



# HOUSTON, WE HAVE BETA

From Markowitz To Free Cash Flow

Manish Aurora

Rational Investing LLC

212 466 1119

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



# The Clean Room

- Human endeavor is required to make a market efficient, but
  - Biased and Noisy
- Even those with real knowledge do not act consistently
- 80% of quantitative finance focuses on market prices. **Yet, we did not run a simulation for the first 4 years**
- Objective -> automated DCF model -> **corporate finance** with high Signal / Noise -> No guidance, consensus, or 'experts'
- Thesis - stock prices revert around a Beta captured by
  - Consistent cash flow statement normalization and projection
  - Event processing and error reduction
  - A risk adjusted forward looking discount rate
  - Out of 10 mm DCF models out there, <10 are really predictive<sub>2</sub>

# ● ● ● | Refresher – Modern Portfolio Theory

- Risk Aversion - Public vs. Private Investor - Cost of Information
- Portfolio Diversification - (Maximize) Mean (Minimize) Variance
- Beta - Correlation to Market Portfolio? No Explanatory Power!
- Isolated evidence of un-diversifiable fundamental factors in returns such as size, distress, R&D with unique payoffs
- Technology -> risk structure -> Junk bonds, CDS, CMO's
- The solution: A comprehensive, integrated discount rate incorporating
  - Beta i.e. exposure to Economic Cycle, Size, Product Cycle, Market Position
  - Macro Impact: Credit Conditions, Regulation



# Existing Quantitative Methodologies

## 5 Factors for 5 Minutes or 5 Decades

### **Short Term Anomaly or Multi-Decade Fundamentals**

- Statistical Arbitrage – price autocorrelation or mean reversion
- Multi-Factor Models – cross sectional regression on a few factors
- Very short or very long timelines - Most ‘anomalies’ face severe limits of opportunity size

### **The World is more nuanced:**

- Consistent, scalable approach to corporate finance
- Observation with intuition i.e. ‘Why?’
- Cash only - accounting is irrelevant
- Unstable Equilibrium: Macro cycle changes factor weights
- Result: A general purpose solution

# A New Reformation



Copyright © 2002 United Feature Syndicate, Inc.

- Henry VIII ended the Papal monopoly on talking to God:
  - ‘When I speak, the Lord answers’ (and grants him 5 divorces)
- Time to end S&P’s monopoly on defining risk as correlation to its indices
- A capitalization weighted index based on the historical performance of components => high (late stage) momentum risk and low size risk
- ‘Alpha’ vs. S&P 500 is, to steal a phrase from Eugene Fama, **economic nonsense**.
- So what really is Beta, anyway? And what then might alpha be?



# Building the Perfect Elephant v1.0



# Defining A Forward Beta

- If only historical correlation mattered, the actuaries would be rich.
- **Expected sensitivity of the company's cash flow to that of economy => Forward estimate of correlation to market**
- What time horizon? Beta for 30 days very different from 3 years.
- Is Harry Markowitz right? The Rational (Investing's) answer is (conceptually) Yes
- Published evidence is weak because analysis is backward looking
- Mr. Markowitz begins his presentations with a slide
  - 'In theory, there is no difference between theory and practice. In practice, there is.'
- In practice, a good DCF estimates Beta a year forward, not back



# A Whole Truth Made Up of A Lot of Partial Truths....

- **Free Cash Flow normalization** that parses hedges, asset reserves, litigation, mergers, divestitures etc.
- **Projection of financial statements** using Artificial Intelligence
- **Discount Rate** impacted by product and economic cycles
- The impact of **Leverage, and Monetary Policy**
- **Swing Analysis** – Understand movement of model vs. market
- **Marginal Returns and Costs** – Relating changes in CapEx and working capital to revenue change is hard
- **Market Neutral Constraint** – Must work just as well picking shorts as longs – destroys 80% of conventional wisdom

