

## Week 1: Introduction

- Real vs Financial assets
  - Real assets earn income → tangible and intangible (e.g. Intellectual Property)
  - Financial assets are claims to income earned by real assets
- Financial markets
  - **Money markets** = short-term, marketable, liquid, low-risk debt securities
    - T-bills
    - Certificate of Deposits → term deposits
    - Commercial paper
    - Bankers' acceptance
    - Eurodollars
    - Repurchase agreements
    - Federal funds
    - Brokers' calls
  - **Capital markets** = longer term and riskier securities
    - 1) Longer term bond markets
      - Treasury notes (10 years) and bonds (10-30 years) → TIPS = inflation protected
      - Corporate bonds → secured, unsecured (debentures), subordinated debentures (lower repayment priority = riskier)
      - Municipal bonds → tax-free bonds issued by State or Local Government
      - Mortgage securities
      - Federal agency debt – e.g. by Fannie Mae and Freddie Mac
    - 2) Equity markets
      - Common stock
      - Preferred stock
    - 3) Derivative markets for options (RIGHT) and futures (OBLIGATION)
      - OPTION: Call option (buy) + Put option (sell) → purchase price
      - FUTURE: Long position (buy) + Short position (sell) → no cost to enter
- Passive vs Active management
  - Efficient Market Hypothesis (EMH)
  - Passive = market efficient
  - Active = market not efficient
- **GFC (2008)**
  - TED spread → 3month LIBOR – 3month T-bill → indicates credit default risk in banking sector
  - Case-Shiller Index of US Housing Prices → in 2008, house prices rose as more finance available from securitised mortgages, that were traded to investors
  - Homeowner = borrows money from Loan Originator (Bank) → homeowner repays interest + principle to Loan Originator
  - Loan Originator = passes on P + I to agency (Freddie or Fannie), but retain a service fee
  - Agency = pools the loans into mortgage-backed securities → sells the securities to investors (pension funds/mutual funds) → agency guarantees the default risk of loans in each pool → and retains a guarantee fee before passing remaining cash flow to investor.
    - In GFC, Fannie and Freddie had to be bailed out

## Week 2: Investment Vehicles

- Types of Markets
  - Direct search markets → buyers and sellers directly seek each other (e.g. private stocks)
  - Brokered markets → brokers
  - Dealer markets → dealers specialise in specific stocks, and buy/sell assets in their own accounts (quicker for dealer to trade)
  - Auction markets → ASX – limit order book
- Bid-ask spread

- Bid = buy price
- Ask = sell price
- Type of Orders
  - Market order → order executed immediately, but at current market price
  - Price-contingent orders → limit order
- Globalisation of stock markets
  - More members join an exchange → value of exchange increases for all participants, due to liquidity
- Trading costs
  - EXPLICIT cost → broker commissions for broker services (execute orders, short sale, provide advice)
  - IMPLICIT cost → bid-ask spread
  - Price Concession = price impact cost → from 'walking the books'
- **Buying on Margin**
  - Investor borrows part of the stock's purchase price from a broker to buy that stock
  - Investor scales up their returns from an increase in share price
  - **Margin** in account = is the portion of the purchase price contributed by the investor → rest is borrowed from broker
  - **Percentage margin** = ratio of the net worth ("equity value") of the account to the MV of the securities

$$\text{Margin (\%)} = \frac{\text{Equity in account (Equity Value)}}{\text{Market Value of Stock}} = \frac{\text{Total no. of shares} \times \text{Price} - \text{Loan from broker} - \text{Interest}}{\text{Total no. of shares} \times \text{Price}}$$

$$\text{Rate of return} = \frac{\text{Ending equity in account} - \text{Initial equity in account}}{\text{Initial equity in account}}$$

