**CFA 9 Portfolio Management**

**9.1 Portfolio risk and return 1**

**Historical risk and return**

Historically, greater average returns 🡪 Higher SD

Real returns = Nominal returns – Inflation

Returns are not a normal distribution

* Are negatively skewed with greater kurtosis 🡪 Tendency for large downside deviations

Liquidity affects returns 🡪 Concern for EM and infrequently traded assets

**Risk aversion**

Risk averse: If 2 investments have the same EV, the less risky one is preferred

Risk seeking: If 2 investments have the same EV, the more risky one is preferred

Indifference curve: Shows risk and return preferences which the investor is indifferent to

* Slope upwards for risk averse (will only take on more risk for greater expected returns)

If we have asset and asset , the expected return is:

The portfolio variance is given by:

If is a risk-free asset, then:

2-fund separation theorem: Optimal portfolio is a combo of risky assets and risk-free assets

Capital allocation line: Possible combinations of risk free assets and optimal risky assets

* Optimum portfolio for investor is where their indifference curve is tangential to the capital allocation line

**Portfolio standard deviation (memorise)**

Population variance is given by:

The sample variance is given by (the one we mostly use):

Sample covariance is given by:

is the return on asset 1

is the mean return on asset 1

Correlation is given by:

Variance of portfolio of 2 risky assets is:

**Risk of perfect correlation**

If 2 assets are perfectly correlated , then SD is given by:

This gives the greatest portfolio risk

If correlation is 0, third term is made 0

If correlation is negative then portfolio risk is reduced

**Minimum variance frontier**

Minimum variance frontier: For each EV of returns, the lowest SD portfolio

Efficient frontier: The greatest EV of return for each level of SD

* Top portion of the minimum variance frontier

Risk averse investor will only choose efficient frontier portfolios

Global minimum variance portfolio: Portfolio on the efficient frontier with the least risk

**9.2 Portfolio risk and return 2**

**Capital allocation line**

In practice, investors can have different expectations of expected returns and SD

🡪 Different optimal risky asset portfolio and CAL

We assume they have homogenous expectations 🡪 Same efficient frontier, optimal risky portfolio and CAL

Capital market line: Optimal CAL, which is the one that is tangential to the Efficient frontier

* Every investor will use same risky portfolio but can choose different weights
* Called Market portfolio where it is tangential
* Shows total risk

Capital market line equation:

Intuition:

* Investor who choses no risk will get , the rest is market premium
* They can either lend or borrow at the risk free rate

To the right of Market portfolio is borrowing

To the left of Market portfolio is lending

Passive investment: Allocate between risky asset index and risk free asset according to market portfolio

Active investment: Not use weights of market portfolio

**Systematic and nonsystematic risk**

Unsystematic risk: Risk eliminated through diversification

* AKA firm-specific risk

Systematic risk: Can’t be diversified away

* AKA market risk

Companies can have different responsiveness to systematic risk

* E.g., Consumer discretionary responsive, utilities non-responsive

Having 12-18 stocks achieves 90% of max diversification

Adding stocks decreases unsystematic risk, but can increase or decrease systematic risk

Equilibrium security returns depend on portfolio’s systematic risk, not total risk

* Riskiest stocks don’t necessarily have the greatest expected return

Assume diversification is free

* Investors get no compensation for risk that can be eliminated for free

**Return generating models**

Return generating models: Estimate expected returns on risky securities based on specific factors (macro, fundamental, statistical)

Multifactor model: Uses macro and fundamentals

Multifactor model is given as:

Expected excess return is the sum of each Factor sensitivity multiplied by the EV

Fama French and Carhart multifactor mode: Firm size, BV/Market value ratio, Market portfolio excess return, price momentum of prior periods

Market model: Estimates portfolio beta and security abnormal return

is the risk free rate multiplied by

and are measured using historical data

is abnormal returns on the asset

is sensitivity to the market portfolio

**Beta (learn both)**

Beta: Sensitivity of asset return on the market index

Regressing market excess return on market excess return gives security characteristics line

* The slope is the beta

**CAPM**

Security market line (SML): Plots covariance between the asset and the market, and EV of asset return

SML equation is:

is beta

CAPM is given by:

Assumptions of CAPM:

* Risk averse, utility maximising investors
* Frictionless, competitive markets
* One period horizon for all
* Homogenous expectations

**CML vs SML**

CML has total risk on x axis

* Only efficient portfolios plotted

SML has beta (systematic risk) on the x axis

* All properly priced portfolios plotted

Non-diversified (non-efficient) portfolios are below the CML line

All stocks and portfolios are on the SML line (if it is accurately priced)

