SLOVENSKÁ SPOLOČNOSŤ PRE HOSPODÁRSKU INFORMATIKU

SLOVAK SOCIETY FOR ECONOMIC INFORMATICS

PROCEEDINGS OF ABSTRACTS

21st International Scientific Conference

„AIESA – BUILDING OF SOCIETY BASED ON KNOWLEDGE“

A I E S A

Applied Informatics Econometrics Statistics Accounting

November 14 – 15, 2024 | BRATISLAVA

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„AIESA – BUILDING OF SOCIETY BASED ON KNOWLEDGE“

organized by

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prof. Mgr. Erik Šoltés, PhD.

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Plenary Session

Establishing a Disclosure Framework for Corporate Digital Responsibility (CDR): Toward Transparency, Standardization, and Sustainability

Michaela Bednárová, Enrique Bonsón

Abstract
This paper conceptualizes Corporate Digital Responsibility (CDR), particularly in the context of the growing integration of artificial intelligence (AI) and digital technologies across industries. The study proposes a reporting framework for CDR disclosure, focusing on the need for transparency, standardization, and a unified approach to address societal expectations and foster trust. The methodology includes a literature review on CDR conceptualization, an analysis of regulatory landscapes, and an exploration of current CDR disclosure practices. Central to the paper is the introduction of the EESGD (economic, environmental, social, governance, digital) framework, which underscores the interconnectedness of sustainability and digital responsibility. Additionally, the paper presents a hierarchy of digital needs to understand CDR's impact at the individual level.

Key words
Corporate Digital Responsibility, Transparency, Standardization, EESGD Approach

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AI in VUB

Jakub Červeň, Anton Kovaľ, Tomáš Horníček

Abstract
This presentation delves into the intricate integration of business and IT within a cohesive community, emphasizing the significant value creation facilitated by open-source Large Language Models (LLM) and Artificial Intelligence (AI). We identify our stakeholders, addressing their unique needs through specific use cases, and explain our commitment to open-source solutions. Furthermore, we explore the development of a Generative AI (Gen-AI) ecosystem designed to foster synergies and optimize innovative solutions.
Our discussion highlights the comprehensive AI strategy implemented at VÚB Banka, one of the largest banks in Slovakia, detailing the timeline and evolution of our AI use cases. We showcase the successful deployment of over three distinct use cases utilizing AI and GenAI technologies, demonstrating tangible benefits. Our unique approach not only underscores the value delivered to our stakeholders but also sets a precedent for future initiatives.
In addition, we examine the collaborative efforts and partnerships that have been instrumental in advancing our AI objectives. We conclude by outlining our future steps, which include scaling our AI applications, enhancing stakeholder engagement, and continuously refining our strategies to adapt to the ever-evolving technological landscape. This presentation aims to provide a comprehensive overview of our journey and the transformative impact of AI within our community.

Key words
AI, GenAI, LLM, VUB, banking

Economic and Social Age Aspects According to 8 Sustainable Development Goal – Selected Issues

Małgorzata Gawrycka, Michał Bernard Pietrzak

Abstract
The purpose of the study is to identify changes in the implementation of Sustainable Development Goal 8 in the context of social policy evaluation and to indicate whether the observed changes in the ratio of the minimum wage to the average wage are economically and socially justified. Data from the Social Security Administration and Eurostat were analyzed: GDP per capita, labor's share of national income, minimum and average wages, and labor productivity. The study from 2010 to 2021 made it possible to determine the dynamics of change and observe the relationships between variables. The share of the minimum wage in the average wage has increased, which is justified by social motives. Its dynamic growth, in turn, has an economic rationale. Despite the increase in labor productivity, no significant increase in the share of labor in national income was observed during the period studied.

Key words
Sustainable development goals, national economy, capital and labour, minimum wage, average wage

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Innovative Solutions in Auditing: How Data Analytics, Automation, Artificial Intelligence and the Use of Internal Controls are Changing Audit

Jakub Hollý, Filip Mihál

Abstract
The topic explores the transformative impact of emerging technologies on the audit profession. Data analytics enables auditors to process vast amounts of data more efficiently, providing deeper insights and enhancing the accuracy of audit conclusions. Automation streamlines repetitive tasks, reducing human error and increasing operational efficiency. Artificial Intelligence helps process large amounts of text quickly and generate accurate and concise summaries. Additionally, the integration of advanced control processes strengthens risk management and ensures compliance with regulatory standards. Together, these innovations are reshaping traditional auditing practices, making them more proactive, efficient, and data-driven, while offering greater transparency and value to stakeholders.

Key words
Data analytics, Automation, Artificial Intelligence, Innovation, Internal controls

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Liquidity Risk management in Insurance Companies and other changes coming from Solvency II review

Mária Kamenárová

Abstract
Liquidity risk is inherently different compared to the risk of capital insufficiency, caused by different as well as the different time horizon when the consequences of the liquidity risk will manifest themselves. An insurance company can meet the capital adequacy requirement and at the same time be illiquid, it can be exposed to an immediate lack of liquid funds to pay its due obligations. IFRS 17 and coming changes of Solvency II review are bringing new challenges in this area. Liquidity risk management is mandatory for insurance companies and comprise on measurement of liquidity in business as usual and under stressed conditions. Insurance liabilities are usually illiquid based on different products and their features that determines the investment assets risk profile. Methods used for measuring of the liquidity risk are: stock method, flow method and sustainable method.

Key words
Liquidity Risk Management for Insurance Companies, Liquidity Stress Testing for Insurance Companies, Flow Method, Sustainable Method, Stock Method

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Multidimensional Bibliometric Analysis of Publications on Statistical Learning – Based on the Scopus Database

Józef Pociecha, Barbara Pawełek

Abstract
The paper presents results of the multidimensional bibliometric analysis of the development the number of publications in the field of statistical learning (SL) with the network of connections between SL and machine learning (ML). We search distributions of the number of publications on SL by subject area, document type, source type, keyword, country, author name and affiliation, co-occurrence network of keywords in publications, thematic map and evolution of themes based on keywords, a collaboration network between authors, institutions and countries based on publications in the years 1994-2023. We also analysed their division into groups in the considered sub-periods, the frequency of occurrence of authors and their linkage and grouping by country, linkage and grouping of authors by surname. The source of data for the analysis is the Scopus database from, available as part of the Virtual Library of Science. The results of the analysis allow us to formulate many interesting conclusions regarding the development of SL as the new sub-discipline of statistical knowledge.

