



# Artificial Intelligence (AI) For Investments

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# Lesson 1: Portfolio Management Strategies



# Introduction

- Introduction to portfolio management
- Portfolio management: passive strategies
- Tracking error and index portfolio construction
- Portfolio management: active strategies
- Investing styles
- Value vs. growth investing



# Portfolio Management Strategies

# Portfolio Management Strategies

Portfolio management strategies can be placed into either a passive or active category

- The passive category portfolios aim to replicate some index (e.g., Nifty)
- Since not much effort is put in terms of time and resources in the acquisition of information, these strategies involve very less management fees
- In contrast, active portfolio management involves continuous accumulation of information to achieve higher risk-adjusted returns as compared to the market or some other benchmark
- Given this effort of management, management charges excess fees

# Portfolio Management Strategies – Passive Strategy

The total returns from the passive strategy are decomposed into two components: risk-free return + risk premium

- Passive funds follow the approach called indexing
- It is a long-term buy-and-hold strategy, except for the occasional rebalancing of the portfolio that is required due to changes in the index
- The deviation between the passive funds and index returns is called ‘tracking error’
- The portfolio is judged by its ability to minimize this tracking error

# Portfolio Management Strategies – Active Strategy

The active funds, in contrast, attempt to beat the market and claim to offer some risk-adjusted excess abnormal returns, often denoted as ‘Alpha’

- That is, to outperform some benchmark (usually an index) on a risk-adjusted basis
- This Alpha is the difference between the actual and expected returns
- Essentially, this Alpha is the value a manager had added or subtracted from the investment process

# Portfolio Management Strategies

An investor faces certain trade-offs while selecting between these two active and passive strategies

- Indexing is a low-cost (because of the low management fee) strategy but assured returns
- The active strategy may offer, at times, lucrative returns but with higher management costs
- At times, these higher management costs make net-returns inferior to investors



# Portfolio Management Strategies

Stock markets world-over are said to be considerably efficient

- The implication is that it is extremely difficult for active fund managers to beat the market and justify the active management fee (1%–2%) charged
- Passive funds do not charge this management fee
- However, passive management strategies also require buying and selling of portfolios over time
- This leads to a slight underperformance by the fund amounting to 0.05% to 0.25%



# Passive Portfolio Management Strategies

# Passive Strategies

Often three techniques are employed to construct a passive index portfolio

**(a) Full replication:** all the securities in the index are purchased in proportion to their weights in the index

- While this strategy ensures extremely efficient tracking, but the need to purchase/sell many securities will reduce the returns by transaction costs
- Also, for such a large number of securities, a considerable amount of dividends are paid

# Passive Strategies

**(b) Sampling:** in this technique, only a limited sample of stocks are employed that broadly represent all the industry sector classification, as captured by the benchmark index

- This solves the problem of buying a large number of stocks
- In particular, the stocks with large weights are purchased according to their weight in the index
- The small stocks are purchased to approximate/mimic their aggregate characteristics in the index (e.g., beta, industry, and dividend yield)
- While this will decrease the transaction cost, the efficiency of tracking, and therefore, the returns of the portfolio may differ from the benchmark

# Passive Strategies

(c) **Quadratic programming:** in this case, the sampling technique differs from sampling

- That is, for sampling, rather than matching the characteristics of the security, historical information about the security returns and correlations are employed to construct a portfolio that can minimize the return deviations from the benchmark
- One challenge is that this technique draws heavily from the past information of the securities, and, therefore, if the security characteristics change from that observed in the past, then the portfolio may not be efficient in tracking the returns



# Tracking Error and Index Portfolio Construction

# Tracking Error and Index Portfolio Construction

- The main objective of a passive portfolio is to replicate a particular benchmark index
- It does not aim to achieve higher returns but to match the performance of that portfolio
- Therefore, a manager is judged by his performance relative to the performance of the benchmark, using a measure called tracking error

