PLR4 PRINCIPLES OF CORPORATE FINANCE

Risk and Return

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Risk and Return

• Rational firms/individuals invest in projects yielding return greater than **minimum acceptable hurdle rate (bottomline/benchmark).**

• Rational entities MUST produce returns higher than hurdle rate.

• The hurdle rate is higher for riskier projects and also reflecting financing mix used - owners' funds (equity) or borrowed money (debt)

• Financing mix is also known as capital structure

- Choosing financing mix that minimizes hurdle rate and matches assets being financed (Issue of corporate credit ratings e.g. Standard & Poor's, Moody's and Fitch Ratings).

• If there are not enough investments that earn the hurdle rate, return cash to stockholders !!!!

-The form of returns – dividends, capital gains and stock buybacks (a.k.a. share repurchase)

- will depend upon stockholders' characteristics e.g. short run vs. long run investors horizon.

Principal Objective: Maximize the Value of the Firm

- Hurdle rate of a project sets the minimum qualification before it is deemed to be acceptable.
- Hurdle rate is the minimum rate of return that investors must get.

Hurdle rate = Riskless Rate + Risk Premium

- Riskless rate is what you would make on a riskless investment
- Risk Premium is an increasing function of the riskiness of the project

Questions:

1. How do you measure risk?
2. How do you translate this risk measure into a risk premium?

Answer to Question 1

Types of Risks:

1. Systematic risk is inherent to the entire market/sector.

- Also known as *un-diversifiable risk* or *market risk*.
- Interest rates, recession, inflation, wars etc. represent sources of systematic risk, affecting entire market and cannot be avoided through diversification.
- Systematic risk affects a broad range of securities.
- Systematic risk can be mitigated only by being hedged.

2. Unsystematic risk affects specific groups of securities or an individual security.

- Company or industry specific risk that is inherent in each investment.
- The amount of unsystematic risk can be reduced through appropriate diversification.
- A.k.a. *specific risk, diversifiable risk or residual risk*.
- For example, news that is specific to a small number of stocks, such as a sudden strike by the employees of a company you have shares in, is considered to be unsystematic risk.

Answer to Question 2

- Beta coefficient is a **standardized** measure of the non-diversifiable risk.
- Beta represents sensitivity of an equity stock to the change in market/sector price changes (indexes such as S&P500, FTSE100 etc.)

Expected Return

Let S denote the total number of states of the world, ris the return in state s, for stock i, and ps the probability of state s. Then the expected return is given by:

$$E(r_i) = \sum_{s=1}^{S} p_s * r_{is}$$

However, it is difficult to get these probabilities and returns by state.

Example:

State of Economy	Probability of State 's'	Return in of State 's'	Product
+1% change in GNP	.25	-.05	-.0125
+2% change in GNP	.50	.15	.0750
+3% change in GNP	.25	.35	.0875
	1.00	**Expected Returns E(r) =.15**	

Assume that risk-free rate of return is 5% p.a.

