



THE ATHENS INSTITUTE FOR EDUCATION AND RESEARCH

Abstract Book

**17th Annual International Conference on
Mathematics: Teaching, Theory &
Applications
26-29 June 2023 Athens, Greece**

**Edited by
Codruta Stoica & Olga Gkounta**

2023

Abstracts
17th Annual International
Conference on Mathematics:
Teaching, Theory & Applications
26-29 June 2023, Athens, Greece

Edited by
Codruta Stoica & Olga Gkounta

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Preface

This book includes the abstracts of all the papers presented at the 17th Annual International Conference on Mathematics: Teaching, Theory & Applications (26-29 June 2023), organized by the Athens Institute for Education and Research (ATINER).

A full conference program can be found before the relevant abstracts. In accordance with ATINER's Publication Policy, the papers presented during this conference will be considered for inclusion in one of ATINER's many publications only after a blind peer review process.

The purpose of this abstract book is to provide members of ATINER and other academics around the world with a resource through which they can discover colleagues and additional research relevant to their own work. This purpose is in congruence with the overall mission of the association. ATINER was established in 1995 as an independent academic organization with the mission to become a forum where academics and researchers from all over the world can meet to exchange ideas on their research and consider the future developments of their fields of study.

To facilitate the communication, a new references section includes all the abstract books published as part of this conference (Table 1). I invite the readers to access these abstract books –these are available for free– and compare how the themes of the conference have evolved over the years. According to ATINER's mission, the presenters in these conferences are coming from many different countries, presenting various topics.

Table 1. *Publication of Books of Abstracts of Proceedings, 2010-2023*

Year	Papers	Countries	References
2023	41	24	Stoica and Gkounta (2023)
2022	34	22	Stoica and Gkounta (2022)
2021	38	19	Papanikos (2021)
2020	44	25	Papanikos (2020)
2019	28	15	Papanikos (2019)
2018	31	19	Papanikos (2018)
2017	29	16	Papanikos (2017)
2016	21	14	Papanikos (2016)
2015	36	18	Papanikos (2015)
2014	35	21	Papanikos (2014)
2013	60	33	Papanikos (2013)
2012	43	27	Papanikos (2012)
2011	78	33	Papanikos (2011)
2010	28	15	Papanikos (2010)

It is our hope that through ATINER's conferences and publications, Athens will become a place where academics and researchers from all over the world can regularly meet to discuss the developments of their disciplines and present their work. Since 1995, ATINER has organized more than 400 international conferences and has published over 200 books. Academically, the institute is organized into 6 divisions and 37 units. Each unit organizes at least one annual conference and undertakes various small and large research projects.

For each of these events, the involvement of multiple parties is crucial. I would like to thank all the participants, the members of the organizing and academic committees, and most importantly the administration staff of ATINER for putting this conference and its subsequent publications together.

Gregory T. Papanikos
President

Editors' Note

These abstracts provide a vital means to the dissemination of scholarly inquiry in the field of Mathematics. The breadth and depth of research approaches and topics represented in this book underscores the diversity of the conference.

ATINER's mission is to bring together academics from all corners of the world in order to engage with each other, brainstorm, exchange ideas, be inspired by one another, and once they are back in their institutions and countries to implement what they have acquired. The *17th Annual International Conference on Mathematics: Teaching, Theory & Applications* accomplished this goal by bringing together academics and scholars from 24 different countries (Algeria, Australia, Canada, China, Colombia, France, Georgia, Germany, India, Indonesia, Israel, Italy, Japan, Kuwait, Poland, Portugal, Romania, Saudi Arabia, Serbia, Spain, Türkiye, UAE, UK, USA), which brought in the conference the perspectives of many different country approaches and realities in the field.

Publishing this book can help that spirit of engaged scholarship continue into the future. With our joint efforts, the next editions of this conference will be even better. We hope that this abstract book as a whole will be both of interest and of value to the reading audience. May it be a stimulus for further research and the progress of the discipline.

Codruta Stoica & Olga Gkounta
Editors

**17th Annual International Conference on Mathematics:
Teaching, Theory & Applications, 26-29 June 2023, Athens,
Greece**

Organizing & Scientific Committee

All ATINER's conferences are organized by the Academic Council. This conference has been organized with the assistance of the following academic members of ATINER, who contributed by reviewing the submitted abstracts and papers.

1. Gregory T. Papanikos, President, ATINER & Honorary Professor, University of Stirling, U.K.
2. Codruta Simona Stoica, Head, Mathematics & Statistics Unit & Professor and Vice-Rector, Aurel Vlaicu University of Arad, Romania.
3. Timothy M. Young, Director, Center for Data Science (CDS), Emeritus Professor, The University of Tennessee, USA & CEO and President, T.M. Young Institute, LLC, USA.

FINAL CONFERENCE PROGRAM

17th Annual International Conference on Mathematics: Teaching, Theory & Applications, 26-29 June 2023, Athens, Greece

PROGRAM

Monday 26 June 2023

08.30-09.30
Registration

09:30-10:00

Opening and Welcoming Remarks:

- **Gregory T. Papanikos**, President, ATINER.

10:00-11:30 Session 1

Moderator: Timothy M. Young, Emeritus Professor, The University of Tennessee, USA & CEO and President, T.M. Young Institute, LLC, USA.

1. **Codruta Stoica**, Professor, Aurel Vlaicu University of Arad, Romania.
Title: Advances in the Study of Integral Type Properties.
2. **Victor Oxman**, Professor, Western Galilee College, Israel.
Title: Using Hint Buttons in GeoGebra applets when teaching Geometric Proofs.
3. **Khalid Mohammed Alkhuzaim**, Professor, Imam Mohammad ibn Saud Islamic University (IMSIU), Saudi Arabia.
Thamer Ali Alwahbi, Teacher, Riyadh, Kingdom of Saudi Arabia Ministry of Education, Saudi Arabia.
Title: The Availability Level of the Aesthetic Approach in Mathematics Textbooks for the Higher Grades at the Primary Stage in Saudi Arabia.
4. **Barbara Barańska**, Associate Professor, Pedagogical University of Cracow, Poland.
Małgorzata Zambrowska, Associate Professor, The Maria Grzegorzewska University of Warsaw, Poland.
Title: No Teacher (Should Be) Left Behind: Teaching Mathematics as a Second Subject – Educational Challenges for Teacher Training Programs.

Discussion

11:30-13:00 Session 2

Moderator: Codruta Stoica, Professor, Aurel Vlaicu University of Arad, Romania.

1. **Timothy M. Young**, Emeritus Professor, The University of Tennessee, USA & CEO and President, T.M. Young Institute, LLC, USA.
Ampalavanar Nanthakumar, Professor, State University of New York at Oswego, USA.
Title: On the Use of Copula for Quality Control based on an AR(2) Model.
2. **Ampalavanar Nanthakumar**, Professor, State University of New York at Oswego, USA.
Title: A Copula based Investigation about the Effect of the Sample Size on the Range Distribution.
3. **Philippe Ryckelynck**, Associate Professor, University of Littoral-Côte-d'Opale, France.
Title: On Regular Arrangements of Lines in the Plane.
4. **Mihai Halic**, Associate Professor, Gulf University for Science and Technology, Kuwait.
Title: Classical and Modern Applications of Linear Algebra in Mathematics and Science.

Discussion

13:00-15:00 Session 3

Moderator: Mohsen Javdani, Associate Professor, Simon Fraser University, Canada.

1. **Ainara Rodriguez-Sanchez**, Professor, UNED-National Distance Education University, Spain.
Román Salmeron-Gomez, Professor, University of Granada, Spain.
Catalina Garcia-Garcia, Professor, University of Granada, Spain.
Title: Multicollinearity Problem in Economic Models with Panel Data.
2. **Claudia Garcia-Garcia**, Assistant Professor, University of Madrid, Spain.
Catalina B. Garcia-Garcia, Full Professor, University of Granada, Spain.
Román Salmeron-Gomez, Full Professor, University of Granada, Spain.
Title: Interactions in Environmental Studies: A New Approach for Mitigating Potential Multicollinearity.
3. **Christina Anderl**, Senior Lecturer, London South Bank University, UK.
Title: Forecasting Inflation with a Zero Lower Bound and Negative Interest Rates: Evidence from Point and Density Forecasts.
4. **Leonard Grebe**, Research Assistant, Technical University of Darmstadt, Germany.
Title: Uncertainty Structure Hypothesis – Seasonal Patterns in Uncertain Times at the Stock Market?

Discussion

15:00-16:00 Discussion + Lunch

16:00-18:00 Session 4

Moderator: Mr Konstantinos Manolidis (ATINER Administration).

