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Northfield News

Quarterly Newsletter for the Friends and Clients of Northfield Information Services

Inside this Issue

- ▶ **Northfield Risk Models: The Next Generation**
- ▶ **Rimes Technologies-a New Northfield Partner**
- ▶ **Northfield Staff Speaking Engagements**
- ▶ **Northfield Asia Office Opening Soon**
- ▶ **Resampled Efficiency Issues**

Special points of Interest:

- ▶ **Upcoming Summer Seminar - Newport, RI**
- ▶ **Risk Attribution on Factset**
- ▶ **New Product Updates- Performance Beta, New PACO features**
- ▶ **Annual Conference Wrap-up**

Northfield Risk Models: The Next Generation

By Dan diBartolomeo

A new generation of Northfield risk models is currently under development. All of our current models will be retained, but each of these models will be enhanced with new features that have proven valuable in some of our other risk models, making the best-performing features of each model available in other models. This "best practices" approach will also unify the risk models, making both the structure and the output of the models more similar.

There are a number of analytical methods that will be made standard on all of our risk models. The first of these is the application of the Parkinson volatility estimator to adjust asset specific risk for serial correlation and heteroskedasticity. As discussed in the prior issue of this newsletter, the Parkinson method uses the observed low-to-high range of an asset's price over each time period to infer asset total volatility. We then incorporate this information into our factor models as an adjustment to the asset specific risk in those cases where the Parkinson method estimates a higher total volatility than the conventional estimate (standard deviation of past returns).

The introduction of "hybrid" modeling in our line of Single Market models has been extremely well received. We will extend the hybrid approach to almost all our models as part of our "best practices" program. In a hybrid model, we first build our usual observ-

(Continued on page 3)

New Features in PACO

By Sandy Warrick

In March, Northfield reached the one-year anniversary of releasing the beta for the new 32-bit, client server version of PACO, our asset allocation optimizer. During this past year, we have done a "soft release" converting our existing clients and taking on a few new clients. All existing PACO clients should have switched to the new system by now, because data support for the old system will be discontinued in the near future.

The new version of PACO now does everything the old one did, but is more attractive, robust and does not require monthly updates – all of the series data resides on Northfield's servers. Existing features include old friends such as:

- The browser allows you to select from over 10,000 mutual funds and hundreds of indices to include in your portfolio.
- The sector ranking allows you to rank funds in a category on risk and return characteristics over past time periods that you can specify.
- The main table and optimizer produce over 18 different reports and graphs. Many

(Continued on page 5)

2003 Newport Annual Summer Seminar

Tennis Hall of Fame • Newport, Rhode Island • June 6, 2003



International Tennis Hall of Fame

We are pleased to invite you and your colleagues to our annual summer seminar. The purpose of the seminar is to present recent research and technical advances to our clients and friends while enjoying the many pleasures afforded by our unique venue.

This year we return to the International Tennis Hall of Fame. Our meeting date has been selected to coincide with the US Professional Championships of Court Tennis. This year's tournament promises to be even stronger than last year with 11 of the top 15 players in the world competing. After tennis on Friday evening, an oceanfront dinner party will be held at Johnnie's Atlantic Beach Club and Pavilion in nearby Middletown RI (Purgatory Road). There will be no tennis tournament play on Saturday, however, we do have another sport planned. Weather permitting; the adventurous may join in a surfing outing at Newport's Second Beach.

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There is no charge for participation in any aspect of this event. Please RSVP to Kathy Prasad at 617-208-2020, or email, kathy@northinfo.com. Detailed information, and the full seminar will be posted to www.northinfo.com/events, as it becomes available. Send an e-mail to events@northinfo.com, to be added to our mailing list for future events.

2003 Northfield Annual Research Conference Wrap-up

Topnotch Resort and Spa • Stowe, Vermont • March 16-18, 2003

Northfield's annual Research Conference took place at the Topnotch Resort and Spa, in Stowe Vermont, March 16-18th. Among America's earliest ski resorts, Stowe offered our participants a peaceful atmosphere conducive to full attention on the issues under discussion, while also offering immense natural beauty and recreational opportunities.



