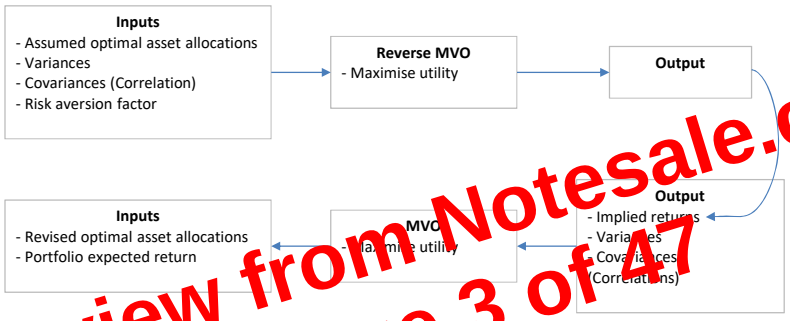
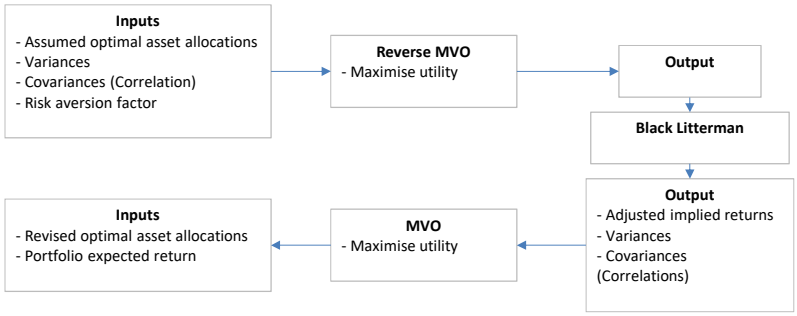
Concepts	Description
	Principles of asset allocation
Mean-variance optimisation	**Mean-variance optimisation (MVO)** : identify portfolio allocations that maximise return for every level of risk **Assumptions** : assume investors are risk adverse → prefer more return for for same level of risk Approach to find the most efficient portfolio : $Utility\ maximisation: U_i = E(R_i) = 0.5 \times \lambda \times Var_i$ U_i=investor's utility from investing in portfolio with asset allocation i $E(R_i)$=expected return of portfolio with asset allocation i λ=investor's risk aversion coefficient $Var_i = \sigma_i^2$=variance of portfolio with asset allocation i λ : Investor's preference for risk - return trade off - Higher expected return for same level of risk : Higher λ - Lower expected return for same level of risk : Lower λ - Range of λ : From 1 to 10, with risk neutral investor's λ = 0. - Average λ = 4 Common constraints : - Budget constraints/Utility constraint : Sum of weights of all asset classes = 100% - Non-negativity constraint : Weight of each asset class is between 0% and 100%
Criticisms of MVO	**1. Garbage-in-garbage-out (GIGO)** : quality of output is sensitive to quality of inputs **2. Concentrated asset allocation** : MVO often identifies efficient portfolios that are highly concentrated in a subset of asset classes, and zero allocation to others→ lowest standard deviation does not mean diversification **3. Skewness / Kurtosis** : asset returns are not normally distributed, but MVO ignore skewness and kurtosis **4. Risk diversification** : MVO diversify asset allocation across asset classes, but may not diversify source of risk **5. Ignore liabilities of investors** **6. Single-period framework** : ignore interim CF / serial correlatio of asset returns from each period → ignore potential costs/benefits of rebalancing
Improve inputs quality - Reverse optimisation	 Advantages : - Address criticism #4 - Risk diversification : Already reflect highly diversified portfolio - Address criticism #1 - GIGO : Improve return estimates
Improve inputs quality - Black Litterman model	**Black Litterman model** : extension of reverse optimisation, with implied returns are adjusted to reflect investor's view of future returns 
Improve inputs quality - Add more constraints	Adding more constraints : to include / exclude certain asset classes Examples : - Specifiy a fixed allocation to one or more assets (e.g.: human capital, nontradable assets) - Set asset allocation range for asset class - Set upper limit allocated for asset class to address liquidity issues - Specify relative allocation between 2 or more classes - Include constraints to require allocation to assets that hedge the liability in liability-relative setting
Improve inputs quality - Resampled MVO	Step 1 : Best estimates of expected returns, sigma, correlation → MVO → Efficient frontier of Optimal allocations Step 2 : Monte Carlo simulations to generate random variations for inputs around initial estimtes→ Efficient frontier + asset allocation for each point in the frontier Step 3 : Average simulated efficient frontier + asset allocation
Improve inputs quality - Non-normal distributions (Skewness and Kurtosis)	Directly incorporate skewness / kurtosis in utility function, using asymmetric definition of risk (Value-at-Risk) instead of variance

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Approaches to Tactical asset allocation	**1. Discretionary** : - Rely on qualitative assessment of macroeconomic variables - to increase returns in rising market + hedge risks in falling markets by forecasting ST deviations from expected returns for an asset class - Data to be used : + Macroeconomic data : bond yield, credit spreads, monetary policy, GDP growth, earnings, inflations + Fundamental data : deviation of PB / PE / dividend yield from historical means + Economic sentiment : using consumer confidence index - Assess of market sentiment : + Margin borrowing : ↑ margin purchase → ↑ price ↑ bullish ; margin purchase too high → bearish sign + Short interest : ↑ short interest → ↓ price → bearish ; very high short interest → market is at low + Volatility index : calculate using bid-ask spread on index option, indicate fear level. More put purchase → increase volatility ; more call purchase → decrease volatility **2. Systematic approach** : earn excess return using strategies with predictable + persistent history **3. Value approach** : earn excess return of value stocks over growth stocks - Value equities : identified using dividends yield / CF yields - Value currencies : identified using ST interest rate difference - Value commodities : identified using roll yield - Value fixed income : udentified using yield spread over risk free rate **4. Momentum approach** : assume trend will persist - Most recent 12m trend : assume this trend will persist for the next 12m - Moving-average crossover : ST moving average cross above LT moving average → uptrend; and vice versa
