

Chapter 4 – Discounted Cash Flow Valuation

Annuities

Suppose you are offered \$10,000 per year for three years. If the interest rate is 10 percent, what is the value of the cash flows today?

Annuity due

Suppose the annuity payments of \$10,000 begin today. What is the value of the cash flows now?

Future Value of Annuities

You are planning to save \$5,000 per year for the next 30 years toward retirement with the first payment occurring one year from today. If you can earn an 11 percent interest rate, what will the value of your retirement portfolio be?

Future Value of Annuities Due

Suppose the first payment on the previous annuity is today. What is the value of your retirement account now?

Annuities

You will receive \$50,000 per year for 10 years with the first payment occurring 7 years from today. If the appropriate interest rate is 9 percent, what is the value of the cash flows today?

Comparing Cash Flows

Suppose a quarterback and wide receiver have both signed new contracts. The quarterback's contract calls for an immediate signing bonus of \$6 million and an annual salary of \$4 million for three years. The wide receiver's contract calls for a signing bonus of \$3.5 million and an annual salary of \$5 million for three years. Assuming all salary payments are at the end of the year and the interest rate is 18 percent, which contract is worth more?

$$\text{EAR} = \left[1 + \frac{\text{APR}}{m} \right]^m - 1$$

EAR vs APR

Your Uncle Fester has just won the lottery. Because of his new wealth, people are now approaching him with schemes that they say will make him even wealthier. Fester is not the brightest bulb in the pack, but he is smart enough to ask for your help. He has just been approached with the following investment: If he invests \$100,000 today, he will receive cash flows of \$10,000 in one year, \$20,000 a year for the next four years and \$30,000 in the sixth year. All cash flows are at the end of the year. Alternatively, Fester could invest the money in a CD that will pay 6% compounded quarterly. From a purely financial perspective, what would you recommend to your Uncle Fester?

Annuities

You have decided to get a new car and are deciding whether to lease the car or purchase it on a 4-year loan. The car you wish to buy costs \$40,000. The dealer has a leasing arrangement where you pay \$3,000 today and \$580 per month for the next two years. If you purchase the car, you will pay it off in monthly payments over the next four years at a 7% APR. You believe that you will be able to sell the car for \$29,000 in two years. Should you buy or lease the car? What is the break-even resale price in two years such that you would be indifferent between buying and leasing?

Perpetuities

You will receive \$75,000 per year forever with the first payment occurring one year from today. If the interest rate is 6 percent, what is the value of the perpetuity today?

Perpetuities

Suppose the perpetuity payments in the previous problem start 9 years from today. What is the value of the cash flows now?

Growing Perpetuities

You will receive perpetuity with a payment of \$10,000 next year. The payment will grow by 2.5 percent per year forever. If the appropriate interest rate is 8 percent, what is the value of the cash flows today?

Growing Perpetuities

You want to buy a song catalog. The royalties next year will be \$1 million, and are expected to decrease by 8 percent per year indefinitely. If you want a 13 percent return, what is the most you should pay for the catalog?

Growing Annuities

Suppose you will receive a payment of \$20,000 next year. You will receive 15 payments, and the payments will grow by 5 percent per year. If the appropriate interest rate is 12 percent, what is the present value?

$$PV = C \left[\frac{1}{r-g} - \frac{1}{r-g} \times \left(\frac{1+g}{1+r} \right)^T \right] = C \left[\frac{1 - \left(\frac{1+g}{1+r} \right)^T}{r-g} \right]$$

Growing Annuities

You have just had a child and are planning for your child's college fund. Your child will attend college 18 years from today and the tuition and expenses are due at the beginning of the semester. You anticipate that the cost of college will be \$65,000 per year in 18 years and will increase at 5 percent per year. You plan to make payment each year for the next 18 years on your child's birthday. On the date of the last deposit, you will make the first withdrawal. You plan to increase your deposits by 4 percent per year. If you can earn an 11 percent rate of return, what is the amount of your first deposit?

Loan Amortization

Pure Discount Loan

You take out a four-year loan for \$100,000 (you will receive that amount today) and will repay that amount with one payment at the end of the loan. If the interest rate is 8 percent, what are the cash flows?

Interest Only Loan

You take out a four-year loan for \$100,000 and will repay the interest every year, and repay the principal at the end of the loan. If the interest rate is 8 percent, what are the cash flows?

Equal Payment

You take out a four-year loan for \$100,000 and will repay the loan with four annual payments of equal amount. If the interest rate is 8 percent, what are the cash flows?