Key words
Statistical learning, machine learning, cluster analysis, data analysis

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Cybersecurity at strategic level

Zoltán Rajnai

Abstract
The presentation reviews the need to create a cybersecurity strategy for the European Union. It provides an analysis primarily of the cyber security strategies of the Visegrad countries, comparing the importance and most important characteristics of the cyber security strategies of the Czech Republic, Poland, Slovakia and Hungary. The strategic management of cyber security in Hungary is presented. It presents the role of the state in cyber security, as well as the role of the market sphere in coordination.

Key words
Cybersecurity, European Union, Strategy, Visegrad countries

Overview of how technology impacts insurance

Michal Uherek

Abstract
The presentation provides a comprehensive overview of the dynamic insurtech market, focusing on the distinctions between insurtech incumbents and companies specializing in supporting specific parts of the insurance lifecycle. It explores the rapid growth and investment trends driving the sector, highlighting key technologies such as AI, blockchain, IoT, and big data analytics that are reshaping the industry. By comparing digital-first insurers and on-demand insurance providers with specialized service companies, the presentation underscores the varied business models and customer experience enhancements brought by each. Additionally, it includes examples of how different insurtechs have performed over the past years, offering insights into their unique contributions and strategic approaches.

Key words
Insurance, Insuretech, Technology

Parallel Sessions

Table editor application options for analysis of patients' condition

Aigul Baimakhanova Bekmoldaevna, Jaroslav Kultan

Abstract
The modern use of IT is possible not only through the implementation of complex medical technologies and hospital management systems, but also through the effective use of simple, publicly available software, such as text processors, spreadsheet applications, and graphic editors. Among these tools, spreadsheet editors stand out for their ability to store data on a patient's condition and, based on this data, generate graphical representations of the disease's progression, monitor key values (such as temperature, blood pressure, external conditions, etc.), or calculate potential trends in the disease's development. Additionally, spreadsheet editors can create correlation functions between monitored variables and generate pivot tables to illustrate relationships between different parameters.
This paper focuses on analyzing the possibilities of using a spreadsheet editor for the daily work of on-duty doctors in a hospital. The main examples of using spreadsheet editors are based on real measurements of patients' health parameters from a specific hospital, while fully respecting all patient confidentiality and personal data.

Key words
Information technology, spreadsheet editors, graphical representation of studied values, medical history, patient

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Flexible quantifiers in aggregation

Nina Barčáková, Miroslav Hudec

Abstract
Conjunction of elementary conditions is a restrictive aggregation (regardless we have fuzzy or crisp conditions), i.e., all elementary conditions should be at least partially satisfied to avoid so-called empty answer problem. As the number of atomic conditions increases, the probability of empty-answer as well. In some real-world cases, an aggregation of elementary condition might be relaxed into the form "majority of elementary conditions should be met" or "to more the merrier". Thus, we need to formalise this aggregation by the quantifier "most of", or variants thereof. Quantifier can be formalized as a monotone or strict monotone function. In the former, we cover data evaluation, i.e., only entity which fully meets all elementary conditions gets degree of 1. In the latter, we are able to classify into rejected entities, partially accepted entities and fully accepted entities, because function has an interval of ideal values. As we work with intensities of satisfying elementary conditions, this approach covers variety of data types like fuzzy numbers.

Key words
Fuzzy quantifier, Monotone and strict monotone function, Data evaluation, data classification

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Enhancing the accuracy of decision trees using bagging

Andrej Bednařík

Abstract
Bagging, short for Bootstrap Aggregating, is an ensemble method that improves the stability and accuracy of machine learning models by reducing variance. This article focuses on the application of bagging to decision trees, examining its theoretical foundations and practical implementations. This article discusses the advantages of bagging, such as reducing overfitting and increasing the generalization ability of models. Through experiments on datasets, this article demonstrates how bagging enhances performance compared to traditional decision trees. In conclusion, this article assesses the significance of bagging in the context of modern machine learning techniques and its potential for future applications.

Key words
Bagging, Decision Trees, Variance Reduction, Accuracy

Impact of ESG Reporting and CSR on Company's Reputation

Miriama Blahušiaková

Abstract
The importance of ESG reporting and CSR has increased over past decades in business practices, reflecting a growing recognition of the importance of sustainability and ethical governance. ESG reporting is a framework for companies to disclose their performance and impact in these critical areas, enabling investors and other stakeholders to make reasonable decisions. Conversely, CSR embodies a company's commitment to conducting business responsibly, fostering positive societal and environmental impacts beyond mere profit generation. These practices promote transparency, accountability, and stakeholder engagement, enhancing a company's reputation and creating long-term value. The synergy between ESG and CSR initiatives underscores the shift toward a more sustainable business model, attracting those who prefer ethical considerations. The paper deals with stakeholders' perceptions of CSR and its impact on the company's reputation.

Keywords
CSR, ESG reporting, sustainability, CSRD, ESRS

Enhancing Portfolio Optimization Stability: The Impact of Stein-Type Shrinkage Estimators on Covariance Matrix Estimation

Michal Bogár, Peter Knížat, Andrea Furková

Abstract
Estimating the covariance matrix is crucial for modern portfolio optimization, as it determines the risk through variances and covariances of asset returns. High-dimensional portfolios often lead to instability in these estimates, evident from large eigenvalue dispersion in the sample covariance matrix. This study evaluates the impact of a Stein-type shrinkage estimator on improving the stability of the covariance matrix and, consequently, on the portfolio's performance. We employ an adjusted Stein-type shrinkage estimator to ensure positive and ordered eigenvalues, preserving matrix properties. Applying this to portfolio optimization with US mid-cap asset returns from 2017 to 2021, we find that the shrinkage estimator, particularly when applied to the Cholesky factorization, produces comparable or superior portfolio utility results to other methods. This paper was supported by the grant VEGA 1/0047/23 “The importance of spatial spillover effects in the context of the EU's greener and carbon-free Europe priority”.

