Problems for Chapter 7: Savings, Investment, and Interest Rates.

1. If you deposit $100 in a savings account for 5 years at 5% interest, what will your account balance be at the end of the 5 years?

2. If you want a $100 balance in your savings account 5 years from today, how much must you deposit in the bank today if the nominal interest rate is 5%?

3. If the nominal interest rate is 8%, what is the present value of $100 received
   a. 1 year from today.
   b. 2 years from today.
   c. 20 years from today.

4. Suppose that you are fortunate enough to have won a $5 million lottery. You have been offered the choice between 5 payments of $1 million over the next 5 years (first payment today) or $4 million today. If you could earn 7 percent interest on money deposited in the bank, which would you prefer and why?

5. Suppose that a relative is in the military and has been offered a "buy-out" package. Your relative has been offered the opportunity to choose between two annual payments of $26,000 (first payment today) and a package that would pay $12,000 per year for the next 5 years (first payment today). Which option should be chosen if your relative will invest the buy-out package for retirement at 8% interest? Why?

Investment demand and loan market equilibrium.

Suppose that you can purchase a machine today for $40,000. You can lease the machine for $10,000 per year for each of the next 5 years. Your first payment will be received one year from today. At the end of the 5 years, you can sell the machine for $5,000. The expected inflation rate is zero.

6. What is the NPV of this investment if the interest rate is:
   a. 0
   b. 10%
   c. 11%
   d. 12%

7. Based on the answers to (1),
   a. What (approximately) is the internal rate of return on this investment project?
   b. Under what conditions would this machine be a “good” investment?

8. Suppose that there was 5% inflation expected and that you expect that the lease payments you can receive and the salvage value will grow with the inflation rate. How will this affect the internal rate of return on this project? How does it affect the conditions under which this machine would be a good investment?

The determinants of saving.

9a. Suppose that your life is split into two periods -- this year and next year. If you earn $30,000 per year, what is your wealth today assuming a 5% interest rate?
   b. Assuming that you can borrow or lend at 5% interest, how much can you consume next year if you consume
      i. $0 this year?
      ii. $20,000 this year?
      iii. $30,000 this year?
      iv. $40,000 this year?
   c. Draw the budget constraint for consumption this year and next year using the income and interest rate given in (a).
   d. If the interest rate is 5%, for every $1 of consumption this year, how many dollars of consumption must be given up in the next year?
Temporary and Permanent changes in income.
Suppose that your life has two periods, this year and next year. You expect to earn $50,000 this year, and $30,000 next year.

10. If the interest rate is 5%, what is your wealth?
11. If you wish to “smooth out” consumption (i.e. have the same level of consumption in each period), how much can you consume in each period? What will saving be this year?
12. If your income rises by $10,000 this year and next year, how much can you consume in each year if you smooth out consumption? How much will this year’s consumption and savings change?
13. If your income rises by $10,000 this year but is unchanged next year, how much can you consume in each year if you smooth out consumption? How much will this year’s consumption and savings change?
14. Based on your answers in (12-13), does this year’s consumption increase more in response to a permanent or temporary increase in income? How about saving?
15. If you hear news that causes you to expect that next year’s income will be $10,000 higher than you previously believed, how will this affect this year’s consumption? Saving?

Interest rates.

16. Consider the same income path as above ($50,000 this year and $30,000 next year). If the interest rate increased to 10% and you smooth consumption, what will this year’s consumption and saving be?
17. If the interest rate rises from 5 to 10%, what has happened to the opportunity cost of today’s consumption in terms of consumption next year? How will this influence your willingness to consume today?

18a. What are the two major components of loan demand?
b. What is the source of loan supply?
19. Explain how each of the following will affect loan demand and/or loan supply, the amount of investment in the economy, the amount of saving in the economy, and the equilibrium interest rate. Be able to support your explanations with the appropriate graphic analysis.
a. There is an increase in the government’s budget deficit.
b. Consumers become convinced that their incomes will be higher next year than they previously believed.
c. There is a technological innovation that generates many new profitable investment opportunities at the current interest rate.

