FRONTIER NEWS

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THE QUARTERLY NEWSLETTER FROM
SUNGARD® EXPERT SOLUTIONS

SECOND QUARTER 01

CONTENTS

ALLOCATIONMASTER SIMULATION

A major new development released this quarter is Monte Carlo Simulation in AllocationMaster. Monte Carlo simulation uses random number generation to create a set of possible future outcomes. With the results, the client and advisor can "pre-experience" the future. Two hundred random draws for each year of the projection are used to develop alternative investment return scenarios. These stochastic returns are applied to the financial forecast to generate ranges of expected outcomes.

Simulated ranges are useful in evaluating risk-return trade-offs and estimating probabilities of possible outcomes. The results show the range of investment returns and terminal asset values. In addition, the results will be used to calculate target return probabilities and asset value levels.

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DIGEST

COMPANY NEWS, NOTES AND DATES

BUSINESS ADVISORY BOARD SECOND QUARTER 2001

Pictured (L to R): Blaine Maxfield, Harry Markowitz, Alan Reid, Kamaryn Tanner , Randy Moore, Roger Gibson and Richard Michaud.

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- **COMPANY ANNIVERSARY.** On June 19, 2001, SunGard Expert Solutions celebrates the one-year anniversary since the acquisition of Frontier Analytics, Inc. by Sterling Wentworth Corp. The group was subsequently renamed SunGard Expert Solutions on January 1, 2001. While Frontier Analytics has essentially continued with its original business model, many product and operational integration goals were achieved over the past year. There are many more goals planned for the second year of the integration effort.
- **WEB SITES**. Significant updates have been made to the company and product web sites during the Second Quarter 2001. Our users are encouraged to visit the AllocationMaster (www.allocationmaster.com), FactMaster (www.factmaster.com) and Investment Plus (www.investmentplus.net) web sites.
- **COMPUTER HARDWARE.** In an effort to continually improve our internal infrastructure, we have upgraded our computer hardware to IBM NetVista workstations. Our developers now use Pentium IV machines that operate at 1.5 Mghz! In addition, we have installed a VPN connection between San Diego and Salt Lake City. This network connection will facilitate co-development at both locations.
- **ALLOCATIONMASTER USER'S GUIDES.** Completely updated *AllocationMaster User's Guides* have been published. The user's guide describes the new features and enhancements that have been made to AllocationMaster in the past year. Throughout the quarter, copies of the new manual will be sent to each registered user of AllocationMaster.
- **BUSINESS ADVISORY BOARD.** The First Quarter 2001 meeting of the Business Advisory Board was held on March 16, 2001. The topics discussed were: The Resampled Efficient Frontier (see our Aspects article), a follow-up on Tax-Efficient Optimization (see last quarters' Feature article), the incorporation of Monte Carlo Simulation into AllocationMaster, and our Optimization Inputs Survey. Along with our staff, members in attendance were: Richard O. Michaud (New Frontier Advisors), Harry M. Markowitz, Roger Gibson (Gibson Capital) and Alan Reid (Forward Funds). We are pleased to announce that Alan Reid has joined the BAB as a permanent member.
- **FRONTIER BOOKSHELF.** The Frontier Bookshelf for the Second Quarter 2001 is "Puzzles of Finance: Six Practical Problems and Their Remarkable Solutions" by Mark P. Kritzman. Kritzman is also the author of the best-selling "The Portable Financial Analyst." His new book covers some of the main anomalies confronting finance. In the process of exploring each counter-intuitive "puzzle," Kritzman provides several lessons that are of general use to any investment advisor. Some of the topics that are especially relevant to users of asset allocation software such are: Expected Return, Time Diversification and Loss Probabilities. To order, see the enclosed Frontier Bookshelf flyer.
- **IMCA CONFERENCE.** The Professional Development Conference for the Investment Management Consultant's Association was held in Naples, Florida on May 6-9, 2001. During the conference, Randy Moore spoke on "New Twists and Turns in Investment Technology"

WEB-BASED PORTFOLIO OPTIMIZATION ADVANCES

PortfolioMaster is the new web-based portfolio optimizer from SunGard Expert Solutions. It has been tailored to the needs of companies that are already using our AllocationMaster asset allocation software on an enterprise-wide basis.

