



September 2014

Northfield News

A Newsletter for the Friends and Clients of Northfield

On a Positive Definition of Asset Specific Risk

By Dan diBartolomeo

Special Points of Interest:

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- ▶ **Annual Conference and Asia Seminar Agendas**
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In building risk models of the sort that Northfield provides to our clients, it has been the custom of the asset management industry to use “asset specific risk”, “idiosyncratic risk” and “residual risk” all interchangeably. When we model risk at the security level, we allocate observed variations in security returns to linear relationships with “common factors” that are believed to be relevant in differing degrees to all securities. The factors are thereby responsible for explaining the covariance of securities, including a large portion of the variance of a given security. Such assumptions of linear return/risk relationships are the underpinning of theories of capital market equilibrium such as the CAPM and APT. To statistically estimate the nature and magnitude of the relationships among securities that are driven by factors, we typically use standard techniques such as regression analysis. In a typical “ordinary least squares” regression we fit the relationship between the dependent variable (security returns) and the independent variables (factor exposures or factor returns depending on the type of model) so as to minimize the “residuals”, the portion of the security returns that are not explained by the factors. The standard deviation of the residuals is closely related to the standard error of the regression. To the extent, we cannot explain the variation in security returns as coming from a common factor, it is customary and *seemingly logical* to assume that these residual events arise from causes which are idiosyncratic in nature and specific to the particular asset in question.

However, there is something conceptually unsatisfying about this process. *We are defining asset specific risk based on our assessment of what we don't know, rather than any kind of affirmative definition in which we would try to quantify and explain asset specific risk based on what we do know.* Having a better assessment of specific risk may be useful in a number of ways. First, it may help us get a better assessment of volatility at the individual security level, and particularly how the expectation of volatility may be different in the long term as compared to a short horizon. Secondly, such improved estimates at the security level may help us get better estimates of portfolio risk, and particularly the marginal contributions of individual security positions to portfolio risk. Perhaps most importantly of all is that for many investment strategies (e.g. classic “stock picking”) the opportunity set available to the investor to obtain extraordinary risk-adjusted returns (i.e. alpha) is presumed to be a linear function of the security level specific risk magnitudes, as described in Grinold (Journal Portfolio Management, 1994). Taken jointly, the latter two issues combine to impact the optimality of portfolio position sizes.

Another drawback of a negative definition of asset specific risk is the inability to easily reconcile observed return behavior across different traded securities within the capital structure of a company. If we are interested in understanding the idiosyncratic risks of Firm X, the estimate we might get from residual return volatility in stock returns might be very different from what we would get from observing residual return volatility from the corporate bonds of the same firm. While theoretical constructs exist to link across

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Upcoming and Recent Events

2014 Northfield Annual Research Conference

The Stowe Mountain Lodge • Stowe, Vermont • October 5-8, 2014

We are pleased to announce our 27th annual research conference at the Stowe Mountain Lodge, in Stowe, Vermont. The conference will officially start on Sunday, October 5th and end on Wednesday, October 8th.

For over a century Stowe has attracted the world's most discerning travelers, who have cherished the beauty of the area's covered bridges, sparkling lakes, rambling woodlands and majestic peaks. The Stowe Mountain Lodge has set a new standard of luxury and aesthetics for the East Coast's most magnificent resort.

We are accepting online registrations only. To complete your online registration, hotel requirements, and to view the full agenda with detailed presentation abstracts, visit <http://www.northinfo.com/events.php>. All hotel reservations are to be made directly by calling the Stowe Mountain Lodge, or by visiting their website at <http://www.stowemountainlodge.com>. Contact Kathy Prasad if you have any difficulties registering, kathy@northinfo.com, 617.208.2020.



Stowe Mountain Lodge

Agenda

The agenda will consist of twelve 1-hour presentations. CFA Institute has approved this program, offered by Northfield Information Services, Inc, for 12 CE credit hours.

AIG Before, During and After the Crisis

Bill Poutsiaka, AIG (CIO)

Decomposing Variance Risk for Long-Term Investors – On a Few Elementary Formulas

Yan Ge, CPPIB

To Rebalance or Not to Rebalance: A Statistical Comparison of Terminal Wealth of Fixed- Weight and Buy-and-Hold Portfolio

Eddie Qian, Panagora Asset Management

Did You Choose Well the When, Where and to Whom of Your Birth?