* Can deviate from line if not accurately priced

**CAPM and SML applications**

At equilibrium, expected return and required return are equal

* CAPM can be used to estimate a required return

SML shows required return based on beta

If forecast return < Required return

* Stock overvalued, below SML

If forecast return > Required return

* Stock undervalued, above SML

**Performance evaluation**

Performance evaluation: Analysis of risk and return of active manager’s portfolio

Attribution analysis: Sources of returns differences between active portfolio and passive portfolio

**Sharpe ratio**

Sharpe ratio:

Shows excess returns per unit of portfolio risk

* Higher is better
* Based on total risk 🡪 Can evaluate anything

Can show expected returns (ex ante) or evaluate performance (ex post)

**(Sharpe as a %)**

Can use to evaluate risky assets instead of Sharpe

* Gives the same risk-adj portfolio rankings as Sharpe, but in percentage terms

Shows the return of the portfolio if it had the same risk level as the market

**Treynor measure**

Treynor measure is a measure of slope

Shows excess returns per unit of systematic risk

* As opposed to total risk (which is Sharpe)

**Jensen’s alpha**

Jenson’s alpha shows percentage returns in excess of those from a portfolio that has the same beta but likes on the SML

**Which performance measures to use**

Depends on if the portfolio has unsystematic risk

* A single manager: Use total risk (Sharpe, MM)
* Multiple managers: Use systematic risk (Treynor, Jensen)

If portfolio lies above CML or SML, it has beaten the market

Expected return may not be equal to historical value

**9.3 Portfolio management overview**

**Portfolio investing**

Portfolio perspective: Evaluating individual investments by contribution to risk and return of portfolio

Diversification ratio:

Lower diversification ratio means greater risk reduction from diversification

Diversification may reduce in financial crisis, where correlations increase

**Portfolio management process steps**

1) Planning

* Looks at investor needs for risk and return
* Results in the Investment Policy Statement – contains objectives and constraints

2) Execution

* Top down analysis: Choose asset class allocations
* Bottom up analysis: Choose undervalued securities

3) Feedback

* Rebalance portfolio to changing asset prices

**Investor types**

Endowment: Fund to provide ongoing support for a specific purpose

Foundation: Fund for charitable purposes for specific purposes or research

* Long horizons, high risk tolerance, low liquidity needs

Bank: Earn more on loans than what it pays for deposits

* Short horizons, low risk tolerance, high liquidity needs

Insurance companies: Invest customer premiums to fund claims

* Life insurance: Long horizons
* Property & Casualty: Shorter horizons
* Low risk tolerance, high liquidity needs

Investment companies: Manage pooled funds for many investors

* Mutual funds: Have particular styles
* Risk and horizons vary, liquidity needs high

Sovereign wealth funds: Pools of assets owned by gov

Defined benefit pensions

* High risk tolerance, long horizons, low liquidity needs

**Defined contribution vs defined benefit**

Defined contribution: Firm contributes a sum each period in employee retirement account

* No promise on future value of assets
* Employee assumes risk

Defined benefit: Firm promises to make periodic payments to employees after retirement

* Future benefit defined
* Employer assumes risk

**Asset management industry**

Full service asset managers: Variety of investment styles and asset classes

Specialist asset managers: Focus on specific style or asset class

Multi-boutique firm: Holding company with several specialist asset managers

Active management: Outperform a chosen benchmark with skill

* Higher fees, higher taxes (from higher portfolio turnover)

Passive management: Replicate an index

* Smart beta: Focuses on particular market risk factor
* Lower fees

Asset management trends

* Market share of passive growing over time – lower fees, and questions if active outperform
* Data sources have growth – have invested in data processing
* Robo-advisors – offer advice based on algorithms

**Mutual funds**

Are a form of pooled investments

* Each investor owns shares (value is Net Asset Value)

Open-end fund: Investors can buy new shares at the NAV, and sell shares back to fund at NAV

* No-load fund: No additional fees for purchasing shares or redeeming shares
* Load fund: Charge fees

Closed-end fund: Do not take new investments into the fund or redeem investor shares

* Shares are like equity shares

Money market funds: Invest in short term debt and provide interest income with low risk

Bond mutual funds: Invest in fixed income

Index funds: Passively managed, invests in stocks

**Other pooled investments**

ETFs: Passively managed, trade like close-end funds

* Market prices very close to NAVs
* Need to pay brokerage commissions when trading (unlike open-end)
* Don’t need the fund to sell securities 🡪 Less capital gains tax

Separately managed account: Portfolio owned by a single investor, managed according to their needs

