



# Rational Investing

Artificial Intelligence . Forward Beta . Valuation

Manish Aurora

212 466 1119

[manish.aurora@rationalinvesting.com](mailto:manish.aurora@rationalinvesting.com)



## Forward (Looking) Beta

- We were once told, 'We only know the past.' Our answer: It is not quite that simple.
- While no one knows the future, the forecasting process reveals quite a bit
- Potential future paths: likely, possible, and modeling limits
- Modeling limits, where valuation fundamentals break, drive the point of trade entry. E.g. If a market is trading at a P/CF of 100, a lot is possible, but making money buying stocks is not one of them
- Forecasting allows us to gravitate towards the most likely path and its potential risk as assessed by the market, resulting in a Risk Adjusted Expected Return
- In contrast, typical historical models break during structural change in the economy. To paraphrase Warren Buffet, if historical statistics were all that mattered, the actuaries would be rich.
- Rational Investing is a *forward looking* measure of a stock's expected correlation to the market, driving which is the expected sensitivity of the company's future health to that of the economy.
- Our system builds a risk adjusted Discounted Cash Flow valuation
- We use artificial intelligence to generate linked trees of contingent probabilities and expected values; our resulting expected return focuses on future risks

# Systematic Valuation Architecture



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- Rational Investing is an equity valuation system using sophisticated financial heuristics (rules)
- It parses a massive, distributed decision tree to produce a DCF model with
  - **Free Cash Flow normalization** which is reviewed and supplemented by an analyst team
  - **Projection of financial statements line item by line item** using the last 2 years of data
  - A unique, **forward looking Risk Adjusted Expected Return estimate** for each stock, impacted by company and sector fundamentals
  - The impact of **Leverage, Taxes and Monetary Policy**
- A sum-of-parts calculation highlights **capital structure and projected financing**
- The result is a sophisticated forward looking risk calculation and equity valuation system covering 4000 US and global stocks.



## Methodology Consistency, Accurate Information, and Economic Data Scrubbing

- We have scrubbed US corporate data history from SEC filings for 2750 firms
- We adjust GAAP numbers to generate sustainable cash flow, e.g.
  - Revenue is normalized from quarterly, annual, run rate, cyclical and seasonal trends
  - Cash acquisitions are added to CapEx
  - Maintenance CapEx is subtracted from EBITDA for debt service analysis
  - Outsized marketing expenses are toned down over time
- A single valuation template leads to consistency across sectors
- Our analyst team enhances the systematic results by
  - Reviewing models, within hours on request, as earnings are released, and correcting for a variety of one-off items
  - Incorporating and projecting balance sheet changes and financial engineering from disclosures in footnotes e.g. option issuance, stock issuance and buybacks
  - Building a history of M&A and divestitures to understand management behavior



## Refresher – Modern Portfolio Theory

- Risk Aversion leads to Diversification - (Maximize) Mean (Minimize) Variance
- Adding securities to a portfolio leads to convergence of returns while stabilizing variance
- Beta – Correlation to Market Portfolio is the driver of risk.
- Beta is elusive in calculation and implementation
- As US ‘industrials’ splintered, so did the measurable proxies of risk and expected returns
- Changes in the marketplace – Junk bonds, FDA approval, litigation, deregulation, swaps, intellectual property e.g. media, technology, bio-techs, momentum investing vs. private equity
- Evidence of ‘un-diversifiable’ fundamental factors in returns such as size, distress, R&D
- We use some of these factors as components to calculate forward looking risks and Beta
- Rational Investing: A comprehensive, integrated valuation model incorporating
  - **Fundamental historical inputs related to Industry, Firm, Cap Structure**
  - **The risk aversion of Public rather than Private Investors**
  - **The impact of the Yield Curve**
  - **Forward looking Risk Adjusted Expected Return**



## Fundamental Factors Used to Estimate A Forward Beta

- Rational Investing is a comprehensive solution for Equity Pricing and Debt Risk analysis
- Our Risk Adjusted Expected Return effectively calculates a forward looking beta using a multi-factor Capital Asset Pricing Model as a component of the estimation framework
  - Interest rates and growth expectations drive the impact of a variety of measurable factors
  - Inter-relationships between firm size and distress (Fama-French), R&D spending, competition, business or product cycle, regulatory burdens, debt and macro economy
- Focus on Uncertainty as Viewed by Public Markets
  - Model the risk aversion of public markets rather than private investors by applying different costs of capital to price the firm and its securities
  - The differences reflect the nature and cost of information available
  - Forward looking; 10 year projection with terminal margins reflecting barriers to entry
  - Highlight points of inflection in revenues and costs which change return expectations
- The result is a powerful research tool that produces investment candidates based on a sophisticated combination of cash flow normalization and risk evaluation
- Significant outperformance vs. S&P500 in simulation and actual trading by constructing a long/short book from the best and worst ranked valuations



