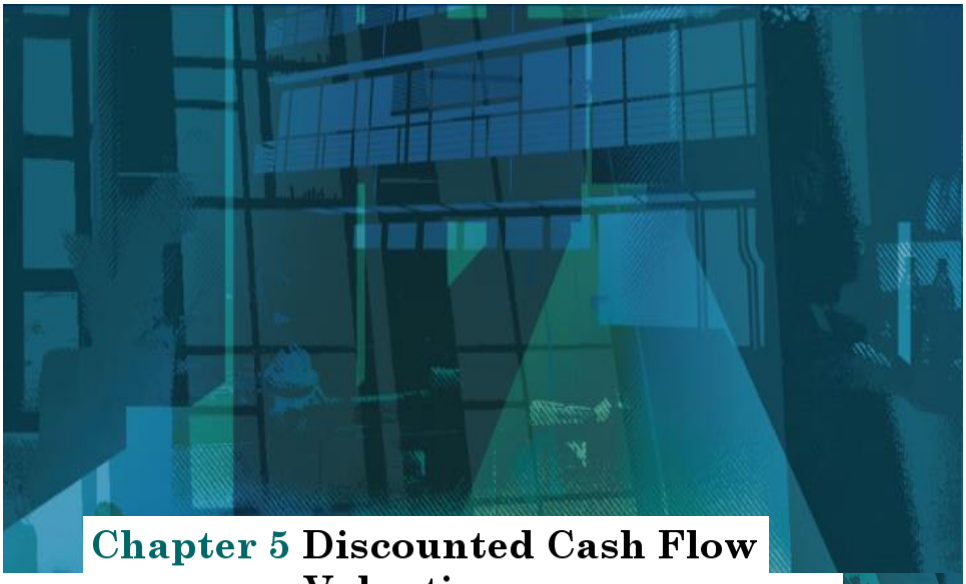


Chapter 5 Discounted Cash Flow Valuation

Key Concepts and Skills

After studying this chapter, you should be able to:

- Determine the future value and present value of investments with multiple cash flows.
- Calculate loan payments, and find the interest rate on a loan.
- Describe how loans are amortized or paid off.
- Explain how interest rates are quoted (and misquoted).

Chapter Outline

5.1 Future and Present Values of Multiple Cash Flows

5.2 Valuing Level Cash Flows: Annuities and Perpetuities

5.3 Comparing Rates: The Effect of Compounding Periods

5.4 Loan Types and Loan Amortization

Multiple Cash Flows
Computational Methods

- TVM Formulas
- Texas Instruments BA II+
  - PV/FV keys
  - Cash Flow Worksheet
    - Present Value only
- Excel Spreadsheet/Functions

Future Value: Multiple Cash Flows
Example 5.1

- You think you will be able to deposit $4,000 at the end of each of the next three years in a bank account paying 8 percent interest.
- You currently have $7,000 in the account.
- How much will you have in 3 years?
- How much in 4 years?

Future Value: Multiple Cash Flows
Example 5.1 - Formulas

- Find the value at year 3 of each cash flow and add them together.
  - Year 0: FV = $7,000(1.08)^3 = $ 8,817.98
  - Year 1: FV = $4,000(1.08)^2 = $ 4,665.60
  - Year 2: FV = $4,000(1.08)^1 = $ 4,320.00
  - Year 3: value = $ 4,000.00
  - Total value in 3 years = $21,803.58

- Value at year 4 = $21,803.58(1.08)= $23,547.87

Calculator and Excel Solution

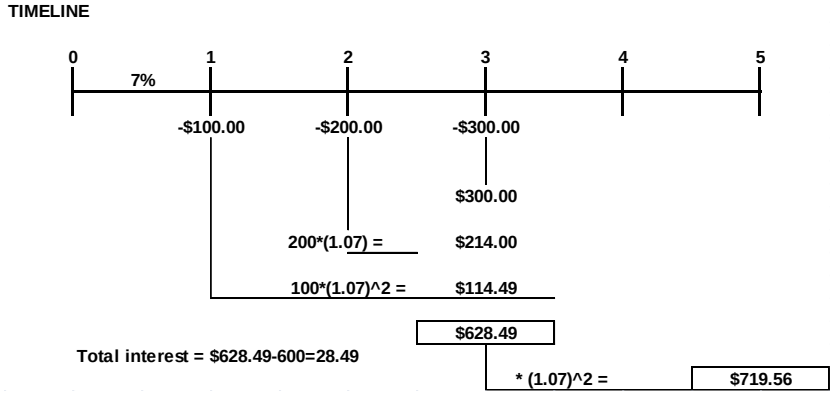
Future Value: Multiple Cash Flows

Example 5.2

- If you deposit $100 in one year, $200 in two years and $300 in three years.
- How much will you have in three years at 7 percent interest?
- How much in five years if you don't add additional amounts?
  - Year 1 CF: 2 N; -100 PV; 7 I/Y; CPT FV = 114.49
  - Year 2 CF: 1 N; -200 PV; 7 I/Y; CPT FV = 214.00
  - Year 3 CF: 0 N; -300 PV; 7 I/Y; CPT FV = 300.00
  - Total FV_3 = 628.49
  - Total $FV_5 = 628.49 * (1.07)^2 = 719.56$