Topnotch Resort

The conference presented recent research and technical advances to a sold-out audience of Northfield clients and friends. The agenda consisted of 12 presentations including: Cash Flows, Asset Values, and Investment Returns; There's No Accounting For Quants; Using Statistical Process Control To Monitor Active Managers; Differential Market Reactions to Revenue and Expense Surprises; The Procter & Gamble – Bankers Trust Transaction; Enterprise Financial Risk Management; The Hierarchy of Investment Choice: A Normative Approach; Tactical Asset Allocation With Pair-wise Strategies; Is Dead Data Really Dead? Multiple Views of Historical Fundamental Data; A foundation for Quantitative Finance: From Randomness Engineering to Financial Engineering; Monte Carlo Simulation-based Analysis of Performance Based Fees; and Volatility Metrics and Management Style.

As is Northfield tradition, the working sessions were accompanied by a complete recreational and social calendar. The conference started on Saturday evening with the "unofficial" welcome reception. The Vermont themed event started outside underneath a "Yurt" (traditional Mongolian tent) where cocktails and Hors D'oeuvres were served along with live music by an acapella singing group, followed by a bonfire and horse drawn sleigh rides. The party then moved indoors for a buffet dinner.

Sunday morning was reserved for recreational pursuits with outings for down hill skiing, snowshoeing and cross county skiing. Sunday evening featured an elegant "black tie" gala, with a six course meal with wine pairing, and dancing with the orchestra.

Monday evening featured a unique Vermont experience at the nearby Midway Lodge. Pre-dinner cocktails and Hors D'oeuvres were accompanied by an Irish singing duo (commemorating Saint Patrick's day). Before everyone sat down to dinner, there was a torchlight parade of 50 skiers and snowboarders skiing down the mountain, followed by a spectacular fireworks display.

Complete seminar proceedings will be posted to our website at <http://www.northinfo.com/papers>.

(Risk Models: The Next Generation, continued from page1)

able-factor model with whatever known factors are most appropriate to the observed market data. The hybrid models address one of the key limitations of traditional risk models; the fact that they are not adaptive. One of our assumptions in building any factor model is that the factors we specify account for all the sources of correlation between securities. Unfortunately, we can only build our factor models from past data. As such, our model will provide an imperfect representation of future correlations as conditions change, often resulting in an omitted variable bias. We can correct for this bias by performing a statistical procedure called a principal components analysis on the security returns not explained by the model's factors.

Using the output from this analysis, we can then add temporary factors to the model if needed. These new factors can quantify the existence of whatever new forces are influencing the market currently. In this way our hybrid models are adaptive to market changes in a way that traditional observable-factor models are not, yet unlike "blind factor" models wherein the principal components analysis is used to explain all of the security correlation, our hybrid models have a fully specified (and clearly understandable) observable-factor structure. The temporary factors will be used from time to time only to measure the small amount of risk arising from transient abnormalities in market conditions. In that the expected value of the variance explained by the temporary factors is zero, the use of temporary factors in this fashion adapts our model very quickly to new influences in the market. We are pleased to note that Jason MacQueen, the founder of Quantec, has recently written an independent working paper endorsing the hybrid approach for future risk models.

Exponential weighting of past return observations for computation of factor covariance matrices and factor exposures will be another major change to our risk model estimation. All factor models are based on observations of the past covariances among securities over some series of past time periods (e.g. past 60 months). Rather than view all of these past observations as being of equal importance, most recent observations will be given emphasis. The extent of the emphasis on recent observations will vary from model to model. For example, in emerging markets such as China, the emphasis on more recent data will be substantial as the constant evolution in such markets makes data from the far past of little analytical value. On the other hand, stable markets such as the United States will have a slighter emphasis so that we aren't ignoring any of the past data that may still contain useful information. With the exception of our "Short Term Model", the amount of exponential weighting will be tuned to provide our best forecast of twelve month future portfolio risk.

A subtle change will occur in the way that factor return variances are calculated. In a normal variance computation, we are measuring the squared differences from the mean of a series of factor returns. In that factors returns often show a trending behavior, we will be calculating variances as the squared value of the factor return. Implicitly, we are pretending that the sample mean for a given factor return is always zero. Empirically, most factor returns do have means close to zero, so this really doesn't do very much. However, when a factor return is consistently large and of one sign (i.e. positive returns to the Internet factor during the tech bubble), this procedure will automatically upward bias the factor variance values to provide a sort of warning of the unusual factor behavior. More on this issue can be found in http://www.northinfo.com/papers/pdf/19991025_anomalies_internet.pdf.