# Artificial Intelligence In One Template

- Parallel intertwined decision trees => nuanced execution
- Mathematics only i.e. without human bias
- A set of 'Risk Switches' rather than sector specificity
  - eliminates variance, improves noise handling, reduces cost
  - Non-linear economic linkages between risks and estimates
- Impact of R&D, economic cycle, product cycle, margins
- **Biases ruin human estimates**
  - Reasonableness and consistency of model fit across sectors => returns are superior to the best analysts' work over time
  - Risk adjusted E(R): risk mismatches => spread volatility
  - Forward looking 5-10 year projection; terminal margins reflect barriers to entry



# Scale Requires Focused Process, Intuitive Results

- Result is a classic DCF spreadsheet model
- Entire production process is focused on valuation review and swing analysis – change and consistency in mispricing
- No communication with market actors
- Cross – sectional fit: Complex inter-relationships between multiple factors are hard to isolate, but an integrated model can be tested across an entire market 2500+ G7 firms supported live
- Typical portfolio 500 longs / 500 shorts
- **When Momentum Changes - Capture points of inflection the Market takes time to react to**

- ● ●

# Version 2.0

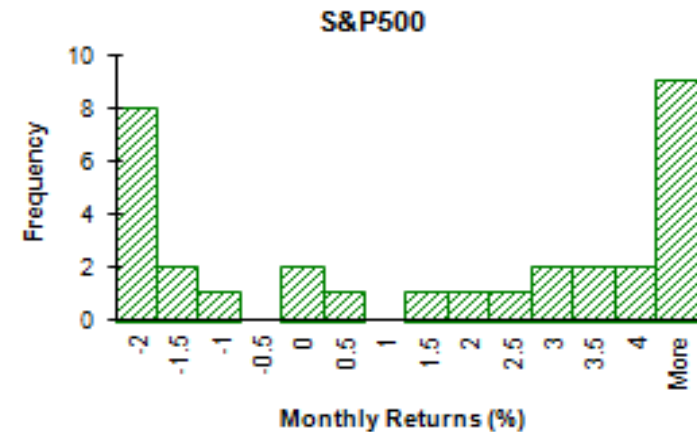
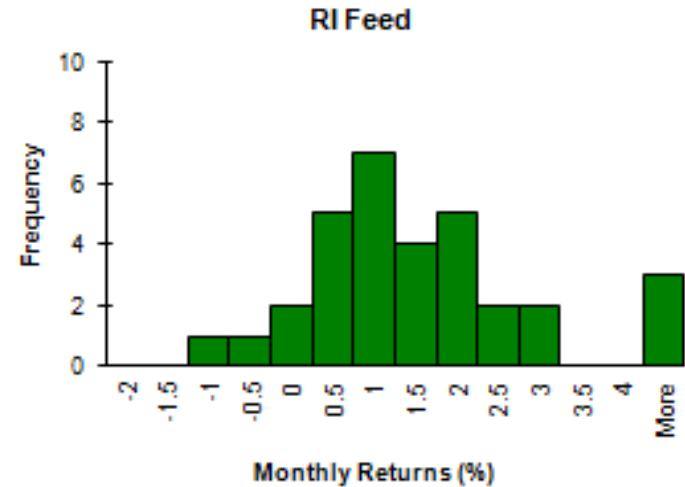


# Feed

| Qtr Ending        | Unlevered Return | Long / Short Positions | S&P500 Return |
|-------------------|------------------|------------------------|---------------|
| Feb-09            | 1.5% *           | 1215 / 106             | -18.6%        |
| May-09            | 14.4%            | 934 / 261              | 25.0%         |
| Aug-09            | 5.1%             | 761 / 373              | 11.0%         |
| Nov-09            | 2.6%             | 651 / 361              | 7.3%          |
| Feb-10            | 3.0%             | 630 / 376              | 0.8%          |
| May-10            | 4.6%             | 757 / 333              | -1.4%         |
| Aug-10            | 2.9%             | 974 / 207              | -3.7%         |
| Nov-10            | 7.9%             | 687 / 365              | 12.5%         |
| Feb-11            | 4.7%             | 619 / 434              | 12.4%         |
| May-11            | 1.1%             | 553 / 477              | 1.3%          |
| Aug-11            | -0.5%            | 687 / 386              | -9.4%         |
| <b>Cumulative</b> | <b>57.8%</b>     |                        | <b>34.8%</b>  |