Future Value: Multiple Uneven Cash Flows

Example 5.2 – Formulas & Time Line



Future Value: Multiple Cash Flows
Example 5.2

Rate	7%			
Year	Nper	CF	FV	Function
1	2	-100	$114.49	=FV(0.07,2,0,-100)
2	1	-200	$214.00	=FV(0.07,1,0,-200)
3	0	-300	$300.00	=FV(0.07,0,0,-300)
Total FV at Year 3			$628.49	
Total FV at Year 5			$719.56	=(628.49)*(1.07)^2

Future Value: Multiple Cash Flows
Example

- Suppose you invest $500 in a mutual fund today and $600 in one year.
- If the fund pays 9% annually, how much will you have in two years?

FV = $ 500 x $(1.09)^2$ = $ 594.05
+ $ 600 x (1.09) = $ 654.00
= $1,248.05

Example Continued

- How much will you have in 5 years if you make no further deposits?
- First way:
  - FV = $500(1.09)^5 + $600(1.09)^4 = $1,616.26
- Second way – use value at year 2:
  - FV = $1,248.05(1.09)^3 = $1,616.26

Calculator and Excel Solution

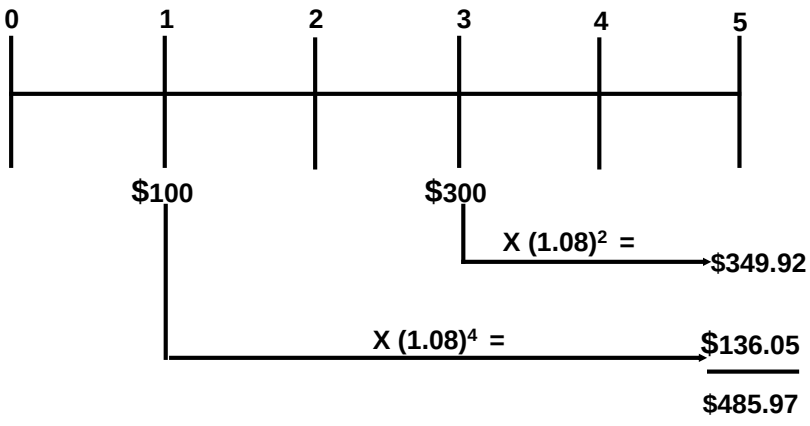
Future Value: Multiple Cash Flows
Example 3 - Formula

- Suppose you plan to deposit $100 into an account in one year and $300 into the account in three years.
- How much will be in the account in five years if the interest rate is 8%?

FV = $100(1.08)^4 + $300(1.08)^2 = $136.05 + $349.92 = $485.97

Calculator and Excel Solution

Example 3 Time Line



Present Value: Multiple Cash Flows
Example 5.3

– You are offered an investment that will pay
- $200 in year 1,
- $400 the next year,
- $600 the following year, and
- $800 at the end of the 4th year.
- You can earn 12 percent on similar investments.
- What is the most you should pay for this one?

Present Value: Multiple Cash Flows

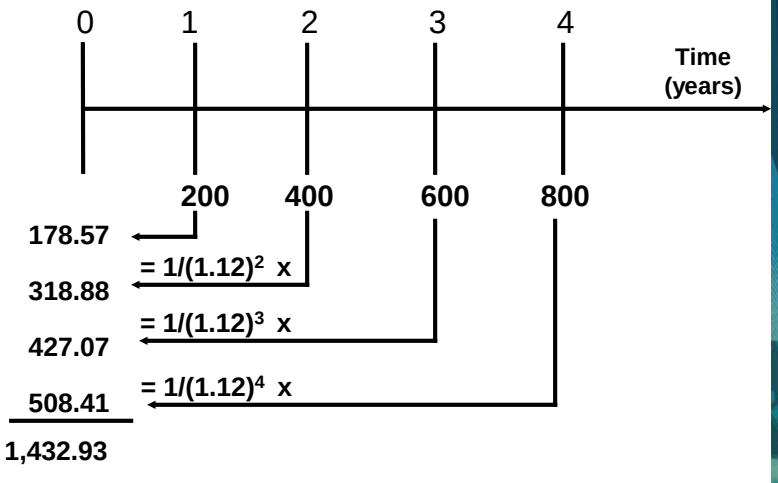
Example 5.3 - Formula

Find the PV of each cash flow and add them:

- Year 1 CF: $200 / $(1.12)^1$ = $ 178.57
- Year 2 CF: $400 / $(1.12)^2$ = $ 318.88
- Year 3 CF: $600 / $(1.12)^3$ = $ 427.07
- Year 4 CF: $800 / $(1.12)^4$ = $ 508.41
- Total PV = $1,432.93

Calculator and Excel Solution

Example 5.3 Time Line



Multiple Uneven Cash Flows
TI BAII + CF Worksheet

- Clear all:
  - Press ***CF***
  - Then ***2nd***
  - Then ***CE/C***
- CF_0 is displayed as **0.00**
- Enter the Period 0 cash flow
  - If an outflow, press ***+/–*** to change the sign
- To enter the figure in the cash flow register, press ***ENTER***