For our Global, EE and Single Market models, we will be modifying one of the factors. In these models we currently use a measure of dividend yield to represent the value/growth characteristics of each stock. We chose dividend yield for the global context as there is little accounting ambiguity to this measure, as compared to measures like price/book value ratios. This factor will be modified to include both dividend yield and a response coefficient to the cross-sectional dispersion of stock returns within a market. Our research has found a strong relationship between the return spreads between value and growth style indices and the "net of market effect" dispersion among stock returns. This issue is described more fully in http://www.northinfo.com/papers/pdf/dan_crossvol_2003.pdf

Finally, model specific adjustments are being made to particular risk models. For example, the Credit Risk Premium factor in our US Macroeconomic model is derived from bond index yields. We are changing the yield time series to indices that have a broader number of bonds so as to be less impacted by dramatic widening of credit spreads on specific issues such as Enron and WorldCom.

It is our expectation that the unified second generation of Northfield risk models will provide more accurate and informative risk information about our client's portfolios. We expect to release all the new models early this autumn. All historical files for all models will be appropriately reproduced so that historical simulation studies can be conducted using the improved risk models as a positive change.

Northfield Staff Speaking Engagements

Northfield President Dan diBartolomeo will be speaking at the FactSet Application Development Conference on May 8th in Boston. The topic will be on the analytical requirements for robust simulation and back-testing of investment strategies. Further information is available at <http://www.factset.com/adc2003/index.htm>

Dan will also be presenting at the FactSet European Users Conference, on June 17th (London) and June 19th (Amsterdam). The topic will be on-going research into the relationship between cross-sectional return dispersion in international equity markets and the relative returns to different strategic investment themes such as growth, value and momentum.

Northfield's Sandy Warrick will be speaking at the Eastern Finance Association Annual Meeting on April 11th in Orlando, Florida. The topic will be on Socially Responsible Investing

New Performance Attribution Released

Previously in Northfield News, we mentioned that our new "built from scratch" Performance Attribution system was nearing completion and would soon be released for beta testing. The new software, NISPerf32 Beta version 1.0, was released for the first time to several Northfield clients in early March.

Unlike the old system that was limited to US equities, the new system can handle any of the Northfield models covering equities or fixed income securities anywhere in the world. ASCII data files are shared with our Open optimizer software making it simple to jointly operate the two systems, and to do data maintenance tasks. Risk reporting has also been enhanced and the new system is much faster in operation.

The production release of the new system will also incorporate new analytical reports to explain the differences between actual portfolio returns and the returns arising from the "monthly buy-and-hold" method that is widely used in attribution studies. The new reports will use daily information to highlight both the securities and the trading dates that played a material role in the returns arising from day to day portfolio activity. The rationale for doing this form of analysis on a daily basis, rather than running a full attribution daily, is the subject of a paper by Dan diBartolomeo that is forthcoming in a finance journal.

Any clients interested in participating in the beta test process are encouraged to contact your Northfield representative.

Asia Office Opening Autumn 2003

We are excited to announce that as of the autumn this year, we will be opening a new office in Tokyo, bolstering our ability to support clients in Australia, Hong Kong, Japan, Singapore, and the rest of the Pacific Rim.

Northfield's Nick Wade (formerly Director of Product Development and Consulting) will be taking on the new role of Marketing for Asia. Based in Tokyo, Nick will be traveling extensively throughout the region on a regular basis. Previously, Nick was responsible for the development of our Short Term Model, and our Everything Everywhere (EE) Model. He has also been responsible for our research into the use of principal components, option-implied information as a forward-looking adjustment to risk forecasts, convertible bonds (in conjunction with Emilian Belev, lead developer of EE), and modeling the risks of mortgage-backed securities. As the head of the consulting department, Nick has brought to bear the experience he gained internationally with AMS Management Systems and has helped Northfield establish a substantial and growing reputation for valuable and practical consulting service across the full range of asset management processes from strategic asset allocation, through alpha generation and portfolio construction, to performance attribution and data integration.