\*Two months

Average Annual Return      18.6%  
 SD Annualized                      7.5%  
 Sharpe Ratio                      2.46



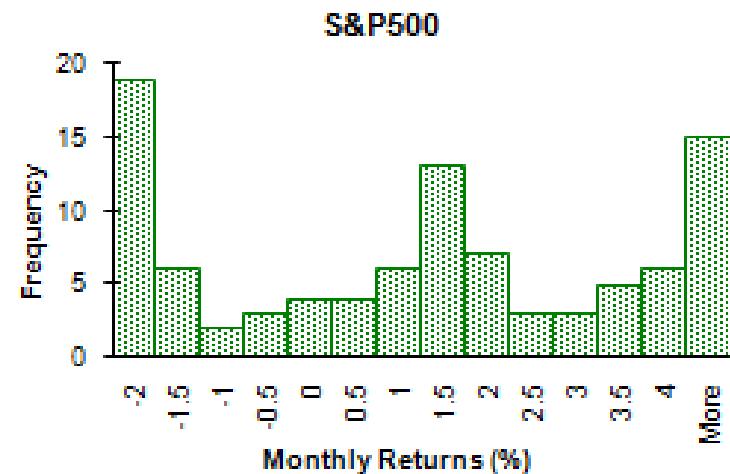
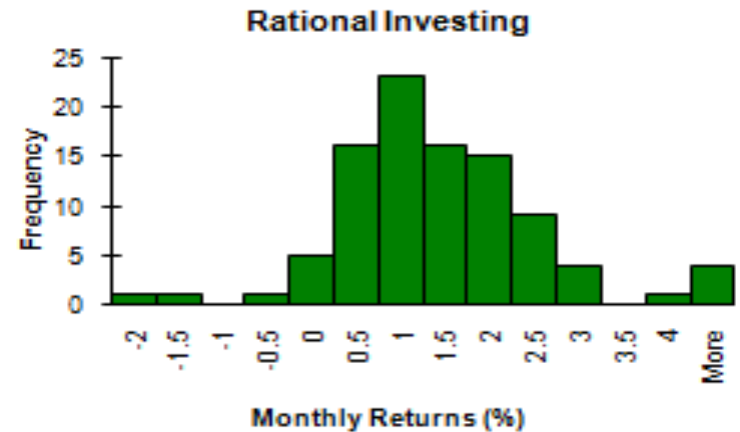
# 8 years

| Year Ending       | Unlevered Return | Long / Short Positions | S&P500 Return |
|-------------------|------------------|------------------------|---------------|
| Mar-04            | 21.5%            | 723 / 611              | 32.8%         |
| Mar-05            | 13.9%            | 686 / 708              | 4.8%          |
| Mar-06            | 11.3%            | 432 / 969              | 9.7%          |
| Mar-07            | 8.0%             | 369 / 862              | 9.7%          |
| Mar-08            | 6.4%             | 100 / 1023             | -6.9%         |
| Mar-09            | 19.4%            | 452 / 793              | -39.7%        |
| Mar-10            | 33.9%            | 979 / 333              | 46.6%         |
| Mar-11            | 18.8%            | 754 / 489              | 13.4%         |
| <b>Cumulative</b> | <b>236.0%</b>    |                        | <b>56.3%</b>  |