TI BAII+: Uneven Cash Flows

- Press the down arrow to move to the next cash flow register
- Enter the cash flow amount, press ***ENTER*** and the down arrow to move to the cash flow counter (**Fnn**)
- The default counter value is "**1**"
  - To accept the value of "1", press the down arrow again
  - To change the counter, enter the correct count, press ***ENTER*** and then the down arrow

TI BAII+: Uneven Cash Flows

- Repeat for all cash flows, in order.
- To find NPV:
  - Press ***NPV***: I appears on the screen.
  - Enter the interest rate, press ***ENTER***, and then the down arrow to display NPV.
  - Press ***CPT***.

TI BAII+: Uneven Cash Flows

Cash Flows:

CF0	**=**	**0**
CF1	**=**	**200**
CF2	**=**	**400**
CF3	**=**	**600**
CF4	**=**	**800**

Excel Solution

Display	*You Enter*
	CF 2nd CE/C
C00	***0 ENTER***
C01	***200 ENTER***
F01	***1 ENTER***
C02	***400 ENTER***
F02	***1 ENTER***
C03	***600 ENTER***
F03	***1 ENTER***
C04	***800 ENTER***
F04	***1 ENTER NPV***
I	***12 ENTER down***
NPV	***CPT***
1432.93	

Present Value: Multiple Cash Flows
Another Example – Formula Solution

- You are considering an investment that will pay you $1,000 in one year, $2,000 in two years and $3,000 in three years.
- If you want to earn 10% on your money, how much would you be willing to pay?
  - PV = $1,000 / $(1.1)^1$ = $ 909.09
  - PV = $2,000 / $(1.1)^2$ = $1,652.89
  - PV = $3,000 / $(1.1)^3$ = $2,253.94
  - PV = $4,815.92

Calculator and Excel Solution

Decisions, Decisions

- Your broker calls you and tells you that he has this great investment opportunity.
- If you invest $100 today, you will receive $40 in one year and $75 in two years.
- If you require a 15% return on investments of this risk, should you take the investment?
- No – the broker is charging more than you would be willing to pay.

Use cash flow keys:

	CF
	2nd CE/C
CF0	*0 ENTER*
C01	*40 ENTER*
F01	*1 ENTER*
C02	*75 ENTER*
F02	*1 ENTER*
	NPV
I	*15 ENTER*
	DOWN CPT
91.49	

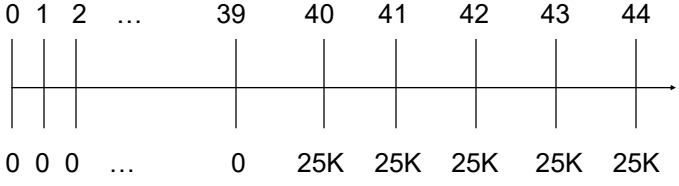
Saving For Retirement

- You are offered the opportunity to put some money away for retirement. You will receive five annual payments of $25,000 each beginning in 40 years.

  How much would you be willing to invest today if you desire an interest rate of 12%?

Use cash flow keys:	
	CF
	2nd CE/C
CF0	*0 ENTER*
C01	*0 ENTER*
F01	*39 ENTER*
C02	*25000 ENTER*
F02	*5 ENTER*
	NPV
I	*12 ENTER*
	DOWN
	CPT
1084.71	

Saving For Retirement Time Line



Notice that the year 0 cash flow = 0 ($CF_0 = 0$)

Cash flows years 1–39 = 0 (C01 = 0; F01 = 39)

Cash flows years 40–44 = 25,000 (C02 = 25,000; F02 = 5)

Quick Quiz: Part 1

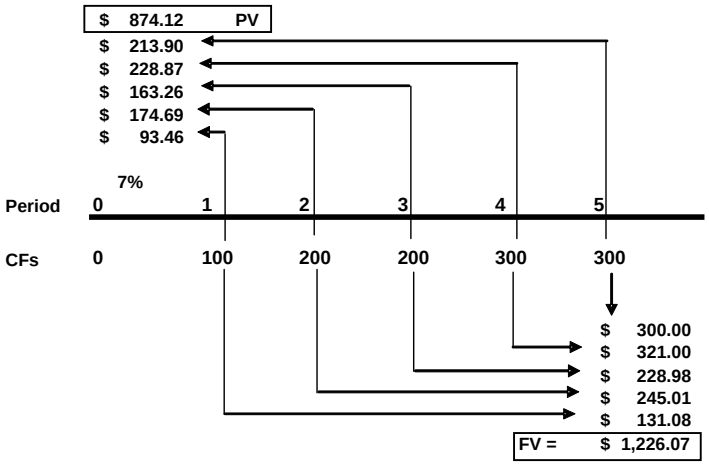
- Suppose you are looking at the following possible cash flows:
  - Year 1 CF = $100;
  - Years 2 and 3 CFs = $200;
  - Years 4 and 5 CFs = $300.
  - The required discount rate is 7%
- What is the value of the CFs at year 5?
- What is the value of the CFs today?

