Chapter 9 - Capital Budgeting and Risk

In this chapter we will further develop our understanding of how to determine the discount rate for a project's cash flows. In particular we will:

1) Learn why discounting at the WACC (or the project's financing cost) is only appropriate in limited circumstances.
2) Learn how to calculate the WACC and asset betas.
3) Understand how changes in capital structure affect the expected returns, required returns, and betas of the firm's securities.
4) Understand how acceptance of a project affects the expected returns, required returns, and betas of the firm's securities.
5) Learn how to estimate stock betas and how to use these estimates to calculate asset betas.
6) Learn how to use the WACC and asset betas of comparable companies to determine the discount rate.
7) Learn how to estimate beta in tough situations.
8) Understand why projects with different degrees of risk over time cause special problems.

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Chapter 9 - Capital Budgeting and Risk

Summary so far:

- Chapter 1 – Why most large businesses operate as a corporation
- Chapter 2 – Overview of investment decisions (cash flows, risk, opportunity cost of capital) as they relate to the objective of the firm
- Chapter 3 – Time value of money
- Chapter 5 – NPV should be used to make investment decisions
- Chapter 6 – How to calculate project cash flows
- Chapter 7 & 8 – Risk and return and the CAPM

Chapter 9 is a continuation of Chapters 7 and 8. The ultimate goal is to answer the question: What discount rate should the corporation use to evaluate a project?

Note: In this chapter, we will assume financial markets are perfect, efficient, and in equilibrium.

What do we want? Project cash flows should be discounted at the project's opportunity cost of capital

- **Definition**: The **opportunity cost of capital** for the cash flows of a project is the expected rate of return for investments in the financial markets that have the exact same amount of risk as the project's cash flows.

- **Risk-free cash flows**. Use the risk-free interest rate. The current one-month Treasury Bill rate is a good estimate of the risk free rate. (We have been using 5% as the risk free rate.)

- **What about risky cash flows?** From Chapters 7 and 8:

1. We calculated risk of the project's cash flows (we used beta as a measure of risk)
2. We used the CAPM to calculate the required (expected) return for financial assets with the same beta risk as the project's cash flows. (Remember, with perfect, efficient, and in equilibrium markets, a financial asset's expected rate of return equals its required rate of return.)
3. We used the CAPM required (expected) return as the discount rate for the project's cash flows

The **WACC** (weighted-average cost of capital, or "company cost of capital") can also be used in certain circumstances as the discount rate for a project's cash flows.

The WACC is the required return (and expected return) for a portfolio of all of the firm's securities. The WACC tells us what it will cost the firm (on average) to raise new capital to fund a project. In this chapter, we ignore income taxes. Assuming no income taxes:

$$r_{assets} = WACC = (\text{debt }\%)\ (r_D) + (\text{equity }\%)\ (r_E)$$

Important! The effect of income taxes on the WACC is discussed in Chapter 19. The with tax formula is:

$$r_{assets} = WACC = (\text{debt }\%)\ (1 - T)\ (r_D) + (\text{equity }\%)\ (r_E)$$

Example of the calculation of the WACC:

ABC Inc.'s market value balance sheet.

Asset (1) has a market value of $300 and a beta of 0.90
Asset (2) has a market value of $600 and a beta of 0.27

Debt has a market value of $540. The debt is risk free. Beta = ________
Equity has a market value of $360. The beta of the equity is 1.2

Current firm market value = $900.

The risk-free interest rate is 5%.
The expected (required) return for the market is 13.4%. (The market risk premium is 8.4%.)

Questions:

1) What are the debt and equity percentages?

2) What is r_D and r_E? (Use CAPM)

3) What is the WACC for ABC Inc.?

When can the WACC be used as the discount rate for project cash flows?

Assume the firm has two potential projects (projects A and B from the Chapter 7 and 8 notes).

