December 2015

# Northfield News

A Newsletter for the Friends and Clients of Northfield

## Making "Robo-Investing" Work: Key Requirements

*By Dan diBartolomeo*

*"There is always a well-known solution for every human problem – neat, plausible and wrong" - H.L. Mencken*

As the catch phrase "robo-investing" has gained popularity in the retail end of the financial services industry, the Northfield view has been an uneasy combination of satisfaction, and concern. We started using the terminology "portfolio manufacturing" twelve years ago in 2003. Just three years later in 2006 our website featured animated videos depicting *an assembly line of industrial robots* as an illustration of our MARS wealth management platform. Also in the 2006, the CFA Research Foundation published the book *Investment Management for Private, Taxable Wealth* (authors: diBartolomeo, Horwitz, and Wilcox) that included a chapter devoted to automating the customization of asset allocation, security portfolio composition and trading to the needs of specific individual households.

We feel satisfied because we believe that our conceptual innovations have contributed to the development of "robo-investing" as a legitimate step in evolving improved investment services for retail households. However, we are also concerned that in an effort to make this sort of financial service appealing to consumers, the investment processes that are being marketed under this banner have been oversimplified to the point where the degree of benefit to investors is far, far less than is readily achievable.

More than simply an academic interest, Northfield has more than two decades of commercial experience in the analytical and technological needs of wealth management. In 1995, we created the first portfolio optimizer that was capital gain tax sensitive, which led to materially broader use of quantitative methods in wealth management. Since then our MARS and WealthBalancer systems have been used by dozens of firms to manage the investments of hundreds of thousands of households. Additionally, some specific components (e.g. our AHP computation engine) have formed the analytical core of online systems for asset allocation, and mutual fund selection available to retail investors.

Given the experience of two decades and hundreds of thousands of portfolios, we've formulated a listing of the most important capabilities that an automated investment system should have. Each of the keys items described herein has three important attributes in common. First, that there is an obvious benefit by incorporating this particular aspect of the investment process as opposed to ignoring it. Second, that there is a meaningful body of published literature establishing the reasonableness of an existing method to address the issue. Third, we know that *each particular capability needed already exists within the systems already supplied by Northfield for wealth management,* so the marginal cost of including a given capability into an automated financial platform is small.

Herewith is our listing of key requirements for automated investment systems. Please

*(Robo, Continued on page 8)*

### Special Points of Interest:



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### Inside This Issue:

## Recent and Upcoming Events

### Webinar - Reconciliation of Default Risk and Spread Risk in Fixed Income

**December 29, 2015 • 11:00 AM EST**

Northfield President Dan diBartolomeo will be hosting a webinar on December 29, 2015.

#### Abstract

There are two conflicting concepts of what credit risk actually is. The classic definition has to do with the likelihood that a given fixed income instrument will default (Probability of Default, PD), and the expected severity of economic loss in the event of a default (Loss Given Default, or LGD). In this view, the focus is on the "tail risk" (negative skew in the return distribution) associated with the default event. Many fixed income market participants prefer to think of a given fixed income instrument as offering a credit related yield spread above a comparable duration riskless instrument. These investors think of credit risk as the volatility of the credit yield spread and related impact on the market value of an instrument (conditional on the duration). If investors are not risk-neutral, the credit spread will compensate investors for their expected loss (PD*LGD), plus provide a risk premium to induce risk averse investors to hold these instruments. These two concepts of credit risk are not equivalent because credit spreads can change over time both because of changes in expected loss, and separately because aggregate investor risk aversion can change, forcing a change in the risk premium (incremental yield) which fixed income borrowers must pay. In this presentation, we will provide review relevant approaches to credit risk, and illustrate how to reconcile the two views in order to satisfy the default risk concerns of "buy and hold" investors, while simultaneously explaining yield spread volatility for investors who are more concerned with controlling variation in period to period returns.

Visit **https://northinfoevents.webex.com** to register. There is no charge to register. If you cannot attend the live session, please register and we will send you the post webinar recording.

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### Northfield Annual Holiday Party Wrap-up

**Boston • December 8, 2015**

Clients and friends joined Northfield for our annual holiday party on the evening of December 8th.

Complimentary cocktails and and Hors d 'Oeuvres were served. A band made up of students from the Berkeley College of Music provided the evening's entertainment. Registration opens in early December for this annual event.

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### Webinar Wrap-up: Risk Model Testing, or Horses for Courses

**November 24, 2015 • 11:00 AM EST**

Northfield's Director of Research, Jason MacQueen, hosted a webinar on Tuesday, November 24th where he discussed how the decision as to which risk model an asset owner or a fund manager should use balances a preference for a particular view of the world with risk model accuracy. This talk presented the results of testing several different risk models over the last 10 years, and discussed the market conditions and types of portfolios for which the different models performed better or worse. Jason also covered the details of risk model construction, the use (or not) of dummy variables, and the use of Bayesian statistics for determining whether a security is exposed to which individual factors.

The presentation slides are available at **http://www.northinfo.com/documents/675.pdf**. Contact your Northfield Sales Representative if you are interested in viewing the full presentation recording of the event.