Projected or expected risk premium

= Expected return - Risk-free rate = E(r) – rf

=15%-5%= 10%

The Effects of Diversification

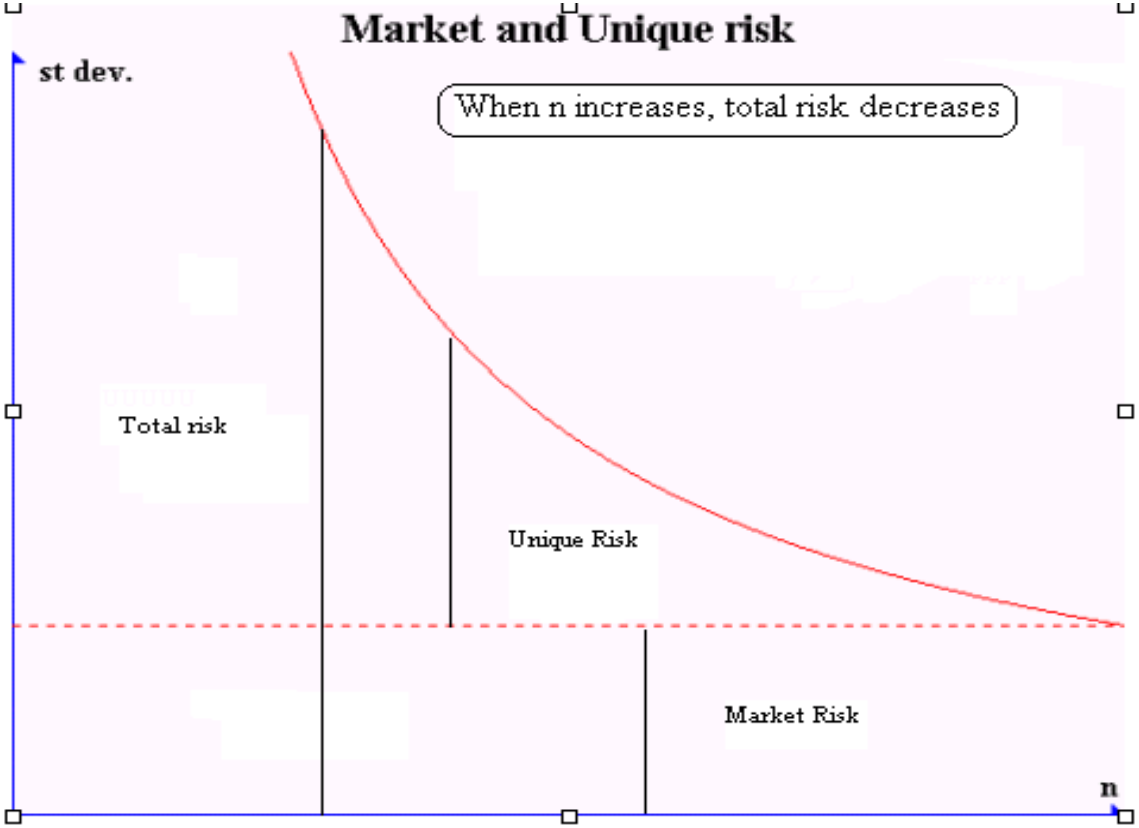
- Firm-specific risk can be reduced, if not fully eliminated, by increasing the number of investments in your portfolio (famous saying: don't put all eggs in one basket).
- Market-wide risk cannot be reduced. This can be justified on economic grounds.

• On economic grounds, diversified portfolio eliminates firm-specific risk for two reasons-

(a) Each investment is a much smaller percentage of the portfolio, muting the effect (positive or negative) on the overall portfolio.

(b) Firm-specific actions can be either positive or negative. In a large portfolio, these effects may even out each other. (For every firm, where something bad happens, there will be some other firm, where something good happens.)

Total Portfolio Risk as you add stocks to your portfolio



Asset allocation with two Risky Assets

- Portfolio risk depends on the correlation between the returns of the assets in the portfolio.
- Asset allocation across the three key asset classes: stocks, bonds, and risk-free money market securities.

Example: suppose there are three possible scenarios for an economy: a recession period, a normal growth period, and a boom period. The stock fund will have a rate of return of –11% in recession, 13% in normal period and 27% in boom period.

Suppose that a bond fund will provide ROR of 16% in the recession, 6% in the normal period and –4% in the boom period.

What is the expected or mean return for both stock and bond funds?

Solution: The expected return on each fund equals the probability-weighted average of outcomes in the scenarios.

The variance is the probability-weighted average across all scenarios of the squared deviation between the actual returns of the fund and its expected return.

		stock fund	stock fund	bond fund	bond fund
(A)	(B)	(C)	(D)	(E)	(F)
			Col. B		Col. B
		Rate of	×	Rate of	×
Scenario	Probability	Return	Col. C	Return	Col. E
Recession	0.3	-11	-3.3	16	4.8
Normal	0.4	13	5.2	6	2.4
Boom	0.3	27	8.1	-4	-1.2
Expected	Return =	sum	10	sum	6

Suppose, we form a portfolio with 60% invested in the stock fund and 40% in the bond fund.

Calculate portfolio return in recession

portfolio return in each scenario is the weighted average of the returns on the two funds.

Calculate portfolio return in recession =

0.60 (-11%) + 0.40 (16%)

-0.20%

$$E(rp) = \sum_{i=1}^{N} (\alpha_i \times E(r_i))$$

Portfolios can be described by the percentages of the portfolio's total value invested in each security, i.e., by the security's portfolio weights, αi.