John O'Brien; University of California at Berkeley

Correlations, Diversification, and Hedging: A Critical Review of Portfolio Diversification Measures

Randy O'Toole, Federated Investors

The Art of Tracking Corporate Bond Indices

Marielle deJong, Amundi

Valuation of Asset Management Firms

Bernd Scherer, EDHEC

TRC Networks and Systemic Risk

Roger M. Stein, MIT

What Would Yale Do If It Were Taxable?

Lisa Goldberg, Aperio Group and the University of California at Berkeley

Multiperiod Portfolio Selection and Bayesian Dynamic Models

Petter Kolm, New York University

Taking the Art out of Smart Beta

Ed Fishwick, Blackrock

On a Positive Definition of Asset Specific Risk

Dan diBartolomeo, Northfield

Northfield Asia Seminar Series – Research on Investment Management and Risk Hong Kong • Sydney • Singapore • October 27th, 29th and 31st

Northfield will be hosting three one day seminars in Hong Kong, Singapore and Sydney. The purpose of the seminars is to showcase our research on various topics in investment and risk management to our growing list of Australian and Far East clients and prospects.

To register, visit <http://www.northinfo.com/events.php>, or contact Nick Wade in Tokyo if you would like to attend, +81.3.5403.4655 or e-mail: events@northinfo.com. There is no cost for registering for any of the seminars.

The seminars are pending approval for CFA CE units at the time of this writing.

To view the full agendas with detailed presentation abstracts visit www.northinfo.com/events.php

Hong Kong Agenda:

Monday, October 27, 2014, 9:00 am - 3:00 pm • Landmark Mandarin Oriental, Central, Hong Kong

- Does Market Efficiency Imply that Long Term Return Premia Must Be Predictable?
- Seeing The Big Picture: Financial Markets, Conflict and Corruption
- Estimating Time-Varying Equity Risk Premium II - *Presented by Dr. Katsunari Yamaguchi, President, Ibbotson Japan*
- On a Positive Definition of Asset Specific Risk
- Understanding Risk Decomposition

Sydney Agenda:

Wednesday, October 29, 2014, 9:00 am – 4:00 pm • The Quay Restaurant, The Rocks, Sydney

- Does Market Efficiency Imply that Long Term Return Premia Must Be Predictable?
- Seeing The Big Picture: Financial Markets, Conflict and Corruption
- Tail Risk and the Return Distribution of Hedge Funds
- On a Positive Definition of Asset Specific Risk
- Portfolio Optimization with VaR, CVaR, Skew and Kurtosis
- Risk Management Priorities for Asset Owners: What Senior Management and Trustees Need to Know

Singapore Agenda:

Friday, October 31, 2014, 9:00 am - 3:30 pm • The Fullerton Hotel, Singapore

- Does Market Efficiency Imply that Long Term Return Premia Must Be Predictable?
- Seeing The Big Picture: Financial Markets, Conflict and Corruption
- Tail Risk and the Return Distribution of Hedge Funds
- On a Positive Definition of Asset Specific Risk
- Portfolio Optimization with VaR, CVaR, Skew and Kurtosis
- Understanding Risk Decomposition



Quay Restaurant



Landmark Mandarin Oriental



Fullerton Hotel

Webinar: Measuring Skill in Active Managers

October 1, 2014 • 11:00 A.M., E.D.T.

Northfield President Dan diBartolomeo will be hosting a webinar on October 1, 2014.

Presentation Abstract:

Every active manager and every investor who invests with an active manager must believe that the manager must possess an above average ability to make investment decisions else it would be more beneficial to pursue passive strategies. However, the effective identification of skill (as opposed to luck) in investment management has proven elusive, as the volatility of financial markets creates a low "signal to noise ratio" setting.

In this webinar, Dan will present the Northfield PWER methodology, a sophisticated multiple step process for statistical analysis of manager skill that we began to develop in 2006. Within this method are approaches to creating effective peer groups, finding optimal evaluation periods, weighting past return observations, and a Bayesian construct for the consideration of luck versus skill. PWER ratings of more than 100,000 mutual funds, hedge funds and separate accounts are now conducted on a monthly basis.

