Asset Performance Management

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Asset Management

- Replace poles before failure
- Maintain transformers before failure
- Replace insulators before failure
- Maintain tree trimming before failure
- Maintain inventory of spare transformers
- Etc.

Equivalences

- Asset Management
  - Maximize profit within contract constraints
  - Subject to sufficient cash flow
  - Subject to time horizon
  - Without taking significant risk
- Risk Management
  - Limit losses
  - Mitigate potential losses

Supply Chain

- Fuel resource
  - Coal, oil, natural gas, wind, water, etc.
- Transportation to conversion facility
- Conversion to electricity – GENCO
- Transportation to customer site – TRANSCO and DISTCO
- Customer use
  - Light, heat, movement, communication, analysis, etc.

Other Supply Chains

- Natural gas pipelines
  - Connect NG to customer application
  - Storage, limited
- LNG, CNG
  - Global connection for NG
- Oil pipelines, and truck delivery
  - Storage, limited
- Wind, hydrogen, biomass, etc.
  - Distributed generation

Selection of Supply Chain

- Customer buys commodity
  - Heat – (electricity, natural gas, oil, coal, hydrogen, wood, etc.)
  - Lights – (electricity, ?)
  - Movement – (gas, oil, hydrogen, biomass, diesel or other petroleum based fuels)
  - Cooling – (electricity, natural gas)
  - Customer can store some of these on site especially in the hydrogen economy with fuel cells

Timing of Selection

- Customer can alter the time table of consumption
  - Cold storage
  - Heat storage
  - Fuel storage
  - Compressed air
  - Hydrogen generation

Company Position

- Framework for financial audit and corporate governance, based on economic laws

- Provides ability:
  - Identify important risks to firm
  - Classify risks as controllable and uncontrollable
  - Identify causes
  - Identify mitigation strategies
  - Provide measured feedback on changes in risks
  - Relate changes to management

Portfolio

- Firm builds a portfolio of assets
  - Equipment
  - Materials
  - Labor
  - Customers
- Asset Portfolio Characteristics
  - Liquid
  - Predictable to build business plan

Framework Implementation

- Establish business model with value adding processes and activities

- Determine risk factors and earnings functions

- Determine loss models (distributions)

- Determine threshold for loss

- Capture excess loss data (filters, scenarios, etc.)

Framework Assumptions

- Operational risk measure & control
  - must reflect variability of earnings as a result of losses due to errors and omissions and control breakdowns or rare events,
  - reflecting the two categories of
    - (a) high frequency, low impact events that are expected and cause operation losses and
    - (b) low frequency, high impact events that occur unexpectedly and cause extraordinary or excess losses.

Framework

- Integrates a measurement methodology with the business model

- Firm
  - Creates earning potential by buying and selling a portfolio of assets/commodities
  - Creates earning potential by buying resources (materials and labor)
  - Creates earnings by providing services (production)

Positions in Supply Chain

- Contracts are the glue between supplier and buyer at each point in the supply chain, for each supply chain.

- Contracts form a portfolio.

- Portfolio has to provide a suitable ROI subject to a constrained risk frontier, as suitable for a company in the same line of business, with the same WACC.

Each Link in Chain

- Each link in the chain is a company that has to provide a business plan to yield a ROI for the risk for that business.

- Each company must be able to predict (forecast) the future vector of payoffs with acceptable accuracy.

- Strategic strength of each company is it's capability to maintain it's present position in the link and, with diligence, to improve that position.

