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En este libro puede volver al índice
pulsando el pie de la página

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INDEX

Asset Concentration, Connectedness and Financial Stability

How Quality Factors Affect Patient Satisfaction in the Spanish Healthcare System

On The Usage of Regulation-Based Investment Policies of Mutual Funds: A Performance Comparison.

Beta Is Not Dead: Developed Vs. Emerging Markets

Analysis of the Law Of Falling Rate of Profit for the European Case

A Risk-Based Model for the Replacement Rate Evaluation in A Defined Contribution Pension Scheme

The Esg Score and the Corporate Finance Ratios: The Case Of Europe

New Method To Solve Integral Equations for Variable Annuities Evaluation With Stochastic Volatility

How Health-Related Issues in Esg Insurance Industry Can Influence Adverse Selection

How Many Factors Explain the O&G Sector? An Approach From Random Matrix Theory

6. Posters.

Tourism Facilities As A Case Study For Group-Pahp Consistency Checks During The Covid-19 Epidemic

A Dynamic Approach of Ahpsortii To Classify Stem Master's Courses in Italy

A Fuzzy-Based Thematic Classification Method for the Real Albergo Dei Poveri, Naples (Italy)

Bayesian Space-Time Modeling of Ischemic Stroke Incidence and Mortality in Almería Using Inla

Research Evaluation with Neural Networks

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5. ABSTRACTS

DESCRIPTION OF BEHAVIORAL INVESTORS' TYPE THROUGH THE DISCOUNT FUNCTION AND FUNCTIONAL DATA ANALYSIS

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Abstract

Classical models of finance assume a rational decision-maker, considering that investors are take all available information into account when deciding where to invest. Behavioural finance, on the other hand, recognises the limits of human rationality and investigates methods to improve individual financial decision-making. The aim is to find answers to questions that classical finance cannot answer, combining normative theory with studies in cognitive psychology. One application of personality theories to financial decision-making is the work of Pompian, who defined a model of four Behavioural Investor Types (BITs) by combining behavioural finance studies with Keirsey's temperament model. The present paper aims to investigate how the four temperaments interact with uncertainty through the analysis of individual discount functions in the context of intertemporal choices. Functional Data Analysis (FDA) will identify relationships and properties that enrich the profiling of the four behavioural investors.

Keywords: *Behavioral finance, Functional Data Analysis, BITs, Keirsey´s Temperament, Impatience, Uncertainty.*

UNCERTAINTY AND SUBJECTIVE PROBABILITY IN DECISION-MAKING: INSIGHTS FROM INTERTEMPORAL CHOICES

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Abstract

Recent research findings suggest that incorporating uncertainty into risk assessment is crucial when making financial decisions. This work aims to investigate how uncertainty interacts with subjective probability during the risk evaluation process in a context of intertemporal choices in which uncertainty is generated by the passage of time. To delve deeper into the role of different time frames in shaping one's perception of probability, random probabilities across various temporal perspectives are analysed, matching both risky and uncertain intertemporal scenarios. Through a combination of empirical findings and modelling, our research reveals that subjective probability fluctuates over time, demonstrating behavioural patterns consistent with the observed non-rationality associated with hyperbolic discount functions. By employing the theory of belief functions, the relationship between a steeper discount function in intertemporal choice and the preference for Larger Later alternatives in risky intertemporal choice tasks is formalised. Our results confirm a distinct "preference for uncertainty," where individuals exhibit greater patience in pursuit of a reward. The experimental methodology employed in the present study, along with the resulting insights, enrich our understanding of the nuanced interplay between risk and uncertainty, providing both qualitative and quantitative perspectives on this relationship, and increasing knowledge in financial decision-making research field when outcome are distributed over time.

Keywords: *Intertemporal choice, Uncertainty, Financial Decision-Making, Subjective Probability.*

IMPATIENCE IN INTERTEMPORAL CHOICE AND MEDITERRANEAN DIET

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Abstract

The main objective of this work is the analysis of impatience in intertemporal choice and its application in the field of health. Specifically, we study the relationship between impatience and healthy eating habits, measuring the latter by means of the KIDMED test of adherence to the Mediterranean Diet (MD). We use the discount rate as an appropriate indicator of the level of impatience in intertemporal choice of monetary rewards and apply the 27-item monetary choice questionnaire. In addition, we study whether the magnitude effect holds. We survey a sample of Italian students in order to classify them in three groups of adherence to MD and test the following hypothesis: subjects with high adherence to MD show lower discount rates. Conversely, subjects with low adherence to MD show higher impulsivity. We consider that the results of this analysis could be useful when designing public health policies and identifying the target population to which preventive measures should be directed.

Keywords: *Impatience, intertemporal choice, Mediterranean Diet, discount function.*

A PRELIMINARY STUDY ON IMPATIENCE IN INTERTEMPORAL CHOICE AND MAGNITUDE EFFECT IN ADOLESCENTS

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Abstract

Several anomalies have been revealed in the empirical study of Samuelson (1937) discounted utility model. This model is used to value the utility of amounts or rewards that are available at different dates (instants in time) when making intertemporal choices. In this paper, we are going to focus on the study of one of these anomalies: the magnitude effect that implies a lower discount on bigger rewards than on smaller ones. Or, equivalently, the application of a smaller discount rate for higher amount rewards. We run a preliminary empirical study surveying a sample of high-school students. We apply the 27-item monetary choice questionnaire to calculate the discount rate used by each individual and to study if the magnitude effect holds. The study of this anomaly is useful since it has potential applications not only in the field of finance but also in the field of health.

Keywords: *Magnitude effect, intertemporal choice, impatience, anomalies.*

CONSTRUCTING CARDINALITY-CONSTRAINED LONG-SHORT PORTFOLIOS: AN ADAPTIVE EVOLUTIONARY APPROACH

_____

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Abstract

The uniperiodal portfolio selection problem aims at finding the optimal composition of a portfolio over a given time horizon. The portfolio should be cheap to rebalance, i.e. it should have ideally a low turnover and transaction costs. This can be attained by using an appropriate risk measure and by constraining the number of assets in a portfolio or the minimum/maximum amount of wealth invested in a specific asset or the amount invested in a specific asset, making the problem hard to solve and for which metaheuristics seem to be a viable tool for providing a near-optimal solution so far. The aim of this paper, therefore, is to present a solution for the portfolio optimization problem, based on an adaptive evolutionary algorithm. Empirical results show that our approach can be used to construct effective long-short portfolios, since it is possible to achieve better risk-return tradeoffs compared to standard portfolios with long-only formulations.

Keywords: *None.*

AGING AMONG ETHNIC AND RELIGIOUS GROUPS IN ROMANIA – AN EXPLORATORY STUDY

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Abstract

Aging is nowadays a common challenge among almost every country and/ or territory. This reality comes with multiple within the social and economic context. In this research, we are rely on a large data set (over 8.3 millions persons) from the latest censuses in Romania: 1977, 1992, 2002 and 2011. However, exogenous restrictions raise methodological difficulties (especially for the religious groups). From the outcomes perspective, the current research shows important age differences among different ethnic and religious groups. However, for Romania as a whole, the domination of Romanian ethnicity and Eastern Orthodox religion tend to impose the trend, nationally.

Keywords: *None.*

A PROPOSAL FOR OPTIMAL VaR AND CVaR PARAMETERS ESTIMATION

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Abstract

Traditional strategies of managing financial portfolios are based on the assumption of normally distributed losses, i.e., the likelihood of observing extreme adverse events is negligible and close to zero. Indeed, many financial data reject the Gaussian model and exhibits fat-tailed distributions.

In this paper we analyze and compare VaR and CVaR with respect to daily stock market returns of four different emerging markets indexes, i.e., MSCI Emerging Markets, Latin America, Middle East Europe and Africa index and South Africa.

All indices exhibit slightly negative skewed distributions and are characterized by a significant positive excess of kurtosis. This implies heavy tails in the distribution of risky returns, which are thus more likely of being affected by extreme values.

In order to discriminate among time-series datasets we conducted two different level of analyses: 1) identify the timing of regional markets crashes along with the related market crisis periods 2) measure the strength of co-movements among time-series across different timescales.

What emerges is that all markets have been affected by the same crisis but their effects, in terms of price decline and duration, appear to be less severe for the MSCI South Africa. Moreover, it would seem that the MXZA index is positively lagged with respect to the other markets. In order to give evidence to the above consideration we have run a Wavelet Multiple (Cross) Correlation analysis.

We backtest the risk measures over several classes of density distributions and well-known modeling approaches such as the Exponential Weighted Moving Average and the Historical Simulation Method.

Results give evidence of how the efficacy of the applied risk measures as well as of the selected model strictly depends on the cumbersome parameters' settings. In this view, we propose an algorithm for optimally estimating and fitting within an Extreme Value Theory framework the two-sided tail distribution of returns.

Keywords: *VaR, Conditional VaR, Parameters Estimation, Metaheuristics.*

DYNAMIC RISK MEASURES AND NON-LINEAR PRICING RULES GENERATED BY A BIVARIATE DEMPSTER-SHAFER PROCESS

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Abstract

We consider a multi-period finite-horizon market model formed by a basket of two stocks with frictions in the form of bid-ask spread, and a non-frictional risk-free bond. The two stocks lower prices are jointly modeled by a bivariate multiplicative binomial process whose uncertainty is captured by a belief function in Dempster-Shafer theory [4,5].
We provide a suitable notion of Markov and time-homogeneity properties for a bivariate multiplicative random process in the Dempster-Shafer framework. Adopting the product (geometric) conditioning rule for belief functions, we fix a family of joint transition belief functions depending on two pairs of (strictly positive) parameters, where each pair can be interpreted as (weighted) one-step up and down conditional marginal belief function. We prove the existence of a global belief function that makes the process Markovian and time-homogeneous. The introduced bivariate Dempster-Shafer multiplicative binomial process allows us to characterize the corresponding conditional Choquet expectation operator of any function of the pair of stock lower prices with a closed form expression. The Choquet expectation operator is well-studied both in the field of risk measurement, since a Choquet risk measure is coherent if the integrating capacity is (at least) 2-monotone [3], and as non-linear pricing rule [2]. Thus, we define a dynamic risk measure [1] for real-valued functions of the pair of stock lower prices through the introduced conditional Choquet expectation operator and we show that (dynamic) coherence is trivially satisfied. Finally, we investigate the discounted conditional Choquet expectation operator as non-linear pricing rule for derivatives whose underlying asset is the pair of stock lower prices. The existence of an equivalent Choquet martingale belief function is discussed.

Keywords: *Dynamic risk measures, non-linear pricing rules, belief functions, conditional Choquet expectation.*

OPTIMAL TRANSPORT IN DEMPSTER-SHAFER THEORY

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Abstract

We consider the marginal problem in Dempster-Shafer theory [3], investigating the structure of the set of bivariate joint belief functions having fixed marginals, by relying on copula theory [2]. Next, we formulate a Kantorovich-like optimal transport problem [5], seeking to minimize the Choquet integral of a given cost function with respect to the set of joint belief functions. The resulting theory distinguishes from other proposals present in the literature [4] and is motivated by two noticeable applications in decision making under ambiguity. First, the choice of a symmetric cost function permits the definition of a Choquet-Wasserstein distance that can be used to compare belief functions, when the marginal spaces coincide. Second, we show that the particular subcase given by an additive marginal and a non-additive one allows to model a game under ambiguity, through the definition of the Stackelbeg-Cournot-Nash equilibrium under ambiguity (SCNEA), which generalizes [1].

Keywords: *Optimal transport, Belief functions, Choquet-Wasserstein distance, Stackelbeg-Cournot-Nash equilibrium under ambiguity.*

A PHYSICAL SUB-DIFFUSION APPROACH FOR ILLIQUID MARKETS

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Abstract

The classical diffusion models for continuous time like Black-Scholes-Merton (B-S) are incapable of adequately modelling illiquidity for real-life asset dynamic and evaluate derivatives. This happens because Brownian motions in B-S model are perpetually moving and we can not use it for modeling periods with motionless stock returns.

In order to overcome this difficulty in continuous case one can notice, that the constant periods of stagnation in financial processes are analogous in nature to the trapping events of the subdiffusive particle. Therefore, the subdiffusive approach, which is used in statistical physics can be applied for modelling illiquid markets.

In physics, this process usually is described by Fokker-Planck fractal equations. Equivalent description of subdiffusion there exists in terms of subordination, where the standard diffusive process is time-changed by the some stochastic process H(t), which is called the inverse subordinator. The inverse subordinator H(t) is also called a "hitting time" or "stochastic clock" and it is defined as the time of first reaching a certain price, which may not change for some time. By construction, the inverted process may be constant. Therefore, any process subordinated by H(t) demonstrates motionless periods.

The definition of the inverse subordinator is based on the use of some other random process called a subordinator G(t), which is often called "waiting" time.

In this paper the Inverse Gaussian and Gamma processes were proposed as a subordinators for the subdiffusive modelling of illiquidity. Some properties of the model were considered. The covariation structure was investigated and long-range dependence was studied. The simulation of the trajectories for subordinator, inverse subordinator and subdiffusive GBM were performed. The Monte Carlo method for option evaluation was applied. The Value-at-Risk evaluating procedure for proposed model was discussed.

Keywords: *Option pricing, subdiffusion models, subordinator, hitting time.*

A JOINT PROCEDURE FOR RANKING AND CLUSTERING THE NETWORKED EUROPEAN RESEARCH PROJECTS

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Abstract

In this talk we present an analysis of the funded research projects. We specifically consider the funded projects of the 7th Framework Programme for Research and Technological Development and Horizon 2020 over the time range 2007–2020. The analysis is carried out by firstly modelling the networked nature of the organizations involved in the same research projects. We will build a network for each investigated year. Then, we rank some relevant centrality measures of the obtained networks and we cluster the outcoming rank-size distributions on a yearly basis. The heterogeneity of the employed methodological instruments gives a panoramic view of the current research activity in Europe.

Keywords: *European research projects, Complex networks, Rank-size analysis, Cluster analysis.*

PREDICTION MODEL WITH LIGHTGBM METHOD FOR PREDICTION PRICES FOR NEW PRODUCTS

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Abstract

Data analysis and the ability to preserve user privacy has become very important nowadays. So the data is coded without losing important information and made available for research. Gradient-boosted decision trees provide competitive, robust regression and classification procedures that can be interpreted and implemented to predict cold-start processes and are particularly suitable for working with less clean data. The LightGBM method is generally used for classification problems, both for open and encoded data. It is proposed to apply this method for forecasting the demand price of a product without history. We propose to use LightGBM as a safe and fast implementation of a loaded decision tree algorithm, which is widely used in data mining and machine learning tasks. For research, it is important to have a fairly wide base of goods with certain categories and goods with detailed characteristics.

Keywords: *GBM, GBDT, LightGBM, GOSS, predictive model.*

IMPROVED ESTIMATION OF THE ASSETS' PRECISION MATRIX VIA SHRINKAGE

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Abstract

A well-known result in finance is that the sample covariance matrix should not be used for the purpose of building portfolios. In fact, the sample estimator contains so much estimation error that the portfolio resulting from its use performs poorly in out-of-sample. We note, however, that in the mean-variance portfolio selection is more important to achieve a good estimate of the precision matrix rather than the covariance. Starting from this intuition, we develop a new linear shrinkage estimator for the precision matrix with the aim of maximizing the investor's utility function, thus reducing the estimation error. An oracle estimator is proposed and many feasible estimators are discussed in detail. The proposed shrinkage estimator's performance is evaluated with a simulation study and a real data experiment.

Keywords: *Portfolio Selection, Shrinkage Estimator, Covariance Matrix, Estimation Error, Precision Shrinkage.*

PROGRESS IN BIBLIOMETRIC ANALYSIS USE IN BUSINESS AND MANAGEMENT: A METHODOLOGICAL LITERATURE REVIEW

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Abstract

Bibliometric analysis is a modern literature review technique with a demonstrated ability to analyze a large amount of bibliographic data. This technique has been increasingly adopted in business, economics, and management research disciplines over the last decade and has become an essential element of researchers' methodological toolbox. However, the bibliometric analysis review technique has undergone massive critiques regarding its rigor and added value to the existing literature, raising the question of whether the method's users are following the best practice guidelines. Accordingly, a methodological literature review of studies adopting bibliometric analysis appears to be a timely and valuable endeavor. This paper offers a methodological review of 835 articles that applied bibliometric analysis from 1981 to 2022 in the fields of business, business finance, economics, and management. Findings show that the misuse of bibliometric analysis can be avoided. Critical issues related to the review methodology of bibliometric analysis, contribution to theory and practice, and review team composition are discussed in detail. Based on our review results, we provide recommendations for future bibliometric analysis use, offer guidelines for the review technique's application, and identify areas of further research interest. The originality and value-added of this study are that it is the first to highlight the use and misuse of bibliometric analysis in the business, economics, and management disciplines.

Keywords: *Research Methodology, Bibliometric Review, Guidelines.*

EXPLORING THE ELEMENTS AND INTELLECTUAL FRAMEWORK OF AGRICULTURAL COMPETITIVENESS RESEARCH

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Abstract

While agricultural competitiveness has a long history in academia, recent developments have rekindled interest among researchers. Factors like climate change, food security, price volatility, and shifts in agriculture have fueled this resurgence in scholarly attention, leading to a growing body of literature that reshapes research trends.

This study aims to comprehensively understand the components of agricultural competitiveness research and reveal the intellectual and cognitive frameworks from 1990 to 2022. Using bibliometric analysis, including bibliographic coupling and co-word analyses, we analyzed 622 articles from the Web of Science database with VOSviewer.

Findings show a notable surge in research activity, with a significant portion of contributions from the United States. Six distinct research themes emerged: energy efficiency and bioenergy, price volatility, uncertainty, and market behavior, structural changes in agriculture, rural development, policy issues, and climate change. This research also identifies potential future research areas.

This study is unique in its amalgamation of bibliometric techniques and significantly advances agricultural competitiveness research.

Keywords: *Agriculture, Competitiveness, Bibliographic Coupling, Current Research Trends.*

A NEW APPROACH TO STATISTICAL ARBITRAGE STRATEGY: TRIPLES TRADING

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Abstract

The statistical arbitrage strategy is one of the most widely applied approaches to detect trading opportunities in the stock market. Currently, this approach has been applied using portfolios formed by two pairs of stocks with similar co-movement.
In this article, we will apply a novelty, which will be to apply portfolios with triple stocks. To select these triple stocks, we will apply the Hurst exponent method.
Previous studies have shown that this strategy is profitable in inefficient markets and periods of high volatility. For this purpose, we will use stocks from the US energy market, during the periods 2000 to 2020, obtaining better results with triples than with pairs.

Keywords: *Statistical Arbitrage; Volatility, Triples Trading; Pairs Trading.*

REGULATION AND ENFORCEMENT IN THE EXPLOITATION OF THE GROUNDWATER RESOURCE

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Abstract

Sustainable pumping of water resource requires intervention by a public agency in order to avoid over-exploitation. For this reason, we study the evolution of compliance and regulation of grandwater resource when farmers can decide on wheter to comply or not with pumping quotas in a differential game. The public agency sets the optimal quotas and the farmers can choose between compliance or violation. We investigate the policy of the public agency which may impose sanctions to discourage withdrawals that deviate from the optimal quota. Using numerical simulations we analyze the effects that parameters have on the equilibrium of the aquifer and on the farmers behavior.

Keywords: *Groungwater Exploitation, Differential Game, Optimal Quota.*

AIBERTINO FOR STOCK PRICE PREDICTION: A GIBBS SAMPLING APPROACH

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Abstract

BERT (Bidirectional Encoder Representations from Transformers) is one of the most popular models in Natural Language Processing (NLP) for Sentiment Analysis. The main goal is to classify sentences (or entire texts) and to obtain a score in relation to their polarity: positive, negative or neutral. Recently, a Transformer-based architecture, the fine-tuned AlBERTo (Polignano et al. (2019)), has been introduced to determine a sentiment score in the financial sector through a specialized corpus of sentences. In this paper, we use the sentiment (polarity) score to improve the stocks forecasting. We apply the BERT model to determine the score associated to various events (both positive and negative) that have affected some stocks in the market. The sentences used to determine the scores are newspaper articles published on MilanoFinanza. We compute both the average sentiment score and the polarity, and we use a Monte Carlo method to generate (starting from the day the article was released) a series of possible paths for the next trading days, exploiting the Bayesian inference to determine a new series of bounded drift and volatility values on the basis of the score; thus, returning an exact and direct price as a result.

Keywords: *BERT, Sentiment Analysis, Stock market, Price forecasting.*

'HERD BEHAVIOR' IN THE COMMODITIES MARKET. A NEURO-FUZZY AGENT 'HERDING' ON DEEP LEARNING TRADERS

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Abstract

This paper analyzes the trading strategies of five state-of-the-art agents based on Reinforcement Learning on six commodity futures: Brent Oil, Corn, Gold, Coal, Natural Gas, and Sugar. Some of these were chosen because of the periods considered (when they became essential commodities), i.e., before and after the 2022 Russia-Ukraine conflict. Agents behavior was assessed using a series of financial indicators, and the trader with the best strategy was selected. Top traders´ behavior helped train our recently introduced neuro- fuzzy agent, which adjusted its trading strategy through "herd behavior".
The results highlight how the Reinforcement Learning agents performed excellently and how our neuro-fuzzy trader could improve its strategy using competitor movement information. Finally, we performed experiments with and without transaction costs, observing that, despite these costs, there are fewer transactions. Moreover, intelligent agents´ performances are outstanding and surpassed by the neuro-fuzzy agent.

Keywords: *Trading agents, Reinforcement Learning, Commodity, Herd behavior, Neuro- fuzzy system.*

ANT COLONY OPTIMIZATION FOR CHINESE POSTMAN PROBLEM

GIACINTO ANGELO SGARRO
LUCA GRILLI

University of Foggia

Abstract

This paper aims to solve the Chinese Postman Problem (CPP) using an Ant Colony Optimization (ACO) algorithm. In graph theory, the CPP looks for the shortest closed path that visits every edge of a connected undirected graph. This problem has many applications, including route optimization, interactive system analysis, and flow design. Although numerous algorithms aimed at solving CPP are present in the literature, there are very few meta-heuristic algorithms proposed, and no ACO applications have been proposed to solve it. This paper tries to fill this gap by presenting an ACO algorithm that solves CPP (ACO-CPP). In addition, it compares its performances with a Genetic Algorithm (GA) and a recursive algorithm that explores all the possible solutions and selects the best one. Experiments show that the ACO-CPP algorithm is efficient and can maintain consistency even when the number of possible solutions is much greater than the number of solutions explored.

Keywords: *Ant Colony Optimization, metaheuristic, Chinese Postman Problem, Eulerian path, Vehicle Routing Problem.*

DUALITY RESULTS FOR NONSMOOTH MATHEMATICAL PROBLEMS WITH VANISHING CONSTRAINTS

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University of Messina [(1)],
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Abstract

In this paper, we formulate and study the duality problems for nondifferentiable convex optimization problems with vanishing con- straints. We derive the weak, strong and strict converse duality results for the problems utilizing the convex subdifferential.

Keywords: *Anishing constraints, Duality results, Optimality conditions, convex subdifferential.*

TOWARDS MODELLING AND MEASURING THE NON-RANDOM WALK DOWN WALL STREET

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Abstract

We have heard of Burton G. Malkiel classic book and the - now - well-known phrase. A random walk down wall street or putting it another way; The best we can predict about tomorrows price of an asset is today price. If this is the case, then we would say that investors behave in a so-called rational manner. This, then, allows the application of the Geometric Brownian Motion model to model the processes that generate histograms (read empirical distribution) of the returns of assets, and it has a bell shape, (normal distribution;). However, empirical observation of histograms of asset prices shows peakier distributions with "fat tails" not always fitting a normal distribution.

So, an innovative extension of the Geometric Brownian Motion model is developed to incorporate these "fat tails". This newly designed model is called Irrational Fractional Brownian Motion" with optimal weighting factors. This model has a better capacity in fitting the returns distribution of historic data price indices than the Geometric Brownian Motion. Namely, it captures better the peakiness and fat tails generated by historical paths. With the Irrational Fractional Brownian Motion model, we re-examine agents; behaviours reacting to time-dependent news on the returns, thereby modifying a financial market evolution. We specifically discuss the role of financial news or economic information positive or negative feedback of such irrational (or contrarian) agents upon the price evolution. We observe a kink-like effect reminiscent of soliton behaviour, suggesting how analysts forecasts errors induce stock prices to adjust accordingly, thereby proposing a measure of the irrational force in a market. Subsequently, we quantify and forecast the fat tail(s) numerical value in asset returns distributions using the irrational fractional Brownian motion model. Optimal model parameter values are obtained from fits to consecutive daily 2-year period returns of index over [1950–2016], generating 33-time series estimations. Through an econometric model, the kurtosis of returns empirical distributions is modelled as a function of these models parameters. An auto-regressive analysis on the estimated parameters advances the modelling implications, making possible the forecasting of kurtosis. Concluding, the models improvement increases the ability to fit the empirical return; distributions, providing a more accurate theoretical shape of the returns distributions. Consequently, the tools to make financial evaluations based on the returns; distribution assumptions can be used under this alternative approach, such as the Value at Risk case.

Keywords: *None.*

ADVANCES ON LSTM MODELING ANALYZING CREDIT RISK MANAGEMENT AND CAUSAL IMPACT EVIDENCES

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MASSIMILIANO FERRARA

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Abstract

The aim of this talk is to present some new findings related to Deep learning and its connections with other fields strictly related to itself as Business Analytics and Bayesian Statistics. The talk is divided into two parts.

Although deep learning has seen widespread adoption recently, it has not been widely used in the credit-scoring industry. This talk - in the first part- applies the complicated field of deep learning known as stacked unidirectional and bidirectional LSTM (long short-term memory) networks to resolve credit scoring issues. Since credit scoring is not a time sequence problem, the suggested robust model uses the full capability of the three-layer stacked LSTM and BDLSTM (bidirectional LSTM) architecture by treating and modeling public datasets in a new way. Our suggested models beat state-of-the-art, considerably more complicated deep learning methods, proving that we could keep complexity to a minimum.

In the second slot, we propose by using a combination of two models, the Google model (named CasualImpact) and a Bidirectional LSTM, along with an Incremental Difference in Difference model, to infer information from time series data in order to analyse the causal impact of an event on a particular phenomenon over time. This study aims to integrate the use of these three models and iterate this approach in order to give a thorough analysis of the temporal causal influence of an event on a phenomenon.

Keywords: *Credit scoring, deep learning, business analytics, Long Short-Term Memory (LSTM), credit risk management.*

RESILIENCE BONDS, GREEN TRANSITION AND COMPLEX DYNAMICS

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Abstract

In our model there is a set of firms (policy-holders) exposed to possibly catastrophic risks, which could be mitigated through the implementation of green technologies. Hence, the insurance company (or a pool of them) issues periodically so called resilience bonds, which are designed as cat-bonds, but, in case the risk and thus their interest rates, decrease by the adoption of green technologies from a sufficient number of firms, they contribute to finance the green transition (e.g., through a premium discount). On the other hand, the public administration (e.g., the state) is interested to favor the adoption of green technologies, by lowering the threshold of its coverage when the green technology spreads. This way a dynamical interaction takes place, involving the bonds interest rate, the share of virtuous firms and the threshold of the state coverage. We study such a dynamics adopting a discrete dynamical model, through a simplified, but realistic and strongly nonlinear, version. In fact, we were able to detect two main scenarios generated by the system. In one, all the trajectories converge to the optimal equilibrium, where all the firms adopt green technologies and the rate (or spread) of the resilience bonds is minimum. In the other scenario, instead, a region denoted as a "poverty trap" appears, meaning that if, in particular, the virtuous firms are initially below a critical mass, the trajectories starting in that region converge to a sub-optimal equilibrium, where the share of virtuous firms is lower than 1 and the resilience bonds interest rate is not minimum. In conclusion, the research is addressed to detect the parameter values, i.e. the political and technical conditions, leading to either scenario.

Keywords: *Green transition, Resilience bonds, Discrete dynamics, Poverty trap.*

LONGEVITY RISK MODELLING USING NEURAL NETWORKS

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Parthenope University of Naples

Abstract

Quantiles of the mortality rates are relevant in life insurance to control longevity risk properly. In this work a neural network is employed to calibrate individual quantile Lee-Carter models (Santolino 2020) jointly using all the available mortality data. In this setting, some common network parameters are used to learn the age and period effects of multiple quantile LC models. Numerical experiments performed on all the countries of the Human Mortality Database validate our approach. The predictions obtained considering the median level appear more accurate than those obtained with the mean models; moreover, those at the tail quantile levels capture the future mortality evolution of the populations well.

Keywords: *Lee-Carter Model, Multi-population mortality modelling, Multivariate time series, Neural Network.*

AN EXPLAINABLE DEEP LEARNING EXTENSION OF THE LSMC FOR SOLVENCY CAPITAL

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Abstract

The European Union Directive 2009/138/EC -- better known as Salvency II requires that, to be solvent, insurance and reinsurance undertakings should hold their own funds able to cover losses in excess to expected ones at the 99.5% confidence level over a one-year period. For the insurance company that adopts the internal model, the measurement of this Solvency Capital Requirement (SCR) requires deriving the full probability distribution of the Net Asset Value (NAV), the value of assets minus the value of liabilities, over a one-year period.

To comply with the market-consistent evaluation principles imposed by the Directive, the calculation of this distribution follows a two-level simulation procedure that presents prohibitive computational times, even using distributed computation with several hundreds of cores. The Least Square Monte Carlo (LSMC) is one of the most popular methods used for reducing the computational costs of full nested simulations. The main idea consists of finding an approximation for the conditional expectation function to obtain an estimate of the NAV in each scenario, avoiding the second stage of simulations.

We introduce an extension of the LSMC method based on modern explainable deep learning models. More specifically, the proposed method combines the flexibility of the Neural Networks with the explainable structure of the Generalised Linear Model. Numerical results performed on realistic insurance portfolio data show that our method is able to obtain accurate results and provide useful insights about the impact of the risk drivers on the NAV of the portfolio.

Keywords: *Neural Networks, Life-Insurance, Least Squares Monte Carlo.*

THE OPEN MANAGER APPROACH: INNOVATION
IN MANAGEMENT STYLES

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PAOLO BRUTTINI
PAOLO MARIANI
MICHELE GALLO

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Abstract

Using a sample of about 323 Italian companies and 423 managers from July 2020 - March 2021, the work tests hypotheses on reliability of The Open MOOd Questionnaire. Data collected are analyzed by a psychometric model and a latent trait is found. Results are verified and validated. Moreover, external robustness is assured by comparing the Rasch Analysis results with other statistical methods. The purpose of this work is to measure the level of openness of managers through the Open MOOd Questionnaire. Which aspects allow us to identify different management styles, and if the openness characterises specific clusters of managers. The study shows that the openness attitude in the professional activity of the managers is very high. the Open MOOd Questionnaire can be improved by considering some dichotomic items. The study highlights the model proposed identifies the Open Manager´s competencies, and identifies teaching methods for their development. The authors propose a new model to study openness. Diagnostic tools of consolidated statistical methods show that the Open MOOd Questionnaire is an effective tool to evaluate the openness.

Keywords: *Openness, Innovation, Human Resources Analysis, Open Manager, Partial Credit Model.*

DATA SCIENCE IN HUMAN & SOCIAL SCIENCE: BEHAVIORAL INTENTION

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Abstract

In recent years it has been seen an increasing use of Data Science also in education, social sciences and humanities fields. In this paper we want to present the overall work that led to the creation of a competence framework in data science, which aims to provide a comprehensive and coherent set of learning outcomes and assessment criteria for data science education at university level. The questionnaire was designed to assess the students' self-perception of their data science competencies according to the Framework, as well as their motivation, interest, and confidence in pursuing a career in data science. The study involved a sample of 440 students from different European universities, with the aim of assessing their level of knowledge and acceptance of Data Science. An exploratory analysis was carried out through Principal Component Analysis (PCA) to assess the uni-dimensionality of the scale. Next, the model was analyzed using the Partial Least Squares Structural Equation Modeling (PLS-SEM) to evaluate the impact of Individual Reaction (IR) and Data Science scale (DS) usage on Behavioral Intention (BI) about using data science. In particular, we intend to examine the effect that IR and DS have on BI. The results show that both IR, measured through constructs of performance expectation, effort expectation, self-efficacy, social influence, and DS utilization, measured through constructs of attitude, perceived ability, interest, and value, positively influence BI. The model highlights the presence of direct relationships between IR and BI, and between DS and BI. Good IR and high DS values predict greater behavioral intent (BI) in using DS in the future. These results therefore suggest that improving IR and developing a positive attitude towards DS may encourage the adoption of data analysis techniques by university students in the humanities and social sciences.

Keywords: *Data Science, Social Science, PLS-SEM.*

ON THE COMPATIBILITY AMONG PRIORITY VECTORS AT VARYING TRANSITIVITY THRESHOLDS

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Abstract

Pairwise comparisons are the most common tool used for representing preferences in multi-criteria decision problems. However, judgements expressed by pairwise comparisons could be not consistent. It is important to distinguish between cardinal and ordinal consistency. The former implies that the judgements are both transitive and proportional, whereas the latter refers only to transitive judgements.

Several consistency indices have been proposed in the literature to measure the level of inconsistency in a set of pairwise judgements. Many authors introduced threshold values for some consistency indices according to different sizes of the pairwise comparison matrix (PCM). The consistency of judgements is strictly connected with the reliability of the preferences expressed by the priority vector. If the judgements are not consistent (that is both cardinal and ordinal consistent), then the prioritization methods could provide different results. However, if a PCM is transitive, then most methods provide vectors representing the same ranking, expressing in this way the same preferences: only the intensity of the preferences may vary. Amenta et al. introduced approximated transitivity thresholds for some consistency indices. These thresholds are useful because they may allow to avoid the revision of the judgements, if the decision maker is only interested in the ordinal consistency, and they ensure that all vectors prioritization methods provide the same ranking. If the value assumed by the consistency index is ranged between the consistency and the transitivity threshold values, then we are confident about the reliability of the preferences.

This paper focuses on the transitivity thresholds and analyzes, through a simulation study, the compatibility among priority vectors computed by three different prioritization methods. Furthermore, a measure of the reliability of priority vectors is computed to evaluate the agreement between priority vectors and the entries of PCM.

Keywords: *Pairwise Comparison Matrix, Transitivity Thresholds, Compatibility Measure, Priority Vector.*

TESTING CAUSAL RELATIONS IN MEASUREMENT MODELS: THE IMPACT OF ADJUSTMENT CRITERIA IN CTA-PLS

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University of Salento [1],
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Abstract

In Structural Equation Modelling (SEM), latent constructs are analysed using observed indicators, with connections between latent and manifest variables characterised as either reflective or formative. Reflective measurement assumes latent constructs exist independently of their manifest indicators, while formative measurement views the latent variable as a composite of different observed aspects.

Robust techniques within Partial Least Squares SEM (PLS-SEM) efficiently manage both measurement modes. However, choosing between them has computational and conceptual implications for model interpretation. This prompts the research of new techniques to support the selection of the measurement mode, in addition to theoretical considerations. This contribution focuses on Confirmatory Tetrad Analysis in PLS-SEM (CTA-PLS), which extends the tetrad test [1] into the PLS-SEM framework [2], and explores it from a decision-making perspective. When the choice between reflective and formative modes is formalised through a set of assumptions regarding vanishing tetrads, the decision relies on multiple hypothesis testing; then, we investigate the impact of various criteria for adjusting the statistical significance level. Specifically, we compare the well-established Bonferroni correction with alternatives like the Benjamini-Hochberg and Benjamini-Yekutieli corrections. Through a simulation study, we assess the superior performance of the Benjamini-Hochberg method in terms of test power. We also analyse its significance level across diverse empirical datasets. For both of these analyses, we discuss the impact of the number of manifest variables and the sample size.

Keywords: *Tetrads, Multiple Testing, CTA-PLS, PLS-SEM.*

NON-EQUILIBRIUM FINANCIAL MARKET DYNAMICS

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M.A. SÁNCHEZ-GRANERO [1]
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Abstract

In this work we study the broad stochastic behavior of Financial Markets and their dynamics [1, 2], by considering an approach from Non-Equilibrium Statistical Mechanics [3]. We empirically explore price fluctuation distributions from the currency exchange market, and their relation to market evolution when variables such as market volume or different classes of market investors dominate market operations. A model is proposed which allows efficiently resolving currency market price fluctuations, where prices are constraint at short times, thus where currency prices move according to diffusion and subdiffusion, and able to display larger price variations at long times due to market movements, either inherent or external to the market [4]. Within such framework, it is possible to resolve currency exchange market states in time by establishing magnitudes characteristic to many body stochastic systems, in turn characteristic to different market conditions. We extend our approach to other financial markets such as the commodities one, or the stock exchange, and now, we also focus on the evolution of market volatility in time. We consider Timer Resolved Correlation Techniques usually employed in non-equilibrium systems [5], which allow to efficiently track market volatility and relate it to market phase dynamics, and furthermore, to risk assessment. Consequently, we establish a framework in which market efficiency can be evaluated in real time and correlate it to operating market variables, such as trading and investment volumes, amount of operations in time, and the role of different investors. Finally, we propose to synergize our findings with investment strategies, and the learning and operating processes in AI and Machine learning on financial markets such as the stock one, cryptocurrencies, commodities, currency exchanges, futures, and derivatives.

Keywords: *financial markets, market dynamics, volatility, market efficiency, risk management.*

CLASSIFYING HOUSEHOLD LIFE SATISFACTION AT THE COUNTRY LEVEL: A FINANCIAL SERVICES PERSPECTIVE.

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Abstract

The objective of this study is to examine the impact of financial services on household life satisfaction while generating a classification model utilizing the random forest algorithm to predict satisfaction levels in each country. The data was derived from the World Bank's Global Findex Database and the Gallup World Poll covering the years 2014, 2017, and 2021. The sample consists of 6,660 observations from a total of 120 countries. Results demonstrate that financial inclusion (having a bank account) and credit card usage are critical predictors of life satisfaction level. Additionally, the classification model effectively predicts household life satisfaction with an accuracy rate of 83.6%. These findings have significant implications for financial service providers, policymakers, and researchers who seek to comprehend the connection between financial inclusion and household well-being. By providing an improved comprehension of the factors affecting household life satisfaction, this study can inform policy and financial product development to facilitate enhanced financial inclusion and, ultimately, enhance overall well-being.

Keywords: *Life satisfaction, financial services, financial inclusion, random forest algorithm.*

ASSET CONCENTRATION, CONNECTEDNESS AND FINANCIAL STABILITY

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Abstract

Bank competition is reduced as assets become increasingly concentrated in a smaller set of financial institutions due to the fusions and acquisitions that are increasingly happening throughout the world. The effect of higher asset concentration on financial stability intrinsically depends on its effect on the topology of the financial system, since connectedness is one of the most relevant sources of systemic risk. This paper dynamically evaluates the effect of asset concentration on the interconnectedness of the financial system and analyzes its implications for its stability. By employing inference methods for dynamic networks, the continuity and linearity of the relationship is analyzed. We expect asset concentration to have a strong impact on financial markets, which may not be monotonic or linear over time. This has important implications for internal risk management, macroprudential, and microprudential policy, since as asset concentration increases, the financial system is redefined, and so should be risk models and measures.

Keywords: *Asset concentration, Bank competition, Financial stability, Connectedness.*

HOW QUALITY FACTORS AFFECT PATIENT SATISFACTION IN THE SPANISH HEALTHCARE SYSTEM

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SALVADOR CRUZ RAMBAUD
JAVIER SANCHEZ GARCIA

University of Almeria

Abstract

Healthcare is one of the main concerns of every country. An effective and efficient healthcare system is understood in terms of quality and patient satisfaction. Therefore, its relationship must be studied in order to find the quality factors that affect patient satisfaction. The main objective of this work is to explain the link that exists between quality indicators and the dimensions of patient satisfaction. After a review of the literature, a Generalized Method of Moments (GMM) regression analysis with panel data, will be performed, to explain how macro-financial variables influence quality factors and how these factors influence patient satisfaction in the end. The preliminary results are theoretical. On the one hand, they provide a theoretical explanation of the main quality indicators that are related to economic circumstances. On the other, they specify the expected relationship between quality of care factors and patient satisfaction. The importance and novelty of this work is based, above all, on the relationship between the three concepts, macro-finance, quality of care, and patient satisfaction.

Keywords: *Patient satisfaction, quality of care, healthcare system, panel data econometrics.*

ON THE USAGE OF REGULATION-BASED INVESTMENT POLICIES OF MUTUAL FUNDS: A PERFORMANCE COMPARISON.

EDVINAS GRIZICKAS SAPKUTE
MIGUEL A. SÁNCHEZ GRANERO
JUAN E. TRINIDAD SEGOVIA

University of Almería

Abstract

Mutual fund performance is a very important topic that has been dealt with by lots of researchers. In the last decade, the main question is expanded to the socially responsible and environmental funds, comparing their behavior against the conventional peers. Lately, some studies about the regulatory frameworks arose, regarding the usage of the investment policies that the North American and European collective institutions must abide to, displaying that the regulation-based constraints allow for better results, especially from the efficiency standpoint. In the current research, we will expand the latest topic by simulating another legislation-restricted scenario that matches the general ruling for regions like Canada or India, in order to present more evidence of how these imposed limits affect the performance of these investment organizations. The data from our latest simulations will be compared with the previously available evidence as well, in order to see the main changes that may occur within the various boundaries, providing therefore a better understanding of these constraining features.

Keywords: *Mutual Funds, Constraints, Performance, Thresholds.*

BETA IS NOT DEAD: DEVELOPED VS. EMERGING MARKETS

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JUAN E. TRINIDAD SEGOVIA
MIGUEL A. SÁNCHEZ GRANERO

University of Almería

Abstract

Since the first doubts about the explanatory power of the Sharpe Model appeared, a great variety of alternative factors have been proposed by the financial literature to explain the cross-sectional expected returns of the financial assets. Many studies have been carried out to determine the plausability of these proposed alternative factors. In Molero-González et. al (2023) we presented a new approach from Random Matrix Theory to determine if Abitrage Pricing Theory models are better than the Sharpe Model to explain the cross-sectional expected returns, demonstrating that just one factor resulted to be significant for the S&P500 and Nasdaq markets: the market factor.

In this paper, we continue the analysis already begun, generalising the study to the rest of the world's markets, differentiating between developed and emerging markets.

Keywords: *Random Matrix Theory, APT Models, Sharpe Model, Emerging Markets, Market Beta.*

ANALYSIS OF THE LAW OF FALLING RATE OF PROFIT
FOR THE EUROPEAN CASE

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Abstract

The aim of this work is to analyze the existence or not of a decreasing rate of profit in Europe, as well as to determine the factors influencing it according to the Marxist theory of profitability. To do so, a panel data model has been estimated for 7 European countries over a period of more than 60 years (from 1960 to 2021 inclusive). The results obtained allow us to verify the existence of a tendency for the profitability to fall, which could lead the capitalist system to fail.

Keywords: *Marxian Economics, Falling Rate of Profit, Panel Data Analysis.*

A RISK-BASED MODEL FOR THE REPLACEMENT RATE EVALUATION IN A DEFINED CONTRIBUTION PENSION SCHEME

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Abstract

Due to the provisions issued by EIOPA in 2019 [2] and 2021 [4], a pension scheme is obliged to implement an internal model aimed at estimating the optimal trade-off between the long-time pension fund's economic sustainability and the adequacy of benefits for pensioners.

The research proposes a multi-phase risk-based model that allows for the estimate of the conditional probability distribution of the stochastic variable replacement rate subject to the stochastic variable yield return of assets.

The problem is to calculate the probability distribution of the stochastic replacement rate at time T, given the salary value at the retirement time, subject to a specific financial scenario conditional to the stochastic variation of the market value of the financial portfolio backing the workers´ pension obligations time by time.

To this aim, we consider a Defined Contribution pension scheme and a worker's position during the so-called accumulation phase. The multi-phase model here proposed consists of a four-step simulation approach:

i) An economic and financial scenario generator is developed based on a real-world approach, to run the financial results of the replacement rate;

ii) The actuarial risk is performed using the Crisma-Pitacco model [1];

iii) A simulation of the pension account value for each financial scenario is given, and then a calculation of the replacement rate is provided;

iv) The estimation of the conditional probability distribution of the replacement rate at time T, given a given asset strategy is performed.

An application of the stochastic approach is performed based on a real dataset from a defined contribution pension scheme.

Keywords: *Dened Contribution Pension Scheme, Replacement Rate, Crisma-Pitacco Model.*

THE ESG SCORE AND THE CORPORATE FINANCE RATIOS:
THE CASE OF EUROPE

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Abstract

ESG issues play a central role in the foundation of business strategies; for asset managers and financial institutions, ESG is now an essential part of risk management. Measuring the ESG commitment of companies using ESG ratings has been questioned but is becoming common for stock selections and asset management strategies. In this paper, we want to analyze the role played by ESG ratings in the performance of European-listed companies. We use ESG ratings and corporate balance sheet information for the European companies constituent the various stock indices, to identify which are the company structural drivers explaining the ESG score for the European companies. We use a Machine Learning approach to account for non-linear relationships and to identify, for each country, the main drivers of the ESG score, providing insights for sustainable investment selections. We also study how the Environment, Social, and Governance components affect the various economic sectors and explain their recent dynamics in Europe.

Keywords: *ESG score, Machine Learning, Corporate Finance, Sustainability.*

NEW METHOD TO SOLVE INTEGRAL EQUATIONS FOR VARIABLE ANNUITIES EVALUATION WITH STOCHASTIC VOLATILITY

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Abstract

A Variable Annuity (VA) differs from traditional life insurance products because, when the insurer invests the policy premium in a risky portfolio, the policyholder bears profits or losses, according to the investment performances. In general, the dynamics of such a portfolio are defined via a geometric Brownian motion with constant interest rate and volatility, see e.g. Shen et al. (2016) and De Angelis et al. (2022). However, such a choice might be unrealistic, since it fails to incorporate well-known stylized facts observed in the financial market, such as the volatility smile/skew, see e.g.Heston (1993).

Moreover, the presence of an American option embedded in the structure of a VA makes it unfeasible to determine a closed-form formula for such a contract, regardless of the market model. Therefore, we have to resort to ad-hoc numerical techniques, such as nite difference methods for the associated PDE, see e.g. Shen et al. (2016). Another possible route is to refer to the integral equation characterizing the early exercise boundary, as shown in Kim (1990).

Within the latter setting, and along the lines of Adolfsson et al. (2013), in this paper we propose a novel algorithm to solve integral non-linear two-dimensional Volterra equations in a stochastic volatility framework by exploiting specific features of the Fourier-type integrals involved.

Keywords: *Variable Annuities, Integral Equations, Stochastic Volatility, Numerical Methods.*

HOW HEALTH-RELATED ISSUES IN ESG INSURANCE INDUSTRY CAN INFLUENCE ADVERSE SELECTION

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Abstract

Sustainable criteria, i.e. environmental, social and corporate governance (ESG) factors are attracting the attention of investors, policy makers, and civil society stakeholders. ESG factors pose considerable challenges in insurance industry too. According to Insurance Distribution Directive (August 2022), insurers must quantify how far their products satisfy sustainability criteria. In particular, health insurers that are not able to meet the sustainability criteria that their customers are seeking, may perform badly in terms of ESG ratings, which might result in reputational damage (Milliman White paper). Broadly speaking, in line with the double materiality concept, the health-related issues are growing more important for the rating process as well as the rating process could affect the financial stability of health insurers. Furthermore, the individual investors with strong sustainability preferences represent a target group more willing to invest in health and life insurance products. The empirical evidences show that these customers are also characterised by a lower probability for preexisting medical disorders, potentially leading to a lower or higher portfolio risk for the insurer in respect of the different line of business. In this research, we intend to investigate the correlation among the sensitivity to the health-related issues in ESG and the mechanism of the potential adverse selection (Cutler et al. 1998; Simon 2005).

Keywords: *ESG, Adverse selection.*

HOW MANY FACTORS EXPLAIN THE O&G SECTOR? AN APPROACH FROM RANDOM MATRIX THEORY

ANTONIO JESUS GARCIA AMATE
LAURA MOLERO GONZALEZ
JUAN EVANGELISTA TRINIDAD SEGOVIA
MIGUEL ANGEL SANCHEZ GRANERO
ANDRES GARCIA MEDINA

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Abstract

Most of the energy consumed is oil and gas. Increasingly, O&G companies are playing a key role in providing the world with safe and efficient energy. For decades, attempts have been made to study the factors that explain the price performance in this sector. The aim of this paper is to find out how many factors explain the performance of the O&G sub-sectors through Random Matrix Theory. It also tests whether the Brent price is as important as previous literature estimates. According to the results, Brent becomes the only factor explaining the price in the upstream and midstream subsectors for certain time-frames, while for most of the time the only factor is the market. For the downstream subsector there are no significant factors except in certain periods. These results may have far-reaching implications for investors and policy makers.

Keywords: *O&G sector, RMT, Brent.*

6. POSTERS

TOURISM FACILITIES AS A CASE STUDY FOR GROUP-PAHP CONSISTENCY CHECKS DURING THE COVID-19 EPIDEMIC

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Abstract

The COVID-19 pandemic crisis brought to light the world's tourist systems' high susceptibility and defined a scenario marked by significant uncertainty, bad prospects, and pervasive fragility. In our research, we suggest using MultiCriteria Decision Aiding (MCDA) to examine the possibility of local territorial development through the enhancement of the tourism infrastructure. To be more specific, we suggest applying the Parsimonious AHP (Abastante et al. 2019) for group decisions to study a problem involving the upgrading of tourism facilities. There might be issues with judgment consistency, which would affect the consistency of the matrices as the complexity of the decision-making problem and the number of decision-makers increase (Brunelli and Cavallo 2020a). In the real world, consistency is difficult to attain.

Keywords: *MCDA, Parsimonious AHP, Decision Analysis, Consistency.*

A DYNAMIC APPROACH OF AHPSORTII TO CLASSIFY STEM MASTER'S COURSES IN ITALY

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Abstract

This paper proposes a dynamic AHPSort II for performance evaluation in public administration by introducing a new methodological approach for determining the profiles useful for alternatives sorting. In particular, the paper analyzes the performance of master's graduates [1] in STEM (Science, Technology, Engineering, Mathematics) disciplines in Italy. Data are from the Almalaurea surveys on the employment status of graduates, related to the period 2018-2022, and refer to graduates three years after graduation. The analysis considers nine indicators that account for academic performance, employment, and satisfaction for the course of study and for the current work. STEM disciplines include 41 master's degree classes that correspond to over 600 courses.

In the first step, information on individual master's courses is analyzed and synthesized in order to identify any similarities among STEM disciplines and/or associations among the indicators examined. The results obtained by applying the Principal Component Analysis show that degree courses with similar characteristics define groups mostly coinciding with the 4 STEM categories. In the second step, in order to sort the 41 master's degree classes taking into account the 9 indicators, we use AHPSortII [2], a multicriteria method that, among those proposed in the literature, allows handling a large number of alternatives and criteria. The procedure can be repeated or easily automated. In applying this method, contrary to what is provided in the literature [3] [4], we propose to determine the central (or limiting) profiles using thresholds defined as a function of tertiles; this prevents arbitrariness that represents the main weakness of the AHPSortII method. The method is applied with reference to each year of the period 2018-2022, then proposing for the first time a dynamic approach.

Keywords:C*classification method, AHPSortII, PCA, STEM degree courses.*

A FUZZY-BASED THEMATIC CLASSIFICATION METHOD FOR THE REAL ALBERGO DEI POVERI, NAPLES (ITALY)

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Abstract

In recent years, EU policies have aimed to establish circular transition pathways towards sustainable urban and territorial models. The Circular City Model (CCM), aligned with circular economy principles, provides a theoretical framework for sustainable urban development and evaluation. Specifically, CCM encourages reflections on re-using dismissed or under-used cultural heritage as a fundamental element of local identity, social cohesion, and a driver for context regeneration and reduced land consumption.

In response to a Municipality of Naples' request, starting from funding under the National Recovery and Resilience Plan (PNRR), this research aims to develop a methodology to define the cultural potential of the Real Albergo dei Poveri, as a meanwhile space waiting for suitable re-use strategies. Rewriting the role of this important building could be a way to operationalize the CCM by initiating processes of urban transformation and social and cultural innovation.

The goal is to create a Fuzzy thematic classification model based on Fuzzy C-means clustering that identifies a network of cultural, creative, and social non-governmental organizations, humanitarian organizations, and informal groups that could enable a culture-led re-use process.

The methodological framework includes. a) a mapping of associative realities present in the Naples area; b) a fuzzy-based thematic classification, accommodating multi-valued definitions; c) the elaboration of dataset with diverse attributes, allowing each data points to join multiple clusters with varying fuzzy membership degrees; d) the implementation of results into a Geographic Information System (GIS) environment.

The research intends to contribute to implementing the CCM, fostering a sustainable and resilient urban environment, providing a data-driven approach to leveraging AI for cultural assessment and urban regeneration, and helping to activate aware re-use strategies for cultural heritage.

Keywords: *Fuzzy C-Mean Algorithm, Circular City Model, Circular Economy, Cultural Heritage.*

BAYESIAN SPACE-TIME MODELING OF ISCHEMIC STROKE INCIDENCE AND MORTALITY IN ALMERÍA USING INLA

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Abstract

Introduction:

Ischaemic stroke represents a public health problem likely to increase due to population ageing.

This study focuses on the region of Almería, using a Bayesian spatiotemporal approach to understand the local patterns of this disease.

Objetive:

Analyze the risk zones associated with ischemic stroke mortality in the province of Almeria. [1] Ecological design study with an inferential component on a retrospective cohort of patients with a primary diagnosis of ischemic stroke and the development of predictive models to predict the relative risk of incidence and mortality of ischemic stroke.

Rstudio was used to analyze data from the Conjunto Mínimo Básico de Datos (CMBD) using Bayesian inference methods for spatiotemporal data.

This model assumes that the number of cases Y_{ij} observed in county i and year j are modeled.

Spatial and temporal structures that take into account spatial and spatiotemporal correlation. The relative risk quantifies whether the disease risk in municipality than the average risk in Almería.

A spatial-temporal model with INLA was chosen due to the low prevalence of the pathology, enabling the illustration of geographical variations with greater precision in the corresponding figure. To obtain the list of neighbors for each of the municipalities, poly2bn() function of the sdep package will be used [2] Bayesian inference will be performed to fit spatial and spatiotemporal models of disease risk using the R-INLA package [3]. We estimate the relative risk of mortality and incidence for each Municipality and Year using the model of Bernardinelli [4]. The model includes a spatial random effect that smoothes the data according to a neighborhood structure and an unstructured component that models uncorrelated noise [5].

Discussion:

In the time period studied, under a Bayesian approach, we conclude a discrete increase in the incidence rate, with a decrease in mortality of possible multifactorial origin.

Keywords: *Ischaemic Stroke, Bayesian, INLA, Incidence, Mortality.*

RESEARCH EVALUATION WITH NEURAL NETWORKS

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Abstract

In many countries, the evaluation of the is performed by public agencies, that produce an assessment of the activities produced by universities and other HEIs. This assessment is important since the allocation of public funds is based on this information. In our contribution, we are using neural networks to predict this exercise, and comparing our results with linear models proposed in the existing literature. Results show that our approach can effectively predict the research evaluation performed in the UK.

Keywords: *None.*