Average Annual Return                      16.4%

SD Annualized                                      5.2%

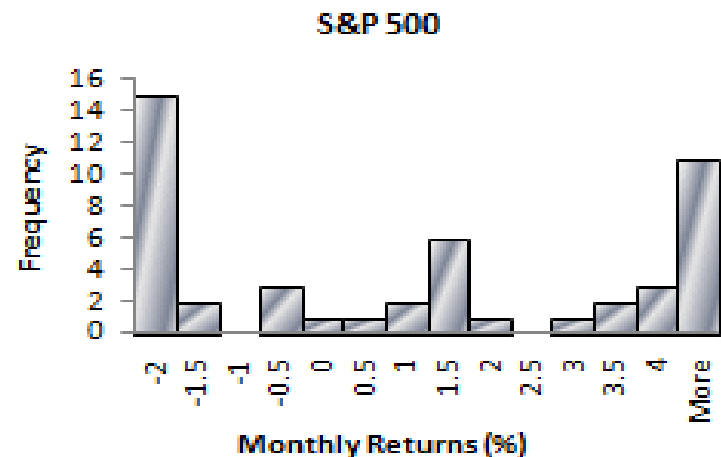
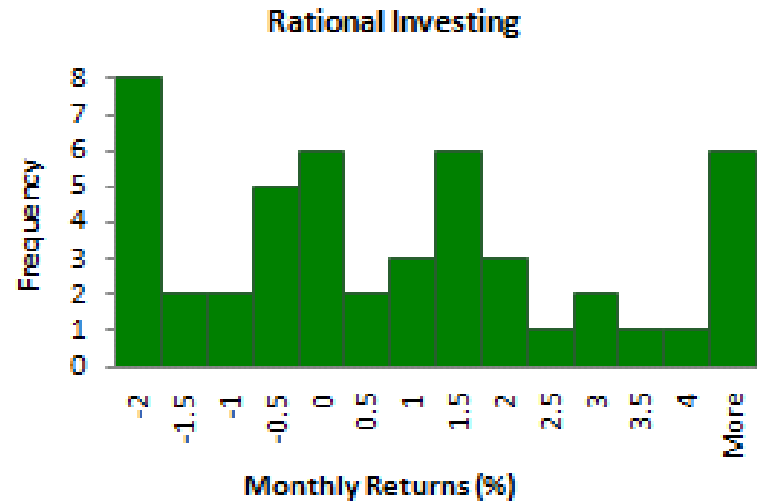
Sharpe Ratio                                        2.76



Excluding financials and utilities. Exposure is aggregate of individual buy/sell decisions by Rational Investing model, 13 10% per sector net limit, 10% monthly stop loss, 25% mis-pricing threshold for initial investment, 10% for exit .

# Credit Default Swap Simulation

| Qtr Ending        | Unlevered Return | Long / Short Positions | S&P500        |
|-------------------|------------------|------------------------|---------------|
| Mar-07            | -0.7%            | 24 / 14                | 0.2%          |
| Jun-07            | 2.2%             | 23 / 15                | 5.8%          |
| Sep-07            | -2.8%            | 41 / 11                | 1.6%          |
| Dec-07            | 10.6%            | 51 / 6                 | -3.8%         |
| Mar-08            | 29.2%            | 37 / 5                 | -9.9%         |
| Jun-08            | -1.9%            | 35 / 16                | -3.2%         |
| Sep-08            | -1.1%            | 31 / 14                | -8.9%         |
| Dec-08            | 20.8%            | 28 / 14                | -22.6%        |
| Mar-09            | -3.9%            | 36 / 14                | -11.7%        |
| Jun-09            | -3.0%            | 20 / 34                | 15.2%         |
| Sep-09            | -5.0%            | 32 / 27                | 15.0%         |
| Dec-09            | 3.0%             | 17 / 30                | 5.5%          |
| Mar-10            | -0.2%            | 11 / 39                | 4.9%          |
| Jun-10            | 7.7%             | 8 / 43                 | -11.9%        |
| Sep-10            | 3.6%             | 4 / 44                 | 10.7%         |
| Dec-10            | 0.3%             | 6 / 33                 | 10.2%         |
| <b>Cumulative</b> | <b>68.1%</b>     |                        | <b>-11.3%</b> |