# Tracking Error and Index Portfolio Construction

- Consider a period  $t$  return on a portfolio of  $N$  assets:

$$R_{pt} = \sum_{i=1}^N w_i R_{it} \text{ where } N \text{ is the number of assets in the portfolio}$$

- The difference between the period  $t$  benchmark portfolio and index returns:

$$\Delta_t = R_{pt} - R_{bt}; \text{ generally, } \Delta_t \text{ is a function of the portfolio weights}$$

- Also, since all the assets (mostly the small ones) may not be included in the managed portfolio, weight  $(w) = 0$  for those assets



# Tracking Error and Index Portfolio Construction

- For a sample of  $T$  return observations, the variance of  $\Delta_t$  can be calculated as:

$$\sigma_{\Delta}^2 = \frac{\sum_{t=1}^T (\Delta_t - \bar{\Delta})^2}{(T-1)}$$

- If  $\sigma_{\Delta}$  is calculated for daily period then annualized tracking error (TE) =  $\sigma_{\Delta}\sqrt{252}$
- For monthly period the error will be  $TE = \sigma_{\Delta}\sqrt{12}$
- Basically,  $TE \text{ (Annualized)} = \sigma_{\Delta}\sqrt{t}$ , where  $t$  are the number of returns periods in the year

# Tracking Error and Index Portfolio Construction

Period	Return on Portfolio (%)	Return on Index (%)	Difference (%)
1	2.3	2.7%	-0.4%
2	-3.6	-4.6	1.0
3	11.2	10.1	1.1
4	1.2	2.2	-1.0
5	1.5	0.4	1.1
6	3.2	2.8	0.4
7	8.9	8.1	0.8
8	-0.8	0.6	-1.4
		Average	0.20%

$$\sigma_{\Delta}^2 = \frac{\sum_{t=1}^T (\Delta_t - \bar{\Delta})^2}{(T-1)} = \frac{[(-0.4-0.2)^2 + (1.0-.2)^2 + \dots + (-1.4-0.2)^2]}{(8-1)} = 1.0; \sigma_{\Delta} = 1.0\% \text{ quarterly}$$

$$TE = \sigma_{\Delta} * \sqrt{4} = 2.0\%$$



# Active Investment Strategies

# Active Investment Strategies

Active equity management strategies aim to earn returns that exceed market (benchmark) returns, net of transaction costs

- These strategies aim to increase the exposure to those stocks/sectors that the fund considers undervalued
- It may be noted that increasing exposure to a certain sector may lead to additional risk
- However, the fund management may believe that actual returns will be higher (net of transaction costs) than those justified by the risk premium associated with the risk of investment

# Active Investment Strategies

Active equity management strategies are classified in three buckets: (A) fundamental, (B) technical, and (C) market anomalies and security attributes

**(A) Fundamental strategies:** The fundamental strategies are of two kinds (a) top-down and (b) bottom-up

- In the top-down investment process, one starts with the broad country level and sector level analysis. Then, move towards asset class to security specific allocation

# Active Investment Strategies

- The bottom-up approach straight away focusses on the individual security rather than the market-sector analysis. Then, if found good, the analysis moves from asset class to sector, and then to the country level
- The end objective in both the approaches is to identify the securities that are undervalued given their fundamentals

# Active Investment Strategies

(A) **Fundamental strategies:** a fund manager may identify the asset class that is undervalued, e.g., stocks, bonds, and government securities

- They may increase the exposure to that asset class as a whole
- Second, they may invest (increase exposure) in certain industry sectors or the investment styles (large cap, small cap, value, and growth)
- Finally, funds can identify and add undervalued stocks to their portfolios
- Another strategy recently developed, called as “130/30.” Funds take long positions up to 130% of the original capital. Then, they take short positions of 30%

# Active Investment Strategies

(B) **Technical strategies:** rely on two aspects of past price performance: (a) the past trends will continue and (b) the past trends will reverse