Key words
Portfolio optimization, Covariance matrix, Singular value decomposition, Stein-type shrinkage estimator, Cholesky factorization

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Engagement by Design: How Gamification Transforms Rural Heritage into a Digital Hub

Samo Bozic, Ana Starešinič, Rhea Nina Klansek Bozic

Abstract
Advancements in digital technology present new opportunities for community engagement in depopulated rural areas. This case study analyses Preloka.si, a virtual Slovenian village, which achieved high daily active users, 100 times greater than its physical counterpart. Using gamification techniques, dopamine-driven design, and neuromarketing tools, Preloka.si successfully revitalizes community engagement, interaction, and cultural preservation in a digital space. This research details the impact of these strategies and advancements in data technology on user behaviour and explores the potential of AI in optimizing engagement and mitigating the trivialization of web content. Our findings offer actionable insights for leveraging web technology to foster vibrant digital communities in regions facing demographic decline.

Key words
Gamification, dopamine-driven design, neuromarketing, product analytics

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Alternative solution of travelling salesman problem in MS Excel

Ivan Brezina, Juraj Pekár, Marian Reiff

Abstract
Optimisation of a Travelling salesman's itinerary (TSP) is a typical logistics problem. In a standard software package MS Excel, this problem can be solved as an optimisation problem using the Solver Add-in by utilising the simplex method. At the same time, this solution approach is limited by the dimension of the problem. Another approach can also be used in the Solver Add-in, namely, the evolutionary algorithm (from MS Excel version 2010 onwards), which searches for solutions representing different combinations of numbers from 1 to *n*, while the INDEX function can be used. In the case of solving TSP problems with a few vertices (10), the evolutionary algorithm provides an optimal solution in a reasonably short computational time. The computations were also performed on real problems with a larger number of vertices (100). The achieved results differed significantly (best solution 1131.2, worst solution 407.6).

Keywords
Travelling Salesman Problem, Evolutionary Algorithm, MS Excel

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How well do machine learning methods forecast inflation in Slovakia?

Ádám Csápai

Abstract
Accurate inflation forecasting is crucial for effective policy interventions and maintaining economic stability. This study examines the application of machine learning techniques to predict inflation in Slovakia across different time periods, including the highly volatile phase during and after the COVID-19 pandemic. Our analysis shows that models like Lasso and Boosting, which leverage regularization and handle nonlinear patterns, outperform traditional forecasting methods in both predictive accuracy and trend detection. By applying nonlinear techniques on a regularized dataset, we achieve further improvements in performance. These advanced approaches enhance policymakers' ability to make informed decisions, particularly in small, open economies within monetary unions. The findings highlight the value of using sophisticated statistical tools to improve the accuracy of economic forecasts.

Keywords
Machine learning, inflation, forecasting

Game theory and location problem

Zuzana Čičková

Abstract
Location-allocation problems are widely studied and many variants are known. We consider the problem of locating two facilities among a set of possible location considering a service of some demand points within a predermined distance, where each demand point is served from the closest facility. The problem can be solved as mixed integer programing problem. We explore the problem of locating two facilities from the view of game theory and we formulate that problem as bimatrix game. The goal is to find Nash equilibrium in corresponding game to obtain alternative solutions. We will discuss the stability of those solutions to point out the fact that some of the solution may contribute more to system stability than others. This work is supported by VEGA 1/0115/23 Applications of cooperative game theory models in economics and in international relations.

Key words
Location problem, Bimatrix game, Nash equilibrium, Stability

Measuring systemic risk in the context of climate risk

Anna Denkowska, Stanisław Wanat

Abstract
Since the agreement in 2019, the European Commission has been implementing an economic growth strategy thanks to which Europe will become climate neutral by 2050. One of the three specific objectives of the Green Deal policy, presented in short as ESG (Environment, Social, Governance), is environmental and climate protection.
Subsequent legislative changes supporting the implementation of sustainable development goals pose a major challenge to the insurance sector, especially due to the lack of developed market practice. To better understand the impact of climate change on the insurance sector, it is necessary to establish quantitative tools that will allow linking climate risk with systemic risk. In empirical research, we analyze the impact of climate disasters on a selected measure of systemic risk.

Key words
Systemic risk, climate risk, disasters, DeltaCoVaR

Utilisation of AI model-based software tools in research paper production process

Daniel Dudek

Abstract
Whether wholly or partially based on neural networks, software tools have become integral to the business-as-usual process. Their use in knowledge or money-producing matters was considered taboo. While these tools are embraced in money-generating processes, we believe their use should be appropriately and fruitfully standardised, even in knowledge-obtaining processes. This article aims to map the best and most used software tools, fully or partially based on various AI models, that could be used to support the process of scientific paper creation or to help gather relevant information for research. We will also model a process that should best utilise these tools that, if followed, could decrease time spent on creating a scientific article or increase the impact and quality of that article.

Key words
AI Tools, Chatbots, Artificial Intelligence, Scientific Papers Support

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Coalition Strategies and Game Theory in Competitive Market

Monika Ferenčáková

Abstract
Cooperative and negotiation theories examine the dynamics of coalition formation and its impact on competitive environments, focusing on mathematical models that quantify the benefits of collaboration. Models take into account both legal and economic limitations, including antitrust regulations, and analyse coalition strategies and collective decision-making. In a non-cooperative environment, cooperation can provide firms with a competitive advantage by pooling resources, sharing risks, and enhancing bargaining power. Antitrust laws are crucial for maintaining fair competition and preventing monopolistic practices that can harm consumers and the overall market. Computational tools, such as the Shapley value, assess each participant's contribution to a coalition's success, emphasizing the role of cooperation in enhancing outcomes and optimizing market performance.

Key words
Coalition power, Antitrust regulations, Economic Competition

Modelling and Analysis of Coopetition Strategy in Business

Petr Fiala

Abstract
This paper focuses on the modelling and analysis of coopetition strategy in business. Coopetition is a business strategy that combines the benefits of competition and cooperation into a new approach that can be used not only to achieve higher profits but also to change the nature of the business environment for the benefit of users. The coopetition business model has PARTS of business strategy - five dimensions that a business can use to identify game changing strategies: Players, Added Value, Rules, Tactics and Scope. Players are the firm, customers, suppliers, competitors, and complementors, which are competitors whose products add value to the firm. The proposed approach is based on biform games that combines non-cooperative and cooperative game theory models. The approach proposes an extension of biform games that allows dynamic analysis for negotiation between participants.

