



Tennessee
TECH

The Cost of Capital Overview



The cost of capital

- Capital is provided to firms by investors-through interest bearing debt, preferred stock and common equity.
- The investors who provide capital to the firm expect to earn at least their required rate of return on that capital. This required return represents the firm's cost of capital.
- This cost of capital is calculated as a weighted average of the various types of funds used over time—hence the weighted average cost of capital (wacc).
 - Calculating the wacc requires adopting a long-run view.



The Cost of Capital

- This cost of capital is calculated as a weighted average of the various types of funds used over time.

$$wacc = w_d r_d (1 - T) + w_p r_p + w_c r_s$$

- w_d , w_p , w_c reflect the weight of debt, preferred equity and common equity in financing the firm
 - i.e. weight of debt=what percentage of the firm is financed by debt
 - Weights are based on market values and not accounting data
 - Weights are also known as the firm's capital structure
- r_d , r_p , r_s reflect the cost, respectively, of debt, preferred equity and common equity
 - $(1-T)$ is included with debt to reflect the tax benefit of deducting interest payments before paying taxes



The cost of capital: Calculations



Example:

- Hawkes Inc. recently hired you to estimate the cost of capital for a new project. You are given the following information about the firm:
 - The firm has a target capital structure that consists of 30% debt, 50% common equity and 20% preferred equity. The firm has outstanding bonds with a current price of \$950, 15 years to maturity and a 10% coupon. The firm is subject to a 25% tax rate. The firm's preferred stock pays an annual dividend of \$12 and each preferred share currently sells for \$100. The firm does not plan to issue new equity; it will retain earnings instead. Hawkes has no preferred way of calculating the cost of common equity so they ask you to use your expertise to come up with a good estimate. Management provides you the following information about their common stock:
 - Hawkes is a mature firm expected to grow at a constant rate of 2% forever. The firm is expected to pay a dividend of \$5 at the end of the year and the common stock price is \$40 per share. Hawkes Inc.'s beta is 1.75. In addition, the current risk-free rate is 1% and the return on the market is 8%. The common stock is more risky than the firm's outstanding bonds such that a premium of 3% would reflect the additional risk.





The cost of capital: Capital Components



The Cost of Debt

- The interest rate a firm pays on its new debt is its before-tax cost of debt, r_d .
 - What is relevant is the cost of new debt because we are interested in how much it will cost the firm to finance new projects. Therefore, how much it paid to borrow in the past is irrelevant.
 - In other words, we do NOT care about the coupon rate. We need YTM or YTC of outstanding bonds.

****Recall****

N=effective maturity

I/YR=?? Yield to Maturity

PV=Current Price of the bond

PMT=Coupon payment

FV=Par value



The Cost of Debt

- To calculate the weighted average cost of capital, use the after-tax cost of debt:

$$r_d(1-T)$$

- Why? Because the wacc is used to select new projects that will maximize the value of the firm's stock. The value of the firm's stock depends on after-tax cash flows. Since debt has a preferential tax treatment, we must adjust for that.



The Cost of Preferred Stock

- There are no tax savings associated with preferred stock.

- The cost of preferred stock is: $r_p = \frac{D_p}{P_p}$

****Recall****

$$P_p = \frac{D_p}{r_p}$$



The Cost of Common Equity

- New common equity is raised in two ways:
 - By retaining some of the current year's earnings
 - By issuing new common stock
 - Equity raised by issuing new stock is more costly because of **flotation costs** required to sell the new stock



The cost of retained earnings

- Some argue that the cost of retained earnings should be zero. After all, retained earnings are what is left after the firm pays dividends. However, managers decide to retain earnings or pay them out as dividends. If they decide to retain earnings, this suggests that investors are at least as well off as they would be if dividends were paid. If dividends had been paid, investors could invest in an alternative investment of similar risk. Thus the cost of retained earnings is not explicit. It is an opportunity cost.
- The cost of retained earnings is the required return on an investment of similar risk, r_s .
- Unlike bonds which have contractual obligations and costs stated in their contracts, stocks have no stated rate. Therefore, r_s must be estimated. There are 3 general ways of estimating r_s .



