Mean Variance Portfolio Optimization With Excel

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Mean-variance Portfolio Optimization when Means and Covariances are Unknown Open Dissertation Press
A comprehensive portfolio optimization guide, with provided MATLAB code Robust Equity Portfolio Management + Website offers the most comprehensive coverage available in this burgeoning field. Beginning with the fundamentals before moving into advanced techniques, this book provides useful coverage for both beginners and advanced readers. MATLAB code is provided to allow readers of all levels to begin implementing robust models immediately, with detailed explanations and applications in the equity market included to help you grasp the real-world use of each technique. The discussion includes the most up-to-date thinking and cutting-edge methods, including a much-needed alternative to the traditional Markowitz mean-variance model. Unparalleled in depth and breadth, this book is an invaluable reference for all risk managers, portfolio managers, and analysts. Portfolio construction models originating from the standard Markowitz mean-variance model have a high input sensitivity that threatens optimization, spawning a flurry of research into new analytic techniques. This book covers the latest developments along with the basics, to give you a truly comprehensive understanding backed by a robust, practical skill set. Get up to speed on the latest developments in portfolio optimization Implement robust models using provided MATLAB code Learn advanced optimization methods with equity portfolio applications Understand the formulations, performances, and properties of robust portfolios The Markowitz mean-variance model remains the standard framework for portfolio optimization, but the interest in—and need for—an alternative is rapidly increasing. Resolving the sensitivity issue and dramatically reducing portfolio risk is a major focus of today's portfolio manager. Robust Equity Portfolio Management + Website provides a viable alternative framework, and the hard skills to implement any optimization method.
Mean-variance Analysis in Portfolio Choice and Capital Markets Springer Nature
Tail Mean-Variance (TMV) has emerged from the actuarial community as a criterion for risk management and portfolio selection, with a focus on extreme losses. The existing literature on portfolio optimization under the TMV criterion relies on the plug-in approach that substitutes the unknown mean and covariance of asset returns in the optimal portfolio weight with their

sample counterparts. The plug-in method inevitably introduces estimation risk and usually has poor out-of-sample performance. We propose an optimal combination of the plug-in and 1/N rules to improve out-of-sample performance. Our proposed combined portfolio consistently outperforms both the plug-in and 1/N portfolios on both simulated and real-world datasets.

Fast Quadratic Programming for Mean-Variance Portfolio Optimization Cambridge, Mass., USA : Blackwell

In this paper, a vectorized quadratic convex optimization algorithm based on Matlab's quadprog built-in function is proposed. We target specifically a classic problem confronted by portfolio analysts, that of optimizing asset allocation when choosing among several asset classes, in the context of Markowitz's modern portfolio theory. Simulating return trajectories for several asset classes, we formulate the optimization routine in such a way that is able to handle multiple scenarios at the same time, instead of on a one-by-one basis, reducing computational times significantly, without introducing observable estimation errors. A sensitivity analysis is offered with respect to the optimal batch size.

A Geometric Approach to Multiperiod Mean Variance Optimization of Assets and Liabilities John Wiley & Sons

We investigate the time-consistent mean-variance (MV) portfolio optimization problem under a realistic context that involves the simultaneous application of different types of investment constraints and modelling assumptions, for which a closed-form solution is not known to exist. We develop an efficient numerical partial differential equation method for determining the optimal control for this problem. Central to our method is a combination of (i) an impulse control formulation of the MV investment problem, and (ii) a discretized version of the dynamic programming principle enforcing a time-consistency constraint. We impose realistic investment constraints, such as no trading if insolvent, leverage restrictions and different interest rates for borrowing/lending. Our method requires solution of linear partial integro-differential equations between intervention times, which is numerically simple and computationally effective. The proposed method can handle both continuous and discrete rebalancings.We study the substantial effect and economic implications of realistic investment constraints and modelling assumptions on the MV efficient frontier and the resulting investment strategies. This includes (i) a comprehensive comparison study of the pre-commitment and time-consistent optimal strategies, and (ii) an investigation on the significant impact of a wealth-dependent risk aversion parameter on the optimal controls.

Mean-Variance Portfolia Optimization When Means and Covariances are Unknown Springer Science & Business Media

Dimension reduction methods are useful pre-processing tools for efficient quantitative analysis with the aim to preserve the main features of the multidimensional data. However, negative values resulting from the transformation may obscure the interpretation of the analysis. This novel study aims to investigate the effects of non-negative dimension reduction methods on the mean-variance portfolio optimization model. Backtesting results for major stock market indices show that reducing dimensionality of asset prices may improve the overall efficiency of the mean-variance portfolio optimization output.

