BOMA International's Asset Management Series:

Measuring Financial Returns

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BOMA International's
Asset Management Series:

Measuring Financial Return and Investment Analysis

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Objectives

At the end of this session, the participant will be able to:

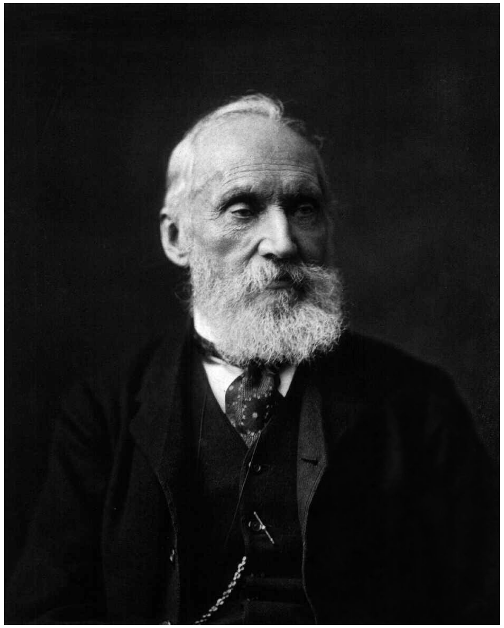
- *Calculate return on investment (ROI)*
- *Calculate asset value using the IRV formula*
- *Calculate an investment's yield/return (cash-on-cash return)*
- *Describe the process of asset appreciation and depreciation*
- *Define discount rate, and explain how it impacts the value of an investment*

Objectives

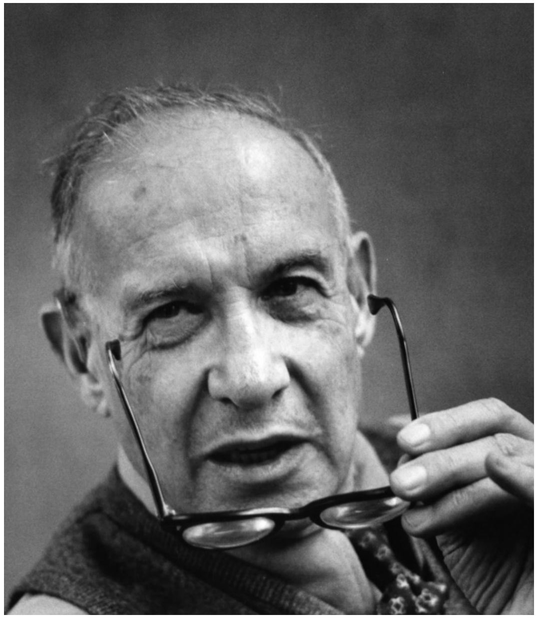
At the end of this session, the participant will be able to:

- *Explain how the time value of money (TVM) impacts real estate investments, and calculate:*
  - *Present Value (PV)*
  - *Future Value (FV)*
  - *Net Present Value (NPV)*
  - *Internal Rate of Return (IRR)*

If you cannot measure it, you cannot manage it



William Thomson
First Baron Kelvin



Peter Drucker

Simple Payback

The amount of time it takes to recoup the initial cost of an investment – either through income generated (lease) or cost savings (lighting retrofit)

$$Simple\ Payback = \frac{Investment\ Cost}{Income\ or\ Savings\ from\ Investment}$$

1 | Putting it Into Practice

The investor is considering a lighting retrofit that will cost $60,000 and that will reduce energy consumption by $40,000 per year.

The simple payback for this investment would be:

$$Simple\ Payback = \frac{Investment\ Cost}{Income\ or\ Savings\ from\ Investment}$$

1 | Putting it Into Practice

The investor is considering a lighting retrofit that will cost $60,000 and that will reduce energy consumption by $40,000 per year.

The simple payback for this investment would be:

$$\textit{Simple Payback} = \frac{\textit{Investment Cost}}{\textit{Income or Savings from Investment}}$$

$$\textit{Simple Payback} = \frac{\$60,000}{\$40,000}$$

1 | Putting it Into Practice

The investor is considering a lighting retrofit that will cost $60,000 and that will reduce energy consumption by $40,000 per year.

The simple payback for this investment would be:

$$Simple\ Payback = \frac{Investment\ Cost}{Income\ or\ Savings\ from\ Investment}$$

$$Simple\ Payback = \frac{\$60,000}{\$40,000}$$

$$\frac{\$60,000}{\$40,000} = 1.5\ years\ (18\ months)$$

2 | Putting it Into Practice

Assume a new tenant moves into a vacant space.

The landlord's leasing costs include:

- **$100,000 for brokerage commissions**
- **$200,000 for tenant improvements**
- **$10,000 in lease-related legal costs**

The tenant will pay $500,000 in rent over the 5-year lease term.

