

Problem Set 1

Due Friday, February 19

1. BM problem 2.4 (page 31).
2. **Rent vs. Buy**

Suppose that you have found a fantastic apartment in Beacon Hill, and you are trying to decide whether to buy or rent it. In either case, you plan to live in the apartment for only the next two years. The purchase price of the apartment is \$300,000, and the monthly rent is \$1,800. If you buy, you can afford a down payment of \$15,000, and you will take a 30-year mortgage on the remaining balance. You will make the down payment on October 1, 1997, and the first mortgage payment on November 1, 1997. You will sell the apartment on October 1, 1999, and make the last mortgage payment on September 1, 1999. On October 1, 1999 you will pay the remaining balance on the mortgage. If you rent, you will make the first payment on October 1, 1997, and the last payment on September 1, 1999.

- (a) Provide a 23-month amortization table that specifies how much of each mortgage payment goes to interest and how much goes to principal reduction. (See the table on the next page.) Note that this requires you to calculate the monthly payment of the 30-year mortgage. Assume that the effective annual interest rate on the mortgage is 8%.
- (b) To make your decision, you need to consider the costs and benefits associated with home ownership.

Current tax law permits mortgage interest payments to be deducted from your taxable income, which will reduce your tax bill by your marginal tax rate times the total interest you pay in a given year. Assume that your marginal tax rate is 28%. So that you don't have to worry about issues related to withholding, assume that you pay your taxes for the previous year on April 1. (For example, this assumption implies that you will pay your 1997 taxes on April 1, 1998.) Note that this may require you to consider cash flows that extend beyond the 2-year horizon.

Because the real estate market in Beacon Hill is so good, you expect to be able to sell your house for \$320,000 two years from now. Normally you would need to pay taxes on capital gains, but current tax law allows you to "rollover" these

gains into a new home as long as you satisfy certain requirements¹. This means that we can safely ignore the taxes on your expected gain for the purposes of our calculations.

When you sell your apartment, the broker will take approximately 5% of the selling price as a commission. Buyers do not usually pay this commission because brokers typically represent the seller's interests and not the buyer's.

There are other costs that should be considered as well, such as property taxes, repair costs, insurance, etc. While these costs are typically nontrivial, we will ignore them for simplicity.

On the basis of the information given, use NPV analysis to guide your decision of whether to rent or buy. Use a discount rate of 8% for all cash flows.

(c) What monthly rent makes you indifferent between buying and renting?

Month	Monthly Payment	Outstanding Principal	Interest	Principal Reduction	Outstanding Principal After Payment
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					

¹For example, for the past several years, one could avoid these taxes by purchasing a more expensive home. Recent tax law changes will make it even easier to avoid these taxes.

3. Viatical Insurance Companies

Viatication permits terminally ill people to acquire the benefits of their life insurance policies before they die. Normally, a \$50,000 life insurance policy, for example, would pay \$50,000 to a designated beneficiary upon a person's death in exchange for a specified monthly premium (payment), say \$150 per month. However, a terminally ill person may have "last wishes" or other expenses they need to meet, so they may consider selling (viaticating) their life insurance while they are still alive.

Once a doctor certifies that a person is dying and estimates their life expectancy, a viatical insurance company will offer that person a certain percentage of the benefit (the \$50,000 in the example above) payable today in exchange for being the beneficiary of the policy. The viatical insurance company typically assumes the policy payments (the \$150 in the example above), and it also bears the risk that the person will live longer than expected. Some recent figures include 69% of the benefit for persons who are expected to live 3 years and 80% for people who are expected to live 9 months or less.

- (a) Explain why the percentage paid by the viatical insurance company decreases as a person's life expectancy increases (all else equal).
- (b) Suppose that a viatical insurance company offers a dying patient \$15,000 for a \$20,000 life insurance policy. The policy costs \$75 per month. What is the company's internal rate of return (IRR) if the patient dies in one year? What is the company's IRR if the patient dies in two years? Assume that the premium is due at the beginning of each month and that the patient dies at the end of the month. Express rates of return as EAR's.
- (c) Suppose that the company wants an IRR of 15% if the person lives for one year, which is the person's life expectancy. How much is the company willing to pay on a \$50,000 policy that costs \$200 per month?

