Northfield News

March 2014

A Newsletter for the Friends and Clients of Northfield

Optimal Retirement Policy: Funding and Spending

By Dan diBartolomeo

Perhaps the most widely shared problem in investing is the process of a single household trying to save enough wealth to fund a comfortable standard of living during their retirement years. In recent years, the global trend toward defined contribution retirement schemes replacing defined benefit pensions has greatly accelerated the need for households to make intelligent decisions about how their wealth is to be invested during their employment years. Additionally, households need guidance in understanding how much spending in retirement their savings will support, and how to potentially adjust their spending level if investment returns are above or below expectations. The seminal question presented on billboards and in television commercials around the world is "Will my retirement fund last my lifetime?"

The seriousness of this problem was underscored in the passage of the US Dodd-Frank (2010) legislation during the financial crisis. In that law, the SEC (US securities regulator) is mandated to consider rules that would put broker-dealers and other investment agents for households under standards of fiduciary behavior comparable to investment advisers.

To address this problem, we have combined two sophisticated analytical techniques in a new way within the next version of our WealthBalancer asset allocation process. The

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Special Points of Interest:

- Main Article: Optimal Retirement Policy: Funding and Spending
- Second Article: The Pitfalls of a Index Based Approach to Managing Real Estate Investment Risk
- Tech Tip: Understanding the Optimization Log

Inside This Issue:

The Pitfalls of an Index-Based Approach to Managing Real Estate Investment Risk

By Emilian Belev, CFA and Richard Gold

In 2004, Northfield pioneered an innovative property-level approach to measuring and managing directly owned real estate risk using a general and widely accepted risk driver framework. Unlike other methodologies, Northfield's approach operates without the use of appraisal-based indices. In this article we would like to revisit the reasoning behind our methodology and why we feel this approach is central to the field of real estate risk management. In addition, we will also contrast Northfield's factor-based framework with the index-based methodologies which have been recently introduced into the marketplace.

At the heart of the problem is the simple question of how to effectively measure real estate risk? Due to its heterogeneity, large trading unit size such that you can't buy or sell 500 square feet of an office building to balance a portfolio, and it's inherent illiquidity, real estate indices have traditionally required the pervasive use of appraisal-based price estimates. This in turn has forced industry benchmarks such as the NCREIF and IPD property indices to use appraisals despite their well documented problems perhaps best

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Upcoming and Recent Events

Northfield's Private Wealth Webinar Series:

How Common Practice Falls Short of Best Practices

April 8th, 9th, and 10th, 2014

Northfield's Private Wealth Webinar Series will feature three presentations that address critical topics in the management of private wealth. The range of material will cover a range of best practices that benefit investors through superior after-tax returns, and also benefit asset management firms through greater operational efficiency.

All three topics will be presented by Northfield President Dan diBartolomeo.

Webinar 1: Non-parametric Methods for Asset Allocation in Private Wealth

April 8, 2014 ● 11:00 A.M. EDT

Webinar 2: Portfolio Management For Private Taxable Wealth: Basic Concepts and Operations

April 9, 2014 ● 11:00 A.M. EDT

Webinar 3: Generating Tax "Alpha" for Private Wealth Households.

April 10, 2014 ● 11:00 A.M. EDT

All three webinars will run for approximately one hour. There is no charge to register. To register, and view the complete presentation abstracts, visit www.northinfo.com/events.php. If you cannot attend the live sessions, please register and we will send you the webinar recording after the event

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Webinar: Introducing Illiquid Investments to Total Portfolio Management and ERM

April 30, 2014 ● 12:00 P.M., E.D.T.

Northfield's Emilian Belev, CFA, ARPM, Head of Enterprise Risk Analytics and Richard Gold, Senior Real Estate Risk Analyst will be hosting a webinar where they will discussing the rigorous risk analysis of illiquid investments like real estate and infrastructure alongside publicly traded investments in an ERM setting .

This is a Professional Risk Managers' International Association (PRMIA) event in coordination with the CFA Institute and qualifies for 1 CPE Credit. There is no charge to participate. Visit http://www.northinfo.com/events.php to register and view the full presentation abstract.