Focus Analysis

- Control of trading floor is extended to corporate wide handling of contracts

- Contracts
  - Procurement (equipment, materials, labor, etc.)
  - Sales (transportation to customer, customer procurement)
  - Contingent contracts ("insurance")

Math

- Optimization
  - maximize active returns
  - minus
  - adjusted risk penalty
- Compare-to
  - Capital Asset Pricing model (CAPM)
  - Arbitrage pricing Theory (APT)

CAPM

Assume: (1) All investors are Markowitz mean-variance investors.
(2) Short selling is allowed.
(3) There exists a risk free asset.
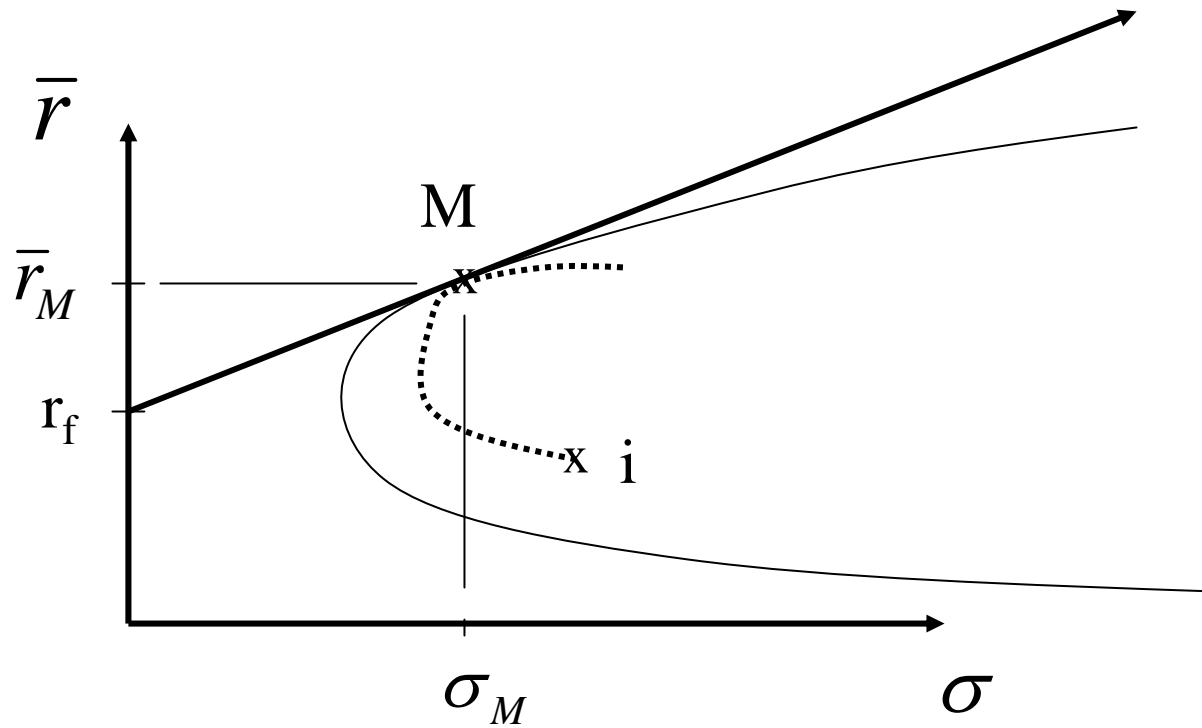(4) Investors share same predictions of means, variances and covariances

Theorem: (Capital Asset Pricing Model)

If the market portfolio M is efficient, the expected return $\bar{r}_i$ of any asset i satisfies

