


Chapter 4

Time Value of Money

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This is the most important chapter in the course. The rest of the course will apply valuation techniques learned in this chapter.

Need to absorb - Almost everything plus learn to use your financial calculator or spreadsheet. Specifically, you can solve for any of the variables (present value, future value, payment, interest rate, and number of periods) for present value, future value, and annuity problems. You should be able to solve for the present value of: annuities, perpetuities, growing perpetuities, and a stream of uneven cash flows. You should be able to convert simple interest (aka APR, stated rate, quoted rate, and a many other names for an un compounded annual interest rate) to an effective annual interest rate and/or a periodic rate. You should be able to solve multiple step time value of money problems. You should be able to solve all of the end-of-chapter questions and problems. The following EOC problems are exam level problems 5, 8, 18, 19, 21b, 24, and 27-34.

Need to Read – You will need to read parts of the chapter.

Need to Do – Make 100 on the quiz, open the quiz five times. Learn to use a financial calculator and spreadsheet.

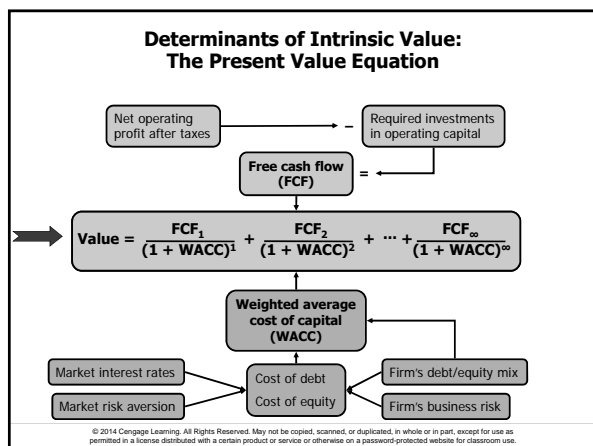
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Time Value Topics

- Future value
- Present value
- Rates of return
- Amortization

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Key Concepts and Skills

- Be able to compute the future value of multiple cash flows
- Be able to compute the present value of multiple cash flows
- Be able to compute loan payments
- Be able to find the interest rate on a loan
- Understand how interest rates are quoted
- Understand how loans are amortized or paid off

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1. Draw a Time Line

0 1 2 End

$i\%$

CF_0 CF_1 CF_2 CF_3

There are only three types of problems:

1. Even Cash Flows, like Present Value, Future Value, and Annuities
2. Perpetuities, where the cash flows last forever
3. Uneven Cash Flow problems, like Net Present Value and Internal Rate of Return

LOTS OF HELP AVAILABLE

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Hints on Solving Time Value of Money Problems

- Draw a Time Line
- Begin with the End in Mind
- Watch the Signs of the Cash Flows
- The Number of Periods (N) usually equals the greater of the number of Cash Flows or the Number of Years
- Always use either the Effective Annual or the Periodic Interest Rate
- Recognize hidden Perpetuities, Annuities, and Annuities Due.
- Set up the Calculator correctly and always Clear the Calculator before starting a problem.
- Use the course webpage and internet
- Practice

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Contact Charles Hodges

- Email D2L Email or chodges@siu.edu
- Chat Sessions
- Skype (bufordshighway), LinkedIn and Facebook (Charles Hodges).
- Office Phone (678)839-4816 and Cell Phone (770)301-8648, target is under 24 hours

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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 \$5,000.
 - What is the annual payment?
 - 4 N
 - 8 I/Y
 - 5,000 PV
 - CPT PMT = -1,509.60
- Click on the Excel icon to see the amortization table

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Year	Beginning Balance	Total 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	1,397.78	0.01
Totals		6,038.40	1,038.41	4,999.99	

Note: The ending balance of .01 is due to rounding. The last payment would actually be 1,509.61.

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Amortization Relationships

- $\text{Payment} = \text{Principal} + \text{Interest}$
- $\text{Beginning Balance} = \text{Previous Ending Balance}$
- $\text{Interest} = \text{Beginning Balance} * \text{Interest Rate}$
- $\text{Beginning Balance} - \text{Principal} = \text{Ending Balance}$
- $\text{Ending Balance} - \text{Beginning Balance} = \text{Principal}$

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Solving with Calculators

- Find the Payment
- Without clearing calculator, change N and compute FV
 - May need to do this twice, with some questions
- Use Amortization Relationships to answer question

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A sample problem

- You are buying a car with an out-the-door price of \$26,000. The APR is 7% and you are financing the car over 5 years with monthly payments.
 - What is the monthly payment
 - How much will you owe after 30 payments?
 - How much of 30th payment is interest?
 - How much of 30th payment is principal?