For a 2 stock portfolio:

$$\sigma_P^2 = \alpha_i^2\sigma_i^2 + \alpha_j^2\sigma_j^2 + 2\,\alpha_i\alpha_j\,Cov(r_i\,r_j)$$

For an n-stock portfolio:

$$\sigma_P^2 = \sum_{i=1}^{N}\alpha_i^2\sigma_i^2 + \alpha_j^2\sigma_j^2 + 2\sum_{i=1}^{N}\sum_{j=i+1}^{N}\alpha_i\alpha_j Cov(r_i\,r_j)$$

Covariance is also product of individual asset standard deviations and coefficient of correlation (ρ_{ij}) between them

$COV(ri,rj) = \rho_{ij}\,\sigma_i\,\sigma_j$

where $-1 < \rho_{ij} < 1$ (why??)

Correlation coefficient (ρ)= covariance/ $\sigma_{STOCK}\,\sigma_{BOND}$

- Correlation can range from values of –1 to 1.
- Correlation of zero indicate that the returns on the two assets are unrelated to each other.
- Positive correlated shows two series move in the same direction.

- The negative value for the covariance indicates that the two asset vary inversely, i.e. when one assets performs well, the other tends to perform poorly (What about gold and oil prices?).
- Difficult to interpret the magnitude of covariance. An easier statistics to interpret is the correlation coefficient (why?).
- Negative correlation between two stocks bring down the two stock portfolio risk

(Refer to portfolio return and risk spreadsheet)

Beta (β) Measuring Systematic Risk:

• Beta coefficient (β) is a measure of how much systematic risk an asset has relative to an average risk asset when an investor holds a large portfolio.

$\beta i = (Cov.\ (r_i, r_m)/(\ Variance\ r_m)$

r_m = the return on the market portfolio, (e.g. S&P 500, FTSE100).

• Beta measures the responsiveness of returns of a security (r_i) to movements in the market portfolio.

Common publicaly available sources of beta: http://uk.finance.yahoo.com/, http://www.google.com/finance, http://www.reuters.com/

Variance of a portfolio is composed of two parts:

σ_p^2== Market risk + Unique risk

$$= \beta_p^2 \sigma_m^2 + (1/N) \sum_{i=1}^{N} \sigma_{\varepsilon i}^2$$

As N becomes large $\sigma_{\varepsilon i}$ --> 0 only market risk of a security remains

$$\mathbf{R_i = \alpha_i + \beta_i R_m + e_i}$$

(Beta Calculations spreadsheets)

Portfolio Betas

- While portfolio variance is not equal to a simple weighted sum of individual security variances, portfolio betas are equal to the weighted sum of individual security betas.
- **Example:**

(1)	(2)	(3)	(4)	
Stock	Amount Invested	Portfolio Weight	Beta Coefficient	Product (3) x (4)
A	$6000	50%	.75	.375
B	$4000	33%	1.01	.336
C	$2000	17%	1.16	.197
Portfolio		100%		**.91**

Capital Asset Pricing Model (CAPM): A Landmark Theory

CAPM is often used when it comes to putting a risk label on securities in order to make that risk judgment.

• Goal of CAPM is to determine a required rate of return to justify adding an asset to an already well-diversified portfolio, considering that asset's non-diversifiable risk.

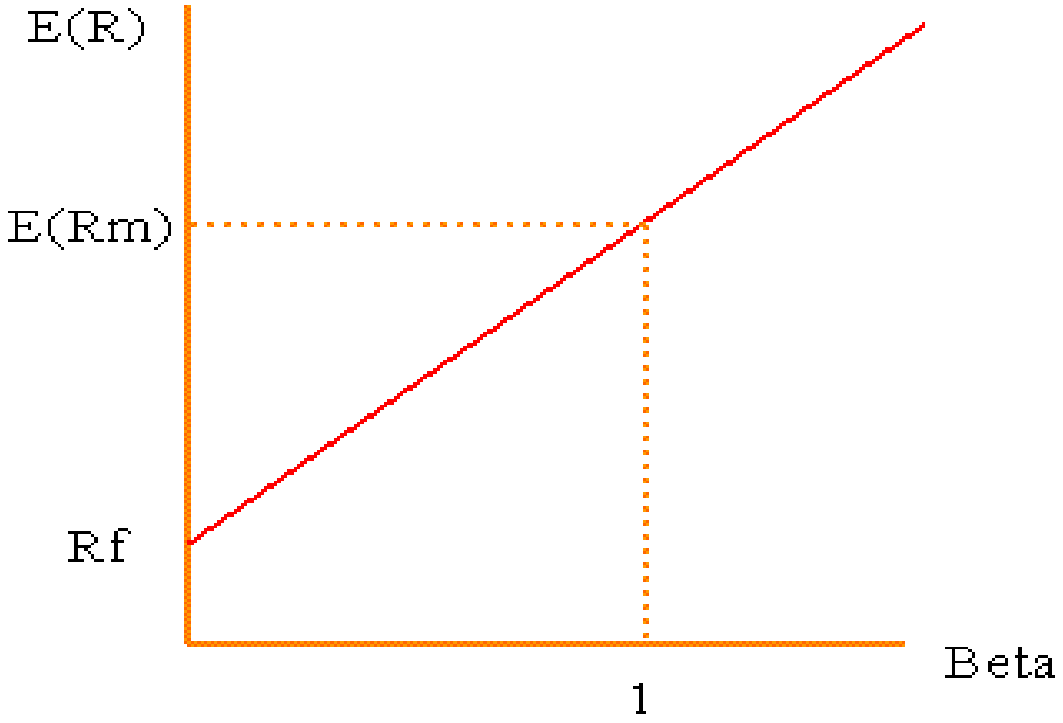
• Introduced in 1964 by John Lintner, Jack Treynor, William Sharpe and Jan Mossin. An extension of the earlier work of Harry Markowitz on diversification and modern portfolio theory. William Sharpe later received a Nobel Memorial Prize in Economics along with Merton Miller and Markowitz for their further contributions to CAPM-based theory, in 1990.