Key words
Coopetition, Business model, Biform games, Negotiation

Possibilities of Optimal Location for Collection Points in Regions with Sparse Infrastructure

Pavel Gežík

Abstract
Slovakia launched a collection system for plastic packaging at the beginning of 2022, and the results exceeded expectations in the first year. The effectiveness of the system is mainly influenced by the availability of collection points (machines, where citizens can return marked plastic bottles from beverages). There are currently 3545 collection points in Slovakia, but they are unevenly distributed. There are 754 of them surrounding the capital, but only 79 on the border part of eastern Slovakia. This area is known for its underdeveloped infrastructure and undeveloped drinking water distribution system. Slovakia has almost 470 municipalities without a public water supply system. That is the is very important to have well-arranged collection points, especially in these municipalities.

Key words
Optimal Location, Collection Points, Plastic Bottles, Drinking Water

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Reporting of non-financial information or sustainability of groups of the accounting entities after the amendment of Act No. 431/2002 Coll. on Accounting, as amended, in the Slovak Republic

Renáta Hornická

Abstract
The issue of reporting of non-financial information or sustainability is constantly growing in importance. The Slovak Republic, as a member state of the European Union, adopts the requirements related to sustainability reporting into its national legislation from European legislation. First, it was the transposition of Directive 2014/95/EU (NFRD), the provisions of which Member States had to start complying with from 2017. The latest amendment to Act No 431/2002 Coll. on Accounting, as amended, this year also included the implementation of Directive EU 2022/2464 (CSRD). Sustainability reporting refers not only to individual reporting but also to reporting for the group, i.e., consolidated reporting. Based on the currently applicable provisions of the Accounting Act, the paper analyses the requirements for reporting sustainability information on a consolidated basis and identifies the scope and content of sustainability reporting for a group of entities (parent and its subsidiaries).

Key words
Sustainability, group, parent, subsidiary, consolidated information

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Comparison of European Union countries based on selected indicators of poverty and social exclusion using the scoring method

Ľubica Hurbánková

Abstract
The paper deals with the comparison of European Union countries. The aim of the paper is to rank these countries from best to worst in terms of poverty and social exclusion in 2019 and 2023. The countries are compared using four indicators – the percentage of the population at risk of poverty or social exclusion, the percentage of the population severely materially and socially deprived, the percentage of the population living in households with very low work intensity and the percentage of the population who are unable to face unexpected financial expenses. The ranking of countries is compiled based on the use of one of the methods of multivariate comparison, namely the scoring method. In 2023, the first places belonged to the Czech Republic, Slovenia and Netherlands. Slovakia took 12th place. Bulgaria, Greece and Romania were in the last places.

Key words
Powerty and social exclusion, Scoring method, European Union countries

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Economic Growth and Environmental Degradation: A Spatial Approach

Michaela Chocholatá

Abstract
Emissions of CO_2 reduce the quality of environment and furthermore, they can have negative impact on economic growth by influencing human health, which can lead to the reduction of labour productivity and production. Another point of view could be to examine the impact of the region's economic level on the environmental degradation. This paper is focused on the priority "greener, carbon-free Europe" in the context of EU strategic policy. We assume that the closer the regions are in terms of geographic distance, the more likely it is that economic activities and environmental degradation in each spatial unit will influence each other. The use of tools of spatial statistics and econometrics enable to analyse the impact of various economic factors (e.g., GDP level) on degradation of the environment. This paper was supported by the grant VEGA 1/0047/23 "The importance of spatial spillover effects in the context of the EU's greener and carbon-free Europe priority".

Key words
Emissions of CO_2, Economic degradation, Economic growth, Spatial approach

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Models for ranking of decision making units in DEA models: a comparative study

Josef Jablonský

Abstract
Data envelopment analysis (DEA) techniques belong to the most often applied models for ranking of decision making units (DMU) or alternatives according to their input and output characteristics. Traditional DEA models assign to the DMUs efficiency scores that allow their ranking – higher scores higher position in the final ranking. The frequently discussed problem is ranking of efficient units because they reach maximum efficiency score. Their number can be quite high depending on the number of DMUs and the number of variables (inputs and outputs) of the model. The aim of the paper is to compare the most important methods for ranking of DMUs. Their application may lead to different rankings. In this case we offer a procedure for aggregation of several different rankings into one final result. The proposed methodology will be illustrated on a numerical example and the results discussed.

Key words
Data envelopment analysis, ranking, efficiency, super-efficiency, aggregation

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Reputation Risk of Auditing Companies on X, Formerly Twitter, and Advertising Decrease on Platform

Zuzana Juhászová, Martina Ballová

Abstract
X corp. previously known as Twitter is facing last 2 years decrease in reputation and many companies are afraid that connection with this company will decrease also their reputation. As of today, the world biggest auditing companies KPMG, EY, PWC, Deloitte have accounts on X. In November 2023 advertisers Disney, Apple, Paramount and Lionsgate halted marketing on X, which decreased revenues of platform. As of 31.12.2021 revenue of then Twitter was 5 billion USD, as of 31.12.2023 revenues decreased to 2.5 billion USD. Research by company Kantar published in September 2024 found that 26% of marketers plan to decrease of their spending on platform in 2025. This potentially can reduce revenue in 625 million USD. Research of future impact of advertising and created accounts on platforms which face decreases of reputation can be created in following years.

Key words
Reputation, X, Auditing, Revenue, Decrease

A detailed comparison of selected applications to support team communication usable in a business environment

Pavol Jurík, Natália Babjaková

Abstract
In today's globalized world, companies strive for greater simplification of communication in order to increase efficiency and competitiveness. With this in mind, team communication applications have become powerful tools for transforming workplace collaboration. Team communication applications enable real-time communication through instant messaging, allowing workers to quickly share information. This ability is especially useful when making operational decisions and quickly solving problems. Team communication applications allow employees to collaborate more effectively, teams of workers can share ideas and solve company problems "with one click". In this article, we focus on comparing Microsoft Teams, Slack and Google Chat.