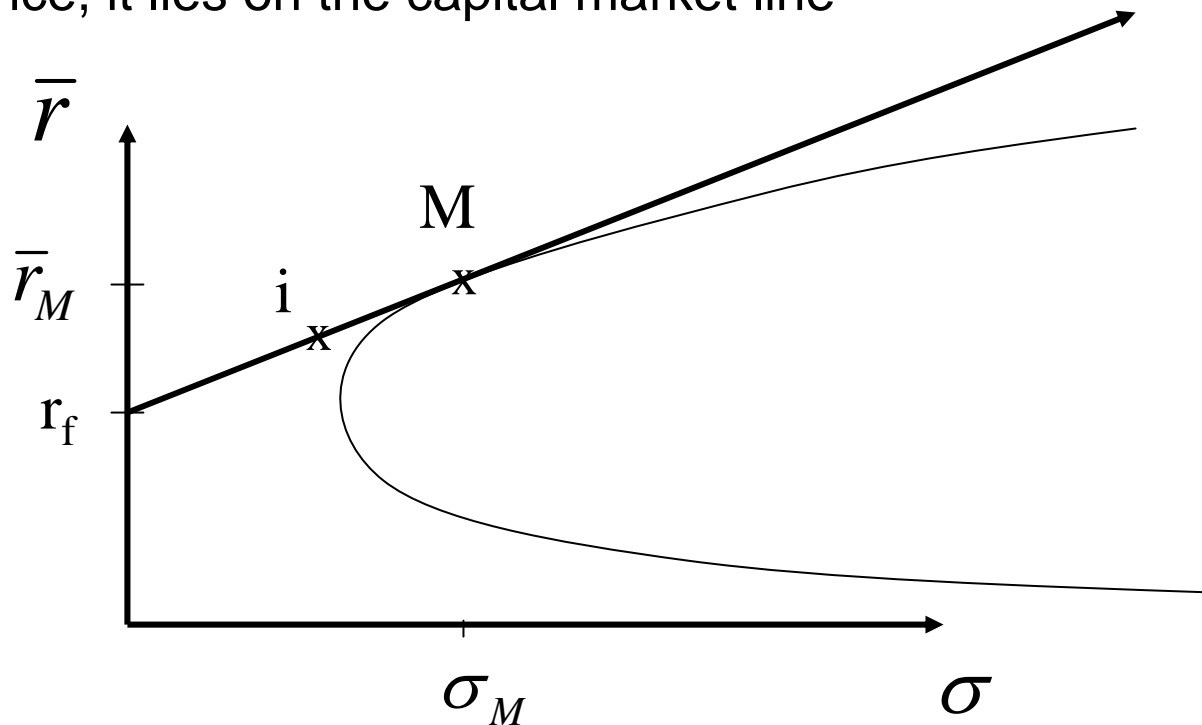$$\bar{r}_i - r_f = \beta_i(\bar{r}_M - r_f)$$

where $\beta_i = \dfrac{\sigma_{iM}}{\sigma_M^2}$
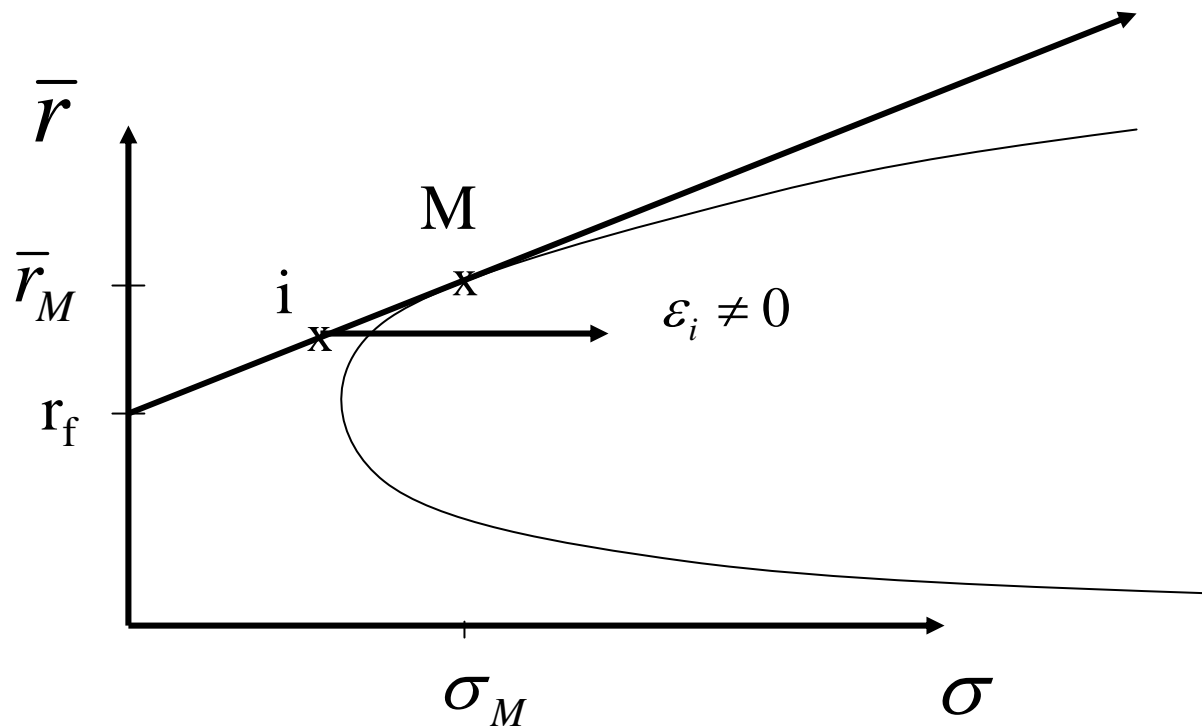
CAPM Graphic