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### Webinar Wrap-up: Back-testing: A Useful Tool or "Financial Charlatanism

**October 22, 2015 • 11:00 AM EDT**

Northfield President Dan diBartolomeo hosted a webinar on Thursday, October 22nd where he described the causes for the minimal validity of back-tests, and suggested methods to mitigate the problems. He also discussed the current day implications of material from seminal studies on the relationship of past and future performance, on common statistical errors in investment tests and the conceptual and philosophical limitations of back-tests. The final portion of the presentation was devoted to a detailed exposition of how practitioners can limit the risk of "overfitting."

The presentation slides are available at **http://www.northinfo.com/documents/660.pdf**. Contact your Northfield Sales Representative if you are interested in viewing the full presentation recording of the event.

## 2015 Northfield Annual Research Conference Wrap-up

**Loew's Don CeSar Hotel • St. Petersburg, Florida • October 29 - November 1, 2015**

Northfield held its 28th annual research conference at the Loew's Don CeSar Hotel in St. Petersburg, Florida.

The conference presented recent research and technical advances to a sold out audience of Northfield clients and friends. The agenda consisted of twelve presentations. Topics included: "Can Financial Engineering Cure Cancer?," "Investment Strategies for Taxable Clients," "Is It Worth It? Assessing the Value of Risk-Managed Investing," "Modified Information Ratio to Predict Fund Performance," "Optimal Deal Flow for Illiquid Assets," "Optimizing Value," "Risk Model Testing, or Horses for Courses," Target Retirement Income Plus (TRIP) Fund," "The Triumph of Mediocrity: A Case Study of 'Naïve Beta'," "Trading Cost Models Across Multiple Asset Classes and Their Use in Investment Decisions," "Weathered for Climate Risk," and "What's Next for Retail Asset Management?."

Loews Don CeSar Hotel

The conference started on Thursday evening with the "unofficial" welcome cocktail party and dinner. Friday morning was reserved for recreational pursuits. Conference attendees had a choice of Northfield sponsored activities including a sailing and dolphin watch, a tour of the Dali Museum or a Northfield sponsored beach day which included a choice of kayaking, paddle boarding, banana boat rides or wave running.

Friday evening featured the traditional Northfield elegant "black tie" gala. The final group dinner on Saturday featured a cocktail reception and dinner at the beach pavilion.

The proceedings have been posted to **http://www.northinfo.com/research.php**.

## Northfield Asia Seminars Wrap-up

**Hong Kong • Singapore • Sydney • November 2015**

Northfield hosted our annual Asia Seminar Series with three highly successful events in Hong Kong, Singapore and Sydney. The seminars showcased our research on key topics in investment and risk management to our growing family of Australian and Far Eastern clients and prospects and broadened awareness of the range and depth of Northfield products, services, and research.

The presentations were given by Northfield's Dan diBartolomeo, Jason MacQueen and Nick Wade. Guest Speaker Matthew Van der Weide, FactSet Vice President Portfolio and Quantitative Analytics Asia Pacific also presented. Topics included: "An Asian perspective on Smart Beta Strategies: Asia versus global markets," "Behavioral Aspects of Risk," "Optimal Deal Flow for Illiquid Assets," "The Choice of Model Factors under Multiple Definitions of Risk," "Risk Systems That Read," "Smart Portfolios" and "Why Doesn't Skill = Outperformance."

The proceedings have been posted to **http://www.northinfo.com/research.php.**

## Webinar Wrap-up: Behavioral Aspects of Risk

**September 29, 2015 • 11:00 AM EDT**

Northfield President Dan diBartolomeo hosted a webinar on Tuesday, September 29th where he presented a philosophical and semantic discussion of what risk is and how investors talk about it. The presentation included a review of plausible investor utility functions so as to have a context from which to distinguish what seems to be very sensible behavior by investors in response to investment risk, from apparently irrational behavior. The presentation then focused on high level behavioral aspects of risk, and how the many seemingly bizarre behaviors arise from investors and managers trying to give the appearance of good risk management.

The presentation slides are available at **http://www.northinfo.com/documents/659.pdf**. Contact your Northfield Sales Representative if you are interested in viewing the full presentation recording of the event.

# Northfield Staff Profiles

## Ian Bomberowitz - Sales and Marketing, Americas

Ian joined the staff of Northfield in the autumn of 2005 to work with Dan diBartolomeo on written materials that Northfield produced for publication in academic and trade journals. While continuing with his editorial duties, Ian moved into technical support to better understand the Northfield models and software. After spending a few years in technical support, Ian was tasked with building a sales and marketing presence in Latin America. That effort is ongoing, as Ian now takes on sales responsibilities in the United States as well.

Prior to working at Northfield, Ian taught English at the Fessenden school. Ian received his bachelor's degree in philosophy from Kalamazoo College, and his Graduate Diploma in philosophy from the University of St. Andrews. His research focused on temporal metaphysics and legal and medical ethics.

## Lalitha Raman - Investment Analytics Support Analyst – EMEA Region

Lalitha joined our London office in September 2014 as an Investment Analytics Support Analyst covering the EMEA region.

Lalitha is a graduate in Mathematics from University College London and has also obtained a Masters in Software Engineering from Birkbeck University of London.

