IMPLEMENTATION ISSUES FOR U.S. EQUITY MANAGERS

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The Benchmark

This is the starting point. Indices are common benchmarks for institutional managers, but mutual fund managers are usually compared to competitors within an objective category. Style analysis can be helpful in getting a rough idea of what the median fund has looked like. Broad indices, such as the Russell 3000, EAFE, and the Lehman Aggregate, are relatively uncorrelated to each other, but can 't offer any insights into the finer questions of growth vs. value or large vs. small. The problem with these more finely cut indices is their high correlation to each other, i.e., multicollinearity. The computer can't tell them apart very well. An innovative technique for making these various risk "vectors" orthogonal is to difference them relative to the broad underlying index, let the regression return the results, and then do some simple algebraic manipulation to solve for the final index weights. The second regression is more intuitively appealing and has index coefficients with higher t-statistics (higher confidence).

Due to business risk considerations, most managers focus upon tracking error. However, if the benchmark index is less than efficient, being chained too closely to it may not yield mean-variance efficient portfolios. By putting some amount of cash into the benchmark portfolio, along with the index, the result is more likely to be mean-variance efficient, but also not ridiculously different from the benchmark index.

The Universe

A quantitative investment process allows for a large universe without adding very much cost to the research function. The payoff from broadening the selection set can be significant, and in any event must be at least as mean-variance attractive as the smaller set.

Different groups of securities call for different alpha models. Factor payoffs have and should continue to differ depending upon size (large vs. small/mid cap.) and industry or sector. The investment rewards are worth the additional effort.

The Risk Model(s)

By combining three risk models that vary drastically by philosophy and construction, out-of-sample portfolio risk can be better controlled, in that the "blind spots" on any one will not dominate. Quadratic penalties on each factor in each risk model should be weighted according to this formula: penalty = (portfolio factor exposure - benchmark factor exposure)^2 * historical variance of risk factor payoff.

Better yet is building your own risk model. By simultaneously estimating exposures and payoffs to risk and return factors, you can be sure that your alpha will not be "eaten" by the risk control process. Overspecified models with too many factors are notorious for this problem, as are models that do not allow the user to "turn off" risk factor penalties. Most researchers agree that there are probably only about five factors, give or take, so a parsimonious macroeconomic APT factor model has a lot of appeal. Factors based on market prices, not government statistics, should be used to measure changing expectations.

Transaction Costs

A volume-sensitive transaction cost estimate should be a component of any optimization process. Several optimization loops may be necessary to converge upon a solution. As important as making the optimizer sensitive to transaction costs is making your traders sensitive to transaction costs. Measuring realized execution relative to a target for each trade via a profit/loss account for each trader is an effective means of accomplishing this objective.

The Optimization Process

Use daily rebalancing, if possible. The value of information can quickly decay, especially for momentum-based factors.

Don't give the optimizer raw "scores", but refined "alphas" given by this formula: alpha = score * volatility * information coefficient. Volatility is the residual variance from your risk model(s), and measures how much "wiggle room" a stock has to outperform. The information coefficient is the correlation between your forecasts and the actual excess returns, and measures how confident you should be in your scores.

Don't let traditional portfolio managers thwart actions that result from insights from your quantitative process. Allow veto power only on individual trades. Also, use these insights in the design of the quantitative models; you'll get better models and greater agreement on the results.

Implementation Issues for U.S. Equity Managers

A Presentation to the

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by
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Implementation Issues

- The Benchmark
- The Universe
- The Risk Model(s)
- Transaction Costs
- The Optimization Process

The Benchmark

- Competitive style analysis or indexes?
- Tracking error or absolute volatility?