- Initial margin → typically 50% → to limit the margin loan
- Maintenance margin → usually below initial margin → margin call = investor must contribute money to get the equity value back to initial margin
- **Short sale**
  - Investor profits from a fall in share price
  - Investor borrows stock from broker → sells it in the market → then repurchases it at a later date to return to broker → MUST also pay dividends to broker
  - Cash from initial sale is kept with broker
  - Broker also requires margin on short sales → investor puts in additional assets (e.g. T-bills)
  - Equity = Cash proceeds from initial sale + T-bills (or other assets) – No. of stocks owed\*Price

$$\text{Margin on short position (\%)} = \frac{\text{Equity}}{\text{Value of Stock owed}} = \frac{\text{Assets} - \text{Liabilities}}{\text{Value of Stock Owed}} = \frac{[\text{Cash from initial short sale} + \text{Investor's assets}] - [\text{No. of stocks} \times \text{Price} - \text{Interest} - \text{Dividends owed}]}{\text{No. of stocks} \times \text{Price}}$$

- **Investment Companies**
  - Pools funds together and invests on behalf of individual investors
  - Functions of investment companies:
    - 1) Record keeping + admin
    - 2) Diversification + divisibility → pool of funds enable diversification + divide claims to assets (NAV) among investors
$$\text{NAV} = \frac{\text{Market Value of Assets} - \text{Liabilities}}{\text{Shares Outstanding}}$$
    - 3) Professional management → portfolio managers seek to improve returns by market research (active management)
    - 4) Lower transaction costs → investment firms negotiate better deals with brokers + economies of scale
- **Types of Investment Companies:**
  - 1) **Unit Investment Trusts**

- Pools money invested in a portfolio → portfolio is FIXED for life
- Sponsor buys securities for the portfolio and deposits them in a trust → sells “units” or “shares” of that trust at a PREMIUM over the NAV of securities
- Shareholders can sell units back to trustee for NAV → Trustee sells enough securities or sells the units to a new investor (at PREMIUM) to repay original shareholder
- ALL income + principal are paid to shareholders
- UNMANAGED → no active management as the fund’s composition is fixed
- LOW TRANSACTION COST → since composition of portfolio is fixed
- Uniform assets → e.g. the trust invests in only corporate bonds, OR municipal bonds

## 2) **Managed Investment Companies**

- OPEN-ENDED (e.g. Mutual Funds)
  - Fund stands ready to redeem or issue shares at NAV (redemptions/purchases may involve sale charge = **load** = sales fees) → provides LIQUIDITY
  - Units are priced at NAV → investors buy shares at NAV, and sell back to the fund at NAV
  - Shareholders can only sell back to the fund → shares outstanding changes daily
  - **Evelyn (1999)** → open-ended mutual underperforms due to higher asset turnover → fund is managed, and have greater trading activities = higher transaction cost → BUT, it provides liquidity to investors
- CLOSED-ENDED
  - Do not redeem or issue shares → shares outstanding unchanged
  - Shareholders can only sell to secondary market
  - Price differs from NAV
  - If share is priced (i.e. its market value) at a discount → if fund sells all assets, its per-share increase in wealth =  $MV - NAV$

$$\text{Premium or Discount} = \frac{\text{Market Price} - \text{NAV}}{\text{NAV}}$$

## 3) **Other Investment Organisations**

- Commingled fund
  - Partnership of investors
  - Formed to invest in real estate, commercial property
  - Like an open-ended fund → offers “units” instead of “shares” → sold and bought at NAV
- Real Estate Investment Trusts (REITs)
  - Similar to closed-ended fund
  - Equity trusts → invests in real estate directly
  - Mortgage Trusts → invests in mortgages
- Hedge Funds
  - Like mutual funds → only private investors pool money together
  - Unlike mutual funds → structured as private partnerships = limited disclosure requirements
  - Lock-up periods
- Pension funds
  - Funds of funds
  - Prefer illiquid assets → to gain illiquidity premium
  - Allocation to illiquid assets due to:
    - 1) Age of members → allocation to illiquid assets high if members are young → investors don’t liquidate until later – so transaction cost not incurred until much later
    - 2) In-house management → fund has managers that specialise in illiquid asset
    - 3) Nature of cash flows → higher periodic cash inflows (i.e. member contributions are higher than redemptions) – fund can avoid high transaction cost related to illiquid assets

