Portfolios with Hedge Funds and Other Alternative Investments

Introduction to a Work in Progress

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Abstract

We develop a flexible simulation-based optimization (SBO) method for the construction of optimal portfolios including hedge funds and other types of alternative investments. This method takes into account the skew and kurtosis of asset returns, the time series structure of asset returns, and the asymmetric nature of investor preferences for gains versus losses. Johnson (1949) translation is used to model non-normality in asset returns. Vector autoregression (VAR) methods are used to model the temporal relations among asset returns. Investor preferences are represented by the Kahneman-Tversky (1979) family of utility functions that incorporate both risk and loss aversion.

Current findings are based on CSFB hedge fund indices and standard index proxies for regular asset classes. Survivorship bias is controlled for by uniform reduction in hedge fund expected returns. Preliminary results suggest that market-neutral and global macro funds have risk-return characteristics that make them attractive investment vehicles for risk and loss averse investors.

1 Introduction

Hedge funds, venture capital investment, and other alternative investments are increasingly popular with the investing public. This popularity poses significant dilemmas for both financial theorists and for investment practitioners interested in providing prudent advice regarding how such investments should be incorporated into the portfolios of different types of investors. Rules of thumb based on the Sharpe ratio and more sophisticated analyses based on the mean-variance efficient frontier of Markowitz (1952) or the continuous-time model of Merton (1972) are clearly inadequate because the risk characteristics of these investments depart strongly from the classical assumptions of (log)normally distributed returns without serial correlation. Further, common sense and recent theoretical and experimental work suggest that the standard models also provide a poor representation of investor preferences.

The inadequacy of traditional approaches has led to the introduction of new methods, including the Stutzer (2001) performance index and the Omega measure of Keating and Shadwick (2002a and 2002b). The Stutzer index is a generalization of the Sharpe ratio that penalizes the performance of assets with negatively skewed returns. The Omega measure provides a more complete way to compare assets with different return distributions. These measures provide new and useful statistical approaches to study return distributions, however, they provide only limited guidance on transforming this new information into portfolio allocations. Further, they explicitly or implicitly assume the absence of serial correlation.

The approach described here assembles existing tools in a new and more powerful framework. The Johnson (1949) translation system is the principal method used to build explicit models of the distributional characteristics of individual assets. This approach allows explicit modelling of the skew and kurtosis of asset returns. Simpler methods based on the empirical distribution function and the Student-t distribution are also studied. Concerns regarding the time series structure of hedge fund returns have been expressed by Asness, Krail, and Liew (2001), Brooks and Kat (2001a), and others. According we construct time series models of returns. We find cointegration and, accordingly, use VEC methods.

Investors are assumed to be both risk and loss averse. Risk aversion is a measure of a general tendency to avoid risk. Loss aversion is a specific measure of how much more weight an investor accords to a loss of a given magnitude in comparison to an equivalent gain. The model is due to Kahneman and Tversky (1979), the foundational work in modern behavioral finance. Loss aversion is represented by a simple asymmetric representation of the impact of gains versus losses: $U(-x) = -\lambda U(x)$, $\lambda > 1$, $U(0) = 0$, where zero return is, for now, assumed to be the investor's anchoring point. Kahneman and Tversky (1979) suggest $\lambda \approx 2.25$. This may be interpreted as 125% loss aversion.[1] We take 100% loss aversion a reference point for loss averse preferences.

The model of the investment environment is then used as an input to the optimization process. Hundreds or thousands of scenarios consistent with observed asset return characteristics are generated. The optimal portfolio for given levels of loss and risk aversion is the one that maximizes the corresponding utility function.

The short history of hedge fund data, the lack of transparency of hedge fund investment strategy, and statistical issues stemming from the way that hedge fund performance data become available all indicate that professional judgement in the prospective revision of historically observed relationships is important. High rates of hedge fund attrition rate and the resulting survivorship bias are well documented (*e.g.*, Ackermann, McEnally and Ravenscraft (1999), Bares, Gibson and Gyger (2001), Brooks and Kat (2001b), Brown, Goetzmann and Ibbotson (1999), Brown, Goetzmann and Park (2001), Fung and Hsieh (2000), and Liang (2000, 2001)). We follow Brown, Goetzmann and Ibbotson (1999) and Brooks and Kat (2001b) in considering the bias to be best represented as the average performance difference between all fund in a sample and the survivors. Survival bias is believed to vary systematically with the age, size, and strategy of a fund. Presently, we model the bias as a uniform downward adjustment in hedge fund returns. We study the effects of 2% and 3% annual downward "haircut" adjustments, in line with general findings. Direct downward adjustment, however, does not capture the risk reflected by attrition. We are considering default-like models of attrition risk.