3 Ways to Estimate Cost of Retained Earnings

1. CAPM: $r_s = r_{rf} + \beta(r_m - r_{rf})$

2. Bond yield plus premium: $r_s = \text{BondYield} + \text{Risk Premium}$

3. Dividend yield + growth:

$$r_s = \frac{D_1}{P_0} + g$$

SO WHICH APPROACH DO YOU USE?

Depends on the information given.

If highly confident in one method, choose that one.

Otherwise, if possible, take the average of all the methods possible



Estimating Cost of Retained Earnings: CAPM

$$\text{CAPM: } r_s = r_{rf} + \beta(r_m - r_{rf})$$

- Nominal risk-free rate, r_{rf}
 - Use a long-term bond such as the yield on a 10-year T-bond because you are looking at long-term decisions
- Beta, β
 - Can be obtained by running a linear regression with the market returns as the independent variable and the stock's returns as the dependent variable
- The market risk premium ($r_m - r_{rf}$)
 - Use historical data which is easily attainable
 - Conduct surveys of market experts
 - Use forward-looking estimates



Estimating Cost of Retained Earnings: Bond Yield + Premium

Bond yield plus premium :

- ❖ Studies suggest that the risk premium of a firm's stock over its bonds is generally between 3-5 percentage points.
- ❖ The intuition is that firm's with risky, high interest rate debt also have risky high cost equity.
- ❖ Weakness: not precise but it is a reasonable approximation
- ❖ The premium will be specified in the problem.



Estimating the Cost of Retained Earnings: Dividend Yield + Growth

$$r_s = \frac{D_1}{P_0} + g$$

- Is a rewritten version of the Gordon Model
- To get g , 2 approaches:
 - $g = \text{ROE} \times \text{retention ratio}$
 - Estimate g from analyst estimates.
- Weaknesses:
 - dividend yield is easy to calculate but since prices change everyday, r_s will also change. Also, investors may not believe that the company's past growth rate will be the future growth rate.



Calculation-Independent Practice

- Adams Corporation estimates that it can issue debt at a rate of $r_d = 10\%$, and its tax rate is 30%. It can issue preferred stock that pays a constant dividend of \$5.00 per year at \$49.00 per share. Also, its common stock currently sells for \$36.00 per share; the next expected dividend, D_1 is \$3.50; and the dividend is expected to grow at a constant rate of 6% per year. The target capital structure consists of 75% common stock, 15% debt, and 10% preferred stock. What is Adams' WACC?



Independent Practice Solution



Calculation-Independent Practice

Green Foods Inc. has a target capital structure that consists of 40% debt, 50% common equity, and 10% preferred stock. The firm has outstanding bonds with a current price of \$926.40, 10 years to maturity and a 5% coupon. The firm is subject to a 40% tax rate. Green Firm's preferred stock pays a constant dividend of \$9 per year and is currently trading for a price of \$112.50 per share. The firm does not plan to issue new common equity; it will retain earnings instead. Management provides you the following information about their common stock: Green Foods Inc. is a mature firm expected to grow at a constant rate of 4% forever. The firm is expected to pay a dividend of \$3 at year end and its common stock trades at a price of \$60 per share. The firm's beta is 0.75, the risk free-rate is 2% and the return on the market is 12%. Also, the firm's stock is risky enough that it commands a 3.1% premium over the bond yield. Estimate Green Foods' weighted average cost of capital.



Independent Practice Solution



Capital Budgeting: WACC Conceptual Issues



Conceptual Issues

- Investors' required rates of return (common stock, preferred stock, and bonds) are based on current market conditions and not past market conditions.
 - Includes the weights which should be based on market values not book values
- Use the wacc to evaluate projects even if currently you are using only one capital component for financing.
- The wacc is the hurdle rate for a project of average risk. If the firm is undertaking a particularly risky (safe) project, the hurdle rate should be increased (lowered).