1. **Zani Anjani Rafsanjani HSM**, Lecturer, Diponegoro University, Indonesia.
Ratna Herdiana, Lecturer, Diponegoro University, Indonesia.
R. Heru Tjahjana, Lecturer, Diponegoro University, UAE.
Yogi Ahmad Erlangga, Lecturer, Zayed University University, Indonesia.
Title: Traffic Spreading Model with Traffic Light Control Treatment.
2. **Khaled Alqahtani**, Assistant Professor, Prince Sattam bin Abdulaziz University, Saudi Arabia.
Title: Sparse-Smoothed Cox PH for Genomic Profiles.
3. **Gohar Marikyan**, Professor, Empire State University of SUNY, USA.
Title: Teaching Mathematics with Visuals.
4. **Jocelyn Quainatnce**, Lecturer, University of Pennsylvania, USA.
Harry Gingold, Professor, West Virginia University USA.
Title: Is the Addition of Arrows Commutative?
5. **Milica Stojanović**, Professor, University of Belgrade, Serbia.
Title: Upgrading the Axiomatic System to 4-Dimensional Space – Axioms of Incidence.
6. **Anant Godbole**, Professor, East Tennessee State University, USA.
Title: Statistics and Biostatistics Instruction to Rural High School Students and Teachers in Tennessee.

Discussion

20:00-22:00

Athenian Early Evening Symposium (includes in order of appearance: continuous academic discussions, dinner, wine/water, music and dance)

Tuesday 27 June 2023

Session 5

09:00-11:00 Session 5a

Moderator: Mr Konstantinos Manolidis (ATINER Administration).

1. **Qichuan Xia**, Student, Narrabundah College, Australia.
Xiaoyan Liu, Professor, University of La Verne, USA.
Title: Investigating on Selected Factors that Could Affect the Public Transportation Patronage.
2. **Bhakti Bhusan Manna**, Assistant Professor, IIT Hyderabad, India.
Title: One-Dimensional Concentrating Solutions for a Class of Super-Linear Elliptic Equations in R^3 .
3. **Laurent Moutet**, Researcher, Rectorat of the Amiens Academy, France.
Title: A Project on Stick Insects in Priority Education in France.
4. **Claudia Franceschini**, Research Fellow, University of Padua, Italy.
Danila Azzolina, Assistant Professor, University of Ferrara, Italy.
Dario Gregori, Full Professor, University of Padua, Italy.
Title: Importance of Evaluating the Quality of Teaching Statistics in Biomedical Education: A Text Mining Approach for Identifying Areas for Improvement

Discussion

08:00-10:30 Session 5b

Old and New-An Educational Urban Walk

The urban walk ticket is not included as part of your registration fee. It includes transportation costs and the cost to enter the Parthenon and the other monuments on the Acropolis Hill. The urban walk tour includes the broader area of Athens. Among other sites, it includes: Zappion, Syntagma Square, Temple of Olympian Zeus, Ancient Roman Agora and on Acropolis Hill: the Propylaea, the Temple of Athena Nike, the Erechtheion, and the Parthenon. The program of the tour may be adjusted, if there is a need beyond our control. This is a private event organized by ATINER exclusively for the conference participants.

11:30-13:00 Session 6

Moderator: Philippe Ryckelynck, Associate Professor, University of Littoral-Côte-d'Opale, France.

1. **Getachew Dagne**, Professor, University of South Florida, USA.
Title: Piecewise Regression Mixture Models with Skewness.
2. **Sibel Atan**, Professor, Ankara Hacı Bayram Veli University, Türkiye.
Murat Atan, Professor, Ankara Hacı Bayram Veli University, Türkiye.
Şahika Gökmen, Assistant Professor, Ankara Hacı Bayram Veli University, Türkiye.
Title: Examination of Internal Migration in Turkey by Markov Method.
3. **Sahika Gokmen**, Assistant Professor, Ankara Hacı Bayram Veli University, Türkiye.
Title: Ranking of Countries According to the Index of Economic Freedom with Multi-Criteria Decision-Making Methods.
4. **Tea Shavadze**, Scientist, Ilia Vekua Institute of Applied Mathematics (VIAM) of Ivane Javakhishvili Tbilisi State University, Georgia.
Title: On the representation of a Solution for the Perturbed Quasi-Linear Controlled Neutral Functional Differential Equation.

Discussion

13:00-15:00 Session 7

Moderator: Getachew Dagne, Professor, University of South Florida, USA.

1. **Norman Sedgley**, Professor, Loyola University Maryland, USA.
Title: The Skilled Worker Premium and Labor's Share of Income: Recent Trends in US Manufacturing.
2. **Xinyu Hou**, Researcher, University of Cambridge, UK.
Philip Dybvig, Professor, Washington University in St. Louis, USA.
Title: Gambling for Redemption or Ripoff, and the Impact of Superpriority.
3. **Masayuki Yao**, Lecturer, Hakuoh University, Japan.
Title: The Envelope Theorem for Optimization Problems with Composite Modeling Structure.
4. **Alessandro Ganoulis**, PhD Student, The University of Law, UK.
Title: Decoy Effects from memory and Loss Aversion.
5. **Jan Peter Wogart**, Research Fellow, German Institute For Global And Area Studies, Germany.
Title: Highs and Lows of Brazilian Developmentalism in The 20th and 21st Centuries.

Discussion

15:00-16:00 Discussion + Lunch

16:00-17:30 Session 8

Moderator: Olga Gkounta, Researcher, ATINER.

1. **Akira Shimada**, Associate Professor, Nagasaki University, Japan.
Title: Study Migrants' Skilled Human Capital Formation under Deregulated Immigration Policies in an Overlapping Generations Economy.
2. **Lina Vyas**, Associate Professor, The Education University of Hong Kong, China.
Title: Hong Kong Civil Service Work from Home Arrangement and Work-Life Balance: The Policy Responses to the Pandemic.
3. **Demetra Arsalidou**, Associate Professor, Cardiff University, UK.
Title: Bonus Caps, Deferrals and Clawbacks: A Banking Regulation Quandary.
4. **Dihya Hesses**, PhD Student, University of Mouloud Mammeri, Algeria.
Title: Change Management in the Face of ICT Integration within Organizations.
5. **Ryszard Wojnar**, Researcher, Institute of Fundamental Technological Research PAS, Poland.
Jolanta Wołowicz, Researcher, Institute of Fundamental Technological Research PAS, Poland.
Andrzej Lissowski, Researcher, Institute of Fundamental Technological Research PAS, Poland.
Title: Why Colouring? Voronoi Tessalation and Crystallization.

Discussion

17:30-19:00 Session 9

Moderator: Olga Gkounta, Researcher, ATINER.

1. **Jorge Cerdeira**, Assistant Professor, University of Porto, Portugal.
Title: FDI Determinants in Developing Countries: A Firm-Level Analysis.
2. **José-Manuel Giménez-Gómez**, Professor, University of Rovira i Virgili, Spain.
Title: Allocating Remaining Carbon Budgets and Mitigation Costs.
3. **Daniel Gomez Abella**, Lecturer, University of La Sabana, Colombia.
Title: Ex-post Evaluation of RTAs of Colombia: A Partial Analysis with Structural Gravity Model.
4. **Xiao Han**, Lecturer, University of Toronto, Canada.
Dusiying Jin, Student, White Oaks Secondary School, Canada.
Title: Contamination in Drinking Water Environment and the Associated Public Health Risk from Mining Discharge Pollution: A Comparative Study Chile, China and US.
5. **Konstantinos Giannakas**, Professor, University of Nebraska-Lincoln, USA.

Ahmed Chennak, Researcher, University of Nebraska-Lincoln, USA.

Title: The Role of Cooperatives in Innovation Licensing.

Discussion

19:00-20:30

Ancient Athenian Dinner (includes in order of appearance: continuous academic discussions, dinner with recipes from ancient Athens, wine/water)

Wednesday 28 June 2023
An Educational Visit to Selected Islands
or
Mycenae Visit

Thursday 29 June 2023
Visiting the Oracle of Delphi

Friday 30 June 2023
Visiting the Ancient Corinth and Cape Sounio

Khaled Alqahtani

Assistant Professor, Prince Sattam bin Abdulaziz University, Saudi
Arabia

Sparse-Smoothed Cox PH for Genomic Profiles

Copy number alterations (CNA) provides a genome wide information which is potentially useful for survival modeling. One modeling challenge is that the data contains many features (CNA) but only a few samples. Existing methods to overcome these challenges include feature selection, shrinkage method (ridge, lasso, elastic net), and partial least squares. However, these methods first ignore the spatial structure of CNA data. Moreover, some of these methods employ all predictors regardless of their relevance which make it difficult to interpret the results. In this paper, we propose a new formulation of sparse smoothed Cox proportional hazard (SSCox) procedure for survival data to allow first for the spatial information of CNA and simultaneous sparse variable selection. We introduced a computing algorithm to estimate genome-wide CNA profiles as random predictors and the patients clinical information remains as fixed predictors in the model. The new algorithm is based on a combination of gradient ascent optimization with the NewtonRaphson algorithm. We illustrate the method with a real dataset from a lung cancer cohort and simulated data. For the simulation studies, we find that our SSCox method generally performed better than the Sparse PLS methods in prediction performance. Our estimator had smaller mean square error, and mean absolute error than its main competitors. For the real data set, we find that the SSCox model is suitable and has enabled a survival probability prediction based on the patients clinical information and CNA profiles. The results indicate that cancer T- and N-staging are significant factors in affecting the patients survival, and the estimates of random effects allow us to examine the contribution to the survival of some genomic regions across the genome.