Portfolio Optimization Using Markowitz Mean-variance Model and Stochastic Programming Rmetrics

In spite of theoretical benefits, Markowitz mean-variance (MV) optimized portfolios often fail to meet practical investment goals of marketability, usability, and performance, prompting many investors to seek simpler alternatives. Financial experts Richard and Robert Michaud demonstrate that the limitations of MV optimization are not the result of conceptual flaws in Markowitz theory but unrealistic representation of investment information. What is missing is a realistic treatment of estimation error in the optimization and rebalancing process. The text provides a non-technical review of classical Markowitz optimization and traditional objections. The authors demonstrate that in practice the single most important limitation of MV optimization is oversensitivity to estimation error. Portfolio optimization requires a modern statistical perspective. Efficient Asset Management, Second Edition uses Monte Carlo resampling to address information uncertainty and define Resampled Efficiency (RE) technology. RE optimized portfolios represent a new definition of portfolio optimality that is more investment intuitive, robust, and provably investment effective. RE rebalancing provides the first rigorous portfolio trading, monitoring, and asset importance rules, avoiding widespread ad hoc methods in current practice. The Second Edition resolves several open issues and misunderstandings that have emerged since the original edition. The new edition includes new proofs of effectiveness, substantial revisions of statistical estimation, extensive discussion of long-short optimization, and new tools for dealing with estimation error in applications and enhancing computational efficiency. RE optimization is shown to be a Bayesian-based generalization and enhancement of Markowitz's solution. RE technology corrects many current practices that may adversely impact the investment value of trillions of dollars under current asset management. RE optimization technology may also be useful in other financial optimizations and more generally in multivariate estimation contexts of information uncertainty with Bayesian linear constraints. Michaud and Michaud's new book includes numerous additional proposals to enhance investment value including Stein and Bayesian methods for improved input estimation, the use of portfolio priors, and an economic perspective for asset-liability optimization. Applications include investment policy, asset allocation, and equity portfolio optimization. A simple global asset allocation problem illustrates portfolio optimization techniques. A final chapter includes practical advice for avoiding simple portfolio design errors. With its important implications for investment practice, Efficient Asset Management 's highly intuitive yet rigorous approach to defining optimal portfolios will appeal to investment management executives, consultants, brokers, and anyone seeking to stay abreast of current investment technology. Through practical examples and illustrations, Michaud and Michaud update the practice of optimization for modern investment management.

Mean-Variance Portfolio Optimization

Based on Ordinal Information Oxford University Press
In 1952, Harry Markowitz published "Portfolio Selection," a paper which revolutionized modern investment theory and practice. The paper proposed that, in selecting investments, the investor should consider both expected return and variability of return on the portfolio as a whole. Portfolios that minimized variance for a given expected return were demonstrated to be the most efficient. Markowitz formulated the full solution of the general mean-variance efficient set problem in 1956 and presented it in the appendix to his 1959 book, Portfolio Selection. Though certain special cases of the general model have become widely known, both in academia and among managers of large institutional portfolios, the characteristics of the general solution were not presented in finance books for students at any level. And although the results of the general solution are used in a few advanced portfolio optimization programs, the solution to the general problem should not be seen merely as a computing procedure. It is a body of propositions and formulas concerning the shapes and properties of mean-variance efficient sets with implications for financial theory and practice beyond those of widely known cases. The purpose of the present book, originally published in 1987, is to present a comprehensive and accessible account of the general mean-variance portfolio analysis, and to illustrate its usefulness in the practice of portfolio management and the theory of capital markets. The portfolio selection program in Part IV of the 1987 edition has been updated and contains exercises and solutions.
מזכרת פאקש... John Wiley & Sons
For a number of different formulations of robust portfolio optimization, quadratic and absolute, we show that a) in the limit of low uncertainty in estimated asset mean returns the robust portfolio converges towards the mean-variance portfolio obtained with the same inputs; and b) in the limit of high uncertainty the robust portfolio converges towards a risk-based portfolio, which is a function of how the uncertainty in estimated asset mean returns is defined. We give examples in which the robust portfolio converges toward the minimum variance, the inverse variance, the equal-risk budget and the equally weighted portfolio in the limit of sufficiently large uncertainty in asset mean returns. At intermediate levels of uncertainty we find that a weighted average of the mean-variance portfolio and the respective limiting risk-based portfolio offer a good representation of the robust portfolio, in particular in the case of the quadratic formulation. The results remain valid even in the presence of portfolio constraints, in which case the limiting portfolios are the corresponding constrained mean-variance and constrained risk-based portfolios. We believe our results are important in particular for risk-based investors who wish to take into account expected returns to gently tilt away from their current allocations, e.g. risk parity or minimum variance.
Mean-variance Portfolio Optimisation John Wiley & Sons
This dissertation, "Mean Variance Portfolio Management: Time Consistent Approach" by Kwok-chuen, Wong, □□□, was obtained from The University of Hong Kong (Pokfulam, Hong Kong) and is being sold pursuant to Creative Commons: Attribution 3.0 Hong Kong License. The content of this dissertation has not been altered in any way. We