Answers:
1. \[127.63 = 100 \times (1.05)^{1}\]
2. \[78.35 = 100 \times (1.05)^{5}\]
3a. \[100/(1.08) = 92.59\] b. \[100/(1.08)^2 = 85.73\] c. \[100/(1.08)^3 = 21.45\]
4. Since the PV of the 5 payments using a 7 percent interest rate is $4.39 million, the payments would be preferred to the lump sum at the 7 percent interest rate.
5. Using an 8 percent interest rate, the present value of the 5 payments of $12,000 is $51,745 and the present value of the two payments at $26,000 is $50,074. The 5 payments are thus preferred.
6a. $15,000 (b) 1012; (c) -74 (d) -1115
7a. The internal rate of return must be slightly less than 11 percent since the NPV is positive at 10 percent and slightly negative at 11 percent.
7b. The machine would be a good investment if the NPV of the project is positive. In order for this to be true, you would have to be able to borrow at less than the internal rate of return (i.e. less than 11 percent).
8. If the net income from the project grew at 5 percent per year, the internal rate of return on the project would be approximately 5 percent higher.

9a. Wealth this year is $58,571 which is calculated as the present value of lifetime income ($30,000 + $30,000/(1+i) where i is the nominal interest rate).

b. The amount that can be consumed next year can be determined as (W-C0)*(1+i) where W is wealth measured today (i.e. present value of lifetime income), C0 is this year’s consumption, and i is the nominal interest rate. Using this formula, consumption next year is:
   i. $61,500 if C0=0; ii. $40,500 if C0=$20,000; iii. $30,000 if C0=$30,000; iv. $19,500 if C0=$40,000

c. For every $1 of consumption this year, $1*(1+i) must be given up next year. If the interest is 5%, every $1 of consumption this year reduces next years consumption by $1.05.

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11. Consumption in each period will be $40,244; saving this year will be $9756. If consumption is smoothed in each period, its level must be W(1+i)/(2+i) where i is the nominal interest rate and W is wealth measured at the beginning of the first year.

12. Consumption in each year will rise to $50,244 (a $10,000 increase from earlier). This means that all of the permanent increase in income is consumed and there is no change in saving.

13. In this case, consumption will increase to $45,366 (a $5122 increase from the original). Hence, since this year’s income rose by $10,000 and this year’s consumption increased only $5,122, saving increased by almost one-half of the temporary increase in income.

14. When there is a permanent increase in annual income, consumption increases by the full amount. When there is a temporary increase in this year’s income, most of it is saved. The reason is that if people consumption smooth over their life-time, then a temporary increase in income must be partly saved in order to increase allow consumption to increase in all periods.

15. If future income is expected to increase, current wealth is enhanced making it possible to consume more in all periods. This will increase consumption and reduce saving in the current period.

16. $40,476 which is greater than the $40,244 of consumption when the interest rate was 5%. Thus, an increase in interest rates has a “wealth” effect in this example that leads to increased consumption and reduced saving. If, however, this person had higher income in year 2 than year 1 and was thus a large borrower in the first year, the wealth effect would decrease consumption and increase saving.

17. When the interest rate increases, the opportunity cost of consumption this year rises in terms of consumption next year. This will create a “substitution effect” that encourages people to save more today by consuming less.

18a. The two major sources of loan demand are investment demand and the government budget deficit.

b. The major source of loan supply is saving.

19a. An increase in government budget deficit will increase loan demand. This will drive up the equilibrium interest rate, decrease private investment, and increase the level of saving.

b. If consumers believe that next year’s income will be higher than they previously thought, they will decrease saving today. This will decrease loan supply, drive up interest rates, and decrease private investment.

c. If there is a technological innovation that makes for many new investment opportunities, the investment demand and loan demand curves will shift right. This will drive up interest rates, increase the level of saving and there will be a higher level of investment than previously.