To conclude, Dan will also show how "fund of fund" and multi-manager funds can augment PWER scores with the concept of the Effective Information Coefficient, which uses risk models and position information to simultaneously evaluate both the predictive power and the portfolio construction skills of active managers.

Visit <http://www.northinfo.com/events.php> to register and view the full presentation abstract. There is no charge to register. If you cannot attend the live session, please register from the link above and we will send you the post webinar recording.

Webinar Wrap-up: Risk Management Priorities for Asset Owners - What Senior Management and Trustees Need to Know

August 26, 2014

Dan diBartolomeo hosted a webinar on August 26th where he discussed effective risk management for large asset owners. While most of the material presented was suitable for all asset owners, Dan also spent time differentiating the needs of defined benefit pension funds, defined contribution funds, endowments, family offices and public mutual funds. Among the topics covered were the levels of risk associated with strategic and tactical asset allocation, hedge funds, illiquid investments (e.g. real estate and private equity), and active management.

The presentation slides are available at <http://www.northinfo.com/documents/609.pdf>. Contact your Northfield Sales Representative if you are interested in viewing the full presentation recording of the event.

Webinar Wrap-up: Portfolio Optimization with VaR, CVaR, Skew and Kurtosis

July 16, 2014

Dan diBartolomeo's webinar on July 16th discussed the ongoing debate as to the necessity of including higher moments of return distributions (skew and kurtosis) into the portfolio optimization process. The presentation identified the portfolio situations where the importance of higher moments appears to be economically material and statistically significant. Dan used the example of "catastrophe" bonds to illustrate two broad approaches to incorporate higher moments into portfolio optimization.

The presentation slides are available at <http://www.northinfo.com/documents/608.pdf>. Contact your Northfield Sales Representative if you are interested in viewing the full presentation recording of the event.

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the capital structure such as Merton (Journal of Finance, 1974), the heterogeneous nature of investors and liquidity levels across the different types of financial instruments makes the analysis difficult. A more affirmative definition of asset specific risk could also help draw the distinction between “stock specific risk” and “firm specific risk”. It seems intuitive to suggest that stock specific risk might include short-term variations in stock returns caused by time-varying investor behavior, which would not necessarily have any impact on the underlying business risks at the firm level. In the long run, transient investor-driven effects should wash out leaving long term estimates of stock specific risk to converge to the firm-specific risk level.

The final unpleasant aspect of the current negative definition of asset specific risk is *ambiguity of magnitude*. The residual risk of a stock’s return is the portion of the observed return variation over some sample period that is not explained by the set of factors defined to span the matrix of covariance among the assets. This means that the estimated value of asset specific risk will be impacted by the nature and estimation process of the risk model in use. We will see what we have chosen to see by virtue of many choices: the sample period over which returns are observed, the frequency of return observations (daily returns have very different properties than monthly returns), any weighting scheme for the observations, the number of factors chosen, the particular nature of each factor chosen to participate in the risk model as an independent variable, and finally the particular statistical procedures used to estimate the various components of the model. Some factors such as balance sheet leverage (debt/equity) relate to bankruptcy risk and are therefore related to highly non-linear return events. For a useful discussion of these issues see diBartolomeo (Chapter 14, [Oxford Handbook of Quantitative Asset Management](#), 2012.). Another issue is whether the model is unconditional (based purely on the past), or like Northfield models, is conditioned on contemporaneous information in order to differentiate between short-horizon and long-horizon forecasts).

In our models, there is yet another nuance to be considered. We assume that our models will be used for portfolio management, and there is a broad assumption in portfolio theory that security returns approximately follow geometric Brownian motion, which implies a normal distribution, consistent volatility and no serial correlation. To the extent that we observe return distributions that do not have these IID properties, we make adjustments in the estimated total volatility of a security’s returns during the sample period. The magnitude of the adjustment is based on a method from Parkinson (Journal of Business, 1980) in which security volatility is observed not as the time series standard deviation of periodic returns, but rather mathematically inferred from the “high/low” price range ob-

served for the security during each observation during the sample period. Empirical research papers have shown that “rescaled range” measures of volatility are more efficient than the traditional statistical calculation because we are not ignoring what happens between the start and end points in time for each observation. If security return behavior is IID, the two measures of observed total volatility will agree. If they disagree, we try to be conservative by using the higher of the two values as our initial estimate of total volatility. To the extent that this procedure does not impact the explained portion of observed return variation, adjustments in estimate stock total volatility will manifest as changes in estimated stock specific risk.

