CHAPTER 4
Discounted Cash Flow Valuation

http://www2.gsu.edu/~fnccwh/pdf/ch4jaffeoverview.pdf

Slide 3

Key Concepts and Skills
- Be able to compute the future value and/or present value of a single cash flow or series of cash flows
- Be able to compute the return on an investment
- Be able to use a financial calculator and/or spreadsheet to solve time value problems
- Understand perpetuities and annuities

Problem Types
- Four Basic Problems Types:
  - Perpetuity/Growing Perpetuity
    • \( PV_n = \frac{\text{Cash Flow}_n + 1}{\text{Interest Rate} - \text{growth rate}} \)
  - Time Value of Money (PV, FV, N, PMT, I)
  - Uneven Cash Flows (NPV and IRR)
- Multi-Step Problems
  - Time Value of Money (solve for missing inputs before solving for answer)
  - Future Value of Uneven Cash Flows (solve for NPV of known cash flows, use this known cash flow to solve for unknown cash flows)

Chapter Outline
4.1 Valuation: The One-Period Case
4.2 The Multiperiod Case
4.3 Compounding Periods
4.4 Simplifications
4.5 What Is a Firm Worth?
4.4 Simplifications

- **Perpetuity**
  - A constant stream of cash flows that lasts forever
- **Growing perpetuity**
  - A stream of cash flows that grows at a constant rate forever
- **Annuity**
  - A stream of constant cash flows that lasts for a fixed number of periods
- **Growing annuity**
  - A stream of cash flows that grows at a constant rate for a fixed number of periods

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This is my calculator, my friend!

- Your financial calculator has two major menus that you must become familiar with:
  - The time value of money keys:
    - N; I/YR; PV; PMT; FV
    - Use this menu to value things with level cash flows, like annuities e.g. student loans.
    - It can even be used to value growing annuities.
  - The cash flow menu for uneven cash flows
    - CF; et cetera
    - Use this menu to value "lumpy" cash flow streams.

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How do you get to Carnegie Hall?

- Practice, practice, practice.
- It’s easy to watch Olympic gymnasts and convince yourself that you are a leotard purchase away from a triple back flip.
- It’s also easy to watch your finance professor do time value of money problems and convince yourself that you can do them too.
- There is no substitute for getting out the calculator and flogging the keys until you can do these correctly and quickly.
Calculator Keys

- Texas Instruments BA-II Plus
  - FV = future value
  - PV = present value
  - I/Y = periodic interest rate
    - P/Y must equal 1 for the I/Y to be the periodic rate
    - Interest is entered as a percent, not a decimal
  - N = number of periods
  - Remember to clear the registers (CLR TVM) after each problem
  - Other calculators are similar in format

4.1 The One-Period Case

- If you were to invest $10,000 at 5-percent interest for one year, your investment would grow to $10,500.
  - $500 would be interest ($10,000 \times .05)
  - $10,000 is the principal repayment ($10,000 \times 1)
  - $10,500 is the total due. It can be calculated as:
    - $10,500 = $10,000 \times (1.05)
- The total amount due at the end of the investment is called the *Future Value (FV)*.

Future Value and Compounding

- $1.10 \times (1.40)^5$
- $1.10 \times (1.40)^4$
- $1.10 \times (1.40)^3$
- $1.10 \times (1.40)^2$
- $1.10 \times (1.40)$
- $1.10$

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<tr>
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</tbody>
</table>

Present Value

- If you were to be promised $10,000 due in one year when interest rates are 5-percent, your investment would be worth $9,523.81 in today’s dollars.
  - $9,523.81 = \frac{$10,000}{1.05}$
- The amount that a borrower would need to set aside today to be able to meet the promised payment of $10,000 in one year is called the *Present Value (PV)*.
  - Note that $10,000 = $9,523.81 \times (1.05)$. 
Present Value and Discounting

• How much would an investor have to set aside today in order to have $20,000 five years from now if the current rate is 15%?

\[
P(V) = \frac{P}{(1 + r)^n}
\]

\[
9,943.53 = \frac{20,000}{(1.15)^5}
\]

Net Present Value

• The Net Present Value (NPV) of an investment is the present value of the expected cash flows, less the cost of the investment.

• Suppose an investment that promises to pay $10,000 in one year is offered for sale for $9,500. Your interest rate is 5%. Should you buy?

\[
NPV = \frac{10,000}{1.05} - 9,500 = 500 \text{ positive}
\]

The present value of the cash inflow is greater than the cost. In other words, the Net Present Value is positive, so the investment should be purchased.

Net Present Value

In the one-period case, the formula for NPV can be written as:

\[
NPV = -Cost + PV
\]

If we had not undertaken the positive NPV project considered on the last slide, and instead invested our $9,500 elsewhere at 5 percent, our FV would be less than the $10,000 the investment promised, and we would be worse off in FV terms:

\[
9,500 \times (1.05) = 9,975 < 10,000
\]
EAR on a financial Calculator

Hewlett Packard 10B

key: \[ \text{12} \ \text{P/YR} \]
\[ \text{12.00} \] Sets 12
\[ \text{EFF\%} \]
\[ \text{19.56} \]

key: \[ \text{18} \ \text{NOM\%} \]
\[ \text{18.00} \] Sets 18
\[ \text{APR} \]
\[ \text{C/Y=12} \]

Texas Instruments BAII Plus

key: \[ \text{2nd} \ \text{ICONV} \]
\[ \text{EFF=} \] 
\[ \text{CPT} \]
\[ \text{19.56} \]
\[ \text{NOM=} \]
\[ \text{18} \] 
\[ \text{ENTER} \] Sets 18
\[ \text{C/Y=} \]
\[ \text{12} \] 
\[ \text{ENTER} \] Sets 12 payments per year

Perpetuity

A constant stream of cash flows that lasts forever

\[ PV = \frac{C}{(1+r)} + \frac{C}{(1+r)^2} + \frac{C}{(1+r)^3} + \ldots \]

\[ PV = \frac{C}{r} \]

Perpetuity: Example

What is the value of a British consol that promises to pay £15 every year for ever?

The interest rate is 10-percent.

\[ PV = \frac{\£15}{.10} = \£150 \]
Growing Perpetuity

A growing stream of cash flows that lasts forever

\[ PV = \frac{C}{(1 + r)} + \frac{C(1 + g)}{(1 + r)^2} + \frac{C(1 + g)^2}{(1 + r)^3} + \cdots \]

\[ PV = \frac{C}{r - g} \]

Growing Perpetuity: Example

The expected dividend next year is $1.30, and dividends are expected to grow at 5% forever. If the discount rate is 10%, what is the value of this promised dividend stream?

\[ PV = \frac{\$1.30}{.10 - .05} = \$26.00 \]

Contact Information

- **Professor:** Charles Hodges
- **Webpage:** WEBCT
- **Phone:** (678) 839-4816
- **Email:** chodges@westga.edu
- **Office:** Room 205B – Adamson Hall
- **Office Hrs:** Not Applicable (I am in my office most days. Feel free to “drop-in.”)