Calculator Solution

Quick Quiz: Part 1 – Excel Solution

	A	B	C	D	E
1	Chapter 5 - Quick Quiz 1				
2		Rate	7%		
3	Year	Nper	CF	PV	Formula
4	1	1	100	$93.46	=-PV(C2,A4,0,C4)
5	2	2	200	$174.69	=-PV(C2,A5,0,C5)
6	3	3	200	$163.26	=-PV(C2,A6,0,C6)
7	4	4	300	$228.87	=-PV(C2,A7,0,C7)
8	5	5	300	$213.90	=-PV(C2,A8,0,C8)
9			Total PV	**$874.17**	=SUM(C4:C8)
10					
11	Year	Nper	CF	FV	Year
12	1	4	100	$131.08	=-FV(C2,B12,0,C12)
13	2	3	200	$245.01	=-FV(C2,B13,0,C13)
14	3	2	200	$228.98	=-FV(C2,B14,0,C14)
15	4	1	300	$321.00	=-FV(C2,B15,0,C15)
16	5	0	300	$300.00	=-FV(C2,B16,0,C16)
17			Total FV	**$1,226.07**	=SUM(C12:C16)

Chapter 5 – Quick Quiz: Part 1



Annuities and Perpetuities

- **Annuity** – finite series of equal payments that occur at regular intervals
  - If the first payment occurs at the end of the period, it is called an *ordinary annuity*
  - If the first payment occurs at the beginning of the period, it is called an *annuity due*
- **Perpetuity** – infinite series of equal payments.

Annuities and Perpetuities
Basic Formulas

- Perpetuity: PV = PMT / r
- Annuities:

$$PV = PMT\left[\frac{1-\frac{1}{(1+r)^t}}{r}\right]$$

$$FV = PMT\left[\frac{(1+r)^t-1}{r}\right]$$

Annuities and the Calculator

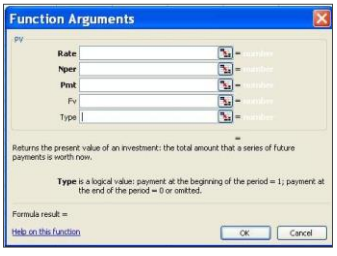
- The ***PMT*** key on the calculator is used for the equal payment
- The sign convention still holds
- Ordinary annuity versus Annuity due
  - Switch your calculator between the two types (next slide)
  - If you see "**BGN**" or "**Begin**" in the display of your calculator, you have it set for an annuity due
  - Most problems are ordinary annuities

TI BAII+:
Set Annuity Time Value Parameters

- Set END for an ordinary annuity or BGN for an annuity due
  - Press ***2nd BGN*** (above ***PMT***)
  - This is a toggle switch. The default is END.
  - To change to BEGIN, press ***2nd SET*** (above ***ENTER***) to go back and forth.

Excel Spreadsheet Functions

- FV(Rate,Nper,Pmt,PV,***0/1***)
- PV(Rate,Nper,Pmt,FV,***0/1***)
- RATE(Nper,Pmt,PV,FV,***0/1***)
- NPER(Rate,Pmt,PV,FV,***0/1***)
- PMT(Rate,Nper,PV,FV,***0/1***)



- Inside parens: (RATE,NPER,PMT,PV,FV,***0/1***)
- ***"0/1"*** *Ordinary annuity = 0 (default; no entry needed)*
  Annuity Due = 1 (must be entered)

Important Points to Remember

- Interest rate and time period must match!
  - Annual periods ⇒ annual rate
  - Monthly periods ⇒ monthly rate
- The Sign Convention
  - Cash inflows are positive
  - Cash outflows are negative

Sign Convention Example

5	N
10	I/Y
-100	PV
20	**PMT**

CPT FV = $38.95

Implies you deposited $100 today and plan to **WITHDRAW** $20 a year for 5 years

+CF = Cash INFLOW to YOU

5	N
10	I/Y
-100	PV
-20	**PMT**

CPT FV = $283.15

Implies you deposited $100 today and plan to **ADD** $20 a year for 5 years

-CF = Cash OUTFLOW from you

Annuity
Example 5.5

- You can afford $632 per month.
- Going rate = 1%/month for 48 months.
- How much can you borrow?
- You borrow money TODAY so you need to compute the present value.

48 *N*
1 *I/Y*
632 *PMT*
0 *FV*
CPT PV = 23,999.54
($24,000)

$$PV = 632\left[\frac{1-\frac{1}{(1.01)^{48}}}{.01}\right] = 23{,}999.54$$

=PV(0.01,48,-632,0)

Annuity: Sweepstakes Example

- Suppose you win the Publishers Clearinghouse $10 million sweepstakes.
- The money is paid in equal annual installments of $333,333.33 over 30 years.
- If the appropriate discount rate is 5%, how much is the sweepstakes actually worth today?
  - PV = $333,333.33[1 – 1/1.05^{30}] / .05 = $5,124,150.29

Calculator and Excel Solution

Buying a House

- You are ready to buy a house and you have $20,000 for a down payment and closing costs.
- Closing costs are estimated to be 4% of the loan value.
- You have an annual salary of $36,000.
- The bank is willing to allow your monthly mortgage payment to be equal to 28% of your monthly income.
- The interest rate on the loan is 6% per year with monthly compounding (.5% per month) for a 30-year fixed rate loan.
- How much money will the bank loan you?
- How much can you offer for the house?