• The CAPM takes into account the non-diversifiable market risks or beta (β) in addition the expected return of a risk-free asset.

While CAPM is accepted academically, current empirical evidence no longer finds it as rigorous as it might have appeared to be initially.

The following assumptions apply to the CAPM:

- All investors are risk averse by nature
- Investors have the same time period to evaluate information
- There is unlimited capital to borrow at the risk-free rate of return
- Investments can be divided into unlimited pieces and sizes
- There are no taxes, inflation or transactions costs


E(R)
E(Rm)
Rf
Beta
1

The Security Market Line

SML gives the expected return - systematic risk combinations

- Market Portfolio has an "average" systematic risk, i.e., it has a beta of 1.
- Since all assets must lie on the security market line when appropriately priced, so must the market portfolio.

$(E(r_A) - r_f)/\beta_A = (E(r_A) - r_f)/1$

= SLOPE OF SML

- Assuming diversification costs nothing (in terms of transactions costs), and that all assets can be traded, the limit of diversification is to hold a portfolio of every single asset in the economy (in proportion to market value). This portfolio is called the market portfolio.
- Individual investors will adjust for risk, by adjusting their allocations to this market portfolio and a riskless asset (such as a T-Bill)

- **Preferred risk level Allocation decision**

-No risk 100% in T-Bills

-Some risk 50% in T-Bills; 50% in Market Portfolio;