An important piece of research related to this issue is Govindaraj, Livnat, Savor and Zhao (2013) which was presented on at the Northfield client conference in Montreal, <http://www.northinfo.com/documents/566.pdf>. In this study, all occurrences of a one day stock return with absolute value greater than five percent were recorded over a large universe of stocks from 1982 to 2011. During the period from 1982 to 2011, the study then observes changes in analyst’s earnings estimates for the week *subsequent* to the price change. From 1999 to 2011, they also observed changes in the analyst’s target prices for the stock over the same subsequent week. The premise is that if the large price changes (abs > 5%) were investor’s response to actual changes in the business conditions of the firm, either the earnings estimates or the share price targets would change as well. If the large price changes were the result of transitory investor activity such as a shareholder making a wholesale change in asset allocation from stocks to bonds, it would be unrelated to the firm’s business and therefore we would expect no change in the earnings estimates or share price targets. It was found that no changes in earnings estimates or share price targets occurred in approximately 80% of the events. This lends substantial credence to the idea that the volatility of stocks returns is greater than the operating risks of the underlying firms. It also suggests that longer term estimates of asset specific risk should be lower, as the random shocks associated with transient investor behavior average out.

Another possible approach to making a more affirmative definition of asset specific risk would be through analysis of the capital structure of a firm. If a firm has debt, the possibility of defaulting on the debt will be approximately coincident with the value of the equity of the firm going to zero, as described by the “contingent claims analysis” method of Merton (1974). If a firm has traded debt with observable market yields, we can subtract out the yield on a comparable duration of riskless debt (i.e. Treasuries) to obtain a credit related yield spread. To the extent that corporate bonds are often callable before maturity, the credit spread is usually adjusted into a measure called an “option

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adjusted spread" (OAS). This is the extra yield that investors demand for the credit risk of that firm. In diBartolomeo (Journal of Investing, 2010), a Merton style model is presented that links stock volatility to the volatility of the firm's underlying assets, and to the resultant probability of default (PD) on debt when the value of the firm's assets goes below the face value of the firm's debt. This study shows that given stock prices and observed stock volatilities for US stocks (including ADRs) from 1992 to 2009, the implied "half-life" of firms was about 20 years, comparable to a default probability of 3.4% per annum. To the extent that bond defaults are actually less frequent than 3.4%, we might conclude that stock volatility is upward biased relative to the actual risks of the firm, consistent with the our inferences drawn from the results of Govindaraj, et. al. We can also exploit this process to *estimate specific risk at the individual firm or stock level*. As described in diBartolomeo (2012) we can also use the Merton process to estimate the "loss given default" (LGD) on a corporate bond. The product of PD and LGD is the "expected loss" (EL) due to credit risk. OAS is the lower bound of the market's estimate of expected loss. If we can observe the OAS on the bonds of a particular firm, we can work backward through the model to solve for the corresponding level of stock volatility (and variance). We can then subtract out the stock return variance explained by our factors and arrive at an implied estimate of specific risk. One subtlety associated with obtaining an OAS implied value for specific risk is that a non-zero probability of default will mean that the distribution of equity returns will be non-normal with left skew and kurtosis. To incorporate these higher moments into an equivalent volatility measure, we suggest following approximation:

$$S^* \sim (S^2 - (200/(6*S)) [(2/3)* MS^3 + (1/2)* KS^4])^5$$

Where:

- S* = adjusted volatility
- S = traditional volatility
- M = skew
- K = kurtosis