Our principal finding to date is that hedge funds do, in fact, appear to hedge. These results are based on the CSFB/Tremont hedge fund indices, with data currently covering the period from 1994/1 to 2001/11. We use construct optimal portfolios from universe of 10 hedge fund indices, the S&P 500, the MSCI EAFE index, long-term bonds, and treasury bills. No hedge fund index outperforms the S&P 500 over this period. Generally, risk neutral investors will invest entirely in the S&P 500. However, we find that, both separately and together,

[1] Kahneman and Tversky (1979) also find a level of risk aversion of approximately 0.88 in their experiments. There is no reason to assume that these exact factors are common to all investors. In this work we study a range of possible risk and loss aversion levels.

increasing risk aversion and increasing loss aversion lead to large increases in allocations to hedge indices. These results are robust to a number of assumptions. In particular, these results are robust to conservative assumptions regarding the effects of survivorship bias on hedge fund returns. Charts 1 and 2 present results for the zero loss aversion and 100% loss aversion scenarios, respectively, both incorporating a 3% annual downward reduction in expected annual returns across all hedge indices to correct for survivorship bias.

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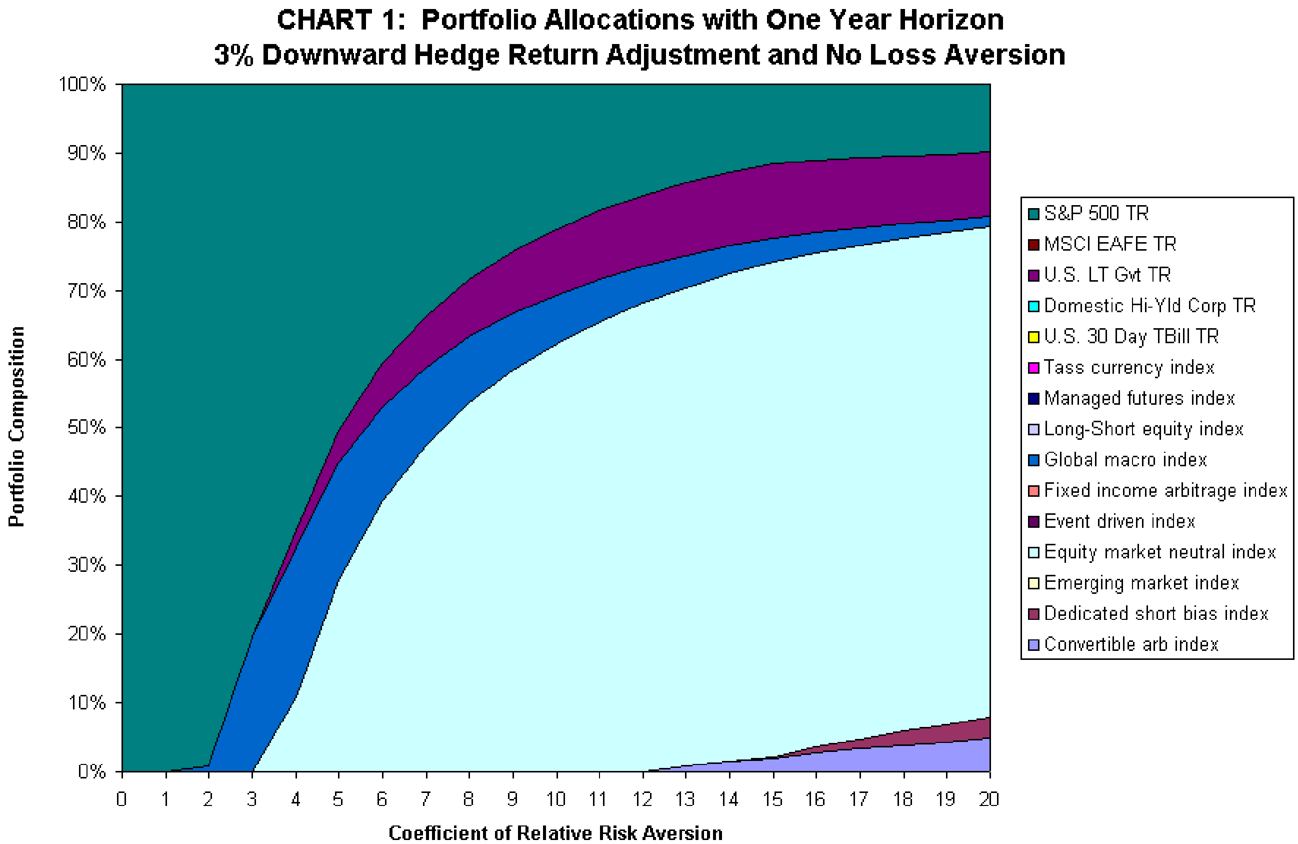

Chart 1: This chart represents optimal asset allocations as a function of an investor's coefficient of relative risk aversion under the assumption of zero loss aversion. The horizontal axis represents risk aversion. Level 0 is to the left and represents risk neutrality. Level 1 is logarithmic utility. The vertical axis represents the optimal allocation. The fraction of the vertical distance occupied by any index at a particular level of risk aversion is its allocation in the corresponding optimal portfolio.

