May 2009

Northfield News

A Newsletter for the Friends and Clients of Northfield Information Services

Special Points of Interest:

- Main Article: New Product Releases
- Annual Research Conference-Venice Italy
- Tech Support Tip: New Optimization features

Inside This Issue:

The Biggest Release of Product Enhancements in Northfield History

By Dan diBartolomeo

We are very pleased to announce that the end of April 2009 release of the Northfield Open Optimizer and associated risk models represent the largest simultaneous set of product enhancements in our history. These enhancements represent years of research in three separate areas: near horizon risk models, estimation error in optimization, and forecasting liquidity and trading costs.

Near Horizon Risk Models

We are beginning to make our "near horizon" risk models available to clients. While it has always been the tradition in our industry to talk about return volatility in annual units, there has always been ambiguity as to whether we are really forecasting annual risk (the risk expected over the upcoming year), or the *annualized value* of risk over some shorter time horizon. Given the extreme volatility that has been present in equity markets in recent months, we believe that making the differences between short term and long term risk levels more explicit will be an important advantage to clients in trying to adapt their portfolios to rapid changes in market conditions.

Rather than focusing on our traditional risk forecast horizon of a year, a new version of each of our models is now available focusing on a much shorter horizon, the *annualized value of the risk over the next two weeks*. In a few months, we will also make one week and one month horizon versions of the models available. The two week horizon (i.e. ten trading days) was chosen to be consistent with the most common time horizon used for Value-at-Risk calculations, and some regulatory regimes such as UCITS3 rules in Europe. Updates to the short horizon models will be made available daily.

Our new models are based on an innovative methodology that allows us to keep the fac-

(Product Enhancements, continued on page 3)

Northfield's Boston Office Has Moved

Northfield's Boston office moved a new location on Friday, April 3, 2009.

The new address is:

Northfield Information Services
77 North Washington Street, Floor 9
Boston, MA 02114

The new office is located near Boston's historic North End and is conveniently situated near public transportation including North Station and the Government Center and Haymarket subway stops.

The newly renovated larger space offers room for Northfield's ongoing expansion.

Northfield Events

2009 Northfield Annual Research Conference

The Grand Hotel Excelsior, Venice Lido Resort • Venice, Italy • June 1-3, 2009

Grand Hotel Excelsior, Venice Lido

This year we are returning to our host city of the first Annual Research Conference, twenty years ago—Venice Italy! The Grand Hotel Excelsior is located on the Lido in Venice and offers the best of both worlds: the wonders and history of Venice with all of the comforts of a beachfront resort.

The conference will start on Sunday Evening, May 31st, with the "Unofficial" welcome cocktail party and dinner. As is customary at Northfield events, a complete recreational and social calendar will accompany the working sessions. The sessions will begin on Monday morning and Monday afternoon will be reserved for recreational pursuits. Northfield is offering attendees a variety of activities, which are appropriate choices to our beautiful venue: walking tour of Venice, secret passages of the Dodge's Palace, excursion to the islands of Murano and Torcello and a gondola race. Monday evening will feature an elegant "black tie" gala and Tuesday will feature a Venice themed evening.

Northfield is holding a block of rooms for the nights of Sunday, May 31st through Tuesday, June 2nd. **All room rates will be in Euros for this event.** The conference room rate is discounted at € 225.00 double room for single occupancy; and € 274.00 double room for double occupancy plus applicable taxes and service charges and is payable directly to the hotel. Additional room types are available at an additional cost.

We are accepting online registrations only. To complete your online registration, hotel requirements, and to view the detailed conference agenda, visit http://www.northinfo.com/events.cfm. Contact Kathy Prasad if you have any difficulties registering, kathy@northinfo.com, 617.208.2020.

Agenda

The agenda will consist of eleven 1-hour presentations.

The Earnings Estimate Dispersion Effect in International Stock Returns
Markus Leippold, Imperial College London and Harald Lohre, Union Investment

Stress Testing: Black Swans of Shades of Grey
Daniel Satchkov, FactSet

Is Quant Investing Dead? A Formal Debate
Ed Fish wick, Blackrock
Jason MacQueen, R-Squared

The Relationship Between Market Volatility and Investment Style
Dan Bukowski, QSG

Structure for Retirement Investing
John O'Brien, University of California at Berkeley

Diversification Effects Associated with Global Value Investing
Eddie Qian, Panagora Asset Management

The Triangle of Guidance, Revisions and Surprise From A Practitioner's Perspective
Keith Quinton, Fidelity Management & Research

Ensuring Trading Fairness in Asset Management
Bernd Scherer, Morgan Stanley

Tax Adjusted Portfolio Optimization and Asset Location
Ashraf Al Zaman, Saint Mary's University

The Rocky Ride of Break Even Inflation Rates
Marielle de Jong, Sinopia Asset Management

Market Mayhem, Mortgages and Madoff
Dan diBartolomeo, Northfield Information Services, Inc.