2014 Newport Annual Summer Seminar

Tennis Hall of Fame ● Newport, Rhode Island ● June 6, 2014

Northfield's Annual Summer Seminar will be held at the International Tennis Hall of Fame in Newport, Rhode Island on June 6, 2014. The purpose of the seminar is to present recent research and technical advances to our clients and friends. Our meeting date has been selected to coincide with the US Professional Championships of Court Tennis. Following the day's presentations, there will be a Court Tennis demonstration by Northfield President Dan diBartolomeo, and then a Court Tennis match. Court Tennis, or "real tennis" is the medieval sport that is the progenitor of all modern racquet sports. After tennis, there will be a relaxing oceanfront dinner party at Oceancliff.

Tennis Hall of Fame

We will be accepting donations on behalf of the Pine Street Inn, Boston's largest homeless shelter for this event. The full seminar agenda and registration information will be posted to www.northinfo.com/events.php as it becomes available.

Webinar Wrap-up: There's More to Evaluating Risk in Real Estate Portfolios than Location, Location, Location!

March 5, 2014

Rick Gold, Northfield's Senior Real Estate Analyst hosted a webinar on March 5th where he discussed the unique challenges of measuring the risk that REIT holdings add to a portfolio. The presentation is suitable for anyone who uses real estate as part of their investment portfolio and is particularly appropriate for those managing either public or private real estate portfolios.

The presentation slides are available at **http://www.northinfo.com/documents/588.pdf**. Contact your Northfield Sales Representative if you are interested in viewing the full presentation recording of the event.

Webinar Wrap-up: Understanding Risk Decomposition

January 29, 2014

Northfield President Dan diBartolomeo hosted a webinar on January 29th where he discussed how both quants and fundamental investors can understand the results they see in their risk decomposition reports. Attendees were given ways to distinguish which sources of risk in their portfolio are acceptable and which should be a concern.

The presentation slides are available at **http://www.northinfo.com/documents/587.pdf**. Contact your Northfield Sales Representative if you are interested in viewing the full presentation recording of the event.

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first of these methods is the Analytic Hierarchy Process (AHP) initially proposed by Saaty (1980). The second is the Discretionary Wealth Hypothesis from Wilcox (2003). AHP is a non-parametric technique that is particularly well suited for making complex decisions in a robust fashion. One class of such decisions is the question of asset allocation for households. There may be many considerations that are difficult to reduce to the familiar two-parameter Markowitz problem. In addition, there may be issues of a non-economic nature arising from the attitudes and experiences of the investor, as well as questions of legal aspects of suitability, liquidity, taxation and inter-generational transfers.

The Analytic Hierarchy Process is one of the most widely used mathematical applications in decision theory. Originally developed in the 1970s, the AHP has been used for an almost innumerable set of applications from ranking the importance of historic buildings for the purpose of budgeting funds for restoration to determining where industrial firms should locate off-shore manufacturing plants for optimal long-term profitability. Under certain assumptions it is mathematically demonstrable that the AHP produces optimal decision outcomes for a wide variety of problems, particularly those involving multiple, potential conflicting criteria or contributing opinions.

The basic idea of AHP is to formulate multiple decision criteria in the form of questions, with each question having multiple discrete answers (e.g. a typical multiple choice test). For each possible question response (such as an asset class), every solution choice is subjectively evaluated *by experts within the financial services firm* in a pair-wise comparison. For example, we might say that in the absence of other information, that an individual between 25 and 35 years of age is three times better off investing in equities than holding cash. Similarly, we might believe that in the absence of other information that bonds are four times as good an investment as small cap stocks for an individual living on a modest retirement income. By rating all possible pair-wise comparisons possible given the set of questions, answers and solution choices we form a set of numerical matrices that describes all of the relevant information and preferences. The mathematical core of the AHP method is that the eigenvectors of these matrices have special properties that can identify optimal solutions. An animated video illustrating the AHP approach is available at:
http://www.northinfo.com/modelssoftware. php#details.

Oddly, the AHP has received relatively little attention in the investment arena. Given the complex objectives of real world investors, AHP would seem to be a natural complement to other analytical solutions for asset allocation such as the mean-variance method of Markowitz (1952). The first research which proposed AHP as an alternative asset

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allocation method for investors was Khasari, Kamath and Grieves (1989).