## Artificial Intelligence Applied to Data Normalization and Firm Valuation

- Sophisticated interpolation, data scrubbing and boundary estimation techniques,
- Economic linkages using contingent probability based economic rules rather than statistical ratios, are used to project financial statement line items and eliminate noise in the data
- Projections are uniform across industry sectors creating a general purpose solution incorporating relevant fundamental information from the past 2 years
- Our models and support process are a unique, practical, integrated solution for equity valuation
  - Eliminate accounting tradition variations and 'guidance'; avoids 'drift' by limiting analyst role to a handful of risk factor and transaction settings
  - The reasonableness and consistency of the fit across companies and sectors allows for high confidence in relative value analysis
- Scalable software and enterprise quality infrastructure support a significant portfolio management effort
  - The underlying engineering has been refined since 1999
  - We have modeled a variety of US indexes line item by line item at [www.rationalinvesting.com](http://www.rationalinvesting.com)
  - We can support Canada, UK, India on demand, other geographies on 90 days notice.



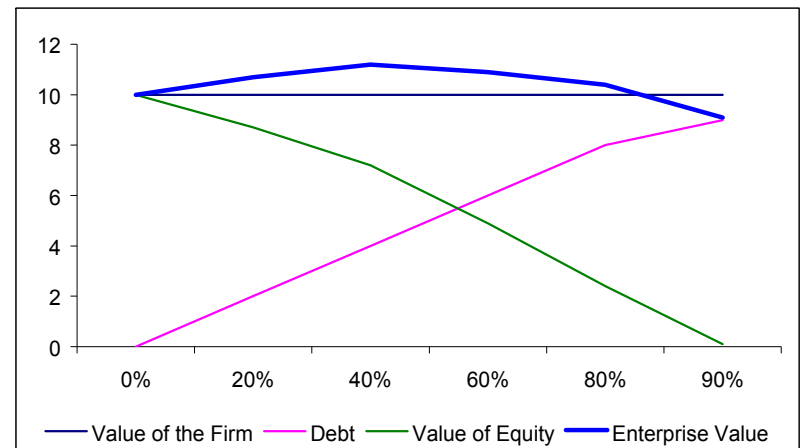
# A Superior Screening and Valuation Process

- Traditional factor screening does not account for dozens of subtle reasons why a stock might be cheap or expensive. Recursive logic can capture the impact of an infinite variety of economic conditions.
- A single set of rules avoids the difficulty of sector specific analysis, which is incapable of measuring relative value across sectors.
- A lot of risk drivers have non-linear inter-relationships driven by monetary policy
- Normalizing accounting statements across sectors and countries is critical
- The gain in productivity is remarkable: an analyst can track 10x the typical number of firms. Our reports allow a quick grip on marginal impact of information
- Our system and offshore team in Mumbai, India, do the 'economic scrubbing' and backup research on hedges, mineral reserves, debt maturity schedules. It is expensive for a firm to duplicate our results in New York, London or Tokyo
- True insight and productivity gains occur when one plays with aggregated data, or can rapidly apply changes to several hundred models
- Using a consistent methodology on the entire market produces a strong sense of relative value, and portfolio level grasp of fundamentals



# Credit, Private Market Value, and Capital Structure

- The rating agencies begin with a statistical ‘black box’, and rely upon historical correlations. Their methodologies have failed spectacularly in this recession.
- We have modeled forward risk estimation rather than historical measures into our artificial intelligence engine, and integrated with our DCF valuation
- First, the firm is valued pre-tax, disregarding capital structure - the ‘Miller-Modigliani’ line. Then financing costs are projected, including those of new issuance net of buybacks, then taxes are modeled and deducted, resulting in free cash flow to equity
- Since the system integrates equity and debt modeling, the same information consistently drives both equity valuation and debt analysis.
- The model calculates the gap between the private market value of the firm and the face value of debt and market value of equity
- The difference **after taxes** sheds light on information in equity prices regarding the quality of the firm’s balance sheet
- This gap reflects the firm’s ability to raise capital or withstand distress