HFs: Not regulated, qualified investors only, high minimum investments

**9.4 Portfolio planning and construction**

**Investment policy statement**

Investment policy statement: States investor’s risk and return goals

* Manager needs to make sure they are realistic
* Starting point of process

Components

* Description of client circumstances
* Statement of purpose
* Statement of responsibilities (for manager, custodian, client)
* Procedures to update IPS
* Investment objectives, constraints, guidelines
* Evaluation of performance (benchmark portfolio)
* Appendices on asset reallocation

Risk objectives – can be either

* Absolute risk objective: An absolute % term or dollar term
* Relative risk objective: Relative to a specific benchmark

**Bearing risk**

Ability to bear risk: Depends on financial circumstances (wealth, horizon length, insurance)

* If low and willingness is high, then it overrides willingness to bear risk

Willingness to bear risk: Depends on investor attitudes (subjective)

* If low and ability is high, educate investor but don’t force

**Investment constraints**

Investment constraints: RRTTLLU

* Risk, Return, Time horizon, Tax, Liquidity, Legal restrictions, Unique constraints

Time horizon: Longer means more risk and less liquidity

Tax: Overall tax rate, tax treatment of various investment accounts (should look at after tax returns)

Liquidity: Depends on investors need to access funds frequently

Legal: Investor may be restricted on certain assets

Unique constraints: Investor preferences

**Asset allocation**

Strategic asset allocation: Specifies the % allocations between asset classes

Correlations of returns within an asset class should be high

Correlations of returns between asset classes should be low (for diversification)

Equites: Can be divided geographically, size, etc

Bonds: Can be divided on maturities, issuer, risk

Alt investments: Have gained more prominence

Manager needs to find the risk, return, correlation for each asset class

Efficient frontier: Can be constructed with the computer

* Match portfolios on efficient frontier with risk return objectives from IPS

Active allocation:

* Tactical asset allocation: Vary from strategic asset allocation to take advantage of short term opportunities
* Security selection: Deviation from index weights to individual securities

Risk budgeting: Overall risk limit for portfolio

* Allocates a portion of permitted risk to systematic risk, tactical asset allocation, security selection risk

Issues of active allocation:

* If an investor has multiple managers, trades may offset each other 🡪 Underutilise risk budget
* Excessive trading 🡪 Potentially higher capital gains tax

Core-satellite approach can address issues

* Core in passive indexes, satellite in active strategies

**ESG considerations in portfolio construction**

Negative screening: Exclude based on ESG

Positive screening: Include based on ESG

Thematic/Impact investing: Choosing sectors/companies to promote ESG goals

Engagement/Active ownership: Influence company (need to specify if investors vote or managers vote)

Need to choose benchmark appropriately if excluding assets

Will affect performance

* Limiting selection: Negative
* Low ESG risks: Positive

**9.5 Behavioural biases of individuals**

Cognitive errors and emotions lead to biases

* Cognitive errors: Due to faulty reasoning or irrationality (can be reduced)
* Emotional biases: From feelings, impulses, intuition (harder to overcome)
* Biases can be both

**Cognitive errors: Belief perseverance**

Cognitive dissonance: Holds conflicting beliefs

* Bias towards holding currently held beliefs, and discarding new ones

Conservatism bias: Fail to change existing view to new information

* Risk: Hold prior forecasts and allocations for too long

Confirmation bias: Focus on info that supports prior beliefs, and avoiding conflicting info

Representativeness bias: Falsely believe 2 things are similar more than that actually are

* Base rate neglect: Analysing an individual member of the population and forgetting to consider the probability of the characteristic in the population
* Sample size neglect: Believing population reflects small sample

Illusion of control bias: Believe they can affect outcomes that they can’t actually

* Illusion of knowledge (believe you know things you don’t know)
* Self-attrition (belief you personally caused something to happen)
* Overconfidence (unwarranted belief you are right)

Hindsight bias: Selective memory which makes things look more predictable than reality

* Can lead to overconfidence

**Cognitive errors: Info processing biases**

Anchoring and adjustment bias: Overweighting expectations on a prior number and making adjustments to it

Mental accounting bias: View money in different accounts or from different sources differently when investing

* Not considering it in context of broader portfolio

Framing bias: Decisions affected by the way the question is framed

* E.g., framing as loss or gain (loss aversion can be shown)

Availability bias: Undue emphasis on readily available info (e.g., experience, knowledge)

* Judge probability of event by how easily examples come to mind

**Emotional biases**

Emotional bias: If it is from unconscious emotion that can’t be changed

* Cognitive bias: Can be changed simply with thought process change

Loss aversion: People fear losses more than they value gains

* Not the same as risk aversion

Overconfidence bias: Overestimate their own ability (mentioned earlier)

