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Mean Variance Portfolio Optimization With Excel

Mean Variance Portfolio Theory Simply Explained Mean variance optimization Mean Variance Portfolio Optimization I Mean Variance Portfolio Optimization III 14. Portfolio Theory Markowitz Model and Modern Portfolio Theory - Explained Mean Variance Portfolio using Solver Chapter 10 - The Minimum Variance Portfolio and the Efficient Frontier Mean Variance Portfolio Theory Concepts Using Solver to Find Minimum Variance Portfolio in Excel Portfolio Optimization in Excel R3-1. Mean-Variance Optimization and Efficient Frontier 1 CFA® Level I Portfolio Management - Minimum Variance Portfolios and Efficient Frontier Mean Variance Analysis Diversification with Two Assets Investment Science: Portfolio Optimization Lecture 42: Mean Variance Portfolio Optimization II Lecture 43: Mean Variance Portfolio Optimization III Mean Variance Stock Portfolio Optimization | Algorithmic Investing Markowitz Portfolio Optimization Mean Variance Portfolio Optimization II Portfolio Optimization: Mean-Variance Optimization and the Critical Line Algorithm. Lecture 48: Mean Variance Portfolio Optimization VIII Mean Variance Portfolio Optimization IV IQF Chapter 4 Part3 (Mean-variance portfolio optimization with risk-free asset, market portfolio)

Portfolio Optimization in Excel
Efficient Asset Management
Efficient Diversification of Investments
Portfolio Optimization with R/Rmetrics
Portfolio Optimization with Alternative Assets
Portfolio Optimization
Three Studies on Portfolio Optimization and Performance Appraisal
Statistical Models and Methods for Financial Markets
Portfolio Selection
Financial Analytics with R
A Library of GAMS Models
מזכרת פאקש...
Optimization Methods in Finance
Achieving California's 33 Percent Renewable Portfolio Standard Goal
A Geometric Approach to Multiperiod Mean Variance Optimization of Assets and Liabilities
Mean-Variance Portfolio Optimization When Means and Covariances are Unknown
Characteristic-based Mean-variance Portfolio Choice
Mean-variance Portfolio Optimization and the Currency Hedging Decision
Cheechoo, Shirley
Random Matrix Approach to Minimum Variance Portfolio Optimization with High Frequency Data
Formulations, Implementations, and Properties using MATLAB

Practical Financial Optimization
A Global Equity Approach for the American Investor
A Practical Guide to Stock Portfolio Optimization and Asset Allocation
A Modified Mean-variance-conditional Value at Risk Model of Multi-objective Portfolio Optimization with an Application in Finance
A Mean-variance Portfolio Optimization of California's Generation Mix to 2020

Mean Variance Portfolio Optimization With Excel *OMB No. 8323542601759 edited by*

RODRIGO GEORGE

Efficient Asset Management Yale University Press
In recent years portfolio optimization and construction methodologies have become an increasingly critical ingredient of asset and fund management, while at the same time portfolio risk assessment has become an essential ingredient in risk management. This trend will only accelerate in the coming years. This practical handbook fills the gap between current university instruction and current industry practice. It provides a comprehensive computationally-oriented treatment of modern portfolio optimization and construction methods using the powerful NUOPT for S-PLUS optimizer.
Efficient Diversification of Investments Mean-Variance Analysis in Portfolio Choice and Capital Markets
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.

Portfolio Optimization with R/Rmetrics Springer Science & Business Media

Eschewing a more theoretical approach, Portfolio Optimization shows how the mathematical tools of linear algebra and optimization can quickly and clearly formulate important ideas on the subject. This practical book extends the concepts of the Markowitz "budget constraint only" model to a linearly constrained model. Only requiring elementary linear algebra, the text begins with the necessary and sufficient conditions for optimal quadratic minimization that is subject to linear equality constraints. It then develops the key properties of the efficient frontier, extends the results to problems with a risk-free asset, and presents Sharpe ratios and implied risk-free rates. After focusing on quadratic programming, the author discusses a constrained portfolio optimization problem and uses an algorithm to determine the entire (constrained) efficient frontier, its corner portfolios, the piecewise linear expected returns, and the piecewise quadratic variances. The final chapter illustrates infinitely many implied risk returns for certain market portfolios. Drawing on the author’s experiences in the academic world and as a consultant to many financial institutions, this text provides a hands-on foundation in portfolio optimization. Although the author clearly describes how to implement each technique by hand, he includes several MATLAB® programs designed to implement the methods and offers these programs on the accompanying CD-ROM.

Portfolio Optimization with Alternative Assets Open Dissertation Press

Financial Analytics with R sharpens readers' skills in time-series, forecasting, portfolio selection, covariance clustering, prediction, and derivative securities.

Portfolio Optimization Oxford University Press

Financial Risk Modelling and Portfolio Optimization with R, 2nd Edition Bernhard Pfaff, Invesco Global Asset Allocation, Germany A must have text for risk modelling and portfolio optimization using R. This book introduces the latest techniques advocated for measuring financial market risk and portfolio optimization, and provides a plethora of R code examples that enable the reader to

replicate the results featured throughout the book. This edition has been extensively revised to include new topics on risk surfaces and probabilistic utility optimization as well as an extended introduction to R language. Financial Risk Modelling and Portfolio Optimization with R: Demonstrates techniques in modelling financial risks and applying portfolio optimization techniques as well as recent advances in the field. Introduces stylized facts, loss function and risk measures, conditional and unconditional modelling of risk; extreme value theory, generalized hyperbolic distribution, volatility modelling and concepts for capturing dependencies. Explores portfolio risk concepts and optimization with risk constraints. Is accompanied by a supporting website featuring examples and case studies in R. Includes updated list of R packages for enabling the reader to replicate the results in the book. Graduate and postgraduate students in finance, economics, risk management as well as practitioners in finance and portfolio optimization will find this book beneficial. It also serves well as an accompanying text in computer-lab classes and is therefore suitable for self-study.

Three Studies on Portfolio Optimization and Performance Appraisal

John Wiley & Sons
In answer to the intense development of new financial products and the increasing complexity of portfolio management theory, Portfolio Optimization and Performance Analysis offers a solid grounding in modern portfolio theory. The book presents both standard and novel results on the axiomatics of the individual choice in an uncertain framework, contains a precise overview of standard portfolio optimization, provides a review of the main results for static and dynamic cases, and shows how theoretical results can be applied to practical and operational portfolio optimization. Divided into four sections that mirror the book's aims, this resource first describes the fundamental results of decision theory, including utility maximization and risk measure minimization. Covering both active and passive portfolio management, the second part discusses standard portfolio optimization and performance measures. The book subsequently introduces dynamic portfolio optimization based on stochastic control and martingale theory. It also outlines portfolio optimization with market frictions, such as incompleteness, transaction costs, labor income, and random time horizon. The final section applies theoretical results to practical portfolio optimization, including structured portfolio management. It details portfolio insurance methods as well as performance measures for alternative investments, such as hedge funds. Taking into account the different features of portfolio management theory, this book promotes a thorough understanding for students and professionals in the field.

Statistical Models and Methods for Financial Markets Springer Science & Business Media
We study empirical mean-variance optimization when the portfolio weights are restricted to be direct functions of underlying stock characteristics such as value and momentum. The closed-form solution to the portfolio weights estimator shows that the portfolio problem in this case reduces to a mean-

variance analysis of assets with returns given by single-characteristic strategies (e.g., momentum or value). In an empirical application to international stock return indexes, we show that the direct approach to estimating portfolio weights clearly beats a naive regression-based approach that models the conditional mean. However, a portfolio based on equal weights of the single-characteristic strategies performs about as well, and sometimes better, than the direct estimation approach, highlighting again the difficulties in beating the equal-weighted case in mean-variance analysis. The empirical results also highlight the potential for "stock-picking" in international indexes, using characteristics such as value and momentum, with the characteristic-based portfolios obtaining Sharpe ratios approximately three times larger than the world market.

Portfolio Selection

John Wiley & Sons
Mean-variance optimization provides a framework for constructing portfolios that have minimum risk for a given level of expected return. The required inputs are the expected asset returns, the asset covariance matrix, and a set of investment constraints. While portfolio optimization always leads to an increase in ex ante risk-adjusted performance, there is no guarantee that this performance improvement carries over ex post. The culprit is that both the expected return forecasts and the asset covariance matrix contain estimation error. In this paper, we explore the impact of sampling error in the covariance matrix when using mean-variance optimization for portfolio construction. In particular, we show that sampling error leads to several adverse effects, such as: (a) under-forecasting of risk, (b) increased out-of-sample volatility, (c) increased leverage and turnover, and (d) inefficient allocation of the risk budget.Moreover, we introduce a new framework to explain and understand the origin of these adverse effects. We decompose the optimal portfolio into an alpha portfolio which explains expected returns, and a hedge portfolio which has zero expected return but serves to reduce portfolio risk. We show that sampling error in the asset covariance matrix leads to systematic biases in the volatility and correlation forecasts of these portfolios.We also provide a geometric interpretation showing how these biases lead to the adverse effects described above.
Financial Analytics with R Springer Science & Business Media
This thesis studies three important issues in portfolio management: the impact of estimation risk on portfolio optimization, the role of fundamental analysis in portfolio selection and the power of the bootstrap approach for separating skill from luck across a sample of portfolio managers. The first study examines the practical value of the mean-variance portfolio optimization. This issue arises from the concern that the performance of the meanvariance portfolio suffers seriously from estimation errors in input parameters. Based on simulated asset returns, we compare the performance of selected popular portfolios against the naïve equally weighted portfolio (1/N) in terms of the Sharpe Ratio. We conclude that given relatively small and persistent anomalies, some sophisticated portfolio rules can outperform the naïve one at estimation windows of reasonable lengths. We find that (1) an estimation window of 120 months is needed for the

optimization-based portfolio rules to outperform the 1/N rule when annual abnormal returns lie between a certain range; (2) given the same abnormal returns, even longer estimation windows are needed when asset returns exhibit fat tails; (3) our preferred portfolio rule, which combines optimally the sample tangency portfolio with MacKinlay and Pástor's (2000) portfolio, performs well relative to other rules. Our second study examines the role of fundamental analysis in portfolio selection. Fundamental analysis assumes implicitly that asset prices mean-revert to their fundamental values. We solve the instantaneous mean-variance portfolio choice problem when asset prices mean-revert to their fundamentals and analyze how this meanreversion feature affects the performance of the optimal portfolio. Our analytical results show that the expected appraisal ratio of the optimal portfolio is increasing in the meanreversion speed for a given stationary distribution of the mispricing and it is increasing in the standard deviation of the stationary distribution for a given level of the meanreversion speed. The contribution from dividends is positive, increasing in the dividend yield and is tantamount to increasing the mean-reversion speed. Our numerical examples indicate that fundamental analysis can be more helpful than practitioners' performance shows. One implication of this is that it must be very challenging to obtain reasonable forecasts of the mispricing. Our third study provides a simulation analysis of the power of the bootstrap approach for identifying skill among a large population of mutual funds. Unlike the standard t-test, this approach does not require ex ante parametric assumption on fund alphas and allows us to infer on the existence of genuine skill across a large sample of fund managers. Its recent applications in mutual fund performance analysis have produced strikingly different findings from those documented in the classical literature. However, as far as we know, its power has not been subject to any rigorous statistical analysis. We provide a Monte Carlo simulation analysis of the validity and power of this method by applying it to evaluating the performance of hypothetical funds under varieties of parameter assumptions. We find that this method can be misleading, which is true regardless of using alpha estimates or their t-statistics. This makes the recent findings dubious. The major problem with this method lies in the inappropriate use or misinterpretation of what Fama and French (2010) call "likelihoods" in testing for difference between realized and bootstrapped alphas at selected percentiles. We also show that the variance decomposition and the Kolmogrov-Smirnov test can lead to correct inferences on fund managers' skill when likelihoods fail to do so.

A Library of GAMS Models Rmetrics Mean-variance analysis in portfolio... / Markowitz, H.M.

מזכרת פאקש...

CRC Press

Eine zunehmende Anzahl von Investoren schichten ihr Kapital in alternative Investments um, um die Leistungsfähigkeit ihrer Portfolios zu verbessern. Laut zahlreicher wissenschaftlicher Publikationen bieten alternative Anlagen die Möglichkeit, die risikoadjustierte Performance des Portfolios zu erhöhen. Daher ist das Ziel dieser Diplomarbeit zu untersuchen, ob diese positiven Eigenschaften wirklich

existieren. Um diese Frage zu beantworten, werden drei alternative Anlageklassen, nämlich Private Equity, Rohstoffe und Immobilien durch sekundäre und empirische Forschung analysiert. Bei der sekundären Forschung werden die drei alternativen Anlageklassen mit ihren Vorteilen und Risiken vorgestellt, während der empirische Teil aus einer Mean-Variance Optimierung besteht. Für diesen Teil wurden Indexdaten aus den letzen 20 Jahren analysiert. Das Ziel der empirischen Analyse ist, die Rolle von alternativen Anlageklassen zu untersuchen und ihren optimalen Anlageanteil festzustellen. Das Ergebnis der empirischen Analyse zeigt, dass eine geringe Anlage an Rohstoffen und Immobilien die risikoadjustierte Performance eines traditionellen Portfolios erhöht. Für das gemischte Anlageportfolio, das sowohl traditionelle als auch alternative Anlagen enthält, sind die Ergebnisse nicht mehr so eindeutig. In diesem Fall führt die Verwendung von alternativen Anlagen zu keinem besseren Minimum-Varianz-Portfolio, aber ermöglicht die Verwirklichung höherer Rendite bei gleichen Risikostufen.*****An increasing number of investors are shifting their asset allocation towards alternative investments in order to improve the performance of their portfolios. According to numerous academic publications, alternative investments have the ability to increase the risk-adjusted performance of portfolios. Therefore, the aim of this thesis is to investigate whether this beneficial attribute actually exists. To answer the research question, three alternative asset classes, namely private equity, commodities and real estate, are analyzed through both secondary and empirical research. Secondary research is used to introduce each of the asset classes and list their benefits and risks, while the empirical part consists of a mean-variance optimization, using a historical data set of indexes for the last twenty years. The aim of this analysis is to investigate the role of alternative asset classes in a portfolio, moreover to identify their optimal asset allocation weights. The outcome of the empirical analysis shows that a modest allocation of funds to two out of three alternative asset classes (commodities and real estate) increases the risk-adjusted performance of a traditional portfolio. For the mixed asset portfolio that includes stocks, bonds and all three alternative asset classes, the results are not straightforward. In this case alternative investments do not yield a superior minimum-variance portfolio however by including some of them, investors can achieve higher returns with the same level of risk.
Optimization Methods in Finance CRC Press
Mean-Variance Analysis in Portfolio Choice and Capital MarketsJohn Wiley & Sons

Achieving California's 33 Percent Renewable Portfolio Standard Goal

Cambridge, Mass., USA : Blackwell
In this thesis, we solve a mean-variance portfolio optimization problem with portfolio constraints under a regime-switching model. Specifically, we seek a portfolio process which minimizes the variance of the terminal wealth, subject to a terminal wealth constraint and convex portfolio constraints. The regime-switching is modeled using a finite state space, continuous-time Markov chain

and the market parameters are allowed to be random processes. The solution to this problem is of interest to investors in financial markets, such as pension funds, insurance companies and individuals. We establish the existence and characterization of the solution to the given problem using a convex duality method. We encode the constraints on the given problem as static penalty functions in order to derive the primal problem. Next, we synthesize the dual problem from the primal problem using convex conjugate functions. We show that the solution to the dual problem exists. From the construction of the dual problem, we find a set of necessary and sufficient conditions for the primal and dual problems to each have a solution. Using these conditions, we can show the existence of the solution to the given problem and characterize it in terms of the market parameters and the solution to the dual problem. The results of the thesis lay the foundation to find an actual solution to the given problem, by looking at specific examples. If we can find the solution to the dual problem for a specific example, then, using the characterization of the solution to the given problem, we may be able to find the actual solution to the specific example. In order to use the convex duality method, we have to prove a martingale representation theorem for processes which are locally square-integrable martingales with respect to the filtration generated by a Brownian motion and a finite state space, continuous-time Markov chain. This result may be of interest in problems involving regime-switching models which require a martingale representation theorem.

A Geometric Approach to Multiperiod Mean Variance Optimization of Assets and Liabilities Cambridge University Press

The idea of writing this bookarosein 2000when the ?rst author wasassigned to teach the required course STATS 240 (Statistical Methods in Finance) in the new M. S. program in ?nancial mathematics at Stanford, which is an interdisciplinary program that aims to provide a master’s-level education in applied mathematics, statistics, computing, ?nance, and economics. Students in the programhad di?erent backgroundsin statistics. Some had only taken a basic course in statistical inference, while others had taken a broad spectrum of M. S. - and Ph. D. - level statistics courses. On the other hand, all of them had already taken required core courses in investment theory and derivative pricing, and STATS 240 was supposed to link the theory and pricing formulas to real-world data and pricing or investment strategies. Besides students in theprogram,thecoursealso attractedmanystudentsfromother departments in the university, further increasing the heterogeneity of students, as many of them had a strong background in mathematical and statistical modeling from the mathematical, physical, and engineering sciences but no previous experience in ?nance. To address the diversity in background but common strong interest in the subject and in a potential career as a “quant” in the ?nancialindustry,thecoursematerialwascarefullychosennotonlytopresent basic statistical methods of importance to quantitative ?nance but also to summarize domain knowledge in ?nance and show how it can be combined with statistical modeling in ?nancial analysis and decision making. The course material evolved over the years,

especially after the second author helped as the head TA during the years 2004 and 2005.

Mean-Variance Portfolio Optimization When Means and Covariances are Unknown 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.

Characteristic-based Mean-variance Portfolio Choice

John Wiley & Sons

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.

Mean-variance Portfolio Optimization and the Currency Hedging Decision

John Wiley & Sons

The Markowitz mean-variance portfolio optimization is a well known and also widely used investment theory in allocating the assets. However, this theory is also familiar with the extremely sensitive outcome by the small changes in the data. Ben-Tal and Nemirovski [3]

therefore introduced the robust counterpart approach of the optimization problem to provide more conservative results. And on the ground of their work, Schottle [26] furthermore proposed the local robust counterpart approach with the smaller uncertainty set. This paper presents an overview of the local robust counterpart approach of the optimization problem with uncertainty. The classical mean-variance portfolio optimization problem is presented in the first place, and followed by the description of the general convex conic optimization problem with data uncertainty. Afterwards, the concept of the local robust counterpart approach of the optimization problem will be discussed and then applied into the foreign currency market.

Cheechoo, Shirley Createspace Independent Publishing Platform

Embracing finance, economics, operations research, and computers, this book applies modern techniques of analysis and computation to find combinations of securities that best meet the needs of private or institutional investors.

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

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 have altered the formatting in order to facilitate the ease of printing and reading of the dissertation. All rights not granted by the above license are retained by the author. 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 set-tings. 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 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.

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