Chapter 10 - Project Analysis (Section 10.1, the first page of 10.2, and pages 257 to the top of 262 of section 10.3)

In this chapter we will discuss other methods of assessing project risk. In particular, we will:

1) Define stand-alone risk and within-firm risk.
2) Re-emphasize that well-diversified investors are only concerned with non-diversifiable risk (beta risk).
3) Identify decision makers who are concerned about stand-alone risk and within-firm risk.
4) Learn how to measure stand-alone risk and when it is beneficial to "buy" additional information.
5) Briefly discuss sensitivity analysis, scenario analysis, break-even analysis, Monte-Carlo simulations, and using decision-trees.

****

Chapter 10 - Project Analysis

In the previous chapter we learned that **beta** is the appropriate measure of risk used to determine the discount rate for a project's cash flows. [This assumes that the CAPM is the correct model in calculating expected (and required) returns for assets.]

Beta is the portion of a project's risk that affects a well-diversified investor.
Project beta is estimated by averaging the asset betas of other firms doing business in a similar industry.

Computer spreadsheet programs can be used to provide additional information regarding project risk - particularly an assessment of **stand-alone** risk.

Stand-alone risk reflects the **total riskiness** of the project (without consideration of any diversification benefits). It is measured by examining the uncertainty of the project NPV. Example:

Project X (beta = 0.0, the risk-free rate is 5% and the market risk premium is 8.4%, discount rate = 5%)

Initial investment = -$1000
Time one cash flow (50% chance) = $1165.50
Time one cash flow (50% chance) = $1144.50

NPV =

Project Y (beta = 0.0, the risk-free rate is 5% and the market risk premium is 8.4%, discount rate = 5%)

Initial investment = -$1000
Time one cash flow (50% chance) = $1302
Time one cash flow (50% chance) = $1029

NPV =

Side note: Obviously there is risk with these two projects, but the beta is zero. How come?

	Lowest Possible NPV (50% chance)	Highest Possible NPV (50% chance)	NPV
Project X			
Project Y			

Which of the two projects has the higher stand-alone risk?
Which of the two projects has the higher NPV?

Important. There is only **one** NPV for a project. It is determined by discounting the project's *expected* cash flows at the opportunity cost of capital.

We will call the highest and lowest NPVs in the above example 'what-if' NPVs.

"What-if" NPVs tell us how acceptance of the project will affect our firm if the worst set (or best set) of assumptions were realized.

The two extreme values for the 'what-if' NPV give one measure for a project's stand-alone risk. More calculation methods are discussed later.

Within-firm risk measures how the project contributes to the overall riskiness of the firm.

Within-firm risk is related to the correlation of the new project's returns with the returns of the existing assets of the firm.

In most circumstances, a project with high stand-alone risk will have high within-firm risk. However, it is possible that a project with high stand-alone risk might actually **reduce** firm risk.

For example, is it possible that Project X is risk increasing for the firm and Project Y is risk reducing?

	Firm cash flows are high	Firm cash flows are low
Project X NPV		
Project Y NPV		

Well-diversified investors are concerned with non-diversifiable risk (beta risk).

The **beta risk** of the project is not necessarily related to the **stand-alone risk** (or **within-firm risk**) of a project.

For instance, a project with high stand-alone risk and high within-firm risk might (depending on the correlation of the project's returns with the market's returns) have a beta close to zero, or even have a negative beta.

Consider the "windmill" project discussed during the first few days of this class

Does the windmill project have high stand-alone risk?

Does the windmill project have high within-firm risk?

Does the windmill project have high beta risk?

Who is concerned about a project's stand-alone risk, within firm risk, or beta risk? Consider the following set of concerned individuals:

1) The project manager and other employees that work on the project.
2) Firm employees that work on other projects.
3) Managers of the firm (President, VP, Treasurer, etc.)
4) Investors in the firm's stock (not diversified)
5) Investors in the firm's stock (well-diversified)

Consider the project manager (#1 above). How can this project manager hurt the firm by being too concerned about the project's stand-alone risk?

Consider the president of the firm (#3 above). How can this president hurt the firm by being too concerned about the project's within-firm risk?

How can we get the project manager and firm president to think more like a well-diversified stockholder?

Even though stand-alone risk does not take into account diversification, it provides valuable information about the project's total riskiness. For example, it might force managers to make better estimates or find ways to prevent

bad outcomes.

Methods of Assessing Stand-Alone Risk:

- Sensitivity Analysis
- Scenario Analysis
- Break-Even Analysis
- Monte Carlo Simulations

Sensitivity Analysis - How much does project NPV change when a single variable is changed? **Example**:

1. A project involves purchasing a product for resale to the public
2. The time zero initial investment = $3770
3. Sales price: $14.50 (20% chance), $14.00 (50% chance), or $13.50 (30% chance)
4. Unit sales: 1080 (20% chance), 1010 (50% chance), or 930 (30% chance)
5. Variable cost per unit = $10

Perform a sensitivity analysis on the project's sales price and unit sales. The beta of the time one expected cash flow = 0.0, the risk-free rate is 5% and the market risk premium is 8.4%. Use the CAPM.

Sales Price Sensitivity Analysis
(Be able to calculate the numbers in italics)

	Prob.	Sales Price	Cost	Units	Net CF (t = 1)	PV (at 5%)	Invest	NPV	Decision
Optimistic	20%	$14.50	-$10.00	*1000*	*$4500*	*$4285.71*	-$3770	*$515.71*	
Most Likely	50%	$14.00	-$10.00	*1000*	*$4000*	*$3809.52*	-$3770	*$39.52*	
Pessimistic	30%	$13.50	-$10.00	*1000*	*$3500*	*$3333.33*	-$3770	*-$436.67*	
Expected		*$13.95*	*-$10.00*	*1000*	*$3950*	*$3761.90*	*-$3770*	*-$8.10*	*Reject*

- What is the **most likely** sale's price? What is the expected sale's price?
- What are the highest and lowest possible ('what if') NPVs for the project?
- What is the NPV of the project?

Unit Sales Sensitivity Analysis
(Be able to calculate the numbers in italics)

	Prob.	Sales Price	Cost	Units	Net CF (t = 1)	PV (at 5%)	Invest	NPV	Decision
Optimistic	20%	*$13.95*	-$10.00	1080	*$4266.00*	*$4062.86*	-$3770	*$292.86*	
Most Likely	50%	*$13.95*	-$10.00	1010	*$3989.50*	*$3799.52*	-$3770	*$29.52*	
Pessimistic	30%	*$13.95*	-$10.00	930	*$3673.50*	*$3498.57*	-$3770	*-$271.43*	
Expected		*$13.95*	*-$10.00*	*1000*	*$3950*	*$3761.90*	*-$3770*	*-$8.10*	*Reject*

Which of the two variables (sales price or units) presents the most stand-alone risk for the project?

Some questions:

How does the firm determine the above distributions of possible sales prices and unit sales?

Should the firm spend time and money to further refine these figures?

Wait – isn't the NPV negative – shouldn't we just reject the project?

If we plan to gather more information, which variable (sales price or unit sales) should the firm address?

The value (and costs) of gathering more information