Behavioral issues	**1. Loss aversion** : dislike same loss > like same gain - Solution : goal-based investing (high priority goal is funded with less risky assets, and vice versa) **2. Illusion of control** : overestimate the ability to control events - Signs : + Frequent trading / tactical allocation for market timing + Actively security selection by instutional investors, who believes that their resources give them superior asset selection skills + Above average use of short selling and leverage + Shift assets allocation without concensus opinion + Concentrated position → not diversify + Use biased risk/return forecasts → inappropriate allocation - Solution : + market portfolio should be created from basic CAPM mean-variance + Allocation shift should have formal review process **3. Mental accounting** : separate assets/ liabilities to different groups based on subjective criteria → suboptimal asset allocation + less chance to meet goals - Solution : goal-based investing **4. Representative bias / Recency bias** : perceive recent data more important than old data → shift allocation to assets that have performed well recently - Solution : strong governance + objective asset allocation process **5. Framing bias** : the way information is presented affect the decision - Solution : provide full range of relevant information. E.g.: Risk (standard deviation, VAR, shortfall probability) **6. Availability bias** : personal experience is more influenced in decision making **7. Familiarity bias** : familiar event → more influenced to decision process **8. Home bias** : over allocate in domestic securities → missing opportunities in international securities
Investment governance	Effective framework should include : - Clear ST and LT objectives - Logical allocation of responsibility for asset allocation decisions based on skills and workload - Process for develop + approve IPS - Process for develop + approve strategic asset allocation - Framework to monitor + report performance relative to specified goals / objectives - Periodic audits

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Factors for / against fully hedge	1. Short time horizon → hedge 2. High risk aversion → hedge 3. Client with no concern of opportunities costs → hedge 4. High ST income needs + High liquidity needs → hedge 5. Significant foreign currency bond exposure → hedge 6. Low hedging costs → hedge 7. Client with doubt of benefits of discretionary management → hedge
Active strategies - Economic fundamentals	**1. Assumptions** : Currency value will return to fair value in LT **2. Factors that increase value of currency in ST** : - Currency is undervalued relative to fundamental value - Currency with highest rate in increase of fundamental value - Currency with higher real / nominal interest rates - Currency with lower inflation - Currency with decreasing risk premium
Active strategies - Technical analysis	**1. Principals** : - Past price data reflect fundamental + other information → could predict future price movement - Human react similarly to similar events → past price pattern will repeat - Only necessary to know where the currency will trade. Not necessary to know its fundamental value **2. Typical patterns** : - Overbought / Oversold : market has gone too far up / down → price will reverse - Support level : price falls to support level will reverse + bounce higher - Resistance level : price rise to resistance level will reverse + bounce lower * If market break through resistance / support level , the current trend will continue - Moving average : ST moving average cross LT moving average → trigger signal
Active strategies - Carry trade	**1. Definition** : borrow @ lower interest rate currency + invest @ higher interest rate currency **2. Uncovered interest rate parity** : $\frac{F}{S} = \frac{1+i_D}{1+i_F}$ - Currency with higher interest rate → Decrease in value → trade @ forward discount - Currency with lower interest rate → Increase in value → trade @ forward premium **Goal** : Carry trade exploits violation in UIRP. In fact : - Higher interest rate currency depreciation < predicted by UIRP → carry trade earns profit - Small % of time (e.g.: hyperinflation, economic crisis), higher interest rate currency depreciate much more than predicted in UIRP → carry trade suffer large loss
Active strategies - Volatility trading	**1. definition** : earn profit from predicting changes in currency volatility **2. Term** : - Delta : change in option price due to change in underlying value - Vega : change in option price due to change in volatility of underlying **3. Method** : - Delta hedging : create delta-neutral position (delta = 0) → option price only changes with change in volatility, not with change in underlying price - Expect volatility to increase → long straddle (long at-the-money call + put) - Expect volatility to decrease → short straddle (short at-the-money call + put)