- For example, a contrarian strategy will suggest that the best time to buy a stock when everybody is acting bearish (selling) and vice versa
- This strategy relies on the overreaction hypothesis: investors overreact to the information leading to excess movements in the prices
- As the prices correct in the short to medium term, there is a reversal
- The contrarian investor will purchase the stock when the price is low and falling and sell it when the price is high and rising



# Active Investment Strategies

(B) **Technical strategies:** in contrast, the momentum trading strategy assumes that the momentum will continue

- This strategy relies on the underreaction hypothesis
- That is, investors have limited capacity to absorb information
- As the information arrives in the market, investors gradually absorb this information
- The investor following the momentum strategy buys the stock when the prices start rising and holds in expectation of further increase, and vice versa

# Active Investment Strategies

(C) **Anomalies and attributes:** these strategies rely on anomalies or firm attributes

- It has been observed that firms with small capitalizations produce bigger risk-adjusted returns than those with large market capitalizations
- Similarly, firms with low P/E and P/BV ratios produce higher risk-adjusted returns than those with higher levels of these ratios
- It appears that market, at times, favors some attributes more than others
- In this context, sector rotation involves increasing (overweighing) stocks with certain attributes and decreasing the stocks with opposite attributes



# Investing Styles

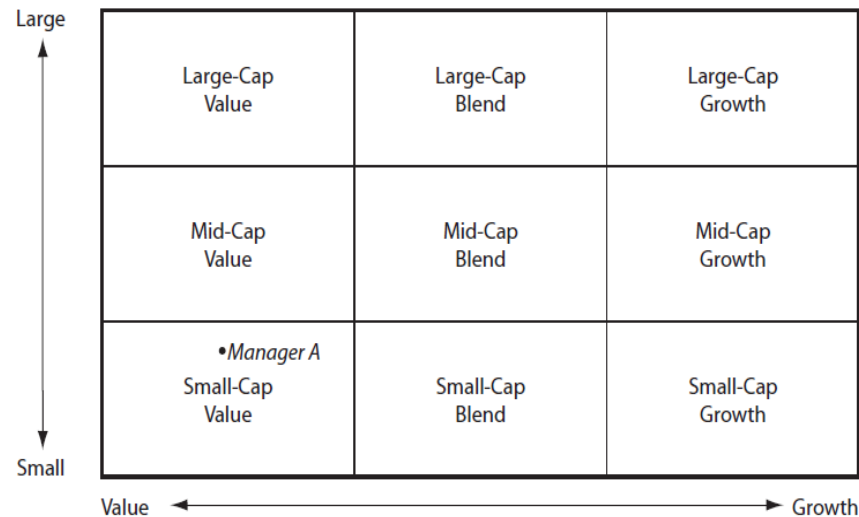
# Investing Styles

Various investment styles are available to investors

- These include forming portfolios with stock characteristics including market capitalization, leverage, industry sector, relative valuation, and growth potential
- Essentially, style analysis defines benchmark portfolios (index) based on these characteristics
- Securities are chosen depending upon their sensitivity to this portfolio
- The relationship between a funds return to that with various indices is examined
- The higher the correlation of the fund with a portfolio associated with certain characteristics, it is said that the portfolio manager gives a higher weight to that investment style