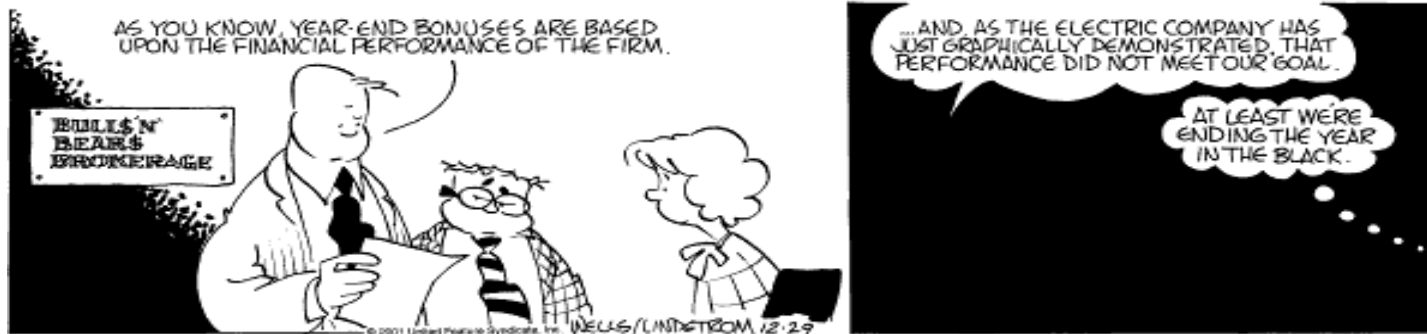




## Why Forecast Debt Service Coverage?

- The fixed income business has placed its faith in the rating agencies' historical statistical pooling process to rate creditworthiness
- Only recently have analysts started paying attention to information in stock prices
- Beta is a dynamic concept and needs to be forward looking to be accurate. The case for a good forecasting engine lies in the failure of backward looking models to adapt: to points of inflection in business and the impact of the yield curve
- Merton models (linking equity prices to debt valuation) use only market information. This approach is backward looking, and not particularly useful for high yield debt or volatile stocks
- Rational Investing uses fundamental cash flow trends and impact of refinancing to construct such linkage, which allows a look at illiquid equity or business units or private entities
- We also inject the impact of the Treasury curve and the duration of existing debt
- Rating agency models are tuned to long periods of history, and concerned with timeliness of payment before value in bankruptcy, whereas markets respond to recent trends in Debt Service Coverage in assessing future risks and price in Chapter 11 outcomes. Almost by definition, a comprehensive, forward looking measure of value is a superior tool

# A Turning Point in Financial Technology



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- **A flexible, markets driven worldview:** We observe how markets behave and construct rules to model expectations, rather than fitting historical data into theory and calling the rest 'error'.
- Our **data is superior** to other quantitative models which do not have an analyst team normalizing the true cash flow of the company and checking for errors and transactions **in the context of the model**.
- **A Forward Beta estimated from Factor Interrelationships impacting firm risk.** The historical definition of beta has proved almost irrelevant in valuation, but the concept is correct and we have created the best measure of risk. Period.
- **Unbiased Valuation and Debt Service Ratios** Our system generates a full blown DCF spreadsheet on the fly, from nothing more than a ticker.



## Results

- Intuitive and malleable Microsoft Excel valuation for non-financial, non-utility Wilshire 5000, most ADR's and many Canadian, European and Asian firms.
- Apples to apples comparison of relative value between companies in different sectors by using a single modeling template and risk factor 'switches'
- Reveal a firm's competitive position and financial strength by projecting long term trends in capital expenditure, margins, and funding costs
- Simulations of a hedged investment strategy using the Rational Investing system produce substantial market neutral returns; actual trading outperforms comparable exposure to S&P.
- The modeling process often points out issues in data; correcting data improves the model, creating a firm/period specific positive feedback loop.
- We have experience in gathering information from multiple sources and cross-checking it for emerging markets firms.
- Index valuation results are available at

<http://www.rationalinvesting.com/ETFPortfolio.asp?etf=3&name=%20Diamond>

<http://www.rationalinvesting.com/ETFPortfolio.asp?etf=2&name=%20Spider>

<http://www.rationalinvesting.com/ETFPortfolio.asp?etf=4&name=%20Nasdaq+100>



# Historical Simulation of Systematic Returns

(All sectors, exc. financials & utilities, equal weight, sample size 1,673 stocks, 4 years)

