Financial Economics

Review

LIN, Mengyun SOE&WISE

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Course Outline

- Lecture 01 Finance and the Financial System (Chp01&02)
- Lecture 02 Time Value of Money (Chp03)
- Lecture 03 Corporate Finance (Chp05&Chp15)
- Lecture 04 Principles of Market Valuation (Chp06)
- Lecture 05 Valuation of Bonds (Chp07)

- Lecture 06 Valuation of Stocks (Chp08)
- Lecture 07 Principles of Risk Management (Chp09)
- Lecture 08 Portfolio Choice (Chp11)
- Lecture 09 Capital Market Equilibrium (Chp12)
- Lecture 10 Household Finance (not tested)

Lecture 01. Financial Economics and Financial System

- Household & Corporate Financial Decisions
- The Financial System
  - Financial intermediaries, Financial markets, Service firms, Other institutions used to carry out the financial decisions of households, business firms, and governments
- Financial System Functions
  - Transferring Resources Across Time & Space; Clearing and Settling Payments; Providing Information; Managing Risk; Pooling Resources and Subdividing Shares; Dealing with Incentive Problems
- Financial Markets Rates
  - Interest rates; Exchange rates; Stock-market indicators

Lecture 02. Time Value of Money

- Future Value and Compounding
  - $FV = PV \times (1+i)^n$
- Present Value and Discounting
  - $PV = \frac{FV}{(1+i)^n} = FV \times (1+i)^{-n}$
- Annuities
  - Perpetual annuities: $PV = \frac{pmt}{i}$
  - Growing annuities: $PV = \frac{C_1}{i-g}$
- Capital Budgeting Decision Rule
  - NPV (=PV of all cash inflows – PV of all cash outflows) >0
  - IRR (the discount rate that makes the NPV of an investment zero) > cost of capital

Lecture 03. Corporate Finance

- Estimate Future Cash Flows
  - Incremental cash flow
  - Operation cash flow and net working capital
  - Tax and depreciation
- Scenario Analysis and Sensitivity Analysis
  - Base case, upper bound, lower bound
- Estimate Cost of Capital
  - Actually
- Financial Structure of the Firm
  - Internal vs. external financing
  - M&M theory: In an economist's idealized world of frictionless markets (**Frictionless Environment Assumptions**), the value of the firm is independent of firm's capital structure.
  - Pecking order theory

Lecture 04. Principles of Market Valuation

- Law of one-price and arbitrage
  - In a competitive market, if two assets are equivalent, they will tend to have the same price
  - Interest-arbitrage; exchange-rate triangular arbitrage
- Valuation models
  - Using comparables
  - Stock valuation using P/E ratio
- The efficient market hypothesis
  - An asset's current price reflects all publicly available information about future economic fundamentals affecting the market price

Lecture 05. Valuation of bonds

- PV formulas and valuation of known cash flows
- Pure discount bonds (zero-coupon bonds)
  - $P = \frac{F}{(1+i)^n}$
- Coupon bonds
  - $P = \sum_{t=1}^{T} \frac{Coupon}{(1+i)^t} + \frac{F}{(1+i)^n}$
- Are bonds risk free?
  - Default risk (credit risk)
  - Interest rate risk/inflation risk
  - Call risk/reinvestment risk
  - Exchange rate risk
  - Liquidity risk

Lecture 06. Valuation of Stocks

- The discounted dividend model
  - $P_0 = \frac{D_1 + P_1}{1+k} = \sum_{t=1}^{\infty} \frac{D_t}{(1+k)^t}$
- The constant-growth-rate DDM
  - $P_0 = \frac{D_1}{k-g}$
- Earning and investment opportunity
  - $P_0 = \frac{E_1}{k} + NPV\ of\ Future\ Investments$
- Dividend policies
  - Cash dividends and share repurchases
  - Stock dividends and stock split
  - How # of shares outstanding, price per share, and shareholders wealth change?