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

Although involved in every aspect of general investment analytics support, her focus for the past year at Northfield has been the Everything Everywhere Model.

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

## Richard Young - Risk Model Specialist

Richard has been a specialist in the estimation and use of equity risk for over 20 years.

A graduate in Electrical Engineering from University of Sheffield Richard later obtained, with Distinction, a Masters in Software Engineering from De Montfort University.

Richard started his career in financial software at QUANTEC Ltd where he wrote the reverse optimizer, the mean-variance optimizer that was used in all QUANTEC's products, and the code to create all QUANTEC's risk models. Richard was the head of Software and Product Development at QUANTEC Ltd when it was bought.

He was a founder and is a former Director of the London Quant Group.

As an independent consultant Richard has worked for a number of significant organizations including Old Mutual on equity covariance, Thomson Financial Ltd on practical uses of Monte Carlo simulation and applications of quantitative methodologies and the American Stock Exchange on systems to price ETFs on undisclosed Active funds.

He founded R-Squared Risk Management Ltd with Jason MacQueen where he developed the multi-model generation software to build all variations of Hybrid Equity Risk Models, this being the enabling technology for the custom risk model business of R-Squared.

# Tech Tip: Understanding Blind Factors

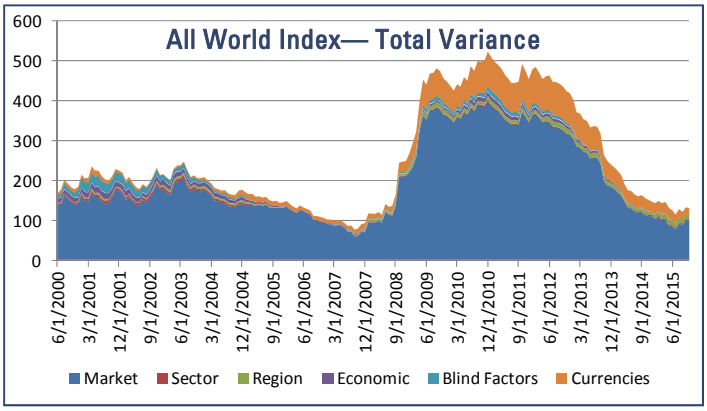
*By Steve Dyer*

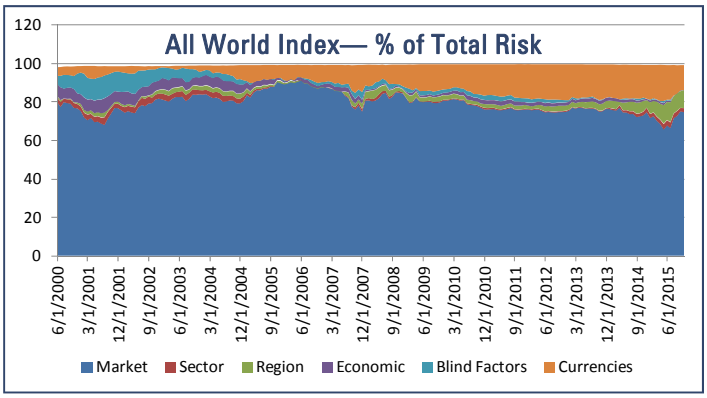
When constructing a factor model, there are several basic criteria we look for in the selection of factors. The data for each factor should be *observable* and easily measured and quantified. It should be *reliable,* which means that it needs to be standardized for all companies in the universe and not subject to subsequent change. The factor should be *pervasive* through time so that we can use it to analyze and compare portfolios through time in a common framework. The factors should be *intuitive:* easy to understand and communicate amongst the entire investment team and to describe to clients without specialized knowledge. The factors should be suitable to the investment universe, investment goals, and time horizon. Lastly, the factors should be *economically meaningful*, with an underlying reason why the factor is associated with price movement. On top of all of these criteria, we also want to create a model with a small number of factors to avoid over specifying and overfitting the model.

Of course, many of these criteria can be in opposition – there are many examples of economically meaningful phenomena that aren't pervasive through time, from bubbles in particular sectors or industries to political strife in certain geographies and other short-term, transient influences on the markets. We want to avoid overfitting the model with too many factors, but we also do not know ahead of time if there are factors missing from the model, which could be just due to our human inability to tell the future, but the "missing" factor could also be intangible, unintuitive and unquantifiable.

How do we balance specifying a realistic set of factors with the concerns of the inherent contradictions that arise? For most of the Northfield models, we use *blind factors*, also called *statistical factors*. After regressing the security returns against the traditional specified factors like beta, market capitalization, and interest rates, we use principal components analysis (PCA) on the residuals of these regressions to pick up any transient or intangible factors that are present in the data. The reason they are called "blind" factors is that we can't "see" ahead of time what the factor is. For the identified factors, we either specify the sensitivity of the security to the factor (e.g. by directly measuring its market cap for a size factor), or we specify the factor returns (e.g. calculating the variance of market returns). With the blind factors, the PCA technique estimates sensitivity to the factor and the factor returns at the same time, so we can't say with certainty what the variables are, but we can do some analysis to investigate what the blind factors might be picking up.