The simple payback for this investment would be:

$$Simple\ Payback = \frac{Investment\ Cost}{Income\ or\ Savings\ from\ Investment}$$

2 | Putting it Into Practice

$$\textit{Simple Payback} = \frac{\textit{Investment Cost}}{\textit{Income or Savings from Investment}}$$

$$\textit{Simple Payback} = \frac{\$100,000 + \$200,000 + \$10,000}{\$500,000}$$

2 | Putting it Into Practice

$$Simple\ Payback = \frac{Investment\ Cost}{Income\ or\ Savings\ from\ Investment}$$

$$Simple\ Payback = \frac{\$100,000 + \$200,000 + \$10,000}{\$500,000}$$

$$Simple\ Payback = \frac{\$310,000}{\$500,000}$$

2 | Putting it Into Practice

$$Simple\ Payback = \frac{Investment\ Cost}{Income\ or\ Savings\ from\ Investment}$$

$$Simple\ Payback = \frac{\$100,000 + \$200,000 + \$10,000}{\$500,000}$$

$$Simple\ Payback = \frac{\$310,000}{\$500,000}$$

$$\frac{\$310,000}{\$500,000} = 0.62\ of\ lease\ term\ (\sim 37\ months)$$

Life Cycle Costing

Evaluate entire cost of a project over its life

The least expensive installation cost might not be the best option

$$Life\ Cycle\ Cost = \frac{Installation\ Cost + Operating\ Cost + Maintenance\ Cost}{Anticipated\ Useful\ Life\ or\ Investor's\ Hold\ Period}$$

Risk

Investor's expected financial return is directly related to an investment's risk

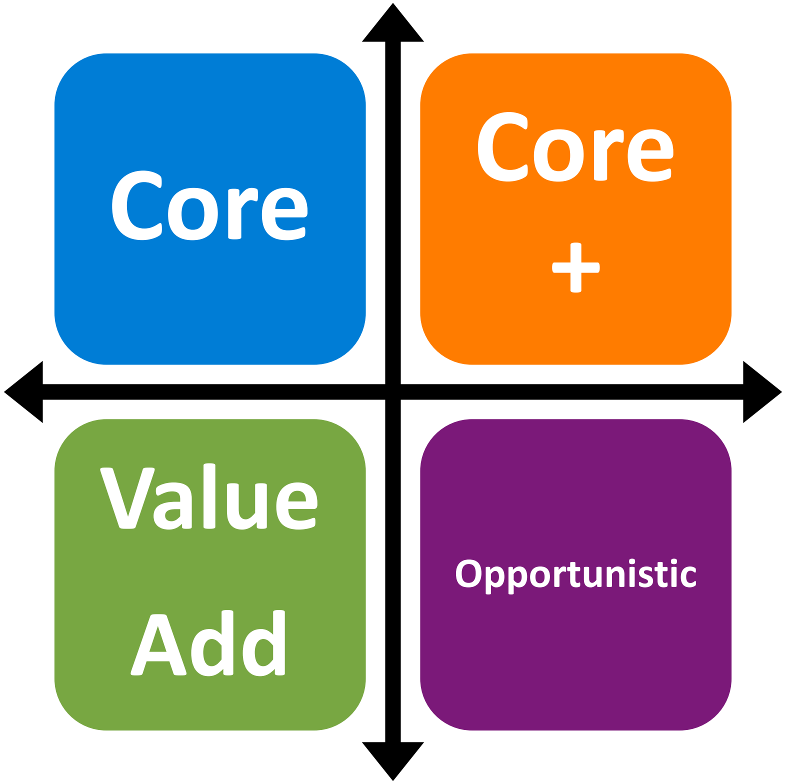
Core → Core+ → Value Add → Opportunistic

Low Risk → High Risk

Lower Return → Higher Return

Balancing Risk

Investors can manage risk through diversification



Return on Investment (ROI)

Measures efficiency of the investment

The financial return of the investment relative to the investment's initial cost

$$ROI = \frac{Gain\ from\ Investment}{Cost\ of\ Investment}$$

3 | Putting it Into Practice

An investor purchased a small office building for $1 million. A year later, he sold the building for $1.2 million. What was the ROI on this investment?

$$ROI = \frac{Gain\ from\ Investment}{Cost\ of\ Investment}$$

3 | Putting it Into Practice

An investor purchased a small office building for $1 million. A year later, he sold the building for $1.2 million. What was the ROI on this investment?

$$ROI = \frac{Gain\ from\ Investment}{Cost\ of\ Investment}$$

$$ROI = \frac{\$1,200,000 - \$1,000,000}{\$1,000,000}$$

3 | Putting it Into Practice

An investor purchased a small office building for $1 million. A year later, he sold the building for $1.2 million. What was the ROI on this investment?

$$ROI = \frac{Gain\ from\ Investment}{Cost\ of\ Investment}$$

$$ROI = \frac{\$1,200,000 - \$1,000,000}{\$1,000,000}$$

$$\frac{\$200,000}{\$1,000,000} = 20\%$$

4 | Putting it Into Practice

The asset manager has two tenants that are competing to occupy the same space. He can only choose one of the tenants, and he wants to choose the one that represents the most efficient use of the investor's capital resources. Which option would he choose?

