ECON 110, Prof. Hogendorn

Problem Set 5

1. *LaborMarket.* Suppose that all firms in the economy have the production function $f(L) = 20L^{1/2}$, and there are 1000 firms. Let L measure hours of labor. Suppose there are 100,000 workers, and each one has a vertical labor supply curve of 8 hours per day. If $p = 10$, what is the equilibrium wage?

2. *USAirways.* In fall 2006, US Airways announced a hostile takeover bid for Delta Air Lines. The investment community and the airline industry responded very positively. Everyone thought that a merger like this would reduce competition and raise profits for *all* airlines, not just the two merging firms.

   (a) With reference to the formula for pricing a stock, did airline stocks rise or fall after the announcement?

   (b) With reference to the formula for pricing a bond, did airline bond yields rise or fall? Did airline bond prices rise or fall? Why?

   (c) Did the news change the coupon payments on airline bonds with a $100 face value issued in August 2006? Is it likely to have changed the coupon payments on airline bonds with a $100 face value issued in December 2006 (i.e. bonds not yet issued at the time of the announcement)? Why?

3. *Jetta.* Suppose you were thinking about buying (with a car loan) or leasing a Volkswagen Jetta.

   Buying with loan: To make this simple, let's assume that each year you pay your entire car payment at the end of the year. Based on

Volkswagen's current financing offer, you would pay $6,186 at the end of year 1, 2, and 3, and then you would own the car. According to the web site, the car will be worth $10,739 at that point.

Leasing: Volkswagen has an offer where you can lease the car with no up-front costs. Again let's make the entire lease payment due at the end of the year, in which case the lease payments are $3,237 at the end of year 1, 2, and 3. After that you just have to give the car back to Volkswagen.

Let's use 5% as the interest rate for this problem.

(a) Write down the formula for the present value of the lease offer, and then find the present value.

(b) Write down the formula for the present value of the buy with loan offer, and then find the present value.

(c) Suppose that you take the buy offer, but then at the end of year 1, right *after* you make the $6,186 payment, you decide to sell the car. The person you sell to will have to pay the remaining two payments. That person gets a value equal to $3,237 in each of the two years from having a car to drive. How much will the buyer pay?

4. *Deflate.* Given the information below about the U.S. economy, how much did real GDP grow between 1980 and 1990? Between 1990 and 2000?

	1980	1985	1990	1995	2000
Nominal GDP (trillions)	2.8	4.21	5.8	7.4	9.96
GDP deflator (1996=100)	57.0	73.7	86.5	98.1	106.9

Review Problem only, not to turn in:

5. *Lula.* Suppose there is a Brazilian government bond with a face value of R$100 (i.e. 100 reals, the currency of Brazil). The bond has a coupon of R$5 and matures in 1 year.

   (a) If the bond's current price is R$80, what is its yield?

   (b) Many investors thought that if Lula da Silva were elected president of Brazil, Brazilian debt would become more risky. Explain what probably happened to the price of Brazilian government bonds when Lula won.

6. *NetAlone.* Suppose netalone.com is an Internet startup that specializes in e-business consulting.

   (a) The following table summarizes the company's projected earnings in the next 5 years:

Year	Earnings
2003	100,000
2004	300,000
2005	500,000
2006	700,000
2007	1,000,000

   The CEO of netalone.com announced that the company was going to issue 10,000,000 shares of common stock and the IPO (initial public offering) price was set at $1 per share. (A share of stock entitles you to a share of ownership of the company, and the company's value is based on its earnings.) Suppose the market discount rate is 10%. Based on the above earnings forecast, will you buy the stock? What do you think is a more reasonable price?

   (b) On the same day, Citibank announced that it was planning to issue corporate bonds that have a face value of $100, a maturity of 5 years, and an annual coupon payment of $6. If the risk

free interest rate is 3% and these bonds require a 2% risk premium, what should be the price of the bond?

7. *UncleKarl.* Your Uncle Karl gives you 20,000 dollars of capital.

   (a) For $1000, you can buy a risk-free government bond with a coupon of $50 (payable at the end of the year), a face value of $1050, and a maturity of one year. What is the yield on this bond?

