

# Problem Session I

April 4th, 2014

Reference: Parkin, Introduction to economics, 2011

1. The firm that printed your Introduction to economics textbook bought the paper from XYZ Paper Mills. Was this purchase of paper part of GDP? If not, how does the value of the paper get counted in GDP?

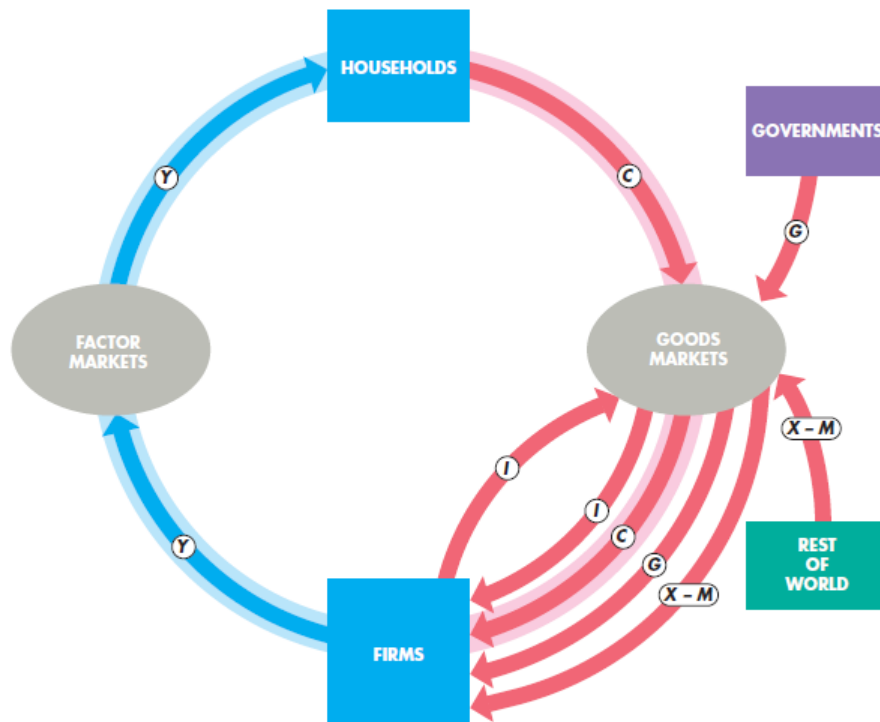
**Solution:** To calculate GDP, we value the final goods and services produced. A final good or service is an item that is bought by its final user during a specified time period. It contrasts with an intermediate good or service, which is an item that is produced by one firm, bought by another firm, and used as a component of a final good or service. In this case, paper is an intermediate good, which is used to "produce" your economics textbook. Therefore, the purchase of paper by the company that printed your book from the XYZ Paper Mills is not a part of GDP. If we were to add the value of intermediate goods and services produced to the value of final goods and services, we would count the same thing many times—a problem called double counting. The value of the book already includes the value of the paper.

2. The circular flow model of an economy is given below. During 2008, in an economy:

- Flow C was 9 trillion dollars,
- Flow G was 2 trillion dollars,
- Flow I was 3 trillion dollars,
- Flow (X-M) was -0.7 trillion dollars.

Name the flows and calculate the value of:

- Aggregate income



- GDP

**Solution:** The figure given in the problem illustrates the circular flow of expenditure and income. The economy consists of households, firms, governments, and the rest of the world, which trade in factor markets and goods (and service) markets. The flows among these can be enlisted as below:

- $Y$ , is the aggregate income of the households, including the retained earnings. Households sell and firms buy the services of labor, capital, and land in factor markets. For these factor services, firms pay income to households: wages for labor services, interest for the use of capital, and rent for the use of land. A fourth factor of production, entrepreneurship, receives profit. Firms' retained earnings-profits that are not distributed to households- are part of the household income. You can think of retained earnings as being income that households save and lend back to firms.