Example

- **Nogrowth** has a policy of no net new investments
  - This does not mean the firm does not invest in new plant and equipment--only that purchases match the loss of value of the existing assets (as measured by depreciation)
  - If we assume everything is in real terms, it is reasonable to assume that nogrowth will pay a constant dividend (say) $15/share each year
  - If the real capitalization rate is 15%, then the stock price of nogrowth is

$$P_0 = \frac{E_1}{k} = \frac{\$15}{15\%} = \$100$$

Example

- **Growthstock** initially has the same earnings as nogrowth, but reinvests 60% of its earnings each year into new investments that yield a real rate of return of 20% per year. The real capitalization rate is 15%.
  - That is, the first year dividend is $\mathrm{D}_1 = \$15 \times 40\% = \$6$
  - The other $\$15 \times 60\% = \$9$ per share is reinvested in the firm
- Although D_1 of Growthstock is lower than that of Nogrowth, but it grows over time at a rate of

$$g = Earnings\ retention\ rate \times Rate\ of\ Return\ on\ New\ Investments$$
$$= 60\% \times 20\% = 12\%$$

  - Earnings retention rate is the proportion of earnings that are reinvested
- Using the constant-growth-rate DDM
  - $P_0 = \frac{D_1}{k-g} = \frac{\$6}{15\%-12\%} = \$200$
  - $NPV\ of\ Future\ Investments = P_0 - \frac{E_1}{k} = \$200 - \$100 = \$100$

Lecture 07. Principles of Risk Management

- Risk and risk management
  - Identify risk exposure under certain circumstances (households, firms, governments, etc)
- Risk management process
  - Risk identification
  - Risk assessment
  - Selection of risk-management techniques
  - Implementation
  - Review