Minimum variance

If $e_i = 0$, then this security has
　　　　minimum variance for its expected return.
Hence, it lies on the capital market line

Non-minimum variance

If $\varepsilon_i \neq 0$, this just increases the variance.

Implications of CAPM

➡ You are only rewarded (expected return) for risk that you cannot diversify away.

➡ Risk is measured by β, not the variance of your asset.

➡ The return on an asset is determined by how it fits into the market portfolio, not by its characteristics alone.

Portfolio and Security Risk

We started at the Portfolio Level

    Markowitz theory minimized the risk (variance) in optimal portfolios.

    At the portfolio level, we measured risk by the portfolio variance.

... and arrived at the Security Level

    At the security level, CAPM says risk is given by beta.

    In fact, CAPM says beta is appropriate at any level, security or portfolio.

CAPM Investment Implications

One fund theorem:
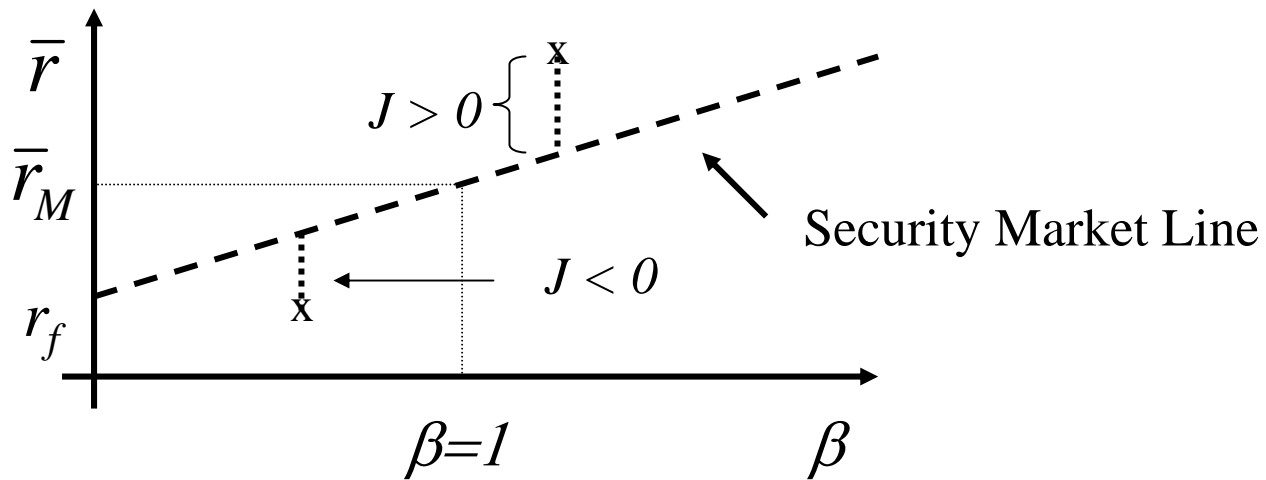
Buy the market plus treasury securities.