Indices with positive allocation are, from the top, the S&P 500 index, the Ibbotson U.S. Long-Term Government Bonds index, the CSFB Global Macro hedge fund index, the CSFB Equity Market Neutral hedge fund index, the CSFB Dedicated Short-Bias hedge fund index, and the CSFB Convertible Arbitrage hedge fund index.

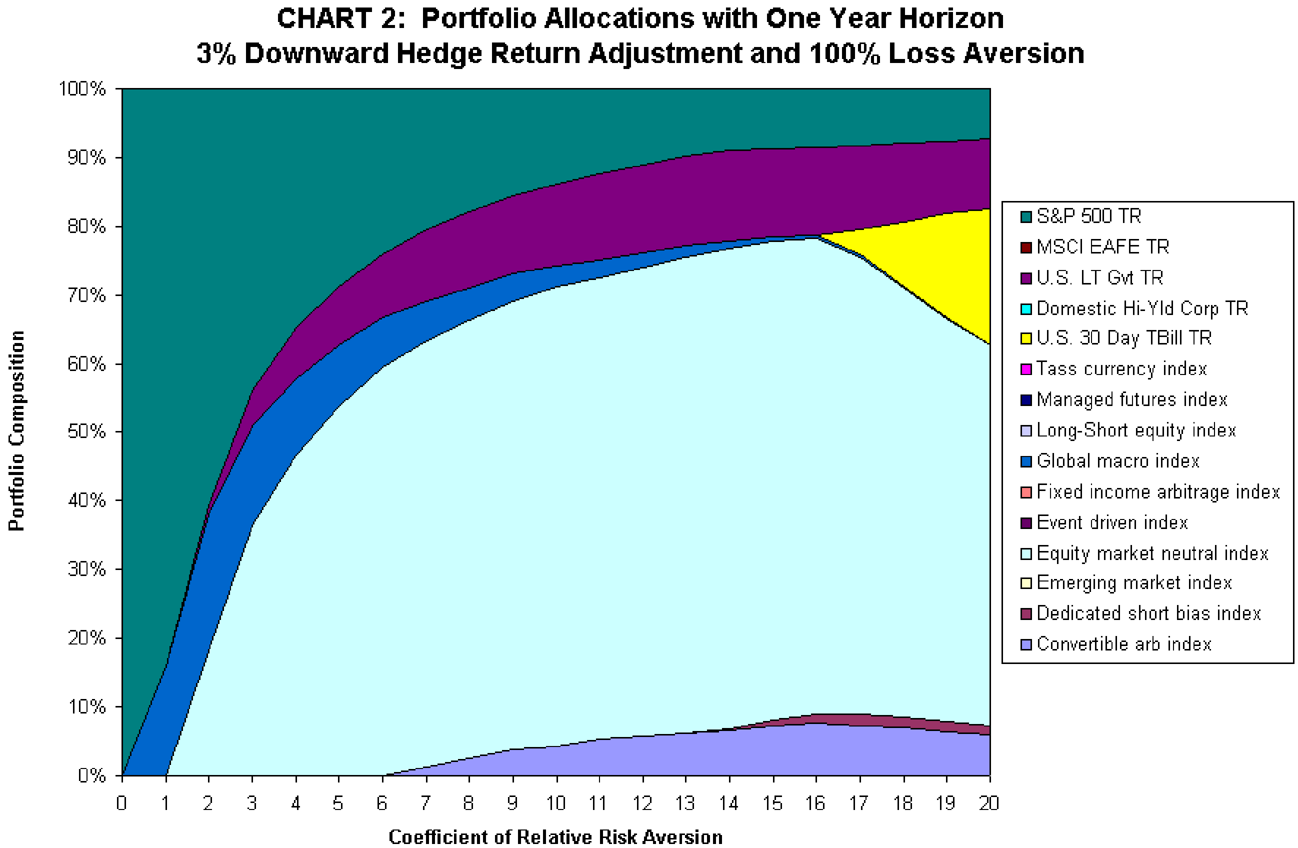

Chart 2: This chart represents optimal asset allocations as a function of an investor's coefficient of relative risk aversion under the assumption of a 40% level of loss aversion. The horizontal axis represents risk aversion. Level 0 is to the left and represents risk neutrality. Level 1 is logarithmic utility. The vertical axis represents the optimal allocation. The fraction of the vertical distance occupied by any index at a particular level of risk aversion is its allocation in the corresponding optimal portfolio.

Indices with positive allocation are, from the top, the S&P 500 index, the Ibbotson U.S. Long-Term Government Bonds index, the CSFB Global Macro hedge fund index (in blue and to the left), the Ibbotson U.S. 30 Day Treasury Bill index (in yellow and to the right), the CSFB Equity Market Neutral hedge fund index, the CSFB Dedicated Short-Bias hedge fund index, and the CSFB Convertible Arbitrage hedge fund index.