 Abstract: In this thesis, two problems of time consistent mean-variance portfolio selection have been studied: mean-variance asset-liability management with regime switchings and mean-variance optimization with state-dependent risk aversion under short-selling prohibition. Due to the non-linear expectation term in the mean-variance utility, the usual Tower Property fails to hold, and the corresponding optimal portfolio selection problem becomes time-inconsistent in the sense that it does not admit the Bellman Optimality Principle. Because of this, in this thesis, time-consistent equilibrium solution of two mean-variance optimization problems is established via a game theoretic approach. In the first part of this thesis, the time consistent solution of the mean-variance asset-liability management is sought for. By using the extended Hamilton-Jacobi- Bellman equation for equilibrium solution, equilibrium feedback control of this MVALM and the corresponding equilibrium value function can be obtained. The equilibrium control is found to be affine in liability. Hence, the time consistent equilibrium control of this problem is state dependent in the sense that it depends on the uncontrollable liability process, which is in substantial contrast with the time consistent solution of the simple classical mean-variance problem in Bjork and Murgoci (2010), in which it was independent of the state. In the second part of this thesis, the time consistent equilibrium strategies for the mean-variance portfolio selection with state dependent risk aversion under short-selling prohibition is studied in both a discrete and a continuous time settings. The motivation that urges us to study this problem is the recent work in Bjork et al. (2012) that considered the mean-variance problem with state dependent risk aversion in the sense that the risk aversion is inversely proportional to the current wealth. There is no short-selling restriction in their problem and the corresponding time consistent control was shown to be linear in wealth. However, we discovered that the counterpart of their continuous time equilibrium control in the discrete time framework behaves unsatisfactory, in the sense that the corresponding "optimal" wealth process can take negative values. This negativity in wealth will change the investor into a risk seeker which results in an unbounded value function that is economically unsound. Therefore, the discretized version of the problem in Bjork et al. (2012) might yield solutions with bankruptcy possibility. Furthermore, such "bankruptcy" solution can converge to the solution in continuous counterpart as Bjork et al. (2012). This means that the negative risk aversion drawback could appear in implementing the solution in Bjork et al. (2012) discretely in practice. This drawback urges us to prohibit short-selling in order to eliminate the chance of getting non-positive wealth. Using backward induction, the equilibrium control in discrete time setting is explicit solvable and is shown to be linear in wealth. An application of the extended Hamilton-Jacobi-Bellman equation leads us to conclude that the continuous time equilibrium control is also linear in wealth. Also, the investment to wealth ratio would satisfy an integral equation which is uniquely solvable. The discrete

