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**CHAPTER 12:
SYSTEMATIC RISK AND THE
EQUITY RISK PREMIUM**

Business Finance 3220

Final wed 12/12 8:45-9:00 PM
at 100 independence Hall

standard deviation - total risk and
quantified the risk

Portfolios

- A portfolio is a collection of assets, such as stocks & bonds
- An asset's risk and return are important in how they affect the risk and return of the portfolio
- The risk-return trade-off for a portfolio is measured by the portfolio expected return and standard deviation, just as with individual assets

Talking about same thing but
on portfolio basis

systematic - macro → affected by economy
- invest in risky asset in market that has risk
unsystematic - firm specific (not diversified)
- don't expect firm to do any better

expectations of return
should stay same.

Portfolio Expected Returns

- The expected return of a portfolio is the weighted average of the expected returns for each asset in the portfolio

$$E(R_p) = \sum_{j=1}^n w_j E(R_j)$$

- You can also find the expected return by finding the portfolio return in each possible state and computing the expected value as we did with individual securities

10% vs 20% ⇒ half in each
0.5(10%) + 0.5(20%) = 15%

Portfolio Variance won't have to do w
more than 2 assets

- This is more difficult to compute. We can't take the individual variances & multiply by their weights

$$Var(R_p) = w_1^2 SD(R_1)^2 + w_2^2 SD(R_2)^2 + 2w_1 w_2 Corr(R_1, R_2) SD(R_1) SD(R_2)$$

lower correlation
lower risk

invest in key on
want to buy less
correlation drive

- If one of the two assets (say, asset 2) is a risk-free rate, then formula becomes:
 $Var(R_p) = w_1^2 SD(R_1)^2$ and $SD(R_p) = w_1 SD(R_1)$
- Variance more generally called "sigma squared" or σ^2
- Standard deviation more generally called "sigma" or σ

weight invested in each stock
x expected return in future
function of weights and expected
return of assets

correlation how closely related are assets
(p) how closely move together [-1, 1]
- all move together ⇒ +1 same risk.

relation
my low

Example: Portfolio Return and Variance

- Assume two stocks, X and Y. $E(R_X) = 10\%$; $E(R_Y) = 12\%$. $\sigma_X = 25\%$; $\sigma_Y = 35\%$. $\rho_{XY} = 0.15$
- What is the expected return and standard deviation of a portfolio that invests 50% of our wealth in each asset?
- $E(R_p) = (.5 * 10) + (.5 * 12) = 11\%$ -- the midpoint between 10% and 12%. Will the standard deviation be the midpoint, also, i.e. 30%?
- No, it is 22.98%, less than either standard deviation. Why is this?

Problem 13

- You have a portfolio with standard deviation of 30% and an expected return of 18%. You are considering adding one of the two stocks in the table below. If after adding the stock you will have 20% of your money in the new stock and 80% of your money in your existing portfolio, which one should you add?

	E(R)	Std. Dev.	Correlation
Stock A	15%	25%	0.2
Stock B	15%	20%	0.6

lower correlation
make
3rd term
lower low
total risk
(unsystematic)

$$Var(R_p) = 0.5^2(25^2) + 0.5^2(35^2) + 2(.5)(.5)(.15)(.25)(.35)$$

$$\sigma^2 = 12.5 + 62.5 + 2.625 = 77.625$$

$$\sigma = \sqrt{77.625} = 27.86\%$$

returns exactly same as E(R)

$$Var(R_p) = .8^2(30)^2 + .2^2(25)^2 + 2(.8)(.2)(.6)(30)(20) = 707.2$$

$$\sigma = \sqrt{707.2} = 26.59$$

only way to get rid of un systematic is out of risky/market portfolio
 $\beta < 1$ less risky than avg company

if my comp have β below market-wxvny

Measuring Systematic Risk

- How do we measure systematic risk?
- We use the beta coefficient to measure systematic risk
- What does beta tell us?
 - A beta of 1 implies the asset has the same systematic risk as the overall market
 - A beta < 1 implies the asset has less systematic risk than the overall market
 - A beta > 1 implies the asset has more systematic risk than the overall market
- The beta of a portfolio is just the weighted-average of the individual betas.

november.