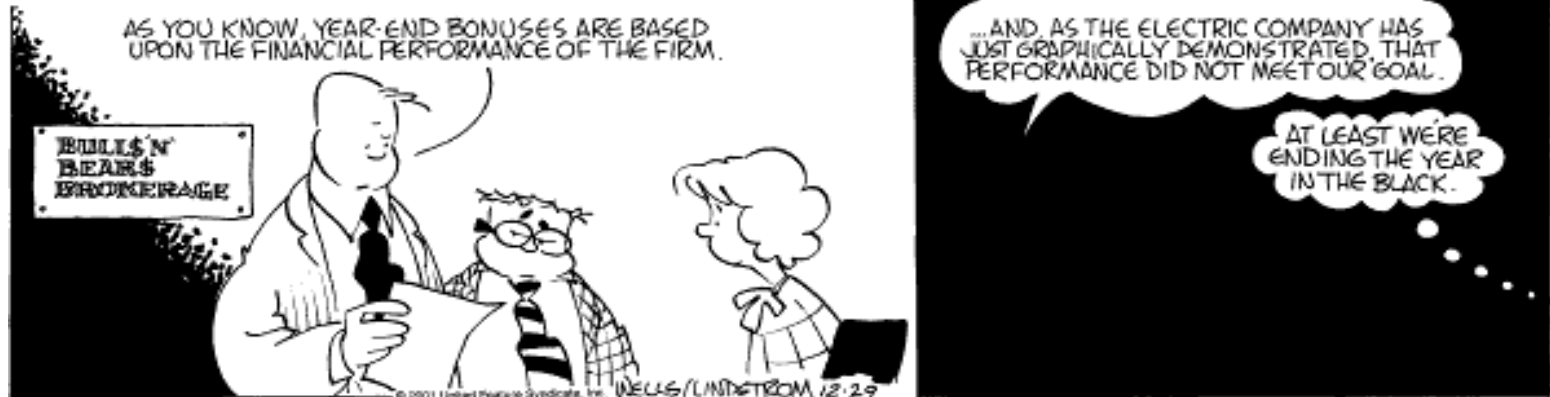


Average Annual Return                      13.9%

SD Annualized                                      16.3%

Sharpe Ratio    0.76

# Science is Better than 'Facts'



Copyright © 2001 United Feature Syndicate, Inc.

- **Possession of non-public information getting, well, harder to justify**
- Offshore cost saving allowed complex time intensive development effort
- Enterprise infrastructure to aggregate global corporate information, coverage of G7, statarb quality history of US, Japan, UK
- Comprehensive understanding of the market
  - [www.rationalinvesting.com](http://www.rationalinvesting.com) models 4500 firms line item by line item
  - DIA / SPY valuation is usually within a 10% band of the market.



# Biography

**Manish Aurora**, Quantitative Methodology and Product Architecture, New York

- Co-founded Rational Investing LLC and built its first models starting in 1998. Running Distributed Risk LLC, an analytics consulting business, since 1996
- Designed and developed the FX trading platform of [www.fxcm.com](http://www.fxcm.com) now supporting 100K+ retail and 1000+ institutional clients. FXCM is now the world's largest non-bank online FX dealer
- 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
- Reprogrammed JP Morgan's global swaps pricing and counterparty credit risk calculation using Massively Parallel Supercomputing technology
- Converted Merrill's European FX derivatives exposure at NYC, London, Singapore offices to the Euro
- Constructed earliest CMBS and Corporate Bond credit risk models at BlackRock, allowing it to increase its book tenfold at the time.
- 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 from the University of Scranton



## Appendix: Relationship with Cost of Credit

- 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
- Our system is able to predict stock price movement within a horizon of a few months; in the case of more extreme mis-valuation, a relationship with the price of credit is a fair assumption.
- Merton models could lag severely for illiquid high yield debt issuers or small caps
- Rational Investing uses fundamental information to construct such a linkage, which allows a look at firms with private or illiquid equity.
- We inject the impact of LIBOR, the Treasury curve and the duration of debt
- Context: Rating agency models are tuned to long periods of time, and concerned with timeliness of payment, whereas market prices respond to recent information. For shorter term trades, our model is a superior tool
- Our measures adjust for trends in non-operating income, maintenance CAPEX, charges and restatements; a plain EBITDA multiple is misleading