Christina Anderl

Senior Lecturer, London South Bank University, UK

Forecasting Inflation with a Zero Lower Bound and Negative Interest Rates: Evidence from Point and Density Forecasts

This paper investigates the predictive power of the shadow rate for the inflation rate in countries with a zero lower bound (the US, the UK and Canada) and in those with negative rates (Japan, the Euro Area and Switzerland). Using shadow rates obtained from two different models (the Wu-Xia (2016) and the Krippner (2015a) ones) and for different lower bound parameters we compare the out-of-sample forecasting performance of an inflation model including a shadow rate with a benchmark one excluding it. Both specifications are estimated by OLS (Ordinary Least Squares) and includes a range of macroeconomic factors computed by means of principal component analysis. Both point and density forecasts of the inflation rate are evaluated. The models including the shadow rate are found to outperform the benchmark ones according to both sets of criteria except in countries operating an official inflation targeting regime. Both types of shadow rates appear to produce equally accurate out-of-sample inflation forecasts.

Demetra Arsalidou

Associate Professor, Cardiff University, UK

Bonus Caps, Deferrals and Clawbacks: A Banking Regulation Quandary

The way bankers are remunerated has been a controversial subject for some time, made worse since the Global Financial Crisis of 2007-08. A direct consequence of the financial crisis of 2008, the Capital Requirements Directive (EU Directive 2013/36/EU) (“CRD”) was adopted in 2013 (following a subsequently withdrawn legal challenge from the UK Government). The UK implemented the bonus cap rules in the ‘Remuneration’ and ‘Remuneration Code’ parts of the PRA Rulebook and FCA Handbook, respectively. The bonus cap (more accurately described as a limit on the ratio of a bonus to fixed pay) applies to UK banks, building societies and designated investment firms, and is set out in PRA and FCA rules. Its effect is to limit an employee’s bonus so that it does not exceed 100% of their fixed annual pay or, provided there is shareholder approval, 200%. Nonetheless, the UK government plans step toward more financial deregulation by removing the cap on bankers’ bonuses. It is believed that this will entice global banks to create jobs, invest and pay taxes in London (rather than show a preference for other strong markets such as New York, Frankfurt and Paris). Pay in bonuses, the PRA suggests, brings into line the incentives of individuals with those of the bank; this, in turn, helps the UK economy to grow. The Bank of England, which also supports the removal the bonus cap, supports the use of other, more effective tools for ensuring bankers take proper account of risks (such as the Senior Managers Regime and remuneration rules requiring deferral of bonus payments). For others however, bonus restrictions make a lot of sense. Bonuses, it is said, stimulate excessive risk-taking and focus on short-term profit; a cap on bonuses can augment financial stability.

There are a number of sticky issues that must be understood on the implementation of bonus restrictions. This paper considers whether constraints on bonus payments, such as bonus cap and malus, influence executives’ choices of risk and make a positive contribution to the remuneration debate. We will look at the debate around this issue. The analysis aims to answer two questions. First, is the bonus cap the right policy or is the idea underpinning it, misguided? Second, in considering bonus restrictions, are there other, more efficient means of controlling risk-taking?

Sibel Atan

Professor, Ankara Hacı Bayram Veli University, Türkiye

Murat Atan

Professor, Ankara Hacı Bayram Veli University, Türkiye

&

Şahika Gökmen

Assistant Professor, Ankara Hacı Bayram Veli University, Türkiye

Examination of Internal Migration in Turkey by Markov Method

There are economic, social differences and development between different geographical regions within the country. In the simplest way, migration can be defined as the displacement of the population between geographical regions. However, due to the consequences of migration, the society's social, economic, cultural, psychological, political and so on. It is an important concept that affects its structure. Migration movements are examined in two parts as internal and external migration. Internal migration is the movement of people living within the borders of the country from one part of the country to another for the purpose of working and settling. In other words, the difference between the place of birth of any population and the place of last residence indicates the "domestic" migration of this population. It will be possible to minimize the negative effects that may occur on the society by analyzing the causes of internal migration within the country and creating measures to prevent migration accordingly. In this way, it will play an important role in minimizing all the negative effects of migration in both the internal migration and internal migration regions. In social studies on the causes of internal migration in Turkey, there are findings that men are in the majority in the migrating population and that migration is more towards regions with higher socio-advanced levels. In this study, using the 2021-2022 population information in the NUTS level 1 region classification in Turkey, how the internal migration will change on the basis of gender (female - male) and NUTS level 1 was calculated by the Markov method and policy recommendations were made in accordance with the results.

Barbara Barańska

Associate Professor, Pedagogical University of Cracow, Poland

&

Małgorzata Zambrowska

Associate Professor, The Maria Grzegorzewska University of Warsaw,
Poland

No Teacher (Should Be) Left Behind: Teaching Mathematics as a Second Subject – Educational Challenges for Teacher Training Programs

The phenomenon known as ‘teaching-out-of-field’ refers to a situation when teachers are assigned subjects that they are not qualified to teach. The most common reason for such practices are shortages of adequately qualified teachers. In Poland, where there is a growing problem of teachers dropping their positions and graduates qualified as teachers choosing different career paths, a partial solution to this problem has been adopted. Various universities and educational centers collaborating with universities in Poland offer post-graduate studies for teachers that last at least three semesters and provide qualifications one needs to teach another subject. In the last decades it was not uncommon to meet teachers trained in one field who began teaching subjects from rather distant disciplines, e.g. physical education teachers or catechists who began teaching mathematics as a second subject. Since such teachers have received some training in mathematics, one can hardly say they are teaching out-of-field. On the other hand, however, it cannot be said that the preparation they obtained is the same as that of students taking full-cycle studies in mathematics, with specialization in mathematics teaching. We consider the teachers who complete post-graduate pedagogical studies qualifying for teaching mathematics as a second subject to be neither fully ‘in’, nor completely ‘out’ of the field.

In our talk we will present data collected among 185 teachers who completed post-graduate pedagogical studies giving them qualifications to teach mathematics as a second subject. Respondents were asked to evaluate the quality of the training at their studies, to indicate what knowledge and skills they had acquired during the studies, and also to provide examples showing what specific knowledge and competences, important in the course of teaching mathematics, they had still been lacking.

The collected data reveal some challenges of contemporary teacher education. There is an urgent need of crafting the teacher education

programs in such a way, that they could adequately address the real needs of teachers and provide them with substantive and pedagogical preparation that would leave no teacher behind.

This work has been funded by the National Science Centre, Poland - grant number: 2018/31/N/HS6/03976.

Jorge Cerdeira

Assistant Professor, University of Porto, Portugal

FDI Determinants in Developing Countries: A Firm-Level Analysis

Foreign direct investment (FDI) has been an important driver of economic growth in developing countries. Between 2005 and 2017, FDI grew significantly in developing countries as the corresponding global growth rate of FDI inflows is around 32 percentage points higher than the world growth rate. The purpose of this paper is to analyze FDI determinants at the firm level in developing countries.

Using a sample of 96,826 firms from 125 countries between 2005 and 2017, we adopt a fractional probit regression with endogenous covariates, a more suitable estimation method for addressing the FDI variable. The micro-level results show that exports, investment, and human capital have a statistically positive impact on FDI inflows, while credit barriers and taxes have a negative effect. Also, market size and resources foster FDI, whereas inflation and environmental emissions lower foreign investment levels.

This study demonstrates that governments wishing to attract FDI should adopt a variety of policies, including the promotion of international trade and measures that boost investment and human capital in firms and ease the access to credit.

Getachew Dagne

Professor, University of South Florida, USA

Piecewise Regression Mixture Models with Skewness

This presentation focuses on mixture regression models with piecewise growth curves for assessing longitudinal data that exhibit multiphasic features. Some longitudinal data may have features that include skewness, measurement errors in covariates, and heterogeneous population. Within a heterogeneous population, there is a desire to identify differential effects of covariates on a response variable in the context of a mixture of subpopulations. Regression mixture models are key methods for assessing differential effects of covariates. In this presentation, we will discuss the findings of extending regression mixture models to incorporate skew-normal distribution, measurement errors, and piecewise growth mixture modeling for describing multiphasic trajectories over time and analyzing real data from an AIDS clinical study.