INCREASED WEB SITE CAPABILITIES

Expand the capabilities of your company's web site with PortfolioMaster. Increase your web site traffic and produce additional sales. Hosted on your site, the addition of PortfolioMaster enhances your web site with a powerful analytical tool that any customer can use. It produces an action-oriented recommendation that creates sales opportunities. As a referral tool, usage on the web site can lead customers to your investment advisors for further in-depth analysis and recommendations.

TAX-EFFICIENT OPTIMIZATION

PortfolioMaster uses an advanced portfolio optimization algorithm similar to AllocationMaster. It even goes one step further in analyzing the correct asset classes to include in the taxable and tax-deferred parts of the customer's portfolio. This is called "Tax-Efficient Optimization." This area of the program has received industry-wide attention as we look for ways to construct portfolios that minimize the overall tax burden on the portfolio.

ACTION-ORIENTED RESULTS

The final results show the customer, for a specific level of investment risk tolerance, the composition of the portfolio in dollar and percentage terms. The portfolio is shown at the overall composite level, and more-detailed breakdowns are given for the taxable and the tax-deferred portions of the portfolio. A two-page report can be printed with graphs, tables and compliance-approved disclosure statements.

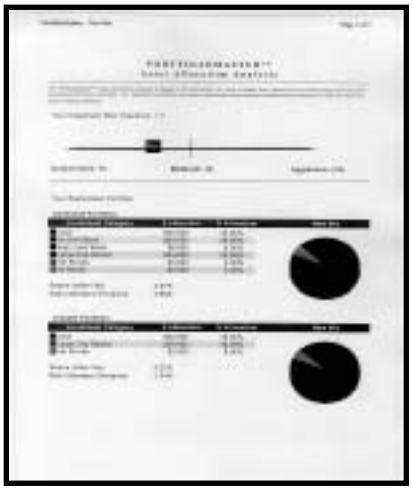
PortfolioMaster generates its results quickly and easily. A complete analysis can be performed by any customer in less than five minutes! No special knowledge is needed to operate the program. Customer use of the program on your web site is unlimited-no per click fee. And, because the results are created on-the-fly, there are no privacy concerns or passwords required.

UPDATES AND ENHANCEMENTS

The program will adapt itself to the "skin" of your web site-closely corresponding to the look and feel of the other parts of your site. The asset classes and performance estimates are customized for each client. Quarterly updates of PortfolioMaster will be used to keep the program current and to introduce new features. Planned for introduction over the next year are: minimum/maximum holding limits, specific product recommendations, holding-level description of the customer's current portfolio, and a customizable risk profiling questionnaire.

PORTFOLIOMASTER IS LICENSED ON AN ENTERPRISE-WIDE BASIS. TO LEARN MORE ABOUT PORTFOLIOMASTER, AND TO ARRANGE FOR A DEMONSTRATION, PLEASE CONTACT BLAINE MAXFIELD, DIRECTOR OF BUSINESS DEVELOPMENT, AT 801/955-6100, EXTENSION 136.

PortfolioMaster
Data Entry Page

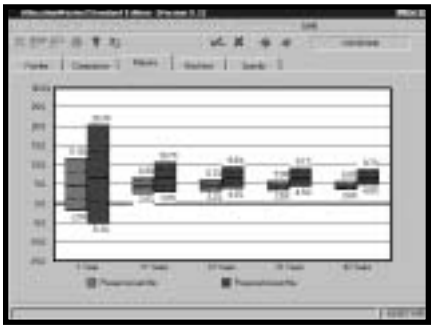


PortfolioMaster
Printed Output Report

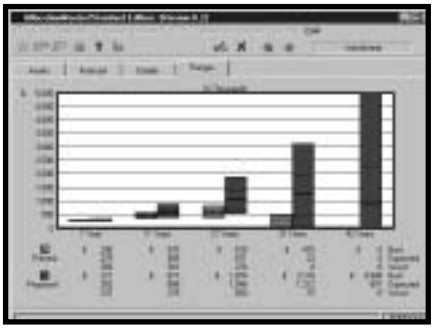
ALLOCATIONMASTER SIMULATION

WHAT IS ALL OF THE FUSS ABOUT MONTE CARLO SIMULATION?