- **Mutual funds:**

- **INVESTMENT STRATEGIES/POLICIES:**

- 1) Money market
- 2) Equity → income funds (stocks with high dividends) + growth funds (low dividends, high growth stocks)
- 3) Sector
- 4) Bond
- 5) International (not USA) + Global (includes USA) + Regional + Emerging Markets
- 6) **Balanced funds**
  - are funds of funds → invest in other mutual funds
  - Designed to be candidates for an individual's entire investment portfolio → holds both equities and fixed-income securities in **relatively stable proportions** → diversified in assets with different risk
  - Life-cycle funds = asset mix ranges from aggressive (marketed to young investors) to conservative (directed at older investors) → addresses sequencing risk → asset mix is switched depending on life-cycle stage of investors (more equity for young investors – loss made early on – there is still time to make up for that loss → but more bonds as investors mature – losses made later on significantly impact the investor near retirement)
- 7) **Asset allocation (flexible) funds**
  - Allocation of funds depends on fund manager's forecast of asset's relative performance → switch between bond/equity depending on which asset class is predicted to perform well
  - Involves active management to outperform market index → market timing, research, not low risk
- 8) **Indexed funds**
  - Passive management
  - Tracks broad market index

- **HOW MUTUAL FUNDS ARE SOLD:**

- Directly (direct-marketed funds) → by fund underwriter → mail/phone/internet
- Indirectly (sales-force distributed) → through broker on behalf of underwriter → for commission
- Financial supermarkets (e.g. AMP) → sells shares in funds of many investment firms → Instead of charging customers sales commission, broker splits management fees with mutual fund company

- **MUTUAL FUNDS FEE STRUCTURE:**

- 1) Operating expenses → admin, advisory fees
- 2) Front-end load → commission/sales charge paid when purchasing shares:

$$\text{Offering Price} = \frac{\text{NAV}}{1 - \text{front end load}}$$

- 3) Back-end load → redemption or exit fee incurred when selling shares
- 4) 12 b-1 charges → in USA; they are annual fees for marketing and distribution costs of the fund
  - SEC regulates these fees (limited to 1% of fund's average net assets per year)
  - in Australia, these fees are lumped together with operating expenses

- **MUTUAL FUND RETURNS vs FEES**

$$\text{Rate of return} = \frac{\text{NAV}_1 - \text{NAV}_0 + \text{Income and capital gain distributions}}{\text{NAV}_0}$$

→ Note: **expense ratios** must be considered in the rate of return

$$\text{Expense Ratio} = \frac{\text{Operating fees} + \text{12b-1 fees}}{\text{Total Net Asset Value}}$$

→ Rate of return = Gross return – expense ratio

- **PORTFOLIO TURNOVER RATE:**

- Rate at which assets in a fund are bought/sold by the fund's managers
- % change of the assets in a fund over a one-year period → fraction of assets that are “replaced” each year:

$$\text{Portfolio Turnover Rate} = \frac{\text{Minimum of Securities Bought or Sold}}{\text{Average Net Assets}} \times 100$$

- Minimum of securities bought or sold = total dollar amount of securities bought or sold (whichever is less) over a one-year period.
- Average net assets = monthly average dollar amount of net assets in the fund.
- High turnover → capital gains/losses realised constantly → hard for investor to manage tax obligations
- Low turnover (e.g. index funds) → more tax-efficient and lower trading costs
- **ETFs**
  - Allow investors to trade index portfolios → in the same way that mutual funds allow shares of stocks to be traded
  - **ADVANTAGES**
    - Trade continuously like stocks → liquidity
    - Can be short sold or purchased on margin
    - Cheaper than mutual funds → as passive investment
    - Tax efficient → in USA (secondary trades in shares of funds do not trigger capital gains tax – unlike secondary trades in the underlying asset)
  - **DISADVANTAGES**
    - Prices can depart from NAV → like close-end mutual fund (can't be liquidated with ETF fund)
    - Must be purchased from a broker (for a fee)