	Beginning balance	Total payment	Interest paid	Principal payment	Ending balance
1	\$100,000.00	\$30,192.08	\$8,000.00	\$22,192.08	\$77,807.92
2	77,807.92	30,192.08	6,224.63	23,967.45	53,840.47
3	53,840.47	30,192.08	4,307.24	25,884.84	27,955.63
4	27,955.63	30,192.08	2,236.45	27,955.63	0.00
		\$120,768.32	\$20,768.32		

Equal Principal

You take out a four-year loan for \$100,000 and will repay the principal four equal annual payments, plus interest. If the interest rate is 8 percent, what are the cash flows?

	Beginning balance	Principal payment	Interest paid	Total payment	Ending balance
1	\$100,000.00	\$25,000.00	\$8,000.00	\$33,000.00	\$75,000.00
2	75,000.00	25,000.00	6,000.00	31,000.00	50,000.00
3	50,000.00	25,000.00	4,000.00	29,000.00	25,000.00
4	25,000.00	25,000.00	2,000.00	27,000.00	0.00
			<u>\$20,000.00</u>	<u>\$120,000.00</u>	

Balloon Payment (or Bullet Loan)

You take out a 30-year mortgage for \$10 million with monthly payments at an 8 percent APR. The loan calls for a balloon payment after 5 years. What is the amount of the balloon payment?

Inflation (or Why Inflation Doesn't Matter)

Today

Interest rate

One year

What was your rate of return?

The Fisher Effect

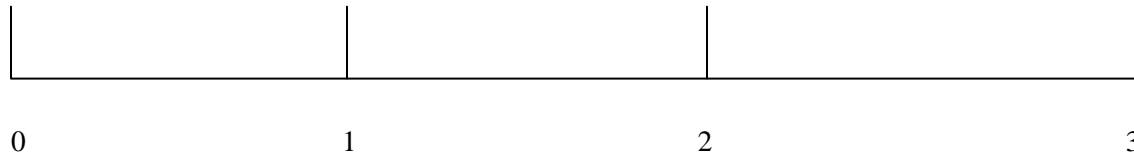
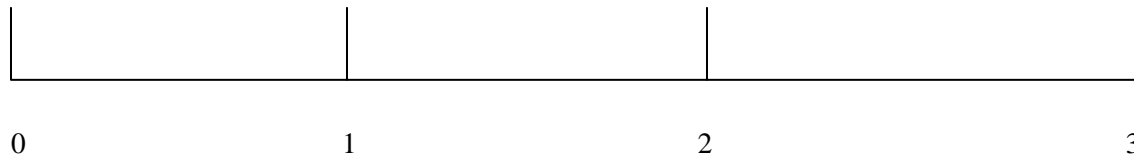
$$(1 + R) = (1 + r)(1 + h)$$

Approximate Fisher Effect

$$R \approx r + h$$

Question

You want to buy a motorcycle one year from now, two years from now, and three years from now. The motorcycle currently costs \$20,000. You can earn a 10 percent return, and the price of the motorcycle will increase at 4 percent per year. How much do you have to deposit today in order to be able to pay cash for each motorcycle?

Nominal cash flowsReal cash flows

Real Cash Flows

You have thirty years left until you retire. After you retire, you want to withdraw \$6,000 per month in real terms for 25 years. When you retire you will be able to earn an 8 percent nominal EAR. To fund your retirement, you currently have \$30,000 in an account that you feel will earn a 12 percent nominal EAR. Additionally, you plan to make monthly deposits into your account to fund your retirement for the next 30 years. You feel that the inflation rate over the next 55 years will be 4.5 percent. How much must you deposit each month in your account to accomplish your goal? What is the amount of your last deposit in nominal terms?

Effective Interest Rates

You have just won the Joe SchmoTM lottery. The payments will be \$250,000 every three years with the first payment occurring 2 years from today. If the appropriate interest rate is a 10 percent APR compounded daily, what is the present value of your winnings?

Real Cash Flows

Ben Bates graduated from college six years ago with a Finance degree. Although he is satisfied with his current job, his goal is to become an investment banker. He feels that a MBA degree would allow him to achieve this goal. Ben currently works at the money management firm of Dewey, Cheatum, and Howe. His annual salary at the firm is \$62,000 per year. He is currently 28 years old and expects to work for 35 more years. The MBA degree requires two years of full-time enrollment at the university, and he will not be able to work during this time. The annual tuition is \$60,000, payable at the beginning of each school year. When Ben enrolls, his tuition is guaranteed not to increase for his second year. Ben believes that after graduation, he will receive a job offer for \$95,000 per year, with a \$15,000 signing bonus. (The salary and bonus are in real dollars.) His salary at both companies will increase at the 4 percent effective annual inflation rate. Assume his salary is paid at the end of the month. If the appropriate rate is a 9 percent effective annual rate in nominal terms, what is the better choice from a purely financial perspective?