- Firms sell and households buy consumer goods and services in the goods market. The total payment for these goods and services is consumption expenditure, shown by the flow labeled C.
- Firms buy and sell new capital equipment in the goods market. Some of what firms produce is not sold but is added to inventory. When a firm adds unsold output to inventory, we can think of the firm as buying goods from itself. The purchase of new plant, equipment, and buildings and the additions to inventories are investment, shown as the flow labeled I.
- Governments buy goods and services from firms and their expenditure on goods and services called government expenditure, shown as the flow labeled G.
- Firms sell goods and services to the rest of the world- exports; and buy goods and services from the rest of the world- imports. The value of exports (X) minus the value of imports (M) is called net exports, shown as the flow (X-M).
- Aggregate income is equal to the total amount paid for the services of the factors of production used to produce final goods and services -wages, interest, rent, and profit. Because firms pay out as incomes everything they receive from the sale of their output, aggregate income equals aggregate expenditure. Aggregate expenditure is the sum of consumption, investment, government expenditure and net exports. Therefore:  $Y=C+I+G+(X-M)=9+2+3+(-0.7)=13.3$  trillion dollars.
- GDP equals aggregate expenditure and equals aggregate income. Therefore GDP is also equal to 13.3 trillion dollars.

3. Use the following data. The BLS reported the following CPI data:

June 2006 201.9

June 2007 207.2

June 2008 217.4

- Calculate the inflation rates for the years ended June 2007 and June 2008.
- Why might these CPI numbers be biased?

**Solution:**

- We calculate the inflation rate as the annual percentage change in the CPI. To calculate the inflation rate, we use the formula:

$$\text{Inflation rate} = \frac{\text{CPI this year} - \text{CPI last year}}{\text{CPI last year}} \times 100.$$

We can use this formula to calculate the inflation rate for the year ended June 2007:

$$\text{Inflation Rate} = \frac{207.2 - 201.9}{201.9} \times 100 = 2.62\%$$

If we calculate the inflation rate for the year ended June 2008:

$$\text{Inflation Rate} = \frac{217.4 - 207.2}{207.2} \times 100 = 4.69 \%$$

- The main sources of bias in the CPI are:
  - New goods bias: Since a PC is more expensive than a typewriter was, the arrival of the PC puts an upward bias into the CPI.
  - Quality change bias: Many goods get better every year. Part of the rise in prices of these items is a payment for improved quality and not inflation. But the CPI counts the entire price as inflation and so overstates the inflation.
  - Commodity substitution bias: Changes in relative prices lead consumers to change the items they buy. For example, if the price of beef increases and the price of chicken remains unchanged, people buy more chicken and less beef. The price of protein has not changed. But the CPI ignores the substitution of chicken for beef, it says the price of protein has increased.
  - Outlet substitution bias: When confronted with higher prices, people use discount stores more frequently and convenience stores less frequently. This phenomenon is called outlet substitution. The CPI surveys do not monitor outlet substitutions.

4. Information regarding the output and prices in an economy for the last three years is depicted in the table below.

Year	Price of Cheese	Quantity of Cheese Produced	Price of Wine	Quantity of Wine Produced
2010	2	100	5	250
2011	4	200	8	400
2012	5	250	10	400

- Compute nominal GDP, real GDP and GDP deflator for all three years, using 2011 as the base year.
- At what rate did the prices change during the period from the beginning of 2010 to the end of 2012?
- In real terms, how much did prosperity in the economy increase during 2012?
- What is the price level in 2011 and what is the rate of inflation in 2010 measured by the GDP deflator?

**Solution:**

- Nominal GDP: Nominal GDP is the value of final goods and services produced in a given year when valued at the prices of that year.  
Nominal GDP in 2010 =  $(2 * 100) + (5 * 250) = 200 + 1250 = 1450$   
Nominal GDP in 2011 =  $(4 * 200) + (8 * 400) = 800 + 3200 = 4000$   
Nominal GDP in 2012 =  $(5 * 250) + (10 * 400) = 1250 + 4000 = 5250$
- Real GDP: Real GDP is the value of final goods and services produced in a given year when valued at the prices of a reference base year. Since 2011 is given as the base year, we can calculate the real GDP as follows:

$$\text{Real GDP in 2010} = (4 * 100) + (8 * 250) = 400 + 2000 = 2400$$

$$\text{Real GDP in 2011} = (4 * 200) + (8 * 400) = 800 + 3200 = 4000$$

(Since 2011 is the base year, nominal and real GDP's are the same)

$$\text{Real GDP in 2012} = (4 * 250) + (8 * 400) = 1000 + 3200 = 4200$$

- GDP Deflator can be found by using the following formula: Then

$$\text{GDP deflator} = (\text{Nominal GDP} \div \text{Real GDP}) \times 100.$$

GDP Deflator can be calculated as follows:

$$\text{GDP Deflator in 2010} = \frac{1450}{2400} \times 100 = 60.4$$

$$\text{GDP Deflator in 2011} = \frac{4000}{4000} \times 100 = 100$$

$$\text{GDP Deflator in 2012} = \frac{5250}{4200} \times 100 = 125$$

- From the beginning of 2010 to the end of 2012, the rate of change in the prices can be found by the change in GDP deflator:

$$\frac{125 - 60.4}{60.4} = 106.95 \%$$

- In order to measure the change of prosperity of the economy during 2012, we should find at which rate the real GDP has changed in 2012.

$$\frac{4200 - 4000}{4000} \times 100 = \frac{200}{4000} \times 100 = 5 \%$$

- We can measure the inflation rate in 2010 by finding the change in GDP deflator from 2010 to 2011:

$$\frac{100 - 60.4}{60.4} \times 100 = 65.56 \%$$

5. When should we expect GDP deflator and CPI to be exactly identical?

**Solution:** CPI measures the price of a certain basket of goods, that is intended to represent the consumption behavior of the consumers. Therefore, it only indicates the price change of the goods that an average consumer consumes.

On the other hand, GDP includes all of the goods produced in the economy. Therefore, GDP deflator indicates the price change of all of the goods and services that is produced in an economy. Hence, it is a more comprehensive measure of price than CPI.

These two indices would be the same if CPI measures all of the goods and services that is produced in an economy, with exactly the same weights.

6. Brazil's real GDP was 1,360 trillion reais in 2009 and 1,434 trillion reais in 2010. Brazil's population was 191.5 million in 2009 and 193.3 million in 2010. Calculate

- The economic growth rate
- The growth rate of real GDP per person.
- The approximate number of years it takes for real GDP per person in Brazil to double if the 2010 economic growth rate and population growth rate are maintained.

**Solution:**

- Growth Rate =  $\frac{1434 - 1360}{1360} \times 100 = 5.44 \%$

- Real GDP per capita in 2009 =  $\frac{1360}{191.5} = 7101 \text{ \$}$

- Real GDP per capita in 2010 =  $\frac{1434}{193.3} = 7418 \text{ \$}$

- Growth rate of GDP per capita in 2009 =  $\frac{7418 - 7101}{7101} \times 100 = 4.46\%$

- We should use the "70-rule" in order to find the approximate doubling period of GDP:

$$\frac{70}{4.46} = 15.69 \text{ years.}$$

7. The following tables describe an economy's labor market and its production function in 2010.

Real wage rate (dollars per hour)	Labor hours supplied	Labor hours demanded
80	45	5
70	40	10
60	35	15
50	30	20
40	25	25
30	20	30
20	15	35

Labor (hours)	Real GDP (2005 dollars)
5	425
10	800
15	1,125
20	1,400
25	1,625
30	1,800
35	1,925
40	2,000

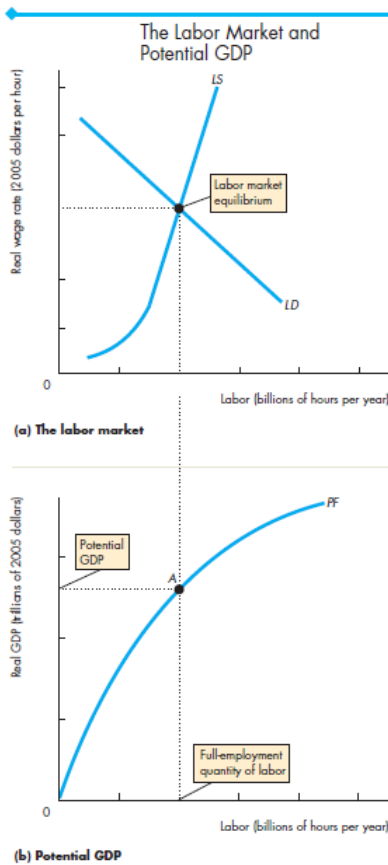
- What are the equilibrium real wage rate, the quantity of labor employed in 2010, labor productivity, and potential GDP in 2010?
- In 2011, the population increases and labor hours supplied increase by 10 at each wage rate, labor productivity, and potential GDP in 2011?