Buying a House (continued)

- Bank loan
  - Monthly income = 36,000 / 12 = 3,000
  - Maximum payment = .28(3,000) = 840
    - 360 N (30*12)
    - 0.5 I/Y
    - -840 PMT
    - **CPT PV** = 140,105

=PV(.005,360,-840,0)

- Total Price
  - Closing costs = .04(140,105) = 5,604
  - Down payment = 20,000 – 5604 = 14,396
  - Total Price = 140,105 + 14,396 = **154,501**

Quick Quiz: Part 2

- You know the payment amount for a loan and you want to know how much was borrowed.
  - Do you compute a present value or a future value?

Quick Quiz: Part 2

- You want to receive $5,000 per month in retirement. If you can earn .75% per month and you expect to need the income for 25 years, how much do you need to have in your account at retirement?
  - 300 N ⬅ Months
  - 0.75 I/Y ⬅ Monthly rate
  - 5000 PMT ⬅ Monthly Payment
  - 0 FV
  - **CPT PV** = -595,808.11

=PV(0.0075,300,5000,0)

Finding the Payment

- Suppose you want to borrow $20,000 for a new car.
- You can borrow at 8% per year, compounded monthly (8/12 = .66667% per month).
- If you take a 4 year loan, what is your monthly payment?

4(12) = 48	N
0.66667	I/Y
20,000	PV
0	FV
CPT PMT = -488.26	

=PMT(0.006667,48,20000,0)

Finding the Number of Payments

Example 5.6

- $1,000 due on credit card
- Payment = $20 month minimum
- Rate = 1.5% per month
- **The sign convention matters!!!**

1.5	I/Y
1000	PV
-20	PMT
0	FV
CPT N = 93.111 months	
= 7.75 years	

=NPER(0.015,-20,1000,0)

Finding the Number of Payments
Another Example

- Suppose you borrow $2,000 at 5% and you are going to make annual payments of $734.42. How long before you pay off the loan?

5	I/Y
2000	PV
-734.42	PMT
0	FV
CPT N = 3 years	

=NPER(0.05,-734.42,2000,0)

Finding the Rate

- Suppose you borrow $10,000 from your parents to buy a car. You agree to pay $207.58 per month for 60 months. What is the monthly interest rate?

60	N
10000	PV
-207.58	PMT
0	FV
CPT I/Y = 0.75% per month	

=RATE(60,-207.58,10000,0)

Quick Quiz: Part 3

- You want to receive $5,000 per month for the next 5 years. How much would you need to deposit today if you can earn .75% per month?

60	N (months)
0.75	I/Y
5000	PMT
0	FV
CPT PV = -240866.87	

=PV(0.0075,60,5000,0)

Quick Quiz: Part 3

- You want to receive $5,000 per month for the next 5 years.
- What monthly rate would you need to earn if you only have $200,000 to deposit?

60	N
-200000	PV
5000	PMT
0	FV
CPT I/Y = 1.4395%	per month

=RATE(60,5000,-200000,0)

Quick Quiz: Part 3

- Suppose you have $200,000 to deposit and can earn .75% per month.
  - How many months could you receive the $5,000 payment?

0.75	I/Y
-200000	PV
5000	PMT
0	FV
CPT N = 47.73 months	
≈ 4 years	

=NPER(0.0075,5000,-200000,0)

Quick Quiz: Part 3

- Suppose you have $200,000 to deposit and can earn .75% per month.
  - How much could you receive every month for 5 years?

60	N
0.75	I/Y
-200000	PV
0	FV
CPT PMT = 4151.67	

=PMT(0.0075,60,-200000,0)

Future Values for Annuities

- Suppose you begin saving for your retirement by depositing $2,000 per year in an IRA. If the interest rate is 7.5%, how much will you have in 40 years?

40	N
7.5	I/Y
0	PV
-2000	PMT
CPT FV = 454513.04	

=FV(0.075,40,-2000,0)

$$FV = PMT\left[\frac{(1+r)^t - 1}{r}\right]$$

$$FV = 2000\left[\frac{(1.075)^{40} - 1}{.075}\right] = 454{,}513.04$$

Annuity Due

- You are saving for a new house and you put $10,000 per year in an account paying 8%. The first payment is made today. How much will you have at the end of 3 years?

2nd BGN 2nd SET	
3	N
8	I/Y
0	PV
-10000	PMT
CPT FV = 35061.12	
2nd BGN 2nd SET	

=FV(0.08,3,-10000,0,1)

$$FV_{AD} = PMT\left[\frac{(1+r)^t - 1}{r}\right](1+r)$$

$$FV_{AD} = 10000\left[\frac{(1.08)^3 - 1}{.08}\right](1.08) = 35{,}061.12$$

⬅ **Reset to END**

Table 5.2

TABLE 5.2

Summary of annuity and perpetuity calculations

I. Symbols
PV = Present value, what future cash flows are worth today
FV_t = Future value, what cash flows are worth in the future at Time t
r = Interest rate, rate of return, or discount rate per period—typically, but not always, one year
t = Number of periods—typically, but not always, the number of years
C = Cash amount

II. Future value of C invested per period for t periods at r percent per period
$FV_t = C \times [(1 + r)^t - 1]/r$
A series of identical cash flows paid for a set number of periods is called an annuity, and the term $[(1 + r)^t - 1]/r$ is called the *annuity future value factor*.