IT IS DIFFICULT TO PICK UP AN INDUSTRY TRADE MAGAZINE OR CONFERENCE BROCHURE WITHOUT SEEING SOMETHING ABOUT IT. IN THIS QUARTER'S FEATURE ARTICLE WE WILL OVERVIEW THE MONTE CARLO SIMULATION METHOD, LOOK AT ITS USES AND DESCRIBE A NEW FEATURE APPEARING IN ALLOCATIONMASTER.



Range of Returns



Range of Assets

DYNAMIC ASSET ALLOCATION PLANNING

In preparing the Financial Forecast for a client, the investment assets have been projected using an essentially static process that assumes constant rates of investment return. In actuality, the client's portfolio is very dynamic. Each variable that impacts the future value of the client's assets has varying degrees of controllability and predictability.

Setting investment objectives and asset allocation strategy is a dynamic process because future investment returns and inflation rates will fluctuate from year-to-year. As a consequence, when the client's investment objectives are stated as a target return objective, or as a target level of future asset value, the actual value will likely differ from the target value in any one year. Helping the client to cope with these normal fluctuations is an important part of the investment consulting process.

Monte Carlo Simulation is a method for analyzing this dynamic process. It is being released as a new feature in AllocationMaster in conjunction with the Second Quarter 2001 Software Update. Note: This feature may not appear in some custom editions of AllocationMaster.

THE MONTE CARLO SIMULATION METHOD

Monte Carlo Simulation is used within AllocationMaster to create a model of future capital market behavior. This is done for the purpose of subjecting the asset allocation plan to different market conditions that might actually be experienced. In this way, Monte Carlo Simulation is used to replicate financial market processes to evaluate the merits of alternative asset allocation strategies.

MONTE CARLO SIMULATION

FEATURE

Monte Carlo Simulation is appropriate when the relationships under alternative investment strategies are sufficiently complex, uncertain and dynamic. Other analytical solutions that do not use simulation may not be able to adequately accommodate this type of problem. Analytical methods are best applied to problems that can be described by simple relationships.

Monte Carlo Simulation solves its problems experimentally rather than analytically. The same Financial Forecast process is repeated many times using alternative random rates of investment return. The results of these experiments are ranges of key financial parameters. This approach can be used to reveal the resultant financial consequences of the asset allocation plan in "operation."

Monte Carlo Simulation makes it relatively easy (but computationally intensive) to test the financial consequences of alternative asset allocation strategies. By modifying the capital market expectations, or the asset allocation strategy, and running additional simulations, alternative scenarios can be evaluated. The long-term investment objectives of the client can be efficiently assessed and refined using this methodology. The exhaustive nature of the simulation process should lend additional assurance that the asset allocation strategy is sound because it has been tested under many different contexts.

AllocationMaster uses Monte Carlo Simulation to project future rates of investment return and asset values, one year at a time, for the entire planning period (up to 75 years). The resulting sequence from a single AllocationMaster simulation is a series of investment returns, one for each year of the projection. The investment return being simulated is the total annual rate which includes capital appreciation (or loss) and income yield. An added complication is that capital appreciation and income yield must be separated so that the appropriate tax treatment can be applied.

The simulated investment return is derived through the use of a random number generator. In AllocationMaster, the same random number table is used for all simulations. By starting in the same position in this table (called "seeding"), the user can be assured that differences in the results are not due to the sequence of simulated random numbers. The annual returns making up the sequence are in random order to reflect the unpredictable nature in which investment values fluctuate. An example of a simulated return sequence might be: Year 1- 12.13%, Year 2 - 5.01%, Year 3 - 4.98%, etc.