4. Asset-Backed Bonds

Investment bankers often look for stable sources of cash flow that can be bundled together in the form of bonds and sold for cash today. These bonds are called *asset-backed bonds* because their values depend on the underlying assets. For example, British rocker David Bowie recently sold some of his future royalties from his music collection for \$55 million to Prudential Insurance Co. In this case, the underlying asset is the legal right to the future royalties from Bowie's music. Many predict that Bowie's deal will start a trend of similar deals.

- (a) Which would make a better asset-backed bond: the future royalties of Crosby, Stills, & Nash or the future endorsement revenue of Tiger Woods? Explain.
- (b) Suppose that Elton John decides to enter into an asset-backed bond deal. He wants to obtain \$100 million today in exchange for a yearly fixed payment taken from his royalties over the next 10 years. What is the minimum amount his royalties must be to make the fixed payments if investors require a 7.5% return? Assume that the first payment is one year from today.

- (c) The Rolling Stones anticipate being able to generate at least \$15 million in royalties each year forever. How much would investors pay for this cash flow if they require a 7.0% return?

5. IRA Accounts

An Individual Retirement Account (IRA) allows you to set aside a limited amount of money each year for retirement. These funds will have a special tax status that depends on several factors.²

Suppose that you have \$2,000 in pretax income to contribute to the IRA at the end of each year. You will retire in 30 years, and your marginal tax rate will be 28% for all years. Suppose that the account returns a fixed 6% each year until you retire. For simplicity, assume that you withdraw all money at your retirement, and any tax-deferred income is taxed at that time.

- How much money will you have in 30 years if neither the contribution nor the interest income is tax-deferred?
- How much money will you have in 30 years if the contribution is not tax-deferred but the interest income is?
- How much money will you have in 30 years if both the contribution and the interest income are tax-deferred?
- Would you expect the benefit of tax deferral to increase or decrease as the tax rate increases? Why?

6. Project Decisions

As the chief financial officer of a civil engineering company, you are offered a contract by the Department of Transportation (DOT) to reconstruct and upgrade the highway network linking several terminals of a major airport and connecting the entire complex with the city. The terms of the contract are as follows:

The DOT would advance 15 percent of the total value (\$16.8 million) at the signing of the contract. The company could then bill the DOT according to the following schedule (each payment is made at the end of the year):

Year 1	\$1,100,000
Year 2	\$4,300,000
Year 3	\$4,800,000
Year 4	\$3,900,000
Year 5	\$2,700,000

The DOT would pay 80 percent of each bill received. The 20 percent deduction would be withheld for

- the recovery of the advance payment (15 percent), and

²These factors include your marital status, whether you have other sources of retirement savings, your income, etc.

- the accumulation of a retention fund (5 percent).

Half of the amount accumulated in the retention fund would be reimbursed at the time of completion (end of year 5). The second half would be repaid at the end of year 6, provided the roads did not show major flaws in their first year of use.

For the company to proceed, equipment would have to be ordered immediately so it would be available at the signing of the contract, when earth-moving would commence. The cost of the equipment would be \$4.6 million with payment due upon delivery. At the end of the project, the equipment would have no salvage value. The engineering department estimates that the cost of completing the project (not including the equipment) would be \$10.8 million. Preliminary site work would require \$700,000 to be expended by the end of year 1. The project would then proceed at estimated costs of \$2.8 million, \$3.1 million, \$2.5 million, and \$1.7 million for the subsequent years.

Write down the cash flows for the construction project year-by-year:

	COSTS	REVENUES	NET CASH FLOW
Year 0			
Year 1			
Year 2			
Year 3			
Year 4			
Year 5			
Year 6			

Using a discount factor of 12%, calculate the NPV of the project. Should the company take the contract?

The assistant to the Chief Financial Officer has decided to calculate the project's internal rate of return, the payback of the project, and the discounted payback. What are these figures? Based on these figures, will the assistant make a different recommendation? Assume a payback period of 5 years.

Suppose that instead of having to pay the entire cost of the machine now, you can pay \$3.6 million now and \$1.13 million at the end of year 1. What is the internal rate of return of this project? Should you take this payment plan or the original payment plan?