First Regression Analysis

Morningstar Variable Growth & Income Funds
October '93 - September '96

	Param Est	***Std Error***	***T-Statistic***
Intercept	0.00	0.00	1.48
Russell 3000	0.84	0.03	24.48
MSCI EAFE	0.04	0.02	2.52
LB Aggregate	0.13	0.05	2.49

First Correlation Matrix

October '93 - September '96

	S&P/BAAR 500 Growth TR	*S&P/BARR 500 Value TR*	*R2500 Growth*	*R2500 Value*
S&P/BARRA 500 Growth T	1.000	-----	-----	-----
S&P BARRA 500 Value TR	0.831	1.000	-----	-----
R2500 Growth	0.718	0.699	1.000	-----
R2500 Value	0.737	0.857	0.866	1.000

Second Correlation Matrix

October '93 - September '96

	Russell 3000	*Ex R3000 S&P Growth*	*Ex R3000 S&P Value*	*Ex R3000 R2500 Growth*	*Ex R3000 R2500 Value*
Russell 3000	1.000	-----	-----	-----	-----
Ex R3000 S&P Growth	-0.160	1.000	-----	-----	-----
Ex R3000 S&P Value	-0.045	-0.481	1.000	-----	-----
Ex R3000 R2500 Growth	0.333	-0.336	-0.501	1.000	-----
EX R3000 R2500 Value	-0.229	-0.618	0.028	0.367	1.000

Second Regression Analysis

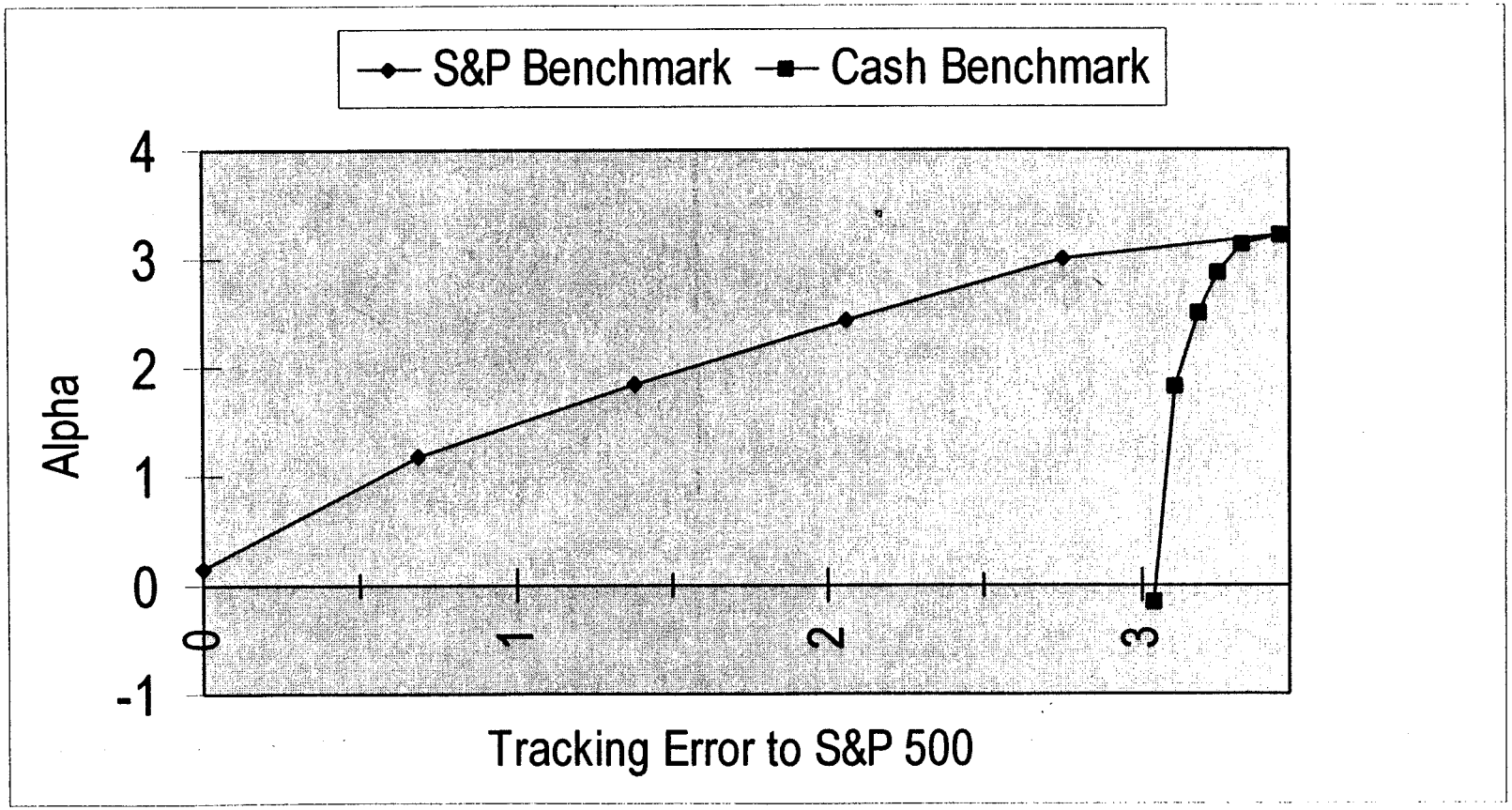
Morningstar Variable Growth & Income Funds
October '93 - September '96