Managerial Decisions and the wacc

- Factors within the firm's control
 - changing the capital structure, changing its dividend payout
- Factors outside the firm's control
 - interest rates in the economy, the market risk premium, tax rates, credit crises, general level of stock prices



Additional Practice

1. Caribbean Enterprises recently hired you to estimate their cost of capital. The firm's capital structure is evenly split between debt and common equity but no preferred stock. The firm has outstanding bonds with 15 years left to maturity and an annual coupon of 6%. The bonds currently trade for \$1,161.09. The firm does not plan on issuing new shares of common equity. It will retain earnings instead. Management has no preferred method for calculating the cost of retained earnings but they provide you with the following information: The company expects dividend growth of 2% forever. The common shares are expected to pay a dividend of \$2 at year-end, and the shares currently trade for \$50 each. Also, the company's common stock is risky enough that it commands a premium of 2% over the company's debt. If the firm faces a flat state-plus-federal tax rate of 25%, what is Caribbean Enterprises' cost of capital?
2. Mirha Corp. recently hired you to estimate their cost of capital. The firm's capital structure is evenly split between debt and common equity but no preferred stock. The firm has outstanding bonds with 10 years left to maturity and an annual coupon of 7%. The bonds currently trade for \$1,073.60. The firm does not plan on issuing new shares of common equity. It will retain earnings instead. Management has no preferred method for calculating the cost of retained earnings but they provide you with the following information: The company expects dividend growth of 4% forever. The common shares are expected to pay a dividend of \$1.75 at year-end, and the shares currently trade for \$25 each. The company has a beta of 0.90, the risk-free rate is 1%, and the return on the market is 12%. Also, the company's common stock is risky enough that it commands a premium of 5% over the company's debt. If the firm faces a flat state-plus-federal tax rate of 40%, what is Mirha Corp's cost of capital?



Additional Practice

3. Data Inc. recently hired you as a consultant to evaluate its cost of capital. Using the following information, determine Data Inc's cost of capital.

- New debt can be raised at a rate equal to the yield to maturity (YTM) on the company's outstanding bonds. Their outstanding bonds mature in 20 years, have an 8% annual coupon, a par value of \$1,000 and a market price of \$1,050.00.
- The company's tax rate is 40%.
- The risk-free rate is 4.50%, the market risk premium is 5.50% and the stock's beta is 1.20.

The target capital structure consists of 35% debt and no preferred stock.



Capital Budgeting: Overview



Capital Budgeting

- The process of planning expenditures on assets with cash flows that are expected to extend beyond one year.

Strategic business plan: a long-run plan that outlines in broad term's the firm's basic strategy for the next 5 to 10 years.

Project Types:

- Replacement: to continue current operations OR as cost reduction
- Expansion: of existing products or markets OR into new products or markets
- Safety and/or environmental projects
- Mergers
- Other



Capital Budgeting Techniques

- Payback
- Discounted Payback
- Net Present Value (NPV) (best method)
- Internal Rate of Return (IRR)
- Modified Internal Rate of Return (MIRR)



Terminology

- **Independent Projects**
 - Projects with cash flows that are not affected by the acceptance or non-acceptance of other projects.
- **Mutually exclusive projects:**
 - set of projects where only one can be accepted.



Capital Budgeting: Payback



Payback

- Payback Period: Length of time required for an investment's net revenues to cover its cost.

$$\text{payback} = \# \text{OfYears PriorToFull Recovery} + \frac{\text{UnrecoveredCostAtStartOfYear}}{\text{CashFlowDuringThe RecoveryYear}}$$

- The shorter the payback, the better the project.
 - If Projects S & L were mutually exclusive and S's payback was shorter than L's, choose Project S.