III. Present value of C per period for t periods at r percent per period
$PV = C \times \{1 - [1/(1 + r)^t]\}/r$
The term $\{1 - [1/(1 + r)^t]\}/r$ is called the *annuity present value factor*.

IV. Present value of a perpetuity of C per period
$PV = C/r$
A perpetuity has the same cash flow every period forever.

Example: Work the Web

- Another online financial calculator can be found at Calculatoredge.com.
- Click on this link, select "Finance" calculator and "Annuity Payments" and work the following example:
  - How much could you withdraw each year if you have $2,500,000, earn 8% and make annual withdrawals for 35 years?

Perpetuity
Example 5.7

- Perpetuity formula: PV = PMT / r
- Current required return:
  - 40 = 1 / r
  - r = .025 or 2.5% per quarter
- Dividend for new preferred:
  - 100 = PMT / .025
  - PMT = 2.50 per quarter

Quick Quiz: Part 4 (1 of 3)

- You want to have $1 million to use for retirement in 35 years. If you can earn 1% per month, how much do you need to deposit on a monthly basis if the first payment is made in one month?

420	N
1	I/Y
0	PV
1000000	FV
CPT PMT = -155.50	

Ordinary Annuity

=PMT(0.01,420,0,1000000)

Quick Quiz: Part 4 (2 of 3)

- You want to have $1 million to use for retirement in 35 years. If you can earn 1% per month, how much do you need to deposit on a monthly basis if the first payment is made today?

2nd BGN 2nd SET	
420	N
1	I/Y
0	PV
1000000	FV
CPT PMT = -153.96	
2nd BGN 2nd SET	

Annuity Due

=PMT(0.01,420,0,1000000,1)

Quick Quiz: Part 4 (3 of 3)

- You are considering preferred stock that pays a quarterly dividend of $1.50. If your desired return is 3% per quarter, how much would you be willing to pay?

$1.50/0.03 = $50

Interest Rates

- Effective Annual Rate (EAR)
  - The interest rate expressed as if it were compounded once per year.
  - Used to compare two alternative investments with different compounding periods
- Annual Percentage Rate (APR) "Nominal"
  - The annual rate quoted by law
  - APR = periodic rate X number of periods per year
  - Periodic rate = APR / periods per year

Return to Quick Quiz

Things to Remember

- You ALWAYS need to make sure that the interest rate and the time period match.
  - Annual periods ➔ annual rate.
  - Monthly periods ➔ monthly rate.
- If you have an APR based on monthly compounding, you have to use monthly periods for lump sums or adjust the interest rate accordingly.

EAR Formula

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

APR = the quoted rate

m = number of compounds per year

EAR and APR in TI BA II+

2nd ICONV

2nd CE/C (to clear the memory)

- 3 fields in worksheet:
  - NOM (Nominal rate-APR)
  - EFF (Effective annual rate)
  - C/Y (Compounding periods/yr)

  - To compute EFF, enter the NOM and C/Y values, move to EFF and press ***CPT***
  - To compute NOM, enter the EFF and C/Y values, move to NOM and press **CPT**

EAR and NOM in Excel

- 2 Functions:

  =EFFECT(Nom, Nper)

  =NOMINAL(Eff, Nper)

- All rates entered as decimals
- Nper = number of compounding periods per year

TOOLS … Add-Ins … ANALYSIS TOOLPAK

Decisions, Decisions

- Which savings accounts should you choose:
  - 5.25% with daily compounding.
  - 5.30% with semiannual compounding.
- First account:
  - EAR = $(1 + .0525/365)^{365} - 1$ = **5.39%**
  - ICONV: NOM=5.25; C/Y=365 **EFF=5.3899**
  - Excel: =EFFECT(0.525,365) = 5.39%
- Second account:
  - EAR = $(1 + .053/2)^2 - 1$ = **5.37%**
  - ICONV: NOM=5.3; C/Y=2 **EFF=5.3702**
  - Excel: =EFFECT(0.53,2) = 5.37%

Computing APRs

- What is the APR if the monthly rate is .5%?
  - .5%(12) = 6%
- What is the APR if the semiannual rate is .5%?
  - .5%(2) = 1%
- What is the monthly rate if the APR is 12% with monthly compounding?
  - 12% / 12 = 1%
  - Can you divide the above APR by 2 to get the semiannual rate?
    - NO. You need an APR based on semiannual compounding to find the semiannual rate.