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Solution

- $N=5*12=60$, $I=7/12=.58333$, $FV=0$, $PV=26000$, solve for $PMT=514.83$
- Without clearing calculation, change $N=30$ and compute $FV=-14131.33$
- Two ways, $14561.22 - Pri = 14313.33$, $Pri = 429.89$ or $514.83 = 84.94 + pri$, $pri = 429.89$
- Without clearing calculator, change $N=29$ and compute $FV=-14561.22$ and solve $14561.22 * .58333\% = 84.94$

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Ethics Issues

- Suppose you are in a hurry to get your income tax refund. If you mail your tax return, you will receive your refund in 6 weeks. If you file the return electronically through a tax service, you can get the estimated refund tomorrow. The service subtracts a \$70 fee and pays you the remaining expected refund. The actual refund is then mailed to the preparation service. Assume you expect to get a refund of \$1500.
- What is the APR with weekly compounding? $(70/(1500-70)) = \text{Periodic rate} = 4.90\%$
- $APR = 4.9\% * 52/6 = 42.46\%$
- What is the EAR? $EFF(42.46\%, 52/6) = 51.36\%$

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Hints on Solving Time Value of Money Problems

Charles Hodges
Professor of Finance

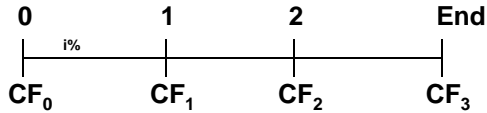
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1. Draw a Time Line

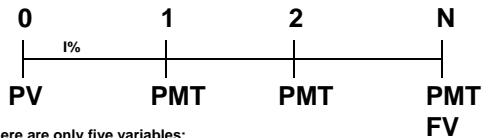


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2. Begin with the End In Mind



There are only five variables:

1. PV = Present Value (occurs in Period 0, single cash flow)
2. FV =Future Value (occurs in Period N/last Period, single cash flow)
3. PMT =Payment (series of N constant payments)
4. i =Interest Rate (either Periodic or Effective Rate)
5. N =Number (greater of # of PMT s or # of years)

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3. Frequency of Cash Flows usually determines the interest rate used. Always use either the Effective Annual or the Periodic Interest Rate. Annual (or less often) cash flows use effective rate, more than one time per year use periodic rate.

nominal, or stated, or quoted, YTM, APR, rate per year. (NEVER USE THIS RATE)

i_{per} = periodic rate= (Nominal / Periods per Year)
 EAR = $EFF\% = ((1 + \text{periodic rate})^{\text{compounding periods per year power}} - 1)$ (use your calculator/spreadsheet)

Payments more than one time per year, use periodic rate
 Payment annually or less often, use effective rate

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4. The Number of Periods (N) usually equals the greater of the number of Cash Flows or the Number of Years

Examples:

1. What is the future value of \$4 compounded at 8% for 5 years? $N=5$ (Effective Rate=8%)
2. What is the monthly payment for a 30-year mortgage at 6% on a \$150,000 home? $N=30 \times 12=360$ (Periodic Rate, $6/12=.5\%$)
3. What is the future value of \$4 compounded at 8% (with quarterly compounding) for 5 years? Can be either, 5 years (Effective rate=8.243%) or 20 (5×4 , Periodic rate=8/4=2%).

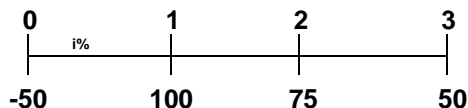
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5. Recognize hidden Perpetuities, Annuities, and Annuities Due.

- Look for Buzzwords
 - "Forever" and "From Now On" imply Perpetuity
 - Anything suggesting level payments, such as rent, mortgage payments, salary, dividends, coupon payments implies annuity
 - "Starting today" and "Beginning Now" indicate Annuity Due (Payments made at beginning of Period)

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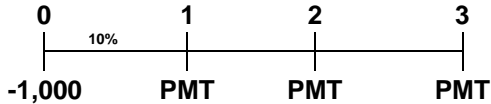
6. Watch the Signs of the Cash Flows



1. Sources= Inflows= +
2. Uses = Outflows = -
3. Only Cash counts

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7. Set up Calculator correctly and always Clear the Calculator before starting a problem.
http://www.tvmcalcs.com/calculator_index



INPUTS	3	10	-1000	0
	N	I/YR	PV	FV
OUTPUT	402.11			

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8. Use the course webpage and internet


- Check your syllabus for my current webpage and email
- Lots of videos, audios, written instructions on my public webpage
- Everything you need in our current Learning Management System
- New resources every day from others
 - Damodaran at NYU
 - Youtube

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Practice, Practice, Practice

Practice, Practice, Practice, Practice,
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