* Self-enhancing: Give personal credit when things go right
* Self-protecting: Blame others when things go wrong
* Prediction overconfidence: Underestimate uncertainty
* Certainty overconfidence: Overstate probability of being right

Self-control bias: Favour short term satisfaction over long term goals

* Hyperbolic discounting

Status quo bias: Comfort with existing situation, resistant to change

Endowment bias: Asset feels more valuable because you already own it

* Common with inherited assets

Regret aversion bias: Do nothing out of fear of being wrong

* They over-weigh errors of commission, and under-weigh errors of omission
* Herding bias: Go with consensus

**Effect of biases on markets**

Many market anomalies can be explained by biases

Bubbles are influenced by biases

* Also have rational reasons too – PMs don’t want to miss opportunity

Halo effect: Good qualities of company (rapid growth and price appreciation) make it look like good stock to own

* Can overvalue growth stocks

Home bias: More investing in companies closer to home

Availability bias: Overestimate returns for firms that do lots of positive marketing

**9.6 Risk Management**

Risk management process:

1. Identify risk tolerances
2. Identify risks faced
3. Monitor and modify the risks

Can increase exposure to manageable risks

Can decrease exposure to unmanageable risks

Risk is not to be avoided 🡪 Returns above risk free rate require risk

* Can control the types of risks and level of risk

**Risk management framework**

Risk management framework

* Establish process for risk governance
* Determine risk tolerance
* Identify existing risks
* Find optimal risk bundle
* Monitor risk over time

Risk governance: Senior management determination of risk tolerance, optimal risk strategy, oversight framework

* Support best business outcome
* Risk management committee can help achieve this

Risk tolerance: Set overall risk tolerance by identifying risks to take/avoid

* Determinants: Expertise, adaptability to negative events, regulations, financial strength
* Consider internal and external risks

Risk budgeting: Allocating resources to investments depending on their risk characteristics and the risk tolerance

* Goal: Greatest expected returns with greatest acceptable risk
* Can allocate based on metrics, asset class
* Up to the max allowable risk

**Sources of risk**

Financial risk

* Credit risk (counterparty may not fulfil obligations)
* Liquidity risk
* Market risk

Non-financial risk

* Operational risk
* Solvency risk
* Regulatory risk
* Government/political risk (inc tax risk)
* Legal risk
* Model risk (asset valuations are wrong)
* Tail risk (extreme events)
* Accounting risk (incorrect accounts)

For individuals

* Mortality risk (risk of death)
* Longevity risk (living longer than expected)

Risks an organisation faces aren’t independent

* More correlated during financial market stress

**Measuring and modifying risk exposure**

Standard deviation: Measures volatility of prices

* May not be appropriate for skewed distributions or kurtosis
* Good for standalone basis

Beta: Measures market risk of equities

* Good for well diversified portfolio

Duration: Price sensitivity of debt to changes in interest rates

Derivatives risks:

* Delta: Sensitivity of deriv values to price of underlying
* Gamma: Sensitivity of deriv values to changes in the price of underlying
* Vega: Sensitivity of deriv values to volatility of price of underlying
* Rho: Sensitivity of deriv values to risk free rate changes

**Tail risk**

Tail risk: Extreme outcome risk

* Can use Value at Risk (VaR) and Conditional VaR to measure

Value at Risk: Minimum loss over a period with a specific probability

* Min amount lost expected to occur x% of the time
* Doesn’t give max loss
* Used for establishing min capital requirements
* Lots of calculation methods – should be used with other risk measures

Conditional Value at Risk: EV of loss, given loss exceeds a min amount

* Probability weighted average loss for all losses that exceed the min amount

**Subjective and market based estimates of risk**

Stress testing: Tests effects of a specific change in a key variable

Scenario analysis: Incorporates changes of multiple inputs

Difficult to quantify effect of infrequent events

* Estimates can be based off market prices of hedging instruments 🡪 Shows market participants estimate

Difficult to quantify operational risks

* Can look at large sample of firms for probability and expected loss

Difficult to predict tax and regulation changes

* Can use subjective estimates

**Modifying risk exposure**

Goal is to optimise risk, not remove it

* Can avoid risk (not do activity)
* Can prevent risk
* Can bear risk (e.g., through diversification)
* Can transfer risk to another party (e.g., insurance – try to have uncorrelated risks)
* Can shift risk (change outcome distribution with derivatives)

Look at costs and benefits to see which to choose

Self-insurance: Bear losses associated with risk

* Possible it shows inaction rather than strategy

Surety bond: Insurance company pays if 3rd party fails to stick to contract

Fidelity bonds: Insurance company pays for employee theft/misconduct