State	1	2	3
Economy	Boom	Normal	Recession
Probability	20%	60%	20%
Risk-Free	$105	$105	$105
Market	$143	$116	$76
Project A	$155	$135	$40
Project B	$15	$105	$136

- Project A has an expected (t = 1) cash flow of $120. $\beta_{\textbf{proj A}}$ = 1.80887, discount rate = 20.1945%
- Project B has an expected (t = 1) cash flow of $93.2. $\beta_{\textbf{proj B}}$ = -1.63175, discount rate = -8.7067%

From the previous chapter, we determined that Project B had a positive NPV and Project A had a negative NPV

- (Correct) NPV of Project A = -$100 + $120 / (1 + 0.201945) = -$100 + $99.8382 = -0.1618
- (Correct) NPV of Project B = -$100 + $93.20 / (1 – 0.087067) = -$100 + $102.0885 = +$2.0885

What would happen if we incorrectly used the firm's WACC as the discount rate for both projects A and B?

- (Incorrect) NPV of Project A = -\$100 + \$120 / 1.09032 = +\$10.06
- (Incorrect) NPV of Project B = -\$100 + \$93.20 / 1.09032 = -\$14.52

Note – if we evaluate all projects at one discount rate (such as the WACC), we do not take into account the riskiness of the project! We could incorrectly:

Accept a bad project, or
Reject a good project.

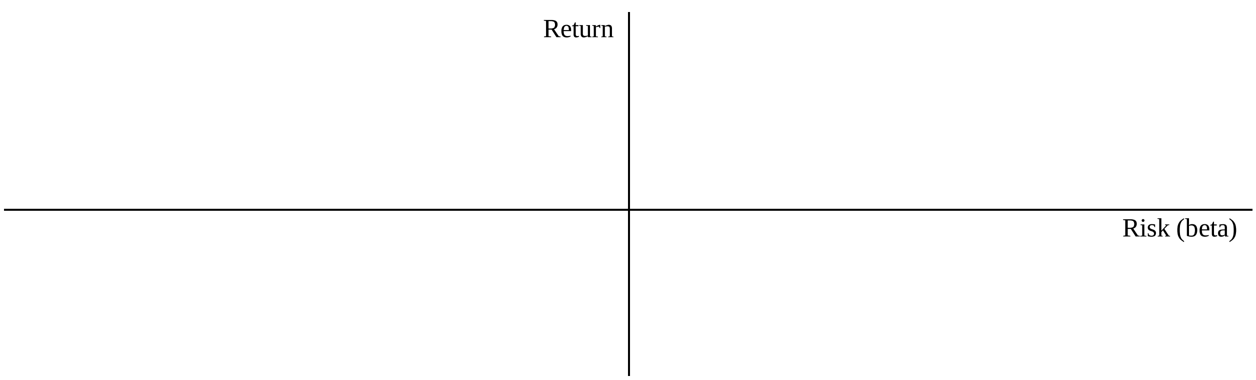
As discussed, we <u>should</u> use a discount rate that reflects the riskiness of the project's cash flows (with the CAPM giving us a reasonable approximation for that discount rate).

A Graphical Explanation of when the WACC can be used as a discount rate

- Assuming the CAPM is correct, the CAPM SML (security market line) plots the risk/required return relationship given by the CAPM equation.

- Projects that plot above the SML should be undertaken and those below should not be undertaken.

- Plot the WACC, the CAPM SML, and projects A and B on the following graph:



- How do you graphically determine if a project has a positive or negative NPV?

- What are the implications of incorrectly using the WACC instead of the SML to evaluate projects?

  Region 1:
  Region 2:
  Region 3:
  Region 4:

- When (if ever) is it proper to use the WACC as the discount rate for a project's cash flows?

The average beta risk for the firm's assets

The average beta for a firm's assets equals the weighted-average beta for each of the firm's individual assets

- β_{assets} = (asset(1) %) ($\beta_{asset\ (1)}$) + (asset(2) %) ($\beta_{asset\ (2)}$) + . . . + (asset(N) %) ($\beta_{asset\ (N)}$)

It is also equal to the weighted-average of the betas of the firm's securities.