(Product Enhancements, continued from page 1)

tor definitions and factor exposures of our regular models, but revise the input items to the risk estimate based on a vector of state variables. In effect, we ask ourselves, "How are market conditions today different than they were on average during the period of history used to estimate the regular model?". To judge the degree of difference, we monitor a variety of information that is not normally used in the risk model, such as the implied volatility of options on stock index and bond futures (e.g. VIX contracts), and the cross-sectional dispersion of stock returns among different sectors and countries. The short horizon models also incorporate adjustments for kurtosis and serial correlation in the distribution of security returns. An excellent summary of the methodology, "Short Term Risk from Long Term Models" by Anish Shah, appeared in our October 2008 newsletter, **http://www.northinfo.com/documents/312.pdf.**

It should be noted that Northfield has used the concept of conditioning shorter horizon risk estimates by using external information as state variables for a long time. This process began in the late 1990s with our US Short-Term risk model that uses individual stock option implied volatility to adjust risk forecasts on a daily basis, as described in diBartolomeo and Warrick (2005). Making use of cross-sectional volatility information to risk estimates adapt more quickly is described in diBartolomeo (2007). We are also exploring the potential to adjust risk estimates directly from the flows of news about financial markets as described in diBartolomeo, Mitra and Mitra (2009).

Estimation Error in Optimization

This month's Open Optimizer release will include five new features designed to help users have more stable and efficient optimization results, while reducing the required amount of data preparation. An extensive "how to" article on using these features appears elsewhere in this issue of our newsletter.

Almost since the origination of Modern Portfolio Theory in Markowitz (1952), investment practitioners have realized textbook approaches to mean-variance optimization had a serious flaw. The theory assumes that *we know with exact certainty*, the expected returns, volatilities and correlations for our assets. It also assumes that the future *is a single long period, during which the expected returns, volatilities and correlations never change*. Clearly, the assumptions don't hold up very well in the real world.

Northfield has been pointing out these limitations and the potential remedies to our clients with research articles for a long time, starting with diBartolomeo (1991). In the intervening years, three basic methodologies have emerged to address parameter (return and risk) estimation errors: Bayesian methods, re-sampling and robust optimization. The predecessor to our current ART asset allocation product included a Bayesian method derived from Jorion (1986) as early as 1994. A re-sampling function, licensed from New Frontier Advisors, was included in the Open Optimizer for a number of years. After nearly twenty years of extensive experience with all three approaches, we have concluded that all three produce quite similar results, and that Bayesian methods offer the most tractable process, particularly for problems with large numbers of assets (i.e. equity portfolios).

Of the five new functions, three are ways of adjusting return expectations (alpha) to more realistically represent the investor's beliefs. For example, if we believe that stock X will outperform the market by 20% over the next year, we need also include in our estimation how confident we are that we're right. If we expect to be right about such forecasts 51% of the time, and wrong 49% of the time, our "certainty-equivalent" estimate of outperformance for stock X will be a lot smaller than 20%.

The first of the new procedures is an alpha scaling approach. User input alphas are first converted to percentile ranks, and then to Z-scores. This first step in the process is similar to that used in Almgren and Chriss (2006). Using the risk model, we forecast the cross-sectional dispersion of future stock returns, and then scale the alphas using an information coefficient supplied by the user, in a fashion similar to Grinold (1994). We believe this approach will be of great value to our many clients who prefer to describe return expectations about securities in the form of decile or quintile ranks.

The second alpha scaling procedure is a Bayesian approach based on the method of Black and Litterman (1991), but done benchmark relative. Users can supply return forecasts with an associated confidence interval. (e.g. IBM's forecast is 3% +/- 1%). The process squeezes forecasts for securities whose benchmark excess returns are highly correlated (based on the risk model) towards each other and creates forecasts for securities missing them. At our 2007 London seminar, guest speaker James Sefton usefully pointed out that this approach aligns alphas with the errors in the risk model, softening their impact, **http://www.northinfo.com/documents/251.pdf.**

The third alpha scaling procedure is a somewhat different Bayesian approach derived from the aforementioned paper, by Jorion (1986). Unlike Black-Litterman which assumes market equilibrium, this process assumes that the true expected returns for an asset lies between the user's expectation, and a central value. This central, or prior value is usu-

(Product Enhancements, continued on page 4)

(Product Enhancements, continued from page 3)

ally the user's expectation for the minimum variance portfolio of risky assets. The rationale for this prior belief is that if an investor had no information about expected returns, but did have a valid understanding of risk they would prefer to hold the least risky portfolio available. All user supplied expected returns are squeezed toward the prior central value (often zero when benchmark relative), and the magnitude of adjustment for each asset is derived from the covariance among the assets. An additional term is also added to the covariance values to account for uncertainty of the return means.

The fourth new Optimizer function has to do with potential errors in the expected covariance among securities. It is derived from Ledoit and Wolf (2004). In mean-variance optimization, the risk term has traditionally been based on a matrix of expected asset covariances. As described in diBartolomeo (1998) every factor risk model has a mathematically equivalent full covariance matrix. The risk models that Northfield provides forecast the future matrix of asset covariances much more efficiently than simply using the historical sample values. *However, even a more efficient forecast can be subject to some errors or statistical outliers*, particularly when we consider the many millions of possible pairwise covariances arising from a universe of thousands of securities.