The ability of AHP to address investor objectives other than simple return and risk was explored in Bolster, Janjigian and Trahan (1995). This paper first addressed the issue of how to incorporate the legal concept of "suitability" into the portfolio allocation process. Investment services are subject to substantial regulation in most countries. The conceptual basis of most of these regulations arises from the "prudent man rule" first articulated by American judge Samuel Putnam in 1830. The issue of using AHP to express investor preferences other than just the mean and variance of return was again addressed in Saraoglu and Detzler (2002). In this study, concepts like investor preferences for portfolio management experience and fee levels were used to match retail investors to open-end mutual funds.

For the purposes of this discussion, the most important paper in the AHP finance literature is that of Bolster and Warrick (2008), both of whom were associated with Northfield at that time. In this paper, AHP and traditional mean-variance methods are first compared to illustrate the fact that "suitable" portfolios formed using AHP methods are often "close enough" to mean-variance efficient under the test criteria established in Jobson (1991). The paper also combines AHP and mean-variance optimization to conform the portfolios created to real world constraints encountered by retail investors. Such constraints would include minimum dollar amounts that can be invested in particular funds, or the unwillingness of an investor to hold more than a selected number of asset classes to be chosen out of a larger set.

Not only can AHP be used to help investors allocate portfolios being used to fund later spending during retirement, it can also be used in combination with traditional mean-variance methods to obtain inferences as to the degree of risk aversion of the investor. While the Markowitz efficient frontier process computes a range of efficient portfolios based on return and risk expectations, there has been relatively little research into how investors should define their own risk aversion so as to be able to choose which portfolio on the efficient frontier they should hold. This is particularly important as financial market conditions vary over time. As markets move, investors and their advisors often struggle to come to decisions about how to revise the portfolio to meet the new circumstances.

To help investors come to appropriate expectations of how much consumption spending their retirement fund will support through their lifetimes, we will consider how AHP can be juxtaposed with the "Discretionary Wealth Hypothesis." In the DWH, Wilcox proposes an analytical solution to the question of what an investor's mean-variance risk aversion *should be*. The optimal degree of risk aversion at any moment in time is derived from a "life balance sheet" representation of the investor's assets and liabilities, inclusive of the present values of expected future savings on the asset side, and expected future consumptions expenditure (e.g. retirement, college tuition) on the liability side.

One of the most vexing problems for retail investors and their advisors is to answer the question "How aggressive should my portfolio be?" The traditional mean-variance utility function from Markowitz and Levy (1979) is stated as:

$$U = \alpha - \lambda \sigma^2 \qquad (1)$$

Where

U is the investor's utility (satisfaction) from the portfolio

α is the mean return

λ is the investor's risk aversion

σ is the standard deviation of return

The λ value represents the slope of a line drawn tangent to the efficient frontier so as to intersect at the chosen portfolio. The problematic aspect is that this means we need to know λ before we can select our optimal portfolio. Even in this idealized case where we have reduced the complex objectives of investors to just risk and return it is heroic to assume that investors can meaningfully articulate a numeric value for their risk aversion.

The AHP method can again be used to add richness to the investor decision process. To the extent that AHP methods can identify a single specific portfolio as appropriate for a given household, we can use our normal capital market assumptions to estimate the value of the return and risk of that portfolio. If we assume the AHP portfolio is "close enough" to the efficient frontier, we can then ask ourselves "If we are happy holding the portfolio derived from the AHP process, what is the value of λ that would have selected this point on the efficient frontier?"

One might reasonably ask why it is important for an investor (or their advisors) to identify an explicit value for risk aversion. A key decision that an investor must make about asset allocation is how to change the allocation when conditions change in the state of the problem. If we have an explicit value for λ, we have a clear path of action depending on the nature of the change. For example, if we believe that expected returns had changed for certain asset classes this would have the effect of changing the shape of the Markowitz efficient frontier. However, there would be no reason that such a change in our return expectations

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would change the investor's risk aversion. We would then apply the same tangency slope to the revised efficient frontier to find our new mean-variance portfolio.