	Param Est	*Std Error*	*T-Statistic*
Intercept	0.00	0.00	2.41
Russell 3000	0.90	0.02	51.11
Ex R3000 S&P Value	.28	0.05	5.21

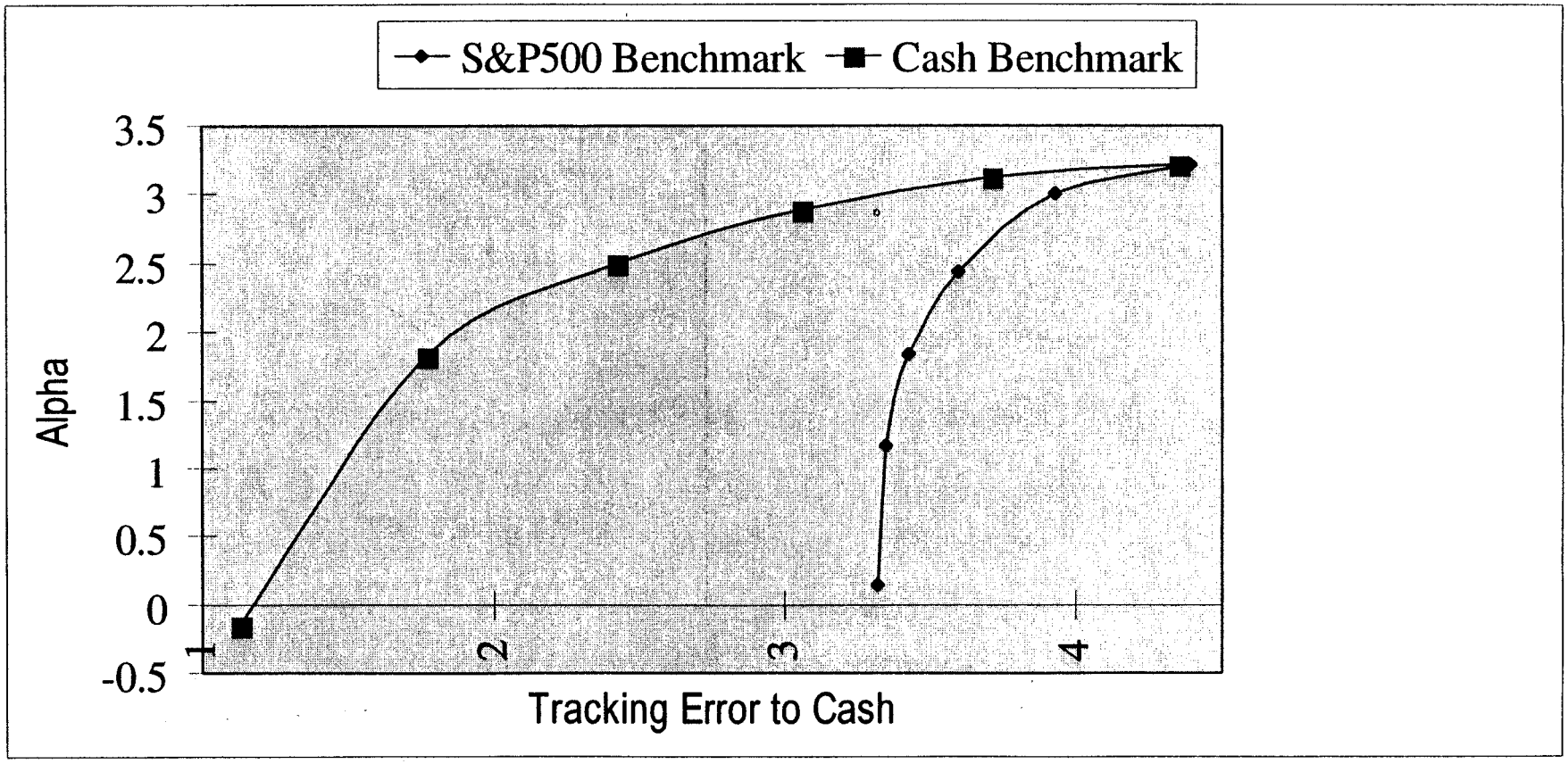
(.28 - .28)