time equilibrium controls are shown to converge to that in continuous time setting. DOI: 10.5353/th_b5153743 S
Robust Mean-Variance and Mean-CVaR in Portfolio Optimization Springer
We integrate appealing features of Markowitz's mean-variance portfolio theory (MVT) and Shefrin and Statman's behavioral portfolio theory (BPT) into a new mental accounting (MA) framework. Features of the MA framework include a mental accounting structure of portfolios, a definition of risk as the probability of failing to reach the threshold level in each mental account, and attitudes toward risk that vary by account. We demonstrate a mathematical equivalence between MVT, MA and risk management using VaR. The aggregate allocation across MA sub-portfolios is mean-variance efficient with short-selling. Short-selling constraints on mental accounts impose very minor reductions in certainty equivalents, only if binding for the aggregate portfolio, or setting utility losses from errors in specifying risk aversion coefficients in MVT applications. These generalizations of MVT and BPT via a united MA framework result in a fruitful connection between investor consumption goals and portfolio production.
Mean-variance Portfolio Optimization and the Currency Hedging Decision John Wiley & Sons
We present a geometric approach to discrete time multiperiod mean variance portfolio optimization that largely simplifies the mathematical analysis and the economic interpretation of such model settings. We show that multiperiod mean variance optimal policies can be decomposed in an orthogonal set of basis strategies, each having a clear economic interpretation. This implies that the corresponding multi period mean variance frontiers are spanned by an orthogonal basis of dynamic returns. Specifically, in a k-period model the optimal strategy is a linear combination of a single k-period global minimum second moment strategy and a sequence of k local excess return strategies which expose the dynamic portfolio optimally to each single-period asset excess return. This decomposition is a multi period version of Hansen and Richard (1987) orthogonal representation of single-period mean variance frontiers and naturally extends the basic economic intuition of the static Markowitz model to the multiperiod context. Using the geometric approach to dynamic mean variance optimization we obtain closed form solutions in the i.i.d. setting for portfolios consisting of both assets and liabilities (AL), each modelled by a distinct state variable. As a special case, the solution of the mean variance problem for the asset only case in Li and Ng (2000) follows directly and can be represented in terms of simple products of some single period orthogonal returns. We illustrate the usefulness of our geometric representation of multi-periods optimal policies and mean variance frontiers by discussing specific issued related to AL portfolios: The impact of taking liabilities into account on the implied mean variance frontiers, the quantification of the impact of the investment horizon and the determination of the optimal initial funding ratio.
Simplified Mean-variance Portfolio Optimisation
Mean-variance analysis in portfolio... / Markowitz, H.M.
A Comparison of the Mean-Variance-Leverage Optimization Model and the Markowitz General Mean-Variance

Portfolio Selection Model

Markowitz's celebrated mean-variance portfolio optimization theory assumes that the means and covariances of the underlying asset returns are known. In practice, they are unknown and have to be estimated from historical data. Plugging the estimates into the efficient frontier that assumes known parameters has led to portfolios that may perform poorly and have counter-intuitive asset allocation weights; this has been referred to as the "Markowitz optimization enigma." After reviewing different approaches in the literature to address these difficulties, we explain the root cause of the enigma and propose a new approach to resolve it. Not only is the new approach shown to provide substantial improvements over previous methods, but it also allows flexible modeling to incorporate dynamic features and fundamental analysis of the training sample of historical data, as illustrated in simulation and empirical studies.

Essays on Mean-variance Portfolio Optimization in Commodity Markets

Designed as a self-contained text, this book covers a wide spectrum of topics on portfolio theory. It covers both the classical-mean-variance portfolio theory as well as non-mean-variance portfolio theory. The book covers topics such as optimal portfolio strategies, bond portfolio optimization and risk management of portfolios. In order to ensure that the book is self-contained and not dependent on any pre-requisites, the book includes three chapters on basics of financial markets, probability theory and asset pricing models, which have resulted in a holistic narrative of the topic. Retaining the spirit of the classical works of stalwarts like Markowitz, Black, Sharpe, etc., this book includes various other aspects of portfolio theory, such as discrete and continuous time optimal portfolios, bond portfolios and risk management. The increase in volume and diversity of banking activities has resulted in a concurrent enhanced importance of portfolio theory, both in terms of management perspective (including risk management) and the resulting mathematical sophistication required. Most books on portfolio theory are written either from the management perspective, or are aimed at advanced graduate students and academicians. This book bridges the gap between these two levels of learning. With many useful solved examples and exercises with solutions as well as a rigorous mathematical approach of portfolio theory, the book is useful to undergraduate students of mathematical finance, business and financial management.

Mean-Variance Analysis in Portfolio Choice and Capital Markets

This paper studies the dynamic mean-risk portfolio optimization problem with variance and Value-at-Risk(VaR) as the risk measures in recognizing the importance of incorporating different risk measures in the portfolio management model. Using the martingale approach and combining it with the quantile optimization technique, we provide the solution framework for this problem and show that the optimal terminal wealth may have different patterns under a general market setting. When the market parameters are deterministic, we develop the closed-form solution for this problem. Examples are provided to illustrate the solution procedure of our method and demonstrate the beneft of our dynamic portfolio model comparing with its static counterpart.