On the other hand, the financial circumstances of a household will inevitably change due to changes in age, marriage status or inheritance wherein a change in the value of risk aversion is appropriate. By helping to explicitly identify appropriate levels of investor risk aversion, the process of revising the asset allocation is neatly divided into situations that involve changes in the state of the world (i.e. capital market expectations) and changes in the circumstances of the investor.

So far our discussion has focused on the frequent inability of investors to explicitly state their risk aversion, without comment as to whether a particular degree of risk aversion is actually appropriate to the investor's circumstances. One ingenious approach to this problem is the "Discretionary Wealth Hypothesis" developed in Wilcox (2003). Stated simply, the DWH says "investors should set their risk aversion so as to maximize the expectation of their geometric mean return on the portion of their wealth that they can afford to lose (but no more)." The implication of this assertion is that investors should operate as to put a "floor" value on the wealth, and that the value of the floor is equal to their financial liabilities.

In Wilcox, the financial condition of a household is expressed in a "life balance sheet" wherein the asset side of the balance sheet contains all available financial resources of the household including the present value of expected future savings, and the liability side of the balance sheet contains all liabilities inclusive of the present value of expected future consumption expenditure (i.e. spending on retirement, children's education, etc.). Like any balance sheet, the surplus of assets over liabilities is the net worth of the household. Wilcox shows that under very reasonable assumptions, the optimal value of the risk aversion parameter λ is linearly given by:

$$\lambda^* = T / (2 * (T-L)) \qquad (2)$$

Where

λ^* = optimal value of risk aversion

T = the total assets on the life balance sheet

L = the total liabilities on the life balance sheet

If we have a sufficient knowledge of the household circumstances, we not only know the best value for λ, but also how this value should change over time as the financial condition from the household changes, both of changes in the market value of assets and the changes in household circumstances such as inheritance or divorce.

For many households, the ability to fund a comfortable retirement is their primary financial objective and the discounted present value of desired consumption spending during retirement is the dominant constituent of the liability portion of the life balance sheet. The calculation of the present value can assume death at any age (e.g. a standard mortality table). We also can adjust the value of λ^* to explicitly reflect the uncertainty about life expectancy using the approach in Wilcox and Fabozzi (2009).

To bring transparency to the seminal issue of *"How much retirement spending can I afford?"* we need only carry out a simple arithmetic exercise. As described above, we can obtain λ_{ahp} as the degree of risk aversion implicit to the portfolio for recommended for a given investor by the experts of the financial services provider. From a life balance sheet analysis we can obtain λ^* the optimal level of risk aversion given the financial circumstances of the investor, conditional on the existing plan for retirement spending. If these two values for λ are equal, then the plan for retirement spending and the investment policies of the asset portfolio are internally consistent and well coordinated.

If λ_{ahp} is greater than λ^* the investment policies are more conservative than they need to be conditional on the desired level of retirement income. The investor can either choose to increase their planned level of spending (which increases L and hence λ^*), or they can make their investment portfolio more aggressive, decreasing λ_{ahp} and increasing return expectations which should lead to an eventual financial legacy in the household estate.

If λ_{ahp} is less than λ^* the investment policies are more aggressive than is reasonable for the financial circumstances of the household and the planned retirement expenditures. This can be addressed in two ways. First, the household can reduce their planned retirement expenditures (reducing L and decreasing λ^*). Alternatively, the household can choose to save more during their working lifetime (increases T and deceases λ^*).

It is the goal of any retirement process to coherently harmonize savings plans, investment policies and spending policies. By taking two different views of the investor's risk aversion, one implied from their investment portfolio, and the other being obtained from the household's financial circumstances, we can create a process that is internally consistent at each moment in time and allows the investor to sensibly revise investment policies and expectations for future spending as events unfold through their lifetime.

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exemplified by the strong presence of serial correlation in appraisal-based real estate indices.

Recently, several index-based real estate risk models have emerged which claim to overcome the handicaps inherent with appraisals; thereby integrating index-based real estate indices with traditional linear risk factor models. What makes these index-based approaches attractive is their minimal appetite for fundamental property-level data within a quantitative risk model environment. However, as we shall soon demonstrate, ignoring multi-faceted property-level information has serious repercussions for risk estimation.