Within this new function, the user can blend in their chosen weighting of three alternative assumptions to the full covariance matrix implied from the factor model in use. The first alternative is that the covariance among securities can be described as a single-index model (market beta only) as described in Sharpe (1964). The second alternative is that the correlation among securities is constant and equal across all pairwise relationships. The third alternative is that the covariance among securities is constant and equal across all pairwise relationships. By blending in these alternatives with the factor model representation, the user can reduce the influence of outliers on risk forecasts and optimal portfolios.

The final new optimizer function relates to the portfolio theory assumption that the future can be adequately described as a single long period during which parameters do not change. In our Optimizer, transaction costs are amortized over the expected holding period of a security. This new function dynamically adjusts the rate of transaction amortization during the optimization process to account for an important nuance that arises when we change our assumption from a single period to a multi-period future:

Imagine we have a portfolio P1, with return R (net of fees and expenses) and standard deviation S. Our usual utility function would be (where T is equal to our risk acceptance parameter):

U = R – S^2/T

Now let's imagine there is another portfolio P2, that has a higher utility, because either the return is higher or the standard deviation is lower. This portfolio has completely different positions than the initial portfolio. Let's assume that this portfolio has a higher return by increment D, so

U2 = (R+D) – S^2/T

Since U2 is greater than U, we should be willing to pay some transaction costs to switch from P1 to P2. Now let's consider a different way to improve our returns. We go back to the manager of Portfolio 1 and ask them to reduce their fees by D, so now our revised utility on P1 is U1(L) for "lowered fees."

U1(L) = (R+D)-S^2/T

Notice that U1(L) and U2 are equal. So if we invest our money in either P2 or P1 (after lowering the fees), the expected value of wealth at the end of time is the same. This suggests that we should be willing to pay the manager an upfront fee to lower his management fees such that it is equal to the trading costs we would be willing to pay to switch from the initial portfolio. As long as conditions never change, this is valid. However, since P2 and P1(L) have different securities, the performance will be different from week to week, month to month, even if the long term average return and volatility are identical. So over any finite time horizon, we cannot be sure which of the portfolios will perform better.

However, we do know that P1(L) will always perform better than P1 over all time horizons, as it is just the same portfolio with lower fees. For P1(L) the probability of outperforming P1 is always 1. On the other hand, even though P2 is guaranteed to be better than P1 in the very long run (if conditions don't change), the probability that P2 will actually outperform P1 over any finite time horizon is between .5 and 1. To the extent that this "probability of better realization" is less than one, *we ought be less willing to bear trading costs to move from P1 to P2, than we are to move from P1 to P1(L). Traditional optimization ignores this difference.*

The key to understanding the math is that the tracking error of P1(L) to P1 is always zero, while the tracking error of P2 to P1 could be anything, depending on portfolio composition. Basically we adjust the transaction amortization parameter dynamically during the optimization to reduce our

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willingness to trade. Let's define the "adjusted transaction amortization" ATA(K), as the user input transaction amortization rate TA, divided by the probability of better realization after K iterations of the optimization process.

ATA(k) = TA / P(k)

The probability of better realization is obtained from a function of the normal cumulative density function of Z-statistic of the improvement in expected utility at K iterations, where U(k) is the expected utility of the partially optimized portfolio U(k), the expected utility of the initial portfolio U(i), the tracking error between initial and partially optimized portfolio Sik and (100/TA) is the expected holding period of the portfolio.

Zk = ((Uk - Ui)/ Sik) * (100/TA)^.5

Liquidity and Trading Cost Estimation

Starting next month, all clients of Northfield equity risk models will receive a new file containing coefficients for our non-linear transaction cost function. This new model of equity liquidity will be updated free of charge on a monthly basis, and will cover all stocks in the Northfield risk model universes.

Many people believe that the current financial market crisis was first manifested in August of 2007, when many quantitatively managed equity portfolios were severely impacted by a decline in liquidity across many financial markets. *Investors are more acutely aware than ever of the need to manage liquidity risks as well as market risks* for their portfolios. Such risks arise both from routine transaction costs, and the potential cost of forced unwinding of positions due to investor redemptions or reductions in allowable leverage.

For many years, our Open Optimizer has allowed users to specify a non-linear process for the market impact portion of transaction costs. Market impact costs are the predominant costs of obtaining sufficient liquidity to accommodate the desired trades of large investors. While many market impact models exist, our client experiences with third party models have been generally unsatisfactory. Most such models are estimated from empirical data without sufficient boundary conditions to make the forecasts stable and rational across the entire spectrum of potential trade sizes.

An extensive discussion of the new market impact model was presented in our September 2008 newsletter, http://www.northinfo.com/documents/311.pdf. It should be noted that an even more sophisticated liquidity model will be available to clients in a few months. This model will be updated daily for a relatively modest fee.

Dan Featured in Risk Professional Magazine

Northfield President Dan diBartolomeo is featured in the cover story of the April 2009 edition of Risk Professional Magazine.

The article titled "Who Knew" profiles leading financial professionals who anticipated the market crash and warned of its dire consequences.

Following is an excerpt from the article: "Some economists, analysts and risk managers warned well ahead of time that the debt bubble was going to burst and were not surprised by the global turmoil that followed. What did they see that others missed, and can their contributions and experiences help avert future disasters." The article is available online to registered users at: http://www.garp.com.