- **Card Store** – Over the 5-year lease term, the tenant will pay $750,000. Including TI costs, commissions, and other capitalized leasing costs, the landlord expects to spend $500,000 to make the deal.
- **Food Service** – Over the 5-year lease term, the tenant will pay $2.1 million in rent, and the landlord's leasing costs are expected to be $1.6 million.

4 | Putting it Into Practice

$$ROI = \frac{Gain\ from\ Investment}{Cost\ of\ Investment}$$

$$ROI = \frac{Gain\ from\ Investment}{Cost\ of\ Investment}$$

4 | Putting it Into Practice

$$ROI = \frac{Gain\ from\ Investment}{Cost\ of\ Investment}$$

$$ROI = \frac{\$750,000 - \$500,000}{\$500,000}$$

$$ROI = \frac{Gain\ from\ Investment}{Cost\ of\ Investment}$$

$$ROI = \frac{\$2,100,000 - \$1,600,000}{\$1,600,000}$$

4 | Putting it Into Practice

$$ROI = \frac{Gain\ from\ Investment}{Cost\ of\ Investment}$$

$$ROI = \frac{\$750,000 - \$500,000}{\$500,000}$$

$$ROI = \frac{\$250,000}{\$500,000}$$

$$ROI = \frac{Gain\ from\ Investment}{Cost\ of\ Investment}$$

$$ROI = \frac{\$2,100,000 - \$1,600,000}{\$1,600,000}$$

$$ROI = \frac{\$500,000}{\$1,600,000}$$

4 | Putting it Into Practice

$$ROI = \frac{Gain\ from\ Investment}{Cost\ of\ Investment}$$

$$ROI = \frac{\$750,000\ - \$500,000}{\$500,000}$$

$$ROI = \frac{\$250,000}{\$500,000}$$

$$\frac{\$250,000}{\$500,000} = 50\%\ ROI$$

$$ROI = \frac{Gain\ from\ Investment}{Cost\ of\ Investment}$$

$$ROI = \frac{\$2,100,000\ - \$1,600,000}{\$1,600,000}$$

$$ROI = \frac{\$500,000}{\$1,600,000}$$

$$\frac{\$500,000}{\$800,000} = 31.25\%\ ROI$$

4 | Putting it Into Practice

$$\frac{\$250,000}{\$500,000} = 50\%\ ROI$$

$$\frac{\$500,000}{\$800,000} = 31.25\%\ ROI$$

Which would you choose?

5 | Putting it Into Practice

The asset manager has two tenants that are competing to occupy the same space. He can only choose one of the tenants, and he wants to choose the one that represents the most efficient use of the investor's capital resources. Which option would he choose?

- Card Store – Over the 10-year lease term, the tenant will pay $750,000. Including TI costs, commissions, and other capitalized leasing costs, the landlord expects to spend $500,000 to make the deal.
- Food Service – Over the 3-year lease term, the tenant will pay $2.1 million in rent, and the landlord's leasing costs are expected to be $1.6 million.

5 | Putting it Into Practice

$$\frac{\$250,000}{\$500,000} = 50\%\ ROI$$

$$\frac{\$600,000}{\$1,600,000} = 31.25\%\ ROI$$

50% ROI/10-year term = 5% per year

31.25% ROI/3-year term = 10.42% per year

Now which would you choose?

Return on Investment (ROI)

The most basic ROI calculation only evaluates start (purchase) and end (sale)

- What about cash flow during the hold period?
- *What about leverage? (Covered in Session 6)*

$$ROI = \frac{Gain\ from\ Investment\ (Including\ Cash\ Flow)}{Cost\ of\ Investment}$$

1 | Nothing is Ever Easy

Recall the previous example: An investor purchased a small office building for $1 million. A year later, he sold the building for $1.2 million. During that year, the investment generated $100,000 in cash flow. What was the ROI on this investment?

$$ROI = \frac{Gain\ from\ Investment}{Cost\ of\ Investment}$$

$$ROI = \frac{\$1,200,000 - \$1,000,000 + \$100,000}{\$1,000,000}$$

$$\frac{\$300,000}{\$1,000,000} = 30\%\ ROI$$

2 | Nothing is Ever Easy

An investor purchased a small office building for $1 million. A year later, he sold the building for $1.2 million. During that year, the investment lost $100,000 in cash flow. What was the ROI on this investment?