We can also use the fact that investors are responding to information about real world events to help us form an affirmative definition of specific risk. There are also numerous research papers that show strong consistently positive linkages between the flow of news and volatility of financial assets. One such paper is Kyle, Obizhaeva, Sinha and Tuzun (2012) that shows that a theoretically predicted relationship between the frequency of news articles on companies, and the volatility of their stocks was fit almost perfectly by the empirical data over hundreds of companies and many years. Another paper is diBartolomeo, Mitra and Mitra (Quantitative Finance, 2009) which showed that the

volatility of major company shares in the US and Europe was more effectively predicted by mathematical summarization of news articles than by the standard method of implying volatility of the market prices of traded stock options. Since the 2009 publication, Northfield has continued research on the relationship between news and volatility, including sponsoring projects for two teams of MIT graduate students. Among the conclusions drawn from this work are that the stock volatility of some firms was consistently related to both the number and "sentiment" (considered good news or bad news) of news stories, while no relationship was detected with other firms. A second conclusion was the impact of a particular event on daily volatility decayed quickly to insignificant levels in a month or less. Finally, we find that daily variation in intra-day volatility to be very closely related to news flows (T statistic > 9 on a sample of 1.7 million data points). At least for short term forecasts, it is apparent that incorporating the impact of news on asset specific risk estimates is another essential element of an affirmative estimation process.

From the foregoing discussion, it should be obvious that models of risk that are based on different security universes, with different observation frequencies, or estimated over different historic sample periods could produce different estimated values for stock specific risk. What is less obvious is the extent to which the specific risk estimates could vary by changing the nature of the risk model while holding all other aspects of the process (universe, sample period, observation frequency) constant. To test this proposition, we compared the vector of estimated stock specific risks for the Northfield US Fundamental Model and the Northfield US "Single Market" Model as of August 31, 2014. As the name Fundamental model implies, in this model the factors are defined by endogenous characteristics of stocks such as industry group, book/price ratio, market cap and momentum. The statistical process needed to estimate the model parameters is a cross-sectional regression analysis across the universe of stocks done separately for each observation month. To the contrary, the US Single Market model uses exogenous information like interest rates, oil prices and the return on the market as factors. The statistical estimation process is a time series process done separately for each stock (like Fama-French). Both models use a 60 month sample period, a comparable degree of exponential weight of observations and the same Parkinson adjustments to the total volatility estimate.

Our results showed that the cross-sectional correlation between two vectors of stock specific risk values was approximately 87% across a universe of about 5000 stocks. The distribution of the differences at the individual stock level had an extremely high degree of kurtosis of more than 14. The average monthly specific risk from the

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Fundamental model was 11.03, while for the US Single Market model it was 11.36. This suggests that the differences in the estimates from the two models were generally small but were very large on a small number of stocks. Comparable tests on the same data for August 2013, and August 2003 produced nearly identical results with cross-sectional correlations even higher at over 90%, and a kurtosis levels over 12. Interesting, for 2013 the average specific risk estimate for the Fundamental model was 13.01 while it was lower at 12.2 for the US Single Market model. This showed that for the five year sample periods both ending August 2013, the in-sample explanatory power of the exogenous model was actually higher than for the Fundamental model. It is often incorrectly assumed that endogenous models have higher in-sample explanatory power than time series models. One might attribute the high explanatory power of the time series model to the fact that the sample period included the large “macro” effects of the Global Financial Crisis in 2008 and 2009. However, we find that the time series model also had higher explanatory power in the five year ending 2003, before the GFC.

It may also be possible to generate convergence between the estimation methods. We can certainly take the endogenous model, estimate factor returns for each time period and then use the time series of factor returns in a time series regression. This would produce new estimates of previously observed factor exposures. We would then repeat the cross-sectional estimation to get new factor returns and cycle through the process again. Eventually, the process would converge to stable values. Similarly, we can take the time series factor exposures as given, and use cross-sectional estimation for factor returns. The new factor return times series would replace the original values in the times series regressions. Again, iterating through the process would eventually reach convergence on a set of internally consistent values.

To further our empirical investigation, we considered that the factors in our risk models might have explanatory power over the specific risk estimate itself. When we build a risk model, our dependent variables are security returns which we try to explain with our selected factors. In this case, we wanted to use the specific risk estimates as the dependent variable and see if there were intuitive relationships between the specific risk estimates and security exposures to factors. As an example, we examined the August 2014 US Fundamental model, and calculated the univariate cross-sectional correlation of the specific risk estimates to the each of the models sixty-eight factor exposure vectors. Unsurprisingly, the strongest correlation was negative 48% between the stock specific risk estimates and the logarithm of market capitalization. The relationship between specific risk and market cap had already been noted in the literature (see [Active Portfolio Management](#)

by Grinold and Kahn, first edition, page 59). Other factor strong relationships included a negative 33% correlation with dividend yield, a positive 20% correlation to trading activity (volume as a % of shares outstanding) and a 17% positive correlation to earnings variability. All of these relationships were highly statistically significant and seem consistent with the intuition of all the foregoing discussion. We also tested “a member/not a member” dummy variable for each of the fifty-five defined industry groups in terms of correlation to the specific risk estimate. The specific risk estimates appeared to be strongly related ($T > 5$) to only the industry dummy for just one industry, pharmaceuticals.