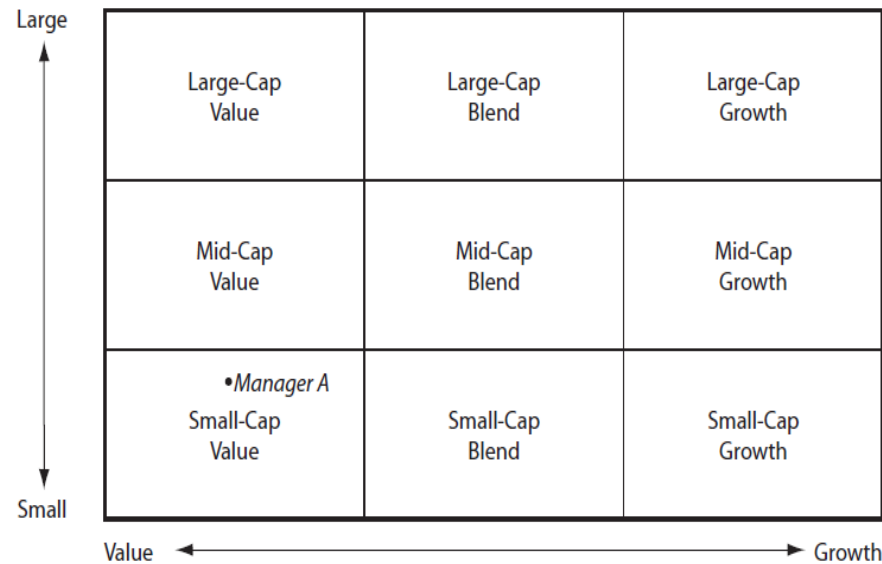
# Investing Styles

- Consider the style grid below. Here, we are trying to capture the performance of the manager along two dimensions: firm size (large-, mid-, and small-cap) and relative value (value, growth, and blend)
- Manager A's performance is best captured by the small-cap value style



# Investing Styles

- These style grids can be formed to classify funds, indices, or other portfolios
- Only those portfolios that are found similar in styles can be compared for their return performances



# Investing Styles – A Formal Approach

A more formal constrained least square approach to style analysis is discussed below

- Only those portfolios that are found similar in styles can be compared for their return performances
- The return from the manager's portfolio ' $R_{pt}$ ' are regressed on the returns on different style ( $j$ ) factor ' $F_{jt}$ ' for the same period
- The following form of regression model is employed
- $$R_{pt} = [b_{p1}F_{1t} + b_{p2}F_{2t} + \dots + b_{pn}F_{nt}] + e_{pt}$$
- Here,  $b_{pj}$  is the sensitivity of the portfolio to style  $j$ .  $e_{pt}$  is the portion of the returns not explained by the variability in the set of employed factors

# Investing Styles – A Formal Approach

$$R_{pt} = [b_{p1}F_{1t} + b_{p2}F_{2t} + \cdots + b_{pn}F_{nt}] + e_{pt}$$

- The regression  $R^2$  is interpreted as the percentage of return variability due to style
- The rest  $(1 - R^2)$  is ascribed to the manager's selection skills
- The styles are measured through benchmark portfolios
- No intercept term is specified, the coefficients must sum to one, and all the coefficients are non-negative
- Here,  $R^2 = 1 - \left[ \frac{\sigma^2(e_p)}{\sigma^2(R_p)} \right]$



# Investing Styles – A Formal Approach

$$R_{pt} = [b_{p1}F_{1t} + b_{p2}F_{2t} + \cdots + b_{pn}F_{nt}] + e_{pt}$$

- It may often be the case that a fund manager may profess a different style while following another style
- This analysis clearly brings forth the true picture
- The analysis also helps in finding out if there has been a style drift.



# Value vs. Growth Investing

# Value vs. Growth Investing

We often hear investment management firms define themselves as value vs. growth firms

- For example, growth firms focus on the earnings (EPS) part of the P/E ratio
- They expect the earnings to grow which will lead prices to rise
- Growth stocks are not necessarily cheap based on the current earnings levels; in fact, they may be costly
- But the investor believes that the earnings will rise significantly and lead to a price rise in the near future