The Monte Carlo Simulation procedure is repeated many times. Each repetition is referred to as a "trial." A greater number of trials performed will increase the accuracy of the analysis. In AllocationMaster, 200 trials are performed for each year in the sequence. If the planning horizon is 20 years, then 4,000 (200 trials x 20 years) simulated investment returns are used! The amount of data employed in Monte Carlo Simulation can be enormous.

There is a great deal of variation among the simulated sequences because of the random-draw process used to create them. As a result, some trials produce relatively large asset value projections that represent "best-case" experiences. Other trials will result in adverse "worst-case" experiences. The variation in simulated results will be more pronounced for riskier portfolios and longer time horizons.

RUNNING THE SIMULATION

The Monte Carlo Simulation feature in AllocationMaster makes it possible to understand the complex and dynamic nature of the client's portfolio. The results will demonstrate the likely volatility of investment returns and fund values. In addition, the probability of meeting the investment objectives of the plan can be evaluated for the Present Asset Mix and the Proposed Asset Mix.

The Scenario Assumptions are the foundation of the analysis. The risk and return estimates for the asset classes in the Scenario Assumptions are used to develop the portfolio's risk and return characteristics under the Asset Mix menu. A deterministic projection assuming the expected risk and return are realized can then be run under the Forecast menu.

A new Simulate menu appears between the Forecast and Implement menus. To perform a Monte Carlo Simulation, choose Run under the Simulate menu. Once the Monte Carlo Simulation results are complete, they can be displayed by choosing the items appearing under the Simulate menu. To print the Monte Carlo Simulation results, go to the Report Setup window under the Print menu. The Monte Carlo Simulation pages will be indicated by the prefix "Simulation-"

Using Monte Carlo Simulation in AllocationMaster assists in modeling and quantifying the dynamic and uncertain nature of the asset allocation strategy. To the extent that the Monte Carlo Simulation procedure reasonably represents the investment conditions to be eventually experienced, it will produce a good estimate of the range of possible future outcomes under a particular set of client investment objectives.

FOR MORE INFORMATION ABOUT MONTE CARLO SIMULATION, SEE THE FEATURE ARTICLE APPEARING IN THE FOURTH QUARTER 2000 EDITION OF FRONTIER NEWS.

ASPECTS

RESAMPLED EFFICIENT ASSET ALLOCATION

By
Richard O. Michaud, Ph.D.
New Frontier Advisors, LLC

For More Information, Visit:
www.newfrontieradvisors.com

Resampled efficient optimization is a newly patented procedure that improves future investment performance, better forecasts risk, and reduces the need to trade. In simple terms, resampled efficiency is a better way to use an investor's information. Investment value is improved because the information used to define the asset allocation is improved. Resampled efficiency is based on research on how optimizers perform in rigorous statistical experiments. These "out-of-sample" tests prove that, on average, resampled efficiency improves performance.

Current Optimizer Limitations. Classical mean-variance asset allocation is unstable and ambiguous. Small changes in inputs or small differences in the risk levels of optimized portfolios may lead to very different asset allocations. Because the inputs are uncertain, the optimal asset allocation is ambiguous. Often, experienced investors find the resulting allocations unintuitive.

In practice, financial advisors constrain the optimization and manage the inputs to obtain allocations that seem reasonable. The end result may be useful for controlling risk and structuring the allocation so that it is consistent with investor objectives. However, investment value is often limited or even nonexistent. Also, these constraints are often highly subjective and time consuming to implement.

Resampled efficiency solves these problems. Resampling methods provide a richer information set to limit instability and ambiguity. The resulting allocations are typically intuitive, stable, and have the added benefit of a much-reduced need to trade. Yet, because resampled efficiency is a generalization of classical methods, the benefits of current techniques are retained.