$$ROI = \frac{Gain\ from\ Investment}{Cost\ of\ Investment}$$

$$ROI = \frac{\$1,200,000 - \$1,000,000 - \$100,000}{\$1,000,000}$$

$$\frac{\$100,000}{\$1,000,000} = 10\%\ ROI$$

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Return on Investment (ROI)

Does not take into consideration Time Value of Money (TVM)

Option 1	
Year 0 – Purchase (Output)	$1,000,000
Year 1 – NOI	($20,000)
Year 2 – NOI	($20,000)
Year 3 – NOI	($20,000)
Year 4 – NOI	($20,000)
Year 5 – NOI	($20,000)
Year 5 – Sale (Input)	($1,200,000)

$$\frac{(\$200,000 + \$100,000)}{\$1,000,000} = 30\%\ ROI$$

Option 2	
Year 0 – Purchase (Output)	$1,000,000
Year 1 – NOI	($100,000)
Year 2 – NOI	$0
Year 3 – NOI	$0
Year 4 – NOI	$0
Year 5 – NOI	$0
Year 5 – Sale (Input)	($1,200,000)

$$\frac{(\$200,000 + \$100,000)}{\$1,000,000} = 30\%\ ROI$$

Option 3	
Year 0 – Purchase (Output)	$1,000,000
Year 1 – NOI	$0
Year 2 – NOI	$0
Year 3 – NOI	$0
Year 4 – NOI	$0
Year 5 – NOI	($100,000)
Year 5 – Sale (Input)	($1,200,000)

$$\frac{(\$200,000 + \$100,000)}{\$1,000,000} = 30\%\ ROI$$

Although each option has the same ROI, not all of these investments are equal

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Return on Investment (ROI)

Does not take into consideration Time Value of Money (TVM)

Option 1	
Year 0 – Purchase (Output)	$1,000,000
Year 1 – NOI	($20,000)
Year 2 – NOI	($20,000)
Year 3 – NOI	($20,000)
Year 4 – NOI	($20,000)
Year 5 – NOI	($20,000)
Year 5 – Sale (Input)	($1,200,000)

$$\frac{(\$200,000 + \$100,000)}{\$1,000,000} = 30\%\ ROI$$

Middle Present Value

Cash flow is spread evenly

Option 2	
Year 0 – Purchase (Output)	$1,000,000
Year 1 – NOI	($100,000)
Year 2 – NOI	$0
Year 3 – NOI	$0
Year 4 – NOI	$0
Year 5 – NOI	$0
Year 5 – Sale (Input)	($1,200,000)

$$\frac{(\$200,000 + \$100,000)}{\$1,000,000} = 30\%\ ROI$$

Highest Present Value

Cash flow is front-loaded

Option 3	
Year 0 – Purchase (Output)	$1,000,000
Year 1 – NOI	$0
Year 2 – NOI	$0
Year 3 – NOI	$0
Year 4 – NOI	$0
Year 5 – NOI	($100,000)
Year 5 – Sale (Input)	($1,200,000)

$$\frac{(\$200,000 + \$100,000)}{\$1,000,000} = 30\%\ ROI$$

Lowest Present Value

Cash flow is back-loaded

Calculating Cap Rate Using IRV

$$R = \frac{I}{V}$$

$$Cap\ Rate = \frac{Net\ Operating\ Income}{Current\ Market\ Value}$$

$$\frac{\$125{,}000}{\$900{,}000} = 13.89\%$$

Social Return on Investment

Cash-on-Cash Return

Measures efficiency of the investment – based upon unleveraged (cash) investment

$$\text{Cash-on-Cash Return} = \frac{\textit{Annual Dollar Income (NCF)}}{\textit{Total Dollar Investment}}$$

6 | Putting it Into Practice

Recall an earlier example: The owner purchased a property for $1 million in cash and sold it in a year for $1.2 million. The property generated $100,000 in cash flow over that time period.

What was the cash-on-cash return on this investment?

$$\text{Cash-on-Cash Return} = \frac{\textit{Annual Dollar Income (NCF)}}{\textit{Total Dollar Investment}}$$

$$\text{Cash-on-Cash Return} = \frac{\$100{,}000}{\$1{,}000{,}000}$$

$$\frac{\$100,000}{\$1,000,000} = 10\%$$

6 | Putting it Into Practice

The owner purchased a property for $1 million ($100,000 in cash and a $900,000 mortgage) and sold it in a year for $1.2 million. The property generated $100,000 in cash flow over that time period.