CAPM helps to evaluate the performance of assets and funds!
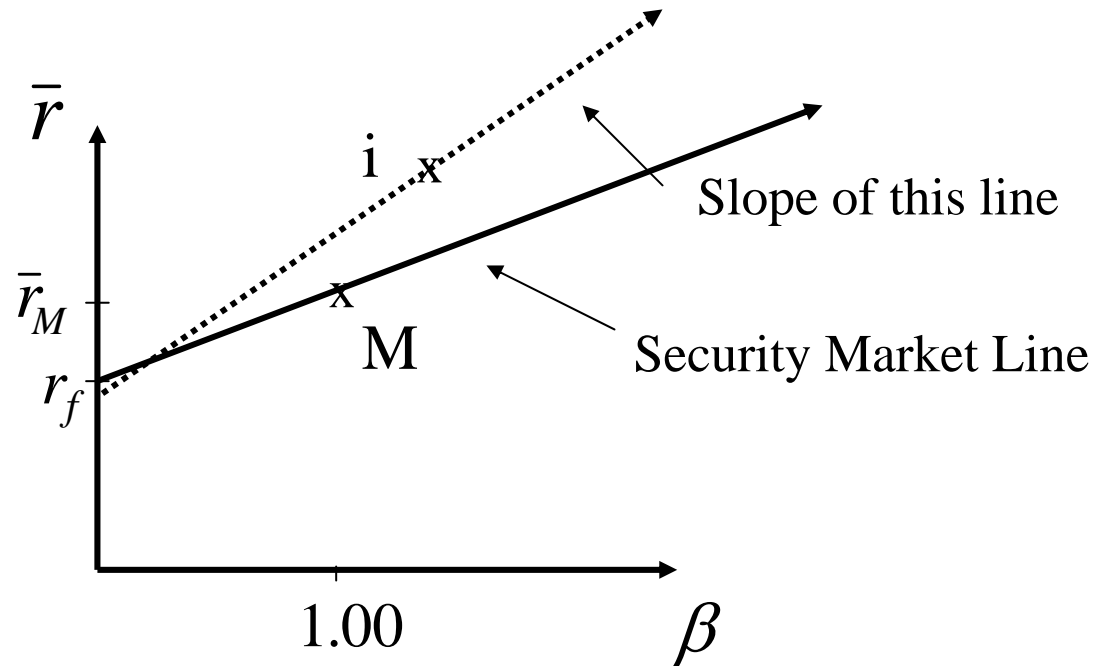
Existing Indices