In the Northfield model, the blind factors rarely explain a large amount of total risk in a diversified portfolio. For this exercise, I analyzed the FTSE All World Index against a cash benchmark on a monthly basis from June 2000 to present using the Northfield Global Equity model. It is a very well diversified index consisting of approximately 3000 of the largest equities in the world, covering 90-95% of the world's market capitalization.




Whether expressed in variance or as a percent of total risk, the blind factors are a small contributor to risk except for the period of 2001-2003, where about 5-10% of the total risk of the index comes from the blind factors.

If we want to explore what the blind factors might be representing during this period, there are two things we would look at. There are two dimensions to this question: first, which periods the blind factors themselves are risky and important, and second, which securities have high exposures to blind factors. To answer the first part of the question, we can look at the total variance of the blind factors over time. Since the blind factors will be explaining transient market effects, there will be some periods in which they contribute more risk than others.

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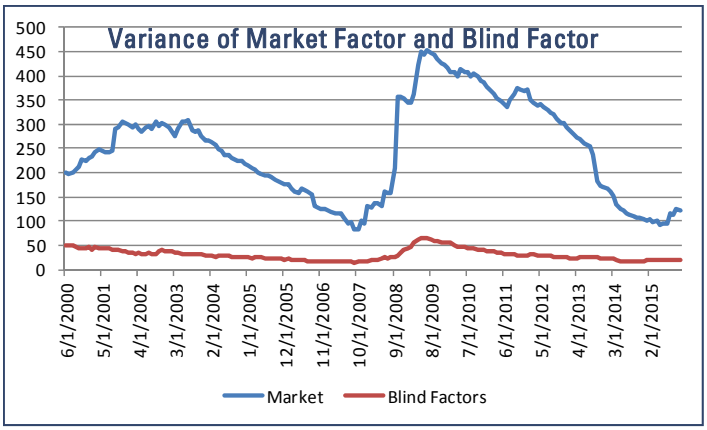
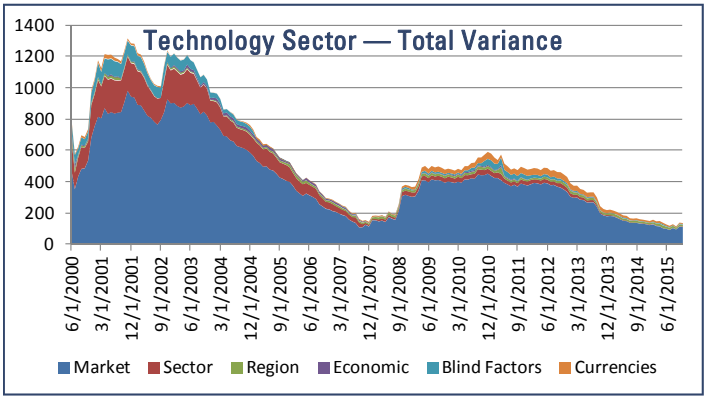
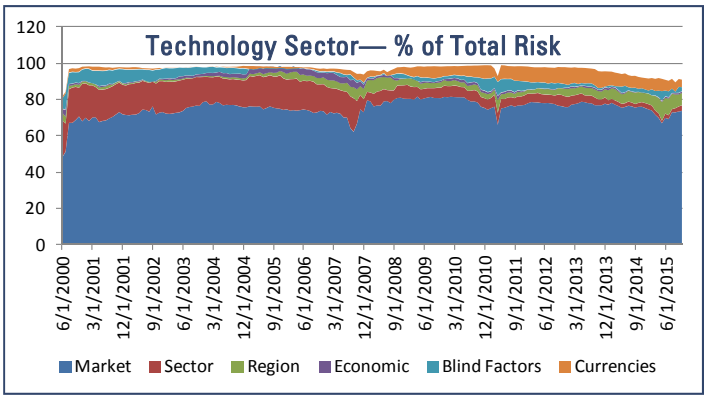



Let's look at the first dimension of the periods during which the blind factors themselves are riskier. Over the analysis period, the market factor is 5-15x riskier than the market, so taking one unit of exposure to the market translates into much more risk than taking one unit of blind factor exposure. We can see that the blind factors are riskier at the beginning of the period, and then there is an uptick near the beginning of the financial crisis period in late 2008. Because so little of the risk of the index comes from blind factors during the financial crisis period, indicating the index constituents have low exposures to the factors, we'll look at the beginning period a little more closely.

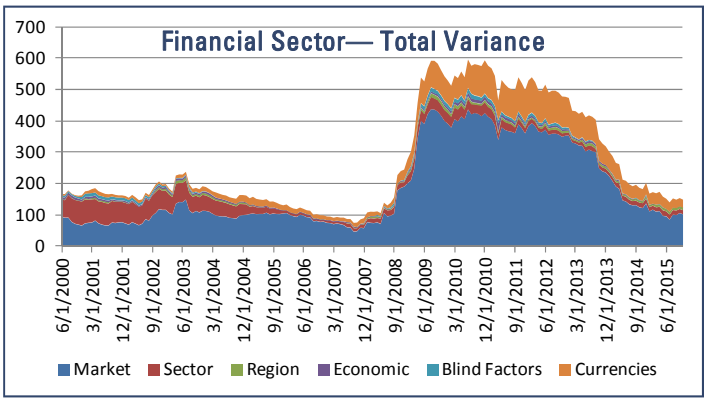
To see what is contributing to the blind factor risk, we would start by drilling down into smaller groups of securities to look for common themes. Different securities will have different sensitivities to the blind factors over time, so it is useful to look at different common groups of securities. Remember that in contrast with the specified factors, there is nothing that links the data for the blind factors from month to month, so they can be explaining completely different causes at any point in time.