What was the cash-on-cash return on this investment?

$$\text{Cash-on-Cash Return} = \frac{Annual\ Dollar\ Income\ (NCF)}{Total\ Dollar\ Investment}$$

$$\text{Cash-on-Cash Return} = \frac{\$100{,}000}{\$100{,}000}$$

$$\frac{\$100,000}{\$100,000} = 100\%$$

6 | Putting it Into Practice

The owner purchased a property for $1 million ($500,000 in cash and a $500,000 mortgage) and sold it in a year for $1.2 million. The property generated $100,000 in cash flow over that time period.

What was the cash-on-cash return on this investment?

$$\text{Cash-on-Cash Return} = \frac{\textit{Annual Dollar Income (NCF)}}{\textit{Total Dollar Investment}}$$

$$\text{Cash-on-Cash Return} = \frac{\$100{,}000}{\$500{,}000}$$

$$\frac{\$100,000}{\$500,000} = 20\%$$

Limitations of Cash-on-Cash Return

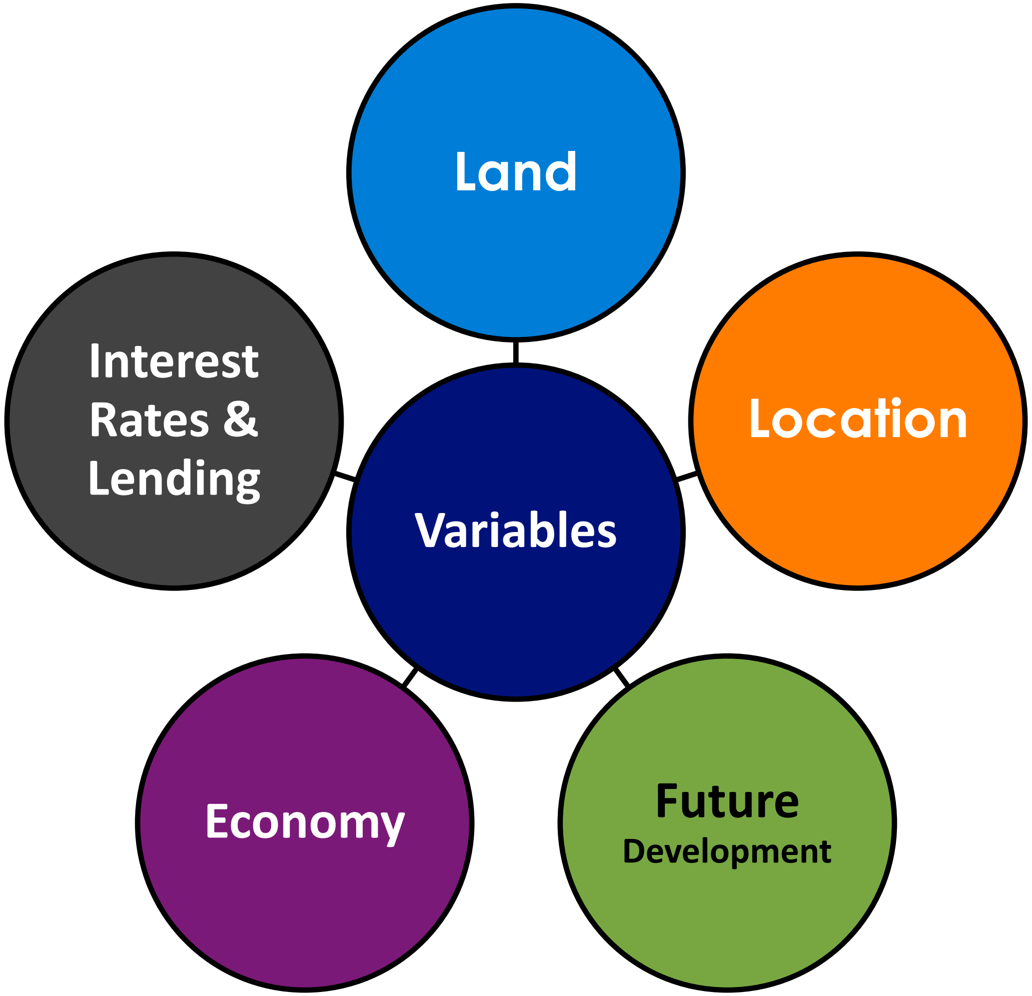
- Cash flow is only one portion of an investor's return – what about asset appreciation and depreciation?
- Does not account for
  - Income tax implications
  - Riskiness of investment
  - Compounded interest

Appreciation/Depreciation

Change in value based upon an investment's market rate

- Controllable/non-controllable factors
- "Cap rate compression"
  - Investors willing to pay lower cap rates (and higher prices) for a particular cash flow
- Value is impacted by cash flow and capital appreciation
  - Maximized when both are increasing