- β_{assets} = (debt %) (β_D) + (equity %) (β_E)

What is the average beta for the assets of ABC Inc.? β_{assets} =

Use the CAPM to calculate the required return for the firm's assets.

- Using CAPM: r_{assets} =

Therefore, the WACC for ABC Inc. can be used to discount a project with a beta equal to ________.

- Describe what this type of project looks like.

- How often would you expect to find such a project?

Expanded Market Value Balance Sheet

	Market Value	Beta	Req. Return		Market Value	Beta	Req. Return
Asset 1				D			
Asset 2				E			
Total				Total			

Some intuition concerning why Project A is a bad project and Project B is a good project

Why is Project A unacceptable even though it has a 20% expected return?

With Project B, the firm invests $100 and receives, on average, $93.20 in one year. The IRR for Project B is negative 6.8%. Why should the firm accept Project B even it is expected to lose money?

Can you think of another good "investment" that companies (or individuals) make that has a negative expected return?

How does a change in capital structure affect the WACC of a corporation?

Example: Assume that ABC Inc. issues $180 of additional debt. Because ABC is more highly levered, the newly issued debt has a beta of 0.4. (The existing debt remains risk-free.) Assume the $180 is used to **repurchase** $180 of ABC's stock. There is no change in ABC's assets.

1) What are the new debt and equity percentages?

2) What is the new $r_{D(1)}$? What is $r_{D(2)}$? (Use CAPM)

3) What is the new beta for ABC's assets? (Hint: remember that there is no change in the composition or riskiness of ABC's assets.) What is the new WACC for ABC Inc.?

4) What is the new r_E? What is the new β_E? Is the new beta for ABC's equity consistent with the new r_E and CAPM?

Summary - Expanded Market Value Balance Sheet

	Market Value	Beta	Req. Return		Market Value	Beta	Req. Return
Asset 1	$300	0.90	12.56%	D(1)	$540	0	5%
Asset 2	$600	0.27	7.268%	D(2)	$180	0.4	
				E	$180		
Total	$900			Total	$900		

Should the cost of funds used to finance the project be considered in the analysis? *No! The opportunity cost of capital for a project reflects where the funds are used, not where the funds come from.*

Example: Assume that Project A will be accepted and financed with a risk-free debt issue (and B rejected). Assume that the interest rate on the risk-free debt issue is 5%.

Aside. Is it reasonable to assume that ABC Inc. can issue risk-free debt to finance a risky project?

What are the expected *after financing* cash flows for Project A?

	0	1
Project A (base case) cash flows		
Financing cash flows		
Project "after financing" cash flows		

What is the NPV of the project "after financing" cash flows?

However, the NPV of Project A is -\$0.1618. Shouldn't acceptance of the project be bad for the firm's stockholders?

Perhaps the low interest rate on the financing changed the project NPV from negative to positive.

Information on risk and required returns

Average beta of existing assets: 0.48
Required return for the existing assets: 9.032%

Beta of Project A: 1.80887
Required return for Project A: 20.1945%
Project A cash flows (boom = \$155, normal = \$135, recession = \$40, expected t = 1 cash flow = \$120

Present value of Project A's expected time 1 cash flow = \$120 / 1.201945 = \$99.8382

Analysis – Complete the expanded balance sheet

	Market Value	Beta	Req. Return		Market Value	Beta	Req. Return
Asset 1	\$300	0.90	12.56%	D(1)	\$540	0	5%
Asset 2	\$600	0.27	7.268%	D(2)	\$100	0	5%
Project A	\$99.8382	1.80887	20.1945%	E			
Total	\$999.8382			Total			

Calculations:

1) What is the market value of the debt and equity (i.e., the right-hand-side of the balance sheet)?

2) What is the market value of the equity?

3) What is the average beta for ABC's assets and WACC?

4) What is the new r_E? What is the new β_E? Is the new beta for ABC's equity consistent with the new r_E and CAPM?

Do stockholders benefit from the acceptance of the project?

To answer, compare the market value of the stock assuming

(1) The project is accepted __________, and
(2) The project is rejected __________.

Based on this, stockholders' stock has decreased in value by __________.

What did we learn?

1) The risk of the equity ___________. Why?
2) The required return of the equity ___________.
3) The expected return of the equity ___________.
4) Firm value ___________.
5) Stock value ___________.

The combined project / financing arrangement looks profitable. What's going on?

Examine the total project and financing cash flows for time one across the three economic states:

	Project A Cash Flow	Financing Cash Flow	After-financing cash flow
1) Boom (20% chance)			
2) Normal (60% chance)			
3) Recession (20% chance)			
Expected cash flow			

The after-financing cash flow is negative at the worst possible time (i.e., during a recession). Even though the expected after-financing cash flow is positive, the firm will find the project unacceptable because of its high amount of risk.

Conclusion - Since the expected return on the debt is equal to its required return (5%), the NPV of the financing is zero. Therefore, the financing choice can be disregarded in the capital budgeting decision.

	0	1	NPV
Project A (base case) cash flows			
Financing cash flows			
Project "after financing" cash flows			

Does the same hold true if we had financed with equity in the above example? Yes

Is the financing NPV always $0? No.

Will we talk about this more in Chapter 9? No.

Some "real world" information on the determination of the risk-adjusted discount rate using the CAPM.

First – an example to work with. Our goal is to calculate the NPV of the following project.

0	1	5	20
-$1000	$500	$500	$500

Assume each cash flow has the following risk:

$\rho_{m,proj} = 2/3$
$\sigma_{proj} = 0.60$
$\sigma_m = 0.20$

How do we determine the discount rate for this project?

1) **Project Beta**: $\beta_{proj} = \rho_{m,proj} [\sigma_{proj} / \sigma_m] =$

2) **Risk-Free Rate** (r_f). What do you want? The rate of return on a security with no risk. Here are some possibilities:

- Interest rate (yield to maturity) on ATT corporate bonds.
- Interest rate (yield to maturity) on long-term (20-year) U.S. Treasury Bonds.
- Interest rate (yield to maturity) on medium-term (5-year) U.S. Treasury Bonds.
- Interest rate (yield to maturity) on short-term (30-day) U.S. Treasury Bills.

Which one should we select? What's wrong with the other two?

3) **Market Risk Premium** (r_m - r_f). What do you want? The expected return for the "market" portfolio minus the risk-free interest rate (i.e., the premium investors require to own the market portfolio).

- U.S. corporations should use the U.S. market risk premium rather than the "world" market risk premium. Why?

As discussed, Brealey and Myers suggest a U.S. market risk premium towards the upper end of a 6% - 8.5% range. We will use 8.4% in this class.

- German corporations should use the German market risk premium. Why?
- When would we want to use a "world" market risk premium?

4) **Maturity risk premium**. If evaluating a **long-term project**, we need to make an adjustment to the CAPM required return. (See footnote 12 in the textbook.) First some numbers:

- Market risk premium: We are using 8.4%
- Long-term maturity risk premium: Average (20-year Treasury Bond minus one-month Treasury Bill) =
- Medium-term maturity risk premium: Average (5-year Treasury Bond minus one-month Treasury Bill) =

5) **CAPM**. Plug this information into the CAPM to determine a discount rate for the project. Make the maturity adjustment as needed

Discount rate for t = 1 cash flow =
Discount rate for t = 5 cash flow =
Discount rate for t = 20 cash flow =

Project NPV =

6) **Is the CAPM the best / most sophisticated method for determining a discount rate?** No. The APT is an alternative method for determining the discount rate.

More details on estimating the beta and discount rate for a project's cash flows.

For illustration purposes, we calculated the exact beta for a project's cash flows (in Chapter 7 notes) based on project cash flows in different states of the economy.

Since this information is rarely available, we need to estimate beta.

What you need? The current beta for the project (i.e., how risky is the project under consideration).

General procedure - calculate the beta of the assets of a company whose assets are just as risky as the project cash flows. Use the CAPM to get the discount rate.

What's available? Historical beta for the stock of a comparable company

The historical stock beta is estimated by regressing the historical stock returns against the historical market returns. **For example**: regress monthly stock returns against monthly market returns using data from the last five years.

> **Beta** for the stock is equal to the **slope** of the regression line.
>
> **Alpha** for the stock is equal to the **intercept** of the regression line. (Average return for the stock when market return equals 0.)
>
> Graphical examples are on pages 225-226 of text.

Stability of Beta - How much do betas change over time? Again, refer to pages 225-226 of the text. However, it is best to use the most recent stock beta estimates in your calculations.

Beta Books: Stock beta estimates are provided by a number of investment advisory firms. **Standard and Poors Stock Guide** and **Value Line** give estimates of **stock** betas. Use these services to obtain stock betas for several firms doing business in the project's "industry."

Accuracy of stock beta estimate

> Remember that beta is estimated. The "true" beta could be above or below the estimated beta. More estimates diversify away the estimation errors. (See Table 9.1 in the text.)
>
> Because of this, "industry" betas give a better estimate of an asset's beta. See the Ibbotson Web site (www.ibbotson.com) for a compilation of individual firm and industry betas.

Calculation of the asset beta – calculate the average asset beta for each firm in the project's industry using each firm's stock beta and a reasonable estimate for their debt beta ("no tax" equation given above).

> Remember to use the MV to determine debt % and equity %.
>
> The average of these asset betas will provide an estimate of the project's beta. Use this estimate for the project beta to plug into the CAPM equation to determine the discount rate. As an alternative, calculate the WACC of each comparison firm. The average of these WACCs will provide an estimate of the discount rate.
>
> **Example –** XYZ Corporation is considering a project that is similar in risk to the assets of ABC Corporation. What discount rate should XYZ use to evaluate the project?
>
> ABC Inc.
>
> Asset (1) has a market value of $300 and a beta of 0.9.
> Asset (2) has a market value of $600 and a beta of 0.27.
>
> Debt has a market value of $540. The debt is risk free and therefore has a beta = 0.
> Equity has a market value of $360. The beta of the equity is 1.2.
>
> Discount rate for XYZ's project =

Computational hints when it is difficult to determine project beta. Possible reasons / suggestions:

- Difficulty in quantifying a particular aspect of the project's risk.

  Avoid fudge factors - don't arbitrarily increase the discount rate because there is difficulty in determining cash flows. If risk is diversifiable, then the discount rate should not be adjusted.

  Solution: See example in text on pages 238-240.

- Difficulty in assigning project to a particular industry.

  Solution: Understand what influence asset betas.

  i) Projects with **cyclical** cash flows tend to have positive betas. (A project with cyclical cash flows has high returns in periods when the market has high returns and vice versa.)

  What about projects with **counter-cyclical** cash flows?

  ii) High project standard deviation does not necessarily mean high positive beta. Remember the formula for the project's beta is $\beta_{proj} = \rho_{m,proj} [\sigma_{proj} / \sigma_m]$. Need to estimate $\rho_{m,proj}$!

  iii) Projects with a high percentage of fixed costs with cyclical cash flows tend to have high positive betas. (Similar to stock betas increasing when leverage is high.)

Skip discussion on Certainty Equivalents

Final thoughts

Income taxes. Remember that we have been ignoring income taxes in this chapter’s discussion of the determination of the discount rate. A detailed discussion is included in Chapter 19.

Foreign projects can have a very high variance of returns, but a low beta. Why?

Long-Term Risky Projects: Cash flows from long-term risky projects may be unduly penalized if their risk decreases over time.

Example: Assume that a project has two expected positive cash flows, one in one year ($50) and another in ten years ($180). The first cash flow is risky (beta = 1) and the second cash flow is risk free. Initial investment = $100. Using 8.4% as the market risk premium, 5% as a risk-free rate, and the CAPM, what is the NPV of the project?

Correct Calculations

NPV =

Consider the following **incorrect** calculations:

$NPV = -\$100 + \$50/1.05 + \$180/1.05^{10} = \$58.12$
$NPV = -\$100 + \$50/1.134 + \$180/1.134^{10} = -\$4.72$

Observation: Compare the relative impact of using the wrong discount rates.

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Chapter 9 Review Questions

1. What is the WACC? How do you calculate the WACC?

2. Be able to calculate the required return for the firm's equity, debt, and assets.

3. Using the graph drawn in class, how can you determine if a project has a positive, negative, or zero NPV?

4. Using the graph drawn in class, when will the use of the WACC as the discount rate give the same acceptance/rejection recommendation as using the SML to determine the discount rate? In what areas will the firm accept a bad project (or reject a good project) using the WACC as a discount rate? What implications does this have for the composition of a firm's assets?

5. Know how to calculate the average beta for a firm's securities and assets.

6. How does a change in capital structure affect the firm?

7. Understand the intuition of why is it inappropriate to use the cost of financing as the discount rate for a project.

8. How does acceptance of a project affect a firm?

9. What "risk-free" rate should be used in the CAPM? What "market-risk premium" should be used in the CAPM? Where would you look to get current figures? What adjustment should be used to evaluate long-term cash flows? What is the purpose of this adjustment?

10. When should the U.S. market risk premium be used (as opposed to the German, or some other country's market risk premium)?

11. How do you estimate the beta for a stock? Why is it better to use an industry beta than an individual stock beta? How do you convert stock betas to asset betas? How do you use this estimate to determine the beta (and discount rate) for a project's cash flows?

12. Understand the discussion in the section titled "Computational hints when it is difficult to determine project beta."

    A) What does it mean to "avoid fudge factors"?
    B) Why do cyclical cash flows tend to have positive betas? Why do counter-cyclical cash flows tend to have negative betas? What if project cash flows are uncorrelated with market factors?
    C) Remember that high variance does not necessarily mean a high positive beta.
    D) What is the relationship between fixed costs and betas?

13. Understand why high (variance) risky foreign projects can have a low beta risk.

14. Understand the discussion on "long-term risky projects." Be able to calculate the present value of a long-term risky project.

Chapter 9 Practice Problems

Problems 1 – 5 use a common set of assumptions:

1. Assume that the risk-free rate is 5% and the market risk premium is 8.4%. If XYZ Inc. has $700 of one-year bonds (beta = 0.2) and $300 of equity (beta = 1.5), what is the WACC for this firm? *9.956%*

2. What is the average beta for XYZ's securities? *0.5900* (Cross-check your answer with the CAPM.)

3. Assume that XYZ has three assets: a risk-free Treasury Bill (market value = $100), a risky corporate bond (beta = 0.4, market value = $200), and an existing project (beta = ____, market value = $700).

A) What is the beta of the existing project? *0.72857*
B) What is the required return for the existing project? *11.12%*
C) What is the average required return for the firm's assets? *9.956%*

4. Assume that XYZ Inc. issues $100 of debt and uses the proceeds of the debt issue to retire $100 of it's stock. This new debt has a beta of 0.4. The beta of the existing debt stays at 0.2. Assume that the composition and riskiness of the firm's assets remains the same. Compute the following:

    A) Required rate of return for the firm's new bonds. *8.36%*
    B) Average beta for the firm's assets. *0.5900*
    C) WACC for the firm. *9.956%*
    D) Required rate of return for the firm's equity. *22.22%*
    E) Beta for the firm's equity. *2.05*

5. Assume that XYZ Inc. has $700 of debt and $300 of equity (as described in the original problem). XYZ Inc. issues $100 of new stock and uses the proceeds of the stock issue to invest in Project B. (Project B is described in the Chapter 7 notes, has a beta of -1.63175, a PV of future cash flows of $102.0885, and a NPV of $2.0885.) Assume that the beta of the $700 of debt remains at 0.2. Compute the following:

    A) Market value of the firm and equity. *$1102.0885 and $402.0885 respectively*
    B) Average asset beta. *0.38420 (Notice the risk reducing benefits of Project B!)*
    C) WACC. *8.2272%*
    D) Required rate of return for the firm's equity. *10.9209%*
    E) Beta for the firm's equity. *0.70486.*

6. Assume that the risk free interest rate is 5% and the market risk premium is 8.4%. ABC Inc. has a WACC of 12%. ABC is considering four projects. These are not mutually exclusive projects. Each project will require an initial investment of $100 and produce one (expected) cash flow in one year. The future cash flow and the beta of that cash flow for each of the projects are listed below.

	Expected time one cash flow	Beta of the time one cash flow
Project A	$120	2.0
Project B	$105	0.5
Project C	$95	-0.5
Project D	$110	1.5

A. What are the projects' NPVs? (Use the CAPM to determine the discount rate.)

    Project A NPV = *-$1.48*
    Project B NPV = *-$3.85*
    Project C NPV = *-$5.75*
    Project D NPV = *-$6.46*

B. Plot the four projects on a beta risk / return graph. *Note – all four projects will plot below the SML.*
C. Which of the four projects will the firm accept if it incorrectly used the WACC to evaluate projects? *Project A*
D. Which of the four projects will the firm accept if it used the CAPM discount rate to evaluate projects? *None of the four projects.*

7. Project Z requires an initial investment of $100 and has a time one expected cash flow of $103. Therefore, its expected return (based on the $100 initial investment) is 3%. The company's WACC is 10%. The company correctly uses the CAPM to determine a discount rate. Using this discount rate, the project NPV is +$1.00. Where does Project Z plot on the graph described in class? *Below the WACC, above the SML*

8. Project X requires an initial investment of $100 and has a time one expected cash flow of $118. Therefore, its expected return (based on the $100 initial investment) is 18%. The company's WACC is 10%. The company correctly uses the CAPM to determine a discount rate. Using this discount rate, the project NPV is +$1.00. Similar to the discussion in class, where does Project X plot on the graph described in class? *Above the WACC, above the SML*

9. Assume that the annual yield for a one-month T-Bill is 5%. The five-year Treasury Note has a yield of 6.8%. Using a five-year maturity premium of 1% and a market risk premium of 8.4%, what is the present value of a time 5 risky cash flow (with a beta of one)? *CF / 1.142*^{5}

10. Using the following information, what is the discount rate for a project's year 5 cash flow? *15.80%*

- The yield-to-maturity for one-month Treasury Bills is currently (as of today's Wall Street Journal) = 2.20%
- The yield-to-maturity for a 5-year Treasury bond is currently (as of today's Wall Street Journal) = 4.80%
- The medium-term maturity risk premium (i.e., the average difference in yields between 5-year Treasury Bonds and one-month Treasury Bills as calculated by Ibbotson Associates) = 1.6%.
- The beta for the year 5 cash flow = 1.5
- The market risk premium = 8.4%

11. Which of the following securities has the greatest price risk (also called interest rate risk, maturity risk, or inflation risk)?

A. A **twenty**-year Treasury Bond paying a fixed coupon payment rate of 2.5% every 6 months. *Correct answer*
B. A **five**-year Treasury Bond paying a fixed coupon payment rate of 2.5% every 6 months.

12. A project has the following expected cash flows. The NPV is calculated as the present value of the $2500 expected cash flow minus the $1000 initial investment. Using the following information, **what is the discount rate for the fifth year cash flow**? (As in class, make the adjustment for the fact that the cash flow comes in five years.) *Answer: the discount rate = 17.4%*

0	1	2	3	4	5
-$1000	$0	$0	$0	$0	$2500

- The latest edition of 'the book' (the Ibbotson book passed around in class) and shows that the maturity risk premium for five-year Treasury securities is 1.2%. (In other words, the average yearly difference since 1926 between the returns for five-year Treasury Securities and one-month Treasury Securities has been 1.20%.)
- Today's Wall Street Journal shows the current yield to maturity for five-year U.S. Treasury Bonds = 6.00%
- Today's Wall Street Journal shows the current yield to maturity for one-month U.S. Treasury Bills = 4.50%
- The market risk premium = 8.4%
- Beta for the time 5 cash flow = 1.5