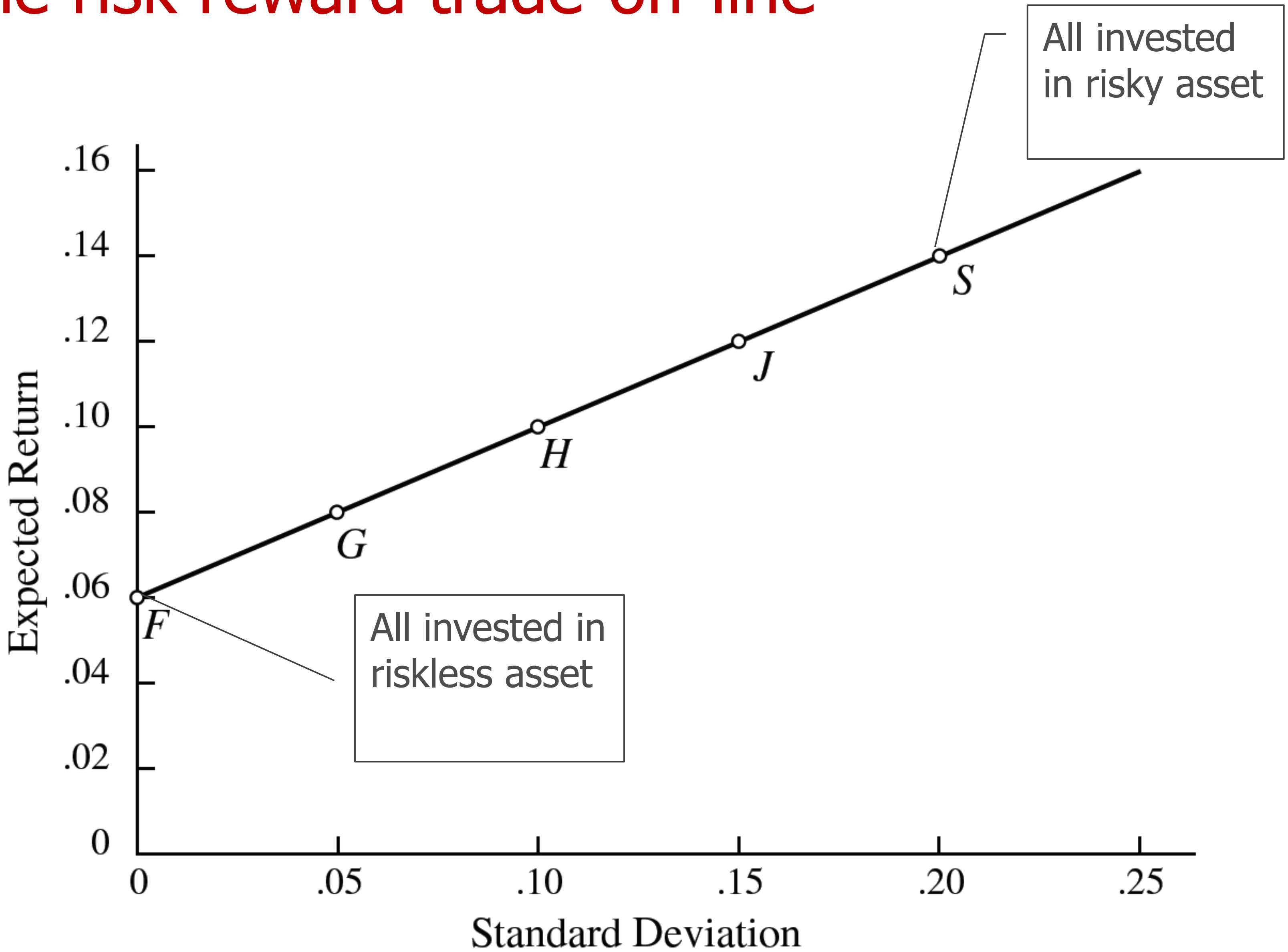
Lecture 08. Portfolio Choice

- The process of personal portfolio selection
  - Age, existing wealth, health, future earnings potential, consumption preferences, risk preferences, life goals, obligations to children and older family members, horizon
  - E.G., Life cycle portfolio selection,
- The trade-off between expected return and risk
  - One riskless asset + one risky asset
  - One riskless asset + two risky assets
- Efficient diversification with many risky assets

Combining the riskless asset and a single risky asset

- Suppose you have $100,000 to invest and choose between
  - Riskless asset: the interest rate of 0.06 per year
  - Risky asset: expected rate of return of 0.14 per year and a standard deviation of 0.2.
  - Suppose we want to identify the portfolio that has an expected rate of return of 0.09

The risk-reward trade-off line



Step 1: Relate portfolio's expected return to the proportion invested in the risky asset

- Let ω denote the proportion of the \$100,000 investment to be allocated to the risky asset.
- The remaining proportion, $1 - \omega$, is invested in riskless asset
- The expected rate of return on any portfolio is given by

$$E(r) = \omega E(r_s) + (1 - \omega) r_f$$

$$= r_f + \omega \left[E(r_s) - r_f \right]$$

$$= 0.06 + \omega(0.14 - 0.06)$$

$$= 0.06 + 0.08\omega$$

  - $E(r_s)$ is the expected rate of return on the risky asset
  - r_f is the riskless rate.

$$E(r) = r_f + \omega\left[E(r_s) - r_f\right]$$

- The portfolio is expected to earn a riskless rate (r_f) plus a risk premium component ($\omega\left[E(r_s) - r_f\right]$).
- a risk premium component depends on the risk premium on the risky asset ($E(r_s) - r_f$) and the proportion invested in the risky asset (ω)

- To find a portfolio composition whose expected rate of return is 0.09,

$$E(r) = r_f + \omega\left[E(r_s) - r_f\right]$$

$$0.09 = 0.06 + 0.08\omega$$

$$\omega = 0.375$$

- The portfolio is a mix of 37.5% risky asset and 62.5% riskless asset.

Step 2: Relate the portfolio standard deviation to the proportion invested in risky asset

- Denoting the standard deviation of the risky asset σ_s, the portfolio's standard deviation is

$$\sigma = \sigma_s \omega = 0.2\omega$$

- The standard deviation corresponds to an expected rate of return of 0.09

$$\sigma = 0.2 \times 0.375 = 0.075$$

Step 3: Relate the portfolio expected rate of return to its standard deviation

$$\sigma = \sigma_s \omega \ \rightarrow \omega = \frac{\sigma}{\sigma_s}$$

$$E(r) = r_f + \omega[E(r_s) - r_f] = r_f + \frac{[E(r_s) - r_f]}{\sigma_s}\sigma$$

The portfolio's rate of return expressed as a function of its standard deviation is a straight line:

$$E(r) = 0.06 + \frac{[0.14 - 0.06]}{0.2}\sigma = 0.6 + 0.4\sigma$$

- Intercept: $r_f = 0.06$
- Slope: $\frac{[E(r_s) - r_f]}{\sigma_s} = 0.4$
  - Measures the extra expected rate the market offers for each unit of