Advantages of forward over future in currency hedging	- Can be customised (future are standardised) - Available for nearly all currency pair (future only available or limited number of currencies) - Future require margin → more complex + require periodic CF - Trading volume of forward is much more than futures → more liquidity
Static hedge / Dynamic hedge	**Static hedge** : no rebalance **Dynamic hedge** : rebalance periodically **Methods for dynamic hedge** : - Method 1 : purchase 1-month forward contract + rollover at expiration → Realise G/L + CF settlement @ expiration → hedge is static over the month but dynamic at rollover - Method 2 : long/short forward contract for the remaining period **Considerations** : - Shorter-term contractts / Dynamic hedge with frequent rebalancing → higher transaction costs, but better hedging results - Higher risk aversion → more rebalancing - Lower risk aversion + strong manager view → allow greater discretion around strategic hedging policy

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Concepts	Description
	Risk management
Risk deduction / Risk management process / Risk governance	**Risk reduction** : recognise + reduce / eliminate / avoid unnecessary risks **Risk management process** : - Top level management set policies + procedures to manage risk - Define risk tolerance to various risks - Measure current level of risk - Adjust level of risk (upward where firm has advantage → increase return ; downward in other cases) - Execute transactions to change level of risk - Identify most appropriate transaction for any given objective - Consider cost of any transaction - Execute transaction **Risk governance** : develop + apply risk management system. Risk governance should be (1) transparent, (2) create clear accountability, (3) cost efficient, (4) effective in achieving desire outcomes - Decentralised risk governance system : Each unit is responsible to execute + Benefit : place risk management on hand of those closest to each part of the organisation - Centralised risk governance system (Enterprise risk management - ERM) : 1 central unit is responsible to execute + Benefit : place responsibility on senior management + offer economies of scale **Steps to manage risk effectively** : - Identify each exposed risk factor - Quantify each factor in measurable terms - Add all exposed risk in a single total measure of firm-wide risk - Identify how each risk contributes to firm-wide risk - Systematically report the risks - Support allocation of capital / risk to each unit of the firm - Monitor compliance with allocated capital / risk limits
Financial risks / Nonfinancial risks	**1. Financial risks** - **Market risk :** risk related to change in interest rates, FX rate, equity price, commodity price, etc. → tie to market supply / demand - **Credit risk** : Counterparty / debtor fail to make promised delivery - **Liquidity risk** : possible loss from inability to liquidate a position quickly at fair price : Indicators include : + Bid-ask spread : apply for small transactions only + Average / Typical trading volume **2. Nonfinancial risks** - **Operational / Operations risk** : Loss due to failure of company's systems / external events outside of company's control - **Settlement risk** : when funds are being exchanged, one party could make a payment, while other party is in the process of defaulting and fail to deliver - **Model risk** : models are only as good as their construction and inputs - **Sovereign risk** : Ability of the government to pay + Willingness of the government to pay the obligations - **Regulatory risk** : not clear how the transaction will be regulated / not sure if the regulations can change - **Tax, Accounting, Legal / Contract risk** : Tax, Accounting and Legal and contractual can change - **Political risk** : risk related to change in government - **ESG risk** : company decision may cause environmental damage / social issues / poor governance policies - **Performance netting risk** : A owe B, B owe C, C owe A → A default trigger a chain of default - **Settlement netting risk** : liquidation of a default counterparty change the term of expected netting agreements
Value at Risk (VaR)	Value at Risk (VaR) : probability of expected loss during a specific time period - Advantages : + Industry standard for risk measurement, required by many regulators + Sum all risk into 1 easy to understand number + Risk budgeting - Can be used in capital allocation : allocate firm-wide VaR to each unit + evaluate each unit on return generated for allocated VaR - Disadvantages : + Some methods are difficult and expensive + Different VaR computing method → different VaR + Outputs are as goods as inputs → false sense of securities + One-side - focus on lefty tail, ignore upside potential **1. Analytical VaR** : based on normal distribution + one-tail confidence intervals $VaR = (R - z \times \sigma) \times V$ $Monthly\ VaR$: $-Divide\ annual\ return\ by\ 12$ $Weekly\ VaR$: $-Divide\ annual\ return\ by\ 52$ $Daily\ VaR$: $-Return = 0$ - Advantages : + Single number → Easy to understand + Allow modelling correlations of risks + Can apply for shorter / longer time periods - Disadvantages : mostly related to assumption that returns are normally distributed + May have skewed return. Long option → positive skew (small frequent losses of premium + large occasional gain of deeip in-the-money). Short option → negative skew + May have higher number of extreme return events than normal distribution → fat tails **2. Historical VaR** : calculate 5% VaR → collect past return, rank from highest to lowest + identify lowest 5% returns - Advantages : + Easy to calculate + understand + Not assume normal distribution of returns + Can apply to different time period - Disadvantages : assume thast past pattern will repeat in the future. Many securities changfe characteristics over time **3. Monte Carlo VaR** : use software to generate possible outcomes → rank from highest to lowest → determine results at any given probability - Advantage : Can use any assumptions about return, correlation, etc - Disadvantage :output is only as good as input

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Equity performance attribution - Macro attribution	**1. 3 main inputs** : - Policy allocation : sponsor determine assets categories + weight + allocation of total fund among fund managers, based on risk tolerance, LT expectations and liabilities - Benchmark portfolio returns : broad market index = benchmark for asset categories ; Narrowly focused index = benchmark for investment style - Fund returns, valuations, external CF **2. 6 sources of changes in MV of fund** : - Net contributions : external CF made by clients → change in MV, but no value added / value lost - RIsk-free investment : Fund's return if beginning value and external CF grow at risk free rate - Asset categories : Fund's return if beginning value and external CF passively replicate strategic asset allocation with index fund (asset category benchmarks weighted = fund's strategic policy) $Incremental\ return\ for\ asset\ category\ strategy = R_{AC} = \sum_{i=1}^{m}(w_i) \times (R_i - R_f)$ - Benchmark level : Fund's return if beginning value and external CF are invested in manager benchmarks (tactical asset allocation by sponsor) If multiple managers : $Incremental\ return\ for\ benchmark\ strategy = R_B = \sum_{i=1}^{m}\sum_{j=1}^{n} w_i \times w_{i,j} \times (R_{B,i,j} - R_i)$ If only 1 manager : $Incremental\ return\ for\ bechmark\ strategy = R_B = \sum_{i=1}^{m} w_i \times (R_{B,i} - R_i)$ - Investment managers / Active management : Fund's return due to manager not perfectly implemented the policy allocation $Incremental\ return\ for\ the\ investment\ manager\ level = R_{IM} = \sum_{i=1}^{m}\sum_{j=1}^{n} w_i \times w_{i,j} \times (R_{m,i,j} - R_{B,i,j})$ - Allocation effects : residual returns
Equity performance attribution - Micro attribution	**Value added return** = Portfolio return - Benchmark return = Pure sector allocation + Within-sector allocation + Allocation/Selection interaction **1. Pure sector allocation** : performance attributed to difference in sector weighting between portfolio and benchmark - Assume manager holds same sectors as benchmark + same securities and securities weight in each sectors $Pure\ sector\ allocation = \sum_{j=1}^{S}(w_{P,j} - W_{B,j}) \times (R_{B,j} - R_B)$ **2. Within-sector allocation** : impact on performance due to security selection only - Assume manager hold same sectors and sector weight as benchmark $Within - sector\ selection = \sum_{j=1}^{S} w_{B,j} \times (R_{P,j} - R_{B,j})$ **3. Allocation/Selection interaction** : joint effect of assigning weights to [illegible] sectors and individual securities $Allocation - Selection\ interaction = \sum_{j=1}^{S}(w_{P,j} - w_{B,j}) \times (R_{P,j} - R_{B,j})$
Equity performance attribution - Fundamental factor models attribution	**Fundamental factor model** : [illegible] economic sector factors wth other fundamental factors (company size, growth characteristics, financial strength) **Steps to construct factor model** : - Identify fundamental factors that generate systematic returns - Determine portfolio and benchmark exposure to fundamental factors at the start of the period - Determine manager's active exposure to each factor (Actual exposure - Normal exposure) - Determine active impact (added return due to active exposure) → Indicate source of portfolio returns, manager's ability to time the market

Equity performance attribution - Fundamental factor models vs. Micro Attribution	Strengths	Limitations
