Toward Maximum Diversification Choueifaty

PRICAI 2019: Trends in Artificial IntelligenceOptimization Methods in FinanceRecent Advances in Theory and Methods for the Analysis of High Dimensional and High Frequency Financial DataTowards Maximum DiversificationDynamic Analysis in Complex Economic EnvironmentsRobo-AdvisoryProperties of the Most Diversified PortfolioBusiness Periodicals IndexDiversification Management of a Multi-Asset PortfolioRao's Quadratic Entropy, Risk Management and Portfolio TheoryOptimal Portfolio Selection with Transaction CostsRisk-Parity and AmbiguityRiskPortfolios Abhaya C. Nayak G□rard Cornu□jols Norman R. Swanson Yves Choueifaty Herbert Dawid Peter Scholz Yves Choueifaty Christoph Kind Nettey Boevi Gilles Koumou N'Golo Kon□ Alexey Medvedev David Ardia

PRICAI 2019: Trends in Artificial Intelligence Optimization Methods in Finance Recent Advances in Theory and Methods for the Analysis of High Dimensional and High Frequency Financial Data Towards Maximum Diversification Dynamic Analysis in Complex Economic Environments Robo-Advisory Properties of the Most Diversified Portfolio Business Periodicals Index Diversification Management of a Multi-Asset Portfolio Rao's Quadratic Entropy, Risk Management and Portfolio Theory Optimal Portfolio Selection with Transaction Costs Risk-Parity and Ambiguity RiskPortfolios *Abhaya C. Nayak G□rard Cornu□jols Norman R. Swanson Yves Choueifaty Herbert Dawid Peter Scholz Yves Choueifaty Christoph Kind Nettey Boevi Gilles Koumou N'Golo Kon□ Alexey Medvedev David Ardia*

this three volume set lnai 11670 lnai 11671 and lnai 11672 constitutes the thoroughly refereed proceedings of the 16th pacific rim conference on artificial intelligence pricai 2019 held in cuvu yanuca island fiji in august 2019 the 111 full papers and 13 short papers presented in these volumes were carefully reviewed and selected from 265 submissions pricai covers a wide range of topics such as ai theories technologies and their applications in the areas of social and economic importance for countries in the pacific rim

optimization methods play a central role in financial modeling this textbook is devoted to explaining how state of the art optimization theory algorithms and software can be used to efficiently solve problems in computational finance it discusses some classical mean variance portfolio optimization models as well as more modern

developments such as models for optimal trade execution and dynamic portfolio allocation with transaction costs and taxes chapters discussing the theory and efficient solution methods for the main classes of optimization problems alternate with chapters discussing their use in the modeling and solution of central problems in mathematical finance this book will be interesting and useful for students academics and practitioners with a background in mathematics operations research or financial engineering the second edition includes new examples and exercises as well as a more detailed discussion of mean variance optimization multi period models and additional material to highlight the relevance to finance

recently considerable attention has been placed on the development and application of tools useful for the analysis of the high dimensional and or high frequency datasets that now dominate the landscape the purpose of this special issue is to collect both methodological and empirical papers that develop and utilize state of the art econometric techniques for the analysis of such data

along with the ongoing effort to build market cap independent portfolios the authors explore the properties of diversification as a driver for portfolio construction they introduce a measure of the diversification of portfolios that they term the diversification ratio the measure is then employed to build risk efficient portfolios the most diversified portfolios and theoretical properties of the resulting portfolios are discussed per se and compared to other popular methodologies market cap weights equal weights minimum variance empirical results confirm that those popular methodologies are dominated by risk efficient portfolios in many aspects the implication is that in the long run actively managed portfolios which maximize diversification are strong candidates for achieving consistently better results than commonly used passive index tracking methodologies the message is clear investors and their trustees cannot afford to ignore the benefits of maximal diversification

this book analyses decision making in dynamic economic environments by applying a wide range of methodological approaches combining both analytical and computational methods the contributors examine various aspects of optimal firm behaviour and relevant policy areas topics covered include optimal control dynamic games economic decision making and applications in finance and economics as well as policy implications in areas such as pollution regulation this book is dedicated to christophe deissenberg a well known and distinguished scholar of economic dynamics and computational economics it appeals to academics in the areas of optimal control dynamic games and computational economics as well as to decision makers working in policy domains such as environmental policy

robo advisory is a field that has gained momentum over recent years propelled by the increasing digitalization and automation of global financial markets more and more

money has been flowing into automated advisory raising essential questions regarding the foundations mechanics and performance of such solutions however a comprehensive summary taking stock of this new solution at the intersection of finance and technology with consideration for both aspects of theory and implementation has so far been wanting this book offers such a summary providing unique insights into the state of robo advisory drawing on a pool of expert authors from within the field this edited collection aims at being the vital go to resource for academics students policy makers and practitioners alike wishing to engage with the topic split into four parts the book begins with a survey of academic literature and its key insights paired with an analysis of market developments in robo advisory thus far the second part tackles specific questions of implementation which are complemented by practical case studies in part iii finally the fourth part looks ahead to the future addressing questions of key importance such as artificial intelligence big data and social networks thereby this timely book conveys both a comprehensive grasp of the status quo as well as a guiding outlook onto future trends and developments within the field

this article expands upon toward maximum diversification by choueifaty and coignard 2008 we present new mathematical properties of the diversification ratio and most diversified portfolio mdp and investigate the optimality of the mdp in a mean variance framework we also introduce a set of portfolio invariance properties providing the basic rules an unbiased portfolio construction process should respect the mdp is then compared in light of these rules to popular methodologies equal weights equal risk contribution minimum variance and their performance is investigated over the past decade using the msci world as reference universe we believe that the results obtained in this article show that the mdp is a strong candidate for being the un diversifiable portfolio and as such delivers investors with the full benefit of the equity premium

it is a well known fact in finance that classical mean variance optimization often leads to highly concentrated portfolios giving equal weights to all portfolio assets will instead allow for maximum nominal diversification more sophisticated ways of nominal diversification are the maximum diversification approach proposed by choueifaty and coignard 2008 or the equal weighting of total risk contributions known as risk parity instead of looking for nominal diversification investors may prefer a diversification of the risk factors that drive portfolio returns in recent papers risk factors have been modelled by principal components following partovi and caputo 2004 meucci et al 2013 show that principal components may not be the best way to model risk factors and propose minimum torsion bets instead the present paper discusses different ways of managing diversification and backtests these strategies in a multi asset portfolio

this thesis is about the concept of diversification and its measurement in portfolio theory diversification is one of the major components of portfolio theory it helps to reduce or ultimately to eliminate portfolio risk thus its measurement and management is of fundamental importance in finance and insurance domains as risk measurement

and management consequently several measures of portfolio diversification were proposed each based on a different criterion unfortunately none of them has proven totally satisfactory all have drawbacks and limited applications developing a coherent measure of portfolio diversification is therefore an active research area in investment management in this thesis a novel coherent general and rigorous theoretical framework to manage and quantify portfolio diversification inspiring from rao 1982a s quadratic entropy rqe a general approach to measuring diversity is proposed more precisely this thesis demonstrates that when rqe is judiciously calibrated it becomes a valid class of portfolio diversification measures summarizing complex features of portfolio diversification in a simple manner and provides at the same time a unified theory that includes many previous contributions next this thesis presents two applications of the proposed class of portfolio diversification measures in the first application new formulations of maximum diversification strategy of choueifaty and coignard 2008 is provided based on the proposed class of measures these new formalizations clarify the investment problem behind the md strategy help identify the source of its strong out of sample performance relative to other diversified portfolios and suggest new directions along which its out of sample performance can be improved in the second application a novel and useful formulation of the mean variance utility function is provided based on the proposed class of measures this new formulation significantly improves the mean variance model understanding in particular in terms of asset pricing it also offers new directions along which the mean variance model can be improved without additional computational costs

the optimal portfolio selection problem has been and continues to be a subject of interest in finance the main objective is to find the best way to allocate the financial resources in a set of assets available on the financial market in order to reduce the portfolio fluctuation risks and achieve high returns nonetheless there has been a strong advance in the literature of the optimal allocation of financial resources since the 20th century with the proposal of several strategies for portfolio selection essentially motivated by the pioneering work of markowitz 1952 which provides a solid basis for portfolio analysis on the financial market this thesis divided into three chapters contributes to this vast literature by proposing various economic tools to improve the process of selecting portfolios on the financial market in order to help stakeholders in this market the first chapter a joint paper with marine carrasco addresses a portfolio selection problem with trading costs on stock market more precisely we develop a simple gmm based test procedure to test the significance of trading costs effect in the economy regardless of the form of the transaction cost in fact most of the studies in the literature about trading costs effect depend largely on the form of the frictions assumed in the model dumas and luciano 1991 lynch and balduzzi 1999 lynch and balduzzi 2000 liu and loewenstein 2002 liu 2004 lesmond et al 2004 buss et al 2011 g□rleanu and pedersen 2013 heaton and lucas 1996 to overcome this problem we develop a simple test procedure which allows us to test the significance of trading costs effect on a given asset in the economy without any assumption about the form of these frictions our test procedure relies on the assumption that the model estimated by gmm is correctly specified a common test used to evaluate this assumption is the

standard j test proposed by hansen 1982 however when the true parameter is close to the boundary of the parameter space the standard j test based on the chi2 critical value suffers from overrejection to overcome this problem we propose a two step procedure to test overidentifying restrictions when the parameter of interest approaches the boundary of the parameter space in an empirical analysis we apply our test procedures to the class of anomalies used in novy marx and velikov 2016 we show that transaction costs have a significant effect on investors behavior for most anomalies in that case investors significantly improve out of sample performance by accounting for trading costs the second chapter addresses a multi period portfolio selection problem when the number of assets in the financial market is large using an exponential utility function the optimal solution is shown to be a function of the inverse of the covariance matrix of asset returns nonetheless when the number of assets grows this inverse becomes unreliable yielding a selected portfolio that is far from the optimal one we propose two solutions to this problem first we penalize the norm of the portfolio weights in the dynamic problem and show that the selected strategy is asymptotically efficient however this method partially controls the estimation error in the optimal solution because it ignores the estimation error in the expected return which may also be important when the number of assets in the financial market increases considerably we propose an alternative method that consists of penalizing the norm of the difference of successive portfolio weights in the dynamic problem to guarantee that the optimal portfolio composition does not fluctuate widely between periods we show under appropriate regularity conditions that we better control the estimation error in the optimal portfolio with this new procedure this second method helps investors to avoid high trading costs in the financial market by selecting stable strategies over time extensive simulations and empirical results confirm that our procedures considerably improve the performance of the dynamic portfolio in the third chapter we use various regularization or stabilization techniques borrowed from the literature on inverse problems to estimate the maximum diversification as defined by choueifaty 2011 in fact the maximum diversification portfolio depends on the vector of asset volatilities and the inverse of the covariance matrix of assets distribution in practice these two quantities need to be replaced by their sample counterparts this results in estimation error which is amplified by the fact that the sample covariance matrix may be close to a singular matrix in a large financial market yielding a selected portfolio far from the optimal one with very poor performance to address this problem we investigate three regularization techniques such as the ridge the spectral cut off and the landweber fridman to stabilize the inverse of the covariance matrix in the investment process these regularization schemes involve a tuning parameter that needs to be chosen so we propose a data driven method for selecting the tuning parameter in an optimal way the resulting regularized rules are compared to several strategies such as the most diversified portfolio the target portfolio the global minimum variance portfolio and the naive 1 n strategy in terms of in sample and out of sample sharpe ratio

we show that risk parity and risk based models in general can be rationalized as an optimal decision under ambiguity risk based framework represents an extension of

maximum diversification approach of choueifaty and coignard 2008 in the presence of ambiguity in risk adjusted expected returns

riskportfolios is an r package for constructing risk based portfolios it provides a set of functionalities to build mean variance minimum variance inverse volatility weighted leote de carvalho lu and moulin 2012 equal risk contribution maillard roncalli and te□letche 2010 maximum diversification choueifaty and coignard 2008 and risk efficient amenc et al 2011 portfolios optimization is achieved with the r packages quadprog weingessel 2013 and nloptr ypma 2014 long or gross constraints can be added to the optimizer as risk based portfolios are mainly based on covariances the package also provides a large set of covariance matrix estimators

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