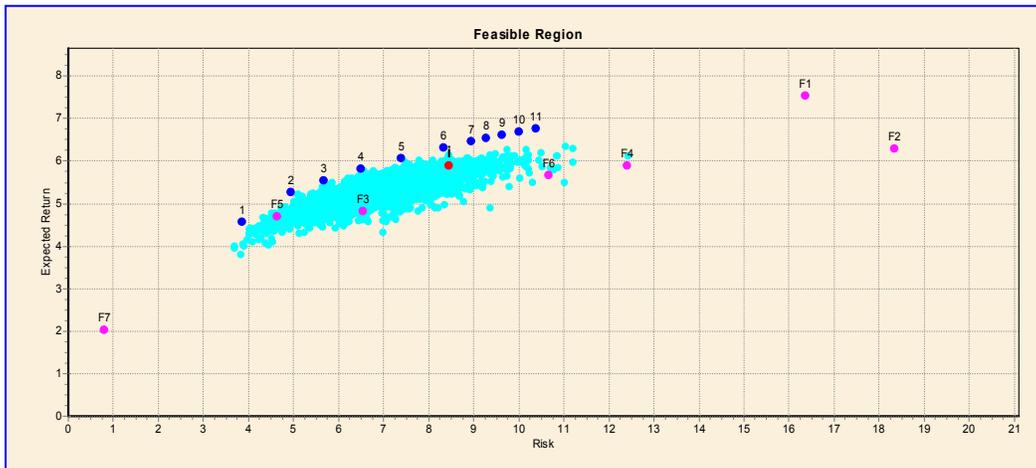
We look forward to being able to serve our Asia clients better with this new position, and trust that you will welcome Nick at your offices soon! Clients based in the regions listed above can contact Nick at 617.208.2030, nick@northinfo.com.

NFA Newsletter available

Northfield's partner, New Frontier Advisors, LLC provides consulting and analytical tools to the financial community.

As Northfield Optimizer users know, their patented efficient resampling technology is embedded in the Optimizer software. This technology assists managers in constructing robust portfolios and making rebalancing decisions. If you would like to receive the NFA quarterly newsletter, or learn more about NFA optimization, contact NFA at 617.482.1433, sales@newfrontieradvisors.com.

If you have any suggestions of what you would like to see covered in upcoming issues, please e-mail your ideas to staff@northinfo.com



(New Paco, continued from page 1)

of the reports and graphs present the results for any of the portfolios on the efficient frontier. All of the graphs and reports can paste to the clipboard save in CSV, TAB or WMF format for convenient use in client presentations.

- Statistical tools that allow you to do univariate and multiple regressions of the data series.
- Historical simulation that let you see the performance of different asset allocation and rebalancing strategies.

The list of market indices covered in the PACO database is being expanded and updated.

The next release of the system will include globalization features so that investors can operate equally efficiently in any base currency.

Continuing on our goal to increase the worldwide usefulness of all of our products, Northfield is discussing adding a number of non U.S. funds and indices with a number of data vendors and expects to add these data to PACO in the near future.

Substantial new capabilities for doing "optimized" backtests has been added to the historical simulation function. This is useful for either simulating a passive strategy (with constant return expectations for each asset class) or an active strategy in which the expectations change periodically. Of particular interest to the tactical asset allocator are time series and cross sectional estimates of the information coefficient (IC) and the ability to short asset classes, which can be especially useful for currency hedging international bond and equity exposures.

Before we developed the new version of PACO, we put considerable development into a new technique of asset

allocation using Analytic Hierarchy Processing. A new module containing our analytic hierarchy process methodology for individual investor asset class/fund allocation has been added. This is a new and unique technology for integrating asset allocation into the personal financial planning process that reconciles the concept of suitable portfolios with optimal portfolios. Suitable portfolios have their asset allocation set using the expert judgment of the suitability of each asset class for an investor. Optimal portfolios are quantitatively calculated to be on the efficient frontier and have a risk level appropriate to the investor, which requires estimating the investor's risk aversion. The AHP process ensures that the suitable portfolios are statistically equivalent to optimal portfolios and have a risk level appropriate to the investor's needs and situation.