Micro attribution	- Split performance between sectors allocation and securities selection - Easy to calculate	- Need to identify appropriate benchmark (with specified securities and weights) at start of the period - Security selection will affect sector weighting
Fundamental Factor Model attribution	- Identify factors other than security selection and sector allocation	- Need to determine exposures to factors at the start of the period - Complex

Fixed income performance attribution	**1. Changes in external interest rate environment** : portfolio return due to shifts and twist in Treasury yield curve → beyond manager's control → not being evaluated - Expected interest rate effect : portfolio return if interest rate changes in accordance to forward curve (as planned) - Unexpected interest rate effect : portfolio return due to changes in forward rates (not as planned) **2. Manager's contribution** : value added/lost due to manager's decision - Interest rate management effect : manager's ability to forecast changes in interest rates + adjust portfolio duration and covexity accordingly + Subdivision : (1) duration, (2) convexity, (3) yield-curve shape effects - Sector/Quality management effect : portfolio return due to change in yield spreads of actual sectors (C-bond, T-bill) + quality of assets (Investment grade, junk bond) in the portfolio + E.g.: Hold C-bond, C-bond spread narrow → portfolio outperform T-bill only simulation - Security selection effect : portfolio return due to change in yiled spread of actual securities held - Trading effect : residual return

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Traditional finance perspective - Efficient market hypothesis	**1. Efficient market hypothesis** : market prices reflect all relevant available information - Weak form efficient : market prices reflect all past price + volume data + cannot earn excess return from technical analysis - Semi-strong form efficient : market prices reflect all public information (including past price + volume data) + cannot earn excess return from technical analysis / fundamental analysis - Strong form efficient : market prices reflect all public + non-public information (including past price + volume data) + cannot earn excess return from technical analysis / fundamental analysis / inside information **2. Supports** : a. Weak form efficient : - Study shows no serial correlation between past prices ad subsequent changes → consistent with weak form - Stock prices are random do not suppot that the price is correctly reflects instrinsic value → could lead to misallocation fo resources b. Semi-strong efficient : - Majority of professional mutual fund manages have negative alpha (negative excess returns) → consistent with semi-strong form - Stock split leads to increase in dividends → increase economic value. However, studies show that stock price rose for up to 2 years before the split → complete upward adjustment in market value → consistent with semi-strong form **3. Challenges** : - Funamental anomalies : studies show that + value stock with lower P/E, P/B and P/S , higher E/P, B/P and dividend yield outperform growth stocks + abnormal return for small-cap stoks → violate both seni-strong form and strong form - Technical anomalies : studies show that + ST moving average above (below) LT moving average → buy (sell) signals + Stock rise above resistance level → buy signal ; stock price frop below support level → sell signal → violate all 3 form of EMH - Calendar anomalies : stocks have abnormally high returns in Jan, last day of each month, and first 4 days of each month → violate all forms of EMH
Behavioural finance perspective	**1. Consumption & savings** : - Traditional finance : investor can save + invest in early stages for early retirement → require self-control - Behavioral finance : investor mentally account for wealth = current income + currently-owned assets + PV of future income + individual more likely to spend from current income than current assets/future income **2. Behavioral asset pricing** : - Discount rate = risk free rate + fundamental premium + Sentiment premium - Sentiment premium : additional premium based on individual's opinion **3. Behavioural portfolio theory** : individuals construct portfolio by layers. Each layer has different expected return and risk. Allocation of funds in each layer depends on : - Importance of each goal : high return goal is important → allocate in high return layer ; low-risk goal is important → allocate in low risk layer - Asset allocation : done by layer, based on the goal of that layer - Number of assets in each layer : based on investor's risk aversion. Risk-averse → larger number of assets in each layer - Investor believes they have advantage information → more concentrated position - Loss-averse investors → larger cash position to avoid having to sell at loss to meet liquidity needs → Overall portfolio : diversified, but sub-optimal (no consideration to correlation between stocks/layers) **4. Adaptive markets hypothesis** : investment success is due to evolution. No adapt → no survive - Assumption : investors satisfice, rather than maximize - If investors feel they have sufficient information to make decision to reach steps toward desired goal (not necessary optimal decision) - If more people apply same rules, rules are reflected in market pricing → market evolves - Conclusion : + Relationship between risk and return : not stable. Change in competitive environment → change in market risk premium + Active management and find arbitrage opportunities → add value + No strategy would work all the time + Adapt + innovate is must have to continue success + Suvivors change + adapt