The optimal combination of two risky assets

- To find the optimal combination of risky assets,
  - Step 1: consider portfolio constructed from the risky assets only
  - Step 2: find the tangency portfolio of risky assets to combine with the risky assets
- We do not need to know
  - Anything about investors' preference
- We need to know the
  - Return distributions of the two risky assets
    - Expected rate of return
    - Standard deviations of the rate of return
    - The correlation between the two rate of return

Portfolio of two risky assets

- A proportion ω in risky asset 1 and $1-\omega$ in risky asset 2
- Expected rate of return

$$E(r) = \omega E(r_1) + (1-\omega)E(r_2)$$

  - Weighted average of expected returns of assets
  - Weights are the proportions invested in the assets

- Variance

$$\sigma^2 = \omega^2\sigma_1^2 + (1-\omega)^2\sigma_2^2 + 2\omega(1-\omega)\rho_{1,2}\sigma_1\sigma_2$$

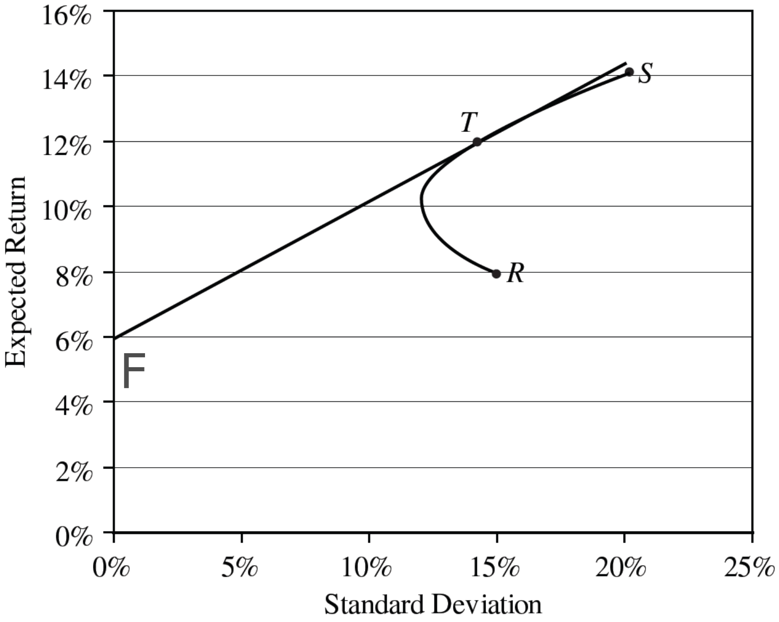
  - $\rho_{1,2}$ is the correlation coefficient between r_1 and r_2.