Northfield Speaking Engagements

On April 24th, Northfield President Dan diBartolomeo spoke at the FRA Performance Measurement Conference, in Cambridge, MA. The topic was "Using Risk Systems to Improve Active Management Performance."

Dan will be presenting at QWAFAFEW in Hartford CT, on May 7th. The topic will be on "Using External Information to Improve Short Horizon Risk Forecasts."

On May 11th, Dan will be speaking at the London Quant Group Conference on "The Analytical Methods used to Uncover the Madoff Fraud."

Dan will be presenting at the DePaul University Finance Conference in Chicago, on May 15th. The topic will be: "Incorporating News Flows in Security Level Risk Forecasts."

Northfield Partner Update

FTSE

Northfield has been working with FTSE to produce a global REIT model based on the EPRA/NAREIT indices. This new model will be called the Northfield global FTSE EPRA/NAREIT REIT model and will be available with the May update. Please contact your Northfield salesperson or sales@northinfo.com for details.

Technical Support Tip: New Optimization Features

By James Williams with Contribution by Anish Shah and Mike Knezevich

As mentioned in the lead article, there are several product enhancements. This article discusses usage of these new features in the Northfield Open Optimizer.

New Features:

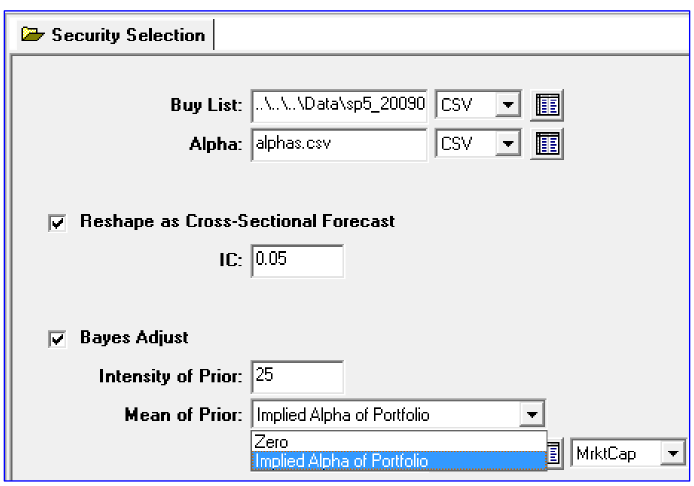
1) The alpha scaling procedures maps alphas to be within a range suitable for the optimizer and to consider the user's belief of forecast accuracy.
2) The estimation error adjustment procedures soften an optimization's sensitivity to the unavoidable imprecision in return and covariance forecasts.
3) The multi-period optimization approximation adjusts the balance between (certain) transaction costs and (uncertain) utility improvement to account for the probability of realizing the improvement over the holding period.

Alpha Scaling Features

➢ Security Selection Input Screen

As the screenshot below shows, the Security Selection Input Screen has been modified to include two alpha scaling options:

1) **Reshape as Cross-Sectional Forecast**
2) **Bayes Adjust**



1.) Reshape as Cross-Sectional Forecast

By selecting this feature, users can express their preferences between stocks in any form, e.g. a ranking from 1-100. These values will then be reshaped to utility function appropriate units.

The reshaping process consists of mapping the preferences to cross-sectional forecasts as follows:

1) Sort preferences from lowest to highest
2) Convert to percentile.
   a. Percentile = rank / (# entries + 1).
   b. Tied entries are assigned their average percentile.
3) Map percentile to normal distribution **(Z-scores).**
4) Calculate the expected cross-sectional variance of security returns via the risk model **(Variance).**
5) User enters the information coefficient **(IC)**
   a. IC = correlation between forecasts and returns
6) **Adjusted alpha forecast =Sqrt(Variance) x IC x Z-Score**

User input:

➢ **IC** Default Value: .05
Reasonable Range: 0.01 to 0.20

- IC = 0 implies no information in the forecasts
- IC = 1 implies perfectly accurate forecasts

2.) Bayes Adjust

The approach is a benchmark relative version of the Black-Litterman model. When using this feature, users need to supply the alpha forecast error term in the third column of the alpha file (see Alpha File Format description, page 7). For example, IBM's alpha forecast is 3% with error of +/-.25%.

In accordance with the user's 'Intensity of Prior' and the error in each forecast, the Bayes Adjust process squeezes forecasts for securities whose benchmark excess returns are highly correlated towards each other and creates alphas for securities that have not been supplied with a forecast.

The process is as follows:

1) Manager has a prior belief on the alphas.
   a. This prior is normally distributed with covariance equal to the covariance of benchmark relative returns / the user's Intensity of Prior.
   b. The mean of the prior is either zero or the benchmark-relative implied alpha of an equilibrium portfolio provided by the user
2) Manager supplies alpha forecasts and their standard error.
   a. Errors are assumed to be normal and uncorrelated across securities.
3) Bayes Adjust returns the alphas that are most likely given the prior and the manager's forecasts.