Claudia Franceschini

Research Fellow, University of Padua, Italy

Danila Azzolina

Assistant Professor, University of Ferrara, Italy

&

Dario Gregori

Full Professor, University of Padua, Italy

Importance of Evaluating the Quality of Teaching Statistics in Biomedical Education: A Text Mining Approach for Identifying Areas for Improvement

Assessing the quality of teaching biostatistics in postgraduate courses, particularly for non-statistical experts in biomedical fields, is crucial to ensure that students receive excellent education and are well-prepared for their future careers.

Teaching biostatistics to clinicians is often challenging due to the gap between their clinical knowledge and understanding of statistical concepts. Clinicians often have extensive clinical practice and patient care knowledge but may lack the mathematical background or experience necessary to comprehend statistical concepts and their applications. Assessing teaching quality in this context is complex due to the subject matter's complexity and the diversity of the student population. In addition, traditional evaluation methods may not be sufficient to capture the full range of knowledge needed, and limitations in available data can make it difficult to draw accurate conclusions about teaching quality.

Sentiment Analysis (SA) allows for the analysis of opinions expressed in text using natural language processing and machine learning to identify sentiments and emotions. This research employs SA to evaluate teaching quality in a completely e-learning post-graduate course called "Biostatistics for scientific research and publication" held by the Unit of Biostatistics, Epidemiology, and Public Health - University of Padua (Italy). The course aims to teach basic statistical concepts applied to the healthcare area to prepare students for producing scientific reports and publications and collaborating with biostatisticians. The course is attended by various clinical professionals, many of whom lack a prior statistical background.

In this regard, 78 questionnaires (43% response rate) have been collected between 2019 and 2022, to summarize the main information about all the numerical evaluations provided by students, and to discover sentiments among written feedback. Each questionnaire

consists of 12 items, of which 3 are provided on a 0-10 rating scale, and 2 are multiple choice variables. The Questionnaire provides also free-text responses that have been analyzed via SA. The SA revealed overall satisfaction among students, with the prevalence of positive sentiments (61%) among the double-edged sword anticipation (13%) and negative emotions (26%). The overall median satisfaction grade is 8/10 (IQR = 2). The tutor's figure emerged as one of the most appreciated aspects of the master's program, providing effective administrative, organizational, and management support and serving as a daily point of reference for students. The heterogeneity of content and the organization of the workload are also seen as positive aspects. However, students express negative sentiments towards homework, citing a desire for more practice exercises before being graded and a higher quantity of homework to acquire and reinforce technical skills. Additionally, students reported a lack of physical interaction with professors, which can generate a sense of frustration, and a skeptical attitude toward the use of the statistical software R for analysis.

The combination of SA with traditional numerical evaluation methods can be a useful tool for assessing and improving teaching quality. Increasing compliance with questionnaires and sensitizing people to the benefits of educational assessment could improve evaluation and identify areas for improvement. The results of this research led to two improvement measures for the 2022-2023 edition of the master's program, which are expected to be maintained for future years: bimonthly meetings with professors and the tutor were scheduled to increase interaction and communication, and multimedia content related to the use of R software will be updated annually to keep up with the fast-changing environment of healthcare and biostatistics.

Alessandro Ganoulis

PhD Student, The University of Law, UK

Decoy Effects from Memory and Loss Aversion

We present a decision making model and new supporting experimental evidence that contextual factors can affect loss aversion. The model presented here allows for the possibility that a person perceives and evaluates an external stimulus *relatively* to other comparative information that person was exposed to, even if this information is in principle irrelevant for the decision under question. The model is based and extends the standard models of Cumulative Prospect Theory drawing also from the range-frequency models from cognitive psychology.

To test the predictions of the model that contextual information may be of relevance in decision making, participants in an experiment were asked to accept or reject a number of 50/50 lotteries. Of these lotteries, $\frac{1}{4}$ were common for all participants while the rest $\frac{3}{4}$ were decoy gambles that varied in skewness between two groups of participants. The empirical results suggest that the (experimentally manipulated) decoy gambles affected the choices and the estimated loss sensitivity of participants revealed in the common gambles. The participants' choices seem to have changed after they had experienced the first few (decoy) gambles.

Additionally, all results are also confirmed by non-parametric tests using the (model free) experimental choice data and are therefore not subject to a critique of possible model misspecification. Different econometric methods are used for robustness.

Claudia Garcia-Garcia

Assistant Professor, University of Madrid, Spain

Catalina B. Garcia-Garcia

Full Professor, University of Granada, Spain

&

Román Salmeron-Gomez

Full Professor, University of Granada, Spain

Interactions in Environmental Studies: A New Approach for Mitigating Potential Multicollinearity

Moderated Regression Analysis (MRA) is a specific application of multiple linear regression analysis, in which the regression equation contains an “interaction term”. This methodology allows analyzing how the effect of one of the independent variables is moderated by a second independent variable by adding a cross product term between them as an additional explanatory variable, the moderated factor.

In this type of studies, the inclusion of an interaction term between two explanatory variables of a model makes strong multicollinearity problems arise. The appearance of strong multicollinearity in a model has important consequences such as inflated variances of the estimators, tendency to consider non-significant some regressors, incorrect signs of the coefficients, high sensibility of the results to small changes in the dataset and difficulties in fixing the individual effects of the explanatory variables to the model in general. These consequences shifted to the moderated analysis may imply that is not worth including an interaction term that may be distorting the model.

Many economic sustainability research include the analysis of possible interactions by using moderated multiple regression. After a review of those works that applied the MRA among the ten top journals of the field, with an amount of 268 reviewed studies in total, this work concludes that multicollinearity is mostly disregarded. Only in 5 of the 10 journals there are some works that investigate the collinearity issue, meaning that, from all reviewed works, only at around 14% of them take into account possible multicollinearity problems (38 papers). From that few works, the most usual methodology for mitigating strong collinearity problems is centering variables.

To overcome the issue, this work analyzes the possible application of the residualization procedure. This method mitigates collinearity from an interpretative point of view maintaining the relevant available information. The collinearity problem arises because the variables are sharing information, so the solution is to delete from one of them the

“joint” or repeated information. Additionally, the global characteristics of the initial model are maintained (sum of squared residuals, estimated variance, coefficient of determination, global significance test and prediction).

The application of this method is implemented to data from countries of the European Union during the last year available regarding: greenhouse gas emissions, per capita GDP and a dummy variable that represents the topography of the country.

The main conclusion of this work is that applying residualization to MRA mitigates strong multicollinearity problems, so the researcher is able to rely on the interaction term when interpreting the results of a particular study.

Konstantinos Giannakas

Professor, University of Nebraska-Lincoln, USA

&

Ahmed Chennak

Researcher, University of Nebraska-Lincoln, USA

The Role of Cooperatives in Innovation Licensing

Research and development of new innovations is a major driver of productivity and economic growth. Patent licensing is a key channel of technology/innovation diffusion, and it is the most frequently observed contractual agreement between firms. It encourages and facilitates the transfer of superior technology from the innovator to other firms in the market and can also mitigate patent infringement issues. In this context, patent licensing can improve firm profitability, economic efficiency, the incentive to innovate, productivity growth, and social welfare.

Despite the prevalence of mixed markets in which cooperatives compete alongside investor-owned firms (IOFs), the involvement of cooperatives in innovation activity, and the importance of firms' organizational structure for the formation of their strategy, the impact of cooperative involvement in licensing of innovations has not been considered by the relevant literature. With the exception of few studies on the involvement of public firms in licensing, the literature has focused, instead, on the optimal patent licensing mechanisms in pure oligopolies (i.e., a small number of profit-maximizing IOFs). This paper extends the literature on technology licensing by considering the impact of organizational structure on firms' licensing behavior.

Specifically, the objective of this paper is to examine the effect of cooperative involvement in the licensing of process innovations. By considering the role of cooperatives in technology licensing, our study contributes to the literature on the design of optimal contracts by heterogeneous principals, the interaction between firms' structure and strategic behavior, and the literature on technology licensing in mixed oligopolies.

To determine the impact of cooperative involvement in technology licensing, we develop, compare and contrast sequential game-theoretic models of technology licensing in pure and mixed oligopoly settings that explicitly account for the empirically relevant pre-innovation cost differences between firms and heterogeneity of consumers and producers; members and non-members of the cooperative. Unlike the representative agent approach, the explicit consideration of this heterogeneity allows for a disaggregation of the welfare impacts of

patent licensing on different consumers and producers, and facilitates our ability to examine cooperatives' licensing behavior in the transfer of process innovations.

Analytical results show that the organizational form does matter in technology licensing; cooperative behavior differs from that of its investor-owned counterparts yielding *significantly* different equilibrium outcomes in mixed oligopolies where the cooperative is either the licensor or the licensee of the process innovation involved.