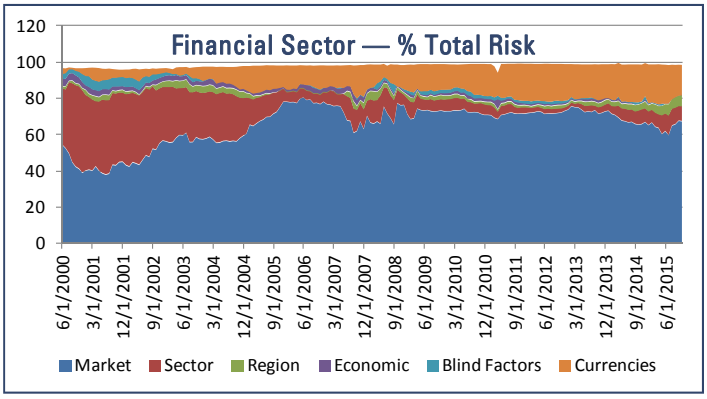
We can look at different sectors first to see if anything jumps out:



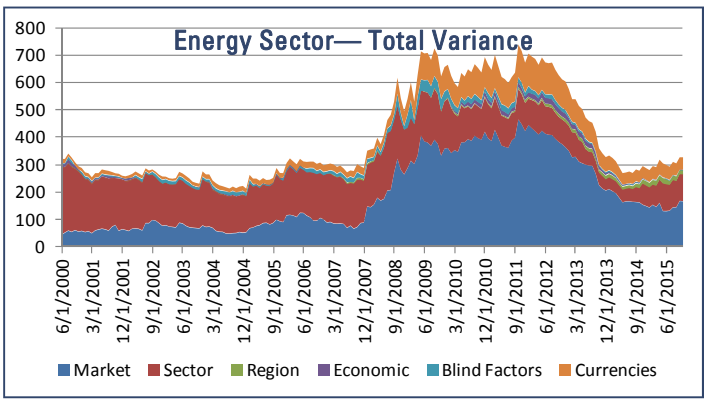




The technology sector sees a lot of risk coming from sector and some from blind factors during the period from late 2000 until about 2004, in the same range of 5-10% that the total index saw.




The financial sector doesn't see much risk coming from blind factors at all during the period.

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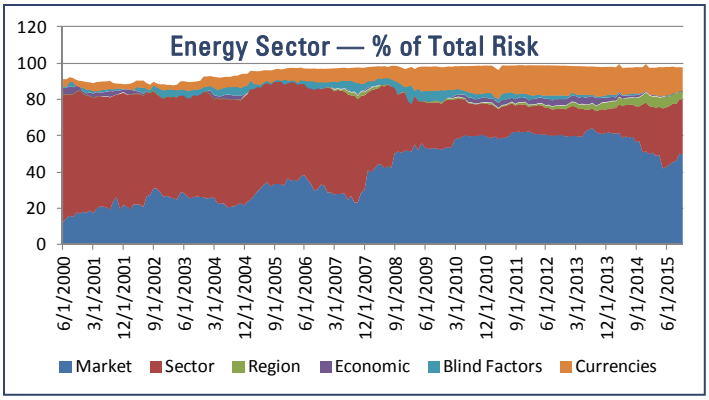
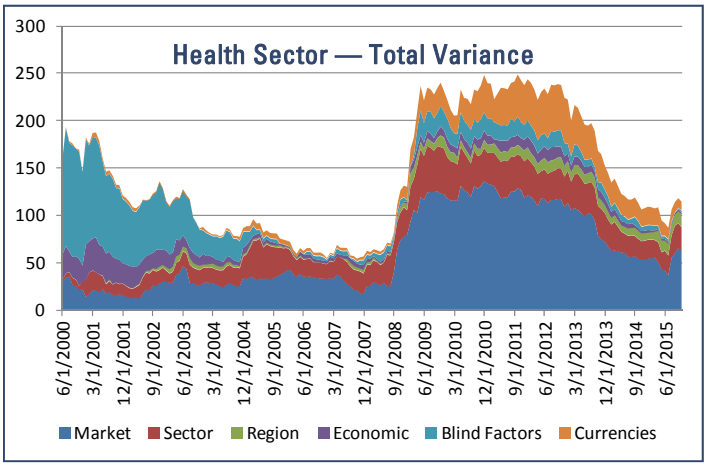
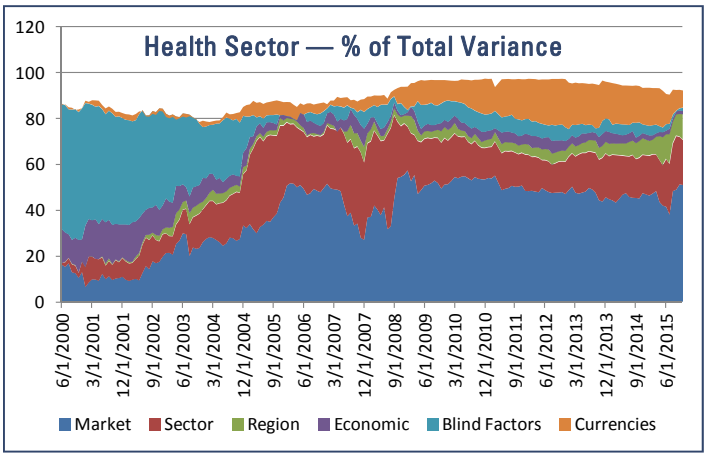