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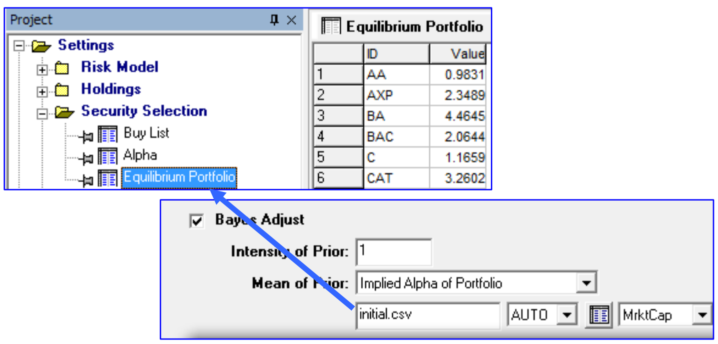
User input:

➢ **Intensity of Prior** — Default Value: 50
Reasonable Range: 0 to 100

➢ **Mean of Prior** — Zero Default or Implied Alpha of Equilibrium Portfolio

If "Implied Alpha of the Equilibrium Portfolio" is selected than the user must supply a separate Equilibrium Portfolio. This is done by the following steps:

1) Select Bayes Adjust in the Security Selection screen.
2) Choose "Implied Alpha of Portfolio" as the option for Mean of Prior.
3) A file input box will then appear, allowing the user to select which file to use as the equilibrium portfolio.
4) The Equilibrium Portfolio setting node will appear under the project tree and the file input box will become visible.



Equilibrium Portfolio

	ID	Value
1	AA	0.9831
2	AXP	2.3489
3	BA	4.4645
4	BAC	2.0644
5	C	1.1659
6	CAT	3.2602

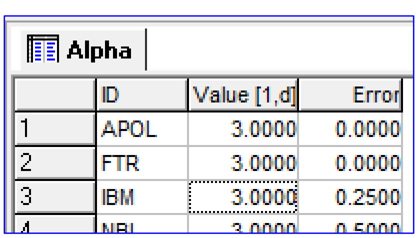
Input File Changes

➢ Equilibrium Portfolio File Format

The Equilibrium Portfolio file format is the same as the normal Holdings file format used with the optimizer: 2 columns consisting of Security ID and Weighting (market cap, shares, percent or equal weight). As illustrated in the screenshot above.

➢ Alpha File Format

The alpha file format has been changed to include a third column, "Error." In this column, users enter the error associated with a forecast, which by default is 0. In the screenshot, the stock symbol APOL has an alpha value of 3% and an error estimate of +/-0%. The stock symbol IBM has the same alpha value of 3% and an error estimate of +/- .25%.



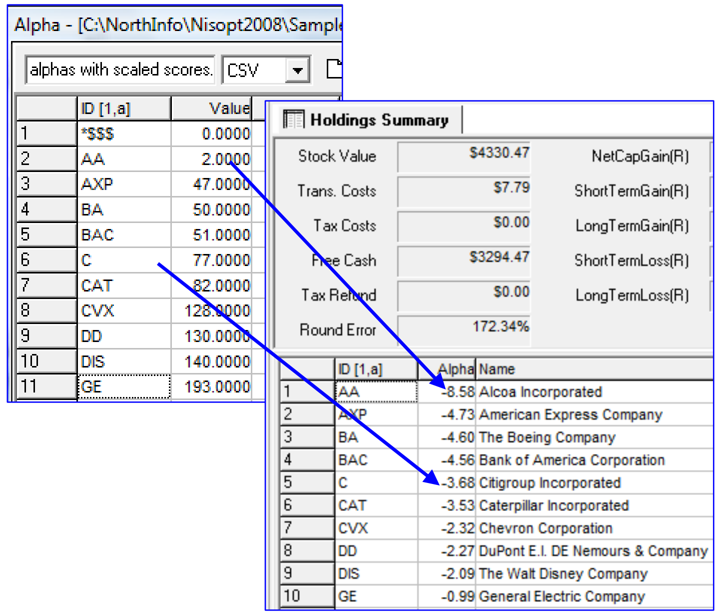
Alpha

	ID	Value [1,d]	Error
1	APOL	3.0000	0.0000
2	FTR	3.0000	0.0000
3	IBM	3.0000	0.2500
4	NBI	3.0000	0.5000

Output Report File Changes:

➢ Holdings Summary Report

Alpha values shown in the Holdings Summary Report reflect the adjusted alpha values.



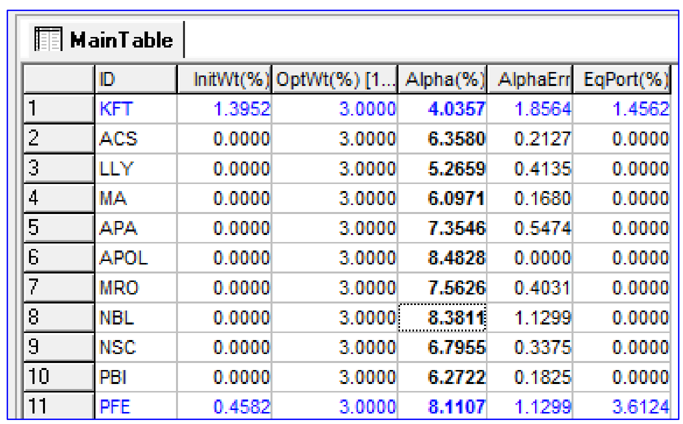
	ID [1,a]	Value
1	*$$$	0.0000
2	AA	2.0000
3	AXP	47.0000
4	BA	50.0000
5	BAC	51.0000
6	C	77.0000
7	CAT	82.0000
8	CVX	128.0000
9	DD	130.0000
10	DIS	140.0000
11	GE	193.0000