José-Manuel Giménez-Gómez
Professor, University of Rovira i Virgili, Spain

Allocating Remaining Carbon Budgets and Mitigation Costs

The concept of carbon budgets has become a key and effective tool in terms of communicating the existing environmental challenge and monitoring environmental policy, in the context of the Paris agreement. In this sense, the literature has addressed different mechanisms to distribute them by countries/groups according to reasonable distribution principles, among which fairness and efficiency play an essential role. Given the problem of agreeing on indicators by countries, the paper proposes the use of claims models as a basis for this distribution, which avoid using indicators and only must agree on elements defining the distribution rules. In this sense and based on a reference of the available global Carbon Budget (Mercator) for 2018-2050, and the CO₂ forecasts taken from the intermediate scenario SSP2-45 (Middle of the road) considered by the IPCC (2021), different distribution rules are addressed proposed by the literature (equality, proportional, and alpha-min) and are evaluated for the available groups of countries. Two relevant exercises are proposed beyond the initial distribution based on the previous theoretical rules: first, evaluate the cost of these distributions in terms of the welfare of each group (in particular, in terms of GDP); and two, use the GDP costs themselves to propose new distribution rules that are cost-efficient. The results imply having not only a global cost-efficient distribution proposal but also an annual path. We understand that the work is useful not only in terms of its methodological proposal but also as an alternative guide that structures future distribution policies.

Anant Godbole

Professor, East Tennessee State University, USA

Statistics and Biostatistics Instruction to Rural High School Students and Teachers in Tennessee

The US Department of Education has awarded a \$8M grant to the philanthropic Niswonger Foundation, which has subcontracted with several partners to bring innovative STEM education to rural school districts in Northeast Tennessee. Partners include East Tennessee State University (ETSU), Walters State Community College, Northeast State Community College, University of Alabama (Huntsville), Purdue University, Biobuilder, Inc of Boston, etc. The author of this paper is organizing the work at ETSU.

The efforts at ETSU are on several fronts. These include:

- (i) Biostatistics and Epidemiology taught to teachers in a professional development format, so as to be embedded in high school mathematics, statistics, and biology curricula,
- (ii) Statistics with R, taught to both students and teachers, both online in a dual enrollment format, and after school, and
- (iii) AI and Machine Learning, taught in a dual-enrollment and after-school format to both students and teachers.

Şahika Gökmen

Assistant Professor, Ankara Hacı Bayram Veli University, Türkiye

Murat Atan

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&

Sibel Atan

Professor, Ankara Hacı Bayram Veli University, Türkiye

Ranking of Countries According to the Index of Economic Freedom with Multi-Criteria Decision-Making Methods

All investors want to carry out their economic or commercial activities comfortably for each country. The public restrictions that individual or institutional investors face while continuing their economic or commercial activities are called economic freedom. In countries with a high level of economic freedom, individual or institutional investors are provided with the opportunity to produce, consume and invest more. A high level of economic freedom for a country indicates that the economy operates in accordance with free market conditions and that institutions and rules are based. The public authority protects individual or institutional investors and secures legal rights. In this study, the level of tariffs in the country, the existence of restrictions on foreign capital and investments, the black-market situation, the taxation process in the country, the presence and weight of the public authority in the economy, the inflation in the country, the country's inflation, the country's level of tariffs, published by the Heritage Foundation, which has been headquartered in the USA since 1996, on the basis of countries. independence of the financial sector and banking sector, wage policies for employees and controls on prices of goods and services, regulation and regulation, property rights of investors, etc. 2019 and 2020 data of the "Economic Freedom Index", which consists of two basic criteria including all stages, has been examined. This index consists of ten and includes these criteria. In this study, multi-criteria decision-making methods are used for the methods and weights determined in the index calculated by the Heritage Foundation. It was aimed to bring a new alternative. Alternative ranking was made for the "Economic Freedom Index" for all countries included in the study.

Daniel Gomez Abella

Lecturer, University of La Sabana, Colombia

Ex-post Evaluation of RTAs of Colombia: A Partial Analysis with Structural Gravity Model

This research presents an ex-post evaluation of the effects of eleven selected Regional Trade Agreements (RTAs) of Colombia that entered into force between the mid-1990s and the 2010s. This evaluation corresponds to a partial equilibrium gravity analysis implemented using the structural gravity model with panel data of 143 countries for the period 1991-2018. Different econometric specifications of the structural gravity model are estimated. However, the analysis of the results is focused on the specification that controls Multilateral Resistance Terms (MRTs) and addresses the potential endogeneity of RTAs. The results suggest that the RTAs with the Andean Community, Mexico have had positives and significant effects on bilateral trade among its members. If trade direction is considered, the RTAs with the Andean Community and Chile have had positives and significant effects on exports of Colombia. Regarding the effect on imports of Colombia, the RTAs with the Andean Community and Mexico have had positive and significant effects while the RTA with the EFTA has had a negative and significant effect.

Leonard Grebe

Research Assistant, Technical University of Darmstadt, Germany

Uncertainty Structure Hypothesis – Seasonal Patterns in Uncertain Times at the Stock Market?

Since 1973 researchers discuss the day-of-the-week effect on stock markets (Cross, 1973). Scientists still discuss about the characteristics of the day-of-the-week effect. On one hand, authors highlight the “Weekend-effect”, the “Friday-effect” or the “Tuesday blues”, on the other hand, others deny the existence of this anomaly (Berument, 2001; Banpinas et al., 2016; Plastun et al., 2019; Chiah and Zhong, 2021). This paper adds a meta-perspective to summarize and generalize results. 94 primary studies from 61 countries are analyzed. Meta-analysis tests geographical, cultural, empirical, time-dependent, and data-dependent moderators. In total, 4085 individual observations are used to run multivariate regressions for the strength and the magnitude of the day-of-the-week effect.

Regarding the magnitude, Mondays and Tuesdays have a significant negative return, while Wednesdays and Fridays show a positive return. Geographical and cultural differences have a weak impact. Moreover, there is no time dependency. Although outliers play a significant role, the choice of empirical methods (OLS or GARCH) does not impact the magnitude of the day-of-the-week effect. In addition, the multivariate regression for the strength of the effect supports a negative correlation on Mondays and positive correlation on Fridays. Time dependency, geographical and cultural differences are non-significant except a significant positive correlation between daily return and African countries.

Mihai Halic

Associate Professor, Gulf University for Science and Technology,
Kuwait

Classical and Modern Applications of Linear Algebra in Mathematics and Science

Nowadays, attracting students towards scientific research turns out to be a challenging task because that students expect working on accessible topics, or at least accessible at the first sight. Yet, proposed projects should have the potential to leading towards genuine work, which is interesting to the scientific community.

Linear Algebra is an ubiquitous subject, belonging to the curriculum of a wide range of students. It is indeed one of the basic, service courses, offered to students enrolled in mathematics, science, or engineering majors. In spite of this fact, basic Linear Algebra has numerous every-day life applications, and quickly leads to important current, open problems in mathematics and even high-energy physics. In my talk, I intend to present my view on these issues and to discuss some of my works in this area.

Xiao Han

Lecturer, University of Toronto, Canada

&

Dusiyang Jin

Student, White Oaks Secondary School, Canada

Contamination in Drinking Water Environment and the Associated Public Health Risk from Mining Discharge Pollution: A Comparative Study Chile, China and US

With the development of industrial technology in modern society, more and more countries rely on mining to obtain resources. While there have been improvements to mining practices in recent years, significant environmental and health risks remain. The impact of mineral pollution on human health from drinking water is significant, although there may be regional, age, gender, and other differences in degree. And public health presents a series of difficult and important but elusive problems that overlaps political, economic, and technical areas.

This paper conducts a comparative investigation of the contamination level, source identification and health risk assessment of mining wastewater discharges in Chile, China and US, and points out the health hazards of drinking water pollution according to different types of discharge. In addition, we explore various water treatment technology and public intervention policies in three countries, and the paper puts forward suggestions for strategies which protect and improve drinking water quality but allows the needed flexibility and cost effectiveness.

In order to protect the drinking water sources of the study areas from further contamination, management techniques and policy for mining operations need to be implemented. Governments should strengthen water intervention management and carry out intervention measures to improve water quality and reduce water pollution's impact on human health.

Dihya Hesas

PhD Student, University of Mouloud Mammeri, Algeria

Change Management in the Face of ICT Integration within Organizations

Change is undoubtedly one of the major challenges facing companies today. It could be considered as a constant in the life of organizations. This phenomenon has been the subject of numerous studies and publications in administrative sciences, and has become a star product of firms, consultants and a constant preoccupation of practitioners. In fact, many changes can shape the business environment, especially those that have become faster and more chaotic than ever. Among these changes, we find economic, political, social and technological changes most often mentioned in the literature. These organizational changes constantly challenge the way organizations operate and often require finding new ways to adjust.

Following these transformations in the environment, change has become a necessity, an irreversible alternative, an obligation of survival for any organization, hence the introduction of ICTs, which constitute an unavoidable and considerable change. The latter radically or partially transform the functioning of organizations.