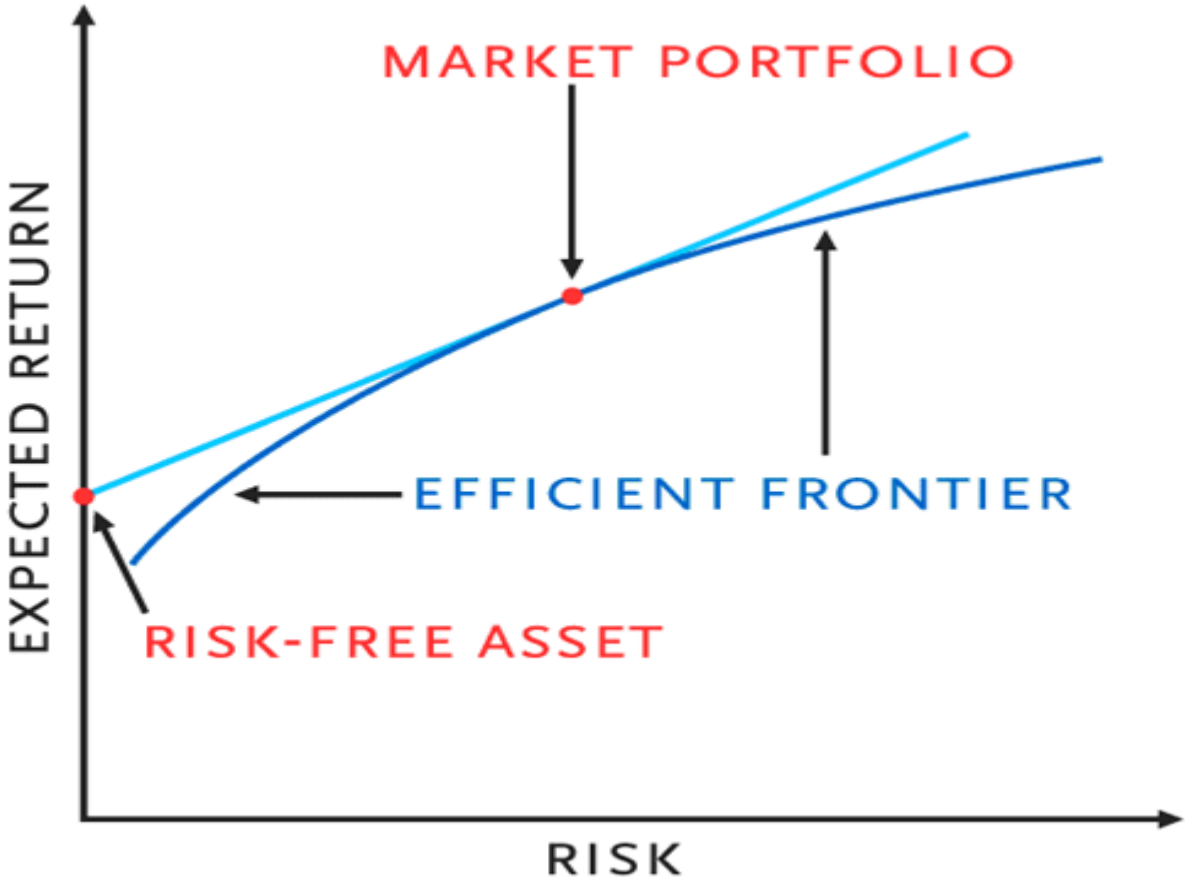
-A little more risk 25% in T-Bills; 75% in Market Portfolio

-Even more risk 100% in Market Portfolio

-Real risk appetite Borrow money; Invest in market portfolio (short vs. long position)

- Generally, investor holds some combination of the risk free asset and the market portfolio.

Cost of Equity = R_f + Equity Beta * ($E(R_m)$ - R_f)



Limitations of the CAPM

1. The model makes unrealistic assumptions
2. The parameters of the model cannot be estimated precisely

- - Definition of a market index
- - Firm may have undergone a complete structural change during the 'estimation' period'

3. The model does not work well

- - If the model is right, there should be a linear relationship between returns and betas

Inputs required to use the CAPM:

(a) current risk-free rate

(b) expected market risk premium (premium expected for investing in risky assets over the riskless asset)

(c) beta of the asset being analyzed.

Risk-free Rate and Time Horizon:

• On a risk-free asset, actual return is equal to the expected return (zero variance around the expected return).

• For an investment to be risk-free two conditions have to be met –

1. No default risk i.e. security issued by the government. (Does governments default? Greece, Mexico, Argentina, South-East Asia and many more).
2. No uncertainty about reinvestment rates i.e. security is a zero coupon security with the same maturity as the cash flow being analyzed.

- Using a long term government rate as the risk-free rate on all of the cash flows in a long term analysis (e.g. U.S. Treasury bonds).
- For short term analysis, it is entirely appropriate to use a short term government security rate as the risk-free rate(e.g. U.S. Treasury bills).
- If the analysis is being done in real terms (rather than nominal terms) use a real risk-free rate, which can be obtained in one of two ways –

1. from an inflation-indexed government bond.
2. equal, approximately, to the long term real growth rate of the economy.

Measurement of the risk premium:

• The risk premium is the premium that investors demand for investing in an average risk investment, relative to the risk-free rate.

• As a general proposition, this premium should be

-greater than zero

-increase with the risk aversion of the investors in that market

-increase with the riskiness of the “average” risk investment

- A simple way of estimating a country risk premium for another country is as below:

Assume that default spread in Argentina is 5.25% more than of USA.

- Risk Premium (Argentina)= U.S. premium + 5.25%
- Country ratings measure default risk.
- While default risk premiums and equity risk premiums are highly correlated, one would expect equity spreads to be higher than debt spreads (Why??).

• For example,

– Standard Deviation in Merval (Equity index performance for Buenos Aires Stock Exchange) = 42.87%

– Standard Deviation in Argentine Long Bond = 21.37%

– Adjusted Equity Spread = 5.25% (42.87/21.37) = 10.53%

Above formula accounts for country, and debt-equity market risk differentials.