	ID [1,a]	Alpha	Name
1	AA	-8.58	Alcoa Incorporated
2	AXP	-4.73	American Express Company
3	BA	-4.60	The Boeing Company
4	BAC	-4.56	Bank of America Corporation
5	C	-3.68	Citigroup Incorporated
6	CAT	-3.53	Caterpillar Incorporated
7	CVX	-2.32	Chevron Corporation
8	DD	-2.27	DuPont E.I. DE Nemours & Company
9	DIS	-2.09	The Walt Disney Company
10	GE	-0.99	General Electric Company

➢ Main Table

In the main table, two columns have been added which relate to the Alpha Scaling Adjustment:

➢ Alpha Error (AlphaErr)
➢ Equilibrium Portfolio (EqPort(%))



MainTable

	ID	InitWt(%)	OptWt(%) [1...	Alpha(%)	AlphaErr	EqPort(%)
1	KFT	1.3952	3.0000	4.0357	1.8564	1.4562
2	ACS	0.0000	3.0000	6.3580	0.2127	0.0000
3	LLY	0.0000	3.0000	5.2659	0.4135	0.0000
4	MA	0.0000	3.0000	6.0971	0.1680	0.0000
5	APA	0.0000	3.0000	7.3546	0.5474	0.0000
6	APOL	0.0000	3.0000	8.4828	0.0000	0.0000
7	MRO	0.0000	3.0000	7.5626	0.4031	0.0000
8	NBL	0.0000	3.0000	8.3811	1.1299	0.0000
9	NSC	0.0000	3.0000	6.7955	0.3375	0.0000
10	PBI	0.0000	3.0000	6.2722	0.1825	0.0000
11	PFE	0.4582	3.0000	8.1107	1.1299	3.6124

Estimation Error Adjustments

➢ Estimation Error Adjustment Screen

As the screenshot at the top of the next page shows, a new section has been added to the project tree and workspace to include estimation error adjustment features:

1) **Bayes-Stein Return Shrinkage**
2) **Blend Covariance**

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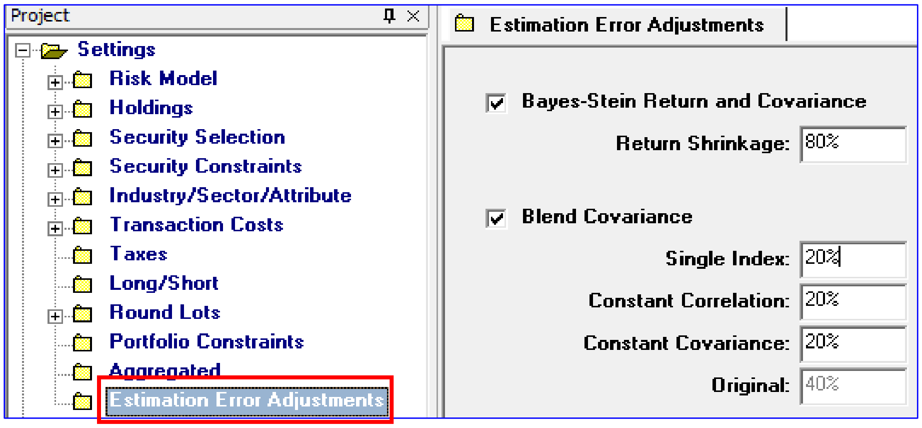

Estimation Error Adjustments Screen

(Tech Support Tip, Continued from page 7)

The techniques we've added to the optimizer are Bayesian in spirit. Classical statistics uses only data to make inferences. Bayesian statistics starts with beliefs; inferences are a balance between data and beliefs.

For example, suppose a stock's regression-inferred sensitivity to the market is 3. Classical statistics would estimate the stock's beta as 3. A Bayesian might start with the belief that stock betas are around 1 and the regression beta of 3 is likely due to the combined effect of a high beta and noise. So the Bayesian's best guess of the stock's beta incorporates both pieces of information. The beta should be between 1 and 3, perhaps 1.8.

1.) Bayes-Stein Return and Covariance

When this option is selected the alpha values provided by the users are squeezed toward the alpha of the minimum variance portfolio. There is a small adjustment to the covariance to account for error in perceiving the means.

User input:

- **Return Shrinkage** Default Value: 80%
  Reasonable Range: 1% to 99%

*Note: If no alphas are supplied by the user and the Bayes-Stein Return and Covariance option is selected, the Open Optimizer will omit the Bayes-Stein Shrinkage since all securities will have the same alpha value.

2.) Blend Covariance

The process shrinks the covariance matrix toward a combination of single-index, constant correlation, and constant covariance models.

Client input:

User selects the percent of each of the following three shrinkage estimates; the weight of the Original matrix is 100% minus the sum of the other weights.

