COMM 475 – Investment Policy
Introduction, Review, and Preview

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* I am grateful to Rob Heinkel and Bill Tilford for sharing their COMM475 lecture notes with me. These notes are largely based on the material they developed.

Instructor

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Course Description

This course provides tools for the portfolio construction process, beginning with establishing objectives, whether for an individual investor or an institutional investor.

- Demonstrate techniques to set **strategic** allocation of funds across broad asset classes
- Explore **dynamic, tactical** strategies that may be added on to the strategic allocation
- Determine how to **assess** the success of strategies in meeting objectives

Common theme – Factors

- The two most important words for an investor are ***bad times***
- “Factor risks” is the set of bad times that span asset classes
- Focusing on asset classes (bonds/stocks/private equity etc.) is too crude and misses why assets earn returns
- Assets are a bundle of factors
- On average you earn a risk premium for holding factor risk to compensate for the fact that factors do bad in bad times!
- In sum
  1. Asset owners need to know their bad times
  2. Factors carry a premium to reward losses in bad times.
     Factors, not asset classes is what matter!

Evaluation

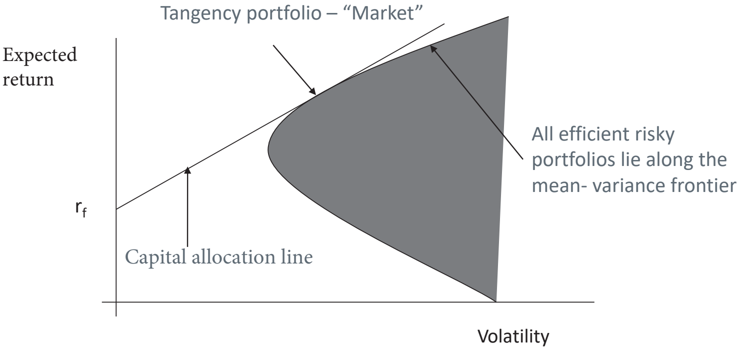
Component	Weight
Assignment #1	10%
Assignment #2	10%
Midterm Exam #1	20%
Midterm Exam #2	20%
Participation	15%
Final Exam	25%
Total	**100%**

- Teams will present course material through the class. Same teams will work together on Assignments as the presentations

Materials

- **Canvas**
  - Syllabus
  - Course Notes (Jupyter notebooks)
  - Lecture notes, Python code, readings (limited use of Excel)
  - Industry materials
- **Jupyter notebooks**
  - Google Colab (cloud)
    https://colab.research.google.com/?utm_source=scs-index
  - Anaconda (local)
    https://www.anaconda.com/download

Review – The Mean-Variance Efficient Frontier



- Harry Markowitz (diversification). We should invest in the efficient frontier, but does not specify where
- Bill Sharpe (CAPM) tells us where in the frontier we should invest

Review – Capital Asset Pricing Model (CAPM)

$$\mathbb{E}[r_s] = r_f + \beta_s(\mathbb{E}[r_m] - r_f) \quad \beta_s = \frac{\text{Cov}\,(r_s, r_m)}{\text{Var}\,(r_m)}$$

- r_s - Return of stock, asset or portfolio s
- r_f - Return of risk-free asset
- r_m - Return of the Market

1. CAPM states that in the mean-variance asset allocation problem with a risk-free asset, all investors hold some combination of the risk-free asset and the tangency portfolio, which must be the market portfolio
2. So the "risk" of any individual asset, and its expected return "reward" depends on its covariance with the market portfolio

Review – Capital Asset Pricing Model (CAPM)

- Tool for consensus expected returns of stocks, assets, investments within companies
- Allows for the separation of returns
  - **Unsystematic**, stock-specific returns
  - **Systematic** returns (market)
- Despite its simplicity and flaws, it is the workhorse in finance for CFOs, investment managers, investment bankers, academics

Review – Revisit the Capital Asset Pricing Model (CAPM)

- The CAPM is a theory about "expected returns", $\mathbb{E}[r_s]$
- Empirically, we state the CAPM model as a "regression" equation

$$r_s = r_f + \beta_s(r_m - r_f) + e_s \tag{1}$$

- Taking the variance of the return equation:

$$\text{Var}(r_s) = \beta_s^2\sigma_m^2 + \sigma_{e_s}^2$$

- A measure of the systematic risk of an investment through its **beta** (β_s)
- Unsystematic risk component $\sigma_{e_s}^2$
- Total risk is the sum of the two components
- Unsystematic risk can be diversified away in a well-diversified portfolio of individual stocks

Review – Revisit the Capital Asset Pricing Model (CAPM)

Investors demand a high **expected return** ($\mathbb{E}[r_S]$) for high **systematic risk** (β_S):

$$\mathbb{E}[r_s] = r_f + \beta_s \underbrace{(\mathbb{E}[r_m] - r_f)}_{\equiv \lambda}$$

Where $\lambda = \mathbb{E}[r_m] - r_f$ is the "**market price of risk**"

- Above equation describes the **Security Market Line** in the $(\beta_s, \mathbb{E}[r_s])$-space

Review – From CAPM to Multi-Risk Factor Model

- Start from

$$r_s = r_f + \beta_s(r_m - r_f) + e_s$$

Add and subtract $\beta_s \mathbb{E}[r_m]$ on the right-hand-side:

$$r_s = \underbrace{r_f + \beta_s\left(\mathbb{E}[r_m] - r_f\right)}_{=\mathbb{E}[r_s] \text{ from CAPM}} + \beta_s \underbrace{\left(r_m - \mathbb{E}[r_m]\right)}_{\textbf{Market Risk factor shock}} + e_s$$

- So

$$r_s = \mathbb{E}[r_s] + \beta_s I_m + e_s$$

- For the CAPM, a stock's actual (ex-post) realized return is decomposed into:
  - The **expected** return, $\mathbb{E}[r_s]$
  - Stock's **actual** return due to an unexpected return on the market portfolio
  - Stock's **idiosyncratic** return

Review – From CAPM to Multi-Risk Factor Model

$$r_s = \mathbb{E}[r_s] + \beta_s I_m + e_s$$

- Unexpected return (surprise) comes from
  - unexpected return on the whole market $I_m \neq 0$
  - unexpected firm-specific news, $e_s \neq 0$.
- Do we believe that the **only** systematic risk factor is the unexpected return (shock) to the whole market portfolio (β_s)?
- Macroeconomic activity? GDP? Interest rates?
- A **Multi-Risk Factor (MRF) model** allows many risk factors not just the market, as in the CAPM.
- The origin of MRF are in Ross (1976)'s Arbitrage Pricing Theory (APT).

Preview – Investment Policy

- Pensions, DB (defined benefit)
- Sovereign wealth funds (e.g. Norway)
- Success of investment policy determines peoples' retirement standard of living
- Size of portfolios, billions
- Do professional, “active” managers beat a well-diversified index?

Preview – Portfolio Management Process

- Client Objectives (preferences)
- Asset Class Choices (factors exposure)
- Strategic Asset Allocation (SAA)
- Portfolio Construction
- Risk Management
- Performance Objectives and Measurement

Institutional Investment

- Institutional Investment is important. Pension earnings determine retirement income!
- Example: Assume a 35-year old will save $5,000 per year for 30 years, then buy a 15-year annuity (they die at 80)

Age	35	36	37	...	64	65	66	67	...	79	80
Cash Flow	$+c$	$+c$	$+c$	...	$+c$	$+c$	$-w$	$-w$		$-w$	$-w$

- Where $c = \$5,000$ and w depends upon our pension earnings from age 36 to 65

Institutional Investment

- **Case A**: suppose the pension earns 3% per year
  - $FV = 5,000 \times \frac{1.03^{30}-1}{0.03} = \$237,877$ is the accumulated account at age 65
- Invest the lump sum and draw down an annuity w for 15 years (from age 66 to 80)
- Assuming a 5% return in retirement, this yields
  - $\$237,877 = w \times \frac{1-1.05^{-15}}{0.05} \implies$ **\$22,918** per year in retirement

Institutional Investment

- **Case B:** suppose the pension earns 10% per year
  - $F = 5,000 \times \frac{1.10^{30}-1}{0.10} = \$822,470$ is the accumulated account at age 65
- Invest the lump sum and draw down an annuity w for 15 years (from age 66 to 80)
- Assuming a 5% return in retirement, this yields
  - $\$822,470 = w \times \frac{1-1.05^{-15}}{0.05} \implies$ **$79,239** per year in retirement
- Earning 10% vs 3% allows us to triple the retirement annuity
- Institutional Investment matters!