	S&P Value	R3000
Russell 3000	.62	
S& P Value	.28	
Cash	.10	
	1.00	

Efficient Frontiers Using Absolute and Relative Risk



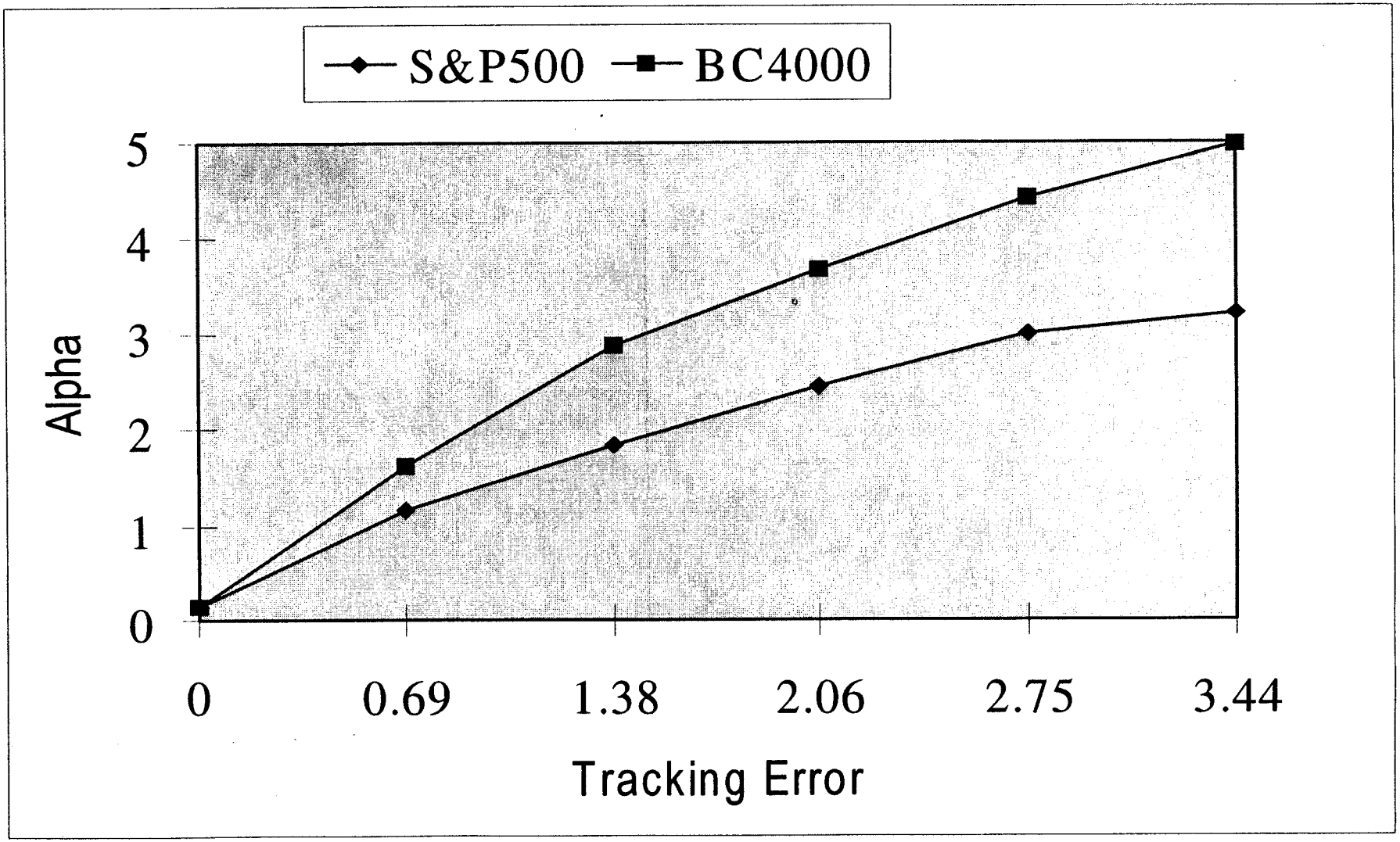
Efficient Frontiers Using Relative and Absolute Risk