First, from a purely theoretical stand point the application of appraisal-based data in a linear factor model is questionable. The argument behind the linear relationship, as embedded in William Sharpe's CAPM and Stephen Ross' APT (See Sharpe, 1964 and Ross, 1976) reasoning, relates to the arbitrage-free equilibrium prices for financial instruments. So by definition, appraisal estimates, which are subjective rather than arm's-length or auction-based, preclude the statistical application of a linear factor model.

The practical implications of appraisal bias can be seen in the quarterly movement of both the NCREIF and IPD Indices. For example, at the national level in the U.S., the NCREIF Index has a pronounced serial correlation bias (i.e. smoothing) with correlation level of 0.8 – 0.9 for a lag of one period (For an example see the chart on Page 18: http://www.northinfo.com/documents/588.pdf). Even if this appraisal bias were to represent only a small proportion of the "true" market value of a property at any given point in time, the problem gets magnified when calculating the standard deviation of return. This compounding happens in two stages. First, when returns from a value-based time series are estimated, the bias gets amplified by the simple nature of a ratio where a relatively unbiased numerator (difference) is divided by a much larger and more biased denominator. Second, when the standard deviation of the time series is calculated, the non-IID nature of the errors contributes to a pronounced suppression of the reported volatility of the series. The bottom line is that appraisal-based return series underestimate volatility of the real estate represented by the index.

As serial correlation became a recognized issue in the industry, it also became the standard practice to de-smooth the affected time series using an Auto-Regressive (AR) model using lags between 1 and N (usually N = 5 or 6 quarters) (See Lee, 2002 for a description of several AR correction approaches used for appraisal-based real estate indices). For an individual time series, the AR correction generally produces a good statistical estimate of the AR coefficient parameters. However, a much less discussed implication of this procedure for a geographically diversified portfolio is the diminished statistical confidence in the joint properties of the aggregate model estimates from the simultaneous use of a number of such "de-smoothed" AR models.

To demonstrate this negative impact, we should first consider that a risk calculation at the portfolio level requires the estimation of a covariance matrix of all investment positions. A pair-wise correlation confidence level of two de-smoothed models each with a confidence level of 90% is 81% when combined (.9 X .9). Since a typical institutional owner will typically need to employ multiple market/property type indices, we can quickly see that the confidence levels associated with de-smoothing decay rapidly. This is in stark contrast with the error terms generated by security-level regressions (generally used for modeling publicly-traded common stock, for instance). At the security level, the estimation errors diversify and become negligible at the portfolio level. With de-smoothed times series which often are used as the basis of model factors, the errors get more pronounced as the number of market/property indices increase due to multiplicative nature of the factor covariance terms and joint probability of the AR model parameter estimators. Eventually, any risk estimate based on this methodology, even for a small portfolio, will be handicapped by the significantly limited confidence levels of its risk parameters.

By virtue of using factor building blocks that are indexes that are based on regions and property types, index-based real estate risk models gravitate to factor sets that are real estate specific. Broad financial market factors used for modeling publicly traded securities are not featured in such models. As a result, portfolio risk metrics tend to operate in idiosyncratic asset classes silos. The silo model framework results in a covariance matrix that looks like a chess board, where each square is a subset of the matrix dedicated to a factor set specific to a particular asset class. In turn, this frequently results in a situation where a stable or useable covariance matrix cannot be estimated because of a dearth of observations. Simply extending the models' estimation period is often difficult because of limited historic data, or impractical due to the relevancy of the resulting factor exposures. The proper approach is to use a limited set of factors relevant to all asset classes. However, this can only be achieved through a bottom-up, economically founded analysis of each and every asset class, which is immediately compromised with an index-based model.

The advantage of using a general and parsimonious set of common factors across all asset classes becomes quite apparent when dealing with portfolio-level issues. For example, if it is found that a significant and unacceptable proportion of your portfolio's risk is contributed by interest rates, it is easy to reduce that exposure – hedge interest rate or bond futures, or sell bonds. If you find that your real

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estate portfolio is concentrated in financial centers such as New York, London, and Frankfurt, and therefore exposed to financial industry credits, you can make immediate steps to manage this risk by selling stocks, futures, or ETFs for those companies/industries found to be tenants in your buildings. The amount of the hedge can be easily determined because of the common factor set of all asset classes. This is not easily done if the applied real estate risk model factors were not identical to the factors in the liquid asset class models. Consequently, the only hedge that the silo models could recommend would be to sell a property at prohibitive transaction costs, eventually rendering the index-based models useless from a cost-benefit perspective.