Another new module proving for returns-based style analysis is being added. This module will incorporate superior analytical features such as confidence intervals (Lobosco and diBartolomeo, Financial Analyst Journal, September 1997) and Kalman filtering (presented at the Northfield 2002 Conference at Yosemite by P.J. Van Der Sluis)

Our current method (Bayesian) for controlling estimation error in optimizations will be supplemented with additional features to assist users in forecasting expected returns. One approach we favor, allows you to specify the weights of a market proxy, and your current risk free and market return expectations. You can also specify an expected alpha for each asset class, which will be combined with market expectations and a beta estimate to create an expected return for each asset class. This estimator will allow simple one click import and export to the main table.

We are planning to add a mechanism for monitoring performance of actively managed funds using the CUSUM statistical techniques presented by Tom Philips at the recent Northfield conference in Stowe, Vermont.

Issues on Resampled Efficiency

By Richard Michaud and Robert Michaud,
New Frontier Advisors

The resampled efficiency approach, developed by New Frontier Advisors (NFA), is a forecast certainty conditional generalization of mean-variance portfolio efficiency.¹ With practitioners around the world now using our optimization methods, interest in this approach has emerged in a number of academic and professional journals, student theses, and presentations. Inevitably, some misinterpretations and misunderstandings have arisen. Here, we address some of the more common misunderstandings about resampled efficiency that have come to our attention.

Markowitz (1959) efficiency is a convenient and useful theoretical tool for defining portfolio optimality. Unfortunately, in practice it is an error-prone procedure that often results in 'error maximized' and 'investment irrelevant' portfolios. Markowitz mean-variance (MV) portfolio optimization implicitly assumes that inputs are 100% certain. However, investors are never 100% certain of their information. As a result, MV efficient portfolios are typically overly specific to the inputs and often lead to disappointing out-of-sample performance as well as investment unintuitive portfolios. Michaud (1998) teaches eight categories of procedures for improving portfolio optimization and asset allocation in practice, including resampled efficiency.²

What is new about resampled efficiency?

NFA resampled efficiency is a new definition of portfolio optimality.³ It is a forecast certainty conditional generalization of the Markowitz MV efficient frontier. Resampling is a powerful statistical procedure for dealing with estimation error in optimization inputs. Resampled efficiency controls estimation error by allowing the user to customize the optimization process according to an assumed level of information certainty. Unlike earlier work that focused on statistical properties of optimized portfolios, resampled efficiency defines a new efficient frontier that is consistent with most applications of MV efficiency.⁴

What are the benefits of resampled efficiency?

NFA resampled efficiency consists of the resampled efficient frontier and the resampled rebalancing rule. The patented resampled efficient frontier (Michaud 1998, Ch. 6) improves investment value, produces intuitive and stable portfolios, reduces the need to trade, lessens the dependency on *ad hoc* constraints, and offers easier manageability than MV efficiency.⁵ The patented resampled rebalancing rule (Michaud 1998, Ch. 7) is the first statistically rigorous portfolio-trading rule available to the investment community.⁶ In general the rebalancing rule leads to a reduced

need to trade. This rebalancing procedure provides a reliable method for deciding when trading is or is not advisable. Furthermore, it is customizable for a wide range of applications.⁷

Will a backtest of resampled efficiency always outperform MV efficiency?

No. Rigorous statistical simulation tests (such as in Michaud (1998), Ch. 6) show that NFA optimization on average improves out-of-sample reward-to-risk ratios relative to classical optimization. This statistical proof is more reliable than a backtest: a backtest is period-specific and provides no reliable out-of-sample investment information. Just as the best team does not always win, a "good" investment strategy may perform poorly and a "poor" strategy may perform well in a given period. Therefore, simulation methods are used to prove investment superiority. Intuitively, a simulation study is a controlled experiment to reliably assess how a strategy performs on average. In many cases, the proper interpretation of backtests is that they are less indicative of the relative investment merits of resampled optimization than as a metric of the predictive content of the input data.

Are Bayes methods more powerful than NFA optimization?