Example

Project S has a cost of \$10,000 and is expected to produce benefits (cash flows) of \$3,000 per year for 5 years. Project L costs \$25,000 and is expected to produce cash flows of \$7,400 per year for 5 years. The firm's cost of capital is 12%.

- Calculate the payback for Project S.



Independent Practice

Project S has a cost of \$10,000 and is expected to produce benefits (cash flows) of \$3,000 per year for 5 years. Project L costs \$25,000 and is expected to produce cash flows of \$7,400 per year for 5 years. The firm's cost of capital is 12%.

- ▶ Calculate the payback for Project L.
- ▶ Assuming the projects are independent, which one(s) would you recommend?
- ▶ If the projects are mutually exclusive, which would you recommend?



Payback

– Advantages

- Simple: the shorter the payback, the better the project
- Reflect risk in that projects that take longer to pay back are riskier
- Appealing for firms that have financing constraints

– Disadvantages

- Ignores cash flows after the cutoff point
- Does not account for the time value of money
- No direct connection to value maximization (acceptable payback period is arbitrary choice)



Capital Budgeting: Discounted Payback



Discounted Payback

- Designed to counter one weakness of the payback method. This method discounts cash flows at the wacc.
 1. Discount all cash flows.
 2. Use present values to determine payback period.Still suffers from other weaknesses.

Although payback and discounted payback have significant shortcomings in ranking projects, they offer information on liquidity and risk. The shorter the payback, the higher the liquidity and the lower the risk of the project. May be most helpful if considered along with other dimensions.



Example

Project S has a cost of \$10,000 and is expected to produce benefits (cash flows) of \$3,000 per year for 5 years. Project L costs \$25,000 and is expected to produce cash flows of \$7,400 per year for 5 years. The firm's cost of capital is 12%.

- Calculate the discounted payback for Project S.



Independent Practice

Project S has a cost of \$10,000 and is expected to produce benefits (cash flows) of \$3,000 per year for 5 years. Project L costs \$25,000 and is expected to produce cash flows of \$7,400 per year for 5 years. The firm's cost of capital is 12%.

- ▶ Calculate the discounted payback for Project L.
- ▶ Assuming the projects are independent, which one(s) would you recommend?
- ▶ If the projects are mutually exclusive, which would you recommend?



Capital Budgeting: Net Present Value (NPV)



Net Present Value (NPV)

- Equals the present value of future net cash flows discounted at the cost of capital.
- The larger the NPV, the more value a project adds, so the higher the stock price
- NPV is the best project selection criterion.



Net Present Value (NPV)

$$NPV = \sum_{t=0}^N \frac{CF_t}{(1 + wacc)^t}$$

1. Discount all cash flows using the wacc.
2. Sum.

If projects are independent, choose all projects with $NPV > 0$.

If projects are mutually exclusive, choose the project with the larger NPV as long as $NPV > 0$.



Example

Project S has a cost of \$10,000 and is expected to produce benefits (cash flows) of \$3,000 per year for 5 years. Project L costs \$25,000 and is expected to produce cash flows of \$7,400 per year for 5 years. The firm's cost of capital is 12%.

- Calculate the NPV for Project S.



Independent Practice

Project S has a cost of \$10,000 and is expected to produce benefits (cash flows) of \$3,000 per year for 5 years. Project L costs \$25,000 and is expected to produce cash flows of \$7,400 per year for 5 years. The firm's cost of capital is 12%.

- ▶ Calculate the NPV for Project L.
- ▶ Assuming the projects are independent, which one(s) would you recommend?
- ▶ If the projects are mutually exclusive, which would you recommend?



