



Technical University of Crete



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7th INTERNATIONAL CONFERENCE ON MULTIDIMENSIONAL FINANCE, INSURANCE AND INVESTMENT

10-12 May 2018
Chania - Greece

Scientific Program & Abstracts

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Welcome

Dear Colleagues and Friends,

We welcome you to the 7th International Conference on Multidimensional Finance (ICMFII), Insurance and Investment. We are proud to host this event that will provide a unique opportunity for exchanging new ideas, having fruitful discussions on our common fields of interest, meeting old friends and making new colleagues in the beautiful town of Chania.

The ICMFII Conferences are devoted to the recent developments and applications of multidimensional and multicriteria decision support methodologies in the fields of finance, insurance and investment. They aim towards disseminating recent methods and procedures designed to solve problems through analytical operational research models in a multidimensional framework considering multiple conflicting and incommensurable decision objectives. The motivation for organizing the ICMFII Conferences is to provide a forum for researchers and practitioners to discuss recent theoretical and methodological developments as well as new empirical results, in all areas related to the above general scope and themes.

The first edition of these meetings was organized in the form of an international workshop on multi-attribute portfolio selection (MAPS). The event was held in Helsinki in 2005 and was chaired by Pekka Korhonen. The second edition of this scientific event took place in Montreal in 2007 and was organized by Belaid Aouni. The next edition was organized by Alejandro Balbás in Madrid in 2009. The 2011 ICMFII Conference (the first in the new format) was held in Hammamet (Tunisia) and chaired by Fouad Ben Abdelaziz, followed by the 5th edition in Bahrain in 2013, chaired by Minwir Al-Shammari. The 2016 ICMFII Conference took place in Alcoy (Spain), chaired by Blanca Pèrez-Gladish.

In 2017 we accepted with pleasure the invitation of the International Committee to organize the next event in Chania. Following the tradition of previous editions, the scientific program of this event includes presentations on various areas of finance, insurance and investments. The presentations cover all the recent trends and advances in financial decision-making, including theoretical and methodological developments, as well real-world applications and new empirical results. Overall, 27 presentations are included in the final scientific program, organized in seven sessions. Moreover, two plenary talks have been scheduled by Prof. Panos Pardalos and Prof. Salvatore Greco, which will cover state-of-the-art techniques for financial decision-making.

We are sure that all participants will enjoy the scientific part of the Conference and will find useful new ideas for their current and future research. We also hope that you will find free time to discover the beauties and the rich history of Chania, experience the traditional Greek hospitality and make this Conference a memorable event.

Michalis Doumpos, Constantin Zopounidis

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Fouad Ben Abdelaziz <i>Rouen Business School, France</i>	Ralph Steuer <i>University of Georgia, USA</i>

Publications

On the occasion of the Conference, three special issues has been arranged:

- *Journal of Global Optimization* (Springer, ISI Impact Factor 2016: 1.733)

Topic: Multiobjective Optimization Models in Finance, Insurance, and Investments

Guest editors: Michalis Doumpos, Constantin Zopounidis

Submission deadline: August 31, 2018

Theme and topics: Optimization models with multiple objectives and goals are particularly relevant in the fields of finance, insurance, and investments. Along with profitability-related criteria, multiple risk factors and measures are of major interest, together with emerging issues such as social responsibility, regulatory requirements, and the individual policies of organizations and investors. The multi-faceted nature of these conflicting dimensions raises many methodological and practical challenges, which have attracted much interest among OR researchers. This special issue seeks to cover all recent advances in the theory and applications of optimization models with multiple objectives in the above areas. On the methodological side, the special issue will cover different types of multi-objective models, including interactive methods, goal programming, models under fuzziness and uncertainty, robust optimization, and metaheuristics. Submitted papers could cover new methodological developments, empirical/computational analyses, and novel case studies, relevant for finance, insurance and investment. Among others, typical areas of interest may involve capital budgeting, financial planning, banking, fund management, insurance pricing, portfolio optimization, financial and insurance risk management, socially responsible investments, etc.

Submission process: Authors should follow the journal's instructions for authors and submit their manuscripts by August 31, 2018, via the journal's submission site:

<http://www.editorialmanager.com/jogo>

When submitting your article, make sure to choose "ICMFII-2018" from the article type list. Please see the Author Instructions on the web site if you have not yet submitted a paper through Springer's web-based system, Editorial Manager.

- *IMA Journal of Management Mathematics* (Oxford Academic, ISI Impact Factor 2016: 1.488)

Topic: Financial Modeling

Guest editors: Michalis Doumpos, Constantin Zopounidis

Submission deadline: December 15, 2018

Theme and topics: The level of analytical sophistication of financial models has increased considerably over the years, in accordance with the increasing challenges that the financial industry faces. Despite the achieved progress, the continuous changes in the financial sector create new opportunities for financial modelling. On the one hand, new tools for managing financial risks are needed for robust decision making, considering multiple types of risks and risk factors, in accordance with the tightening regulatory framework. In addition, existing financial modelling tools should be adapted and extended to new financial products and services, such as alternative investments and new financing/investment platforms outside traditional financial institutions. Finally, the rapid adoption of new technologies, such as big data analytics, further provides new opportunities for enhanced decision support. In the above context, this special issue seeks to cover the recent advances in financial modelling methodologies and their applications in all areas of financial services, including banking, insurance, and investments. On the methodological side, the special issue will cover different types of analytical modelling techniques from the fields of operations research/management science, including but not limited to optimization models, simulation techniques, stochastic

processes, forecasting, business analytics, and decision analysis, among others. Submitted papers could cover new methodological developments, empirical/computational analyses, and novel case studies.

Submission process: Authors should follow the journal's instructions for authors and submit their manuscripts via the journal's submission site:

<https://mc.manuscriptcentral.com/imaman>

- ***International Journal of Financial Engineering and Risk Management*** (Inderscience)

Topic: Decision Support Approaches in Finance and Insurance

Guest editors: Michalis Doumpos, Hatem Masri

Submission deadline: July 31, 2018

Theme and topics: This special issue seeks to present the contributions of decision support methodologies in the fields of finance and insurance. The special issue is particularly interested in approaches that adopt a multidimensional perspective that takes into consideration the multi-faceted nature of the financial and insurance environment. Submissions presenting new methodological developments, empirical results, computational analyses, and cases studies are welcome. Suitable topics include, but are not limited, to algorithmic trading, bank performance and efficiency, behavioural decision models, capital budgeting and financial planning, decision support models in portfolio management, financial decision-making under uncertainty and fuzziness, fund management and performance appraisal, intelligent financial decision support systems, socially responsible investments, etc.

Submission process: Papers should be submitted through the journal's online submission site:

http://www.inderscience.com/info/inauthors/author_submit.php

When submitting the paper, make sure to add a note that it is for the above special issue.

All articles submitted to the above special issues will undergo the standard review process according to the journals' editorial policies. Accepted papers will be published online individually, before print publication. For further inquiries and information about the special issues, you may contact Prof. Michalis Doumpos at: mdoumpos@dpem.tuc.gr

Scientific Program

THURSDAY, MAY 10

- 09:00 – 09:45 REGISTRATION
- 09:45 – 10:00 OPENING SESSION
Chairpersons: Michalis Doumpos, Constantin Zopounidis
- 10:00 – 11:00 PLENARY TALK: Dynamics of Financial Markets (Prof. Panos M. Pardalos)
- 11:00 – 11:15 REFRESHMENT BREAK
- 11:15 – 13:00 **SESSION 1: PORTFOLIO OPTIMIZATION**
Chairperson: Ralph E. Steuer
- An optimization-diversification approach to portfolio selection**
Francesco Cesarone, Andrea Scozzari, Fabio Tardella
- Mean-variance portfolio investments - Which assets are essential?**
Przemysław Juszczuk, Ignacy Kaliszewski, Janusz Miroforidis, Dmitry Podkopaev
- Index tracking and enhanced indexing using mixed conditional value-at-risk**
Anubha Goel, Amita Sharma, Aparna Mehra
- On the analytical derivation of efficient sets in quad-and-higher criterion portfolio selection**
Ralph E. Steuer, Yue Qi
- 13:00 – 14:00 LUNCH
- 14:00 – 15:45 **SESSION 2: CORPORATE PERFORMANCE**
Chairperson: Christos Floros
- Big data analysis tools combined with AHP for improving bank's services sales**
Fernando Mayor-Vitoria, Ana Garcia-Bernabeu
- The use of multi-criteria decision aid methods in portfolio management - The case of the Tunis Stock Exchange**
Halimi Wahiba
- Developing predictive models for US bank failures: An empirical analysis using machine learning approaches**
Georgios Manthoulis, Michalis Doumpos, Constantin Zopounidis, Emilios Galariotis, George Baourakis
- Efficiency of European firms using accounting and financial ratios: New evidence**
Christos Floros, Efthalia Tabouratzi
- 15:45 – 16:00 REFRESHMENT BREAK
- 16:00 – 17:45 **SESSION 3: FINANCIAL MARKETS**
Chairperson: Fouad Ben Abdelaziz
- Realized measures to explain volatility changes over time**
Christos Floros
- Pricing vulnerable power exchange options in an intensity-based framework**
Puneet Pasricha, S. Dharmaraja
- New solutions in terms of quadratures to the CEV model**
Evangelos Melas
- Modelling and trading exchange rates with new learning machines techniques**
Fouad Ben Abdelaziz, Andreas Karathanasopoulos, Mohamed Osman

FRIDAY, MAY 11

- 09:00 – 10:45** **SESSION 4: CORPORATE GOVERNANCE**
Chairperson: Ana Garcia-Bernabeu
- Corporate governance and financial performance in Greek travel and tourism companies**
Evangelia Pappa, John Filos, Pantelis Papanastasiou
- Financial disclosure and narrative information: An updated bibliographic survey**
Stelios Papadakis, Christos Lemonakis, Alexandros Garefalakis
- Management practices and corporate capital structure: Evidence from medium-size firms**
Stavroula Sarri, Fotios Pasiouras
- Measuring ESG trends in the banking sector: A multi-criteria approach**
Ana Garcia-Bernabeu, Javier Reig-Mullor, Jorge Jordan-Nunez
- 10:45 – 11:00** REFRESHMENT BREAK
- 11:00 – 12:00** PLENARY TALK: Financial Rating with Ordinal Classification Based on the Hierarchical SMAA Choquet Integral Approach (Prof. Salvatore Greco)
- 12:00 – 13:15** **SESSION 5: BANKING**
Chairperson: Fotios Pasiouras
- A dynamic evaluation of bank efficiency: evidence for Eurozone countries**
Maria C. Gouveia, Elisabete D. Neves
- An investigation of the fraud risk and fraud scheme methods in Greek commercial banks**
Varvara Veli, Petros Lois, Spyros Repousis
- Is political influence distorting banking supervision? Evidence from the US banking sector**
Panagiota Papadimitri, Fotios Pasiouras, Gioia Pescetto, Ansgar Wohlschlegel
- 13:15 – 14:15** LUNCH
- 14:15 – 16:00** **SESSION 6: ALTERNATIVE INVESTMENTS & FINANCIAL PLANNING**
Chairperson: Gordon H. Dash
- Socially responsible index tracking**
Maximilian Wimmer, Sebastian Utz, Ralph E. Steuer
- Multiobjective stochastic ethical portfolio selection: The case of GCC Islamic securities**
Noushin Bagheri, Anath Rao, Fouad Ben Abdelaziz
- A stochastic goal programming model for managing cash with three criteria**
Francisco Salas-Molina, Juan A. Rodriguez-Aguilar, David Pla-Santamaria
- Efficient multiobjective ESG and short-fall portfolio optimization for non-profit organizations**
Gordon H. Dash, Nina Kajiji
- 16:00 – 16:15** REFRESHMENT BREAK
- 16:15 – 18:00** **SESSION 7: PUBLIC SECTOR**
Chairperson: Evangelos Grigoroudis
- Classification of countries by the degree of interest groups' influence on the economies**
Haris Papadakis, George S. Atsalakis
- Financial development and economic growth: Evidence from Algeria**
Taleb Dalila

New economy and social innovation: A review of new economic models

Micheal Akampa

Evaluating public sector strategy using a balanced scorecard approach

Evangelos Grigoroudis, Constantin Zopounidis, Maria Kainourgiaki

18:00 – 18:15 CLOSING SESSION

21:00 GALA DINNER

SATURDAY, MAY 12

09:00 – 14:00 EXCURSION

PLENARY TALKS

Thursday, May 10, 10:00 – 11:00

Dynamics of Financial Markets

Panos M. Pardalos

Center for Applied Optimization, University of Florida, USA

Abstract: Financial markets, banks, currency exchanges and other institutions can be modeled and analyzed as network structures where nodes are any agents such as companies, shareholders, currencies, or countries. The edges (can be weighted, oriented, etc.) represent any type of relations between agents, for example, ownership, friendship, collaboration, influence, dependence, and correlation. We are going to discuss network and data sciences techniques to study the dynamics of financial markets and other problems in economics.

Prof. Panos Pardalos is a Distinguished Professor and the Paul and Heidi Brown Preeminent Professor in the Departments of Industrial and Systems Engineering at the University of Florida, and a world renowned leader in Global Optimization, Mathematical Modeling, and Data Sciences. He is a Fellow of AAAS, AIMBE, and INFORMS and was awarded the 2013 Constantin Caratheodory Prize of the International Society of Global Optimization. In addition, Dr. Pardalos has been awarded the 2013 EURO Gold Medal prize bestowed by the Association for European Operational Research Societies. This medal is the preeminent European award given to Operations Research (OR) professionals for "scientific contributions that stand the test of time." Dr. Pardalos is also a Member of the New York Academy of Sciences, the Lithuanian Academy of Sciences, the Royal Academy of Spain, and the National Academy of Sciences of Ukraine. He is the Founding Editor of Optimization Letters, Energy Systems, and Co-Founder of the International Journal of Global Optimization. He has published over 500 papers, edited/authored over 200 books and organized over 80 conferences. He has an h-index of 92, an i10-index of 545 (Google Scholar) and has graduated 60 PhD students so far.

Friday, May 11, 11:00 – 12:00

Financial Rating with Ordinal Classification Based on the Hierarchical SMAA Choquet Integral Approach

Sally Giuseppe Arcidiacono¹, Salvatore Corrente¹, Salvatore Greco^{1,2}

¹ Department of Economics and Business, University of Catania, Italy

² University of Portsmouth, Portsmouth Business School, Centre of Operations Research and Logistics, UK

Abstract: We consider financial rating proposing a robust ordinal regression and a stochastic ordinal regression model taking into account interaction in a hierarchy of criteria corresponding to financial and economic indicators underlying the rating. Formally we apply Robust Ordinal Regression (ROR) and Stochastic Multiattribute Acceptability Analysis (SMAA) to a sorting model based on the Choquet integral taking into account a hierarchy of criteria. The advantages of our approach are shown by means of an application to financial rating of European Countries. Economic and financial data used in the analysis are provided by Standard & Poor's Global Inc.

Prof. Salvatore Greco received the degree in economics from University of Catania, Catania, Italy, in 1988. He is currently a Professor of financial and actuarial mathematics with the Department of Economics and Business, Catania University, and a part-time Professor with the Portsmouth Business School, University of Portsmouth, Portsmouth, U.K. He has been an active researcher in the area of multiple criteria decision aiding (MCDA), rough set theory, and nonadditive integrals. He has co-edited the state-of-the art surveys collection in MCDA that has become a reference text in the domain. Salvatore Greco received the Multiple Criteria Decision Making Gold Medal 2013. He is an Associate Editor of International Journal of Multi-Criteria Decision Analysis.

ABSTRACTS

Thursday, May 10

11:15 – 13:00 Session 1: Portfolio Optimization

An Optimization-Diversification Approach to Portfolio Selection

Francesco Cesarone¹, Andrea Scozzari², Fabio Tardella³

¹ *Dipartimento di Studi Aziendali, Università Roma Tre, Italy*

² *Facoltà di Economia, Università Niccolò Cusano, Italy*

³ *Facoltà di Economia, Sapienza Università di Roma, Italy*

The classical approach to portfolio selection calls for finding a feasible portfolio that optimizes one of the several proposed risk measures, or (expected) utility functions, or performance indexes. However, the optimization approach might be misleading due to the difficulty of obtaining good estimates for the parameters involved in the function to be optimized and to the high sensitivity of the optimal solutions to the input data. This observation has led some researchers to claim that a straightforward capital diversification, i.e., the Equally Weighted portfolio can hardly be beaten by an optimized portfolio. However, if the market contains assets with very different intrinsic risks, then this leads to a portfolio with limited total risk diversification. Therefore, alternative risk diversification approaches to portfolio selection have been proposed, such as the practitioners' approach of taking weights proportional to $1/\sigma_i$, where σ_i is the volatility of asset i . A more thorough approach to risk diversification requires to formalize the notion of risk contribution of each asset, and then to manage it by a model. For example, the Risk Parity approach aims at a portfolio where the total risk contributions of all assets are equal among them. The original risk parity approach was applied to volatility. However alternative risk measures can also be considered. It can also be shown that the Risk Parity approach is actually dominated by Equal Risk Bounding, where the total risk contributions of all assets are bounded by a common threshold which is then minimized. Furthermore, several alternative approaches to diversify risk have recently appeared in the literature. We propose here a new approach that tries to reduce the impact of data estimation errors and to join the benefits of the optimization and of the diversification approaches by choosing the portfolio that is best diversified (e.g., Equally Weighted or Risk Parity) on a subset of assets of the market, and that optimizes an appropriate risk, or utility, or performance measure among all portfolios of this type. We show that this approach yields portfolios that are only slightly suboptimal in-sample, and generally show improved out-of-sample performance with respect to their purely diversified or purely optimized counterparts.

Mean-Variance Portfolio Investments – Which Assets are Essential?

Przemysław Juszczak¹, Ignacy Kaliszewski², Janusz Miroforidis², Dmitry Podkopaev²

¹ *University of Economics, Faculty of Informatics and Communication, Poland*

² *Systems Research Institute, Polish Academy of Sciences, Poland*

The Markowitz mean-variance portfolio selection model is used for asset selections as well as for allocations of available capital to selected assets. The advantage of mean-variance related allocation over naive diversifications is still debated in the financial literature. Somewhere in between is the problem to identify assets that essentially contribute to the portfolio Pareto optimality status. This is especially important for assisting investors selecting portfolio from a large number of assets. We started with a rather strong assumption that the portfolio of minimal variance, an element of the Pareto front, is known. With the other element of the Pareto front known upfront, namely the element (a legitimate portfolio) with the maximal return, in the first step, we investigated how close one can approximate the Pareto front with convex combinations of these two portfolios. In successive steps, we investigated approximations resulting from convex combinations of portfolios obtained in the first step with a selected asset. In each step, from all portfolios in hand, non-dominated portfolios are identified to represent the best for the moment lower approximation of the Pareto front. If viable, such an elementary heuristic would be of much interest to investors. In that heuristic, the goodness of approximations is traded against the number of assets in the portfolio, an important indicator of portfolio usefulness in real investments. Next, we investigated the effect of replacing the portfolio of minimal variance with its approximation derived with an evolutionary algorithm. We experimented with mean-variance test problems from Beasley OR Library and with test problems we created from real data. We shall present the results of the experiments which are surprisingly favourable.

Index Tracking and Enhanced Indexing using Mixed Conditional Value-at-Risk

Anubha Goel¹, Amita Sharma², Aparna Mehra¹

¹ *Indian Institute of Technology Delhi, India*

² *Indian Institute of Information Technology Guwahati, India*

Index tracking (IT) and enhanced indexing (EI) are two forms of investment strategies which revolve around the movements of the benchmark index. While IT aims to match the performance of the benchmark index, EI intends to outperform the same. In this paper, we seek to design portfolios for IT and EI problems using mixed conditional value at risk (MCVaR). We propose to use the two tail MCVaR (TMCVaR) measure to track the index. Optimizing TMCVaR is a linear program which minimizes the upper deviation and the downside deviation from the benchmark index and hence meets the objective of IT. On the other hand, we propose a two step procedure for EI problem. In step one, we design a discrete Markov chain model to alter a few stocks on the basis of their high probability of gain over the benchmark index. In step two, we assign optimal weights to the altered assets through maximizing any of the two variants of the STARR ratio with MCVaR or the STARR ratio with deviation MCVaR (DMCVaR). Maximizing the STARR ratio either with MCVaR or DMCVaR is a linear program and hence tractable. We analyze the empirical performance of the proposed models over 17 world-wide indices using the rolling window approach. We consider two IT and four EI models from the literature for a comparative analysis. It is exhibited that the proposed IT model outperforms the other two IT models over several performance measures including higher correlation value with the benchmark index and lower tracking error, and the two proposed EI models outperform the other four EI models in achieving higher excess mean returns from the benchmark index.

On the Analytical Derivation of Efficient Sets in Quad-and-Higher Criterion Portfolio Selection

Ralph E. Steuer¹, Yue Qi²

¹ *University of Georgia, USA*

² *Nankai University, China*

This paper provides results in the area of the analytical derivation of the efficient sets of mean-variance portfolio selection problems that have more than three criteria. By "analytical" we mean derived by formula as opposed to being computed by algorithm. By "more than three criteria", we mean that beyond the mean and variance of regular portfolio selection, the problems addressed have two or more additional linear objectives. The two or more additional objectives might include sustainability, dividend yield, or liquidity as extra objectives like these are being seen with greater frequency. While not all multiple criteria portfolio selection problems lend themselves to an analytical derivation, a certain class does and the problems in this class are covered by the mathematics of this paper. To put the paper in perspective, let k be the number of objectives. In 1972, there was, for standard $k = 2$ mean-variance portfolio selection, the famous analytical derivation paper by Merton, the content of which is core material in finance PhD programs. However, over the years, investment science has become more complex with one aspect of this being that it is now not outlandish to see a portfolio selection problem being proposed with more than two objectives. Since more of this is expected, Qi et al (2017) have extended Merton's analytical derivations to cover the case when $k = 3$. In this paper, we in turn, extend that work to cover cases in which $k = 4$ and more. After an introduction and comments about the most closely related literature, we analytically derive the minimum-variance surface, as well as the efficient and nondominated sets. Then we discuss the dimensionality of the efficient set and study the relationships among efficient sets as additional linear objectives are added to a model. Finally, we provide an illustration of the material of the paper.

14:00 – 15:45 Session 2: Corporate Performance

Big Data Analysis Tools Combined with AHP for Improving Bank's Services Sales

Fernando Mayor-Vitoria, Ana Garcia-Bernabeu

Department of Economics and Social Science, Universitat Politècnica de València, Spain

Real state bubble and the financial crisis in Spain meant that banks had to drastically change their business model since they had to look for new income sources to replace risky products such as subprime mortgages. Moreover, recent court rulings show that many of these loans' conditions were not appropriate for their customers, so the affected financial entities had to pay penalties. In this context, banks have found in the sale of services such as personal insurances, a profitable and risk-free source income. But selling personal

insurances to customers have never be an easy issue and one of the main reasons is that the information is not effectively analyzed before starting the sales process. Therefore, Big Data analysis and multicriteria decision making (MCDM) methods appear as powerful tools to deal with the activity of potential customers before offering them a life insurance. The combination of massive unstructured data analysis and the use of selection methods such as AHP (Saaty, 1977) makes the task of commercial agents more effective in terms of productivity, cost efficiency and time saving. Treatment of information has become so important for public and private decision makers of any kind of business or public institutions. In fact, how the information is obtained, stored and managed has always been important, but the main difference nowadays is the huge quantity of information obtained every single minute and how fast it is generated. The management of massive quantities of information has been previously solved by the implementation of relational data bases, in which the data is structured and then saved in different tables . These tables can be composed by a large but limited number of columns, where there is one column per table that it is used as "id", in order to index it and to create relations among all the tables of the database. Moreover, in traditional database systems, like Oracle, Access or MySQL, where the information is stored into tables connected between them by an index. Data was saved in order to use and process it according to a specific purpose. However, due to the low prices of store systems, the trend now is that the information can be saved "just in case", thus, some data which is not relevant now it is even stored because maybe it could be useful in the future. So this also contributes to the rapid growth in the volume of stored data (Menon, 2012). In the financial field, also huge quantities of data are generated every single minute when customers of financial institutions make transactions. Payments by credit or debit cards, operating in a ATM machine or transactions between private users can generate a massive amount of unstructured data that if it is properly analyzed, can give to the issuing organization value information in terms of life style of their clients and therefore, offering them the most appropriate service in accordance to their needs. The purposes of the present paper are: (a) To explain all the benefits of using Big Data nowadays and to resume how it works; (b) To generate a MapReduce code in Python in order to extract relevant information from a unstructured data base containing the transactions of all client's cards for a period; (c) To apply the AHP methodology as a tool to select potential customers of a bank's commercial office in accordance with a set of defined criteria; and (d) To illustrate all the previous mentioned by the implementation of a case study to offer personal life insurances to real potential clients. This paper is organized as follows. An overview of Big Data is first developed, including main features and components of Big Data analysis. Then, we explain the MapReduce code developed in Python and describe the MCDM methods and in particular AHP, which is applied in the case study. Finally we analyze the results of the case study and describe future areas of research.

The Use of Multi-criteria Decision Aid Methods in Portfolio Management – The Case of the Tunis Stock Exchange

Halimi Wahiba

Department of Management, University of Tlemcen, Algeria

The financial domain is considered as one of the fields of interest and application of the multi-criteria aid decision. During the last decades of the globalization of financial markets, intensification of the competition between the entities of company and the sociopolitical and technological changes increased the complexity of the company, the economic and financial environment. In this new context the financial smooth running of any economic entity becomes a crucial stake for its growth and its development. The increasing complexity of the financial environment puts new challenges which must be confronted. A great deal of new financial products which are now available for companies as instruments of risk management, of the investment and the financing is indicative transformations which took place in the sector of the finance during the last decades and the existing increasing complexity in this domain. To answer this complexity, it is necessary to adjust the methodologies of the financial decision-making support so that they meet the requirements of the new financial environment. The empirical approaches are not adequate anymore. On their place, there is an increasing trend towards the implementation of more sophisticated approaches based on advanced techniques of quantitative analysis, as statistics, the optimization, the forecast, the simulation, the stochastic processes, the artificial intelligence and the operational research. The roots of this new approach of the problem of decision in finance go back to 1950s with the works of the Nobel Prize Harry Markowitz (1952, 1959) on the theory of the wallet and the use of techniques of mathematical programming for the construction of the wallet. Since then, the contribution of the applied mathematics, statistics and econometrics, of the operational research, the artificial intelligence and the computer sciences in conjunction with the progress of the financial theory, played a major role in the treatment of the complexity of the financial decision-making. The application of the aforesaid techniques (the quantitative analysis in the financial decision-making) is of an interest at the same time for the practitioners and the researchers. On one hand,

the practitioners in the industry of the finances are interested in the elaboration and the implementation of effective quantitative approaches which can supply them an effective support in their daily practice. On the other hand, the researchers in the above-mentioned domains often consider the problems of decision-making financial as an excellent ground where the theoretical current results of the search can be tested in real-world complex conditions. Several techniques of quantitative analysis have been applied in the financial domain for the implementation of paradigm of classification, and a wide selection of financial decisions can be taken following this approach. Some typical examples include: the prediction of bankruptcy of companies and it by the discrimination by prediction of the failing companies of those who are healthy, the evaluation of the credit risk (the discrimination of companies with low risk of those at high risk), the mergers and acquisitions of companies (the discrimination between the companies which may be merged or acquired by the companies for which the status of property should not change), the evaluation of the actions "stocks" and the evaluation of the mutual funds (the classification of the actions or the common fund of investment in groups predefined according to their relevance as instruments of investment for a particular investor). The classification can be made according to their future expected yields, their risks, or criterion of evaluation which is considered as relevant by the decision-maker / investor. Several investment firms adopted this approach in their evaluation of the actions and the common fund of investment (Standard et Poors rating agency, 1997, 2000; Moody ' Investors, 1998, 2000; Sharp, on 1998). All the examples above are examples testifying of the importance and the necessity of developing models effective multi-criteria for the financial decision-making. This work determines the practical interest to use (and apply) the multi-criteria methods are alone or jointly according to the stages and the needs for the studied cases and it to help the decision-maker in his decision-making. The case study is among the first works dealing with what is of the joint application of several multi-criteria methods in the stock exchanges of the Arab world generally and in the stock exchange of Tunis more exactly if it is not one and only existing work. The case study included in this work also has for objective to help to emphasize the methods of decision-making support multi-criteria applied in finance (once again furthermore), these methods also allow to appreciate their efficiencies.

Developing Predictive Models for US Bank Failures: An Empirical Analysis Using Machine Learning Approaches

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The banking system is the backbone of every economy. However, banks are highly leveraged and face major risks at the local, country, and global level. Thus, the development of accurate and transparent tools for micro-prudential purposes has become an unavoidable and urgent duty. For this reason, it is important to have reliable techniques to detect early signals when a bank is near to default. Such tools would allow financial authorities to take preventive actions to mitigate contagion effects. This study examines the development of bank default prediction models using a sample of US banks for the period 2005-2015. We consider a rich set of variables through different scenarios. The first scenario incorporates basic CAMEL financial ratios. In the second, we also consider diversification ratios for different areas such as risk, income, expenses, loan portfolio quality, off-balance sheet assets etc. Finally, we use dummy variables to account for regional macroeconomic factors. The prediction horizon varies from 1 to 3 years prior to failure. Analytical models are developed with several machine learning methods, namely logistic regression, support vector machines, naive Bayes, extreme gradient boosting, random forests, and neural networks. Extensive out-of-sample results are reported based on bootstrap tests.

Efficiency of European Firms Using Accounting and Financial Ratios: New Evidence

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This paper provides new evidence on the efficiency of European firms using accounting and financial ratios. In particular, we discuss how DEA can be used with accounting and financial information. We consider different DEA models to examine firms' technical, financial and funding efficiency. Further, several modelling issues are discussed including the selection of variables (inputs/outputs), number of variables, etc. for productivity analysis. Our findings are recommended to financial managers and analysts dealing with European firms.

16:00 – 17:45 Session 3: Financial Markets

Realized Measures to Explain Volatility Changes over Time

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This paper provides daily measures of volatility using high frequency data. We use realized measures to explain volatility changes over time. In particular, we consider several estimators such as the Bipower Variation, Median Realized Variance, Realized Kernel Variance, Realized Semi-Variance, Realized Variance etc. The data covers the period 2000-2018 and includes 20 indices. Our findings are recommended to financial analysts dealing with volatility modelling.

Pricing Vulnerable Power Exchange Options in an Intensity Based Framework

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Power exchange options are the generalization of exchange options and power options and have a number of useful and practical applications. A power exchange option is an European option to exchange the power value $\gamma_1 P_1^{\beta_1}$ of one asset to the power value $\gamma_2 P_2^{\beta_2}$ of another asset. Since these derivatives are traded in over the counter markets which operate with hardly any rules and are less transparent unlike the organized exchanges, the transactions on OTC have a counterparty risk that the other party may not honor its contractual obligations. Hence, the counterparty credit risk of derivative products has become one of the major concern of the investors. In this article, we study the pricing of European vulnerable power exchange options in an intensity based framework. We assume that the default by the counter-party is time of the first jump of a doubly stochastic Poisson process whose intensity is modeled by a jump-diffusion process. The price of the two assets are assumed to be driven by diffusion processes correlated with the default intensity of the counterparty. In the proposed framework, employing the measure change technique, we obtain the explicit formula for the price of the power exchange option with counter-party risk. Finally, sensitivity analysis is given to illustrate the effects of various parameters on option prices.

New Solutions in Terms of Quadratures to the CEV Model

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It is rather intriguing that many of the equations which arise in the Mathematics of Finance are richly endowed with symmetry. These symmetries offer an invaluable device in order to study their solution spaces. This can be accomplished by using group theory in two distinct, complementary, but not overlapping ways: By using Galois theory in the form of Kovacic's algorithm and by using Lie point symmetries in order to probe the solution spaces of these equations. We use both in order to find new solutions to the CEV model. By using Kovacic's algorithm, which finds all solutions in quadratures of linear second order ordinary differential equations with rational function coefficients, we find new solutions to the CEV ODE, and then by separation of variables, new associated solutions to the CEV PDE. Subsequently by deriving and using the Lie point symmetries of the CEV PDE we derive new solutions to the CEV model from the solutions we obtained to the CEV model by Kovacic's algorithm. Approximately 45 years ago Black and Scholes and, independently, Merton developed a model for the pricing of options. By making a number of assumptions they derived an equation, the Black-Scholes-Merton equation which proved to be the holy grail of investors. The Black-Scholes-Merton equation, is a parabolic partial differential equation, and relates the recommended price of the option to four other quantities. Three can be measured directly: time, the price of the asset upon which the option is secured and the risk-free interest rate. The fourth quantity is the volatility of the asset. This is a measure of how erratically its market value changes. The idea behind the Black-Scholes-Merton model, and many subsequent financial models, goes back to Louis Bachelier in 1900, who suggested that fluctuations of the stock market can be modelled by a random process known as Brownian motion. The Black-Scholes-Merton equation implements precisely this Bachelier's vision. The Black-Scholes-Merton equation is also applicable to any financial instrument the future of which is uncertain at the present time and it is the precursor of many partial differential equations which have been derived in the modelling of various financial processes. The Black-Scholes-Merton equation assumes that the asset's volatility remains the same for the lifetime of the option, which need not be correct. Since its original conception, the model

of Black, Scholes and Merton has been extended in various directions, and the assumptions, upon which the theory is based, have been relaxed. The most significant assumption in Black-Scholes-Merton equation is that volatility is constant over time. While volatility can be relatively constant in very short term, it is never constant in longer term. Therefore, a remedy for this shortcoming of Black-Scholes-Merton model is needed. The Constant Elasticity of Variance (CEV model) introduced by Cox is an example of such a remedy. The CEV spot price model is a one-dimensional diffusion model with the instantaneous volatility specified to be a power function of the underlying spot price, $\sigma(S) = aS^\beta$. It was introduced by Cox as one of the early alternatives to the geometric Brownian motion, assumed in the Black-Scholes-Merton model, to model asset prices. The new findings in our paper are: 1) We use Kovacic's algorithm to find Liouillian solutions (i.e. essentially solutions in terms of quadratures) to the CEV ODE, and then, by separation of variables, to the CEV PDE. The solutions we derive are to be juxtaposed with the pricing formulas to the CEV model derived by Cox for $\beta < 0$, by Emanuel and MacBeth for $\beta > 0$, and by Schroder which involve functions expressed in terms of series, and as a result, they need to be appropriately approximated in order to give any concrete information for the pricing of options. In contradistinction the solutions we derive do not need any intermediate approximation scheme in order to give any concrete information for the pricing of financial instruments, 2) we find and use the Lie point symmetries of the CEV PDE in order to find new solutions to the CEV PDE by using as point of departure the solutions we derived in the first part of the paper with Kovacic's algorithm, 3) we discuss the possible applications in the pricing of options of the new solutions we derived to the CEV model.

Modelling and Trading Exchange Rates with New Learning Machines Techniques

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The present paper investigates the performance of state-of-the-art machine learning techniques in trading with the EUR/USD, EUR/GBP and EUR/YEN exchange rates. For this purpose, five supervised learning classification techniques (K-Nearest Neighbors algorithm, Naïve Bayesian Classifier, Artificial Neural Networks, Support Vector Machines and Random Forests) were applied in the problem of the one day ahead movement prediction of the EUR/USD, EUR/GBP and EUR/YEN exchange rates with only autoregressive terms as inputs. For comparison reasons, the performance of all machine learning techniques was benchmarked by two traditional techniques (Naïve Strategy and moving average convergence/divergence model). Trading strategies produced by the machine learning techniques of Support Vector Machines and Random Forests clearly outperformed all other strategies in terms of annualized return annualized volatility, maximum drawdown and Sharpe ratio. To the best of our knowledge, this is the first application of Random Forests and K-Nearest Neighbors in the problem of trading with the above exchange rates providing extremely satisfactory results

Friday, May 11

09:00 – 10:45 Session 4: Corporate Governance

Corporate Governance and Financial Performance in Greek Travel and Tourism Companies

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The last ten years, the Greek financial crisis has necessitated the modernization of the domestic business environment and the acceleration shift from old to new drivers of growth. Corporate governance, along with corporate social responsibility and sustainable development, are strategic pillars of the new dynamic trends of entrepreneurship. Corporate Governance is articulated as a set of principles and codes on the basis of which firm is responsibly organized and well directed and also it is effectively controlled. Thus, the legitimate interests of all its stakeholders are recognized and secured. In particular, the adoption and implementation of Corporate Governance practices is a principle-based approach to independence, integrity and

objectivity. Principles that are diffused both in firms' internal environment (shareholders, employees) and its external environment (affiliates, suppliers, customers, domestic and foreign investors). A strong grid of processes and policies, in conjunction with firms' organizational structure, results in effective Corporate Governance. Consequently, it promotes corporate recognition and reputation and also contributes to enhance corporate performance. The main aim of the paper is to determine the variables of financial performance and the critical dimensions of Corporate Governance. The analysis is based on available secondary data of listed travel and tourism firms collected from their annual reports. Methodologically, the econometric estimation of a regression model using panel data investigates the relationship between financial performance and corporate governance. The paper contributes to the enrichment of the relevant bibliography on corporate governance, covering a research and bibliographic gap both in the Greek economy and in the tourism industry.

Financial Disclosure and Narrative Information: An Updated Bibliographic Survey

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The research on the quality of annual reports, and in their narrative information segment moreover, has long been underestimated, mainly due to the lack of indicators that allow objective measurement and analysis of business narrative information. This research directed towards the identification, recording and understanding, through an extensive review of the relevant literature, searching for the critical dimensions and factors in the thematic area of narrative information, which enhances transparency and corporate governance for globalized operating firms. Likewise, focuses on searching through the most important bibliographic review from Scopus Documents database, with the use of key words. The search refers to some 1,217 references from the years 1971-2017, by international journals, books and book chapters, conference papers and reviews. With the use of an appropriate algorithm, we search for words with the highest frequency of occurrence in Abstracts' Keywords sections, that portray a density factor for relevant scientific research and seek to locate major research gaps for analysts of narrative information in firms' financial statements. Also, the study identifies the current research trends focused on the subject field, while listing the top published research papers in International Journals as well as portraying a spatial-regional analysis for published researches' origin. The findings are of interest to both scholars and decision makers including providers of corporate governance indexes, analysts, academics and rating agencies.

Management Practices and Corporate Capital Structure: Evidence From Medium-size Firms

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Capital structure has received considerable attention in the literature. Starting with the seminal work of Modigliani and Miller (1958) the topic has been debated at the theoretical level and numerous empirical papers have tried to reveal how the facts relate to theory. The recent financial crisis has renewed the interest on the topic. First, because the crisis may affect the capital structure of firms through various channels (Demirguc-Kunt et al., 2015). Second, because the unreasonably high leverage is considered one of the causes of the US financial crisis (see for example US Financial Crisis Inquiry Commission Report, 2011). At the same time the one to "blame" for the crisis is clearly the management team, as the CEO of JP Morgan, Jamie Dimon, strongly supported during his testimony to the US Financial Crisis Inquiry Commission. In our context, this is because the managers are the ones taking the decisions as for the mix of debt (e.g. loans vs bonds, short- vs long-term) but also for the degree of leverage (i.e. debt versus equity). The present paper examines the effect of management practices (as measured by Bloom et al., 2014, Bloom and Van Reenen, 2007; 2010) on corporate capital structure, using a sample of medium-size firms, operating around the globe, over the period 2006-2015. This allows us to consider if management practices play a different role during normal and crisis periods. Our work relates to two stands of the literature. First, it relates to studies mentioning that management effectiveness, as deriving from the managerial practices and ability, seems to influence not only firm performance but also other firm characteristics (Demerjian et al., 2012; Francis et al., 2016, a,b). More detailed, management practices, classified as "good" in terms of firm productivity have an effect on economic results, becoming important assets in the economics and finance fields. Management is considered as the third input of firm production, complementary to labour and capital, and its impact on corporate variables is evident in a several studies (Delis and Tsionas, 2018, Bloom et al. 2012, Bloom and Van Reenen, 2010, Demerjian et al., 2013; Francis et al., 2016; Bonsall et al., 2016). Second, our work also relates to numerous papers that study the determinants of capital structure, with the strand of the literature that is more closely related being the one dealing with corporate governance characteristics (e.g. Alves, et

al., 2015; Liao et al., 2015). In general, these studies conclude that several aspects of the board of directors influence capital structure.

Measuring ESG Trends in the Banking Sector: A Multi-criteria Approach

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Department of Economics and Social Science, Universitat Politècnica de València, Spain

Concepts such as ESG (environmental, social and governance), CSR (corporate social responsibility) and SRI (socially responsible investments) have risen to the forefront of corporate agenda for academia, governments, and industry worldwide about ethics in business. Pursuing a strong ESG performance within a company involves the commitment to integrate sustainability into their business strategy. Although the concept and measurement of sustainability have become a prominent topic among the research and business community, a universal definition and a general method to evaluate sustainability performance have not been accepted yet. In practice, this lack of agreed upon definition and measurement of sustainability has led to different approaches of firm's sustainability performance evaluation from rating agencies. Some recent papers have incorporated Multi-criteria decision making (MCDM) methods to measure the performance of companies in terms of sustainability. These methods provide a wide range of methodological tools for decision under multiple conflicting criteria of diverse nature, taking into account the preferences of the decision makers such as investors, managers, financial analysts, and policy makers. This paper is aimed at providing a benchmarking tool to assess the disclosure and performance of the seven major Spanish banks. The banks selected for the study were: Santander, BBVA, CaixaBank, Bankia, Sabadell, Bankinter and Popular. The broader goal was to gain insight into the strengths and weaknesses of the ESG performance during the period 2013-2015. For this purpose, a fuzzy multi-criteria decision-making (MCDM) method, which is Fuzzy TOPSIS (Technique for Order Preference by Similarity to Ideal Situation) has been proposed. In the Fuzzy TOPSIS methodology Fuzzy Set theory is applied to provide fuzzy numbers for describing any fuzzy subset of responses and preferences with suitable membership functions. In our proposal, the Fuzzy TOPSIS method is applied to rank the banks by the ESG criteria of relative closeness to positive and negative ideal solutions. The results of this study serve as a valuable engagement tool for customers, investors and stakeholders to gain a deeper understanding of each institution's sustainable philosophy and to ascertain how corporate responsibility and ESG performance could be improved. Algorithms of the Fuzzy TOPSIS method were developed on Matlab© and applied to real world ESG data of banks obtained from a rating agency.

12:00 – 13:15 Session 5: Banking

A Dynamic Evaluation of Bank Efficiency: Evidence for Eurozone Countries

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Data envelopment analysis (DEA) was originally designed for production theory, but it has been increasingly applied across several areas. It is a quantitative, empirical and non-parametric method based on linear programming to measure the relative efficiency of observations that represent the performances of organizational units (Decision Making Units - DMUs), operating in a similar technological environment and allowing the consideration of multiple inputs and multiple outputs in global performance evaluation. DEA is generally used for performance evaluation and benchmarking with regard to best-practice, as a Multiple Criteria Decision Aiding (MCDA) tool. The research interest in bank efficiency is linked to the economic situation and an important issue for policy makers is to ensure economic stability. This is line with one of the main objective of the banks, which is a better use of available resources to stabilize the target markets. Nevertheless, managerial decisions and the environment play a critical role in ensuring proper and efficient allocation of the resources. The purpose of this study is to understand which are the main factors that can influence the bank efficiency in the Eurozone countries by means of a dynamic evaluation, comparing the 160 listed banks performances during 2010-2017. The proposed method is the Value-Based DEA, which combines DEA with MCDA. The Value-Based DEA method builds on Multi-Attribute Utility Theory (MAUT), since the input (factors to be minimized) and output (factors to be maximized) factors are firstly converted into utility functions according to preference information. After that, the (marginal) utility functions are aggregated using a weighted sum (additive model of MAUT) and each DMU is free to choose

the weights associated with these functions that minimize the difference of utility to the "best" DMU (bank), according to the "min-max regret" rule. This will provide an intuitive meaning (the loss of utility) to the efficiency measure assigned to each DMU. The performance evaluation by means of the Value-Based DEA method enables to identify the banks that exhibit the best practices defining an efficiency frontier. The gaps to best practices of non-frontier banks are measured and benchmarks against which those inefficient banks should be compared with are identified. The panel data methodology complements this study by showing which variables are determinant for bank efficiency around Eurozone countries and which variables have a positive and negative relationship. This methodology allows controlling the individual or unobserved heterogeneity and corrects the endogeneity problem. The estimation model of dividends is based on the Generalized Method of Moments (Arellano and Bond, 1991 and Blundell and Bond, 1998). The relative comparison of bank performance across Eurozone countries allows to identify the best practices in a way that policies could be established to improve the efficiency of less efficient banks. The results obtained could help managers, investors or governments to know how to improve the efficiency of their banking sector, which is the engine of the economy for civil law countries.

An Investigation of the Fraud Risk and Fraud Scheme Methods in Greek Commercial Banks

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The purpose of this study is to examine types of fraud risk and fraud scheme methods in Greek commercial banks. Data used for this study were obtained from primary source through questionnaires. This method of data collection was followed and was considered appropriate because the information sought is not publicly available and middle management and internal auditors are in a good position to know the answers to the questions asked. Questionnaires were sent to a sample of 230 persons, all bank branch employees (internal auditors were excluded), in the city of Athens (city capital of Greece), in five banks, National Bank of Greece, Piraeus Bank, Alpha Bank, Eurobank and Postal Bank, during February 2017 - March 2017. Finally, of the 230 questionnaires distributed, 225 completed and returned but only 203 of them were usable questionnaires. The Cronbach's alpha was used to test the reliability of variables. Results showed that forgeries, bribery and money laundering are the most important types of fraud risk and the best fraud scheme methods are using dormant accounts and checks. Based on the empirical findings, the study recommends there is a need banks to implement a code of conduct and a code of ethics for staff, staff training, signature verification, control over dormant accounts, asking employees about their opinions and the way they feel about their bank, conducting surprise audits and using a hot line for whistleblowing. The study will help banks in fraud risk management and in the development of policies to reduce risk within the banking sector. Also, will be useful to all categories of potential bank clients and users of financial services including shareholders, creditors, debtors and fund providers. To the best of our knowledge, this is the first study examining middle management and staff opinions about fraud risk and fraud scheme methods in Greek commercial banks.

Is Political Influence Distorting Banking Supervision? Evidence from the US Banking Sector

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The present study examines the interplay between political influence and regulatory decision-making in the banking industry. In particular, the main objective is to assess whether elected officials with power in Congress impact regulatory decision making in the banking industry. Political influence is captured by whether a bank is head-quartered in a state where an elected official holds a chair position at a congressional committee related to banking and financial services. As a proxy for regulatory decisions, we take into account the formal enforcement actions issued by regulators against distressed institutions. Using a sample of US Commercial banks for the period 2000-2015 our findings show that there is an inverse relationship between our political influence variable and enforcement likelihood. Results are robust to the use of alternative model specifications and the restriction of our sample.

14:15 – 16:00 Session 6: Alternative Investments & Financial Planning

Socially Responsible Index Tracking

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In this paper, we introduce a new methodology for modeling optimal institutional portfolios that combines the benefits of passive investing with the needs of socially responsible investors. Our methodology is based on the hypothesis that for socially responsible investors, social responsibility is a third criterion (beyond the two usual financial ones). In a sense, our methodological foundation extends index tracking as expressed in Roll (1992). The significant point here is that when a third criterion is added to a bi-criterion model, the efficient frontier becomes an efficient surface. We utilize insights from this surface for our new analyses. Specifically, we estimate the marginal costs (the difference between the returns on a passive index and the re-returns on a social responsibility-constrained tracking portfolio) that diversified investors will bear when adding a social responsibility threshold to their portfolios. In an empirical application, we parametrize our model with data from the S&P 500 index and perform a rolling window analysis in which we rebalance a tracking portfolio with a social responsibility constraint on a monthly basis. We identify social responsibility by ESG (environmental, social, corporate governance) scores. Following El Ghouli and Karoui (2017), we consider a portfolio social responsibility level to be the weighted ESG scores of the portfolio constituents. Moreover, we set the social responsibility threshold to match the ESG score level of the Dow Jones Sustainability Index (DJSI). That is, we are constructing portfolios that closely track the return of the S&P 500 while maintaining the (substantially higher) level of social responsibility of the DJSI. We demonstrate in an out-of-sample analysis that during our sample period of 2003 to 2014, it was possible to create such a portfolio at virtually no cost. However, the marginal costs defined increase during our sample period.

Multiobjective Stochastic Ethical Portfolio Selection: The Case of GCC Islamic Securities

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This study deals with an ethical multiobjective programming approach to address the ethical portfolio selection problem. First, we present an ethical multiobjective (Deterministic) Programming model under the Islamic compliant framework for our multiobjective portfolio selection problem. Second, we develop an ethical stochastic multiobjective programming model to address the ethical portfolio selection problem in the stochastic environment under the Islamic compliant framework by considering random objectives. Some of the objectives considered in our models are maximizing return, maximizing social welfare, minimizing Market Value/Book Value, minimizing PE ratio and minimizing the risk of portfolio. We apply our models on 60 stocks including conventional and Islamic/ethical securities in GCC. We compare our model to standard portfolio selection models.

A Stochastic Goal Programming Model for Managing Cash with Three Criteria

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Cash management systems with multiple bank accounts are the rule rather than the exception in most firms. In this paper, we consider cash management systems with multiple bank accounts described by a given particular relationship between accounts and by a linear state transition law. Since cash managers may simultaneously consider a number of possibly conflicting goals, we provide a general stochastic goal programming model that is able to handle multiple goals and also the inherent uncertainty introduced by expected cash flows. In addition to cost and risk for optimization purposes, we propose the use a third goal, namely, cash balance stability, which we define as the deviation of daily balances from a given reference. By minimizing this deviation, cash managers can ensure that policies outputs stable balances, which we consider a desirable attribute for short-term financial planning when dealing with the uncertainty introduced by unknown future cash flows. We describe in detail an example of our general model that presents the advantage of

its computational tractability, since we transform the initial stochastic problem into its deterministic linear counterpart with soft constraints. Our model provides a systematic approach to multiple criteria cash management that is ready to be implemented in decision support systems for cash management.

Efficient Multiobjective ESG and Short-Fall Portfolio Optimization for Non-Profit Organizations

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There is an increasing recognition that long-term investment advantages are evidenced by investors who explicitly consider environmental, sustainability and governance factors (ESG factors) in the portfolio diversification process. Despite the investment communities increased reliance on various approaches to the development of ESG factors, the debate on how best to compute a uniform and statistically independent set of ESG factors remains under investigation. Relying upon the Thomson Reuters US Large Cap Corporate Responsibility ESG Portfolio, this research proposes an econometric methodology for the creation of a statistically uniform ESG factor. We incorporate the newly identified ESG factor in the canonical formulation of a multi-index Sharpe portfolio optimization model when applied to the investment plan of a large non-profit. Statistical equivalence between the multi-factor index set and the traditional mean-variance efficient set is established by use of ANCOVA, MANCOVA and related post-hoc tests. The domain-of-applicability of the latent ESG factor model is applied to the socially responsible investment plan of a U.S.-based non-profit organization. This is accomplished by restating the uni-objective Sharpe multi-factor optimization portfolio model to a hierarchical preference-based model formulation. Specifically, we form a nonlinear goal programming model of the canonical portfolio diversification problem with additional goal constraints to control for weighted short-fall (conditional value-at-risk) and ESG targets.

16:15 – 18:00 Session 7: Public Sector

Classification of Countries by the Degree of Interest Groups' Influence on the Economies

Haris Papadakis, George S. Atsalakis

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As it emerges from Olson's theory and as confirmed by the studies that followed, interest groups affect the economies of the countries. This impact of interest groups on the economy of each country is very difficult to quantify, as well as the corruption. The aim of this study is to classify a group of countries by the degree of influence of the interest groups on the economy, following the same methodology as for the countries classification process based on the corruption perception index.

Financial Development and Economic Growth: Evidence from Algeria

Taleb Dalila

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The studies of the relationship between financial development and economic growth continue to interest economists at the theoretical and empirical levels. The current crisis is reminiscent of the magnitude of the impact one can have on the other. The analysis of the causal links between finance and economic growth could be traced back, at least, to Schumpeter (1911), but it has really experienced a revival of interest from the works of Gurley and Shaw (1955), Granger (1963), Patrick (1966), Goldsmith (1969), Hicks (1969) and McKinnon (1973) through the introduction of empirical tests. Theoretically, Patrick (1966) proposes three hypotheses of links between finance and growth. It is first of all the "Supply Leading" hypothesis where financial development is at the root of economic growth. Then, he proposes the inverse hypothesis called "Demand following" where the financial development is a consequence of the growth. Finally, the so-called "stage-of-development" hypothesis states that finance causes growth in less developed economies, but as economies develop, causality is reversed, with growth taking over finance. Subsequently, McKinnon (1973) undertook to test these hypotheses empirically and found that the causal link from financial development to growth is more decisive. These results have had a great influence on the policies of the International Monetary Fund (IMF) and the World Bank in developing countries, particularly with regard to financial system reforms in these countries. Several studies will eventually lead to the same results as McKinnon (1973), such

as those of the World Bank (1989), King and Levine (1993a, b), Pagano (1993), Neusser and Kugler (1998), Levine et al. (2000) and Calderon and Liu (2003). Conversely, fewer studies confirm, empirically, the causality going from growth to finance. However, Robinson (1952) argued that the greater emphasis on finance tended to overlook this latter sense of causality. Given the importance of economic policy implications, research on the links between finance and growth is timely. The financial sector acts on growth through two channels: capital accumulation and productivity improvement. The current study derives its motivation from the budding notion that the finance-growth discourse should be narrowed down to individual countries. It seeks to answer two main questions: (1) Does financial development promote economic growth in the long run? (2) Does financial development promote economic growth in the short run? The aim of this paper is to investigate empirically the question of whether financial development leads to economic growth in a small, developing country like Algeria. The paper focuses on the causal link between finance and economic growth in order to discriminate between several alternative theoretical hypotheses.

New Economy and Social Innovation: A Review of New Economic Models

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Sustainable Investment is increasingly becoming recognized as a key driver for socio-economic progress and the realization of the new sustainable development agenda that aims at ending poverty, protecting the planet, and ensuring prosperity for all. These objectives are enshrined in the agendas of both national governments and intergovernmental organizations. For instance, in national development plans of many countries, in the United Nations' Sustainable Development Goals (SDGs), and in the World Bank's mandate. Despite the impressive economic performance of many developing countries (in for example Africa and Asia), they are still faced by a multitude of social and environmental challenges. To address these challenges and deliver solid socio-economic progress for all requires a new investment methodology that delivers not only positive economic returns, but positive social and environmental impact as well. Different models such as; Economy for the Common Good, Sharing Economy, Growth National Happiness, Slow Growth Movement, The Natural Step, among others have been proposed by different schools of thought to provide frameworks for the new economy and social innovation, and how to invest sustainably in order to achieve sustainable development. At the center of this new economy lies modern information and communication technologies which are the leading driver for social innovation and economic transformation. Using an actual investment case for a proposed eco-village investment project in Uganda, we collect and rank preferences of experts in the identified economic models, across a range of multiple objectives (economic, social, and environmental). In order to make the elicitation, aggregation, analysis and evaluation of this data computationally possible, we use a decision support tool called Multi-criteria decision analysis (MCDA) that is used for handling numerically imprecise information. Through this structured evaluation process, the paper provides a systematic review of how the different frameworks proposed by the different new economic models can be applied. We identify gaps and overlaps in the models, and suggest a comprehensive framework that combines the key elements in the reviewed models. The results of the paper provide insights for sustainable investment professionals and development practitioners on how to appraise sustainable investment projects with complex multiple objectives and stakeholders.

Evaluating Public Sector Strategy Using a Balanced Scorecard Approach

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The Balanced Scorecard (BSC) approach is a strategic planning and management system that is used extensively in business and industry, government, and non-profit organizations worldwide to align business activities to the vision and strategy of the organization, improve internal and external communications, and monitor organization performance against strategic goals. It was originated by Robert Kaplan (Harvard Business School) and David Norton (Renaissance Solutions Inc.) as a performance measurement framework that added strategic non-financial performance measures to traditional financial metrics to give managers and executives a more "balanced" view of organizational performance. The BSC provides a framework that not only provides performance measurements, but helps planners identify what should be done and measured, and thus enables executives to truly execute their strategies. Recognizing some of the weaknesses and vagueness of previous management approaches, the BSC approach provides a clear prescription as to what companies should measure in order to "balance" the financial perspective. As emphasized by several scholars, the BSC is not simply a measurement system; it is actually a management system that enables organizations to clarify their vision and strategy and translate them into action. It provides feedback about both the internal business processes and external outcomes in order to continuously improve

strategic performance and results. When fully deployed, the BSC transforms strategic planning from an academic exercise into the nerve center of a business organization. Public organizations are nowadays under increasing pressure to apply effective management tools. Although the BSC model may be considered as useful management approach, its application should take into account the non-profit nature of the social service sector. For example, several scholars claim that the financial focus of the BSC conflicts with the mission-oriented nature of non-profits, while particular attention should be given when studying the intangible capital (human or intellectual) of such organizations. This is the main reason why, despite the increased adoption of the BSC methodology by numerous business organizations during the last decade, limited case studies concern non-profit organizations (e.g. public sector, educational institutions, healthcare organizations, etc.). In particular, the development, implementation, and evaluation of a strategic plan is one of the most important weaknesses of the public administration. During economic crisis, the necessity of both increased efficiency and fair and transparent procedures by the public sector is increased. The main aim of this study is to develop a strategy evaluation framework based on the BSC methodology in the public sector. The proposed approach considers the distinguished characteristics of the aforementioned sector (e.g., not-for-profit orientation, social mission, etc.) and presents a real world case study for a Greek Tax Office. Recently, significant efforts have been made by several Greek public organizations to improve their efficiency and effectiveness through a series of interventions in their technological infrastructure, organizational culture, and employee education. The proposed strategy evaluation framework is a carefully selected set of performance indicators (KPI - Key Performance Indicators) derived from the organization's strategy, as well as a management tool for communicating, updating, and controlling strategic objectives. The assessed KPIs refer to the most important economic performance indicators, as well as non-financial performance indicators that are able to examine the quality of the provided services, the satisfaction of internal and external customers, the self-improvement system of the organization, and the ability of the organization to adapt and change. The KPIs may be considered as a tool of metrics that shows how the organization is likely to perform over the medium and long term. An effective set of KPIs should have the following important properties:

- The KPIs should be clearly measured, quantified and easily influenced by the organization. Thus, they should be accurately defined and measured, and also they should provide a benchmarking system in order to evaluate organization's outcomes.
- The KPIs should provide metrics of fundamental importance for the competitive advantage or even the success or failure of the organization's strategy. This way, they are able to provide meaningful results and highlight potential improvement actions.
- The KPIs should provide leading information on future performance. In fact, they may be considered as a common point of reference for current performance, indicating the future competitiveness of the organization.
- The KPIs should serve as an important communication tool. Particularly, they should provide a clear set of goals and objectives to every employee, coupled with an understanding of how they relate to the overall success of the organization. In this way they will be able to create a common vision throughout the organization.

The presented analysis is based on a multicriteria decision aid (MCDA) approach, combining AHP and TOPSIS methods in order to aggregate the marginal performance of KPIs. This approach is able to take into account the preferences of the management of the organization regarding the achievement of the defined strategic objectives. The main results of the proposed approach are focused on the evaluation of the overall scores for each one of the main dimensions of the BSC methodology (i.e. financial, customer, internal business process, and innovation-learning). These results are able to help the organization to evaluate and revise its strategy, and generally to adopt modern management approaches in every day practice.

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