

Finance 30220
Solutions to Problem Set #5

- 1) Consider a 180 day T-Bill with \$1,000 of face value.
- a) If the purchase price of this T-Bill is \$994, calculate the bond equivalent yield.

$$BEY = \left(\frac{\$1,000 - \$994}{\$994} \right) \left(\frac{365}{180} \right) * 100 = 1.2\%$$

- b) Suppose that you require at least a 3% annualized yield on this bond. What is the maximum price that you would be willing to pay?

$$\left(\frac{3\%}{100} \right) \left(\frac{180}{365} \right) = .015$$
$$\frac{\$1,000}{1.015} = \$985.22$$

- 2) Suppose that you are currently a college senior. You are currently working a part-time job that pays \$2,000 per year, but you expect to earn \$20,000 next year, after you graduate. Assume that there is no inflation and that the interest rate is 10% per year.
- a) Sketch your budget line for current and future expenditures. Indicate on your graph a likely consumption choice.

If you spent all of your wealth today, you could spend up to

$$W = \$2,000 + \frac{\$20,000}{(1.10)} = \$20,182$$

And still be able to repay your loan next period. This is the intercept on the horizontal axis. If you saved all of your current income for later, you could spend up to

$$W = \$2,000(1.10) + \$20,000 = \$22,200$$

This is the intercept on the vertical axis. Connect them and you get a line with the slope of

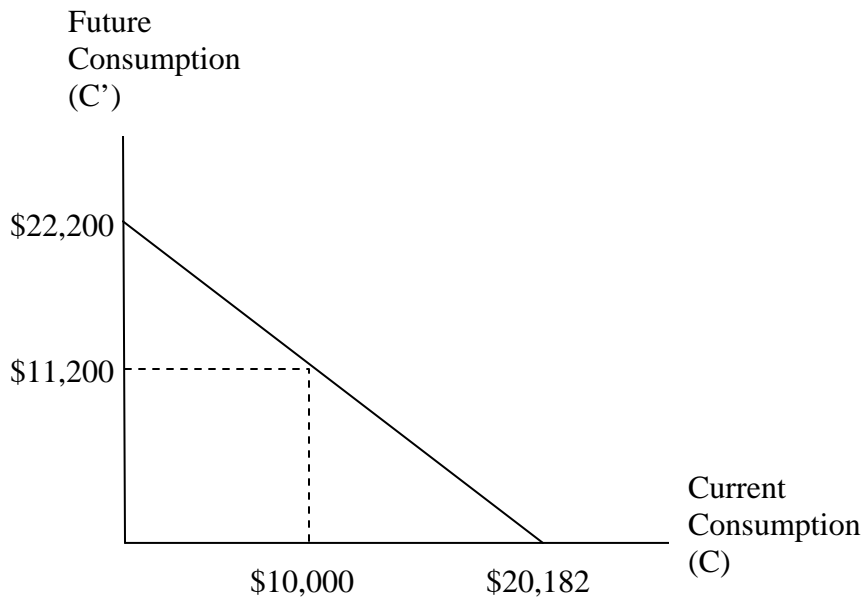
$$Slope = \frac{\$22,200}{\$20,182} = 1.10 = 1 + i$$

Choosing a likely consumption point is somewhat arbitrary – it would depend on individual preferences. I selected (\$10,000, \$11,200) randomly.