While much more research is needed, it would appear that we are not doomed to having a “negative” definition of asset specific risk. There are clear means by which we can distinguish between stock specific risk and specific risk of firms. There are also strong cross-sectional relationships between our estimates of stock specific risk and observable characteristics of stocks and firms. The variation in specific risk over time also seems well explained by quantification of news flows. Our work in this area will be ongoing toward a positive definition of specific risk.

Staff Speaking Engagements

Northfield President Dan diBartolomeo presented “Quantitative Investment as a Social Science” at Boston University, on August 27th.

Dan was at Worcester College in Oxford, UK on September 8-10 for the London Quant Group Annual Conference where he presented “Does Market Efficiency Imply that Long Term Financial Market Returns Must be Predictable?”

Dan will be discussing model testing and validation at the CQA Best Practices Seminar in New York on September 30th.

Dan will be presenting “Risk Management for Pension Trustees” at the Milliman Pension Conference in Lake Tahoe, CA, on October 2nd.

Northfield Asia’s Nick Wade presented at RMIT’s Finance day in Melbourne, Australia on August 22nd. The topic was “Risk Model Methodologies: Understanding, Designing, and Testing Risk Models”

On August 27th, Nick lectured on asset Allocation, Portfolio Construction, and Risk at the CFA Institute in Singapore.

Technical Support Tip: Sources of Statistical Error in Portfolio Risk Estimates

By Steve Dyer

When estimating and interpreting portfolio risk, it is important to keep in mind that in any statistical exercise, there are inevitable sources of estimation error. If you are a manager looking at many reports every month, it is easy and natural to fall into a habit of reading volatility and tracking error values with two decimal places as *precise quantities* rather than a description of a *distribution* of likely outcomes. This article will discuss the sources of estimation error and their magnitudes in the Northfield models.

The first source of error is sampling error, since the estimation of the risk models uses a subset of security returns (60 monthly returns) from the population of all security returns. To approximate the magnitude of this error, let us start off with the simplifying assumptions that the true level of risk in financial markets is constant throughout history and that security returns are random. Even with these simplifying assumptions, if we were to observe what looks like changes in risk it would be because we are observing a finite sample of history (e.g. a 60 month period) rather than an infinite history from the beginning of time. The minimum percentage sampling error for a sample with 60 observations would be approximately, $\frac{1}{\sqrt{(60-1)}}$ or about 13%.

Of course, in the real world the actual level of volatility does change, so we have to account for these simplifying assumptions. The extent to which changes in the true volatility level occur is very dependent on what time horizon you are looking over, and the extent to which the returns have serial correlation. A good example of the magnitude of the effect of serial returns and different time horizons on estimation error is in the following article on high yield bond volatility statistics: <http://www.northinfo.com/Documents/546.pdf>.

To determine the size of the effect of changing volatility levels and serial correlation in equities, the standard errors have been empirically demonstrated in two ways. The first, using a bootstrapping technique as described in Michaud (1989) showed that the implied standard error was between 15 to 20 percent. A second approach in internal Northfield testing used a set of randomly drawn portfolios and compared the ex ante tracking error to the ex post tracking error of the portfolios. While the numbers varied over time, this also produced a standard error between 15 to 20 percent, corroborating the results in Michaud.