Managers have understood that the impact of ICT on the evolution of the organization is becoming more and more remarkable, since the use of ICT is perceived as a key success factor and the best way to improve the level of competitiveness. Sophisticated and indispensable to the functioning of companies, they are increasingly incorporated into ambitious organizational change projects. The construction of an ICT-based system that allows for real-time data availability, data exchange, integration of procedures, etc., has become a key issue (Liao, 2005). In fact, they hold out the promise of profitable changes for organizations in all sectors of activity. The organization no longer has a choice but to be responsive to environmental change. It is therefore impossible to escape technological changes, particularly with regard to ICT, as they affect all areas of the organization. However, there is a lot of resistance on the part of the players following the implementation of this change.

In order to reach their new objective, organizations must focus on the actor as a determining factor in their transformation. Indeed, it is this intangible dimension, the human dimension, that is the key to the success or failure of organizational change.

However, despite the key role of individuals in organizational change (Bareil, 2004), organizations have been more concerned with how to introduce change than how to manage it.

Moreover, organizational changes have multiplied reorganizations, job cuts and increased the erosion of working conditions, which has jeopardized workers' health, particularly their moral health (Vinet et al., 2003).

Xinyu Hou

Researcher, University of Cambridge, UK

&

Philip Dybvig

Professor, Washington University in St. Louis, USA

Gambling for Redemption or Ripoff, and the Impact of Superpriority

Myers (1977) described how firms can gamble using asset substitution, which is switching to a less efficient and more volatile project. Gambling using derivatives is a sharper instrument, allowing the owners to gamble just to what is needed, and with negligible efficiency loss. In our model, “gambling for redemption” operates at small scale and is socially beneficial, while “gambling for ripoff” operates at large scale and is socially inefficient but benefits firm owners at the expense of bondholders. Superpriority laws grant exemptions of derivatives for bankruptcy law, which makes more funds available for gambling. This reduces firm value due to difficulty borrowing in the face of more gambling for ripoff.

Bhakti Bhusan Manna

Assistant Professor, IIT Hyderabad, India

One-Dimensional Concentrating Solutions for a Class of Super-Linear Elliptic Equations in \mathbb{R}^3

In this talk we consider the following singularly perturbed equations

$$\begin{cases} -\epsilon^2 \Delta u + u = u^p \text{ in } A, \\ u > 0 \text{ in } A, \quad u = 0 \text{ on } \partial A \end{cases}$$

where A is an annulus and $p > 1$. We shall discuss on the long standing conjecture that such problems possess solutions having m -dimensional concentration sets for every $0 \leq m \leq n - 1$. For dimension three, solutions with 2-dimensional and 0-dimensional concentration sets are known, while no result was available for 1-dimensional concentration sets. In this talk, we shall discuss the existence of solutions which concentrates on one-dimensional subsets.

To achieve this result, we first consider a suitable problem with weights in dimension four in a symmetric domain. Then we look for solutions which have bi-radial symmetry. This symmetry assumption will reduce the problem to a new equation in dimension two. The same kind of reduction technique is used by Santra and Wei in one of their works. Using finite-dimensional reduction, we shall prove the existence of a point concentrating solution for the reduced problem. Finally, we achieved our result using the Hopf-fibration.

This talk is based on a joint work with Prof. Bernhard Ruf, Prof. P. N. Srikanth, and Dr Alok Kumar Sahoo.

Gohar Marikyan

Professor, Empire State University of SUNY, USA

Teaching Mathematics with Visuals

This article is about research done on the ways of using visuals in teaching introductory mathematics. Research showed that the use of visuals improves the learning of mathematics. However, more research is needed to explore which math concepts need to be addressed, how to choose visuals for that purpose, and how to incorporate them in teaching mathematics. The analysis shows that the effective use of correctly chosen visuals in teaching introductory mathematics positively impacts students' attitudes toward mathematics, and enhances their learning, engagement, and motivation.

Khalid Mohammed Alkhuzaim

Professor, Imam Mohammad ibn Saud Islamic University (IMSIU),
Saudi Arabia

&

Thamer Ali Alwahbi

Teacher, Riyadh, Kingdom of Saudi Arabia Ministry of Education,
Saudi Arabia

**The Availability Level of the Aesthetic Approach in
Mathematics Textbooks for the Higher Grades at the
Primary Stage in Saudi Arabia**

This study aims to establish the presence of aesthetic underpinnings in Saudi mathematics textbooks. For this, the researchers used descriptive-analytical methods. We looked at fourth, fifth, and sixth grade math textbooks. The arbitrated aesthetic method divides 27 signals into seven basic domains. The content availability of each main aesthetic approach area was found to be constant across all books in the elementary stage's upper grades. Aesthetic strategies were used in primary mathematics textbooks at a rate of 34%. The average percentages for the major domains were: 76.9% major themes, 57.7% mental level, 52.8% science framework, 35.4% mathematics and arts, 10.7% mathematics and emotional components, and 2.2% athletic aesthetic criteria. The researchers suggested designing mathematics courses and texts artistically.

Laurent Moutet

Researcher, Rectorat of the Amiens Academy, France

Karine Barla

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Séverine Castelain

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Carole Jumaucourt

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Camille Lamere

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Natacha Manchette

Teacher, Creil District Primary School Inspection, France

Delphine Nunes

Teacher, Creil District Primary School Inspection, France

Audrey Yu

Teacher, Rousseau Middle School, Creil, France

&

Françoise Zabe

Teacher, Creil District Primary School Inspection, France

A Project on Stick Insects in Priority Education in France

A project to study stick insects was set up in the Creil district in France to develop the mathematical skills of pupils in priority education and to enable teachers to improve their skills. A learning community was set up with the teachers participating in this experiment to create a pedagogical sequence and to analyse the results of their actions in class.

The results of French pupils in the national mathematics assessments in grades 1, 2 and 6 show difficulties, particularly when it comes to solving problems and associating a number with a position. This observation is particularly true in priority education and in the Amiens academy. The priority education policy in France aims to reduce the gaps in achievement between pupils in priority education

and those who are not. Two types of network are associated with the Creil study: REP+, which concerns neighbourhoods with the greatest concentration of social difficulties that have a strong impact on school success, and REP, which is more socially mixed but has significant difficulties. The transition from school to middle school is generally difficult for pupils in France, as they move from a single generalist teacher in primary school to several disciplinary teachers. The pedagogical techniques used are generally different. A dialogue with primary school teachers and a secondary school teacher was set up to construct a teaching sequence for problem solving involving mathematical tasks within a project-based approach. The teachers involved in the project are particularly familiar with the pupils in the priority education sector of Creil. They proposed a teaching sequence using the study of stick insects to work on the graphic representation of the evolution of their mass and size over time. The extended mathematical working space is the theoretical framework that allowed the analysis of the modelling tasks implemented with the pupils. It was developed by Moutet (2019, 2021, 2023). It is combined with the Blum and Leiss modelling cycle (2005) to analyse the modelling tasks given to the students. The aim of this project is therefore twofold: to work on pupils mathematical skills through problem solving involving modelling tasks, and to work on co-intervention techniques to increase teachers skills. In this paper, we will focus only on the pupils.

The experimentation with the teachers has made it possible to work on the pupils mathematical skills, particularly in the area of problem solving. The first results seem to show an added value in terms of learning with the pupils. The teachers involved in the study found that the cross-curricular approach made problem solving more concrete and interesting for students who did not feel that they were doing mathematics. The concrete situations allowed the pupils to understand the mathematical tools used in a different way, the links between science and mathematics becoming more explicit for them. It is not possible to go further in our conclusions due to the small number of pupils involved in this study.

Ampalavanar Nanthakumar

Professor, State University of New York at Oswego, USA

**A Copula based Investigation about the Effect of the
Sample Size on the Range Distribution**

NOT AVAILABLE

Victor Oxman

Professor, Western Galilee College, Israel

Using Hint Buttons in GeoGebra Applets when Teaching Geometric Proofs

One of the main tasks in teaching geometry is the development of proof skills. Many students find it difficult not only to complete the proofs on their own, but also to understand the proofs presented to them in completed form (for example, in a textbook). It often takes a lot of effort on the part of the teacher to help the student understand this or that proof, even when it is detailed in the textbook.

Dynamic geometry software such as GeoGebra allows you to create HINT buttons that can help students to prove a geometric theorem on their own or understand a proof suggested to them by a teacher or given in a textbook. The purpose of the HINT buttons is to provide a step-by-step guide to the progress of the proof. When a student has difficulties at some stage of the proof, he can use the appropriate HINT button. The help provided by the HINT buttons is mainly through the use of the following tools: a) dynamic graphics, b) colors, c) mathematical symbols and notations including formulas. Naturally, when working with the HINT buttons while doing proof, the student should be able to contact the teacher for additional help. Applets with HINT buttons can be developed both by the teacher himself, who has the appropriate knowledge and skills in using GeoGebra (this highlights the importance of proper teaching in teacher training at universities and colleges), or by an outside specialist involved for this.