As we already mentioned, the purported benefit of an index is its simplicity inasmuch as it incorporates the characteristics of many constituent properties into one aggregate – an average. This simplicity comes at a high cost, however. First, users are constrained by the characteristics of a particular index. Is the series levered or unlevered? If levered, what is its gearing ratio? Taking it one step further, what is the mix of fixed, floating, cross-collateralized, property level, portfolio level, short-term, and long-term debt exposures? What is the mix of land uses, the size and quality of buildings, and tenant quality? Therefore, investors must take a leap of faith that the characteristics of a particular index mimic their holdings. Our experience, however, and that of our clients, is that the characteristics of individual real estate properties follow a (relatively uniform) distribution that is poorly described by just the average of the peer group. Imagine the credit characteristics of tenants, vacancy rates, and leverage even within the Paris office market ranging widely from the Central Business District all the way to the Arrondissements close to Boulevard Peripherique. For the purpose of pricing a fully represented portfolio of *only and all* Paris Office properties a "Paris Office" index will suffice, but investors will typically hold only a couple of investments in any single market. Ironically, the likelihood that any of these properties sit at the mean is minimal. As such, any inferences of risk based on the index average become non-representative for specific investor positions.

In contrast, Northfield's believes that a real estate risk model should fundamentally integrate the knowledge of brick-and-mortar real estate investment professionals about the idiosyncratic features of particular properties under their supervision. One expression of this model design is found in Bayesian estimation techniques that are often believed to be superior. Incorporating the knowledge and experience of real estate professionals is a prime example of Bayesian priors at work. For example, information garnered from years of observing tenant behavior across the business cycle can be harnessed to improve the quantitative risk management process. There is no room for this when using an index-based model. Another aspect of capturing detailed property knowledge is that a granular bottom-up process provides ample opportunity to integrate both quantitative and qualitative inputs. The modeling process is naturally designed to answer numerous questions like: "What are the implications of increasing the standard lease terms for this building?", "What would be the effect of paying off the financing of the property or refinancing at a floating rather than a fixed rate?", "How would risk change if the credit quality of anchor tenant X in Building Y goes from AA to BBB?" Attempts to transmute appraisal-based indices designed for valuation purposes fall far short of the mark even when addressing the most basic of questions at the property, asset class, and/or portfolio levels.

One alternative to de-smoothing is to employ REIT proxy approach. At a minimum, this technique avoids the pitfalls associated with the de-smoothed appraisal based index methodology. A prime example is the approach taken by Kim and Geltner (See Lee, 2004 and Geltner & Kluger 1998) who feature the use of publicly traded REITs to construct a "pure play" index portfolio by region and property type. This work, when utilized in combination with findings of previous research (See Giliberto, 1990) allows for a procedure that aims at stripping REITs of their stock-like qualities leaving only their "real estate" features. The benefit of using REITs as a starting point is that they are liquid and rely on transaction rather than appraisal-based pricing for their volatility metrics. These methodologies still suffer from two major problems: generality when representing the asset class, and the inability to identify any common factors between real estate and any other asset class in the enterprise portfolio.

In conclusion, while adopting a granular and bottom-up modeling framework is not as simplistic as index-based approaches; the rewards are significant; superior risk estimates for individual properties and real estate portfolios, as well as consistent enterprise risk metrics across all asset classes. To date, Northfield has modeled global portfolios consisting of hundreds of directly-owned properties and third party funds, development properties, real estate backed debt, and infrastructure investments. The results are consistent with our clients' priors: not only is private equity real estate risk considerably higher than appraisal-based indices suggest, but two contiguous properties can have significantly different risk profiles.

Please contact Northfield and we would be happy to share our experiences in greater detail.

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Changes to Northfield's U.S. REIT Model

With the April release of the U.S. REIT model, users will find a change to our U.S. REIT model industry classification definitions.