- In 2011, the population increases and labor hours supplied increase by 10 at each real wage rate. Does the standard of living in this economy increase in 2011? Explain why or why not?

**Solution:**

- As you may remember, the equilibrium in the labor market occurs at the point where labor supply is equal to demand for labor. At the equilibrium, the real wage rate is also determined. Then the equilibrium quantity of labor determines the potential GDP of the economy. You can see these interactions in the figure below:



According to this, we should find the equilibrium quantity of labor

in the labor market first.

Real wage rate (dollars per hour)	Labor hours supplied	Labor hours demanded
80	45	5
70	40	10
60	35	15
50	30	20
40	25	25
30	20	30
20	15	35

Examining the labor market schedule given, we can easily find the equilibrium quantity of labor is 25 hours, at which point the labor supplied is equal to the demand for labor. And the real wage rate is 40 \$/hour. Then from the production function, we can find the potential real GDP of the economy, which is equal to 1625 \$ (in 2005 dollars).

Labor (hours)	Real GDP (2005 dollars)
5	425
10	800
15	1,125
20	1,400
25	1,625
30	1,800
35	1,925
40	2,000

Labor productivity is the quantity of real GDP produced by an hour of labor. Then:

$$\text{Labor productivity in 2010} = \frac{1625}{25} = 65 \text{ \$/hour.}$$

- If the population increases in 2011 and labor hours supplied increase by 10 at each real wage rate, then the labor market schedule

will be as follows:

Real wage rate (dollars per hour)	Labor hours supplied	Labor hours demanded
80	<b>55</b>	5
70	<b>50</b>	10
60	<b>45</b>	15
50	<b>40</b>	20
40	<b>35</b>	25
<b>30</b>	<b>30</b>	<b>30</b>
20	<b>25</b>	35

The potential GDP corresponding to this level of employment will be:

Labor (hours)	Real GDP (2005 dollars)
5	425
10	800
15	1,125
20	1,400
25	1,625
<b>30</b>	<b>1,800</b>
35	1,925
40	2,000

Then we can calculate the new labor productivity as follows:

$$\frac{1800}{30} = 60 \text{ \$/hour.}$$

- Population growth brings growth in the supply of labor, but it does not change the demand for labor or the production function. The economy can produce more output by using more labor, but the labor productivity falls. When labor productivity falls, real GDP per person decreases and brings a decrease in the standard of living. Therefore, in this case,

