1. Introduction

- return on a stock $E(r_{t+1}) = \frac{E(p_{t+1}+d_{t+1})}{p_t} - 1$
- risk-expected return trade-off: there will be a positive relation between risk and expected returns
- **only risk determines expected return**
- small company has higher average return and higher SD than large company
- Investment in stocks should be for the long run, In the short run, volatility is high
- Asset pricing
  - Risk-based models
    - In an efficient market there is no free lunch
  - Relative pricing
    - given the price of the second asset we know the price of the first asset
  - Behavioral biases
    - Investors are not always rational. Hence, prices might deviate from the true prices
- Roles of the financial markets
  - Boosting economic growth
- Fixed Income
  - Money market
    - **TED spread:** The spread of 3-month LIBOR over 3-month T-Bill rates
  - Bond market
    - Mortgage-backed bonds
      - collateral is the houses
      - increase of the loan supply
      - subprime crisis (次贷危机)
      - World recession
- Stock market indexes
  - Price weighted indexes: Dow Jones Industrial Average (DJIA)
  - Value weighted indexes: S&P 500
  - Equal weighted indexes: S&P 500 equal weighted index (gives equal weight to the return)
- total returns
  - reinvested in the whole market

2. Bond valuation

- Coupons are paid once a year (in Europe) or once every six months (in the US).
- TIPS = Treasury Inflation Protected Securities
- The correlation between government bonds and stocks is close to 0 in normal times
- CR>r, trades at a premium
- CR=r, trades at par
- bond prices move to the par value but not monotonic
- Interest rate risk
  - Price risk
    - bond price will change (interest rate up -> price down)
    - short-term investors face
    - risk more when YTM longer
    - short-term inflation-indexed government bond: safest asset for short term investors
    - coupon bond face less price risk
    - long duration bonds has higher price risk
  - Reinvestment risk
    - reinvesting return change (interest rate down -> reinvesting down)
    - long-term investors face
    - for long term invester: long zero > long coupon > roll over short
- YTM vs realized yield
  - YTM like IRR
  - interest rate change -> YTM stay, realized yield changed
- HPR (Holding Period Return)
  - realized yield for one unit period

3. Term Structure

- determination of the interest rates for different horizons
  - The expectations hypothesis
    - investors are risk neutral
    - bonds to different maturities are perfect substitutes
  - The liquidity preference theory
    - investors are risk averse
    - have short investment horizons
    - investors require a higher rate of return on investments in longer term bonds
    - risk aversion: forward rate > expected rate
    - long term bond should offer a risk premium
    - LP: liquidity premium: (forward rate - expected rate)
    - In the data, the liquidity preference theory gains empirical support
  - inflation risk premium
- Forward interest rate
  - f
- The yield curve usually increases
  - steeply upward sloping
    - interest rates are expected to increase
    - a serious economic crisis is expected
  - declining yield curve
    - declining interest rates
    - declining inflation rates

4. Bond Portfolio

- a low interest rate environment is problematic for pension funds
  - it's moredifficult to finance future obligations
- The prices of long term bonds are more sensitive to interest rates than short term
- Duration
  - $w_t = [CF_t/(1+y)^t]/price$
  - **Macaulay duration**: $D = \sum_{t=1}^{T} t * w_t$
  - the elasticity of the bond's price to changes in the average interest rate.
    - Ela = % change in P / % change in Y = -(YdP)/(PdY)
  - **high Duration: long time to maturity, low coupon, low YTM**
  - **Modified Duration**
    - $D^* = D/(1+YTM)$
    - $D^* = -(\frac{\Delta P}{P})/\Delta YTM$
      - if D* = -5, it means -5%
    - consider convexity: $\frac{\Delta P}{P} = -D^* \Delta y + 0.5 Conveixity(\Delta y)^2$
    - D of portfolio: $\sum w_i D_i$
- bank's duration
  - banks make sure their duration does not deviate by much from 0

5. Equity valuation

- Dividend Discount Model
  - $P_0 = \sum_{t=1}^{\infty} \frac{E(D_t)}{(1+k)^t}$
  - $k = E(D_1)/P_0 + g$
- The Gordon model
  - $P_0 = \frac{E(D_1)}{k-g}$
- Stock prices and investment opportunities
  - $P = \frac{EPS}{k} + (PVGO - per - share)$
- **PE ratio (price to earnings)**
  - $PE = \frac{P}{EPS} = 1/k * [1 + \frac{PVGOPS}{(EPS/k)}]$
  - high PE:
    - low risk
    - good investment opportunities
  - current stock price / sum of earnings in the past 12 month
  - or / expectations for next year's earnings
- PEG ratio
  - PEG = (P/E)/Growth
  - when PEG is below 1, the stock might be underpriced
- Shiller's CAPE
  - CAPE = Cyclically Adjusted PE
  - current stock price / average of earnings in the past 10 years

6. Portfolio

- $\sigma_P^2 = \sum_{i=1}^{N} \sum_{j=1}^{N} w_{iP} w_{jP} \sigma_{ij}$
- Firm-specific Risk and Market Risk
- $\sigma_P = w\sigma_x$ where w is the risky weight
- The index model
  - $Cov(r_i, r_j) = \beta_i \beta_j \sigma_m^2$
- risk of security i in the portfolio:
  - $\frac{w_{iP} \sum_{j=1}^{N} w_{jP} \sigma_{ij}}{\sigma_P}$
  - the contribution of security i to the volatility of the whole portfolio

7. CAPM, market efficiency

- CAPM
- Market efficiency
  - asset prices reflect the full information in the market
  - Weak form efficiency: past price
  - Semi-strong form efficiency: public
  - Strong form efficiency: all
- Calendar anomalies
  - January effect
  - The Monday effect

8. Fama French, alternative assets, long Term Investing

- SPY: S&P 500 Total Return
- RSP: S&P 500 equal-weighted index
- Fundamental indices: Research Affiliates Fundamental Index (RAFI)
  - companies with higher book value, cash flow, sales, and dividends receive larger weights
- Fama French 5 factor model
  - The market portfolio
  - SMB
  - HML
  - RMW
  - CMA
- Carhart's momentum factor
  - WML
- Asset class investing
  - Stocks, Bonds, Cash
  - Real estate
  - Private equity
  - Industries
  - Derivatives
  - Corporate bonds
  - Commodities
  - Currencies
  - International equity
  - Style
- long-term investing
  - Rebalancing is important

9. Performance evaluation

- Active portfolio management
  - Stock picking
  - Asset class investing
  - Market timing (rebalancing)
- Performance measures
  - Sharpe ratio
  - The M2 measure
    - M2=r_P*-r_M
    - r_P* use P and risk-free asset, have same volatility with market
  - Jensen's alpha (The CAPM alpha)
    - kind of investor: invest in many different funds
  - Treynor measure
    - excess risk-free return / beta