Key words
Team communication applications, corporate communication, Microsoft Teams, Slack, Google Chat

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Reporting of sustainability information by financial institutions based in Slovakia in accordance with the requirements of the amendment to the Accounting Act

Oľga Kadlečíková

Abstract
With effect from June 1, 2024, an amendment to the Accounting Act entered into force, the biggest changes of which mainly concern the implementation of Directive 2022/2464 of the European Parliament and of the Council of the European Union concerning the reporting of information on the sustainability of enterprises, the so-called CSRD guidelines. The first reporting period for companies that have an obligation to report sustainability information will begin on January 1, 2024. These companies will therefore prepare their first sustainability report as early as 2024. These include banks (except for the National Bank of Slovakia), insurance companies, insurance companies (except health insurance companies), issuers of securities meeting size criteria and exceeding 500 employees.

Key words
CSRD, report, banks

Increasing confidence in reported sustainability information in the context of audit

Veronika Kňažková

Abstract
Sustainability is an important topic in accounting and auditing. Accounting entities are obliged to disclose sustainability-related information in the context of applicable legislation. Confidence in this information can be enhanced by external assurance by the statutory auditor, who practises his profession in the context of international auditing standards, which undergo constant processes of review and amendment in order to achieve audit transparency at a global level. In the context of these intentions, the new auditing standard ISSA 5000 General Requirements for Sustainability Assurance Engagements has been approved. In the preparation and drafting of the audit standard in question, it is possible to speak of a tightening of the legal regulation in the field of sustainability, in order to eliminate the risks related to significant and rapid climate change, which audit firms are unable to recognise, monitor and manage on the basis of their lack of knowledge. It can be concluded that the ISSA in question is both a mechanism for verifying sustainability information and a mechanism for strengthening confidence in that information.

Key words
Audit, sustainability, non-financial information, auditing standards

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Analysis of Material Deprivation in Slovakia in 2022 Based on a Machine Learning Approach

Silvia Komara, Martina Košíková

Abstract
This study applies machine learning techniques to predict material deprivation in Slovakia for the year 2022. Various classification algorithms are employed to identify the most effective model for this task. The analysis reveals that logistic regression emerges as the best-performing model based on its high accuracy. However, despite achieving a high level of accuracy, the model encounters significant challenges due to class imbalance in the dataset. This imbalance leads to skewed prediction performance, where the model excels in identifying non-materially deprived individuals but struggles with accurately predicting those experiencing material deprivation. Addressing this issue involves exploring methods for balancing the dataset, such as SMOTE, to improve the model's generalization and performance on both classes. This study highlights the critical need for careful consideration of data balance when developing predictive models for social indicators.

Key words
Material deprivation, machine learning, classification, imbalanced data, feature importances

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Regional Trade Agreements and Intra-African Trade: Do Colonial Ties Matter?

Brian König, Adamu Braimah Abille

Abstract
Most African countries rarely trade with one another, with intra-African exports estimated at only about 14 % in 2022. Some studies attribute this to colonial infrastructure, which connects these countries more to their colonizers than to each other. African nations have entered various regional economic agreements such as ECOWAS, COMESA, and SADC to counter this. While the impacts of these agreements have been widely studied, the moderating influence of colonial ties on intra-African trade remains under-explored. Using bilateral trade data for global and African countries within a structural gravity framework, we observe the following: (i) the effect of FTA for colonies and non-colonies on trade is positive and much higher for the colonies in the global sample, and (ii) the interaction effect of regional trade agreements and a common colonizer is significantly negative for African countries.

Key words
Trade Agreements, Intra-African Trade, Colonial ties, Africa, Structural gravity

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Revenues and costs in the accounting of public administration entities

Alena Kordošová

Abstract
Revenues and costs in the accounting of public administration entities in the Slovak Republic have their particularities. The paper is focused on examining the particularities of revenues and costs in the conditions of public administration entities in the Slovak Republic. Revenues shall be defined as an increase in economic benefits and costs be defined as a decrease in economic benefits during the accounting period of public administration entities and can be measured reliably. The result of the examination of individual revenues and costs in the accounting of public administration entities is to point out specific items of revenues and costs, their position and the importance in the conditions of public administration entities in the Slovak Republic.

Key words
Revenues, Costs, Accounting, Public administration entities

Execution Efficiency of a Parallelization of a Word Frequency Analysis in text files in a C# Application

Igor Košťál

Abstract
Word frequency analysis, i.e., counting how often each word appears in a given collection of text data, is a frequently occurring programming task during the creation of applications. Its effective implementation in the source code of the application is very important. We have created several event handler methods in our C# application that perform a word frequency analysis in data streams connected to text files. We have created an event handler method that performs this analysis sequentially, and three event handler methods, each with a different number of parallel tasks (4, 8, and 16 tasks), that perform this analysis in parallel. We assume that parallel event handler methods should be more execution efficient than the sequential method. Using the execution times of particular methods, we have examined whether our hypothesis is true or false. The results and evaluation of this experiment are presented in the paper.

Key words
Word frequency analysis, the most common words, sequential event handler method, parallel event handler method, C# application

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Operational risks of insurance companies in Slovakia

Zuzana Krátka

Abstract
The operational risks of insurance companies are mainly related to incorrect setting or failure of their internal mechanisms and controls, errors in their information systems, inappropriate or incorrectly used mathematical models, data and other forms of system or human factor failure, but also with some external factors (e.g., war, terrorist attack). The management of operational risks of insurance companies is also regulated by the regulation of the insurance market of the European Union, called Solvency II. The calculation of the capital coverage of operational risks and the own assessment of risk and solvency (ORSA), carried out by insurance companies at least once a year, are important. The paper focuses on the main operational risks of insurance companies based in Slovakia and on the possibilities of their effective management.