– Jensen

– Treynor

– Sharpe

Jensen Index
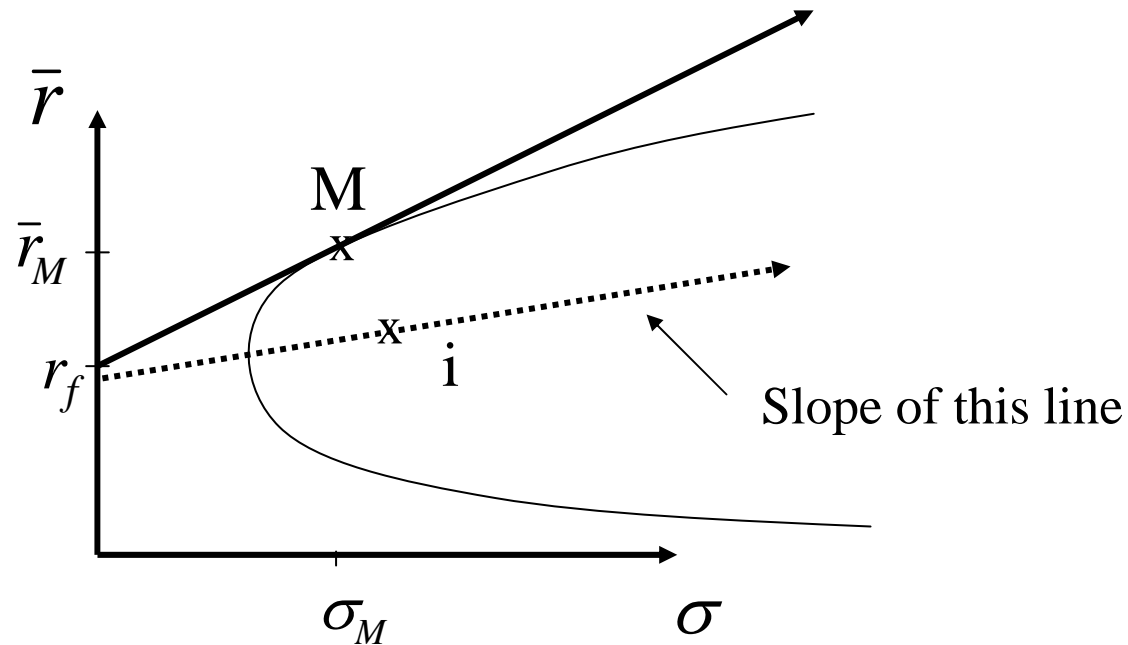
J is known as the Jensen Index.

The Treynor Index

Compute excess return per unit of risk taken.

i

Slope of this line

$\bar{r}_M$

x

M

Security Market Line

r_f

1.00 β

Treynor Index: $= \dfrac{\bar{r}_i - r_f}{\beta_i}$

Treynor index is appropriate for securities, but not portfolios

The Sharpe Index

$$\text{Sharpe Index (Ratio)} = \frac{\bar{r}_i - r_f}{\sigma_i}$$

If fund is efficient, it has the same slope as the capital market line.

Sharpe index is appropriate for portfolios.

Refinements

- Examples of statistical refinements include Bayesian corrections and adjustments for heteroskedasticity and autocorrelations.

- Extract more financial information from the time series:
  - Benchmark timing
  - A priori betas
  - Analyzing value added
  - Controlling for public information
  - Style analysis
  - Controlling for size and value

Method

- Analysis steps:
  - Performance attribution
  - Performance analysis

- Attribution focuses on a single period, attributing return to each component.

- Analysis focuses on times series of returns attributed to each component.

- Where is skill and added value found?

Factors Chosen

- Typically use standard risk-model factors as in typical investment themes
  - Value
  - Momentum
  - Data known at beginning of period (ex ante)
- Use ex post factors for return attribution
  - Data known at end of period
- Beyond manager's returns attributed to factors will remain the specific return to the portfolio, specific asset selection.

Performance Analysis

- Begins with attributed returns each period, and looks at the statically significance and value added of the attributed return series

- This relies on t statistics and information ratios tot determine statistical significance and value added.

Extension

- Next step
- Separate time series into components:
  - Average active beta and benchmark return
  - Average active beta and deviation of realized benchmark return from its expectation
  - Benchmark timing, deviations of active beta from its mean.
- First component is not a component of active management.

Key

- Balance of profit with risk appropriate for that industry
- Mitigation of risk with contingent contracts
  - Suppliers
  - Labor
  - Equipment Vendors
  - Customers
  - Other services

Advanced Tools

- Delta (error propagation)
- Extreme Value Theory (EVT)
- Event studies
- Causal modeling
- Bayesian methods
- Cross-sectional studies
- Six Sigma

Performance Attribution

- Assign returns over a single period to each factor

- Underlying principle is multiple-factor model

- Examining ex post, portfolio's exposure is known at beginning of period, as well as portfolio's realized return and estimated factor returns over the period.

Foundation

- DATA
  - Cost of production
  - Cost of negotiation
  - Cost of mitigation
  - Transaction costs
  - Regulatory costs
  - Competitor position
  - Cost of analysis
  - Etc.

FIN

Questions?