Appreciation/Depreciation



Time Value of Money (TVM)

Money available at present time is worth more than same amount in the future due to its potential earning capacity

Money is worth more the sooner it is received

Present Value

Current worth of a future sum or stream of cash flows given a specified rate of return

- Forward-looking
  - Measures value of future cash flows in today's dollars
- Uses discount rate – owner's expected rate of return (owner's cost of capital)

Choosing a Discount Rate

$$\text{NPV} = \sum_{n=0}^{N} \frac{C_n}{(1+r)^n}$$

Formula represents sum of future cash flows

Over the hold period (N)

In each year of the hold period (n)

Using owner's rate of return (r)

Choosing a Discount Rate

Discount rate can have a tremendous impact on valuation of a cash flow

Period	Cash Flow
0	-$1,000,000
1	$100,000
2	$100,000
3	$100,000
4	$100,000
5	$1,100,000

How much would you pay for this cash flow?

Depending upon the discount rate, investor would pay

Discount Rate	NPV
8%	$79,854
9%	$38,897
10%	$0
11%	($36,959)
12%	($72,096)
13%	($105,517)

Present Value Illustrated

$100 today has a PV of $100

5% Discount Rate			
Time	Starting Amount	Discount Rate	Ending Amount
Year 1	$78.35	$3.92	$82.27
Year 2	$82.27	$4.11	$86.38
Year 3	$86.38	$4.32	$90.70
Year 4	$90.70	$4.53	$95.23
Year 5	$95.23	$4.76	$100.00

15% Discount Rate | Value Add			
Time	Starting Amount	Discount Rate	Ending Amount
Year 1	$49.72	$7.46	$57.18
Year 2	$57.18	$8.58	$65.75
Year 3	$65.75	$9.86	$75.62
Year 4	$75.62	$11.34	$86.96
Year 5	$86.96	$13.04	$100.00

2.4% Discount Rate | T Bond			
Time	Starting Amount	Discount Rate	Ending Amount
Year 1	$88.82	$2.13	$90.95
Year 2	$90.95	$2.18	$93.13
Year 3	$93.13	$2.24	$95.37
Year 4	$95.37	$2.29	$97.66
Year 5	$97.66	$2.34	$100.00

Calculating Present Value

Present value of an investment is based upon this formula:

$$Present\ Value = \frac{C_1}{(1 + r)^n}$$

C_1 = *cash flow at period 1*

r = *discount rate (rate of return)*

n = *number of periods*

Calculating Present Value

The investor wants to earn $100 in 5 years at a 5% discount rate

5% Discount Rate			
Time	Starting Amount	Discount Rate	Ending Amount
Year 1	$78.35	$3.92	$82.27
Year 2	$82.27	$4.11	$86.38
Year 3	$86.38	$4.32	$90.70
Year 4	$90.70	$4.53	$95.23
Year 5	$95.23	$4.76	$100.00

$$Present\ Value = \frac{\$100}{(1+5\%)^5}$$

$$Present\ Value = \frac{\$100}{(1.05)^5}$$

$$Present\ Value = \frac{\$100}{1.27628}$$

$$Present\ Value = \$78.35$$

Calculating Present Value Alternative Formula

Alternatively, PV can be calculated using this formula:

$$Present\ Value = Future\ Value\ \frac{1}{(1+r)^n}$$

$$FV = future\ value$$
$$r = discount\ rate\ (rate\ of\ return)$$
$$n = number\ of\ periods$$

Calculating Present Value | Alternative Formula

The investor wants to earn $100 in 5 years at a 5% discount rate

5% Discount Rate			
Time	Starting Amount	Discount Rate	Ending Amount
Year 1	$78.35	$3.92	$82.27
Year 2	$82.27	$4.11	$86.38
Year 3	$86.38	$4.32	$90.70
Year 4	$90.70	$4.53	$95.23
Year 5	$95.23	$4.76	$100.00

$$Present\ Value = \$100\ \frac{1}{(1 + 5\%)^5}$$

$$Present\ Value = \$100\ \frac{1}{(1.05)^5}$$

$$Present\ Value = \$100\ \frac{1}{1.27628}$$

$$Present\ Value = \$78.35$$

Future Value

Predict value today of a future cash flow

- Opposite of Present Value
- Retrospective
- Uses discount rate – owner's expected rate of return (owner's cost of capital)

Future Value Illustrated

$100 paid in Year 5 has a FV of $100

5% Discount Rate			
Time	Starting Amount	Discount Rate	Ending Amount
Year 1	$100.00	$5.00	$105.00
Year 2	$105.00	$5.25	$110.25
Year 3	$110.25	$5.51	$115.76
Year 4	$115.76	$5.79	$121.55
Year 5	$121.55	$6.08	$127.63