- **Single Index** Default Value: 20%
  Reasonable Range:0% to 100%

Stocks are correlated only through the market portfolio. Betas to the market portfolio are backed out from the risk model (covariance with market portfolio / variance of market portfolio). A stock's total variance is unchanged. The market portfolio is a cap-weighted portfolio of all securities in the portfolio, benchmark and buy list

- **Constant Correlation** Default Value: 20%
  Reasonable Range: 0% to 100%

Stocks have the same pairwise correlation, but different variances. Correlation is estimatedfrom the variance of the market portfolio. A stock's total variance is unchanged.

- **Constant Covariance** Default Value: 20%
  Reasonable Range: 0% to 100%

Constant covariance maximally dulls the information in the covariance matrix estimate. All stocks have the same variance and correlation with each other. Correlation and variance are those implied by the estimated variance of the market portfolio (the cap-weighted portfolio of all stocks in the portfolio, benchmark, or buy list excluding cash)

- **Original** automatically calculated,
  100%-the sum of the others.

Output Report File Changes:

New rows have been added to the following reports:

- Risk Decomposition Report
- Return Decomposition Report
- RiskModel Table
- Main Table

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(Tech Support Tip, Continued from page 8)

➢ Risk Decomposition Report

Risk Decomposition

	Factor	PortExp	BenchExp
63	Gas & Water Utilities	0.0000	0.0046
64	Oil Integrated Majors	0.0953	0.0902
65	Oil Refining & Sales	0.0050	0.0024
66	Oil Extraction	0.0232	0.0185
67	Oil Services	0.0100	0.0155
68	Est Err - Bayes-Stein Adj	1.0000	1.0000
69	Est Err - Single Index	0.9733	1.0000
70	Est Err - Constant Correlation	0.9397	0.9779
71	Est Err - Constant Covariance	0.9706	0.9706

➢ Return Decomposition Report

Return Decomposition

	Factor	PortExp	BenchExp	ActiveExp
58	Drugs	0.0443	0.0735	-0.0292
59	Medical Supplies	0.0585	0.0586	-0.0001
60	Medical Services	0.0313	0.0137	0.0176
61	Telecommunications	0.0423	0.0482	-0.0059
62	Electric Utilities	0.0313	0.0420	-0.0108
63	Gas & Water Utilities	0.0000	0.0046	-0.0046
64	Oil Integrated Majors	0.0953	0.0902	0.0050
65	Oil Refining & Sales	0.0050	0.0024	0.0026
66	Oil Extraction	0.0232	0.0185	0.0046
67	Oil Services	0.0100	0.0155	-0.0055
68	Est Err - Bayes-Stein Adj	1.0000	1.0000	0.0000
69	Est Err - Single Index	0.9733	1.0000	-0.0267
70	Est Err - Constant Correlation	0.9397	0.9779	-0.0382
71	Est Err - Constant Covariance	0.9706	0.9706	0.0000

➢ Risk Model Table

RiskModelTable

	ID	Name	Variance	BETA	E/P
53	SOAP	Soaps & Toiletries	39.0106	0.000	0.000
54	DRINK	Beverages	24.8959	0.000	0.000
55	FOODB	Foods Basic	84.3317	0.000	0.000
56	FOODP	Foods Packaged	25.2861	0.000	0.000
57	RETF	Retail Food & Drugs	23.3739	0.000	0.000
58	RX	Drugs	39.1972	0.000	0.000
59	MEDSUP	Medical Supplies	31.4219	0.000	0.000
60	HOSP	Medical Services	51.3776	0.000	0.000
61	PHONE	Telecommunications	28.1325	0.000	0.000
62	EUTIL	Electric Utilities	46.3578	0.000	0.000
63	GUTIL	Gas & Water Utilities	92.8521	0.000	0.000
64	OILBIG	Oil Integrated Majors	75.8305	0.000	0.000
65	PUMP	Oil Refining & Sales	79.1394	0.000	0.000
66	WELL	Oil Extraction	133.5515	0.000	0.000
67	OILSRV	Oil Services	188.6128	0.000	0.000
68	EE_BSA	Est Err - Bayes-Stein Adj	0.0638	0.000	0.000
69	EE_SI	Est Err - Single Index	82.5869	0.000	0.000
70	EE_CCor	Est Err - Constant Correlation	82.5869	0.000	0.000
71	EE_CCov	Est Err - Constant Covariance	82.5869	0.000	0.000

➢ Main Table

MainTable

	ID	EE_BSA	EE_S	EE_CCor	EE_CCov
1	KO	1.000	0.764	0.612	0.971
2	PG	1.000	0.697	0.615	0.971
3	CVX	1.000	0.875	0.824	0.971
4	WMT	1.000	0.632	0.540	0.971
5	IBM	1.000	1.170	0.860	0.971
6	XOM	1.000	0.810	0.653	0.971
7	JNJ	1.000	0.618	0.555	0.971
8	MCD	1.000	0.576	0.460	0.971
9	HPQ	1.000	1.117	0.782	0.971
10	JPM	1.000	1.013	1.298	0.971
11	T	1.000	0.996	0.831	0.971
12	VZ	1.000	0.735	0.674	0.971