How does this amount of error affect the risk number we are used to looking at? In terms of looking at different risk levels, the obvious thing is that volatility can't go below zero, and follows a Chi Squared distribution. The limits of a confidence interval around it would be:

$$\text{Lower Limit } \sigma = \sigma * \text{SQRT} [(n-1) / \text{CHIINV}(\alpha/2), (n-1)]$$

$$\text{UpperLimit } \sigma = \sigma * \text{SQRT} [(n-1) / \text{CHIINV}(1-\alpha/2), (n-1)]$$

Assuming 95% confidence and 60 month of observations, a portfolio with an expected volatility of 10 should be viewed as having a volatility between 8.5% and 12.2%.

$$\text{Lower Limit } \sigma = 10 * \text{SQRT} [(60-1) / 82.12 (= \text{CHIINV}(5\%/2), (60-1))] = 8.5\%$$

$$\text{UpperLimit } \sigma = 10 * \text{SQRT} [(60-1) / 39.66 (= \text{CHIINV}(1-5\%/2), (n-1))] = 12.2\%$$

How can we reduce and mitigate the sampling error? The obvious way to reduce the sampling error is to use more data points (a longer history), but this usually just creates an offsetting increase in the errors associated with real changes in risk levels. These are obviously more likely if you are comparing current conditions to what happened thirty years ago. The other possibility is to use higher frequency observations (daily versus monthly) to get more data points, but all our usual assumptions about normal distribution, no serial correlation, and consistent volatility can be conclusively rejected for daily stock returns. As a result, Northfield Near Horizon models use market implied volatilities and other observable factors in order to adapt quickly to new market conditions.

The additional consideration for tracking error is the relationship between two portfolio volatilities. Tracking error between a portfolio and a benchmark arises from two sources: one is errors in the two portfolio volatilities, and the other is error in the estimate of correlation between the portfolio and benchmark. If the portfolio and the benchmark are of comparable total volatility, we could reasonably assume that any errors in the two absolute volatility values would be similar, and therefore would roughly cancel in the tracking error computation. That would mean that most of the estimation error would arise from error in the correlation. To get the correlation between the portfolio and benchmark, you can take the square root of the R² value in the standard Northfield risk decomposition report. There are several closed-form solutions for the standard error of a correlation coefficient, the most popular of which is:

$$SE_{(R)} = \sqrt{\frac{1 - R^2}{(n - 2)}}$$

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If you have volatility for the portfolio, volatility for the benchmark and the standard error of the correlation, you can algebraically solve for the values of tracking error that would correspond to a "one standard error of correlation, two standard errors in correlation" and so on. The percentage differences between those fitted values and the base tracking error estimate would give you the plausible range on tracking error. In most of the Northfield Models, if the portfolio and benchmark have an R^2 of .90 and 60 observations, then the $SE_{(R)}$ would be 0.04.

It is important that when reviewing the results of your risk estimates and optimizations that you take these estimation errors into consideration. A portfolio with a volatility of 10 and another with a volatility of 10.5 or 9.5 are essentially the same with respect to risk. When troubleshooting your project, it is important not to over constrain your portfolio in order to get results that are not significantly different.

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References

Michaud, Richard, "The Markowitz Optimization Enigma: Is Optimized Optimal?", Financial Analysts Journal, Jan. 1989

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

New London Office Staff Member

Northfield is pleased to announce that Lalitha Raman has joined our London office as an Investment Analytics Support Analyst covering the EMEA region.

With over 10 years of experience in Software Development, Support and Project Management, Lalitha has held various roles including formal certified project management, senior line management as well as technical architecture design and support.

Being an exceptional employee, Lalitha has been awarded the Lucent yearly 'Bravo' award and the Morningstar 'Star' for outstanding achievement.

Lalitha can be reached at lalitha@northinfo.com or +44 (0) 20 3772 8519.

London based support is available for clients 8 – 18 GMT/BST at support-europe@northinfo.com or +44 (0) 17 2244 RISK.

Expansion of Equity Model Coverage

The universe of the Northfield Global Model of equities will be increased in January 2015 from roughly 70,000 stocks to approximately 100,000. The additional coverage will not be new companies but rather additional share classes, depository receipts and secondary exchange listings. A discussion of the analytical aspects of these additional securities appeared in the most recent previous issue of this newsletter. The delivery of the additional data may take different forms (i.e. computer file formats) on depending on whether the usage is with the Northfield Open Optimizer in a desktop installation, or via third-party delivery system such as FactSet, S&P Capital IQ, Thomson Reuters and InvestEdge.

For a complete index of all former Northfield News articles, visit <http://www.northinfo.com/documents/314.pdf>

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