No. Bayesian methods by themselves do not solve the estimation error problem because MV optimized portfolios remain overly specific to inputs. While there are many Bayesian methods to consider, important recent evidence suggests that NFA optimization may often outperform Bayes optimized portfolios out-of-sample.⁸ In general, both Bayesian and NFA optimization procedures are important and not mutually exclusive: Bayesian methods are a way of improving the level of investment information in your optimization inputs while resampled efficiency is a better way of using whatever information you have.⁹

Is resampled efficiency useful for long-short strategies?

Yes. Academic optimization studies often assume completely unconstrained optimization. In such investment irrelevant cases, resampled and MV efficiency coincide. However, in practice long-short strategies assume bounds on asset weights.¹⁰ In investment relevant cases, resampled efficiency is not equivalent to MV efficiency. Since many long-short strategies are levered strategies, the realistic risk estimation benefits of resampled efficiency are particularly important.

Are resampled efficient portfolios overly diversified?

No. There are two separable issues here. 1) Resampled efficiency is forecast certainty conditional MV efficiency. The higher the certainty level, the less diversified the re-

(Resampled Efficiency, Continued from page 6)

sampled optimal portfolio. Resampled efficient portfolios are optimally diversified relative to the chosen level of forecast certainty. 2) It is true that resampled optimized portfolios may often have statistically insignificant weights due to random outcomes in the simulation process. We deal with this issue by computing the theoretically optimal resampled efficient frontier and then finding the nearest investment relevant portfolios.¹¹

Are all resampled optimizers superior to MV efficiency?

No. There are a number of “resampled optimization” proposals in the investment community that have important limitations relative to NFA resampled efficiency. In all the cases we are aware of, these alternative methods do not produce portfolios that uniformly improve performance out-of-sample.¹² NFA’s optimization procedure is the only technology we know that enhances investment value on average across the risk spectrum.

How easy is it to beat MV efficiency out-of-sample?

It is true that non-informative strategies such as minimum variance and equal weighted portfolios may beat many Markowitz MV optimal portfolios out-of-sample. However, such solutions do not incorporate any information from the financial professional, have very limited usefulness for asset management in practice, and are not superior to NFA resampled efficiency.

Is the portfolio weight distribution anomalous?

No. Resampled optimization can be used to estimate the portfolio weight distribution (Michaud 1998, Ch. 7). This information can be very useful for determining which positions in the portfolio have weights that vary greatly in different input scenarios. Our original procedure often led to highly skewed distributions. It is extremely important to note that this skewness is inherent in Markowitz optimization but not obvious since we only see the point estimate of the optimal portfolio. Furthermore, an enhanced resampling procedure leads to substantial reduced skewness and improved asset weight distribution estimation.¹³

Is resampled efficiency sensitive to proper optimization design?

Yes. Optimizers are used to compute optimal allocations among attractive investments. Poor investments, such as baseball cards and postage stamps, are typically excluded in professional studies. Because an MV optimization assumes no information uncertainty, poor investments in the investment universe may (or may not) be ignored in efficient portfolios. However, because resampled efficiency

assumes input uncertainty, poor investments included in the universe may appear more often in resampled efficient portfolios. Consequently, a premium exists for investment expertise in proper optimization design for optimal resampled efficiency results.

Is resampled efficiency just a heuristic?

No. Resampled efficiency is based on one of the most powerful tools in all of modern statistics.¹⁴ Interestingly, Markowitz optimization was also called a heuristic by many of its earliest detractors.

How important are liquidity considerations in optimization?

Liquidity is often a first order factor for defining an investment meaningful portfolio optimization. Many portfolio optimization puzzles can be traced to omission of the liquidity factor. Since liquidity is often hard to measure without advanced statistical methods, illiquid assets often have high estimated returns and low measured risk. An allocation study that includes the S&P 500 index and private equity or hedge funds will often lead to investment irrelevant solutions without an appropriate adjustment for relative liquidity. Liquidity is a non-linear factor that depends on the level of investment and asset size or float. However, liquidity can be managed via careful use of quadratic penalties whenever asset universes have heterogeneous liquidity.

Endnotes

¹ Resampled efficiency, described in Michaud (1998), was co-invented by Richard Michaud and Robert Michaud and is a U.S. patented procedure, #6,003,018, December 1999, patent pending worldwide.

² For example, Chs. 8 and 11 discuss Stein and Bayesian methods.

³ See Michaud (2003) for a more complete description.