13. Assume that the beta for a company's stock is 2.5 and the beta for its debt is 0.3. If the market value of equity as a percent of the market value of assets is 30%, what is the beta for the firm's assets? *0.96*

14. Using a risk-free interest rate of 5% and a market risk premium of 8.4%, what discount rate should you use to evaluate a project with a beta of 0.96? *13.064%*

15. AAA Inc. has assets with an average beta of 0.75. AAA is financed part with debt and part with equity. Its debt is risky. (The debt pays an annual interest rate of 8.36% and has a beta = 0.4.) ABC's equity has a beta of 1.5. Assume that management undertakes actions to reduce the beta of the debt. Holding the market values of the debt and equity constant, and assuming the asset beta remains at 0.75, what effect will the reduction in the debt beta have on the equity beta?

A. The equity beta will decrease.
B. The equity beta will increase. *Correct answer*
C. The equity beta will stay the same.

16. Using the following information, what is the beta of the firm's equity? *2.476*

	Market Value	Beta	Required Return		Market Value	Beta	Required Return
Asset #1	$400	1.400	16.76%	Debt	$580	0.000	5.00%
Asset #2	$600	0.800	11.72%	Equity	$420		
Total	$1,000	1.040	13.74%	Total	$1,000	1.040	13.74%

17. As explained in class, the average beta for Ford Motor Company's assets is estimated by calculating the weighted-average beta of Ford's debt and equity. Ideally, these weights are based on the market values of Ford's debt and equity. In practice, is it easier to get reliable figures for the market value of Ford's equity or Ford's debt?

    A. It is easier to get reliable figures for the market value of Ford's <u>equity</u>. *Correct Answer*
    B. It is easier to get reliable figures for the market value of Ford's <u>debt</u>.

    In practice, the beta of Ford's equity is calculated by:

    A. Estimating the returns for Ford's stock in a boom, normal, and recessionary economy, then using the methods described in Chapter 7 and 8 to calculate beta.
    B. Performing a regression analysis of Ford's stock returns (y-axis) against the market's returns (x-axis). The estimate of beta is the <u>slope</u> for the regression line. *Correct Answer*
    C. Performing a regression analysis of Ford's stock returns (y-axis) against the market's returns (x-axis). The estimate of beta is the <u>intercept</u> of the regression line.

18. Which of the following two firms has the lower weighted average cost of capital (WACC)?

	AAA Inc.	BBB Inc.
Market value of debt	**$400**	**$600**
Beta of debt	0	0
Required return for the debt	5%	5%
Market value of equity	**$600**	**$400**
Beta of equity	2.0	2.0
Required return for the equity	21.8%	21.8%
Market value of firm	$1000	$1000

    A. AAA Inc. has the lower WACC.
    B. BBB Inc. has the lower WACC. *Correct answer*
    C. Both companies have the same WACC.

19. Which of the following two firms' assets have the higher beta?

	AAA Inc.	BBB Inc.
Market value of debt	**$700**	**$300**
Beta of debt	0	0
Required return for the debt	5%	5%
Market value of equity	**$300**	**$700**
Beta of equity	2.0	2.0
Required return for the equity	21.8%	21.8%
Market value of firm	$1000	$1000

    A. The beta of the assets of AAA Inc. is highest.
    B. The beta of the assets of BBB Inc. is highest. *Correct answer*
    C. The beta of both company's assets are the same.

20. Gamma Inc. has assets with a market value of $1000 and an average beta of 2.0. The market value of Gamma's debt is $300. The beta of the debt is 0.5. The market value of Gamma's equity is $700. What is the beta of Gamma's equity? *2.643*

21. Refer back to the previous problem. However, now assume that the market value of the debt is $700 and the market value of the equity is $300. All other information in the previous problem remains the same. What is the beta of the equity after this change in assumption?

    C. The beta of the equity is **less** than the answer to the previous problem.
    D. The beta of the equity is **greater** than the answer to the previous problem. *Correct answer (equity beta = 5.5)*
    E. The beta of the equity is the **same** as answer to the previous problem.