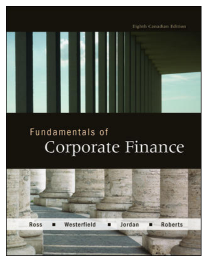
Finance for Management and Organizational Studies

MOS 2310

Chapter 5

Time Value of Money



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Time Value of Money (TVM)

- Future Value and Compounding
- Present Value and Discounting
- Finding the Interest rate (return) on an investment
- How long it takes (number of periods) for an investment to reach a desired value
- Uneven Cash Flows

Relates to the Rest of the Text

All valuation techniques such as:

- Bond and Stock pricing; and
- Capital budgeting rely on present value.

TVM concepts enable us to determine

- Implied interest rates such as YTM and IRR.

Other uses include

- Leases and working capital management

Compounding

- Accumulating interest in an investment over time to earn more interest
- Interest on interest
- Compound interest is earned on both the initial principal and the interest reinvested from prior periods
- Simple interest is earned only on the original principal amount invested

Calculator Keys

- Texas Instruments BA-II Plus
  - FV = future value
  - PV = present value
  - I/Y = period interest rate
    - P/Y must equal 1 for the I/Y to be the period rate
    - Interest is entered as a percent, not a decimal
  - N = number of periods
  - Remember to clear the registers (CLR TVM) after each problem
  - Set decimal places to floating point (2nd Format, Dec = 9 enter)

Future Value (FV)

- End of year

Where: **➔ $FV_t = PV (1 + r)^t$**
r = interest rate
t = compounding periods
FV_t = Future Value at time period t
PV = Present Value (now, today, t = 0)

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Determining Interest Rates

- Determining time periods will tell you the number of compounding periods b/w the PV point and the FV point, or vice versa
- The number of compounding periods is a derivative of the compounding frequency of the interest rate
- If the compounding frequency is monthly, then the number of compounding periods will be in months
- Each calculation may have a different time period (years, quarters, months, days, etc.)

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Present Value (PV)

- A dollar to be received in 10 years is worth much less than if received today
- If we had the dollar today we could be invest it and earn a rate of return. Therefore, its PV would be the FV, $1, discounted at the foregone rate of return $\$1 / (1+r)^t$
- Suppose that delaying this $1 by 10 years, we are forgoing a 15% annual ROR
- $PV=FV/(1+r)^t = 1/(1.15)^{10} = \$0.247184706$

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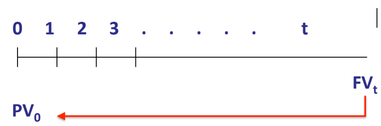
Present Value (PV)

End of year



← $PV_0 = FV_N \; / \; (1 + r)^t$

Finding PVs is discounting, and it's the reverse of compounding.

Rule of 72

- Back-of-the-envelope means to find the number of years required to double your money at a given interest rate
- You divide the compound return into 72
- 72/r%
- This rule is fairly accurate for discount rates in the 5 percent to 20 percent range

Finding the Number of Periods

- Use the basic equation and solve for t
- $FV = PV(1+r)^t$
- t = ln(FV/PV) / ln(1+r)
- Natural logs, LN key on the calculator
- OR use financial calculator and solve for N, just remember the sign convention
- Can also use rule of 72 as well (not as precise) for amounts that double

Calculating the Interest Rate

- We can use either the FV or the PV equation. Both will give you the same answer since they are the inverse of each other
- For individual cash flows:
  - Equation: $r = (FV/PV)^{1/t} - 1$
- If you borrowed $1,000 today and paid interest and principal in a $2,011 lump sum in five years, what would be the implied rate?
- $r = (2011/1000)^{1/5} - 1 = .14996$ = approx. 15%
- For annuities and uneven cash flows use a financial calculator