# Value vs. Growth Investing

In contrast, the value investor defines the price (P) component of P/E ratio

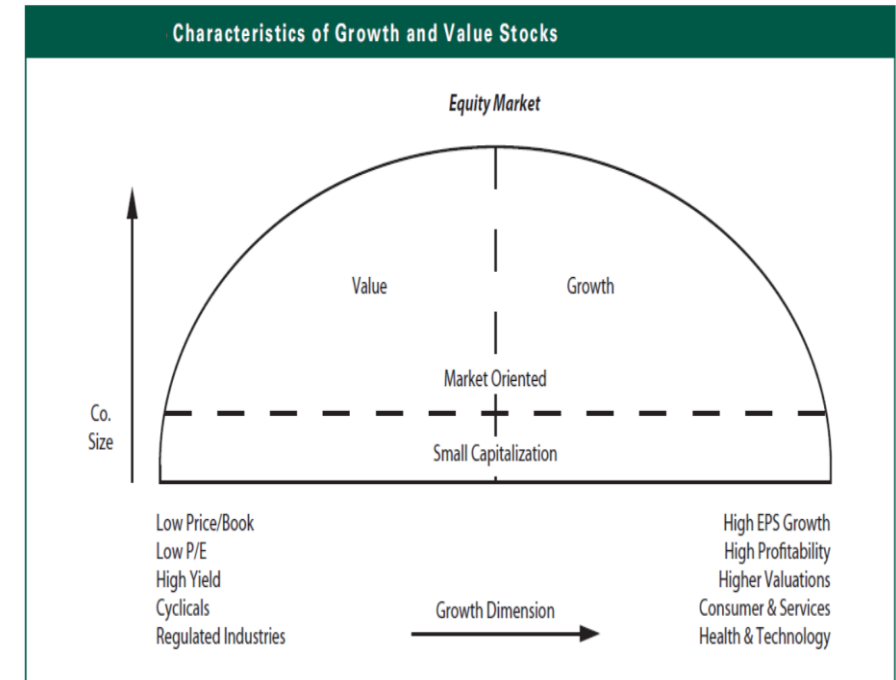
- The value investor believes that given the current level of earnings, prices are low (cheap) as compared to the other stocks in the same industry with similar profile
- P/E level is below the level based on some comparison, and the fact that the market will correct itself in the near term
- The prices will rise; thus, value stocks are cheap given their current earning levels

# Value vs. Growth Investing

- To summarize, growth investor focuses on the current and future economic “story” of the firm, with less regard to share valuation
- The value investor focuses on share prices in anticipation of a market correction, possibly on account of improving company fundamentals

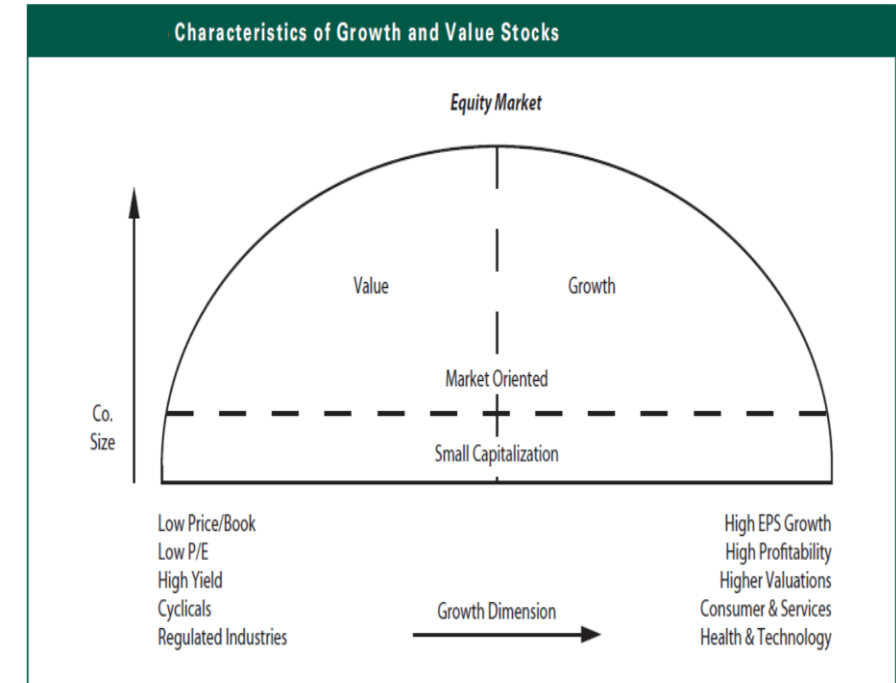
# Value vs. Growth Investing

- Notice the characteristics of the value and growth stocks shown in the figure
- The figure shows one approach to classify securities according to style and market capitalization