- Compared to combining a risky asset with a riskless asset

$$E(r) = \omega E(r_s) + (1-\omega)r_f$$

$$\sigma = \sigma_s\omega$$

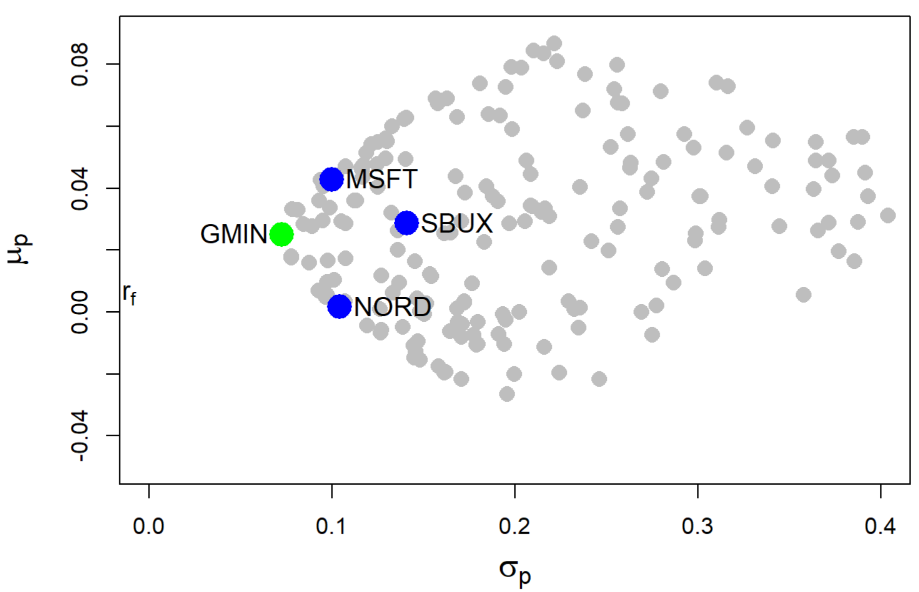
The optimal combination of risky assets

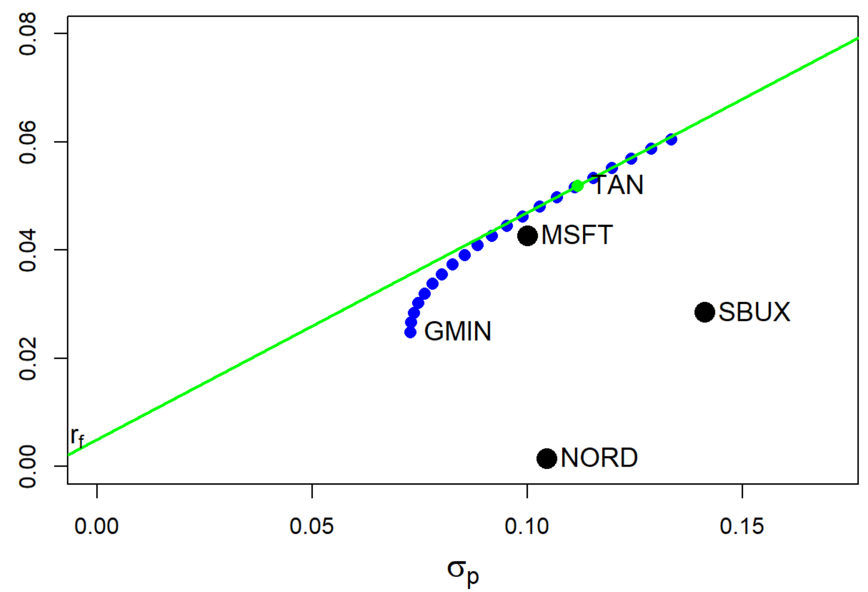


- Tangency point T
  - **Tangency portfolio**
- Compared to other trade-off lines (e.g., FS, FR, and FQ), FT provides higher expected rate of return for any level of risk one is willing to tolerate.

Portfolio of many risky assets

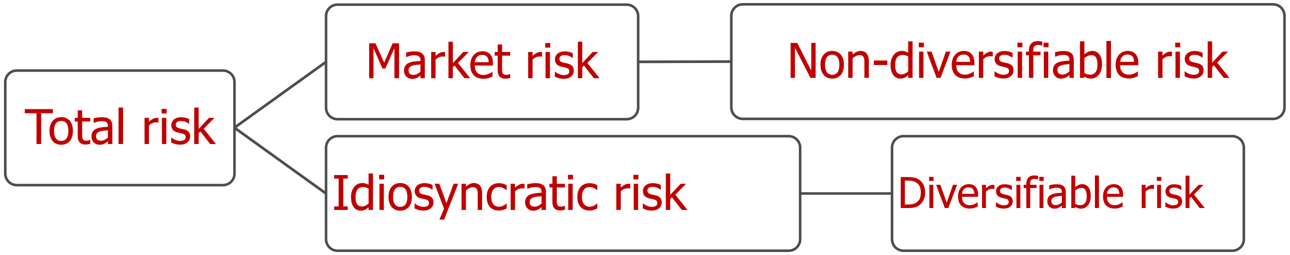
- The idea is roughly the same to find the optimal portfolio
  - Step 1: consider portfolio constructed from the risky assets only
  - Step 2: find the tangency portfolio of risky assets to combine with the





Diversification

- Portfolio of *less than (positively) perfectly correlated* assets always offer at least as good risk-return opportunities than the individual component assets on their own.



- Idiosyncratic risks are diversified (eliminated through diversification).
- Market risk is not diversifiable.

Lecture 09. Capital Market Equilibrium

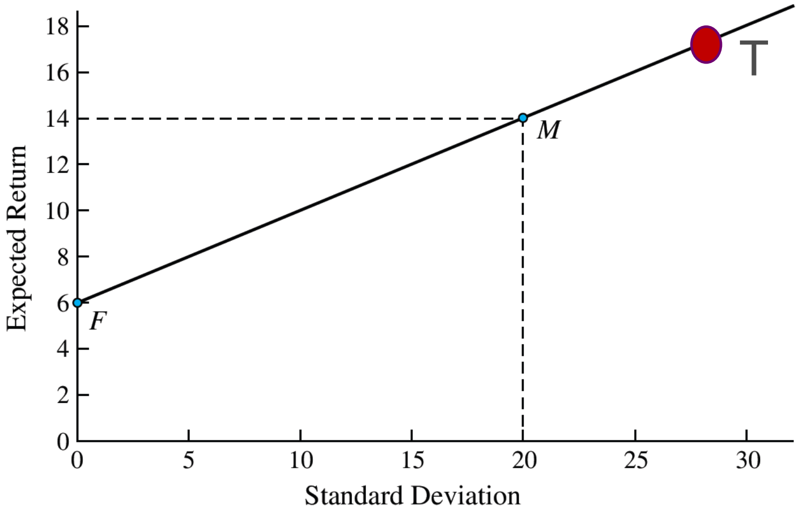
- The Capital Asset Pricing Model
  - Assumption 1: Investors forecasts agree with respect to expectations, standard deviations, and correlations of the returns of risky securities. Therefore all investors hold risky assets in the same relative proportions
  - Assumption 2: Investors behave optimally. In equilibrium, prices adjust so that aggregate demand for each security is equal to its supply

Market portfolio

- A portfolio that holds all assets in proportion to their observed market values
  - E.g., there are only three assets
    - Stock A: $66 billion
    - Stock B: $22 billion
    - Risk-free asset: $12 billion
  - The composition of market portfolio is: 66% stock A, 22% stock B, 12% risk-free asset
- In equilibrium, any investor's relative holdings of **risky assets** will be the same as in the market portfolio
  - E.g., the composition of market portfolio is: 66% stock A, 22% stock B, 12% risk-free asset
  - All investors will hold stock A and stock B in the proportions of 3 to 1 (66/22)

The Capital Market Line

- In equilibrium, CML represents the best risk-reward combinations available to all investors



$$E(r) = r_f + \frac{E(r_M) - r_f}{\sigma_M}\sigma$$

- $E(r_M) - r_f$: risk premium of market portfolio

– Investors get rewarded only for bearing market risk.
  - Find out T: Idiosyncratic risks cancel out, only market risk remains
  - Find out M: Depends on the aggregate risk tolerance of all investors

Risk premium on the market portfolio

- The equilibrium risk premium on the market portfolio is the product of
  - variance of the market, σ^2_M
  - weighted average of the degree of risk aversion of holders of risk, A

$$E(r_M) - r_f = A\sigma_M^2$$

Example: Suppose that the standard deviation of the market portfolio is 0.2, the expected rate of return is 0.14, and the average degree of risk is 2.

- The risk premiums on the market portfolio is

$$E(r_M) - r_f = A\sigma_M^2 = 2 \times 0.2^2 = 0.08$$

- The riskless rate is

$$r_f = E(r_M) - 0.08 = 0.14 - 0.08 = 0.06$$

- The CML is given by

$$E(r) = r_f + \frac{E(r_M) - r_f}{\sigma_M}\sigma = 0.06 + \frac{0.08}{0.2}\sigma = 0.06 + 0.4\sigma$$