15% Discount Rate | Value Add			
Time	Starting Amount	Discount Rate	Ending Amount
Year 1	$100.00	$15.00	$115.00
Year 2	$115.00	$17.25	$132.25
Year 3	$132.25	$19.84	$152.09
Year 4	$152.09	$22.81	$174.90
Year 5	$174.90	$26.24	$201.14

2.4% Discount Rate | T Bond			
Time	Starting Amount	Discount Rate	Ending Amount
Year 1	$100.00	$2.40	$102.40
Year 2	$102.40	$2.46	$104.86
Year 3	$104.86	$2.52	$107.37
Year 4	$107.37	$2.58	$109.95
Year 5	$109.95	$2.64	$112.59

Calculating Future Value

Future value of an investment is based upon this formula:

$$Future\ Value = C_0\ x\ (1 + r)^n$$

C_0 = cash flow at period 0 (purchase)

r = discount rate (rate of return)

n = number of periods

Calculating Future Value

The investor has $100 to invest for 5 years at a 5% discount rate

5% Discount Rate			
Time	Starting Amount	Discount Rate	Ending Amount
Year 1	$100.00	$5.00	$105.00
Year 2	$105.00	$5.25	$110.25
Year 3	$110.25	$5.51	$115.76
Year 4	$115.76	$5.79	$121.55
Year 5	$121.55	$6.08	$127.63

Future Value = $100 (1.05)^5

Future Value = $100 (1.27628)

Future Value = $127.628

Discounted Cash Flow

10-year cash flow represents series of cash flows

Outflows

- Initial investment, including loan points and other fees
- Expenses associated with the investment
- Other cash outflows, such as principal payments to a lender
- Selling expenses upon liquidation of the investment

Inflows

- Annual income from the investment.
- Net proceeds upon liquidation (after loans are repaid)

Discounted Cash Flow

The basic discount cash flow (DCF) is represented by:

Period	Description	Occurs
1	Cash Flow	End of Period 1
2	Cash Flow	End of Period 2
3	Cash Flow	End of Period 3
4	Cash Flow	End of Period 4
5	Cash Flow + Sale Proceeds	End of Period 5

7 | Putting it Into Practice

Assume an investor is interested in purchasing a building with these parameters

Purchase price: $2 million
Capitalization rate: 5%
Annual cash flows:

- Year 1 - $100,000
- Year 2 - $40,000
- Year 3 - $120,000
- Year 4 - $120,000
- Year 5 - $125,000

Sale price: $2.5 million

7 | Putting it Into Practice

Year 1 cash flow ($100,000) has a PV of $95,238

$$Present\ Value = \frac{\$100,000}{(1+5\%)^1}$$

$$Present\ Value = \frac{\$100,000}{(1.05)^1}$$

$$\frac{\$100,000}{(1.05)^1} = \$95,238$$

7 | Putting it Into Practice

Year 2 cash flow ($40,000) has a PV of $36,281

$$Present\ Value = \frac{\$40,000}{(1+5\%)^2}$$

$$Present\ Value = \frac{\$40,000}{(1.05)^2}$$

$$\frac{\$40,000}{1.1025} = \$36,281$$

7 | Putting it Into Practice

Year 3 cash flow ($120,000) has a PV of $103,660

$$Present\ Value = \frac{\$120,000}{(1+5\%)^3}$$

$$Present\ Value = \frac{\$120,000}{(1.05)^3}$$

$$\frac{\$120,000}{1.15763} = \$103,660$$

7 | Putting it Into Practice

Year 4 cash flow ($120,000) has a PV of $98,724

$$\boldsymbol{Present\ Value = \frac{\$120,000}{(1+5\%)^4}}$$

$$\boldsymbol{Present\ Value = \frac{\$120,000}{(1.05)^4}}$$

$$\boldsymbol{\frac{\$120,000}{1.21551} = \$98,724}$$

7 | Putting it Into Practice

Year 5 cash flow ($125,000) and the sale price ($2.5 million) has a PV of $2,056,759

$$Present\ Value = \frac{\$125,000 + \$2,500,000}{(1+5\%)^5}$$

$$Present\ Value = \frac{\$2,625,000}{(1.05)^5}$$

$$\frac{\$2,625,000}{1.27628} = \$2,056,759$$

7 | Putting it Into Practice

To summarize the various cash flows:

Time	Cash Flow	Discounted Cash Flow
Year 1	$100,000	$95,238
Year 2	$40,000	$36,281
Year 3	$120,000	$103,660
Year 4	$120,000	$98,724
Year 5	$2,625,000	$2,056,759
Total	$3,005,000	$2,390,660