Key words
Operational risk, Operational risk management, ORSA, Solvency II

LRC and LIC in the GMM model in the IFRS 17 standard

Ingrid Krčová

Abstract
The paper discusses the General Model Measurement (GMM) valuation method as a central element in IFRS 17, which is designed to bring consistency and transparency to the accounting for insurance contracts. The inclusion of the contract service margin (CSM) is key to achieving profit recognition in line with an insurer's service provision. We also address the critical components of technical provisions for the valuation of insurance contracts, namely the liability for remaining coverage (LRC) and the liability on incurred claims (LIC). We discuss their interaction as a key to understanding the GMM approach. We conclude with a discussion about risk adjustment, the discount rate, contract boundaries and the level of aggregation of contracts into groups with similar risk profiles.

Key words
IFRS 17, General Model Measurement, LCR, LIC

Proposal of a methodological procedure related to the statutory audit in the verification of deconsolidation

Petra Krišková, Ján Užík, Lenka Užíková

Abstract
In practice, the statutory auditor may encounter various specific situations in the context of the verification of consolidated financial statements. One of the possible specifics is the loss of control of the parent accounting unit over its subsidiary accounting unit. Even in this case, the statutory auditor has the obligation to verify the correctness of the execution of the so-called deconsolidation. This is an area that is very error-prone in practice, so we consider it very important to validate this process. A very common mistake in deconsolidation is its incorrect execution, but often also its complete omission. However, if deconsolidation were to be omitted, there would be significant misstatements in the consolidated statements for the period in which the control of the parent accounting unit over the subsidiary accounting unit ended.

Key words
Statutory audit, Statutory auditor, Loss of control, Deconsolidation

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Poverty and Social Exclusion in the Context of the Digital Transformation

Viera Labudová

Abstract
The overarching objectives of this study are to quantify the impact of digitalization on poverty and social exclusion in the last decade across 27 EU Member States. The analysis was based on the data of the Digital Economy and Society Index (DESI) and the At Risk of Poverty or Social Exclusion Rate (AROPE rate). Empirical studies have been conducted in three stages. First, this paper examines the methodology of DESI and presents the composite index used for measuring the digital competitiveness of nations. Second, basic measures of time series dynamics were used to determine the dynamics of changes in index DESI and AROPE rate values. Third, to classify countries in terms of the similarity of value and structure of the DESI, a cluster analysis was used.

Key words
Digitalization, Poverty, Social exclusion, Cluster analysis

Transformations of business companies and cooperatives in Slovakia

Kornélia Lovciová

Abstract
Since the legislation in Slovakia in the area of transformations of commercial companies and cooperatives has been continuously supplemented in accordance with the intentions of the commercial law directives of the European Union, it is complexly fragmented. In order to unify and make the legislation in this area more transparent, the National Council of the Slovak Republic approved Act No. 309/2023 Coll. on transformations of commercial companies and cooperatives and on amendments to certain laws. The aim of the contribution is to provide information on national transformations and a more detailed overview of individual national transformations according to Act no. 309/2023 Coll. on transformations of commercial companies and cooperatives and on amendments to certain laws.

Key words
Transformation of companies and cooperatives, law of transformations of companies

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Evaluation of the Potential Impact of Increasing the Taxable Income Threshold for Business Accounting Entities Applicable to the 15% Corporate Income Tax Rate on Tax Collection

Anton Marci, Miroslava Vašeková

Abstract
The paper evaluates the potential impact of raising the taxable income threshold for business entities eligible for the 15% corporate income tax rate in Slovakia. Focusing on the effect such a change could have on tax revenue collection, business growth, and compliance, the analysis covers current tax policies and simulates various income threshold scenarios. The paper aims to provide insights into the efficiency and fairness of the tax system. Findings suggest that while raising the threshold may benefit small businesses by reducing their tax burden, it could also lead to decreased tax revenue in the short term. However, long-term benefits, such as increased entrepreneurship and economic activity, are also considered.

Key words
Corporate income tax, taxation, tax revenue

Allocation of investment assets by fuzzy logic

Richard Martinus

Abstract
The most used approach in classifying the investor is an investment questionnaire, that determines the risk group the investor falls into. A common problem with this approach is that the potential investor is assigned fully to one category and many of the questions might not be considered in the determination of the investor's risk level. These shortcomings can be improved using fuzzy logic, where investors are ranked by aggregation function using their affiliations to individual sets representing answers to questions. It is thus possible to define the investor's profile more precisely thanks to the ability to identify the difference between investor profiles. Based on the investment profile affiliation, the investor is assigned a set of assets and their optimal allocation for his given profile. This article aims to bring a more accurate classification of investors into risk groups and showing a way to allocate their resources.

Key words
Fuzzy logic, Aggregation functions, Questionnaire, Portfolio, Risk

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The onset of electromobility and its obstacles in Slovakia

Martina Mateášová

Abstract
Social change and climate change have accelerated greatly in recent years. The European Union stopped responding to them with recommendations. The European Union has started to promote clear and concrete commitments that are ambitious and necessary from the point of view of maintaining competitiveness. As you can see, the emergence of e-mobility is a highly discussed area. This global trend appears to be irreversible. Car manufacturers publish the dates when they will end the production and sale of internal combustion engines. It is therefore likely that in a few years electric cars will dominate sales in Slovakia as well. It is therefore necessary to realize that electromobility brings many aspects that need to be taken into account in a broad context in order to avoid possible problems in application practice. Unfortunately, one of the obstacles for the development of electromobility in Slovakia is the non-existent legislation from the point of view of accounting and taxes. Therefore, it is necessary to focus on this area, to implement measures that will indirectly increase the competitiveness of the business environment, accelerate the transition to emission-free mobility, and will also regulate expenses for charging electric vehicles at the expense of the taxpayer.

Key words
Electric cars, electromobility, accounting, taxes

The impact of IFRS 17 on financial reporting of insurance companies

Jitka Meluchová, Ján Vlčko

Abstract
The year 2023 was significant for insurers because the new standard IFRS 17 Insurance contracts entered into force. This standard establishes completely new principles of valuation, reporting and disclosure of information about insurance contracts issued by an insurer. The objective of IFRS 17 is to ensure that the accounting entity provides relevant information that faithfully represents the said contracts. This information provides a basis for users of the financial statements to assess the risk and effect that insurance policies have on the financial position, financial performance and cash flows of the insurance company. The aim of the contribution is to identify significant changes and assess the usefulness of the reported information for users. The implementation of IFRS 17 requires complex cooperation of specialists in the field of risk management, actuarial mathematics, accounting, IT, business processes and others. An important aspect is the synergy with the previous regulation introduced by the Solvency II directive, with the aim of ensuring reliable reporting of risks and expected future payments from managed insurance contracts.