The blind factors are similarly negligible for the energy sector.




The health sector, even though it is less risky than the other sectors over the period in total risk terms, is seeing over half of its total risk coming from the blind factors from the beginning of the period in June 2000 until the end of 2004. At that point, the blind factors become less important and the market and sector become more important.

We can then look at individual securities in the main table to see which securities have high exposures to the blind factors. July 2000 is the date with the highest proportion of risk coming from blind factors, and Blind Factor 3 contributed the most risk out of the 5 blind factors, so I just ranked the securities by exposure to Blind Factor 3 and took the top 10:

| Name | InitWt(%) | BF3 |
|---|---|---|
| LILLY ELI & CO COM | 6.72453468 | 4.3 |
| CSL NPV | 0.168231091 | 3.63 |
| ASTRAZENECA ORD USD0.25 | 4.360339857 | 3.32 |
| MERCK & CO INC COM | 9.44895879 | 3.26 |
| SCHERING PLOUGH CORP COM | 3.624531985 | 3.24 |
| PFIZER INC COM | 15.5601605 | 3.21 |
| JOHNSON & JOHNSON COM | 7.414655816 | 3.12 |
| HEALTHSOUTH CORP COM | 0.131253867 | 2.84 |
| SMITHKLINE BEECHAM ORD | 4.156687307 | 2.33 |
| BRISTOL MYERS SQUIBB CO COM | 5.611245188 | 2.09 |

It's immediately apparent that 9 of 10 are specifically pharmaceutical companies, which distinguishes them from the rest of the sector. From this information, while we can't conclusively say that the blind factor represents pharmaceutical companies, the data certainly point in that direction.

Taking the time to analyze blind factors when they become relevant allows you as an investor to make more informed bets and can even serve as an early warning sign to new or shifting market conditions.

If you have questions about your particular portfolio or analysis, please contact Northfield Technical Support. In Boston, 617.208.2080, **support@northinfo.com.** European clients can contact: **support-europe@northinfo.com** or call +44 (0) 17 2244 RISK. In Asia, call +81(0)3 5403 4655 or +61(0)2 9238 4284 or **support-asia@northinfo.com.**

(Robo, Continued from page 1)
note that the order of presentation does not imply an indication of relative importance:

***Time Varying Risk Aversion Tied to Household Financial Circumstances:*** Proper formation of investment portfolios requires appropriate trade-offs between return and risk. As there is no universal agreement as to the semantics of risk aversion ("conservative", moderate, aggressive), most automated systems do not properly discover investor preferences and more importantly do not discover sufficient information about the household's *ability* to bear risk, as opposed to the *willingness* to bear risk. To address this need, the *Discretionary Wealth Hypothesis* of Wilcox (Journal of Portfolio Management, 2003) has quickly become the industry standard. In essence, the household's ability to bear risk is formulated from a "life balance sheet" where all financial assets and liabilities are included. The present values of future financial events such as accumulation of investment savings, and consumption spending such as college tuition and retirement funding are represented as contingent assets or liabilities. The discount rate to determine such present values may be adjusted to reflect the importance of a consumption goal or the certainty of a future financial gain (e.g. an expected inheritance may be uncertain). As the financial circumstances of the household change over time, the optimal degree of risk aversion changes with it, automatically adjusting the portfolio composition appropriately.

***Proper Incorporation of Household "Human Capital":*** For many households that are not affluent, the bulk of the financial resources that they will use for major consumption expenditure (e.g. college tuition) and to provide retirement income do not yet exist. These resources will be accumulated in the future through the investment of savings taken from earned income, and from the long term compounding of the returns. While almost every automated investment system provides some provision for estimating the need for future savings by a household (often crudely), most do not consider the subtleties of how aspects of the future savings process should impact investment policy today and through time. A household may not realize any savings if the earning members die, are disabled or lose their employment. While the first two problems can be mitigated with insurance products, the third is more nuanced. Consider an individual who earns their living as a school teacher in the USA has a much higher degree of job security than would another individual who works as a financial analyst on Wall Street. In addition, the probability of losing a job as a financial analyst will be much higher in periods of poor financial market outcomes, while the job security of the typical teacher would be much less dependent on financial markets. Put simply, our teacher has a "low beta" job so the beta of present value of their future stream of savings is low. Our financial analyst has a very "high beta" job. After retirement their situations would be more similar. These differences and their likely progression over time should be incorporated into the investment policy and asset allocation processes. For background see Ibbotson, Chen, Milevsky and Zhu (CFA Publications, 2007).