   (b) Alternatively, you can invest some of the capital in a business venture producing downloadable music. For each dollar of capital invested over the course of one year, do you think it is more reasonable to let your cost of that capital be $0.05, $0.10, or $0.15? Discuss your answer with reference to part (a), assuming you can buy fractional amounts of the bonds.

   (c) To simplify, assume no labor is involved in this business; the only factor is capital. Your production function is $q(K) = 100K^{9/10}$, where output is measured in the number of downloads. You must also use $5,000 more of capital to pay a fixed cost to get started. What are the equations for your total, average, and marginal cost curves, using your answer to (b)? Graph the AC and MC curves.

   (d) If each download brings you revenue of $0.04, how much capital should you invest in this business? Show this on your graph. Do you earn a competitive rate of return on your capital, or do you receive rents?

   ## Answers to Review Problems:

5. *Lula.*

   (a) The formula to use here is
   $$P = \frac{A}{1+i} \qquad R\$80 = \frac{R\$5 + R\$100}{1+i} \Rightarrow 1+i = 1.3125 \Rightarrow i = 31.25\%$$

(b) Investors perceived Lula as risky, and they demanded a higher risk premium on Brazilian government bonds. For an existing bond, the coupon and face value have already been set, so the only way for the yield to rise was for the present value to fall, as shown in the formula above.

6. *NetAlone_a.*

   (a)

   $$PV = \frac{100000}{1.10} + \frac{300000}{1.10^2} + \frac{500000}{1.10^3} + \frac{700000}{1.10^4} + \frac{1000000}{1.10^5} = 1813531$$

   The present value of the earnings per share is thus $0.18. Paying $1 per share is too much unless there will be extremely spectacular growth after 2007. A price of $0.18 per share would be the fair value assuming that earnings beyond 2007 are not counted.

   (b) Let's assume that you don't get the first coupon payment until the end of the year. Then the present value is:

   $$PV = \frac{6}{1.05} + \frac{6}{1.05^2} + \frac{6}{1.05^3} + \frac{6}{1.05^4} + \frac{6 + 100}{1.05^5} = 104.33$$

   If these bonds sell for $104.33 each today, they will yield 5% as required.

7. *UncleKarl_a.*

   (a) Assuming you get paid the coupon at the end of the year, the present value equation is:

   $$1000 = \frac{50}{1+i} + \frac{1050}{1+i} \Rightarrow 1000(1+i) = 1100 \Rightarrow i = 10\%$$

   (b) We know that you can buy a risk-free bond and get a yield of 10%. Therefore any risk-free investment should have a cost of capital of $0.10 per dollar invested. Presumably the online

music business is very risky, so a cost of capital of $0.15 would be more appropriate. (Indeed, a cost of capital of more like $0.40 might be reasonable.)
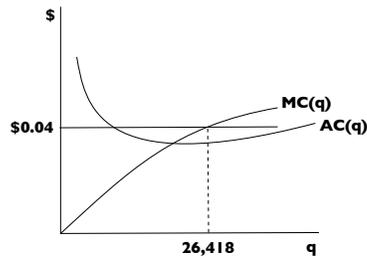
(c) Since $q(K) = 10K^{9/10}$, you need $K(q) = \frac{q}{10}^{10/9}$ units of capital to produce output q. Since capital costs $0.15, and you have an additional fixed cost of $5000 that also comes out of capital, the cost curves are:

$$TC(q) = 0.15 \left(5000 + \frac{q}{10}^{10/9}\right) = 750 + 0.0116q^{10/9}$$
$$AC(q) = \frac{TC(q)}{q} = \frac{750}{q} + 0.0116q^{1/9}$$
$$MC(q) = \frac{dTC(q)}{dq} = 0.0129q^{1/9}$$

If you draw the graph exactly, it is a little strange because marginal cost is concave:

(d) Your profit maximizing quantity is where marginal cost equals price:

$$MC(q) = p \Rightarrow 0.0129q^{1/9} = 0.04 \Rightarrow q^* = 26,418$$

At that quantity, you need to invest $K(26,418) = 6,340$ dollars of capital plus the 5,000 dollar startup cost. Given that your cost of capital is $0.15, your total costs are $1,701. Your total revenue is $pq^* = 0.04 \times 26,418 = \$1,056.72$. Thus you actually lose money on this investment, since your revenues are lower than your costs, including the proper cost of capital. You should buy the bond instead!