$$C = \$10,000$$

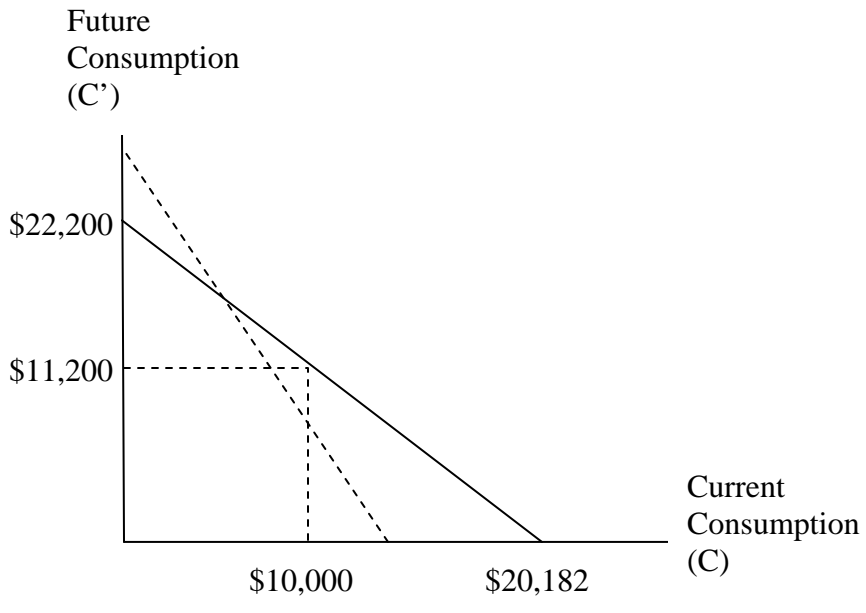
$$S = - \$8,000$$

$$C' = \$20,000 - (\$8,000)(1.10) = \$11,200$$



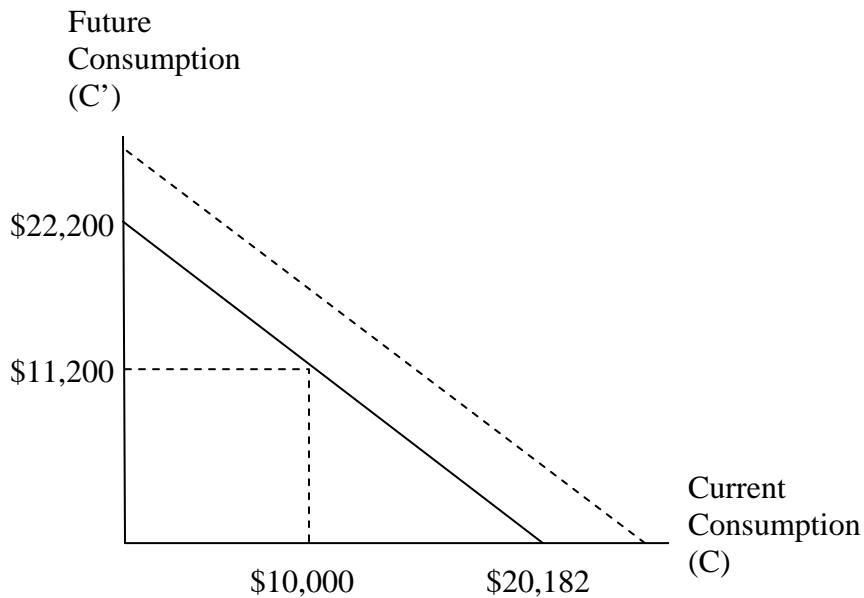
- b) Suppose that the interest rate suddenly increased to 15%. Show the effect of the rise in the interest rate on your budget set. Indicate a new consumption choice on your graph. Explain the reasoning behind your choice. What happens to your savings?

The rise in the interest rate makes current spending more expensive relative to future spending. The horizontal intercept shifts inward while the vertical intercept shifts up (i.e. the constraint rotates around your income point). This creates two possibly offsetting effects. The higher cost of current spending should give you the incentive to save more. However, there is also an income effect. If you are currently saving, the income effect is positive. If you are borrowing the income effect is negative.



- c) Suppose you receive an unexpected inheritance from a long lost Aunt of \$3000. What happens to your current consumption? What happens to your savings? How would your answer change if you didn't expect to receive this inheritance until next year?

The increase in current income shifts your constraint to the right. More than likely, you will use financial markets to spread out this windfall over time (i.e. savings increases).



- 3) Suppose you have the following information for the production of shirts.

# of Sewing Machines	# of Shirts (per year)	MPK	VMPK = P*MPK
1	100	100	200
2	190	90	180
3	270	80	160
4	340	70	140
5	400	60	120
6	450	50	100
7	490	40	80
8	520	30	60
9	540	20	40

10	550	10	20
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The price of a shirt is \$2, and the price of a sewing machine is \$1000. The real interest rate is 5% per year, and sewing machines depreciate at 5% per year.

- a) Calculate the value marginal product of capital (the dollar value of MPK) for sewing machines.