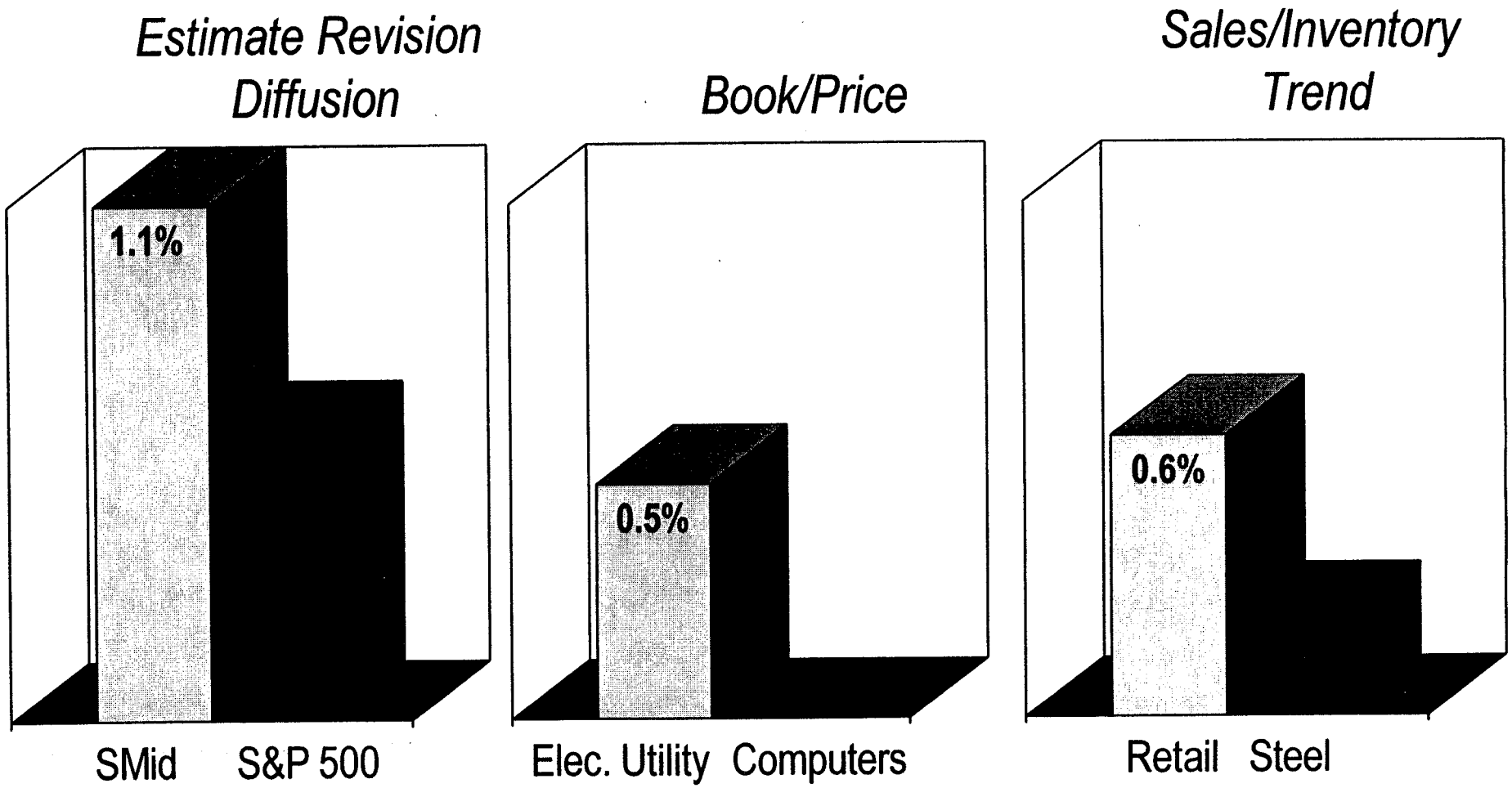
The Universe

- How many securities? Which ones?
- One alpha model or several?

S&P 500 vs. Broad Cap 4000



Expected Factor Payoffs



The Risk Model(s)

- One risk model or several?
- Build or buy?

Comparison of Three Risk Models

	Northfield APT	*BARRA E2*	*APT Inc. US*
Factors	7 Macroeconomic	12 Common 55 Industry	20 Statistical
Sample Period	5 years	Some Current Some 5 years	180 weeks
Periodicity	Monthly	Monthly	Weekly
Data Source	Barron's	Compustat IBES	Prices Only
Missing from Top 4000	872	140	137

Comparison of Three Risk Models

Optimized Using	*# of Stocks*	*Predicted Alpha*	*EPS Growth*	*Analyzed Using* *Northfield*	*APT Inc.*	*BARRA*
Northfield	86	2.80%	T.E.	3.01	2.61	3.69
			Mu/Sigma	0.93	1.07	0.76
APT	70	3.19%	T.E.	3.93	3.01	4.80
			Mu/Sigma	0.81	1.06	0.66
BARRA	150	2.80%	T.E.	3.18	2.85	3.01
			Mu/Sigma	0.88	0.98	0.93
Combined	55	3.03%	T.E.	3.61	2.79	3.89
			Mu/Sigma	0.84	1.09	0.78

Aeltus Risk Model

- Macroeconomic
- APT-Like
- Market-Based
- Updated Daily

Aeltus Risk Model

ST Rate	*Slope*	*Credit*	*EPS Growth*	*Dollar*	*Volatility*	*Market*
3 Mo. T-Bill Yld.	10 yr - 3 mo.	Lehman A-10 yr	IBES S&P 500 Top Dwn Fwd. EPS	JP Morgan Trade-Weighted Dollar	S&P 500 Option Implied Vol.	S&P 500 Return

Transaction Costs

- How do you estimate transaction costs?
- How can you make the optimizer best use the information?
- How can you align your traders interests with yours?

Aeltus Transaction Cost Model

$$\frac{\text{Avg. daily volatility } x \text{ price } x \text{ shares}}{\text{Daily median volume}} \quad \text{Inventory Risk}$$

$$+$$

$$\frac{\text{Bid - Ask Spread}}{2} \quad \text{Liquidity Risk}$$

The Optimization Process

- Rebalance how often?
- Alpha = score *x* volatility *x* information coefficient
- How can you blend quantitative and traditional input?