Net Present Value (NPV)

Advantages:

- Focuses on cash flows
- Accounts for the time value of money
- Adjusts for risk (discount factor should reflect opportunity cost to investors)
- Gives a direct estimate of the change in shareholder wealth as a result of the investment

Disadvantages:

- Ignores the value of managerial flexibility (managers can scale back or abandon bad projects)

****The NPV is generally the preferred method for making capital budgeting decisions.**



Capital Budgeting: Internal Rate of Return (IRR)



Internal Rate of Return (IRR)

- Discount rate that forces a project's NPV=0. It provides an estimate of the project's rate of return and is comparable to finding YTM on a bond.
- Using the NPV formula, replace wacc with IRR and NPV with 0.

$$NPV = \sum_{t=0}^N \frac{CF_t}{(1 + wacc)^t}$$

$$0 = \sum_{t=0}^N \frac{CF_t}{(1 + IRR)^t}$$



Internal Rate of Return (IRR)

- There is no easy way of solving this equation for IRR. You can use trial and error or a financial calculator (or Excel).
- Since IRR is an estimate of the project's rate of return, if $IRR > wacc$ then accept the project.
 - If projects are independent, accept all projects with $IRR > wacc$.
 - If projects are mutually exclusive, accept the one with the highest IRR as long as $IRR > wacc$.



Example

Project S has a cost of \$10,000 and is expected to produce benefits (cash flows) of \$3,000 per year for 5 years. Project L costs \$25,000 and is expected to produce cash flows of \$7,400 per year for 5 years. The firm's cost of capital is 12%.

- Calculate the IRR for Project S.



Independent Practice

Project S has a cost of \$10,000 and is expected to produce benefits (cash flows) of \$3,000 per year for 5 years. Project L costs \$25,000 and is expected to produce cash flows of \$7,400 per year for 5 years. The firm's cost of capital is 12%.

- ▶ Calculate the IRR for Project L.
- ▶ Assuming the projects are independent, which one(s) would you recommend?
- ▶ If the projects are mutually exclusive, which would you recommend?



IRR Decision Rules: Exceptions, Problems, etc.

- Mutually exclusive projects (for simplicity, assuming typical structure of outflows first and subsequent inflows)
 - Scale problem:
 - when comparing mutually exclusive projects, we cannot conclude that the one offering the highest IRR will necessarily create the most wealth
 - Timing Problem
 - When the timing of cash flows is very different across projects, the project with the highest IRR may not necessarily have the highest NPV
- **When faced with scale or timing problems use NPV for a better evaluation!



Internal Rate of Return (IRR)

Advantages:

- Adjusts for the time value of money
- Hurdle rate (wacc) is based on market returns obtainable on similar investments
- Outcome is a rate of return which is intuitively appealing
- Focuses on cash flows

Disadvantages:

- Computational problems
 - Multiple IRRs-usually occur when a firm has alternating cash inflows (positive) and cash outflows (negative). Rule of thumb is that the maximum number of IRRs a firm will have equals the number of sign changes in the cash flow stream. When faced with this problem, use the NPV!
 - No real solution
 - Reinvestment rate assumption: IRR implicitly assumes all cash flow can be reinvested at the IRR while NPV assumes reinvestment at the wacc. NPV is more reasonable.
- Decision Rules are not always straightforward.



Capital Budgeting: Modified Internal Rate of Return (MIRR)



Modified Internal Rate of Return (MIRR)

- Managers want to know the expected rate of return on investments, which is what the IRR should tell them.
 - However, the IRR makes the incorrect assumption that cash flows can be reinvested at the IRR (instead of the wacc). This causes the IRR to overstate the project's true return.
- The MIRR corrects the reinvestment rate assumption.
 - MIRR is the discount rate at which the present value of a project's cost is equal to the present value of its terminal value, where the terminal value is found as the sum of the future values of the cash inflows, compounded at the firm's cost of capital.



MIRR

MIRR: corrects the reinvestment assumption and assumes that the reinvestment rate is the wacc, or some other relevant rate*.