Risk premiums on individual securities

The risk premium on any asset is

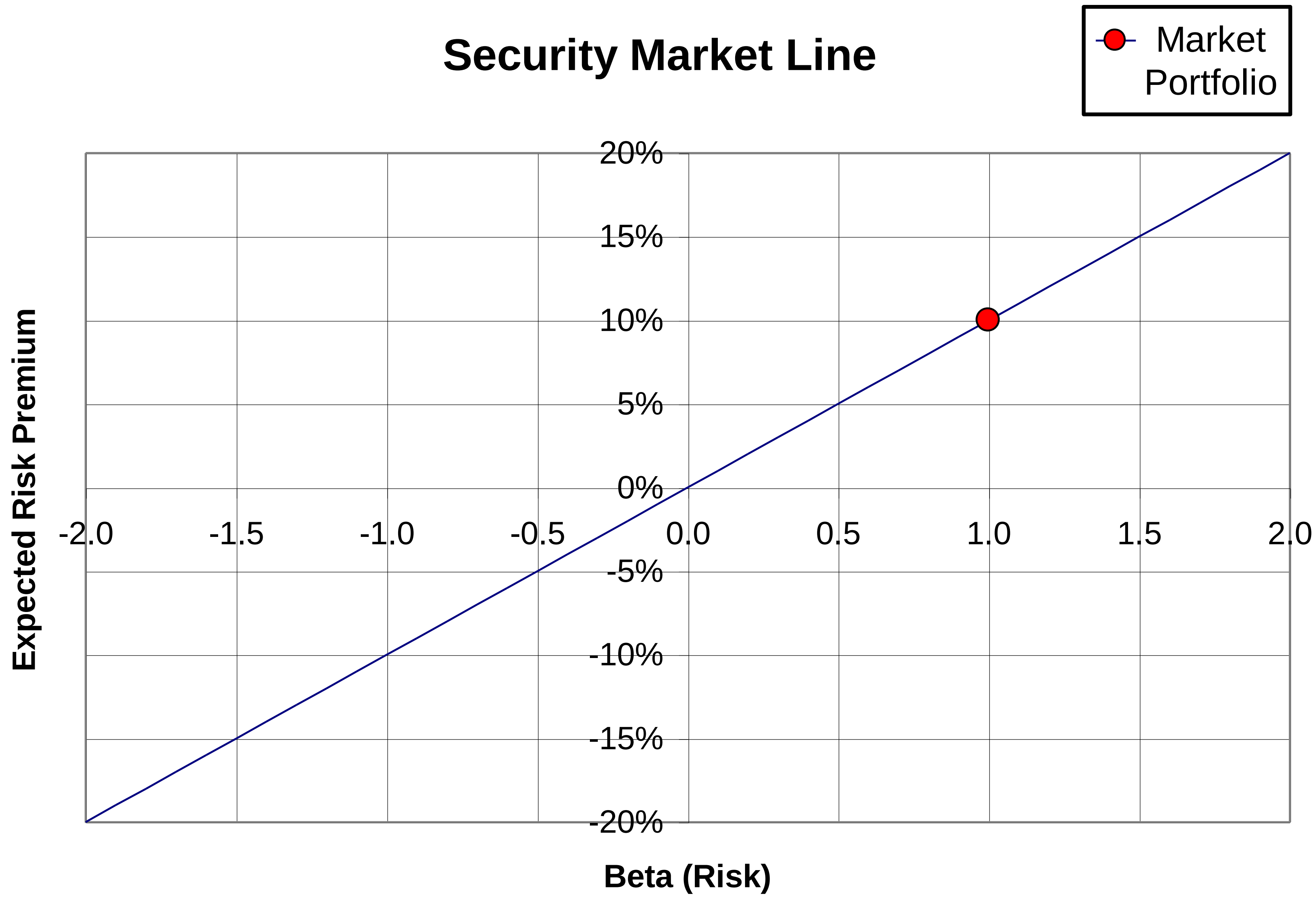
$$E(r_j) - r_f = \beta_j[E(r_M) - r_f]$$

where $\beta_j = \frac{\sigma_{jM}}{\sigma_M^2}$, $\sigma_{jM} = Covariance(r_j, r_M)$.

- Idea of linear regression (Econometrics)

This is called the **Security Market Line (SML).**

- The slope is the risk premium of the market portfolio, $E(r_M) - r_f$, or market premium


Security Market Line
Market Portfolio
20%
15%
10%
5%
0%
-5%
-10%
-15%
-20%
-2.0
-1.5
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0
Expected Risk Premium
Beta (Risk)

The Beta of a Portfolio

- When determining the risk of a portfolio
  - using standard deviation is quite complex
    - Risk of every risky asset: $\sigma_1, \sigma_2, \dots, \sigma_n$
    - Correlation between every two risky assets: $\rho_{1,2}, \rho_{1,3}, \dots, \rho_{n,n-1}$ (a total of $\frac{n(n-1)}{2}$ $\rho' s$)
  - using beta, the formula is linear

$$\beta_p = \omega_1\beta_1 + \omega_2\beta_2 + \cdots + \omega_n\beta_n = \sum_{j=1}^{n} \omega_j\beta_j$$

    - ω_j is the proportion of investment in security j, $\sum_{j=1}^{n} \omega_j = 1$

Concluding remarks

- Thank you for coming and being supportive the semester!
- Hope you find the materials interesting and helpful!
- Good luck on the final exam, and most importantly,

Wish you all the best for everything in the future!