Computing EAR and APR

- Suppose you can earn 1% per month on $1 invested today.
  - What is the APR? 1(12) = 12%
  - How much are you effectively earning?
    - FV = $1(1.01)^{12}$ = 1.1268
    - Rate = (1.1268 – 1) / 1 = .1268 = **12.68%**

INCONV:	**NOM**	**= 12**
	C/Y	**= 12**
	EFF	**= 12.6825**

=EFFECT(0.12,12)

Computing EAR and APR

- Suppose if you put it in another account, you earn 3% per quarter.
  - What is the APR? 3(4) = 12%
  - How much are you effectively earning?
    - FV = $1(1.03)^4$ = 1.1255
    - Rate = (1.1255 – 1) / 1 = .1255 = **12.55%**

ICONV:	**NOM**	**= 12**
	C/Y	**= 4**
	EFF	**= 12.5509**

=EFFECT(0.12,4)

Computing APRs from EARs

$$APR = m\left[(1+EAR)^{1/m} - 1\right]$$

M = number of compounding periods per year

APR - Example

- Suppose you want to earn an effective rate of 12% and you are looking at an account that compounds on a monthly basis. What APR must they pay?

$$APR = 12\left[(1+.12)^{1/12} - 1\right] = .1138655 \text{ or } 11.39\%$$

ICONV: EFF = 12

C/Y = 12

NOM = 11.3866

Excel: =NOMINAL(0.12,12)

Computing Payments with APRs

- Suppose you want to buy a new computer.
- The store is willing to allow you to make monthly payments.
- The entire computer system costs $3,500.
- The loan period is for 2 years.
- The interest rate is 16.9% with monthly compounding.
- What is your monthly payment?

2(12)	**= 24**	**N**
16.9 / 12 = 1.40833		**I/Y**
3500		**PV**
0		**FV**
CPT PMT = -172.88		

=PMT(0.0140833,24,3500,0)

Future Values with Monthly Compounding

- Suppose you deposit $50 a month into an account that has an APR of 9%, based on monthly compounding. How much will you have in the account in 35 years?

420	N	(35*12)
0.75	I/Y	(9/12)
0	PV	
-50	PMT	
CPT FV = 147,089.22		

=FV(0.0075,420,-50,0)

Present Value with Daily Compounding

- You need $15,000 in 3 years for a new car. If you can deposit money into an account that pays an APR of 5.5% based on daily compounding, how much would you need to deposit?

1095	N (3*365)
.015068493	I/Y (5.5/365)
0	PMT
15,000	FV
CPT PV = -12,718.56	

=PV(0.00015,1095,0,15000)

Quick Quiz: Part 5

- What is the definition of an APR?
- What is the effective annual rate?
- Which rate should you use to compare alternative investments or loans?
- Which rate do you need to use in the time value of money calculations?

(Answers = Slide 5.56)

Pure Discount Loans

- Treasury bills are excellent examples of pure discount loans.
  - Principal amount is repaid at some future date
  - No periodic interest payments
- If a T-bill promises to repay $10,000 in 12 months and the market interest rate is 7 percent, how much will the bill sell for in the market?
  - **1 N; 10,000 FV; 7 I/Y; CPT PV = -9345.79**
  - **=PV(.07,1,0,10000)**

Return to Quick Quiz

Amortized Loan with Fixed Payment: Example

- Each payment covers the interest expense plus reduces principal
- Consider a 4-year loan with annual payments. The interest rate is 8% and the principal amount is $5000.
  - What is the annual payment?
    - $5{,}000 = PMT[1 - 1 / 1.08^4] / .08$ ➔ PMT = 1,509.60
    - =PMT(0.08,4,5000,0) = 1509.60
    - 4 N; 8 I/Y; 5000 PV, 0 FV, CPT PMT = 1509.60

Return to Quick Quiz

Amortized Loan with Fixed Payment: Example

Year	Beginning Balance	Total Payment Payment	Interest Paid	Principal Paid	Ending Balance
1	$ 5,000.00	$ 1,509.60	$ 400.00	$ 1,109.60	$ 3,890.40
2	$ 3,890.40	$ 1,509.60	$ 311.23	$ 1,198.37	$ 2,692.03
3	$ 2,692.03	$ 1,509.60	$ 215.36	$ 1,294.24	$ 1,397.79
4	$ 1,397.79	$ 1,509.60	$ 111.82	$ 1,397.79	$ -
Totals		$ 6,038.40	$ 1,038.42	$ 5,000.00	

Interest Paid = Beginning Balance * Rate (8%)

Principal Paid = Total Payment – Interest Paid

Ending Balance = Beginning Balance – Principal Paid

Quick Quiz: Part 6

- What is a pure discount loan?
  - What is a good example of a pure discount loan? (Slide 5.72)
- What is an amortized loan?
  - What is a good example of an amortized loan? (Slide 5.73)

Example: Work the Web

- Several Web sites have calculators that will prepare amortization tables quickly
- One such site is Bankrate.com
- Click on this link, select "Calculators," "Mortgage Payment Calculator," and enter the following information:
  - Loan amount = $20,000
  - Term = 10 years
  - Interest rate = 7.625%
  - What is the monthly payment?