Key words
Insurance contract, IFRS 17, Financial statements

Sustainable performance as a result of the sustainability reporting in the EU

Daša Mokošová

Abstract
The Corporate Sustainability Reporting Directive, or CSRD, is widely regarded as the European reference framework for sustainability reporting. The CSRD is not solely a regulation applicable within the EU member states. There are interactions between the CSRD, the EU Taxonomy and the Corporate Sustainability Due Diligence Directive, or CSDDD that may warrant further examination. The transposition of these directives into the national arrangements of EU Member States is intended not only to ensure improved reporting by the entities concerned, but also to have an impact on their sustainable performance. Assessment of sustainable performance with respect to environmental and social issues needs to be evaluated in relation to the diversity of industries also through ESG Metrics. This paper was supported by the grant VEGA 1/0047/23 “The importance of spatial spillover effects in the context of the EU's greener and carbon-free Europe priority”.

Key words
Sustainable performance, sustainability reporting, CSRD, EU Taxonomy, CSDDD

Modelling risk dependencies in insurance using MB11 copula

Vladimír Mucha

Abstract
The aim of this paper is to demonstrate the use of the MB11 copula as a suitable tool for modelling risk dependencies in insurance. A purpose-built simulation of adequate tail dependence enables the modelling of extreme events that are of interest to risk management. Risk dependencies can be modelled by setting the weights of individual risk scenarios. By generating values of the MB11 copula, it is possible to obtain the values of the joint distribution of the marginal random variables for the purposes of risk aggregation. The emphasis is on presenting the algorithm for simulating the MB11 copula using the Monte Carlo method. The programming language R was used to simulate the values of the MB11 copula and the joint distribution of the marginal random variables. A scatter plot was used for their graphical presentation.

Key words
Risk dependencies, MB11 copula, simulations, joint distribution

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Institute of companies in crisis in connection with a simply joint-stock company

Lucia Ondrušová

Abstract
A simple joint-stock company is a type of business company that was established in the legislation of the Slovak Republic in order to facilitate the functioning of the so-called start-ups. This type of business company has a fixed minimum share capital of 1 euro, which represents the deposit that must be made by shareholders in the company upon its creation. It is this minimum amount of the share capital that is a prerequisite for this type of business company, by which, with a low amount of share capital, the company gets into a crisis. The institution of the company in crisis was enshrined in the legislation for the purpose of protecting the real creditors of the company from the company's shareholders themselves when repaying obligations. It is the simple joint-stock company that represents the type of business company that, of all types of business companies, is most likely to meet the conditions for establishing a company in crisis.

Key words
A simple join-stock company, company in crisis, equity, liabilities

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Strengthening Competencies in the Area of Sustainability in the Education of Future Accountants and Auditors

Renáta Pakšiová

Abstract
The increasing emphasis on sustainability reporting imposes new demands on educating future accountants and auditors. This paper focuses on enhancing sustainability competencies within the accounting and auditing study program. Through theoretical analysis of standards like CSRD and ESRS, we explore integrating sustainability topics into curriculum subjects. Key areas are identified for effective incorporation into second-level courses at the Faculty of Economic Informatics, UE in Bratislava, where I co-guarantee the program. Conclusions highlight the importance of these topics in preparing graduates for market challenges, fostering critical thinking, and developing professional competencies in ESG reporting. This ensures that future professionals can adapt to evolving regulatory requirements and contribute to the transparency and sustainability of business entities.

Key words
Sustainability Competencies, Accounting and Auditing Education, ESG Reporting, Curriculum Integration, Future Accountants and Auditors

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The structure of the virtual environment in Python language

Michal Páleš

Abstract
With a virtual environment, the user has full power to manage libraries and their versions, which are used in the project. Since this is a file that helps maintain the development clear and clean environment, it consists of several parts that help this functionality to fill. Python assumes the use of the venv module, as it is the official recommended one method for creating virtual environments. The file structure of the virtual environment varies depending on the operating system being used.

Key words
Python, virtual environments, venv module, file of the virtual environment

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Project management as a tool for increasing the efficiency of company management

Peter Peťko

Abstract
Project management has rapidly evolved in recent years due to automation technologies and artificial intelligence (AI). Automating routine tasks, such as schedule tracking and reporting, enables project managers to focus on strategic activities like planning and decision-making, significantly reducing costs and enhancing project efficiency and quality. AI-powered tools also support risk management and resource allocation, improving process accuracy and providing real-time data. Agile project management allows company leadership to dedicate less time to preparation and more to effective decision implementation, with various frameworks tailored to project types and organizational specifics. This paper presents theoretical concepts of agile project management that can enhance performance, reduce risks, and increase flexibility, enabling companies to gain a competitive advantage and adapt quickly to market changes.

Key words
Project Management, Automation, Artificial Intelligence, Agile Methodology

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Specifics of hedging the bond portfolio with futures contracts on the long-term interest rate

Ľudovít Pinda

Abstract
Hedging a bond portfolio is more complicated than hedging a stock portfolio with stock index futures contracts. With this hedging, its effectiveness depends only on the stock exchange value of the contract and the value of the stock index at the time of delivery. Hedging the bond portfolio with futures contracts on the long-term interest rate directly affects the choice of the cheapest bond traded on the market, its conversion factor, duration hedging ratio. These values directly affect the number of traded contracts, represented by the selection of the cheapest bond. In practice, if the time between closing and billing is longer, e.g., half to one year, so the duration of the bond portfolio must be recalculated at the time of contract expiration. The position in futures contracts depends on the position of the hedged asset. Correct expectations of interest rate changes will directly affect the profit and efficiency of hedging.

