **E.**  **Velocity**  **(calculated)** | **B.**  **Velocity**  **(as reported by FRED, use 4th Quarter data).** | **C.**  **GDP Deflator**  **(use 4th quarter)** | **D.**  **Real GDP**  **(use 4th quarter)** |
| 1970 |  |  |  |  |  |
| 1980 |  |  |  |  |  |
| 2010 |  |  |  |  |  |
| 2020 |  |  |  |  |  |

E. Calculate Velocity given the data above. How did the calculated velocity compare to velocity as reported by FRED?

F. Calculate the percentage changes using the midpoint formula (∆X/(X2+X1)/2) in the following variables (in percent, to one decimal) .

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Decade** | **%∆M1** | **%∆V** | **%∆P** | **%∆Y** |
| 1970-1980 |  |  |  |  |
| 2010-2020 |  |  |  |  |

G. Does the quantity theory hold true for each of the decades? Explain the relationship between the money supply growth rate and inflation.

**\*8. (Ch 7)(practice - ungraded) Money growth, inflation, and interest rates.**

**a.** Calculate the following missing variables.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Country** | **%ΔM** | **%ΔP** | **r** | **i** |
| United Kingdom | 2.1 | 1.7 |  | 0.5 |
| United States | 4.1 | 1.5 | 1.7 |  |
| Bangladesh | 14.9 |  | 5.4 | 13.0 |
| Brazil | 8.9 | 7.6 |  | 27.4 |

**b.** How does the inflation rate in those countries with high money growth rates compare to the inflation rate in those countries with low money growth rates (and which countries have these high/low rates)?

**c.** Why does the U.K. have such a low nominal interest rate? Why does Brazil have a high nominal interest rate?

1. https://fred.stlouisfed.org/series/ASPNHSUS [↑](#footnote-ref-1)