Multi-period Optimization Approximation

➢ Portfolio Constraints Screen

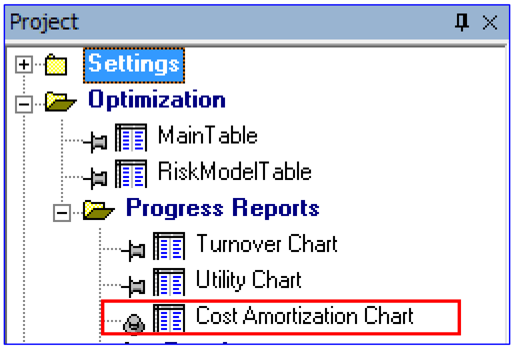
As the screenshot below shows, the new multi-period optimization approximation feature has been added to the Portfolio Constraints screen and a new chart, “Cost Amortization Chart” node (see top of page 10) has been added to the project tree:

Portfolio Constraints

Maximum Turnover:	200%
Maximum Number of Trades:	20000000
Maximum Number of Assets:	5000
Minimum Tracking Error:	4%
Maximum Tracking Error:	4%
Base Currency Symbol:	*$$$
Cost Amortization:	100%
Enable Multiperiod Approximation:	☑
Adjustment Frequency:	1

(Tech Support Tip, Continued on page 10)

(Tech Support Tip, Continued from page 9)



When this feature is enabled, then the Cost Amortization is recalculated dynamically based on the Adjustment Frequency parameter. This process is visible on the Cost Amortization Chart as seen below:

User input:

➢ **Adjutment Frequency** Default Value: 1
Reasonable Range: 1 to 10

For further inquiries, contact Technical Support in Boston: support@northinfo.com or call 617.208.2080. European clients can contact: george@northinfo-europe.com or call +44-(0)-20-7801-6260. In Asia, call +81(0)3 5403 4655 or +61(0)2 9238 4284 or support-asia@northinfo.com.

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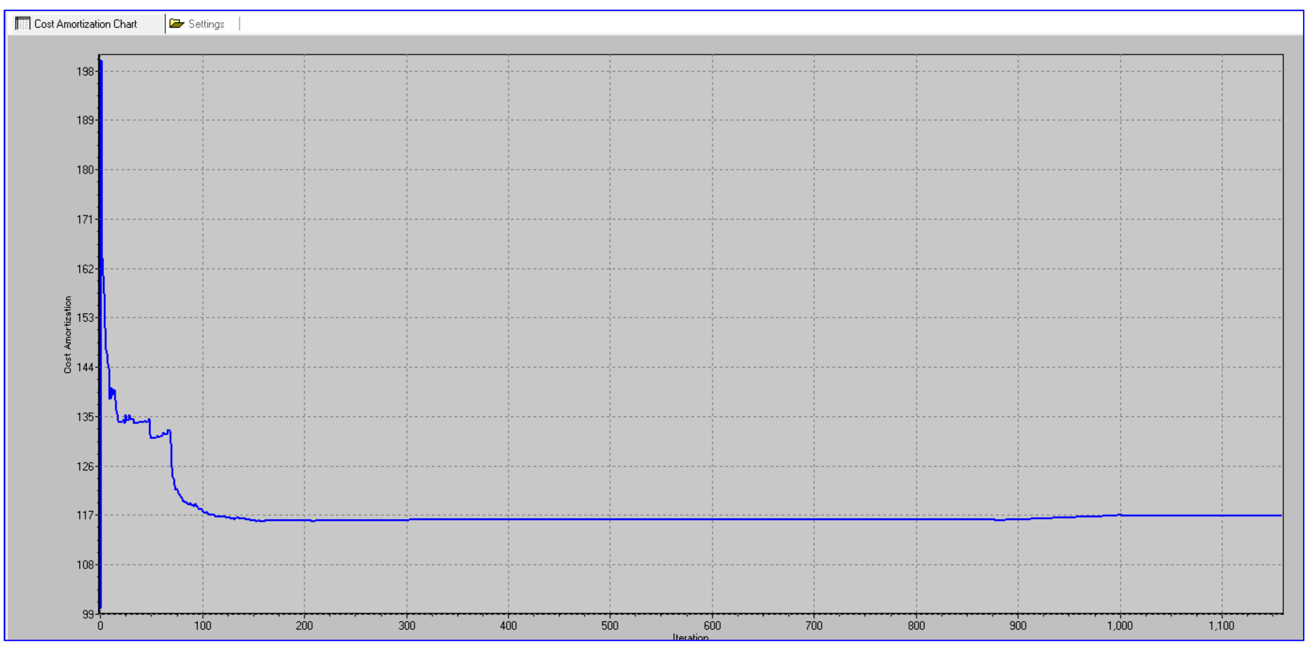

Cost Amortization Chart

Boston Office
77 North Washington Street, 9th Floor
Boston, MA 02114
Phone: 617.451.2222
Fax: 617.451.2122
Sales: 617.208.2050
Tech Support: 617.208.2080

London Office
Shakespeare House
168 Lavender Hill
London, SW11 5TG
Phone: +44-(0)-20-7801-6260
Fax: +44-(0)-20-7801-6261

Tokyo Office
Shiroyama Trust Tower
4-3-1 Toranomon
Minato-ku
Tokyo 105-6016
Phone: +81 (0)3 5403 4655
Fax: +81 (0)3 5403 4646

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