



Nisan Langberg
Corporate Finance FINA4330

Problem Set #2
Valuation - Known Cash Flows (continued)

Start by solving the practice questions in chapter 3 (page 53): 14 (a,b,c), 17, 18, 20, 23, 25.

1. **[Compounded Interest Rate]** You are planning to invest some money with one of your local financial institutions. One is offering an annual percentage rate (APR) of 6% compounded semi-annually, a second institution is offering an APR of 5.95% compounded monthly and a third is offering 5.9% with daily compounding. Rank these three alternative investment projects.

2. **[Arbitrage]** With Bank A you can borrow at an interest rate of 8% up to \$2,500. You've noticed that a 1-year government bond that promises a payment of \$100 in one year from today is selling at \$90.
 - a) Can you make an arbitrage profit (show transactions in detail)?
 - b) Your broker charges a fee of \$100 (paid at the end of the year) for any size transaction (regardless of the amount of government bonds you ask for). Can you still make an arbitrage? If not, then what size credit from Bank A would provide you with an arbitrage opportunity?

3. **[Car loan LA Times example]** You have decided to purchase a new car. The price of the car is \$8,239.05 and the dealer is offering you financing. That is, you may choose not to pay anything upon purchase ("no down payment") and instead pay a stream of fixed payments at the end of each month for duration of four years or 48 months. The interest rate charged by the dealer is 14.2% APR compounded monthly. Suppose that you can save your funds in a money market account (bank account) that yields 8% APR compounded monthly.

- a) Calculate the monthly payment charged by the dealer.
- b) How much would you need to invest currently in the money market account (that yields 8%) in order to exactly finance the payments required by the dealer? That is, you deposit money in your account today and each month you withdraw the required amount to cover the payment to the dealer, such that after the last payment is made (that is, after four years) you will have nothing left in your account.
- c) If you could choose between paying for the car and taking a loan from the dealer what would you do?
- d) Read the article from the *Los Angeles Times*, attached below. Do you think it is correct?

SHOULD YOU PAY CASH FOR A NEW CAR?

By S.J. Diamond, Reprinted in the NEWS-SUN, Saturday/Sunday, September 28-29, 1985

AT FIRST, psychology Professor Geoffrey Keppel of Berkeley, Calif., rejected out of hand his Toyota dealer's offer of financing: He had saved up the price of a new Corolla and, like many people, didn't want a loan because "that's the way I'd been brought up." The dealer even told him he could earn more on the same \$8,300 in an 8 percent certificate of deposit than he'd pay out on a 14.2 percent car loan, "but you just don't believe it," he says. "It's counter-intuitive: Anyone can see 14 is bigger than 8."

He's not unusual. Many people who spend their adult lives avoiding debt have heard from (usually richer) friends that it's generally better to spend borrowed money than savings, but they can never clearly see why, particularly when loan rates are higher than investment yields. What's more, Keppel says, "when you've just spent several hours nickel-and-diming with the auto dealer, you're not inclined to jump when they say they have another good deal for you."

That night, however, Keppel awoke and went to his computer to "work it out for myself, month by month." Calculating different investment yields and weighing them against the total interest that he'd pay on the 14.2% loan, he saw that he'd break even with only a 7 percent investment, and, if he could earn 10 percent, he'd make almost \$1,500.

A COUPLE of points must be interjected here. First of all, this seems a rather exclusive quandary, the concern only of affluent people who have the option of paying outright for their car. But it really isn't. According to J.D. Power & Associates, an automotive market research firm, one-third of the people who buy cars do pay cash and some of the two-thirds who don't probably could.

Second, it's a quandary only today's affluent can easily solve: Yesterday's consumers didn't have the calculators and personal computers for such analysis, and it's laborious to work out by hand.

They might otherwise have seen the advantage in borrowing without taking anyone's word for it. Keppel, for example, calculated that 48 months of interest on a 14.2 percent loan of \$8,239.05 would be \$2,607.62, while the same principal invested at 8 percent, compounded monthly would earn

interest of \$3,095.06 --- a profit of \$487.44.

Tracing both transactions month by month, he could also see that the reason it worked to his advantage was that "the 14 percent is applied to a declining balance and the 8 percent is on an increasing balance." Indeed, over four years, the average outstanding balance of the loan --- the average amount on which he'd be paying interest --- was only about half the total amount borrowed. His investment, on the other hand, would earn interest on his full deposited principal, plus continually compounded interest throughout the term.

GENERALLY SPEAKING, "an easy rule of thumb is if you can earn an interest rate equivalent to half the interest rate on your loan, you'll come out ahead," says Frank Sperling, vice president at Security Pacific National Bank.

This formula, admittedly rough, doesn't take into account the tax advantage of a loan --- all those deductible interest payments --- and rightly so, because it's balanced by the tax liability on the interest earned. If one earns more interest than one pays out, of course, income taxes would cut the gross advantage (unless one found a tax-free investment), but it would remain an advantage.

Moreover, the principle at work here does assume certain factors. The consumer doesn't have to be in any particular tax bracket, but he does, Sperling says, "have to be in a position to itemize his taxes," or the tax on earnings wouldn't be balanced by any deductions for loan interest. More fundamental, he must really have the money for that car, and it must actually be put aside and invested. It's the old rule, Sperling says, that "you have to have money to make money."

The same analysis, including the same assumptions could probably be applied to any consumer loan, with Sperling's Rule a good guide to potential consumer advantage. Certain other items, however, may deserve consideration.

A home equity loan, for example could look good by Sperling's Rule, given fixed interest rates similar to regular auto loan rates, but such loans are essentially mortgages and may levy extra charges for property appraisals, document work and title searches.

Los Angeles Times

4. **[Inflation]** Ms. Wells has a child and wishes to begin saving for Junior's college expenses.

Junior will enter college in six years. Assume that Junior will spend 4 years in college, that the real (i.e., inflation adjusted) annual cost of a college education will remain at \$24,000, that the nominal interest rate is 7.1%, that the expected rate of inflation is 5.0%, and that the first college payment is due at time 6 and the last payment is due at time 9. Ms. Wells wants to make 9 annual investments (beginning one year from now and ending 9 years from now) such that the savings will cover the cost of college. Her first investment (at 1) will be \$A (in real terms) and subsequent investments will grow (in real terms) by 1% per year.

- a) What initial (real) investment, **A**, will be required, at time 1, if Ms. Wells wishes to exactly cover the college expenses? Show your logic.
- b) What is the (real) amount of your last investment, in year 9?
- c) What is the nominal amount invested in year 1 and in year 9?

5. **[Bonus question]** The average base salary for graduating students at the Bauer College of Business (finance major) is \$42,825. The average salary of workers (at about age 25) with only a high school diploma is \$20,000 lower. Calculate the financial benefit of a college diploma according to the above data, for an individual graduating at age 25 (working until age 65). In your calculations suppose that real salaries grow at an annual rate of 1%, and suppose a real interest rate of 4%. Do you think that your calculation overstates or understates the true average benefit from a college degree (hint – (a) what if more talented (and more productive) individuals are likely to choose to go to college, and (b) what if individuals that are likely to benefit the most from a college degree choose to go to college)?