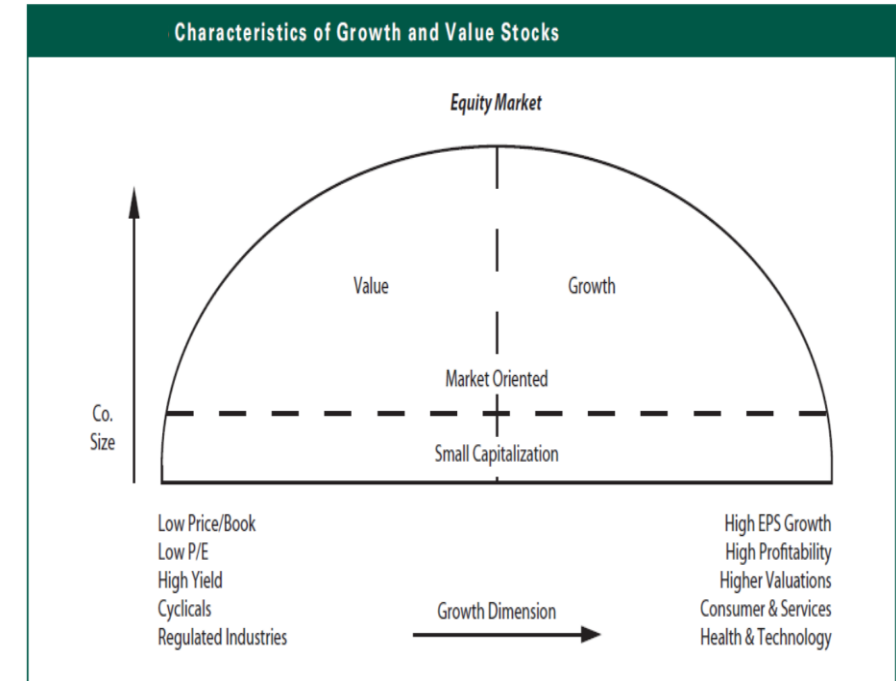
# Value vs. Growth Investing

- We can see that value stocks are cheap (i.e., low P/BV and high yield) and have modest growth opportunities
- In contrast, growth stocks are expensive, reflecting their high future earning potential



# Value vs. Growth Investing

- Value style appears to be more tempting than growth, and in fact, studies show that value style indeed produces higher average returns than growth investing
- However, both strategies have their clientele







# Summary and Concluding Remarks

# Summary and Concluding Remarks

- There are broadly two kinds of portfolio management strategies:  
(a) active management and (b) passive management
- Passive management strategies include: (a) full replication, (b) sampling, and (c) quadratic programming
- Passive management strategies aim to replicate the performance of some benchmark index
- Passive management strategies aspire to minimize the tracking error

# Summary and Concluding Remarks

- Active management strategies aspire to generate higher returns
- Active investment strategies are of three kinds:  
(a) fundamental, (b) technical, and (c) market anomalies and security attributes
- Passive management strategies have low transaction costs, whereas active management may require additional transaction costs

# Summary and Concluding Remarks

- Fund managers often follow one of the two main investing styles: value vs. growth
- Growth stocks sell at premium in anticipation of high future growth while value stock are cheap at their current valuations
- A more formal approach employs regression modelling to examine what factors/styles are being followed by a fund manager



**Thanks!**