⁴ Jobson and Korkie (1981), Michaud (1989), diBartolomeo (1991, 1993), Jorion (1992), and are examples of the pioneering work on this subject.

⁵ In contrast to NFA’s procedure, which has been statistically proven to increase performance, alternative proposals for resampled optimization are actually *ineffective* at enhancing out-of-sample investment value.

⁶ See the comment in Buetow, G., et. al. (2002).

⁷ updates of the rebalancing rule appear in Michaud and Michaud (2002).

⁸ Markowitz (2002) personal communication.

⁹ Much of our ongoing research is devoted to development of new Bayesian procedures.

¹⁰ See Michaud (1993).

¹¹ This functionality is provided by Northfield. Users can control minimum positions, trade sizes and the number of assets held.

¹² Michaud (1998, Ch. 6) also reports that a utility function approach often used in academic papers showed limited improved performance characteristics.

(Continued on page 8)

(Resampled Efficiency, Continued from page 7)

¹³ The new methods are discussed further in Michaud and Michaud (2002).

¹⁴ For a classic resampling reference see Efron and Tibshirani (1993)

References

diBartolomeo, D. 1991. "Estimation Error in Asset Allocation." (www.northinfo.com/papers)

———. 1993. "Portfolio Optimization: The Robust Solution." (www.northinfo.com/papers)

Buetow, G., R. Sellers, D. Trotter, E. Hunt, and W. Whipple. 2002. "The Benefits of Rebalancing." *Journal of Portfolio Management*, Winter.

Efron, B., and R. Tibshirani. 1993. *Introduction to the Bootstrap*, Chapman and Hall, New York.

Jobson, J.D. and B. Korkie. 1981. "Estimation for Markowitz Efficient Portfolios." *Journal of the American Statistical Association* 75(371):544-554.

Jorion, P. 1992. "Portfolio Optimization in Practice." *Financial Analysts Journal* (January/February).

Markowitz, H. 1959. *Portfolio Selection: Efficient Diversification of Investments*. Cambridge, MA: Wiley; 1991 2nd edition published by Blackwell.

Michaud, R. 1989. "The Markowitz Optimization Enigma: Is Optimized Optimal?" *Financial Analysts Journal*, January/February.

———. 1993. "Are Long-Short Equity Strategies Superior?" *Financial Analysts Journal*, (November/December).

———. 1998. *Efficient Asset Management: A Practical Guide to Stock Portfolio Optimization and Asset Allocation*. Boston, MA: Harvard Business School Publishing; 2001 edition published by Oxford University Press, New York.

———. 2003. "An Introduction to Resampled Efficiency." *The Monitor*, Investment Management Consultants Association, February.

Michaud, Robert, and Richard Michaud. 2002. "Resampled Portfolio Rebalancing and Monitoring." *News from New Frontier Advisors* (December):1, 3 (www.newfrontieradvisors.com/publications)..

Northfield Technical Support

Northfield's primary technical support desk is in Boston, the hours are 8:00-6:00 EST. If you need Technical Support, or would like to schedule an online training session, call 617-208-2080 or e-mail to support@northinfo.com.

European clients who need technical support assistance when the Boston office is closed can call the London office, at +44-(0)-20-7801-6260, or e-mail to Rupert Goodwin, rupert@northinfo.com

New Partner-Rimes Technologies

RIMES Technologies, a new Northfield partner, has integrated the Northfield Open Optimizer within RIMES Technologies web based RIMES ONLINE product and also within their Excel client, RTXLnet. The integrated products will be available to clients during the 2nd quarter of this year. RIMES Technologies Corporation www.rimes.com is a provider of financial data and web based applications targeted to investment professionals.

Performance Attribution on FactSet

FactSet Research Systems, a Northfield partner, has announced that Northfield's risk-based performance attribution will be available through Factset's Portfolio Analysis (PA) application during the 2nd quarter of this year. For those familiar with PA, risk-based performance attribution is integrated into the attribution tab as well as a new, eleven tab in the application.

Total Risk Added to Risk Models

In response to client requests, Northfield will provide an additional item of data for each security in all of our models. This new column, at the far right hand side of the data file, will contain the Total Risk of each security, in terms of annual standard deviation. This change should take effect starting with the April 2003 risk model data.



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