Mean-variance Portfolio Optimization

Praise for Robust Portfolio Optimization and Management "In the half century since Harry Markowitz introduced his elegant theory for selecting portfolios, investors and scholars have extended and refined its application to a wide range of real-world problems, culminating in the contents of this masterful book. Fabozzi, Kolm, Pachamanova, and Focardi deserve high praise for producing a technically rigorous yet remarkably accessible guide to the latest advances in portfolio construction." --Mark Kritzman, President and CEO, Windham Capital Management, LLC "The topic of robust optimization (RO) has become 'hot' over the past several years, especially in real-world financial applications. This interest has been sparked, in part, by practitioners who implemented classical portfolio models for asset allocation without considering estimation and model robustness a part of their overall allocation methodology, and experienced poor performance. Anyone interested in these developments ought to own a copy of this book. The authors cover the recent developments of the RO area in an intuitive, easy-to-read manner, provide numerous examples, and discuss practical considerations. I highly recommend this book to finance professionals and students alike." --John M. Mulvey, Professor of Operations Research and Financial Engineering, Princeton University

Robust Portfolio Optimization and Management

We propose a new approach that allows for incorporating qualitative views, such as ordering information, into estimates of future asset returns within the Black-Litterman model. We develop a mathematical framework and numerical computation methods for this setting. We find importance sampling to be the most appropriate numerical approach in terms of accuracy and computation time. Using empirical stock market data, we find our extended Black-Litterman model to process ordering information on future asset returns better than two previously suggested approaches. Our new estimator is successfully evaluated in the context of mean-variance portfolio optimization.

Dynamic Mean-variance Portfolio Optimization with Value-at-Risk Constraint in Continuous-time

This monograph presents a comprehensive study of portfolio optimization, an important area of quantitative finance. Considering that the information available in financial markets is incomplete and that the markets are affected by vagueness and ambiguity, the monograph deals with fuzzy portfolio optimization models. At first, the book makes the reader familiar with basic concepts, including the classical mean–variance portfolio analysis. Then, it introduces advanced optimization techniques and applies them for the development of various multi-criteria portfolio optimization models in an uncertain environment. The models are developed considering both the financial and non-financial criteria of investment decision making, and the inputs from the investment experts. The utility of these models in practice is then demonstrated using numerical illustrations based on real-world data, which were collected from one of the premier stock exchanges in India. The book addresses both academics and professionals pursuing advanced research and/or engaged in practical issues in the rapidly evolving field of portfolio optimization.

Random Matrix Approach to Minimum Variance Portfolio Optimization with High Frequency Data

The mean-variance-leverage (MVL) optimization model (Jacobs and Levy 2012, 2013a) tackles an issue not dealt with by the mean-variance optimization inherent in the general mean-variance portfolio selection model (GPSM) -- that is, the impact on investor utility of the risks that are unique to using leverage. Relying on leverage constraints with a conventional GPSM, as is commonly done today, is unlikely to lead to the portfolio offering a leverage-averse investor the highest utility. But investors can use the MVL model to find optimal portfolios that balance expected return, volatility risk, and leverage risk. The MVL model has intuitive appeal and offers straightforward implementation for portfolio selection. In contrast, practical use of a broader application of GPSM, as suggested by Markowitz (2013), is dependent on successful future development of a stochastic margin-call model (SMCM).

Robust Equity Portfolio Management

Praise for Robust Portfolio Optimization and Management "In the half century since Harry Markowitz introduced his elegant theory for selecting portfolios, investors and scholars have extended and refined its application to a wide range of real-world problems, culminating in the contents of this masterful book. Fabozzi, Kolm, Pachamanova, and Focardi deserve high praise for producing a technically rigorous yet remarkably accessible guide to the latest advances in portfolio construction." --Mark Kritzman, President and CEO, Windham Capital Management, LLC "The topic of robust optimization (RO) has become 'hot' over the past several years, especially in real-world financial applications. This interest has been sparked, in part, by practitioners who implemented classical portfolio models for asset allocation without considering estimation and model robustness a part of their overall allocation methodology, and experienced poor performance. Anyone interested in these developments ought to own a copy of this book. The authors cover the recent developments of the RO area in an intuitive, easy-to-read manner, provide numerous examples, and discuss practical considerations. I highly recommend this book to finance professionals and students alike." --John M. Mulvey, Professor of Operations Research and Financial Engineering, Princeton University

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