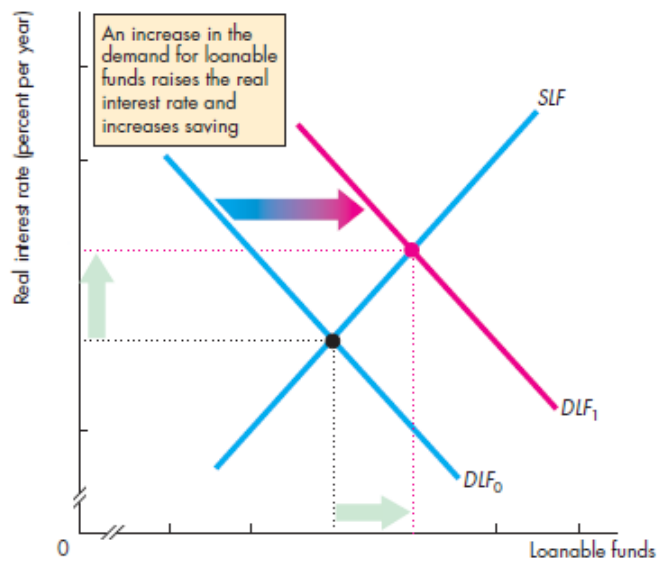
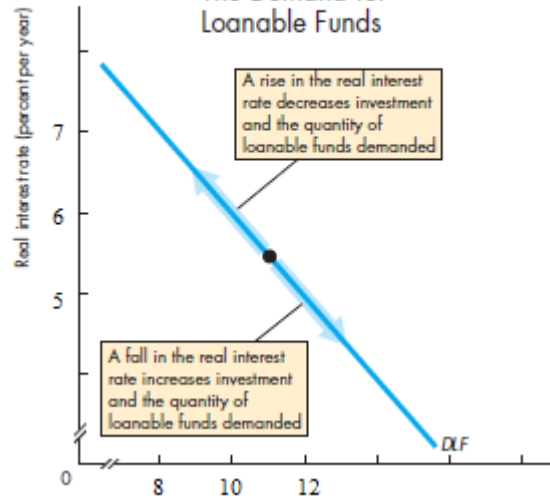
the rise in the real GDP of the overall economy, does not translate into the rise in the standard of living.

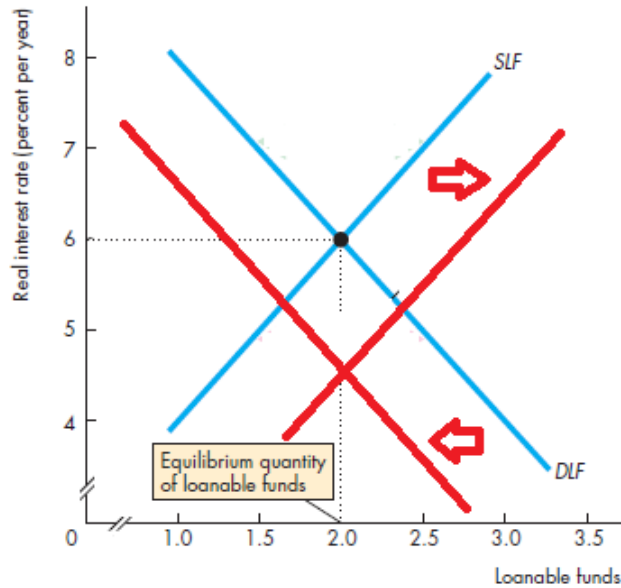
8. First Call, Inc., is a cellular phone company. It plans to build an assembly plant that costs 10 million dollars if the real interest rate is 6 percent a year. If the real interest rate is 5 percent a year, First Call will build a larger plant that costs 12 million dollars. And if the real interest rate is 7 percent a year, First Call will build a smaller plant that costs 8 million dollars.
  - Draw a graph of First Call's demand for loanable funds curve.
  - First Call expects its profit from the sale of cellular phones to double next year. If other things remain the same, explain how this increase in expected profit influences First Call's demand for loanable funds.
  - Draw a graph to illustrate how an increase in the supply of loanable funds and a decrease in the demand for loanable funds can lower the real interest rate and leave the equilibrium quantity of loanable funds unchanged.

**Solution:**

- The demand for loanable funds is the relationship between the quantity of loanable funds demanded and the real interest rate, when all other influences on borrowing plans remain the same. First Call, Inc.'s demand for loanable funds curve can be depicted as in the figure below:
- When the expected profit changes, the demand for loanable funds changes. Other things remaining the same, the greater the expected profit from the new capital, the greater is the amount of investment and the greater the demand for loanable funds. If the demand for loanable funds curve shifts to the right.
- We can depict an increase in the supply of loanable funds and a decrease in the demand for loanable funds can lower the real interest rate and leave the equilibrium quantity of loanable funds unchanged as follows:

### First Call, Inc.'s The Demand for Loanable Funds





9. The following table shows an economy's demand for loanable funds and the supply of loanable funds schedules, when the government's budget is balanced.

