Personal Finance: Another Perspective

Time Value of Money 1: Present and Future Value

Updated 2019/07/08

Objectives

A. Understand Investments

B. Understand the importance of compound interest and time

C. Understand basic finance terminology

D. Know how to solve problems relating to Future Value (FV) and to Present Value (PV)

A. Understand Investments

➢ What is an Investment?

- Current commitment of money or other resources in the expectation of reaping future benefits.

- What is Sacrifice?

  - Current commitment of money or other resources in the expectation of reaping future benefits.

- Is there a difference?

  - Interestingly, in the church we interchange the two.

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Investments (continued)

- Are there priorities of Investments?
  - What are your most important investments?
    - Your testimony
    - Your family
    - Your education
  - The prophet Jacob counseled:
    - "Wherefore, do not spend money for that which is of no worth, nor your labor for that which cannot satisfy." (2 Nephi 9:51)

My Most Important Investments

Investments (continued)

- ## What are your other key investments?
    - ### Education and Skills
    - ### Knowledge and Friendships
    - ### Food Storage and Emergency Funds
    - ### Financial Investments
        - #### Do not be too narrow in your view of investments

Investments (continued)

- ## What investments will we be working with in this class?

    - ### Generally financial investments:

        - Mutual funds, stocks (equities), bonds, cash, etc.
        - We will make reference to other important investments as well

B. Understand the importance of compound interest and time

➢ Albert Einstein commented:

"Compound interest
(which is interest on interest)
is the eighth wonder of the world."

Why?

How Important is Time?

Time

The only tool that is equally on everyone's side

But you have to have the discipline and the foresight to use it!

Use it to your advantage by starting early and not stopping for "diversions" in your spending and your goals

How Important is Interest?

What is interest?

Interest is similar to Rent

Students will pay to be able to rent a place

Interest is payment for allowing others to use your money

Key Principle:

A dollar received today is worth more than a dollar received in the future.

The sooner your money can be invested to earn interest, the faster the interest can earn interest and the more money you will have!

C.   Understand Basic Finance Terminology (the language of finance)

1. Principle

   The money that you have to invest or save, or the stated amount on a bond or deposit instrument

2. Interest or discount rate

   The stated rate that you will receive for investing for a specified time at a specified compounding period

3. Effective Interest Rate

   The actual rate (as opposed to the stated or nominal rate) received after taking into account the effects of compounding

Finance Terminology (continued)

4. Reinvesting

   Taking money that you have earned on an investment and investing it again

5. Future Value (FV)

   The value of an investment at some point in the future

6. Present Value (PV)

   The current value, that is the value in today's dollars of a future sum of money

7. Compounded Annually (quarterly, daily, etc.)

   The number of periods during the year where interest is calculated. The shorter the compounding period, the higher the effective rate of interest.

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Finance Terminology (continued)

8. Annuity

   A series of equal dollar payments coming at the end of each time period for a specified number of time periods, generally months or years.

9. Compound Annuity

   An investment that involves depositing an equal sum of money at the end of each year for a certain number of years and allowing it to grow

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Finance Terminology (continued)

10. Amortized Loan

   A loan paid off in equal payments, which payments
   include both principal and interest

11. Real Return

   The return after the impact of inflation. The formula
   is [(1+ nominal return)/(1 + inflation)] -1

Investment Question #1: Compounding

Key Question:

What is the impact of different compounding periods on my investment and investment returns?

Compounding periods:

The frequency that interest is applied to the investment

Examples -- daily, monthly, or annually

Compounding - Key Relationships

- Time and the Interest Rate
  - The length of the compounding period and the effective annual interest rate are inversely related
    - The shorter the compounding period, the quicker the investment grows (daily)
    - The longer the compounding period, the slower the investment grows (annual)

Compound Interest With Non-annual Periods

What are Effective Interest Rates?

The actual rate you are earning on your investment versus the stated rate (they may be different!)