FV Example 5.1
Calculator Solution

Calculator Solution					
Year	N	I/Y	PV	PMT	CPT FV
0	3	8	-7000	0	8,817.98
1	2	8	-4000	0	4,665.60
2	1	8	-4000	0	4,320.00
3					4,000.00
					21,803.58
Value at year 4:					
Year	N	I/Y	PV	PMT	CPT FV
4	1	8	-21,803.58	0	23,547.87

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FV Example 5.1
Excel Solution

Excel Solution					
Year	Nper	Rate	PV	PMT	FV
0	3	0.08	-7000	0	8,817.98
1	2	0.08	-4000	0	4,665.60
2	1	0.08	-4000	0	4,320.00
3					4,000.00
					21,803.58
Value at year 4:					
Year	Nper	Rate	PV	PMT	FV
4	1	0.08	-21,803.58	0	23,547.87
=FV(Rate, Nper,PMT,PV)					

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FV Example 2
Calculator Solution

Calculator Solution						
						CPT
	Year	N	I/Y	PV	PMT	FV
	0	2	9	500	0	594.05
	1	1	9	600	0	654.00
						1,248.05
	Value at year 4:					CPT
	Year	N	I/Y	PV	PMT	FV
	5	3	9	1,248.05	0	1,616.26
or						CPT
	Year	N	I/Y	PV	PMT	FV
	0	5	9	500	0	769.31
	1	4	9	600	0	846.95
						1,616.26

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FV Example 2
Excel Solution

Excel Solution						
	Year	Nper	Rate	PV	PMT	FV
	0	2	0.09	-500	0	594.05
	1	1	0.09	-600	0	654.00
						1,248.05
	Value at year 4:					
	Year	Nper	Rate	PV	PMT	FV
	5	3	0.09	-1,248.05	0	1,616.26
	=FV(Rate, Nper,PMT,PV)					

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FV Example 3
Calculator and Excel Solution

Calculator Solution					CPT
Year	N	I/Y	PV	PMT	FV
1	4	8	-100	0	136.05
3	2	8	-300	0	349.92
					485.97

Excel Solution					
Year	Nper	Rate	PV	PMT	FV
1	4	0.08	-100	0	136.05
3	2	0.08	-300	0	349.92
					485.97

=FV(Rate, Nper,PMT,PV)

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Multiple Cash Flows: Example 5.3
Calculator Solution

Year	N	I/Y	FV	PMT	CPT PV
1	1	12	200	0	178.57
2	2	12	400	0	318.88
3	3	12	600	0	427.07
4	4	12	800	0	508.41
					1,432.93

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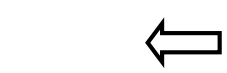
Multiple Cash Flows: Example 5.3 Excel Solution

Excel Solution

Year	Nper	Rate	FV	PMT	PV
1	1	0.12	-200	0	178.57
2	2	0.12	-400	0	318.88
3	3	0.12	-600	0	427.07
4	4	0.12	-800	0	508.41
					1,432.93

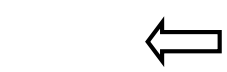
=PV(Rate, Nper,PMT,FV)



Excel: PV of Multiple Uneven CFs

Rate		12%		
Period	Cash Flow		Present Value	Formula
1	$	200.00	($178.57)	=PV(B1,A3,0,B3)
2	$	400.00	($318.88)	=PV(B1,A4,0,B4)
3	$	600.00	($427.07)	=PV(B1,A5,0,B5)
4	$	800.00	($508.41)	=PV(B1,A6,0,B6)
	Total PV =		($1,432.93)	=SUM(C3:C6)
			($1,432.93)	=-NPV(B1,B3:B6)

The functions require a PMT = 0.



Multiple Cash Flows: PV Example Calculator & Excel Solutions

Calculator Solution						CPT
	Year	N	I/Y	FV	PMT	PV
	1	1	10	-1000	0	909.09
	2	2	10	-2000	0	1,652.89
	3	3	10	-3000	0	2,253.94
						4,815.92
Excel Solution						
	Year	Nper	Rate	FV	PMT	PV
	1	1	0.10	-1000	0	909.09
	2	2	0.10	-2000	0	1,652.89
	3	3	0.10	-3000	0	2,253.94
						4,815.92
	=PV(Rate, Nper,PMT,FV)					

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Quick Quiz: Part 1

Discount Rate	7%	Calculator:					
Year	CF	Keystrokes					
1	100	CF	2nd	ClrWork			
2	200	CF0	0	ENTER			
3	200	C01	100	ENTER	F01	1	ENTER
4	300	C02	200	ENTER	F02	2	ENTER
5	300	C03	300	ENTER	F03	2	ENTER
		NPV		ENTER			
		I	7	ENTER			
		DOWN	CPT			874.17	
			Year 3	Year 5			
		N	3	5			
		I/Y	7	7			
		PV	-874.17	-874.17			
		PMT	0	0			
		CPT FV	1070.89	1226.07			

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Annuity – Sweepstakes Example

Sweepstakes Example

	N	30
	I/Y	5
	PMT	$ 333,333.33
	FV	0
CPT	PV	$ (5,124,150.29)

=PV(5, 30, 333333.33, 0) = ($5,124,150.29)

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Chapter 5

END