Specifically, while Northfield will continue to maintain its nine industry taxonomy, it will be eliminating the "Mortgage" category and replacing it with a new industry called "Specialized." This sector will consist of all mortgage REITS as well as any REIT that does not fit into any of the eight other industry categories. For example, included in this new category will be timber, data center, and antenna REITs. Not only does this change reflect the idiosyncratic nature of this grouping but it also is consistent with the Global REIT model.

If you have any questions, please contact Rick Gold at rgold@northinfo.com or call 617-208-2025.

Staff Speaking Engagements

Northfield President Dan diBartolomeo will be presenting "Recent Advances in Risk Analytics" at the FactSet Asian Quant Seminar Series on March 21 (Hong Kong), March 24 (Singapore), March 26 (Melbourne) and March 28 (Sydney).

Dan will be at Rutgers University on April 18th where he will be presenting "Incorporating News Flows in Equity Risk Estimates."

Northfield's Chris Kantos will be presenting "Incorporating News Flows in Equity Risk Estimates," at the CQA Spring Conference Las Vegas on April 24th.

Chris will be speaking at the Systemic Risk Centre Seminar in London on May 6th. The topic will be "What can be learned: Systemic Risk from Past Crises?"

On June 17th, Chris will be at the UNICOM Conference in London where he will present "Market Microstructure and Optimal Trading Methods."

Chris will give a second presentation at the Unicom Conference on June 18th. The topic will be "News Flows and Higher Moments of Return Distributions."

Northfield's London Office Has Moved

We are excited to announce as of March 3, 2014, Northfield's London office has been relocated. Please send future correspondence to:

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2 - 6 Boundary Row
London SE1 8HP

Although email remains the same, our numbers have changed:

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Please take a moment to update your records to reflect these changes.

Technical Support Tip: Demystifying Optimization Using the Optimization Log

By Steve Dyer

Here at the support desk, a common question we often field from new users and experienced power users alike is some variation on "why is the optimizer acting this way?!" Why is it selling this particular tax lot?, Why isn't it selling any shares of this stock I hate? or Why isn't it buying this stock that I love? The truth in these situations is that the answers are not always simple when there are many competing and layered inputs and constraints. Taxes, return beliefs, industry limits, and regulatory compliance constraints across hundreds or thousands of securities in a project can result in a lot of complexity very quickly, and it can be time consuming and frustrating for the user to disentangle outputs when one of the inputs is unknowingly misspecified. While the support desk relishes solving these complicated problems and encourages clients to continue to reach out to us in these situations, we want to highlight a commonly overlooked reporting feature in the optimizer that we often use in troubleshooting. This feature empowers clients to better understand the logic of the optimization algorithm and to avoids overspecifying projects and the challenging string of error messages that inevitably result.

The optimization log, when enabled, contains an incredible amount of detail, logging every decision and consideration the optimizer has every point in the optimization process. While the optimization log's primary function is a debugging report, knowing what information is contained in it and where to look has proven helpful and illuminating for clients and staff alike in better understanding the optimizer's functionality.

All clients should have an understanding of the optimization algorithm [http://www.northinfo.com/Documents/496.pdf], but it can be simplified into three steps:

1) Create an acceptable initial portfolio based on linear constraints.
2) Iteratively buy and sell the securities that will increase the total utility of the portfolio the most, until no more trades will add utility.
3) Resolve all remaining constraints as well as can be done.

Unlike some of the algorithms used by our competitors, the algorithm used in the Northfield Optimizer is not a black box and very similar to the process that someone would use if they were to do the process manually. Especially with regards to step 2 above, by examining the first several trades made in the optimization, you can better understand what factors are driving the optimization and why. On a conceptual level, the utility function "Utility = Return – Risk – Costs – Penalties" makes intuitive sense, but it is helpful to see the underlying calculations written out (previously covered here: http://northinfo.com/Documents/521.pdf). The optimization log **(see below)** shows the marginal utility values for the top trade candidates to buy and sell so you can see at a glance on a relative basis the most and least attractive securities and why:

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========= DETAIL OPTIMIZATION REPORT =======
--------- Main Cycle -----------
==
1>> Assets To BUY: XOM=20.000%, Swap = 10.0121557 (sorted by MuBuy)