# Appendix: Did Fama, French Really Measure Cross Sectional Expectations?

- To a hedged investor with a monthly reporting cycle, risk is a dynamic concept
- Fama French factors Size and Book / Market (distress) reflect the life cycle of the firm, but are static through an economic cycle
- We drank the Kool-Aid as well, but these are useful as components to construct expectations based risk, not complete explanations. FF might agree.
- Historical correlation vs. S&P, or a 'multi-factor' understanding of returns, are fighting this basic fact: risk measurement needs to be dynamic and forward looking.
- Estimate what one cannot measure fully even with hindsight; expectations always differ from subsequent outcomes.
- Mean expectations = an understanding of how information impacts probability assignments and estimates of risk by the market as a whole.
- Alpha = an individual ticker's deviation from this mean expectation of a risk adjusted return, typically reverses to that mean estimate over the course of a few months.
- Accuracy over years is largely irrelevant. (This also answers why index funds distort markets – they promote momentum by targeting historical success.)
- Has to be built the old fashioned way – trial and error wrt impact of fundamental information on cash flow and discount rate expectations



## Q&A: Information Content, Data Scrubbing

- Even high quality SEC data can have numerous unresolved accounting issues for the purpose of free cash flow estimation.
- Ignore GAAP – e.g. cash acquisition = CapEx, use EBITDA – maintenance CapEx
- Non-US models: the effort required to scrub data doubles for European firms, triples for Emerging Markets due to cross-checking
- We produce unparalleled data quality and consistency across sectors
  - Our offshore analyst team does model review and ‘economic scrubbing’
  - Correcting for a variety of accounting irregularities and one-time items
  - Incorporating balance sheet changes e.g. option and stock issuance and buybacks
  - Integrate financial engineering disclosures in footnotes
  - Building a history of M&A activity to understand management behavior and predict liquidity and financing activity



# Why Automate Cash Flow Projection?

- The answer used to be – just pay an ‘expert’.
- Most equity research groups take the DCF projection process for granted. Yet, they generally build models by hand – at least inconsistent, often irrational
- Software is a powerful and transparent deconstructive tool. Once one gets used to the idea, models can be tweaked rapidly
- Help a discretionary trader get a quick grip on valuation in the face of rapidly changing information on a broad spread portfolio
- Our system and offshore team do the ‘economic scrubbing’ of data, i.e. make adjustments for restatements, spin-offs, strip out non-cash items, etc. Difficult to duplicate overnight, and expensive if done in NYC
- 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, this produces a strong measure of relative value, and a 1.5+ Sharpe

# Cash Flow Arbitrage

- Fixed Income Arbitrage – Build a Yield Curve, Interpolate missing pieces, test the fit of a bond, buy or sell (short).
- Knowns – coupon, maturity, rating, benchmark rates. (sometimes) unknown – current price
- Risk – evolution of yield curve, credit spreads
- Result = long and short coupon and principal payments
- Equities – cash flow needs to be estimated
- Unknowns – growth, terminal cash flow
- Our estimation process reduces this to the ‘retention’ parameter
- Risk – Rational Investing’s factors, market multiple
- The modeling process often points out issues in data, which are addressed by our analysts. Improved data improves the model, creating a positive feedback loop.
- The current total sample is 4500 firms. Our system usually finds the Dow mildly cheap and the Nasdaq 100 somewhat expensive. The results are available on [www.rationalinvesting.com/dowjones30.asp](http://www.rationalinvesting.com/dowjones30.asp) and [www.rationalinvesting.com/nasdaq100.asp](http://www.rationalinvesting.com/nasdaq100.asp)