Real interest rate (percent per year)	Loanable funds demanded (trillions of 2005 dollars)	Loanable funds supplied
4	8.5	5.5
5	8.0	6.0
6	7.5	6.5
7	7.0	7.0
8	6.5	7.5
9	6.0	8.0
10	5.5	8.5

- Suppose that the government has a budget surplus of 1 trillion dollar. What are the real interest rate, the quantity of investment, and the quantity of private saving? Is there any crowding out in this situation?

- Suppose that the government has a budget deficit of 1 trillion dollar. What are the real interest rate, the quantity of investment, and the quantity of private saving? Is there any crowding out in this situation?
- Suppose that the government has a budget deficit of 1 trillion and the Ricardo-Barro effect occurs. What are the real interest rate and the quantity of investment?

**Solution:**

- Under current conditions, the equilibrium in the loanable funds market occurs when the loanable funds demanded equals the loanable funds supplied.

Real interest rate (percent per year)	Loanable funds demanded (trillions of 2005 dollars)	Loanable funds supplied
4	8.5	5.5
5	8.0	6.0
6	7.5	6.5
7	7.0	7.0
8	6.5	7.5
9	6.0	8.0
10	5.5	8.5

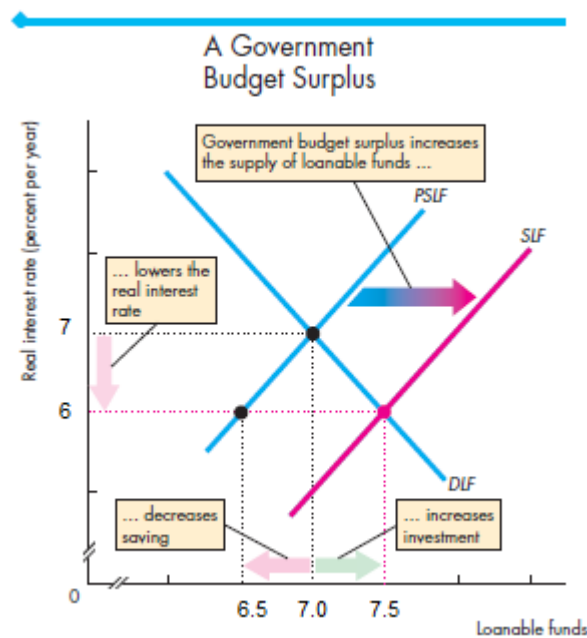
Therefore, the equilibrium level of loanable funds is 7 trillion \$ and the equilibrium real interest rate is 7.

- If the government has a budget surplus of 1 trillion dollars, then the supply of loanable funds increases at each real interest rate by 1 trillion dollars, which means the loanable funds supply curve shifts to the right.

This means that the equilibrium real interest rate falls to 6 percent a year, the quantity of loanable funds increases to 7.5 trillion dollars per year, and investment is 7.5 trillion dollars a year.

The fall in the interest rate decreases private saving to 6.5 trillion dollars, but investment increases to 7.5 trillion dollars, which is financed by private saving plus the government budget surplus (government saving).

Real interest rate (percent per year)	Loanable funds demanded (trillions of 2005 dollars)	Loanable funds supplied
4	8.5	6.5
5	8.0	7.0
6	7.5	7.5
7	7.0	8.0
8	6.5	8.5
9	6.0	9.0
10	5.5	9.5



- If the government has a budget deficit of 1 trillion dollars, then the demand for loanable funds increases at each real interest rate by 1 trillion dollars, which means the demand for loanable funds curve shifts to the right.