Quarter Ending	Gross Return	Average Exposure	S&P500 Return	Systematic Alpha
Jul-05	1.4%	-8.9%	6.7%	2.0%
Oct-05	0.8%	-9.9%	-2.2%	0.6%
Jan-06	1.2%	-9.9%	6.1%	1.8%
Apr-06	0.8%	-9.2%	2.4%	1.1%
Jul-06	0.2%	-10.0%	-2.6%	0.0%
Oct-06	0.7%	-10.0%	7.9%	1.5%
Jan-07	0.6%	-10.0%	4.4%	1.1%
Apr-07	0.2%	-10.0%	3.1%	0.5%
Jul-07	1.0%	-10.0%	-1.8%	0.8%
Oct-07	1.5%	-10.0%	6.5%	2.1%
Jan-08	3.1%	-9.5%	-11.0%	2.0%
Apr-08	0.6%	-6.8%	0.5%	0.7%
Jul-08	2.1%	-1.6%	-8.5%	1.9%
Oct-08	7.3%	3.9%	-23.6%	8.3%
Jan-09	2.5%	9.2%	-14.7%	3.9%
Apr-09	9.6%	8.2%	5.7%	9.1%
<b>Total</b>				<b>43.8%</b>



# Management

## **Manish Aurora**

Quantitative Methodology and Product Architecture, New York

- Co-founded Rational Investing LLC and built its first models starting in 1998. Independent analytics consultant since 1996. Runs Vidya Capital LLC, an equity long / short fund manager in startup mode.
- Designed and developed the FX trading platform of [www.fxcm.com](http://www.fxcm.com) now supporting 40,000 retail and 400 institutional clients. FXCM is the world's largest non-bank online FX dealer
- Converted Merrill's European FX derivatives exposure at NYC, London, Singapore offices to the Euro
- Reprogrammed JP Morgan's global swaps pricing and counterparty credit risk calculation using Massively Parallel Supercomputing technology
- Designed the Value at Risk calculator for the merger of Chase and Chemical, then the biggest ever, under an extremely tight deadline from the Federal Reserve
- Constructed earliest CMBS and Corporate Bond credit risk models at BlackRock, allowing it to increase its book tenfold
- Sell-side analyst at Nomura Securities covering real estate equity and debt including CMBS
- Built the first commercial paper direct issuance and investment management and reporting system for GE Capital, ITT, Ford at Financial Sciences
- MBA from the University of Chicago, BS in Computer Science from the University of Scranton



# Management

**Pieter Hellquist**      Principal Analyst and Project Management, Europe

- An international financial markets professional with over 20 years experience
- Founding Partner of FLP, a Paris based consulting firm. General Manager EMEA and Head of International Operations for Velocity, a provider of electronic trading systems
- 10 years of Eurasian experience with Citibank, most recently as Global Product Manager for a cross border equities data and trading system
- Business Development Manager for the Citi's e-commerce business in Europe before establishing a business development lab based in Australia. Played a key role in several new business initiatives, e.g. Citibank's next generation electronic FX trading system and a multi-bank confirmation service
- Marketing Manager for Information Products for Reuters - Northern Europe, based in London, for 4 years; preceded by six years in Japan where as Marketing Director he guided the company's rapid business expansion to a US\$ 100+ million turnover
- MBA from INSEAD, a Master of Industrial Engineering from Lund University in Sweden and a degree from Ecole Centrale de Paris. Pieter has lived in seven countries and speaks five languages



# Management

**Harbhajan Aurora**      Technology and Research Management, Bombay

- Head of research support and software development effort. Trains the analyst and software engineering teams in corporate finance
- Co-founded Rational Investing LLC and, since 1999, oversees the analyst team. Instrumental in creating the valuation and data normalization processes
- Coordinated all financial technology consulting projects of Distributed Risk LLC and oversaw their engineering including a financial community and the FXCM trading platform
- This is his third career and second successful entrepreneurial venture
- Principal of a textile manufacturing and trading business for 20 years in Bombay and Surat
- Head of Chicago Pneumatic's North Indian marketing, sales and client service, managing 30 professionals selling machinery for large-scale infrastructure projects of national importance
- BSE from the University of Punjab. State record for mathematics proficiency in university entrance exams