## 1. INTRODUCTION

Behavioral finance focuses on human behavior and psychological mecahnisms involved in financial decision-making and seeks to understand and predict the impact of psychological decision-making on the financial markets.

***According to efficient market hypothesis***, financial markets are rational and efficient, and the abnormal returns are either by chance or due to statistical problems associated with analyzing stock returns e.g. neglecting common risk factors etc.

***According to behavioral finance***, although financial markets are rational and efficient, but it is ***not*** necessary that ***all*** the market participants *will be rationale* in their decision making due to various behavioral biases (particularly cognitive biases). This results in the mispricing of securities and thus results in the market anomalies.

The basic idea of behavioral finance is that since investors are humans,

- Investors are imperfect and can make irrational decisions.
- As a result, investors may have *heterogeneous* beliefs regarding asset's value.

**Normative analysis:** Normative analysis involves analyzing how markets and market participants ***should*** behave and make decisions. *Traditional finance* is regarded as normative.

**Descriptive analysis:** Descriptive analysis involves analyzing how markets and market participants ***actually*** behave and make decisions. *Behavioral finance* is regarded as descriptive.

**Prescriptive analysis:** Prescriptive analysis seeks to analyze how markets and market participants should behave and make decisions so that the achieved outcomes are approximately close to those of normative analysis. Efforts to use behavioral finance are regarded as prescriptive.

## 2. BEHAVIORAL VERSUS TRADITIONAL PERSPECTIVES

**Traditional finance assumes that:**

- Market participants are ***rational***;
- Market participants make decisions consistent with the axioms of expected utility theory (explained below);
- Market participants accurately maximize expected utility;
- Market participants are self-interested;
- Market participants are ***risk-averse*** and thus, the utility function is ***concave*** in shape i.e. exhibits a diminishing marginal utility of wealth.
- Stock prices reflect all available and relevant information.
- Market participants revise expectations consistent with Bayes' formula (explained below).
- Market participants have access to perfect information;
- Market participants process all available information in an unbiased way i.e. make unbiased forecasts about the future.

However, in reality, these assumptions may not hold.

**Behavioral finance assumes that:**

- Market participants are "***normal***" not rational;
- Market participants do not necessarily always process all available information in decision making;
- In some circumstances, financial markets are informationally inefficient.

**Two dimensions of Behavioral Finance:**

1) **Behavioral Finance Micro (BFMI):** BFMI seeks to understand behaviors or biases of market participants and their impact of financial decision-making. It is primarily used by wealth managers and investment advisors to manage individual clients.

2) **Behavioral Finance Macro (BFMA):** BFMA seeks to understand behavior of markets and market anomalies that are in contrast to the efficient markets of traditional finance. It is primarily used by fund managers and economists.

**Categories of Behavioral Biases:**

1) **Cognitive errors**: Cognitive errors are mental errors including basic statistical, information-processing, or memory errors that may result from the use of simplified information processing strategies or from reasoning based on faulty thinking.

2) **Emotional biases:** Emotional biases are mental errors that may result from impulse or intuition and/or reasoning based on feelings.

### 2.1.1) Utility Theory and Bayes' Formula

Under the utility theory, an individual always chooses the alternative for which the *expected value of the utility*

*(EXPECTED utility) is maximum*, subject to their budget constraints. In other words, an individual tends to maximize the PV of utility subject to the PV of budget constraint.

- Utility refers to the level of ***relative satisfaction*** received from consuming goods and services. Unlike price, utility depends on the particular circumstances and preferences of the decision maker; as a result, it may vary among individuals.

Expected utility = Weighted sums of the utility values of outcomes

Expected utility = Σ (Utility values of outcomes × Respective probabilities)

- The value of an item is based on its utility rather than its price.
- According to the ***Expected utility theory***, individuals are risk-averse and thus, utility functions are concave in shape and exhibit diminishing marginal utility of wealth.

**Subjective expected utility of an individual**

$$=\Sigma [u(xi) \times P(xi)]$$

Where,

u (xi) = Utility of each possible outcome xi
P (xi) = Subjective probability

**Axioms of Utility Theory:** The four basic axioms of utility theory are as follows:

1) **Completeness:** Completeness assumes that given any two alternatives, an individual can always specify and decide exactly between any of these alternatives.

**Axiom:** Given alternatives A and B, an individual

- Prefers A to B
- Prefers B to A
- Is indifferent between A and B

2) **Transitivity:** Transitivity assumes that, as an individual decides according to the completeness axiom, an individual also decides consistently. According to transitivity, the decisions made by an individual are internally consistent.

**Axiom:** Given alternatives A, B and C, if an individual

- Prefers A to B
- Prefers B to C
  ➔ Then an individual prefers to A to C.
  If an individual
- Prefers A to B
- Is indifferent between B and C
  ➔ Then an individual prefers to A to C.
  If an individual
- Is indifferent between A and B
- Prefers A to C
  ➔ Then an individual prefers to B to C.

3) **Independence:** Independence also assumes that individuals have well-defined preferences and when a 3rd alternative is added to two alternatives, the order of preference remains the same as when two alternatives are presented independently.

**Axiom:** Given three alternatives A, B and C, if an individual prefers A to B and some amount of C (say x) is added to A and B, then an individual will prefer (A + xC) to (B + xC).

**IMPORTANT TO NOTE:**

- If the utility of A depends on availability of alternative C, then utilities are NOT additive.

4) **Continuity:** Continuity assumes that indifference curves* are continuous, implying that an individual is indifferent between all the points on a ***single*** indifference curve.

**Axiom:** Given three alternatives A, B and C, if an individual prefers A to B and B to C, then there should be a possible combination of A and C on the indifference curve in which an individual will be indifferent between this combination and the alternative B.

**Implication of axioms of utility theory:** When an individual makes decisions consistent with the axioms of utility theory, he/she is said to be ***rational***.

***Indifference curve (IC):** An indifference curve shows combinations of two goods among which the individual is indifferent i.e. those bundles of goods provide same level of satisfaction.

- The IC shows the ***marginal rate of substitution*** i.e. the rate at which a consumer is willing to trade or substitute one good for another, at any point.
- The indifference curve that is within budget constraints and furthest from the origin provides the highest utility.
- **For perfect substitutes:** IC represents a line with a constant slope, implying that a consumer is willing to trade or substitute one good for another in fixed ratio.
- **For perfect complements:** IC curve is an L-shaped curve, implying that no incremental utility can be obtained by an additional amount of either good as goods can only be used in combination.

**Bayes' formula:** Bayes' formula is used for revising a probability value of the initial event based on additional information that is later obtained.

***Rule to apply Bayes' formula:*** All possible events must be mutually exclusive and must have known probabilities.

The formula is:

$$P(A|B) = [P(B|A) / P(B)] \times P(A)$$

Where,
P(A | B) = Conditional probability of event A given B. It represents the ***updated*** probability of A given the new information B.
P(B | A) = Conditional probability of event B given A. It represents the probability of the new information (event) B given event A.
P(B) = Prior (unconditional) probability of information (event) B.
P(A) = Prior (unconditional) probability of information (event) A.

***In summary:*** In traditional finance, when market participants make decisions under uncertainty, they

1. Act according to the axioms of utility theory.
2. Make decisions by assigning a probability measure to possible events.
3. Process new information according to Bayes' formula.
4. Select an alternative that generates the maximum expected utility.

**Practice: Example 1, Volume 2, Reading 7**

### 2.1.2) Rational Economic Man

Rational economic man (REM) pursues ***self-interest*** (sole motive) to obtain the highest possible economic well-being (i.e. the highest utility) at the least possible costs given available information about opportunities and constraints on his ability to achieve his goals. In sum,

- REM is Rational
- REM is Self-interested
- REM is Labor averse
- REM possesses perfect information

### 2.1.4) Risk Aversion

**Risk averse:** An individual who prefers to invest to receive an expected value with certainty rather than invest in the uncertain alternative with the same expected value is referred to as risk averse.

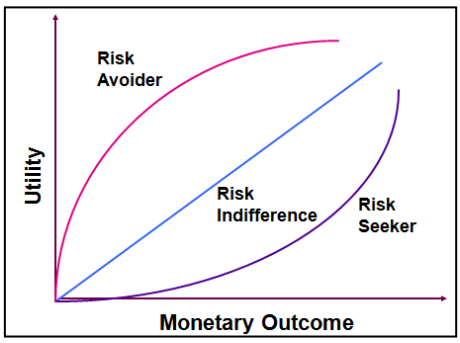
- Risk-averse individuals have *concave utility functions*, reflecting that utility increases at a decreasing rate with increase in wealth (i.e. diminishing marginal utility of wealth).
- The greater the curvature of the utility function, the higher the risk aversion.

**Risk neutral:** An individual who is indifferent between the two investments is called risk-neutral.

- Risk-neutral individuals have *linear utility functions*, reflecting that utility increases at a constant rate with increase in wealth.

**Risk-seeking:** An individual who prefers to invest in the uncertain alternative is called risk-seeking.

- Risk-seeking individuals have *convex utility functions*, reflecting that utility increases at an increasing rate with increase in wealth (i.e. increasing marginal utility of wealth).




**Certainty Equivalent:** It refers to the ***maximum*** amount of money an individual is willing to pay to ***participate*** or the ***minimum*** amount of money an individual is willing to accept to ***not participate*** in the opportunity.

Risk premium = Certainty equivalent – Expected value

*See: Exhibit 2, Volume 2, Reading 7.*

### 2.2.1) Challenges to Rational Economic Man

In reality, financial decisions are also governed by human behavior and biases. This implies that:

- Individuals may sometimes behave in an irrational manner.
- Individuals are not perfectly self-interested.
- Individuals do not have perfect information and many economic decisions are made in the absence of perfect information.
- REM fails to consider that people may suffer from self-control bias i.e. it may be difficult for individuals to prioritize between short-term versus long-term goals (e.g. spending v/s saving).

Despite the limitations of REM, REM concept is useful as it helps to define an optimal outcome.

**Conclusion:**

- ***Individuals are neither perfectly rational nor perfectly irrational***; rather, they tend to have diverse combinations of rational and irrational characteristics.

### 2.2.3) Attitudes toward Risk

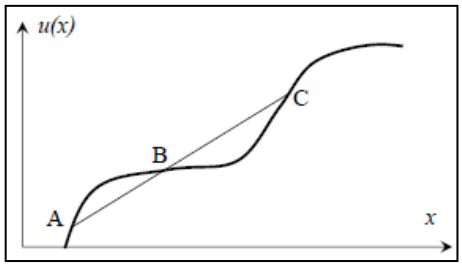
An individual's (investor's) attitude toward risk depends on his/her wealth level and circumstances. This implies that the curvature of an individual's utility function may vary depending on the level of wealth and circumstances.

1. At both low and high wealth (income) level, utility functions tend to exhibit concave shape, reflecting risk-aversion behavior (i.e. at points A and C). This implies that

- At low level of wealth, people may prefer low probability, high payoff risks (e.g. lottery).
- Once certain reasonable level of wealth is reached, the individual becomes risk averse in order to maintain this position.

2. At moderate wealth (income) level, utility functions tend to exhibit convex shape, reflecting risk-seeking behavior (i.e. between points B and C).

- This implies that individuals with moderate level of wealth tend to prefer small, fair gambles.




**Double inflection utility function:** A utility function that changes with changes in the level of wealth is called double inflection utility function (as shown above).

**Risk versus uncertainty:**

- Risk refers to *randomness with* ***knowable*** *probabilities*. Risk is measurable.
- Uncertainty refers to *randomness with* ***unknowable*** *probabilities*. Uncertainty is not measurable.

## 2.3 Neuro-economics

Neuro-economics is a combination of neuroscience, psychology and economics. It seeks to explain the influence of the brain activity on investor behavior and attempts to understand the functioning of the brain with respect to judgment and decision making.

***Criticism of neuro-economics:*** It is argued that the brain activity or chemical levels in the brain are unlikely to have an impact on economic theory.

## 3.1 Decision Theory

Decision theory deals with the study of methods for determining and identifying the optimal decision (i.e. with *highest total expected value*) when a number of alternatives with *uncertain outcomes* are available.

- Both Expected utility and decision theories are ***normative***.
- The decision theory facilitates investors to make better decisions.

**Assumptions of Decision Theory:**

- Decision maker possess all relevant and available information;
- Decision maker has the ability to make accurate quantitative calculations;
- Decision maker is perfectly rational;

**Expected value versus Expected Utility:** Expected value is not the same as expected utility.

- Expected value of an item depends on its price and price is equal for everyone.
- Expected utility of an item depends on an individual's circumstances and it may vary among individuals.

## 3.2 Bounded Rationality

Bounded rationality relaxes the assumption that an individual processes all available information to achieve a wealth-maximizing decision.

According to bounded rationality, an individual behaves *as rationally as possible* given ***informational, intellectual, and computational limitations*** of an individual. As a result,

- Individuals do not necessarily make perfectly rational decisions;
- Individuals tend to ***satisfice*** rather than optimize while making decisions i.e. individuals seek to achieve ***satisfactory and adequate decision*** outcomes (given available information and limited cognitive ability) rather than optimal (best) outcomes given informational, intellectual, and computational limitations and the cost and time associated with determining an optimal (best) choice.

**NOTE:**

**Satisfice** refers to achieving ***satisfactory and adequate decision*** rather than an optimal (best) decision.

**Practice: Example 2, Volume 2, Reading 7**

## 3.3 Prospect Theory

The Prospect theory relaxes the assumptions of expected utility theory. It seeks to explain the behavior of individuals to perceive prospects (alternatives) based on their framing or reference point i.e. people respond

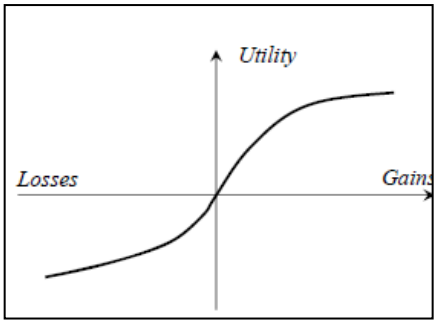
differently depending on how choices are framed e.g. in terms of gains or losses.

- According to prospect theory,
  - Individuals prefer a certain gain more than a probable gain with an equal or greater expected value and the opposite is true for losses.
  - Individuals evaluate gains and losses from a subjective reference point.
- Both Prospect theory and bounded rationality are descriptive.

**Three critical aspects of the value function of a Prospect theory:**

1. Value is assigned to ***changes in wealth*** (i.e. gains/losses) rather than to absolute level of wealth; and instead of probabilities, decision weights are used in the value function.
2. The value function is ***S-shaped*** (see Figure below), and predicted to be ***concave for gains***(indicating risk aversion) above the reference point and ***convex for losses***(indicating risk-seeking) below the reference point.
3. The value function is ***steeper for losses*** than for gains (See Figure below). This means that the displeasure associated with the loss is greater than the pleasure associated with the same amount of gains.

- This implies that individuals are ***loss-averse*** not risk-averse**.** In addition, an individual tends to be risk-seeking in the domain of losses while risk-averse in the domain of gains.
  - People are risk averse for gains of moderate to high probability and losses of low probability.
  - People are risk seeking for gains of low probability and losses of moderate to high probability.
- ***Loss aversion bias*** refers to the tendency of an individual to hold on to losing stocks while selling winning stocks too early. It is also known as "***disposition effect***".




***Phases of decision making in Prospect Theory:***
According to Prospect Theory, individuals go through two distinct phases when making decisions about risky and uncertain options.

**1) Editing or Framing phase:** In this phase, decision makers edit or simplify a complicated decision. The ways in which people edit or simplify a decision vary depending on situational circumstances. Decisions are made based on these edited prospects.

**Six Operations in the Editing process:**

1. **Codification:** Coding refers to categorizing outcomes (prospects) in terms of gains and losses rather than in terms of final absolute wealth level depending on the reference point i.e.

- Outcomes below the reference point are viewed as losses.
- Outcomes above the reference point are viewed as gains.
  - Prospects are coded as (Gain or loss, probability; Gain or loss, probability;…)
  - Initially, the sum of probabilities = 100% or 1.0.

2. **Combination:** Combination refers to adding together the probabilities of prospects with identical gains or losses to simplify a decision. E.g. winning 200 with 25% or winning 200 with 25% can be simply reformulated as winning 200 with 50%.

3. **Segregation:** In this step, the decision maker separates the ***riskless*** component of any prospect from its ***risky*** component. E.g. segregating the prospect of winning 300 with 80% or 200 with 20% into a sure gain of 200 with 100% and the prospect of winning 100 with 80% or nothing (0) with 20%. The same process is applied for losses.

4. **Cancellation:** Cancellation refers to discarding similar outcomes probability pairs between prospects. E.g. if pairs are (200, 0.25; ***~~150, 0.40~~***; 30, 0.35) and (200, 0.3; ***~~150, 0.40~~***; -50. 0.3), they will be simplified as (200, 0.25; 30, 0.35) and (200, 0.30; -50, 0.30).

- Cancellation operation fails to consider components that distinguish prospects.
- Cancellation operation may give rise to ***isolation effect*** because different choice problems can be decomposed in different ways which may lead to inconsistent preferences.

5. **Simplification:** Simplification operation involves mathematical rounding of probabilities and/or discarding (i.e. assigning probability of 0) very unlikely prospects. E.g. if a prospect is coded as (49, 0.51), it is simplified as (50, 0.50).

6. **Detection of dominance:** It involves rejecting (without further evaluation) outcomes that are extremely dominated.

**2) Evaluation phase:** In this phase, once prospects are edited or framed, the decision maker evaluates these edited prospects and chooses between them. This phase is composed of two parts i.e.

***a) Value function***: Unlike expected utility theory function, prospect theory value function measures gains and

losses rather than absolute wealth and is reference-dependent. The value function is s-shaped.

- The value function is generally concave for gains and convex for losses.
- The value function is steeper for losses than for gains, reflecting "loss aversion".

***b) Weighting function:*** It involves assigning ***decision weights*** (rather than subjective probability) to those prospects. Decision weights represent empirically derived assessment of likelihood of an outcome. In general,

- People tend to ***underweight*** moderate and high-probability outcomes.
- People tend to ***overweight*** low-probability outcomes.

➔As a result, unlikely outcomes have unduly more impact on decision making.

Perceived value of each outcome = Value of each outcome × Decision weight

$$\mathbf{U =} \ w(p_1)\, v(x_1) + w(p_2)\, v(x_2) + \ldots + w(p_n)\, v(x_n)$$

Where,

$x_i$ = potential outcomes
$p_i$ = respective probabilities
v = Value function that assigns a value to an outcome
w = probability weighting function

- The decision makers select the prospect with the ***highest perceived value***.

**IMPORTANT TO NOTE:**

- Codification, combination and segregation operations are applied to each prospect individually; whereas, cancellation, simplification and detection of dominance operations are applied to two or more prospects together.

## 4. PERSPECTIVE ON MARKET BEHAVIOR AND PORTFOLIO CONSTRUCTION

### 4.1.1) Review of the Efficient Market Hypothesis

An informationally efficient market (an efficient market) is a market in which,

- Prices are informative i.e. they immediately, fully, accurately and rationally reflect all the available information about fundamental values.
- The market ***quickly*** and ***correctly*** adjusts to new information.
- Asset prices reflect all past and present information.
- The actual price of an asset will represent a good estimate of its intrinsic value at any point in time.
- Investors *cannot* consistently earn abnormal returns* by trading on the basis of information.

*Abnormal return = Actual return – Expected return

**Assumptions of Efficient Market Hypothesis (EMH)**:

- Markets are rational, self-interested, and make optimal decisions;
- Market participants process all available information;
- Markets make unbiased forecasts of the future;

However, EMH is NOT universally accepted.

**NOTE:**

***Grossman-Stiglitz paradox:*** Markets cannot be strong-form informationally efficient because costly information will not be gathered and processed by agents unless they are compensated in the form of trading profits (abnormal returns).

**Inefficient market:** When active investing can earn excess returns after deducting transaction and information acquisition costs, it is referred to as an inefficient market.

**Forms of market efficiency**:

There are three forms of market efficiency.

1) **Weak-form market efficiency:** It assumes that security prices fully reflect all the historical market data i.e. past prices and trading volumes. Thus, when a market is weak-form efficient, all past information regarding price and trading volume is already incorporated in the current prices, implying that *technical analysis will not generate excess returns*.

- However, it is possible to beat the market and earn superior profits in the weak-form of efficient market by using the fundamental analysis or by insider trading.

2) **Semi-strong form market efficiency:** It assumes that security prices fully reflect all publicly available information, both *past and present*. Thus, technical and fundamental analysis will not generate excess returns. However, insider traders can make abnormal profits in semi-strong form of efficiency.

3) **Strong-form market efficiency:** It assumes that security prices quickly and fully reflect all the information including past prices, all publicly available information, plus all private information (e.g. insider information). Thus, when a market is strong-form efficient, it should not be possible to consistently earn abnormal returns from trading on the basis of private or insider information.

#### 4.1.2) Studies in Support of the EMH

**A. Support for the Weak Form of the EMH:** Weak form of the efficient market hypothesis is supported and it is NOT possible to consistently outperform the market using technical analysis because it has been observed that

- Daily changes in stock prices have almost zero positive correlation.
- Market prices follow random patterns and thus, future stock prices are unpredictable.

**B. Support for the Semi-Strong Form of the EMH:** Semi-strong form of the efficient market hypothesis is supported and it is NOT possible to consistently outperform the market using fundamental analysis.

- A common test to examine whether a market is semi-strong efficient is ***event study*** i.e. analyzing similar events of different companies at different times and evaluating their effects on the stock price (on average) of each company.

**C. Support for the Strong Form of the EMH:** Strong form of the efficient market hypothesis is **NOT** supported, implying that it is possible to consistently earn abnormal returns using non-public/insider information.

#### 4.1.3) Studies Challenging the EMH: Anomalies

Market movements that are inconsistent with the efficient market hypothesis are called ***market anomalies***. Market anomalies result in the mispricing of securities.

- However, these market anomalies result in inefficient markets only if they are ***persistent and consistent over reasonably long periods***; and thus, can generate abnormal returns on a consistent basis in the future.
- If these anomalies are <u>not</u> consistent, they may occur as a result of statistical methodologies used to detect the anomalies, for example due to use of inaccurate statistical models, inappropriate sample size, data mining/data snooping (it involves over analyzing the data in an attempt to find the desired results), and results by chance etc.

**Major Types of Market Anomalies:**

There are three major types of identified market anomalies:

**1) Fundamental anomalies:** A fundamental anomaly is related to the fundamental assessment of the stock's value. It includes:

- **Size effect**: According to size-effect anomaly, stocks of small-cap companies tend to outperform stocks of large-cap companies on a risk-adjusted basis.
- **Value Effect:** According to value-effect anomaly, value stocks tend to outperform growth stocks i.e.
  - The stocks with ***low price-to-earnings (P/E)*** ratios, ***low price-to-sales(P/S)*** ratios, and ***low market-to-book (M/B)*** ratios tend to generate more returns and outperform the market relative to growth stocks (i.e. with high P/E, P/S and M/B ratios).
  - Stocks with ***high dividend yield*** tend to outperform the market and generate more return.

However, it has been evidenced that value effect anomalies do not represent actual anomalies because they result from use of incomplete models of asset pricing.

**2) Technical anomalies:** A technical anomaly is related to past prices and volume levels. It includes:

- **Moving averages:** Under this strategy, a ***buy*** signal is generated when *short period averages* rise <u>above</u> long period averages and ***sell*** signal is generated when *short period averages* fall <u>below</u> the long period averages.
- **Trading range break (Support and Resistance):** Under this strategy, a ***buy*** signal is generated when the price reaches the <u>*resistance level*</u>, which is ***maximum*** price level and a ***sell*** signal is generated when the price reaches the <u>*support level*</u> which is ***minimum*** price level.
  - However, in practice, it is generally not possible to earn abnormal profits based on technical anomalies after adjusting for risk, trading costs etc.

**3) Calendar anomalies:** Calendar anomalies are related to a particular time period. For example,

- **January Effect:** According to January effect anomaly, stocks (particularly small cap stocks) tend to exhibit a higher return in <u>*January*</u> than any other month.
- **Turn-of-the-month effect:** According to turn-of-the-month effect, stocks tend to exhibit a higher return on the last day and first four days of each month.

**Conclusion:** In reality, *markets are neither perfectly efficient nor completely anomalous*.

##### 4.1.3.5 Limits to Arbitrage

**Theory of limited arbitrage:** Under certain situations, it may not be possible for rational, well-capitalized traders to correct a mispricing or to exploit arbitrage opportunities, at least not quickly, due to the following reasons:

- It is often risky and/or costly to implement strategies to eliminate mispricing.
- Constraints on short-sale may exist due to which the arbitrageur cannot take a large short position to correct mispricing.
- Liquidity constraints i.e. the potential for withdrawal of money by investors may force managers to close out positions prematurely before the irrational pricing corrects itself.

These risks and costs create barriers, or limits, for arbitrage. As a result, markets may remain ***inefficient*** or in other words, the EMH does not hold.

## 4.2 Traditional Perspectives on Portfolio Construction

From a traditional finance perspective, a portfolio that is ***mean-variance efficient*** is said to be a "***rational portfolio***". A rational portfolio is constructed by considering

- Investors' risk tolerance
- Investor's investment objectives
- Investor's investment constraints
- Investor's circumstances

***Limitation of Mean-variance efficient Portfolio:*** It may not truly incorporate the needs of the investor because of behavioral biases.

## 4.3 Alternative Models of Market Behavior and Portfolio Construction

### 4.3.1) A Behavioral Approach to Consumption and Savings

**Traditional life-cycle model:** The life-cycle hypothesis is strongly based on expected utility theory and assumes that people are rational i.e. they tend to spend and save money in a rational manner and do not suffer from self-control bias as they prefer to achieve long-term goals rather than short-term goals.

**Behavioral life-cycle theory:** The behavioral life-cycle theory considers self-control, mental accounting, and framing biases and their effects on the consumption/saving and investment decisions.

***Mental accounting bias:*** According to the behavioral life-cycle theory, people treat components of their wealth as "non-fungible" or non-interchangeable i.e. wealth is assumed to be divided into three "mental" accounts i.e.

i. Current income
ii. Currently owned assets
iii. Present value of Future income

Marginal propensity to spend (consume)or save varies according to the source of income e.g.

- *Marginal Propensity to* ***spend*** tends to be ***greatest for current income*** and least for future income.
- *Marginal propensity to* ***save*** tends to be ***greatest for future income*** and least for current income.
- *With regard to spending from currently owned assets, people consider their liquidity and maturity i.e.* short-term liquid assets (e.g. cash and checking accounts) are spent first while long-term assets (e.g. home, retirement savings) are less likely to be liquidated.
- It is important to note that any current income that is saved is re-classified as current assets or future income.

***Framing:*** Framing bias refers to the tendency of individuals to respond differently based on how questions are asked (framed).

***Self-control:*** It is the tendency of an individual to consume today (i.e. focus on short-term satisfaction) at the expense of saving for tomorrow (i.e. long-term goals).

### 4.3.2) A behavioral Approach to Asset Pricing

**Behavioral stochastic discount factor-based (SDF-based) asset pricing model**: It is a type of behavioral asset pricing model.

- According to this model, asset prices reflect investor's ***sentiments*** relative to fundamental value.
- ***Sentiments*** refer to the *erroneous beliefs or systematic errors* in judgment about future cash flows and risks of asset.

**Risk premium in the behavioral SDF-based model:** In the behavioral SDF-based model, risk premium is composed of two components i.e.

**Risk premium = Fundamental risk premium + Sentiment risk premium**

In the behavioral SDF-based model, ***dispersion of analysts' forecasts*** serves as a proxy for the sentiment risk premium as it represents a source of risk (e.g. a systematic risk factor) that is not captured by other factors in the model.

- It has been observed that there is an ***inverse*** relationship between the price of the security and the dispersion among analysts' forecasts i.e.
  - The greater (lower) the dispersion ➔the higher (lower) the sentiment premium ➔the greater (lower) the risk premium, ➔the higher (lower) the discount rate* (required rate of return) and thus the lower (higher) the perceived value of an asset.
- A low dispersion is associated with a consensus among the analysts and investors on firms' future prospects and more credible information.
- It is evidenced that dispersion of analyst' forecast is statistically significant in a Fama-French multi-risk-factor framework i.e. the dispersion of analysts' forecasts is <u>*greater for value stocks*</u>; thus, return on value stocks is higher than that of growth stocks.

*__Discount rate or Required rate of return in the behavioral SDF-based model:__ In the behavioral SDF-based model, discount rate is composed of three components i.e.

**Discount rate OR required rate of return =**
Risk free rate (reflecting time value of money) +

Fundamental risk premium (reflecting efficient prices) + Sentiment risk premium (reflecting sentiment-based risk)

- When the subjective beliefs of an investor about the discount rate are the ***same*** as that of traditional finance, the investor is said to have ***zero sentiment***.
  - When sentiment is zero → market prices will be efficient i.e. prices will be the same as prices determined using traditional finance approaches.
- When the subjective beliefs of an investor about the discount rate are ***different*** from that of traditional finance, the investor is said to have ***non-zero sentiment***.
  - When sentiment is non-zero → market prices will be inefficient (or mispriced) i.e. prices will deviate from prices determined using traditional finance approaches.

**Important to Note:** It must be stressed that investors can earn abnormal profits by exploiting sentiment premiums only if they are ***non-random*** in nature i.e. systematically high or low relative to fundamental value; otherwise, it may not be possible to predict them and thus, mispricing may persist.

### 4.3.3) Behavioral Portfolio Theory (BPT)

**BPT versus Markowitz's portfolio theory:**

- BPT uses a ***probability-weighting function*** whereas the Markowitz's portfolio theory uses the ***real probability distribution***.
- The optimal portfolio of a BPT investor is constructed by identifying the portfolios with the highest level of expected wealth for *each probability that wealth would fall below the aspiration level* (i.e. a safety constraint).The BPT optimal portfolio may not be mean-variance efficient.
- In contrast, the perfectly diversified portfolio of Markowitz is constructed by risk-averse investors by identifying portfolios with the highest level of expected wealth for *each level of standard deviation.*
- Under BPT, investors treat their portfolios *not as a whole*, as prescribed by mean-variance portfolio theory, but rather as a ***distinct layered pyramid of assets*** where
  - ***Layers are associated with goals set for each layer*** i.e. bottom layers are designed for downside protection, while top layers are designed for upside potential.
  - ***Attitudes towards risk vary across layers*** i.e. investors are more risk-averse in the downside protection layer whereas less risk-averse in the upside potential layer. In contrast, mean-variance investors have single attitude toward risk.

**The BPT optimal portfolio construction is composed of following five factors:**

1) The allocation of funds among layers depends on the degree of importance assigned to each goal i.e.

- If high importance is assigned to an upside potential goal (downside protection goal), then the allocation of funds to the highest upside potential layer (lowest downside protection layer) will be greater.

2) The asset allocation within a layer depends on the goal set for the layer i.e.

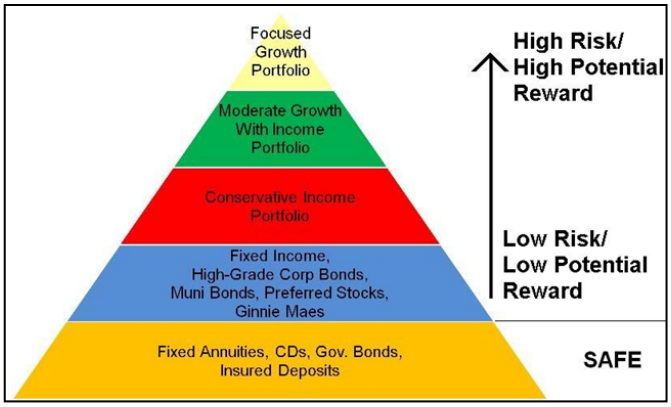
- If the goal is to earn higher returns, then risky or speculative nature assets will be selected for the layer.

3) The number of assets chosen for a layer depends on the shape of the investor's utility function or risk attitude i.e.

- The greater (lower) the concavity or the higher (lower) the risk-aversion, the greater (smaller) the number of securities included in a layer, reflecting a diversified (concentrated or non-diversified) portfolio.

4) The optimal portfolio of a BPT investor may not necessarily be well-diversified. For example, when investors believe to have informational advantage with respect to the securities, they may tend to hold a concentrated portfolio composed of those few securities.

5) Higher loss-averse investors may allocate higher amount to the lowest downside protection layer (i.e. may hold cash or invest in riskless assets) and may tend to suffer from loss-aversion bias.




**Practice: Example 3, Volume 2, Reading 7.**

### 4.3.4) Adaptive Markets Hypothesis (AMH)

The AMH is a revised version of the efficient market hypothesis and it attempts to reconcile efficient market theories with behavioral finance theories.

The Adaptive Markets Hypothesis implies that the degree of market efficiency and financial industry evolution is related to environmental factors that shape the market ecology i.e. number of competitors in the market, the

magnitude of profit opportunities available, and the adaptability of the market participants.
According to the AMH, ***success depends on the ability of an individual to survive*** rather than to achieve highest expected utility.

The AMH is based on the following three principles of evolution:

***1) Competition:*** The greater the competition for scarce resources or the greater the number of competitors in the market, the more difficult it is to survive. Competition drives adaptation and innovation.

***2) Adaption:*** Individuals make mistakes, learn and adapt. The less adaptable the market participants under high competition circumstances and changing environment conditions, the lower the likelihood of surviving.

***3) Natural selection:*** Natural selection shapes market ecology.

**Five implications of the AMH:**

1) The equity risk premium varies over time depending on the recent stock market environment and the demographics of investors in that environment e.g. changes in risk preferences, competitive environment etc.

- E.g. risk aversion may decrease with an increase in competition among market participants.

2) Arbitrage opportunities do arise in the financial markets from time to time which can be exploited (e.g. by using active management) to earn excess returns (i.e. alpha).

3) Any particular investment strategy will not consistently do well; this implies that any investment strategy experiences cycles of superior and inferior performance in response to changing business conditions, the adaptability of investors, number of competitors in the industry and the magnitude of profit opportunities available.

4) The ability to adapt and innovate is critically essential for survival.

5) Survival is ultimately the only vital objective.

**Practice: End of Chapter Practice Problems for Reading 7 & FinQuiz Item-sets.**