Estimation Error Implications. Estimation error is the uncertainty associated with asset allocation estimates. Classical optimization uses inputs literally while resampled efficiency is sensitive to statistical uncertainty. The impact of estimation error on classical methods is far more serious than commonly understood in the investment community.

One way to understand estimation error is to consider a case where the two highest return assets in an asset allocation are equally risky with returns of 20% and 20.1%. Because classical optimization uses information literally, the maximum return optimal portfolio is 100% in the higher return asset. But this makes no investment sense. These assets are statistically equivalent and have essentially the same investment value. This demonstrates a fundamental flaw in how classical efficiency uses information.

Table 1 provides an optimized portfolio illustration of the effect of estimation error on investment value. The first two columns display the annualized means and standard deviations of monthly data for six asset classes for 10 years ending December 1999. The last two columns display the classical and resampled optimal weights with equal annualized standard deviations of 9% in the middle of their respective frontiers.

Note that the classical portfolio has no allocation to small cap stocks. This is because the estimates are used literally and small caps are inferior to large caps. But there is little statistical difference between these assets and an investor may be well advised to include some small caps in their asset allocation. In contrast, resampled efficiency includes a prominent component of small cap stocks. This is because resampled efficiency is sensitive to estimation error and uses input data in a statistically robust manner. Note also that the resampled portfolio is more diversified and intuitively less risky.

These results provide an important illustration of the likely impact of estimation error on optimized asset allocations. While resampled efficiency is sensitive to estimation error classical efficiency is not. Many of the most serious limitations of classical efficiency in practice are the result of estimation error insensitivity.

How Resampled Efficiency Works. Asset allocation estimates of risk and return represent a forecast of the future. Resampling is a Monte Carlo based method for computing many alternative realizations of forecast returns.

The resampling process produces simulated returns and optimization inputs that are statistically consistent with the original estimates. These new input estimates are used to compute simulated efficient frontiers. Because of optimization instability, each simulated efficient frontier may be very different from the original efficient frontier. These differences provide an understanding of the risks of optimizing and leads to a better way of computing optimal efficient portfolios.

Resampled efficient frontiers are an average of the simulated efficient frontier portfolios. These new portfolios are efficient relative to many realizations of forecast return. Because resampled efficient portfolios are defined relative to many alternative ways the future may evolve, the allocations are less extreme, more intuitive, and risk estimation more reliable. Also, they are much more stable; small changes in the inputs typically lead to small changes in the resampled efficient portfolios, reducing the need to trade from one period to another.

Significant Assets. One attractive characteristic of resampled efficiency is the ability to identify the significance and normal variation for each asset allocation. This is because each resampled efficient frontier provides an estimate of the optimal allocation for each asset. Consider the optimal large cap allocation in Table 1. The 10th and 90th percentile values are 31% and 67%. From this data we can say that the allocation to large caps is essential and that 31 to 67% is a normal range of variation.

Rebalancing. One of the most reliable results taught by resampled efficiency is that many trades are unnecessary. This is because reasonable asset allocations are often statistically indistinguishable from optimal ones and don't require rebalancing. Resampled efficiency provides the ability to distinguish whether and when trading may be desirable.

Summary and Conclusions. Estimation error insensitivity is a primary cause of the most serious limitations of classical optimized asset allocations in practice. Resampled efficiency is estimation error sensitive. Resampled efficient allocations are typically more intuitive, may not require ad hoc constraints, substantially reduce the need to trade, and enhance risk estimation reliability. Most importantly, statistical tests show that on average, it is provably effective at improving investment value.