See above chart

- b) Calculate the user cost of sewing machines.

$$UC = P_k(i + \delta) = \$1,000(.05 + .05 = \$100)$$

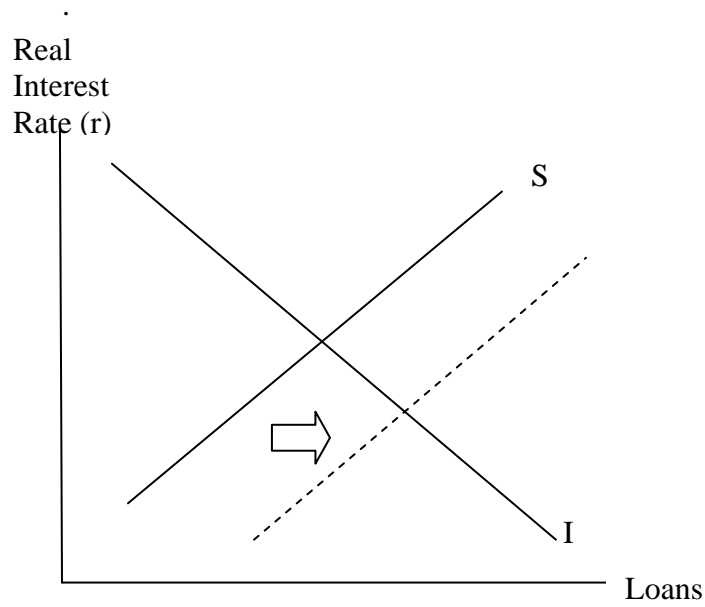
- c) How many sewing machines should the firm purchase?

The firm should purchase 6 machines (VMPK = UC)

4) Certain government regulations tend to reduce the productivity of capital. Show the effects on savings, investment, and the interest rate of the following plans for de-regulation.

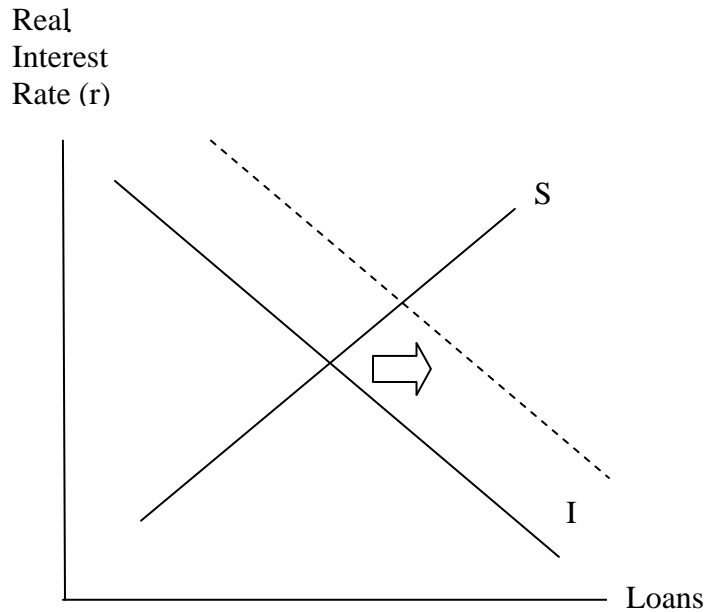
a) A *temporary* easing of regulations.

The temporary productivity improvement increases savings, but not investment. With both the supply of loanable funds increasing, the interest rate decreases, and the quantity of both savings and investment increase.



b) A *permanent* easing of regulations.

The permanent improvement in productivity raises investment demand (i.e. investment shifts left). The increase in income is permanent so savings is unchanged (savings curve doesn't shift). Interest rates rise, investment, and savings increase (movement along the savings curve).



5) Suppose that we have the following yield curve.

Term	Rate
1yr	5%
2yr	5.5%
3yr	6%

a) Calculate the implied forward rates.

Given the current term structure, we can calculate the implied forward rates...

$$F(0,1) = 5\%$$

$$F(1,1) = (1.055)(1.055)/(1.05) = 1.06 = 6\%$$

$$F(2,1) = (1.06)(1.06)(1.06)/(1.055)(1.055) = 1.07 = 7\%$$

- b) During the early 1980's, real interest rates were consistently negative. Remember that a negative real interest rate implies that lenders are being repaid with less purchasing power than they initially loaned out. Why would a lender ever agree to a negative real rate of return?

Negative real interest rates suggest that inflation was underestimated.