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Effect of behavioural factors on analyst's forecast	**1. Overconfidence** : - Reasons : + Illusion of knowledge bias + Illusion of control bias + Representativeness : judge the probability of a forecast being correct by how the available data fit the outcome → incorrectly combine : (1) probability that the data fit a category and (2) probability that the category fit the conclusion + Availability bias : overweight recent/readily available data - Ego defense mechanism : + Self-attribution bias : self-credit for success, blame others for failures + Hindsight bias : selective recalls / reshape details of forecast to fit the outcome - Solutions : + Self-calibration : get immediate feedback via self-evaluations, colleagues, superiors + Always seek for counterargument + Consider sample size : small samples → unreliable models + Apply Bayes behavioural biases **2. The way management presents information** : - Reasons : + Framing : digest same information differently, depend on how it is presented + Anchoring & adjustment : Anchor to previous forecast + Availability bias : data that is easier to recall → more weight + Self-attribution bias : salary and bonus are based on operating results → more likely to overstate results + Recalculate earnings - Solutions : + Focus on verifiable, comparable quantitative data rather than subjective information + Check that the information is framed properly + Recognise appropriate starting point for data **3. Analyst biases in reasearch** : - Reasons : + Confirmation bias : look for confirming information, ignore contradict information + Gambler's fallacy (e.g.: in case of tossing a coin, there is 50/50 chance of head or tail. Gambler's fallacy means that if there is a streak of head, gamblers starts to feel an increased chance of tail) - Solutions : + incorporate new information + apply Bayes's formula + seek contradict information + get promt feedbacks
Effect of behavioural factors on investment committee	**1. Effect** : - Social proof bias : follows the beliefs of a group + uncomfortable expressing opinion that differs from others - Committees includes people with similar background → same point of view on problems **2. Solutions** : - Comprise people with different background - Comprise members who are not afraid of express different opinion - Committee chair should encourage members to speak out - Mutual respect for all members
Impact of behavioral biases on market	**1. Not all mispricing are anomalies :** - Excess retun bay disapears after taking into acount all trading costs and fees - Some anomalies are relection of inadequate pricing model (not include all risk factors) - Small sample size may create illusion of anomalies - Anomalies may exist for short-run before known and exploited - Some anomalies are reflection of relevant economic factors (e.g.: year-end trading to harvest loss + reduce tax) **2. Momentum effect** : - Can last up to 2 years, before reverse back to mean - Reasons : due Herding : follows a large groups/trend. Collective sum of investors trading in the same direction lead to anomalies + Availability bias : recent data/trend is extrapolated by investors in the forecast + Fear of regret : lead to trend-chasing effect **3. Financial bubbles & crashes** - Bubbles / Crashes : an extended period of time that prices are 2 standard deviations from the mean - Reasons : + Overconfidence : underestimate risk + concentrate the portfolios + Confirmation bias + Self-attribution bias + Regret aversion : does not want to miss the trend + Disposition effect : more willing to sell winners + hold losers **4. Values vs. Growth** - Farma and French : value stock outperform growth stock ; Small cap stocks outperform large cap, due to higher risk exposure of companies with particular size and B/V ratio (not reflect in the pricing model) - Other studies : due to behavioural biases + Halo effect : companies with favorable attributes (good record of growth + price performance) → good investment + continued high expected return → good buy + Home bias : investor favor domestic securities

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