### Week 3: Risk and Return

- Interest rates
  - Time value of money
  - Trade-off between consumption today vs saving (investing) money

- **Determinants of interest rates:**

- 1) Supply of funds from savers
- 2) Business demand for funds (for investment)
- 3) Government demand for funds
- 4) Expected inflation rate

- **Real vs Nominal Interest rates**

$$r_{real} = \frac{r_{nom} - i}{1 + i}$$

- $r_{real}$  = real interest rate
- $r_{nom}$  = nominal interest rate
- $i$  = inflation rate

- **COMMON APPROXIMATION:**

$$r_{real} \approx r_{nom} - i$$

- Only true for continuous compounding
- OR if inflation is very low

- **Fisher Equation:**

$$r_{nom} = r_{real} + E(i)$$

- Nominal interest rate should track inflation rate → real rate should be stable
- Works better when inflation is predictable

- **Taxes and Real Interest Rate**

$$r_{nom} \times (1 - t) - i = (r_{real} + i) \times (1 - t) - i = r_{real}(1 - t) - i \times t$$

- $r_{real}$  = real interest rate
- $r_{nom}$  = nominal interest rate
- $i$  = inflation rate
- $t$  = tax rate of individual investor  
→ After-tax return rate falls by  $(i \times t)$

- Most tests of the CAPM are directed at the mean-beta relationship as applied to assets with respect to an observed, but perhaps inefficient, stock index portfolio
- **The CAPM and Investment Industry**
  - Portfolio theory and the CAPM have become accepted tools in the practitioner community
    - Many professionals are comfortable with the use of beta to measure systematic risk
  - Most investors don't beat the index portfolio

## Week 7: Multiple risk factors

### Overview

- **Arbitrage** is the exploitation of security mispricing in such a way that risk-free profits can be earned
  - Most basic principle of capital market theory is that well-functioning security markets rule out arbitrage opportunities
- Generalisation of the security market line of the CAPM to gain richer insight into the risk-return relationship
  - Arbitrage pricing theory (APT)

### Multifactor Models: A Preview

- Recall stock variability may be decomposed into the following sources:
  - Market (i.e., systemic) risk
    - Largely due to macroeconomic events
  - Firm-specific (i.e., idiosyncratic) effects
- Risk premiums may depend on correlations with extra-market risk factors
  - E.g., inflation, interest rates, volatility, credit spreads (yield spread of bond above short-term government bond) etc.
  - Different securities have different sensitivities to these factors → CAPM and Single-index model prices these sensitivities in the same price → APT will price them differently

### Factor Models of Security Returns

- **Single-factor model** of excess returns

$$R_i = E(R_i) + \beta_i F + e_i$$

- $E(R_i)$  = expected excess return on stock i
- $\beta_i$  = sensitivity of firm i
- $F$  = deviation of the common factor from its expected value → any market factor capturing market-wide risk (e.g. GDP growth, inflation, productivity) → if using GDP growth,  $F$  does not measure the absolute change; it will be the deviation of GDP from expected value (e.g. forecasted 3% GDP for that year, but became 5% at the year → then the  $F = 5\% - 3\% = 2\%$ )
- $e_i$  = non-systematic component of return

$$\beta_p = \sum w_i \beta_i; \quad E(R_p) = \sum w_i E(R_i)$$

$$\sigma_p^2 = \beta_p^2 \sigma_F^2 + \sigma^2(e_p)$$

$$\sigma^2(e_p) = \text{Variance}(\sum w_i e_i) = \sum w_i^2 \sigma^2(e_i)$$

$$\sigma^2(e_p) = \sum w_i^2 \sigma^2(e_i) = \sum \left(\frac{1}{n}\right)^2 \sigma^2(e_i) = \frac{1}{n} \sum \frac{\sigma^2(e_i)}{n} = \frac{1}{n} \bar{\sigma}^2(e_i)$$