What is the Formula?

$$[(1 + \text{nominal return}/\text{\# periods})]^{\text{\# periods}}) -1$$

Examples of different periods: daily, weekly, monthly, and semi-annually

Problem #1: Effective Interest Rates – the Impact of Compounding

- Which investment would you rather own:

Investment	Return	Compounding
Investment A	12.0%	annually
Investment B	11.9%	semi-annually
Investment C	11.8%	quarterly
Investment D	11.7%	daily

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Answer #1: Effective Interest Rates

Effective Interest Rate Formula:

$$((1 + \text{Nominal return/\# periods})^{\#\,\text{period}}) - 1$$

$$(1+.12/1)^1 \; -1 \; = 12.00\%$$
$$(1+.119/2)^2 -1 = 12.25\%$$
$$(1+.118/4)^4 -1 = 12.33\%$$
$$(1+.117/365)^{365} - 1 = 12.41\%$$

Even though D has a lower return, due to the compounding, it has a higher effective interest rate.

How you compound makes a difference!

D. Know how to solve problems relating to Present Value (PV)

- Problem:
  - You want to determine the current or present value of an investment
- Problem Statement:
  - What is the present value of an investment that will come to you (n) years in the future and at (I)% interest or discount rate?
- Key information needed:
  - Future value of an investment, how many years will the investment be in force, and at what interest or discount rate
- Results:
  - A dollar amount which is smaller than the investment in the future

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Present Value Equation

Present Value Mathematical Formula:

$$PV = \frac{FV_n}{(1 + i)^n}$$

Key Inputs:

FV_n = the future value of the investment at the end of n years

i = the annual interest or discount rate

n = the number of years

PV = the Present Value, in today's dollars, of a sum of money that you have or plan to have

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Problem #2: Present Value

You are promised $500,000 in 40 years by your rich uncle Phil. Assuming 6% interest, what is the value today of Phil's promise?

Answer #2: Present Value

Set calculator to end mode and clear registers:

$500,000 = FV, 40 = N, 6 = I% and Solve for PV

PV = $48,611

- Money in the future is less valuable than money you have right now because you cannot use it now to make more money!

- If you have a computer with Excel, you can use our Excel Financial Calculator (LT12), which is a spreadsheet-based financial calculator

Excel Financial Calculator (LT12)

The Present Value is -$48,611.09

Present Value =	PV	($48,611.09)
Years/Periods* =	N	40.00
Payments/Year =	P/Yr	1

(Compounding: Annual = 1, Monthly = 12, Quarterly = 4)

Annual Interest =	I_{real}	6.000%
Ann. Nom. Rate =	I_{nom}	6.000%
Ann. Inflation =	I_{infl}	

1 Period Rate = 6.00%

Future Value =	FV	$500,000.00
Payments =	PMT	
Type =	Type	

Payments at: End = 0, Begin = 1

The Excel formula for PV is =PV(I/PY,N*PY,PMT,FV,endperiod)

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Know how to solve problems relating to Future Value (FV)

- Problem:
  - You want to determine the value of an investment at some point in the future.

- Problem Statement:
  - What will be the future value of my investment (N) years in the future if my interest rate is (I)%?

- Key Information Needed:
  - Years in the future, interest rate

- Result:
  - A dollar amount which is larger than the original investment (an approximation is the rule of 72 which states that each time the interest rates * years = 72 the investment doubles in value)

Future Value Equation

- Mathematical Formula
  - $FV_n = PV * (1 + i)^n$

  - Key Inputs:
    - FV = the future value of the investment at the end of n year
    - i = the annual interest (or discount) rate
    - PV = the present value, in today's dollars, of a sum of money that you already have or plan to have

Problem #3: Future Value
(with a slight change)

- A. Calculate the future value, in 15 years, of $5,000 earning 8% assuming an annual compounding period?

- B. Calculate the future value of $5,000 earning 8 percent assuming simple interest (the interest earned does not earn interest)?

- C. How much did interest on interest earn?

Answer #3: 3-5

- A. Compound Interest:
  - Clear registers and memory: Set -$5,000 = PV 8% = I 15 = N and solve for FV: FV = $15,861

- B. Simple Interest (no interest on interest):
  - $5,000 + ((5,000*8%) x 15) = $11,000

- C. Difference:
  - $15,861 – 11,000 = $4,861

This is the Key to Financial Success –

Earn Interest on Interest!!!!!!!!!!!!!!!