TABLE 1
CLASSICAL VS. RESAMPLED OPTIMAL WEIGHTS

	INPUTS		OPTIMAL WEIGHTS	
Asset Class	**Expected Return (%)**	**Std Deviation (%)**	**Classical (%)**	**Resampled (%)**
Treasury Bills	4.8	0.4	0	6
Intermediate-Term Gov't Bonds	7.1	4.3	36	18
Long-Term Corporate Bonds	8.3	6.4	0	12
Large Cap Stocks	17.7	13.4	64	53
Small Cap Stocks	15.7	17.4	0	10
International Stocks	8.3	17.1	0	1

NEW ENTERPRISE-WIDE AGREEMENTS

INSIGHT

CREDIT SUISSE FIRST BOSTON

As a part of an on-going software development and customization effort at Credit Suisse First Boston (CSFB), SunGard Expert Solutions will be providing networked access of AllocationMaster to all Private Advisors and their Assistants in CSFB Private Client Services. In addition, the new web-based PortfolioMaster asset allocation program will be made available to clients on the CSFB website. AllocationMaster will be used in live client presentations, as well as in the office to prepare proposals to send to clients after they have seen a live presentation. PortfolioMaster will be available on www.CSFB.com, as well as on the Private Client website. Release of both programs is planned for the end of May 2001. According to Melanie C. Urick, Head of Asset Allocation & Diversification Services at CSFB, "SunGard Expert Solutions was selected because it is the most comprehensive and user-friendly system available. Moreover, since making the decision to select Frontier Analytics, we have found the staff to be friendly, very accommodating, and give quick response time to our needs and concerns."

Credit Suisse First Boston is a global investment bank. The Private Client Services Group manages relationships with and assets of ultra high net worth individuals, family offices, public and private corporations, and others.

HILLIARD LYONS

Hilliard Lyons has reached agreement with SunGard Expert Solutions to use the 2001 edition of the Asset Allocation Slides on an enterprise-wide basis. According to John Deglow, the project liaison at Hilliard Lyons, "Many of our Financial Consultants had asked for help with seminar presentations on Asset Allocation. After seeing the Microsoft® PowerPoint presentation that SES/Frontier Analytics offers, we decided to provide all of our brokers with a customized version. The PowerPoint presentation correlates so well with the AllocationMaster software that we also use on an enterprise-wide basis." According to Mr. Deglow, "The Asset Allocation Slides will be used during seminars and other client presentations on investments and asset allocation. It will also be used during training sessions with new brokers."

FIRSTAR CORPORATION

Firstar Corporation will begin using a customized edition of AllocationMaster throughout the FIrstar Private Client Group. Representatives of the Private Client Group will use AllocationMaster to design portfolios on an individual basis taking into account current investments and the level of risk tolerance. Portfolios will be invested as conservatively or as aggressively as client needs dictate. On February 27, 2001, Milwaukee-based Firstar Corporation merged with U.S. Bancorp. Minneapolis-based U.S. Bancorp is the parent company of Firstar Corporation. U.S. Bancorp, with assets in excess of $160 billion, is the 8th largest financial services holding company in the U.S.

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INSIDE

JUST RELEASED:
PORTFOLIOMASTER:
New Web-Based Optimizer

FEATURE:
Monte Carlo Simulation
Added to AllocationMaster

New Enterprise-Wide Clients:
Credit Suisse First Boston,
Hilliard Lyons, and Firstar

ASPECTS:
Exploring The "Resampled"
Efficient Frontier

AND MORE!

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THE STRATEGIC EDGE IN INVESTMENT SOFTWARE

With over 18 years of experience, SunGard Expert Solutions is recognized as the market leader in the design, development and implementation of sales, analysis and advisory technologies for the financial services industry. These solutions are widely used by securities brokerage firms, banks, insurance companies, accounting firms and independent investment advisors. The company's mission is to empower consumers and advisors to make intelligent financial decisions.

FRONTIER NEWS SECOND QUARTER 2001

Frontier News provides our clients and other investment professionals with information about our products and trends taking place in the investment technology industry.

CONTACT US!

MONDAY-FRIDAY 7:00 AM TO 4:00 PM, PACIFIC TIME

Our Technical Support team is trained and ready to assist you. You can also learn more on our web site at www.frontieranalytics.com. We want to ensure that you always get the most from our products.