- Extra-market sources of risk may arise from several sources
  - E.g., uncertainty (unexpected realisations) about interest rates or inflation.
  - These market wide measures are not captured in the excess returns of a market index.
- **Multifactor models** posit that returns respond to several systematic risk factors, as well as firm-specific influences

- Useful in risk management applications (e.g. in corporate finance – firms can find out which sources of market-wide risk may impact their product the most)
- $$R_i = E(R_i) + \beta_{iGDP}GDP + \beta_{iIR}IR + e_i$$
- $R_i$  = excess return on security  $i$
  - $\beta_{iGDP}$  = sensitivity of returns to unexpected changes in GDP → ‘unexpected change’ only, since the ‘expected change’ is assumed to be captured in  $R_i$
  - $\beta_{iIR}$  = sensitivity of returns to unexpected changes in interest rates (IR)
  - $e_i$  = non-systematic component of return

## Arbitrage Pricing Theory

- **Arbitrage pricing theory (APT)** was developed by Stephen Ross
  - Predicts a SML linking expected returns to risk, but the path it takes to the SML is quite different –
  - APT relies on three key propositions:
    1. Security returns can be described by a factor model → assumes that systematic risk can be captured by one, two or more factors → if we don’t get the factors right, and we miss a substantial systematic risk factor, our model will be inaccurate
    2. There are sufficient securities to diversify away idiosyncratic risk → same assumption in CAPM, but APT relies on a well-diversified portfolio (rather than market portfolio)
    3. Well-functioning security markets do not allow for the persistence of arbitrage opportunities → arbitrage actions by investors will eliminate arbitrage opportunities

## Arbitrage, Risk Arbitrage, and Equilibrium

- Arbitrage opportunity exists when an investor can earn riskless profits without making a net investment
  - E.g., shares of a stock sell for different prices on two different exchanges → buy in cheaper market, sell in market with higher price → assume no transaction cost
  - Condition 1: Requires zero investment outlay → investors don’t need upfront cash to take arbitrage
  - Condition 2: Zero risk/zero uncertainty in executing arbitrage opportunity
  - Condition 3: Requires positive payoff
- **Law of One Price**
  - Enforced by arbitrageurs; If they observe a violation, they will engage in *arbitrage activity* → before in CAPM, we assumed that the actions of many small investors push price up, but in APT, it is assumed that only few large arbitrageurs push up price through their arbitrage actions
  - This bids up (down) the price where it is low (high) until the arbitrage opportunity is eliminated

## Well-Diversified Portfolios

- In a well-diversified portfolio, firm-specific risk becomes negligible, so that only factor risk remains
  - One effect of diversification is that, when  $n$  is large, non-systematic variance approaches zero
- A **well-diversified portfolio** is one with each weight small enough that for practical purposes the non-systematic variance is negligible
- **Excess Returns as a Function of the Systematic Factor**

$A$  = well-diversified  
 $B$  = undiversified portfolio → if you diversify portfolio, then you diversify firm-specific risk away → thus, must assume that  $F$  describes systematic risk → so for  $A$ , there is a perfect positive correlation
- **Returns as a Function of the Systematic Factor: An Arbitrage Opportunity**
  - $A$  and  $B$  are well-diversified
  - This represents an arbitrage opportunity → where  $F$  is 0,  $B$  has a lower expected return → so sell  $B$  and buy  $A$  and make a risk-free profit of 2%
  - But we sold  $B$  and bought  $A$  simultaneously, there is zero outlay, zero risk/uncertainty (since both these portfolios are perfectly correlated with each other due to the  $F$  factor), and positive returns

## The SML of the APT

- All well-diversified portfolios with the same beta must have the same expected return
- For any well-diversified portfolio  $P$ , the expected excess return must be: