

# *Financial Risk Management*

## MSBA IN FINANCIAL RISK MANAGEMENT



# The Portfolio Management Process



# The Importance of the Portfolio Perspective

- Economic factors influence the average returns of many assets, resulting in correlations between risk and return for multiple assets.
- Analyzing assets in isolation ignores the interrelationships between assets, and can lead to misunderstanding the risk and return prospects for the investor's total position.

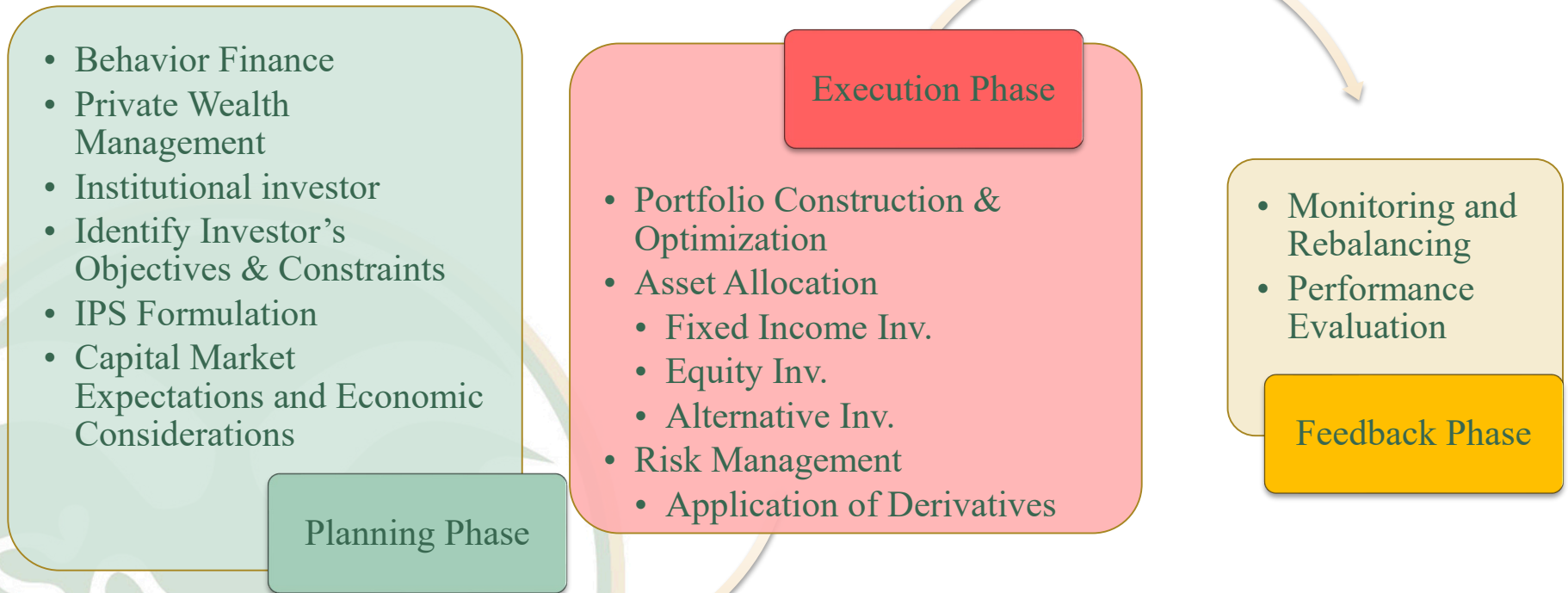


# The Portfolio Management Process

- Portfolio management is an ongoing process in which:
  - Investment objectives and constraints are identified and specified
  - Investment strategies are developed
  - Portfolio composition is decided in detail
  - Portfolio decisions are initiated by portfolio managers and implemented by traders
  - Portfolio performance is measured and evaluated
  - Investor and market conditions are monitored
  - Any necessary rebalancing is implemented

# Steps in the Portfolio Management Process

- The Planning Step.
  - Identify and specify the investor's objectives and constraints
  - Create the investment policy statement
  - Form capital market expectations
  - Create the strategic asset allocation
- The Execution Step
  - Select specific assets and implement decisions
  - Optimize the portfolio
  - Determine need for tactical asset allocation
- The Feedback Step
  - Monitoring and rebalancing
  - Performance evaluation





# The Portfolio Management Process

## The Planning Step



# Managing Portfolios of Individual Investors

- Human capital and insurance
- Investment in residence
- Saving for retirement and the assumption of risk
- Retirement planning models
- Manage your own portfolio or rely on others?





# Investment Policy Statement

- Plays a central role in the portfolio management process
- Outlines investor objectives and constraints, as well as manager requirements for reporting, rebalancing, fees, strategy and style
- Ensures that all future investment decisions are consistent with outlined objectives and constraints
- When visiting a new destination, it helps to map out the directions. An IPS is the map, activity schedule and outcome document between a financial advisor and client.

# Benefits of a Formal Investment Policy Statement

- For Clients:
  - Educational process
  - Reduces need to blindly trust adviser
  - Portable document if change in advisers or second opinion is necessary
- For advisers:
  - Protects adviser
  - Can clarify motivation for decisions
  - Can help identify questionable situations before they become serious



# Elements of an Investment Policy Statement

- Client description
- Purpose of establishing policies and guidelines
- Duties and investment responsibilities of client, manager, custodian and investment committee, particularly:
  - Fiduciary duties
  - Communication
  - Operational Efficiency
  - Accountability
- Statement of investment goals, objectives and constraints
- Schedule for review of performance and IPS
- Performance measures and benchmarks
- Special considerations
- Investment strategies and style
- Guidelines for portfolio rebalancing



# Example of an Investment Policy Statement

- Investor First Advisory, LLC Investment Policy Statement
- **Executive Summary:**
- Juan Martinez, Individual Investor, age 55
  - Portfolio: Individual, Taxable
  - State: California
  - Tax ID: xxx-xx-xxxx
  - Current Assets: \$500,000
  - Return Goal: 6%
  - 1-year loss limit (worst case scenario): 15-18%
- **Objectives:**
  - Long term growth and capital preservation.
  - Risk profile: Conservative
  - Time horizon: Greater than 5 years
  - Short term liquidity needs: None
  - Performance long-term rate of return expectation: 6%
- **Financial Advisor Duties and Responsibilities:**
  - Fiduciary, non-biased third party charged with helping client meet long-term financial goals.
  - Confer with client to create asset allocation.
  - Select assets in accord with asset allocation providing sufficient diversification of risk and returns.
- Control and report all investment costs.
- Monitor all investment options and portfolio custodian.
- (Custodian is responsible for safe keeping of client's assets)
- Value all portfolio holdings on regular basis.
- Provide monthly reports that include securities, cash flow, income, and monthly change in value.
- **Portfolio Selection Guidelines:**
  - In general, long term investment performance is determined by asset performance. Historically, stock assets offer higher rates of return along with greater volatility. Fixed assets generally yield lower rates of return, lower correlation with equities and less risk. Diversification across asset geography and size is recommended.
  - Based upon the client's conservative risk profile the portfolio asset allocation will be 60% stock assets and 40% fixed.
  - The individual composition of holdings will be selected from index funds and exchange traded funds from the following asset classes:

# Example of an Investment Policy Statement

- **Equity**

- U.S.
- High Dividend
- Value
- Small Cap
- International including developed and developing markets

- **Fixed**

- U.S. Bonds
- Corporate Bonds
- Government Bonds
- High Yield Bonds
- Real Estate Investment Trusts (REIT)
- Global Bonds
- Global REIT

- **Rebalancing of Asset Allocation:**

- According to data from Vanguard, there is no universally agreed upon asset allocation. Nor is there data to recommend rebalancing more frequently than annually. Thus, the portfolio will be rebalanced annually, while attempting to minimize the tax consequences of the asset sales.

- **Performance Monitoring:**

- Each index mutual fund or exchange traded funds' returns will be compared with their related benchmark. Deviance from that benchmark will be evaluated and discussed annually. The holdings will also be compared with peer group funds.
- The parameters for selling a fund due to poor performance include 1 year of greater than 1% deviation from benchmark and/or falling in bottom 50% of cohort fund group.
- Costs will be monitored annually to ensure that total costs do not surpass 1% of all investable assets.
- Annually, at a minimum, overall portfolio will be monitored to consider whether initial goals are in place or have changed. Performance and fees will also be included in this conference. Together, Mr. Martinez and the advisor will determine the future portfolio direction.
- <https://www.investopedia.com/articles/investing/060515/example-investment-policy-statement.asp>



## Situational Profiling

- Attempts to categorize investors by stage of life and economic circumstance
- Risk of oversimplifying complex behavior, but can be a useful first step
- Components of a situational profile include:
  - Source of wealth
  - Measure of wealth
  - Stage of life





## Situational Profiling: Source and Measure of Wealth

- Source of wealth
  - Can indicate risk tolerance
  - Entrepreneur may be willing to take business risk but unwilling to take risks that are outside his or her control
  - Heir(ess) may be less experienced and unable to recover from investment setbacks

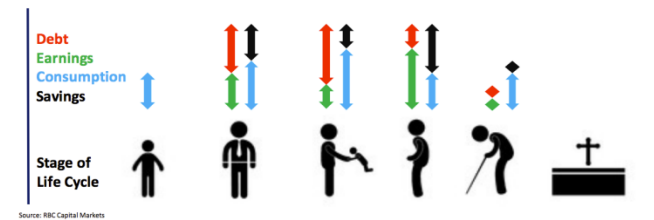
- Measure of wealth
  - How much is enough
  - Investor perceptions can differ
  - Higher perception of wealth generally allows higher risk tolerance



# Situational Profiling: Stage of Life

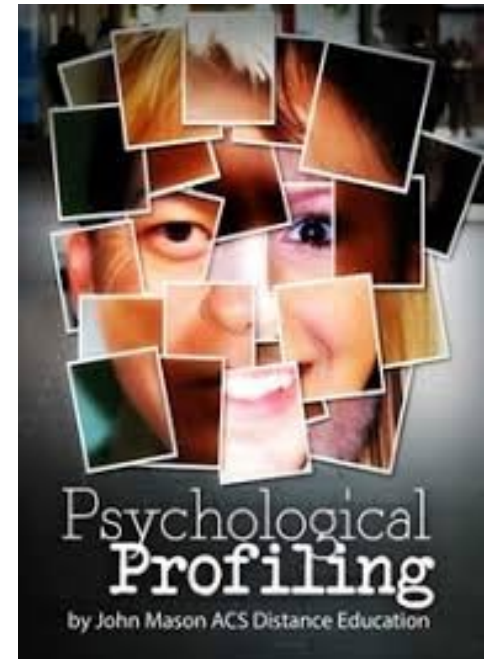
- Foundation stage:
  - Establishes base for wealth creation (skill, education, business formation)
  - Relatively young, long time horizon, increased ability to accept risk
  - Need for liquidity may outweigh risk tolerance
- Accumulation stage
  - Rising income and expenses (marriage, children, home)
  - Later income still rises but expenses decline (children grow up, home paid off), increasing ability to save
  - Increased wealth and still-long time horizon increase risk tolerance
- Maintenance stage (early retirement)
  - Need to maintain lifestyle and financial security
  - Shorter time horizon, less risk tolerance
  - Some risky assets needed to preserve purchasing power
- Distribution stage
  - Gifting to heirs or charities
  - Tax constraints require early planning
- Life events can send an investor backward (new career or family) or forward (injury or illness) to a different stage

Exhibit 4: The stage of the life cycle generally dictates our financial health



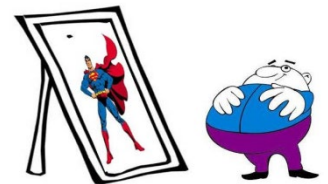
# Psychological Profiling

- Personality plays an important role in establishing investor's risk tolerance and return objectives
- Bridges the gap between traditional finance and behavioral finance
- Traditional finance measures objective circumstances, and assumes investors are risk averse, hold rational expectations and practice asset integration (portfolio context)
- Behavioral finance assumes investor psychology leads investors to be loss averse, hold biased expectations and practice asset segregation (each asset viewed independently)



# Behavioral Finance Investment Framework

- Investors are loss averse
  - Do not view risk as uncertainty but rather as the potential for gain or loss
  - More weight placed on losses than on gains
  - Actually seek risk to avoid a certain loss even when resulting in lower expected value
- Investor expectations are biased
  - Overconfident about future predictions
  - Overestimate significance of rare events and the representativeness of one asset for another
- Investors segregate assets
  - Do not consider interaction
  - Segregate into mental accounts by purpose or preference
- To accommodate behavior, portfolios should be constructed to include subjective constraints and be layered to reflect asset segregation (with the layers forming an integrated whole).





# Personality Typing Questionnaire

- Personality influenced by complex forces
- Understanding personality can lead to better management of expectations and behavior
- Often investor personality type is an ad hoc subjective judgment by the advisor
- Questionnaire can assess investor consistency with regard to behavior and decision making style
- Questionnaire results can be scored across risk tolerance and investment decision making dimensions to categorize investor into one of four groups (methodical, cautious, individualist and spontaneous)



# Investor Personality Types

- Methodical – Risk averse, decisions made based primarily on thinking
  - Rely on hard facts
  - More conservative, less emotional
- Cautious – Risk averse, decisions made based primarily on feeling
  - Loss averse
  - Uncomfortable making decisions but also not easily persuaded by advisors
  - May overanalyze and miss opportunities due to indecision
- Individualist – Less risk averse, decisions made based primarily on thinking
  - Self assured
  - Gain information from multiple sources and take time to reconcile differences
  - Put faith in hard work and insight
  - Confident in results of their efforts
- Spontaneous – Less risk averse, decisions made based primarily on feeling
  - Constantly adjusting portfolio
  - Although non-expert themselves, doubt the advice of others
  - Overmanaged, high-turnover portfolios
  - More concerned with missing a trend than with risk
  - Profits often eroded by trading costs





# Specifying Objectives

- Investment managers must assess the level of risk investors can tolerate in pursuit of higher returns.
- Objectives and risk tolerance differ by type of investor.

## GOALS & OBJECTIVES



# Types of Investment Objectives

- Risk objective
  - How to measure? Volatility, Tracking error relative to benchmark, Downside risk, Value at risk
- Ability to take risk (objective, financial measure) – spending needs, wealth targets, obligations, ability to increase savings, financial strength outside portfolio (income, ability to save)
  - Short term and long-term financial needs
  - Importance of achieving goals and consequences of failure
  - How much loss can be borne without jeopardizing major goals
- Willingness to take risk (subjective, psychological measure)
  - Appetite for risk
  - Conservative investor may be less willing than they are able
  - Aggressive investor may be more willing than they are able
- Risk tolerance/aversion: How much risk is investor both willing and able to bear?
- Risk budgeting – how should the desired level of risk be allocated among various assets?

# Types of Investment Objectives

- Return objective
  - Must be consistent with risk objective and risk objective will largely determine the return objective
  - How to measure return – total return, nominal, real, pre-tax or after-tax?
  - Return desired – is it realistic and consistent with risk objective?
  - Return needed – Specific objectives for ending wealth require specific returns in order to be met.
  - Specific return objective – incorporates above points into measurable annual return objective that could be absolute (i.e. 10%) or relative (i.e. greater than inflation or a benchmark return.)

## Types of Investment Constraints (TTLLU)

- Liquidity
- Time Horizon
- Tax concerns
- Legal and regulatory factors
- Unique circumstances



# Liquidity Requirements

- Liquidity requirements are needs for cash that exceed contributions or savings and ability to meet anticipated and unanticipated demands for cash
- Stem from liquidity events
  - Planned – buying a house in 2 years
  - Unplanned – house damaged in hurricane
- Requires allocation to assets that can be readily converted into cash without impacting value
- Transaction costs and price volatility determine a portfolio's liquidity
- Home and business are illiquid assets that may require separate consideration
- May also be met using insurance or derivative strategies





# Investment Time Horizon

- Time period associated with investment objective – short term or long-term (> 10 years)
  - Affects ability to assume risk
  - Can lead to different asset allocation
  - Must consider investor tolerance for temporary risks
  - Can be constrained by multiple objectives at different times
  - Other constraints interact with time horizon to affect portfolio choice
- Longer time horizon typically allows:
  - higher risk tolerance
  - higher allocation to risky assets
- Multiple time horizons must be considered and can modify ability to accept risk
- Investor willingness and ability to accept risk can limit risk taking available with longer horizon
- Stage of life not always inverse to time horizon – as wealth increases multi-generational plans are more likely





# Taxes Constraint

- Universal and complex
  - Different tax rates applied to income/dividends/gains tax (profits on investments)
  - Property tax (real or financial property)
  - Estate taxes
  - Wealth transfer tax (gift or estate taxes)
  - Tax advantaged savings vehicles
  - Potential policy changes



# Taxes Constraint

- Investment plans must be based on after-tax perspective
- Tax deferral – more frequent periodic payments diminish wealth, so some plans try to defer tax payment as long as possible
- Tax avoidance – tax exempt investments typically come at expense of lower returns, liquidity or control
- Tax reduction – different rates for income or gains
- Wealth transfer – Early transfers (pre-death) may be desirable and also may result in longer tax deferral



# Tax Sheltering for Individual Investors

- Tax-deferral option - controlling the timing of gains on investments.
- Tax-deferred retirement plans
  - IRAs
  - Keogh plans
- Deferred annuities
  - Fixed
  - Variable
- Variable and universal life insurance



## The Tax Shelter

Strategies To Keep More of Your Earnings

# Legal and Regulatory Constraint

- Limits on allocations to certain assets
- Limits on investments in tax-advantaged accounts
- Vary by country and change frequently
- Investment managers must be sure to avoid offering advice that constitutes practice of law
- Trusts
  - Revocable trusts are controlled by grantor, who pays relevant taxes
  - Irrevocable trusts are controlled by trustee, and trust pays own taxes
- Family foundations can be set up to facilitate gifting to children, grandchildren or gifting with a retained interest
- Jurisdiction of taxation and applicable laws





# Unique Circumstances

- Social concerns
- Health needs
- Dependents
- Expertise



**SOCIAL  
CONCERNS**



# Approaches to Investing

- Passive approach does not react to changes in capital market expectations
  - Indexing – holds a portfolio designed to replicate the return of a benchmark index
  - Strict buy and hold strategy selects a group of non-indexed securities to hold until maturity
- Active approach responds to changing conditions.
  - Holdings differ from benchmark according to management's assessment of each holding
  - Goal is to produce excess return (alpha) relative to the benchmark
- Semiactive, risk-controlled active or enhanced index approach seeks positive alpha while tightly controlling risk factors



## Capital Market Expectations

- Managers should form long-term forecasts of the risk and return characteristics of asset classes
- Forms the basis for choosing portfolios that minimize risk relative to return or maximize return relative to risk
- Influences asset allocation strategy and frequency of rebalancing

## Ethical Conduct

- Portfolio manager conduct affects the well-being of clients and others
- Acting in a position of trust, which must be earned
- Ethical conduct is a foundational requirement for managing investment portfolios
- Reflected in the Code of Ethics and Standards of Professional Conduct

# The Portfolio Management Process

## The Execution Step



## Strategic Asset Allocation

- Combine IPS with capital market expectations to determine target weight for each asset class (possibly maximum and minimum weight range)
- Single period perspective simplest
- Multiple period perspective can address liquidity and tax considerations arising from rebalancing as well as serial correlations in returns, but is more costly

# Portfolio Selection, Composition and Implementation

- Portfolio Selection/Composition Decision
  - Managers initiate portfolio decisions based on analysts' input
  - May involve a quantitative optimization process
- Portfolio Implementation Decision
  - Trading desk implements decision
  - Must incorporate transaction costs, including explicit (commissions, fees and taxes) and implicit costs (bid-ask spread, market impact, and opportunity costs when orders are unable to be filled or are filled slowly)





# Asset Allocation

- Deciding how much of the portfolio to invest in each major asset category.
  1. Specify asset classes
  2. Specify capital market expectation
  3. Derive the efficient portfolio frontier
  4. Find the optimal asset mix
  5. Manage taxes



# Trading Costs

- Explicit cost of trading
  - Brokerage Commission
  - fees, taxes
- Implicit cost of trading
  - Bid-ask Spread
  - Missed trade opportunity costs
  - Delay cost



# The Portfolio Management Process

## The Feedback Step



# Performance Evaluation

- Performance evaluation is needed to monitor investor progress toward goals and measure manager skill



- Skill assessment has three components
  - Performance measurement – rate of return
  - Performance attribution – sources of return include strategic allocation, market timing and security selection
  - Performance appraisal – comparison to benchmark

# Monitoring and Rebalancing Portfolios

- Changes in investor circumstances or in market and economic conditions provide feedback to the portfolio management process
- Process needed to keep informed of changes in client circumstances and possible changes in strategic asset allocation that may result
- Changing economic and market conditions cause assets to drift away from target weight and necessitate rebalancing portfolio to ensure client objectives and constraints remain satisfied



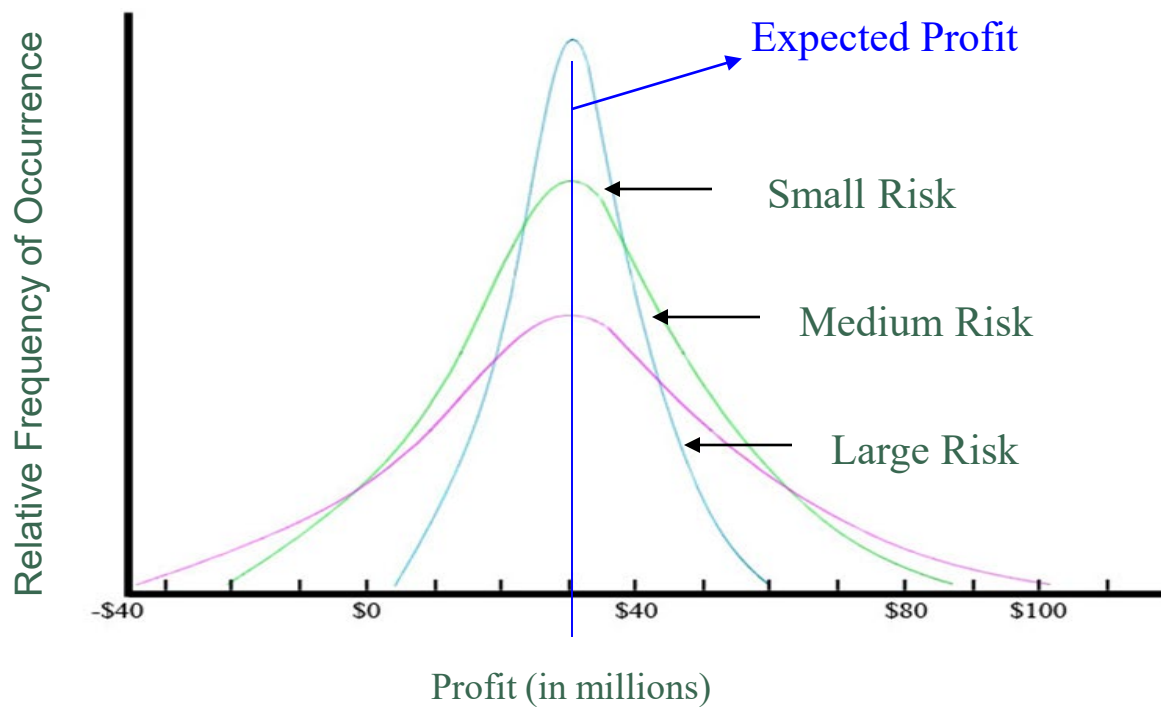
# Risk Measures



# Measures of Risk

## □ Measure of risk?

Profit Distributions for Three different Investment Projects



# Measures of Risk

## □ Range : max - min

- Distance between the highest possible outcome value to the lowest
- Provides a rough measure of the worst situation

## □ Standard Deviation (Volatility) : $\sigma$

- Measure of Average Deviation

## □ Coefficient of variation : $\frac{\sigma}{\mu}$

- A relative value of risk when the means of the distributions to be compared are not equal
- Equals standard deviation divided by mean

# Measures of Risk

## □ Semi-Variance

- Average square deviation, where now sum only the deviations *below* the expected value
- With asymmetric distributions, variance or semi-variance leads to different decisions

- Semi-Standard Deviation =

$$\sqrt{(1 / N_L) \sum_{i=1}^N \text{Min}(0, x_i)^2}$$
$$N_L = \text{count}(x_i < 0)$$

## □ Drawdown

$$DD_i = \frac{x_{max} - x_i}{x_{max}}$$

$$\text{Max drawdown} = \max_i (DD_i)$$

# Measures of Risk - Using Statistics

- ❑ **Skewness:** Skewness measures the degree of asymmetry of a distribution around its mean.
  - ❑ Positive skewness indicates a distribution with an asymmetric tail extending toward more positive values. Negative skewness indicates a distribution with an asymmetric tail extending toward more negative values.
- ❑ **Kurtosis:** Kurtosis measures the degree to which a distribution is more or less peaked than a normal distribution.
  - ❑ Positive kurtosis indicates a relatively peaked distribution. Negative kurtosis indicates a relatively flat distribution. A normal distribution has a kurtosis of 3. Therefore, an investment characterized by high kurtosis will have “fat tails” (higher frequencies of outcomes) at the extreme negative and positive ends of the distribution curve. A distribution of returns exhibiting high kurtosis tends to overestimate the probability of achieving the mean return.

NAME	MOMENT	COMMON NAME	CHARACTERISTIC	PREFERENCE
Mean	First	Expected Return	Balance point of the area under the distribution	Higher values with higher moments constant
Standard Deviation (variance)	Second	Volatility	Measure of the width (dispersion)	Lowest value to meet requirement
Skewness	Third	Fat tail	Measure of symmetry	Positive
Kurtosis	Fourth	Fat tail	Measure of shape, tall or flat	Negative downside, positive upside (Note: Kurtosis for a normal distribution is 3)



# Measures of Risk - Using Statistics

## □ Semi-Variance

- Average square deviation, where now sum only the deviations *below* the expected value
- With asymmetric distributions, variance or semi-variance leads to different decisions

$$SV_{lower}(X) = \frac{1}{n-1} \sum [(X - \bar{X})^2 \cdot IF(X \leq \bar{X})]$$

- Semi-Standard Deviation =  $SV_{upper}(X) = \frac{1}{n-1} \sum [(X - \bar{X})^2 \cdot IF(X \geq \bar{X})] = VAR(X) - SV_{lower}(X)$

□ **Gain/Loss Ratio** = ABS (Average Gain in Gain Period ÷ Average Loss in Loss Period)

□ **Diversification ratio** is the portfolio's weighted average asset volatility to its actual volatility.

$$DR(P) = \frac{\text{Combination of the risks}}{\text{Risk of the combination}} = \frac{\sigma_1 \omega_1 + \sigma_2 \omega_2 + \dots + \sigma_n \omega_n}{\sigma_p}$$

- <http://investexcel.net/downside-deviation-excel>

## Risk parity

- Risk parity (or risk premia parity) is an approach to investment portfolio management which focuses on allocation of risk, usually defined as volatility, rather than allocation of capital.
- The best known version of risk parity is the equally-weighted risk contributions portfolio method.

# Measures of Relative Risk

## □ CAPM $\beta$ (Capital Asset Pricing Model)

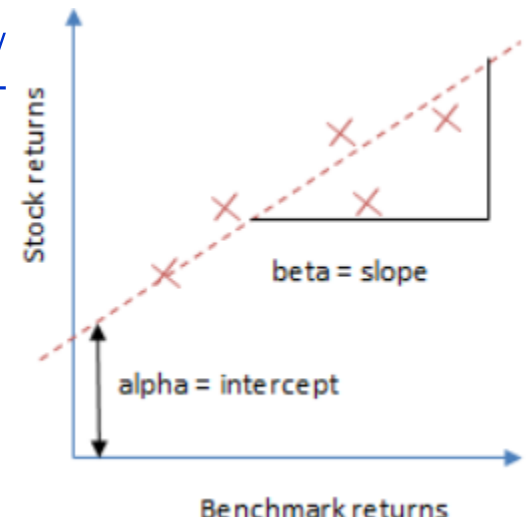
- A measure of the volatility, or systematic risk, of a security or a portfolio in comparison to the market as a whole.

<http://investexcel.net/calculate-stock-beta-with-excel/>

## □ Jensen alpha = $E(R_P) - [R_r + \beta_P(E(R_M) - R_r)]$

- Asset's excess return over the return predicted by the CAPM.

<http://investexcel.net/jensens-alpha-excel/>



# Measures of Relative Risk

□ Sharpe Ratio =  $\frac{E(R_P) - R_f}{\sigma_P}$

- The Sharpe ratio tells us whether a portfolio's returns are due to smart investment decisions or a result of excess risk.

<http://investexcel.net/calculating-the-sharpe-ratio-with-excel>

- <http://investexcel.net/calculating-a-sharpe-optimal-portfolio-with-excel/>

□ Treynor Ratio =  $\frac{E(R_P) - R_f}{\beta_P}$

- A risk-adjusted measure of return based on systematic risk.

- It is similar to the Sharpe ratio, with the difference being that the Treynor ratio uses beta as the measurement of volatility.

<http://investexcel.net/treynor-ratio-excel/>

□ Sortino Ratio =  $\frac{E(R_P) - R_f}{\text{Semi-Standard Deviation}}$

- A risk-adjusted measure of return based on Asymmetric risk.

<http://investexcel.net/calculate-the-sortino-ratio-with-excel>

# Roy's Safety-First Criterion - SFRatio

- Roy's safety-first criterion is an approach to investment decisions that sets a minimum required return for a given level of risk. The Roy's safety-first criterion allows portfolios to be compared based on the probability that their returns will fall below this minimum desired threshold.
- It is calculated by subtracting the minimum desired return from the expected return of the portfolio and dividing the result by the standard deviation of portfolio returns. The optimal portfolio will be the one that minimizes the probability that the portfolio's return will fall below a threshold level. Also known as the SFRatio.

$$RSF = \frac{\hat{R}_P - R_{MAR}}{\sigma_P}$$



# M2 Measure

- ❑ Modigliani risk-adjusted performance (also known as  $M^2$ , M2, Modigliani–Modigliani measure or RAP).
  - ❑ It is derived from the widely used Sharpe ratio, but it has the significant advantage of being in units of percent return (as opposed to the Sharpe ratio – an abstract, dimensionless ratio of limited utility to most investors), which makes it dramatically more intuitive to interpret.
- ❑ In 1997, Nobel-prize winner [Franco Modigliani](#) and his granddaughter, Leah Modigliani, developed what is now called the Modigliani risk-adjusted performance measure.<sup>[3]</sup> They originally called it "RAP" (risk-adjusted performance).
- ❑ They also defined a related statistic, "RAPA" (presumably, an abbreviation of "risk-adjusted performance [alpha](#)"), which was defined as RAP minus the [risk-free rate](#) (i.e., it only involved the risk-adjusted return above the [risk-free rate](#)). Thus, RAPA was effectively the risk-adjusted excess return.

# M2 Measure

## STEP 1

First of all, we need to calculate the Sharpe ratio. In a next step, we will use the Sharpe ratio to derive the m2 measure. Thus, first we perform the following calculation, which is just the standard (annual) Sharpe ratio equation.

$$SR = \frac{r_p - r_f}{\sigma_p}$$

## STEP 2

The second step consists of multiplying the Sharpe ratio by the (annualized) *standard deviation* of a **benchmark**. The benchmark can be freely chosen, e.g. the S&P500 index, the MSCI World index, or another broad index.

# M2 Measure

## STEP 3

In a last step, we add the risk free rate is again

$$M2 = SR \cdot \sigma_{bench} + r_f$$

We can rewrite the above measure differently to get a better understanding of what the m2 measure captures. As shown in the equation below, the M2 measure equals the excess return weighted over the benchmark's and portfolio's standard deviation and increased with the risk free return. Clearly, the M2 measure just equals the portfolio's return when had the standard deviation of the portfolio equaled that of the benchmark. This is the case when happens when the portfolio is simply tracking an index

$$M2 = \frac{r_p - r_f}{\sigma_p} \cdot \sigma_{bench} + r_f$$

# Measures of Relative Risk

- ❑ **Tracking error** is the difference between a portfolio's returns and the benchmark or index it was meant to mimic or beat. **Tracking error** is sometimes called active risk.

$$TE = \sqrt{\frac{\sum_{i=1}^n (R_P - R_B)^2}{N-1}}$$

Where:

TE = Tracking Error

$R_P$  = Return of Manager or Fund

$R_B$  = Return of Benchmark

N = Number of Return Periods

- ❑ **Information Ratio** =  $\frac{E(R_P) - E(R_B)}{\text{tracking error}}$

- ❑ The alpha of the managed portfolio relative to its benchmark divided by the tracking error.
- ❑ <http://investexcel.net/information-ratio/>

# Modified Sharpe ratio

- The Sharpe ratio is useful when assets are normally distributed or when the investor has a quadratic utility function. This means that the portfolio is completely described by its mean and volatility. As soon as the portfolio is invested in technology stocks, distressed companies, hedge funds or high yield bonds, this ratio is not valid anymore. In that case, the risk comes not only from volatility but from higher moments like skewness and kurtosis.
- The Modified Sharpe ratio is the ratio of the excess return divided by the Modified Value-at-Risk. The modified Sharpe ratio is:



## Modified Sharpe ratio

- The Modified Sharpe ratio is the ratio of the excess return divided by the Modified Value-at-Risk. The modified Sharpe ratio is:

$$\text{Modified Sharpe Ratio}_p = -\frac{\mu - R_f}{R_f - MVaR_p}$$

- where the Modified VaR is equal to:

$$MVaR_p = \mu + \left[ z_p + \frac{1}{6}(z_p^2 - 1)S + \frac{1}{24}(z_p^3 - 3z_p)K - \frac{1}{36}(2z_p^3 - 5z_p)S^2 \right] \sigma$$

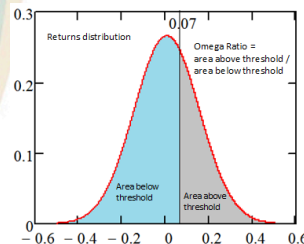
- <http://investexcel.net/calculate-the-modified-sharpe-ratio-with-excel/>

# Omega Ratio

- Traditional performance benchmarks (like the [Sharpe Ratio](#) or [Sortino Ratio](#)) approximate the returns distribution with the mean and the standard deviation. This implicitly assumes that the returns are normally distributed, and discards effects like skew and kurtosis.
- The [Omega Ratio](#), however, captures all the information in the returns distribution. It divides the returns distribution into two parts; one part above a threshold and one part below a threshold.

# Omega Ratio

- The Omega Ratio is simply the area above the threshold divided by the area below the threshold, as described by this equation.
- In taking this approach, the Omega Ratio models the effect of the disastrous high-impact, low-probability events that are not predicted by a normal distribution.
- The Omega Ratio is increasingly being used to benchmark the performance of hedge funds, and other non-traditional investments. These often have an asymmetric returns distribution with significant skew and kurtosis.



# Omega Ratio

- Omega Ratio – The Omega Ratio is a measure of performance that doesn't assume a normal distribution of returns.
- The Omega ratio is a relative measure of the likelihood of achieving a given return, such as a minimum acceptable return (MAR) or a target return.
- The higher the omega value, the greater the probability that a given return will be met or exceeded. Omega represents a ratio of the cumulative probability of an investment's outcome above an investor's defined return level (a threshold level), to the cumulative probability of an investment's outcome below an investor's threshold level. The omega concept divides expected returns into two parts – gains and losses, or returns above the expected rate (the upside) and those below it (the downside). Therefore, in simple terms, consider omega as the ratio of upside returns (good) relative to downside returns (bad).

$$\Omega(r) = \frac{\int_r^b (1-F(x))dx}{\int_a^r F(x)dx}$$

# Kelly Criterion

- The Kelly bet size is found by maximizing the expected value of the logarithm of wealth, which is equivalent to maximizing the expected geometric growth rate.

For simple bets with two outcomes, one involving losing the entire amount bet, and the other involving winning the bet amount multiplied by the payoff [odds](#), the Kelly bet is:

$$f^* = \frac{bp - q}{b} = \frac{bp - (1 - p)}{b} = \frac{p(b + 1) - 1}{b}$$

where:

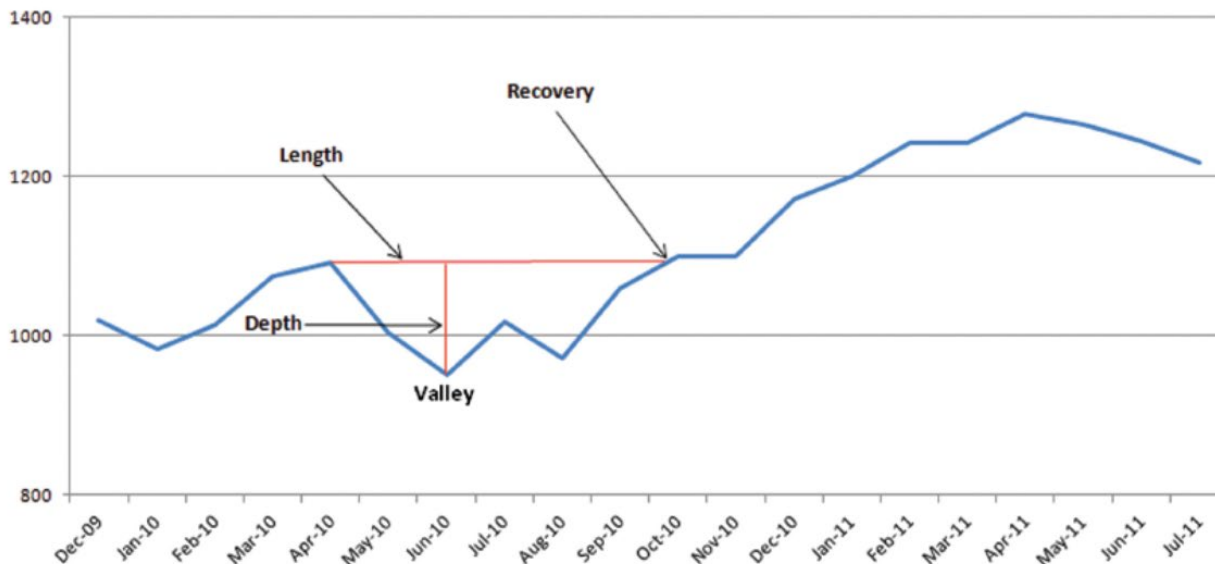
- $f^*$  is the fraction of the current bankroll to wager, i.e. how much to bet;
- $b$  is the net odds received on the wager (" $b$  to 1"), that is, you could win \$ $b$  (on top of getting back the wagered \$1) for a \$1 bet;
- $p$  is the probability of winning;
- $q$  is the probability of losing, which is  $1 - p$ .

As an example, if a gamble has a 60% chance of winning ( $p = 0.60$ ,  $q = 0.40$ ), and the gambler receives 1-to-1 odds on a winning bet ( $b = 1$ ), then the gambler should bet 20% of the bankroll at each opportunity ( $f^* = 0.20$ ), in order to maximize the long-run growth rate of the bankroll.



# Drawdown Analysis

- Drawdown analysis can be an excellent way to screen investments. A Maximum Drawdown is the maximum amount of loss from an equity high through the drawdown and back to the point the equity high is reached again. There could be many drawdowns over a given date range and will be listed starting with the maximum drawdown.

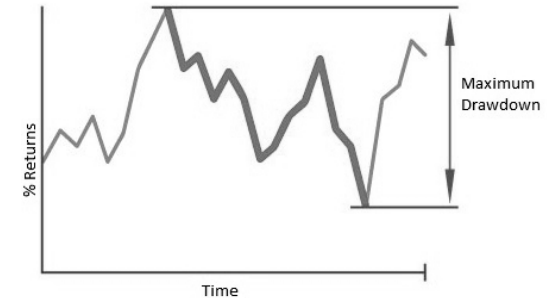


# Drawdown Analysis

- Maximum Drawdown

$$DD_i = \frac{x_{max} - x_i}{x_{max}}$$

$$\text{Max drawdown} = \max_i(DD_i)$$



- Calmar Ratio: The Calmar ratio is the annualized return (for the last 3 years) divided by the maximum drawdown during these years.

$$\text{Calmar Ratio} = \frac{\text{Annualized ROR (last 3 years)}}{\text{Maximum Drawdown (last 3 years)}}$$

$$\text{Calmar Ratio} = \frac{\text{Compounded Annual Return}}{\text{Maximum Drawdown}}$$

- Sterling Ratio: The Sterling ratio is the annualized return (for the last 3 years) divided by the average of the maximum drawdown (in absolute terms) in each of the preceding 3 years, less an arbitrary 10%. An extra 10% is subtracted from the drawdown as one assumes that all maximum drawdowns will be exceeded.

$$\text{Sterling Ratio} = \frac{\text{Annualized ROR (last 3 years)}}{\text{absolute (Average Drawdown - 10%)}}$$

# Portfolio Optimization

- Mean variance optimization – Find the optimal risk adjusted portfolio that lies on the efficient frontier
- Minimize Conditional Value-at-Risk – Optimize the portfolio to minimize the expected tail loss
- Minimize maximum drawdown – Find the portfolio with the minimum worst case drawdown with optional minimum acceptable return
  - Maximize Sortino ratio – Find the portfolio that maximizes the Sortino ratio for the given minimum acceptable return
  - Maximize Omega ratio – Find the portfolio that maximizes the Omega ratio for the given minimum acceptable return
  - Risk Parity – Find the portfolio that equalizes the risk contribution of portfolio assets

# Importing Historical Stock Prices from Yahoo

- This Excel spreadsheet imports historical stock prices from Yahoo Finance (<http://finance.yahoo.com>). You don't need to manually import data with text files. You simply need to specify a ticker symbol, your start and end dates, and then click a button.
- <http://investexcel.net/importing-historical-stock-prices-from-yahoo-into-excel/>
- <http://investexcel.net/google-finance-stock-quotes-in-excel/>

## Multiple Stock Quote Downloader for Excel

- This Excel spreadsheet downloads multiple historical stock quotes into Excel. Just enter a series of ticker symbols, two dates, and click a button.
- This data can be used for [correlation analysis](#), technical analysis with [RSI](#) and [ATR](#), historical back-testing, [portfolio optimization](#) and much more.
- <http://investexcel.net/multiple-stock-quote-downloader-for-excel/>



# Cartoon



"Before we discuss the status of your investment portfolio, do either of you have a heart condition?"