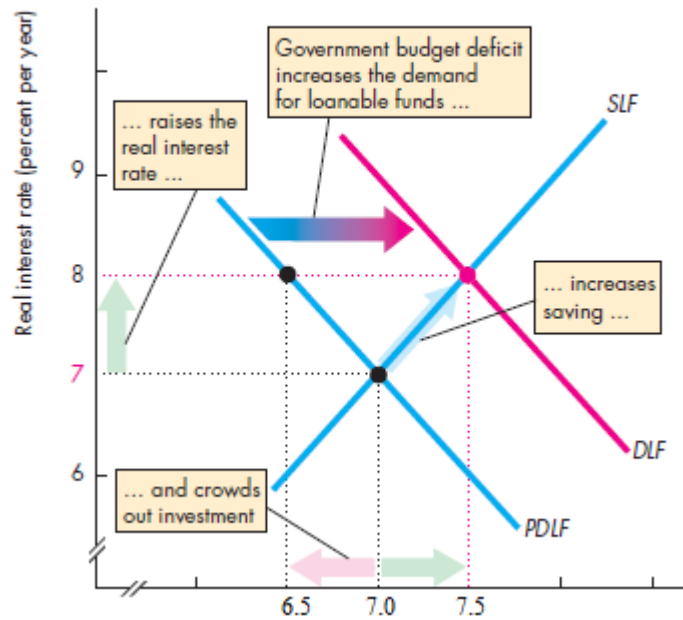
This means that the equilibrium interest rate increases to 8 percent per year. And the equilibrium quantity of loanable funds increases to 7.5 trillion dollars a year.

The rise in the real interest rate increases private saving to 7.5



Real interest rate (percent per year)	Loanable funds demanded (trillions of 2005 dollars)	Loanable funds supplied
4	9.5	5.5
5	9.0	6.0
6	8.5	6.5
7	8.0	7.0
8	7.5	7.5
9	7.0	8.0
10	6.5	8.5

### A Government Budget Deficit

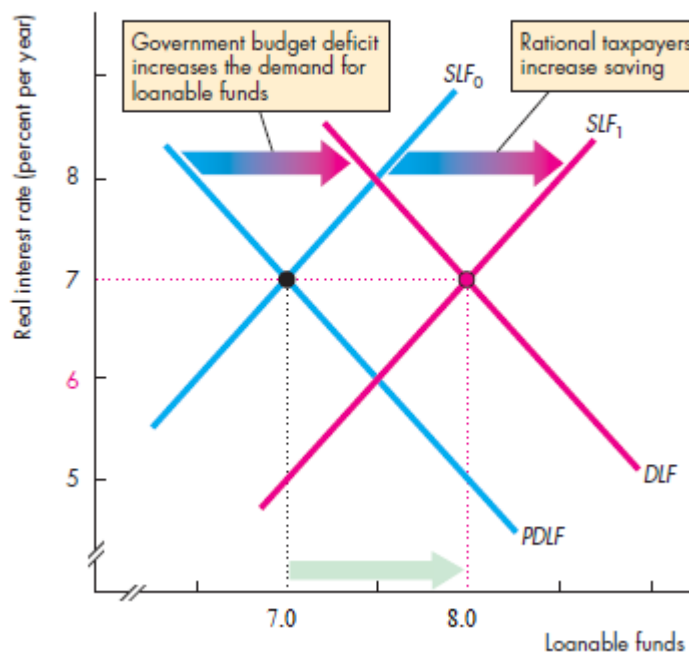


trillion dollars, but investment decreases to 6.5 trillion dollars, because 1 trillion dollar of private saving must finance the government budget deficit.

The tendency for a government deficit to raise the real interest rate and decrease investment is called the crowding-out effect. In this case, the budget deficit of the government crowds out investment by competing with businesses for scarce financial capital.

- Ricardo-Barro Effect means that government budget surplus or deficit has no effect on real interest rate, or investment. Because, tax payers are rational. Deficit today means that future taxes will be higher, and smaller future disposable income, saving increases today. Private saving and private supply of loanable funds increase to match the quantity of loanable funds demanded by the government. So the budget deficit has no effect on the real interest rate or investment.

### The Ricardo-Barro Effect



10. In June 2009, currency held by individuals and businesses was 853 billion dollars; traveller's checks were 5 billion dollars; checkable deposits owned by individuals and businesses were 792 billion dollars; saving deposits were 4,472 billion dollars; time deposits were 1,281 billion dollars; and money market funds and other deposits were 968 billion dollars. Calculate M1 and M2 in June 2009.