Security Market Line

- Remember
 - risk premium = expected return - risk-free rate
- The higher the beta, the greater the risk premium should be
- Can we define the relationship between the risk premium and beta so that we can estimate the expected return? Yes.

now much expect to earn above risk free rate of return

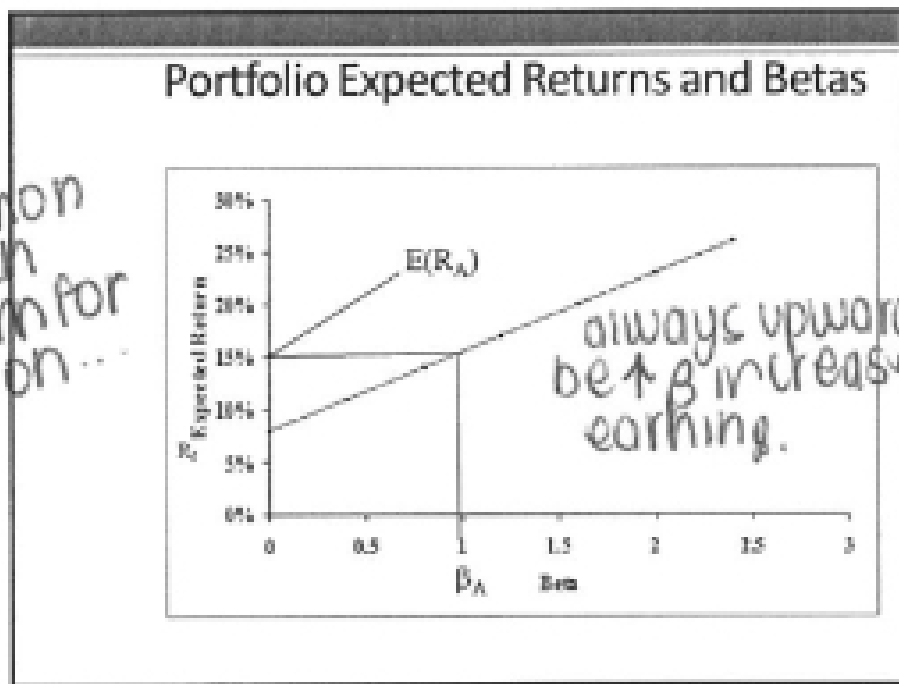
greater risk take = greater risk premium earned
 - β of treasury security 0, β of portfolio entities higher - higher risky return

want to pick stocks diff to lower correlation/risk
 β same risk as overall broad market

finance.

more general form:

slope function how much it'd return for risk take on...



Risk premium is slope of this line

The Capital Asset Pricing Model (CAPM)

- The capital asset pricing model defines the relationship between risk and return
- $E(R_A) = R_f + \beta_A[E(R_M) - R_f]$
- If we know an asset's systematic risk, we can use the CAPM to determine its expected return
- This is true in theory whether we are talking about financial assets or physical assets

first even attempt to measure what we think stock price be
 - expectation start w risk free rate if take on risk (β) increase higher β better return

$E(R_M)$ → expected return of overall market
 $E(R_M) - R_f$ → expected market return risk premium

thanksgiving.

Factors Affecting Expected Return

- the time value of money
 - measured by the risk-free rate
 - R_f : the reward for waiting for your money, w/o taking any risk
- reward per unit of systematic risk
 - measured by the market risk premium
 - $E(R) - R_f$
- the asset's systematic risk
 - measured by beta
 - β

no risk earn risk free rate

Problem 24 $\beta = 1$ means portfolio $\beta =$ expected

- Suppose Intel stock has a beta of 1.6, whereas Boeing stock has a beta of 1. If the risk-free interest rate is 4% and the expected return of the market portfolio is 10%, according to the CAPM,
- A. What is the expected return of Intel stock? intel riskier w high β
- B. What is the expected return of Boeing stock?
- C. What is the beta of a portfolio that consists of 60% Intel stock and 40% Boeing stock?
- D. What is the expected return of a portfolio that consists of 60% Intel stock and 40% Boeing stock?

$E(R_I) = 4\% + 1.6[10\% - 4\%] = 13.6\%$
 $E(R_B) = 4\% + 1[10\% - 4\%] = 10\%$

$\beta_P = 0.6(1.6) + 0.4(1) = 1.36$
 $E(R_P) = 0.6(13.6) + 0.4(10) = 12.16\%$
 $4 + 1.36(10 - 4) = 12.12\%$ } 2 ways of getting there

Problem 28

- At the beginning of 2007, Apple's beta was 1.4 and the risk-free rate was about 4.5%. Apple's price was \$84.84. Apple's price at the end of 2007 was \$198.08. If you estimate the market risk premium to have been 6%, did Apple's managers exceed their investors' required return as given by the CAPM?

$$E(R_{\text{APPLE}}) = 4.5\% + 1.4(6\%) = 12.9\%$$

$$R_{\text{APPLE}} = \frac{198.08 + 84.84}{84.84} = \frac{282.92}{84.84} = 3.3347$$

Apple gained 133.47% so yes exceeded