In our presentation, we give several examples of using the HINT buttons in the process of proving various geometric theorems, accompanied by a demonstration of the corresponding GeoGebra applets. The relation of such proofs to proofs without words (PWW) will also be discussed.

Jocelyn Quainatnce

Lecturer, University of Pennsylvania, USA

&

Harry Gingold

Professor, West Virginia University USA

Is the Addition of Arrows Commutative?

Many people believe that arrows are synonymous with vectors. With one simple example we demonstrate that arrows are not equivalent to vectors. After carefully defining an arrow as an ordered pair of points in three-space, we discuss the geometric interpretation of an arrow and show how this geometric interpretation differs from the geometric interpretation of a vector. Then we use arrows to directly define lines and planes in three-space. Presenting the definitions of lines and planes via arrows simplifies the conceptual learning of these vector calculus concepts for undergraduate students. Finally, in order to demonstrate how arrows are inherently different from vectors, we define the addition of two arrows and answer the question raised above.

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Traffic Spreading Model with Traffic Light Control Treatment

In this paper, we propose a dynamical system to model a traffic activity on the junction which presenting the interaction between incoming road users and road users stuck in a traffic jam. In this case, we investigate population as road users homogenously on cars user. There are four classes in this model to describe the suspected, infected, treated and recover population to the traffic jam. The suspected class describes a number of populations entering the roadway. This might be at risk of getting into the traffic jam. The infected class for this term shows the cars in a traffic jam. The traffic light provides the control action since the proportion of time for the green light can break up congestion. This means that there are a number of cars recovered from the traffic. While cars without treatment are the number of populations which do not get the green light and are still involved in congestion. This study is focuses on the program to control the traffic light duration between the green and red light. The objective of the control strategy is to minimize the number of cars in congestion. A maximum Pontryagrins principle is used to investigate the existence of the optimal control solution. The numerical simulation are provide to show the performance of the analytical results to represent the effectiveness of the treatments to reduce the number of congested cars.

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Multicollinearity Problem in Economic Models with Panel Data

The estimation of panel data models with fixed or random effects consists of modifying the original observation matrix and the estimation of the transformed model by Ordinary Least Squares (OLS). Since OLS estimation is finally applied, the numerical and statistical analysis performed may be affected by the presence of worrying multicollinearity if there is high linear relationship between the independent variables of the transformed model. Among others, the main problems that may appear are: impossibility of isolating the effect of an independent variable on the dependent (non-compliance with *ceteris paribus*), instability in the estimates of the coefficients with the obtaining unexpected signs or estimators with inflated variances that affect to individual significance test.

First of all, this paper establishes that the analysis of the approximate multicollinearity on the original data should only be carried out if pooled OLS is the selected methodology. While if this methodology is discarded, then the detection of this problem has to be focused on the transformed observation matrix and not on the one with the original data.

Secondly, and focusing on the fixed effects approach, this paper analyzes the consequences of the transformation of the original model (by using dummy variables or entity-demeaned OLS) on the degree of approximate multicollinearity that initially existed, and the application of raised regression is proposed as an alternative estimation technique to OLS to mitigate this problem if the approximate multicollinearity detected is considered worrying.

Finally, the study of the random effects approach remains as a future research line.

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On Regular Arrangements of Lines in the Plane

In this work, we address the problem of enumerating connected components (also called chambers), with specific properties, of complements of arrangements of lines in the plane. The study of arrangements is quite old and was initiated by J. Steiner, and has recently been revived, notably with the work of Poonen and Rubinstein. We consider particular regular arrangements, for which the description of the chambers according to their compactness properties or their shape can be treated. The first one is defined using a regular n -gon and gives rise to sequences of bounded length of cardinalities of chambers according to their shapes. The second is defined as the minimal arrangement containing an n -clique and results in sequences of irregular and unbounded cardinalities. Characterizing the connected components among all polygons with vertices in the underlying geometric graph is a complex task, which relies on a transformation of this geometric graph into a non-planar diamond lattice. We also give the adjacency matrices of all geometric arrangement graphs and display them as block matrices by choosing a convenient order of vertices. Finally, the area distribution of the connected compact components in these arrangements gives rise to new challenging summation formulas. We also address the problem of reconstructing arrangements with a prescribed sequence of part cardinalities. Finally, we emphasize the interaction between experimental mathematics (using Matlab and Maple) and Euclidean geometry or topology.

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The Skilled Worker Premium and Labor's Share of Income: Recent Trends in US Manufacturing

A well-established literature documents the role of outsourcing and technological change in explaining the growing skills premium in US manufacturing from the 1970s through the 1990s. In the 1980s labor's share of income relative to capital also begins to decline. These two trends continue through the great recession and beyond. Separate literatures identify different reasons for the change in the skills premium and the decline in labor's share. This paper considers the explanations for these two phenomena in a unified framework. The analysis is based on US manufacturing data from 2002 through 2017, a time period when there were significant shifts in the nature of outsourcing and market concentration. The results are quantitatively and qualitatively different from results reported for earlier time periods. For example, outsourcing now plays a limited role in changing shares. To the degree that outsourcing redistributes factor shares, it favors production workers at the expense of management.

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On the Representation of a Solution for the Perturbed Quasi-Linear Controlled Neutral Functional Differential Equation

The neutral functional differential equation is a mathematical model of such system whose behavior at a given moment depends on the velocity and state of the system in the past. Many real processes are described by neutral functional differential equations and the theory of such equations is presented in [1-3]. In this work, for the controlled neutral functional differential equation

$$\dot{x}(t) = A(t, x(t), x(t-h))\dot{x}(t-\sigma) + f(t, x(t), x(t-\tau), u(t)), \quad t \in [t_0, t_1]$$

with the initial condition

$$x(t) = \varphi(t), \quad t < t_0, \quad x(t_0) = x_0$$

we prove the analytic representation formula of a solution - Variation formula of solution, which is obtained in the left neighborhood of the endpoint of the main interval. In the formula, the effects of perturbations of the delay parameters h, σ, τ , the initial vector x_0 , the initial $\varphi(t)$ and control $u(t)$ functions are detected.

In the particular case, when the matrix function $A(\cdot) \equiv 0$, Variation formulas of solutions for different type of delay functional differential equations are proved in [4, 5].

Theorems of such a type play an important role in studying optimal control problems, proving of the necessary conditions of optimality.

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Study Migrants' Skilled Human Capital Formation under Deregulated Immigration Policies in an Overlapping Generations Economy

This study deals with the problem of study migrants' skilled human capital formation under deregulated immigration policies in a dynamic context. Due to globalisation, workers have become mobile. As a result, skilled workers tended to leave their home countries, and the brain drain happened. To overcome this problem, countries attempted to accept skilled workers from abroad. They also attempted to accept study migrants to complement the skilled labour migrants' acceptance policy. By conducting the study migrants' acceptance policy, they provide study migrants with education and induce them to remain in the host country to work as skilled workers. However, at the same time, countries, especially developed countries, suffered from a shortage of unskilled labour. Although accepting unskilled non-native workers is a contentious issue, these countries had to turn to non-natives to fill the vacancy of unskilled jobs, and for this purpose, they deregulated immigration policies and allowed non-natives to skilled and unskilled jobs. The problem with the study migrants' acceptance policy and the deregulated immigration policy is whether countries can conduct these two policies consistently, i.e., encouraging study migrants to build skilled human capital while increasing opportunities for non-natives to take unskilled jobs. Even if it is possible to increase the acceptance of skilled and unskilled labour migrants simultaneously, study migrants may lose an incentive to build skilled human capital. This study addresses the issue of study migrants' skilled human capital formation under the increased deregulation of immigration policies. This study analytically investigates how increasing deregulation of immigration policies affects study migrants' skilled human capital formation. This study shows that if host countries deregulate immigration policies further to make more unskilled jobs available to non-natives, study migrants reduce the formation of skilled human capital in the short run and in steady state. This is because although unskilled job wages decrease with increases in opportunities for non-natives to take an unskilled job, increased opportunities make an unskilled job more attractive to some study migrants with low innate ability. Due to increased opportunities, they switch from skilled to unskilled human capital formation. Accordingly, ensuring unskilled

labour by non-natives and increasing skilled human capital by accepting study migrants cannot be attained simultaneously. These two policies are incompatible in a dynamic context. However, this study also shows that host countries can partly alleviate the incompatibility by inducing firms to raise skilled job wages and motivating study migrants to build skilled human capital. This study suggests that additional policies that include raising skilled job wages will be effective in accomplishing these two objectives simultaneously. This study contributes to study and labour migrations research by clarifying that host countries' governments cannot manipulate immigration policies and study migrants' acceptance policies independently although they are usually manipulated without noticing incompatibility between them. This study also contributes by showing additional policies that can alleviate their incompatibility.