N	Ticker	MUBUY	MA	MF/RAP	MR/RAP	MTRANS	MIND	MSECT	MQPEN	TRNSELL+	TRNBUY+
1	*$$$	0	0	0	-0	-0	-0	-99	-0	0	0
2	D	-0.22	0	-0.089	0.012	-0.15	-0	-99	-0	0	0
3	AEE	-0.33	0	-0.075	0.0044	-0.26	-0	-99	-0	0	0
	...										
492	*XOM	-5.5	0	-3.2	-2.2	-0.11	-0	-99	-0	0	0

1>> Assets To SELL: AAPL = 19.999, Swap = 10.0121557 (sorted by MuSell)

N	Ticker	MUSELL	MA	MF/RAP	MR/RAP	MTRANS	MIND	MSECT	MQPEN	TRNSELL+	TRNBUY+
1	AAPL	-13	0	-4.5	-8.1	0.02	-0	-99	-0	0	0
2	BAC	-10	0	-5.6	-12	6.7	-0	-99	-0	0	0
3	IBM	-10	-2	-4.3	-3.8	0.057	-0	-99	-0	0	0
26	XOM	-3.9	0	-3.2	-2.2	1.4	-0	-99	-0	0	0
479	SBUX	-0.37	3	-3	-5.5	5.1	-0	-99	-0	0	0

(Tech Tip, Continued from page 9)

This part of the report shows the breakdown of the marginal utility each security would add:

Utility = Return – Risk – Costs – Penalties

Which breaks down more specifically to:

Marginal Utility to Buy/Sell [MUBUY / MUSELL]

Marginal Alpha [MA]

Marginal Factor Variance/SysRAP [MF /RAP]

Marginal Residual Variance/UnsysRAP [MR / RAP]

Marginal Transaction Cost (Transaction costs+tax costs) [MTRANS]

Marginal Quadratic Penalty (Industries) [MIND]

Marginal Quadratic Penalty (Sectors) [MQPEN]

Marginal Quadratic Penalty (Attributes) [MQPEN]

Since all of these terms are in equivalent units and therefore directly comparable, looking at this report is a good way to do a "sanity check" to make sure that alphas are scaled correctly, the RAP values are set sensibly, and that quadratic penalty scales are reasonable. Since tax costs are included in transaction costs, the tax costs in taxable optimizations are calculated at a lot-level basis. In the example below, there are only two lots, but they are sorted in order of biggest losses to biggest gains (Profit % column), which is also the order in which they will be sold under normal settings. Again, since these are in equivalent units, this report is a good way to determine that a particular security isn't being sold because the alpha is too low to justify the tax costs, **(See Table below).**

This log also details aggregate tax information throughout the optimization process, such as if a wash sale rule is in effect, if there are negative aggregate capital gains causing the optimizer to stop explicitly harvesting losses, and if the optimization is close to reaching maximum capital gains, which stops the optimization:

```
InitCapGain = 0
CurCapGain = 637.1322080979727
TotalCapGain = 637.1322080979727
bTaxCapGainViolation = No
bTaxCapGainOnTheEdge = No

InitLongCapGain = 1000000
Current Long CapGain = 637.1322080979727
TotalLongTermCapGain = 1000637.132208098
bLongTaxCapGainViolation = No
bLongTaxCapGainOnTheEdge = No

InitShortCapGain = 1000000
Current Short CapGain = 0
TotalShortTermCapGain = 1000000
bShortTaxCapGainViolation = No
bShortTaxCapGainOnTheEdge = No

Was sold at loss: N/A
   Wash sale date: 2014/01/29 (US)
```

We hope that by highlighting these reports within the optimization log, users can be more comfortable in their understanding of the functionality of the optimizer and more comfortable and confident in the results it produces.

Name	InitSh	Profit(%)	Date	Gains	Price	OptSh	PenToBuy	PenToSell
AAPL	3995.00		2014/02/28	*current*	500.60	3995.00	0.00	0.00
1	2000.00	-1.25	2013/01/01	LTerm	532.00	2000.00		
2	1995.00	52.92	2013/03/01	STerm	400.00	1995.00		

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