At a 5% capitalization rate, the net cash flow $3,005,000 over the life of the investment has a PV of $2,390,660

7 | Putting it Into Practice

The formula to calculate the DCF is essentially a string of PV calculations:

$$\text{Discounted Cash Flow} = \frac{\text{Cash Flow}_{\text{Period 1}}}{(1+r)^1} + \frac{\text{Cash Flow}_{\text{Period 2}}}{(1+r)^2} \ldots \frac{\text{Cash Flow}_{\text{Period x}}}{(1+r)^x} + \ldots$$

DCF formula DOES NOT include purchase price

DCF measures the price investor is willing to pay – in today's dollars – to purchase the asset

Net Present Value

Similar to DCF – *except it includes the purchase price of the asset*

“If I spend (x dollars) today to generate this future cash flow, am I earning more than I paid?"

Negative NPV

Cash flow is worth less than the amount paid to acquire it

Positive NPV

Investor will earn a return on the investment

Net Present Value

Time	Cash Flow	Discounted Cash Flow
Year 1	$100,000	$95,238
Year 2	$40,000	$36,281
Year 3	$120,000	$103,660
Year 4	$120,000	$98,724
Year 5	$2,625,000	$2,056,759
DCF	$3,005,000	$2,390,660
Less Purchase Price	-$2,000,000	-$2,000,000
NPV	$1,005,000	$390,660

The following is the formula for calculating NPV:

C_t = net cash inflow during the period t
C_o= total initial investment costs
r = discount rate, and
t = number of time periods

$$NPV = \sum_{t=1}^{T} \frac{C_t}{(1+r)^t} - C_o$$

DCF & NPV | Evaluating a Lease

The asset manager is evaluating the financial impact of a 5-year lease with the following parameters:

- 5-year lease
- $130,000 annual rent in Year 1 – escalated by 3% each year
- $295,000 in leasing costs (including tenant improvements, commissions, and other leasing costs)
- The investor uses an 8% discount rate/cost of capital

Discounted Cash Flow & Net Present Value		
Time	Cash Flow	Discounted Cash Flow
Year 1	$130,000	$120,370
Year 2	$133,900	$114,798
Year 3	$137,917	$109,483
Year 4	$142,055	$104,415
Year 5	$146,317	$99,581
DCF	$690,189	$548,647
Less: Investment	($295,000)	($295,000)
NPV	$395,189	$253,647

The NPV is positive – so the investment is favorable

DCF & NPV | Evaluating Capital Investments

The asset manager is evaluating the financial impact of a lighting retrofit with the following parameters:

- $295,000 installation cost for the new lighting and lighting controls
- An expected savings of $92,000 per year in energy costs
- The investor uses a 6% discount rate/cost of capital

Discounted Cash Flow & Net Present Value		
Time	Cash Flow	Discounted Cash Flow
Year 1	$92,000	$85,981
Year 2	$92,000	$80,356
Year 3	$92,000	$75,099
Year 4	$92,000	$70,186
Year 5	$92,000	$65,595
DCF	$460,000	$377,217
Less: Investment	($295,000)	($295,000)
NPV	$165,000	$82,217

The NPV is positive – so the investment is favorable

DCF & NPV | Evaluating Capital Investments

The asset manager is evaluating the financial impact of a chiller replacement with the following parameters:

- $400,000 installation cost for the chiller
- An expected savings of $15,000 per year in energy costs
- The investor uses a 6% discount rate/cost of capital

The NPV is positive – so the investment is favorable

Discounted Cash Flow & Net Present Value		
Time	Cash Flow	Discounted Cash Flow
Year 1	$15,000	$14,151
Year 2	$15,000	$13,350
Year 3	$15,000	$12,594
Year 4	$15,000	$11,881
Year 5	$15,000	$11,209
DCF	$75,000	$63,185
Less: Investment	($400,000)	($295,000)
NPV	($325,000)	($336,815)

Internal Rate of Return (IRR)

Interest rate at which NPV of all cash flows = 0

Same formula as NPV – just solve for NPV = 0

Cash Flow	
Period	Cash Flow
0	-$1,000,000
1	$100,000
2	$100,000
3	$100,000
4	$100,000
5	$1,100,000

NPV	
Discount Rate	NPV
8%	$79,854
9%	$38,897
10%	$0
11%	($36,959)
12%	($72,096)
13%	($105,517)

At a discount rate of 10%, the NPV equals 0
For this investment, the IRR is 10%

What Metrics do Asset Managers Use?

It depends

Common metrics used by asset managers:

- Simple Payback – 2 years or less
- Return on Investment (ROI) – 10% or higher
- Net Present Value (NPV) - positive
- Internal Rate of Return (IRR) – 10% or higher