***Retirement Income Needs:*** Most automated investment systems purport to address capital accumulation for retirement by giving the household a fixed dollar value target (e.g. 8 times desired annual income) to accumulate by the expected retirement date. This is a deeply flawed process. To the extent that a retail household has taken on their own mortality risk, the post retirement portfolio must provide a *steady stream of spendable income* over an indefinite future period (we don't know how long we will live). Consider the situation of investor who meets their hypothetical goal for portfolio value of eight times the desired annual income by the day before their retirement by holding a portfolio of zero yield growth stocks. If interest rates happen to drop suddenly the following day, it is likely that the household could not form a viable income portfolio, and would have to liquidate part of the portfolio from time to time to cover consumption expenditures. Given the uncertainty of life span, most investors are very uncomfortable with deciding how much of their portfolio they can liquidate without creating the potential for running out of funds before death. Moving to a more income oriented portfolio is a standard practice of most "target date" funds but those blindly rely on the year of retirement to formulate the "glide path" while ignoring the household levels of wealth, liabilities and a host of other factors. Analytical solutions exist for properly defining the "duration" of the retirement consumption liability (like a short position in a bond), which will result in an appropriate glide path more customized to the needs of the individual investor. In essence, the presence of mortality uncertainty requires that we reframe investment risk in terms of the ability to produce lifetime income rather than as volatility in wealth units or return outcomes. Merton (Harvard Business Review, 2014) provides an excellent summary of the issues.

***Non-Mortality Life Uncertainty:*** In considering the long term financial circumstances of a household, there are many other areas of uncertainty beyond mortality risk. In saving for college tuition for our children, we really don't know if our kids will end up at Harvard or the local community college, so the required magnitude of the tuition consumption expenditure is uncertain. Most automated financial platforms assume that all financial goals are known with absolutely certainty both with respect to magnitudes and timing. In general, the greater the uncertainty of the input parameters of financial decisions, the more conservative the investment policies should be. A primary example of a great uncertainty would be the situation of divorce, which impacts more than half of all marriages. The investment

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policy implications of life uncertainty are well addressed in Wilcox and Fabozzi (Journal of Portfolio Management, 2009) and more specifically about divorce in Scherer (Proceedings of London Quant Group, September 2014).

***Integrated Asset Allocation and Asset Location:*** Many automated investment systems try to address the accumulation of wealth to meet multiple consumption goals as multiple *separate* problems. For example, our college savings fund investment policies are unrelated to how our retirement fund, or other investments are structured. This leads to myopic and often very inefficient combinations. A more relevant distinction is that the financial resources of the household is likely to be split between tax deferred legal structures such as defined contribution retirement plans (e.g. 401K, 403B, IRA or foreign equivalents) and financial accounts that are immediately subject to local and national taxes. To the extent that different financial assets have different tax treatments (e.g. municipal bonds) it is imperative that asset allocation methods provide for asset *location* as well. This is often a subtle issue that involves time horizons, the expected split of returns between income and capital gain, and the need to rebalance the portfolio periodically to whatever is determined to be the optimal state at a point in time. An additional factor is the extent to which individual asset class portfolios are held as simple vehicles (e.g. an ETF) or as individual securities where more sophisticated tax management processes may be employed (e.g. tax loss harvesting). An excellent treatment of this issue appears in the aforementioned diBartolomeo, Horvitz and Wilcox (CFA, 2006).

***"Householding":*** Another variation on the asset location problem is that of "householding." Many households have human or legal members (husband, wife, children, dependent elderly, trust funds) that may have heterogeneous aspects as investors including different tax circumstances, legacy portfolios and levels of risk aversion. While one might choose to treat each of these entities separately, many households express a desire to have the investment policies and holdings for all members of the household be harmonized across tax circumstances and risk aversion so that the aggregate investment portfolio is optimal for the entire household, as compared to each person's portfolio consisting of what is best for them alone. While some automated investment platforms purport to do crude forms of "householding" these methods rely on the simplifying *but false* premise that the sum of optimal portfolios is an optimal portfolio. Stated differently, the real tension in the problem is that if the aggregate portfolio is optimal for the household does not imply that the individual portfolios will be optimal for the specific member to whom it belongs. Do we give priority to the household over the members or the members over the household, or a blending of the two? Structuring the portfolio to emphasize the household over the members is the more analytically challenging process. A suggested method that operates down to the level of individual tax lots of individual securities was presented in diBartolomeo (Northfield News, May 2005).