To find MIRR:

1. Discount all cash outflows at the wacc and add them--becomes PV
2. Compound all cash inflows at the wacc and add them—becomes FV.
3. Now you have a PV, FV, N (# of years the project lasts), assume PMT=0. Find I/YR and that value is the MIRR

The MIRR also corrects the multiple IRR problem.

*For our purposes, the relevant reinvestment rate will be the wacc.



Example

Project S has a cost of \$10,000 and is expected to produce benefits (cash flows) of \$3,000 per year for 5 years. Project L costs \$25,000 and is expected to produce cash flows of \$7,400 per year for 5 years. The firm's cost of capital is 12%.

- Calculate the MIRR for Project S.



Independent Practice

Project S has a cost of \$10,000 and is expected to produce benefits (cash flows) of \$3,000 per year for 5 years. Project L costs \$25,000 and is expected to produce cash flows of \$7,400 per year for 5 years. The firm's cost of capital is 12%.

- ▶ Calculate the MIRR for Project L.
- ▶ Assuming the projects are independent, which one(s) would you recommend?
- ▶ If the projects are mutually exclusive, which would you recommend?



Example 2

- Fernando Designs is considering expansion of their designs to a new geographic area. The capital outlay necessary for the project is \$10 million. The project is expected to last for 5 years. Fernando expects cash flow to be negative \$1 million for the 1st 2 years and \$6 million in each of the following 3 years. If the firm's wacc is 10%, what is the modified internal rate of return of this project?



Conclusions on Evaluation Criteria

- For independent projects, NPV, IRR, and MIRR always reach the same conclusion so any of the three can be used in evaluating independent projects.
- For mutually exclusive projects conflicts can arise. When in doubt, use the NPV.
- NPV is the best criterion because it provides a direct measure of value the project adds to shareholder wealth.
- The MIRR is better than IRR as a measure of a project's true return and it eliminates the multiple IRR problems.
- Payback and discounted payback provide indications of a project's liquidity and risk.
- While more weight should be given to NPV, it would be unwise to ignore the information from the other methods.



Conclusions on Evaluation Criteria

- While these methods are helpful in assessing projects, decisions should not be based solely on these numbers. Managers must consider:
 - Chances of changes in taxes
 - Political uncertainty
 - Macroeconomic uncertainty
 - Competitive forces—given positive NPV projects, what stops a competitor from pursuing similar projects and affecting your expected cash flow?
- In practice, survey data suggests that manager's use NPV and IRR the most but also use payback and discounted payback. Also, the project's manager's track record and confidence in the project matter for decision making.



Additional Practice

- Simms Enterprises is attempting to evaluate the possibility of investing \$85,000 in a machine having a 5-year life. The firm has estimated the cash inflows associated with the proposal as shown below. Simms has a capital structure containing 40% debt, 20% preferred stock, and 40% common stock. The firm's outstanding bonds have an \$80 annual coupon, a par-value of \$1,000, 10 years left to maturity, and a current price of \$1,250. The firm's annual preferred stock dividend is \$4.00 and their preferred shares are currently selling for \$20. The firm's common stock has a beta of 1.3. The risk-free rate is 3% and the required return on the market is 9%. The firm faces a tax rate of 40%.
 - What is the firm's wacc?
 - What is the project's payback?
 - What is the project's discounted payback?
 - What is the projects net present value?
 - What is the internal rate of return on this investment?
 - What is the project's modified internal rate of return?
 - Should you accept this project? Why?

CF1	\$18,000
CF2	\$22,500
CF3	\$27,000
CF4	\$31,500
CF5	\$36,000



Just to be sure...

- Super Grocer is considering the implementation of a new machine to improve inventory tracking. The initial investment for the project is \$800,000 and Super Grocer expects incremental cash flows of \$450,000 in year 1, \$350,000 in year 2 and \$200,000 in Year 3. Evaluate this project using all capital budgeting techniques and make a recommendation to Super Grocer on whether they should buy the machine. The firm's cost of capital is 8%.