Excel Financial Calculator (LT12)	
The Future Value is $15,860.85	
Present Value = PV	($5,000.00)
Years/Periods* = N	15.00
Payments/Year = P/Yr	1
(Compounding: Annual = 1, Monthly = 12, Quarterly = 4)	
Annual Interest = I_{real}	8.000%
Ann. Nom. Rate = I_{nom}	8.000%
Ann. Inflation = I_{infl}	
1 Period Rate =	8.00%
Future Value = FV	$15,860.85
Payments = PMT	
Type = Type	
Payments at: End = 0, Begin = 1	

Review of Objectives

- A. Do you understand investments?

- B. Do you understand the importance of compound interest and time

- C. Do you understand basic finance terminology so you can talk with other finance professionals

- D. Can you solve problems relating to Future Value (FV) and Present Value Value (PV)

Case Study #1

Data

- Brian has a goal to have $500,000 saved by the time he turns sixty-five, which is forty years from now.

Calculation

- Assuming he can make 6 percent on his money, what is the value of that goal now (this indicates present value)? The math formula is as follows:
  - $PV = FV/(1 + i)^n$

Case Study #1 Answer

The mathematical formula is $PV = FV/(1 + i)^n$, or $PV =$ $500,000/(1.06)^{40}$, or $48,611.10. This formula shows you how this equation would be calculated on a standard calculator.

• Using a financial calculator (or LT12), you would clear your memories and then enter the following information: $500,000 = FV, 6\% = I$, which is the interest rate (the annual interest, or discount, rate), $40 = N$, or the number of years, $P/Yr = 1$ and then solve for PV:

• PV = the present value, in today's dollars, of a sum of money that you have invested or plan to invest. If you use a financial calculator for this equation, the present value should come out as $48,611.10.

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Case Study #1 Answer

Using LT12, click on Clear to clear information. Then put in the information, with money going out as a negative sign. Then click on Calculate FV to get your answer

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Case Study #2

Data

- Ron has $2,500 saved.

Calculation

- If his investment earns 8 percent per year for twenty years, how much will his investment be worth in twenty years (the investment's future value)? The math formula is as follows:
  - $FV = PV(1 + i)^n$

Case Study #2 Answer

- The formula is FV = PV $(1 + i)^n$ where PV = present value, I = interest rate, and n = or number of years. The equation would be FV = \$2,500 * $(1 + .08)^{20}$ or \$11,652.39

- If you were using a financial calculator, you would clear your memories, then enter the following: \$2,500 = PV, 8% = I, which is the interest rate (the annual interest, or discount, rate), 40 = N, or the number of years, and solve for FV:
FV = the future value of a sum of money that you have invested. The future value should be \$11,652.39.

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Case Study #2 Answer

Excel Financial Calculator (LT12)	
The Future Value is $11,652.39	
Present Value = PV	($2,500.00)
Years/Periods* = N	20.00
Payments/Year = P/Yr	1
(Compounding: Annual = 1, Monthly = 12, Quarterly = 4)	
Annual Interest = I_{real}	8.000%
Ann. Nom. Rate = I_{nom}	8.000%
Ann. Inflation = I_{infl}	
1 Period Rate =	8.00%
Future Value = FV	$11,652.39
Payments = PMT	
Type = Type	
Payments at: End = 0, Begin = 1	

Time Value Calculations — Inputs Needed

Click to Calculate

	PV	N	I	FV	PMT
PV needs:	x	x	x		
		x	x		x
		x	x	x	x
FV:	x	x	x		
		x	x		x
	x	x	x		x
I:	x	x		x	
	x	x			x
	x	x		x	x
PMT:	x	x	x		
		x	x	x	
	x	x	x		
N:	x		x	x	
	x		x	x	x
	x		x		x

Buttons: Calculate PV, Calculate FV, Calculate I, Calculate PMT, Calculate N, Clear

Using LT12, click on Clear to clear information. Then put in the information, with money going out as a negative sign. Then click on Calculate FV to get your answer

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