***Tax Sensitive Portfolio Rebalancing at the Tax Lot Level, Across Asset Classes:*** Many automated investment systems restrict the set of securities that may be held to simple portfolios of ETFs that represent passive participation in different asset classes. While the benefits and drawbacks of active versus passive investment management are subject to wide debate, there are a couple of key concepts to keep in mind. The first is that ability to engage in tax beneficial transactions arises from the dispersion of returns among the assets of a portfolio. Greater dispersion of gains and losses leads to greater economic benefits which can arise from intelligent offsetting of capital gains and losses. The dispersion of returns can arise in three ways. We can purchase the same asset repeatedly at different times to create dispersion in level of realized capital gain and loss across tax lots. This process takes a considerable period of time to become operational. See Horvitz and Wilcox (Journal of Wealth Management, 2003). Another way to create dispersion is to simply hold lots of individual securities as opposed to traded baskets such as ETFs or mutual funds. The cross-sectional variation of the individual securities will be far greater than the volatility of the related index basket. A good illustration of this is in diBartolomeo (2008, **http://www.northinfo.com/documents/275.pdf).** Finally, we can invest across asset classes either as baskets or (even better from a tax perspective) as individual securities. An excellent paper on tax management of US municipal bonds is Kalotay and Howard (Journal of Portfolio Management, 2014).

***Ability to Handle Concentrated Legacy Positions:*** Most "robo-investing" systems assume that the investor's entire portfolio is on their system and that the portfolio always starts from cash. Transition of any legacy portfolio positions must be able to be accomplished in a tax-sensitive fashion which rationally balances the desire to move to the new optimal portfolio with the costs and tax implications of doing so over a particular time horizon. Given the large tax effects which may arise from liquidation of concentrated legacy positions, this process must be based on an economic objective function that balances considerations of return, risk, trading costs and taxes over multiple periods. Many automated platforms either rely on simple heuristics to prevent "tax dumb" transactions, or ask investors to specify a "tax limit" at which point any rebalancing process is constrained from any transaction which would create a net realized capital gain. Methods to incorporate taxes into rebalancing objectives is covered in diBartolomeo (2003, Chapter 5 in Advances in Portfolio Construction and Implementation). A "complementarity port-

(Robo, Continued on page 10)

*(Robo, Continued from page 9)*

folio" approach to concentrated positions is covered in diBartolomeo, Horvitz and Wilcox (CFA 2006).

***Non-Parametric Treatment of Investor Preferences:*** Traditional approaches to asset allocation (Markowitz, Journal of Finance 1952, 1959) require that all investor preferences be reduced to a balance between two variables, return and risk. Real world investors often have a broad variety of preferences, either described explicitly or arising implicitly from particular aspects of their financial goals. These preferences could take on a myriad of issues from the desire for a socially-responsible investment portfolio to the avoidance of investments expected to do very poorly under the extreme conditions of a global depression. Put simply, the investment policies and implementation should reflect all of the investor's preferences and attributes. Many automated investment platforms offer some kind of multiple-choice questionnaire as the mechanism to elicit information about investor wants and needs. Unfortunately, investor responses to the questions are often evaluated in a completely ad hoc fashion with little analytical rigor. A very well developed non-parametric method for investment allocations is to use the AHP from Saaty (The Analytic Hierarchy Process, 1980). While there is a fairly extensive literature on use of AHP for investment allocation problems, the most directly on point is from two Northfield former associates, Bolster and Warrick (Journal of Wealth Management, 2008).

***Protection from Great Anomalies:*** Many automated systems are based on Monte Carlo simulations that assume that once an investment portfolio is formed, it is always rebalance back to the original allocation. Implicit in such a process is that an asset class or other investment that has fallen in value (and hence portfolio weight) should *always* be bought in order to restore the original allocation. Clearly this would have been a bad policy for investors at the time of the 1929 stock market crash, or when the Russian markets went to zero in 1917 or the shut-down of the Chinese markets in 1949. While such events are rare, they do occur and can have profound impacts on the financial health of households. The aforementioned *Discretionary Wealth Hypothesis* offers a resolution to this problem. As the value of investments within the portfolio falls, the investor becomes "poorer" relative to their liabilities and their ability to bear future risk is diminished, calling for a more risk-averse tradeoff between return opportunities and risk, which may be fully counterbalanced by increases in expected returns. As such, a very wealthy household may have an incentive to buy at the same time. The balance between changes in appropriate risk aversion and changes in expected return will be different for investors with different starting ratios of investment wealth to discretionary wealth. A good discussion of the impact of rare events can be found in Barro (NBER, 2005).

## Staff Speaking Engagements

Northfield President Dan diBartolomeo will presenting at the February 22nd Performance Attribution and Risk Conference at the Princeton Club in New York City. The discussion will be on the Improved Formulation of Active Management Risk.

On January 20th, Northfield's Director or Research, Jason MacQueen will be speaking at the UK INQUIRE Seminar in London. The talk will be on Dynamic Switching between Smart Portfolios.

Dan diBartolomeo and Jason MacQueen spoke at the CQAsia seminar held on November 4th and 5th in Hong Kong, on Risk Management Priorities and Smart Portfolios respectively. In addition, both Dan and Jason sat on the Risk Management panel and Jason joined the Smart Beta panel.

Jason MacQueen presented a the CFA Singapore Professional Development Talk on November 13th on Risk Model Testing.

Jason MacQueen and Jason Liu (S&P Capital IQ's Vice President Investment Management Asia Pacific) presented in Tokyo at the Quants Network Forum on November 18th on "A Chance for Smart Beta?" (JL), Smart Portfolios (JM) and Risk Model Testing (JM).

Jason MacQueen presented Smart Portfolios at a special session of the MPT Forum at Waseda University in Tokyo on the evening of November 18th.



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