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Advances in the Study of Integral Type Properties

In this study, we investigate a wider and more comprehensive idea that generalizes dichotomous and trichotomous behaviours, which assume a splitting into invariant subspaces where the norms of trajectories are bound by certain functions that rely on the initial and ending times of the considered evolution equation. Additional conditions are given by the compatible projector families and the exponential growth of the skew-evolution semiflow.

Due to the fact that the characterizations in this case do not impose limits on the matrix that defines a system of differential equations, or on the solutions, such as bounded growth or decay, the approach of the dichotomy and trichotomy in the integral sense is of general interest. By using the dual of the Banach space, we also seek to characterize the Barbashin properties for the integral type classes of dichotomy and trichotomy.

A few associations with the classic notions of asymptotic behaviours are also provided and specific examples are used to highlight the approach.

A non-trivial aspect refers to analytical tools from the theory of evolution equations, such as the cocycles approach, in order to study the existence problem and the long-time evolution for differential/difference equations.

The need for a new approach arose from extending the uniform setting to a more general nonuniform framework.

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Upgrading the Axiomatic System to 4-Dimensional Space - Axioms of Incidence

There are three ways to approach the Euclidean geometry of four or more dimensions: axiomatic, algebraic (or analytical), and intuitive. Of course, only the first two can be formalized. The algebraic method is well developed and widely used, but that is not the case with the axiomatic. Although the idea of the higher-dimensional space was expressed by I. Kant and the properties have been explored by many mathematicians throughout history, there is no widely used axiomatic system.

Here, following Sommerville's ideas and a convenient axiomatic system for 3-dimensional space, we shall upgrade the axioms of incidence to 4-dimensional space.

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Hong Kong Civil Service Work from Home Arrangement and Work-Life Balance: The Policy Responses to the Pandemic

Governments worldwide implemented several measures to curb the spread of the COVID-19 epidemic. As a response, work from home (WFH) has been one of the government's measures to respond to the outbreak. It has been widely seen that both the private and public sector employees have shifted to WFH during the pandemic. Similarly, many public sector employees in Hong Kong were compelled to adopt such work arrangements during the city's COVID-19 outbreak. This is a rare occurrence in Hong Kong, where public servants were required to work from home. In addition, Hong Kong employees working from home may face more challenges due to their limited home living space. This study, thus, aims to assess how the government provided WFH support to its employees and whether there was an association between WFH support and different aspects of employees' work and work-life balance. The effects of organizational trust and individual working style are also considered since they have been considered related to employees' work and work-life balance. The data was collected through an online survey distributed to Hong Kong government employees. Only 469 respondents experienced work from home during the pandemic, out of a total of five-hundred and seven responses. Multivariate regression analyses were employed to estimate the effects of WFH support and other factors on employees' work and work-life balance. The results showed that 25% of respondents always worked from home during the pandemic. It was found that WFH support, organizational trust and individual working style are significant. Support provided by the government improved its employees' work and work-life balance. Implementing WFH policies or procedures in government organizations could not make an impact except an unexpectedly negative impact on job satisfaction. Compared with specific WFH support provided, the impact of WFH policies or procedures was much more neutral. The result would be the basis for future HR-related policy development for flexible workplaces or work from home for government employees.

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Highs and Lows of Brazilian Developmentalism in the 20th and 21st Centuries

This essay attempts to evaluate to what extent Brazil's economic strategies and policies of developmentalism have contributed to an uneven development process in the context of analyzing the benefits and costs of those policies and reviewing the major contributions both Brazilians and foreigners have made to not only analyze the basic economic variables and results deciding the path of development, but also look at the social and particularly political variables, which played an important role in the outcomes. The most recent developments have led critics to point at the ineffectiveness that this strategy had on moving the economy on to a stable growth path. This essay attempts to point towards the link between that strategy and corruption, which increasingly took place in the first two decades of the 21st century. The New Developmentalism would seem to be more pragmatic, as it has accepted rather orthodox paradigms practiced in the more successful emerging countries of East Asia. However, the proposed policies would seem to be difficult to be undertaken in a country which has become reform fatigued.

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Why Colouring? Voronoi Tessellation and Crystallization

The importance of the mathematical Voronoi algorithm was first presented at the Symposium on Computer Films, Boulders Colorado 1970.

The Voronoi polygon consists of all points of the plane closer to given center (e.g., atom) than to any other center (e.g. atom). Dual to the Voronoi polygons is the Delaunay triangulation, where sides of triangles join the nearest neighbouring Voronoi polygon centers. Centroidal Voronoi Tessellations (CVT) is an iterative algorithm: 1. V = polygons containing all points closest to centers; 2. C = chose centroids of V as the new centers; 3. go to 1.

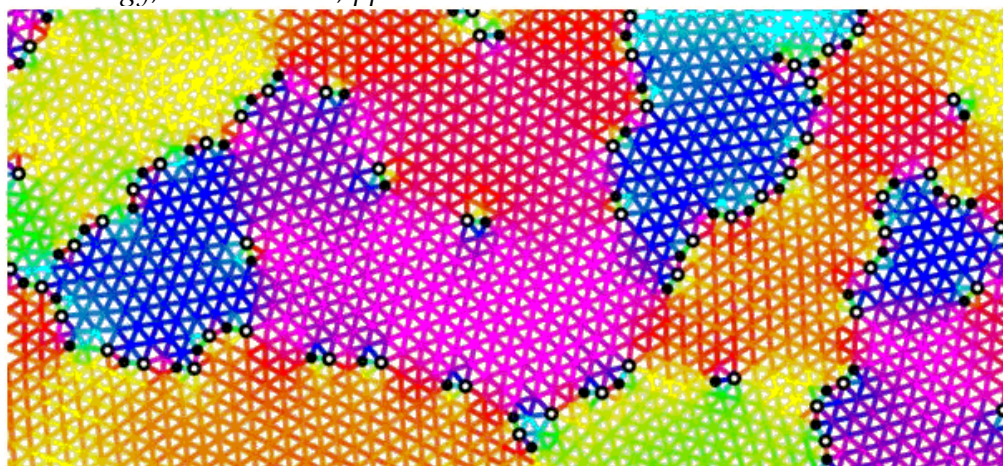
Starting from random uniform distribution, CVT iterations give highly coordinated flips (exchanges of contacts) leading towards more regular 2d polycrystal with diminishing fraction of pentagon-heptagon pairs (5/7 dislocations).

An important novelty in CVT to be presented at the Conference is the introduction of colouring. The colours are assigned to the sides of the triangles. The full color scale is contained in an angle of 60 degrees, modulo. This ensures that all sides of an equilateral triangle are the same color, depending on the orientation of the triangle, and deviations from equilaterality are indicated by a color change of sides. Grain boundaries play an exceptionally important role in the physics of crystallization. They are created by lines formed by 5/7 dislocations pairs. Each pair of 5/7 forms two spirals colored in opposite directions, that is, coloring 5 runs opposite to coloring 7.

One can observe various situations, sometimes dislocations are arranged densely, one after the other; then the grain boundary is well defined. It happens, however, that dislocations with the same direction are spaced sparsely, then grain boundaries are not well distinguishable,

a grain with a given orientation smoothly passes into a grain with a different orientation.

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Investigating on Selected Factors that Could Affect the Public Transportation Patronage

This paper studies three factors for a country (population density, annual income and fuel tax) that could affect the patronage of public transportation by applying the multiple correlation coefficient to these four variables. This is followed by some suggestions on how to increase the efficiency of the public transportation system based on the result of the study.

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The Envelope Theorem for Optimization Problems with Composite Modeling Structure

Recently, Marimon and Werner (2022) introduced the envelope theorem for optimization problems with inequality constraints. They used it to show that the Bellman equation and the Euler equation are linked even if the value function is non-differentiable. In this paper, we consider the optimization problem with more abstract constraints, including the problem dealt with in Marimon and Werner (2022). We show the envelope theorem for the problem with the terms of the composite function expressing the abstract constraints.

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On the Use of Copula for Quality Control based on an AR(2) Model

Manufacturing for a multitude of continuous processing applications in the era of automation and 'Industry 4.0' is focused on successful application of statistical process control (SPC). This study addresses the significant problem of positive autocorrelation in data collected from online sensors which may impair SPC in real-time settings. This paper expands upon a previous paper investigating the performance of 'Copula' based control charts by assessing the average run length (ARL) when the subsequent observations are correlated and follow the AR(1) model. Control Limits using the copulas and the AR(2) model were developed with two criteria for the comparison; Coverage Probability and the Average Run Length (ARL). The following copulas were used in the study; Gaussian Copula, Clayton Copula, Frank Copula, and Gumbel Copula. The Gumbel Copula failed the Coverage Probability criteria. Other copulas passed this coverage probability criteria at the 95% for the nominal coverage level. Only the Gaussian Copula passed this ARL criteria. Clayton Copula and Frank Copula failed this ARL criteria. The Gaussian Copula seems appropriate if the copulas are to be considered in Quality Control, especially in an AR(2) situation.

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