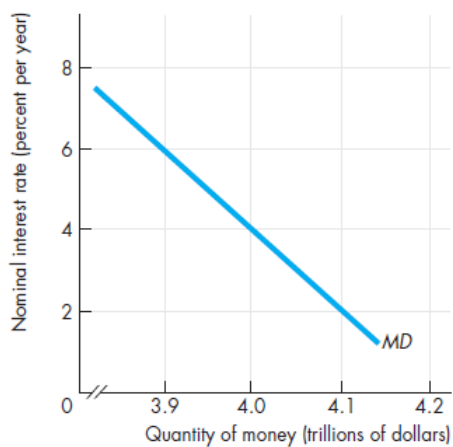
**Solution:** M1 and M2 are two official measures of money. M1 and M2 consist of the following components.

<b>M1</b>	■ Currency and traveler's checks
	■ Checking deposits at commercial banks, savings and loan associations, savings banks, and credit unions
<b>M2</b>	■ M1
	■ Time deposits
	■ Savings deposits
	■ Money market mutual funds and other deposits

Then M1 and M2 can be calculated as follows:

- $M1 = 853 + 5 + 792 = 1650$  \$
- $M2 = 1650 + 4472 + 1281 + 968 = 8371$  \$

11. The figure shows the demand for money curve.

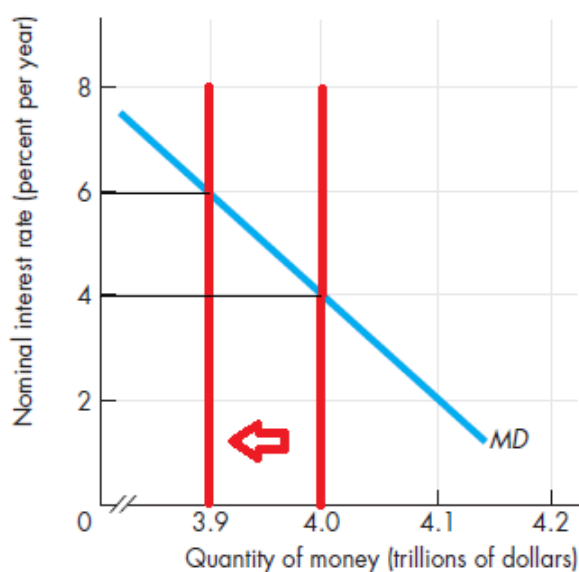


If the Fed decreases the quantity of real money supplied from 4 trillion

dollars to 3.9 trillion dollars, explain how the price of the bond will change.

**Solution:** If Fed decreases the supply of money from 4 trillion dollars to 3.9 trillion dollars, the rate of interest rises from 4 percent to 6 percent.

In order to do this, Fed will sell bonds with open market operations. This will increase the supply of bonds, and increased bond supply will result in a decrease in its price.



12. Quantecon is a country in which the quantity theory of money operates. In year 1, the economy is at full employment and real GDP is 400 million dollars, the price level is 200, and the velocity of circulation is 20. In year 2, the quantity of money increases by 20 percent. Calculate the quantity of money, the price level, real GDP, and the velocity of circulation in year 2.

**Solution:** The quantity theory of money is the proposition that in the long run, an increase in the quantity theory of money brings an equal percentage increase in the price level.

The equation of exchange tells us how Quantity of money (M), Velocity of circulation (V), Aggregate price level (P) and Real GDP (Y) are

connected. This equation is:

$$MV = PY$$

If the quantity of money does not influence the velocity of circulation or real GDP, then this equation becomes the quantity theory of money. In this case, the equation of exchange tells us that in the long run, the price level is determined by the quantity of money. That is, where  $(V/Y)$  is independent of  $M$ . So a change in  $M$  brings a propor-

$$P = M(V/Y)$$

tional change in  $P$ .

In the problem given above, In year 1;

$$M_1V = P_1Y$$

$$M_1 \cdot 20 = 200 \cdot 400$$

$$M_1 = 4000$$

In year 2;

$M$  increases %20. This means that  $M_2 = 1.2M_1 = 1,2 \cdot 4000 = 4800$

Since the velocity of money,  $V=20$  and real GDP=400 is constant in the short-run;

$$4800 \cdot 20 = P_2 \cdot 400$$

$$P_2 = 240$$

Which means a proportional increase in the aggregate price level.