Key words
Hedging, duration, cheapest bond to deliver, short and long position

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Legislative regulations of mergers in the Slovak Republic

Martina Podmanická

Abstract
Mergers are a part of a broader issue of certain types of business joining into larger economic or legal units. The merger can be carried out between mutually independent companies as well as between capital-linked companies. The correct assessment of the given transaction from a legal, accounting and tax point of view is extremely important for the successful management of a merger as a type of business combination. The paper clarifies mergers transaction as possible types of business combinations; explains the fundamental concepts related to the merger, because their understanding is necessary for the correct accounting solution of given transaction; informs about the legal context of mergers to the extent necessary to explain the accounting context. The paper also presents a comprehensive accounting and tax solution to this issue from the acquiring company point of view according to the currently valid accounting and tax legislation.

Key words
Mergers, fair value, goodwill

Deep Fake Technologies in Computer Graphics

Peter Procházka

Abstract
Our work provides a comparative analysis of three advanced technologies for generating deep fake content: Face Swap by picsi.ai, FaceFusion 3.0.0, and kohya_ss for training LoRa models with specific faces. The goal was to evaluate their efficiency, output quality, and usability in various application scenarios. The methodology includes experimental testing of each tool with identical input data to ensure the objectivity of the comparison. The results show differences in accuracy, processing speed, and ease of use, providing valuable insights for researchers and professionals in the fields of computer graphics and artificial intelligence. In the conclusion of the work, we also discuss the ethical and legal aspects of using deep fake technologies, emphasizing the need for responsible approaches and possible regulations in this dynamically evolving area.

Key words
Deep Fake, Face Swap, FaceFusion kohya_ss

Perception of using Artificial Intelligence at the University from the IT Students' Point of View

Eva Rakovská, Veronika Horniaková

Abstract
Although AI has been part of educational tools for a long time, many students and teachers have no idea about the hidden aspects of AI in software products. The universities should be the leaders by setting the AI in education and managing their environment. We have decided to explore students` knowledge of AI which may contribute to some managerial processes in Education. The students of the informatics study program answered a survey about their opinion on whether they use AI for learning, writing projects, and coding and whether they have some expectations and ideas of how to use AI technologies properly. The main output from the survey shows us that it is necessary to teach students not only AI techniques, but they require courses about appropriate usage of AI techniques. Based on the survey, our focus is to summarize the advantages and disadvantages of incorporating AI in universities.

Key words
Artificial Intelligence, AI in Education, University management, AI techniques

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Assessment of solvency and capital adequacy of insurance companies on the Slovak insurance market in 2022

Katarína Sakálová

Abstract
The aim of this contribution is to present data from the mandatory reports on the solvency and financial status of insurance companies for a selected group of nine insurance companies. In order to be able to compare correctly and find out whether insurance companies are solvent or insolvent, we used the calculation for comparison: ratio Solvency II 2021 = eligible own resources for 2021/required capital for 2022, ratio Solvency II 2022 = eligible own resources for 2022/required capital for 2021. The average Solvency II indicator of the nine Slovak insurance companies was 178.55%. Overall, nine insurance companies met in 2022 all solvency requirements and no insolvency risk was noted.

Key words
Solvency, financial status, mandatory report, insurance company

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Implementation of machine learning models to improve predictions for a selected type of non-life insurance

Peter Schmidt, Silvia Zelinová

Abstract
The article focuses on the application of advanced machine learning techniques to enhance the accuracy of predictions in non-life insurance sectors such as property, automobile, and liability insurance. Traditional insurance prediction methods often rely on historical data, while machine learning enables the identification of complex patterns and more accurate risk predictions. Key methods discussed include regression models, random forests, and neural networks capable of handling Not Small - Not Big Data. This approach not only improves prediction accuracy but also optimizes insurance pricing, enhances risk management, and aids in fraud detection. Challenges lie in data acquisition, processing, and integrating machine learning models into existing insurance systems.

Key words
Machine Learning, Non-life Insurance, Risk Prediction, Not Small - Not Big Data, Insurance Pricing Optimization

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The Use of Augmented Reality in Teaching General Mathematics Subjects at the Faculty of Economic Informatics of the University of Economics in Bratislava

Zsolt Simonka

Abstract
Augmented Reality (AR) has great potential to enrich education in general. The idea of this article is to demonstrate how the use of AR can significantly enhance the teaching process and help students better understand complex mathematical and economic concepts. Emphasis is placed on developing spatial vision to facilitate the study of selected parts of general mathematics subjects at EUBA. AR applications such as GeoGebra AR and AR-Math allow students to interactively explore graphs and functions in three-dimensional space, providing a better understanding of function topography and facilitating spatial identification of extremes. They can be used to visualise various types of economic functions of two real variables and allow students to experiment with different parametric values of these functions, contributing to a better understanding of the concept of partial derivatives. The article also provides specific examples of AR applications in teaching, as well as implementation steps for the successful integration of AR into education. The article was developed as part of the KEGA project: The Concept of Constructionism and Augmented Reality in STEM Education.

Key words
Augmented Reality, GeoGebra AR, AR applications, Education, Teaching

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Augmented Reality as an Innovative Tool in Teaching Economic Subjects in Engineering Education: Bridging Theory and Practice

Zsolt Simonka, František Slaninka

Abstract
There is growing interest in the use of modern technologies in education, with augmented reality (AR) emerging as one of the most innovative teaching methods. This article explores the application of AR in teaching economic subjects at engineering-focused universities. The aim is to examine the benefits and challenges that this technology brings to conveying complex economic concepts to students in technical disciplines. Based on case studies and pilot projects at selected universities, we analyse how AR supports interactive learning, visualisation of abstract economic models, and enhances understanding of economic phenomena in the real world. We also discuss the technical and pedagogical aspects of implementing AR into curricula. The findings indicate that augmented reality has the potential to increase student engagement, improve learning effectiveness, and prepare future engineers for a more nuanced understanding of economic processes in practice. This article was developed as part of the KEGA project: The Concept of Constructionism and Augmented Reality in STEM Education.

Key words
Augmented Reality (AR), Innovative Tools, Economic Education, STEM Education

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Application of Clustering in Insurance Industry

Martina Slašťanová

Abstract
We can consider clustering as the classification of objects into individual groups - clusters, in such a way that the objects inside a given cluster are as similar as possible, they have common characteristics, and on the contrary, they are as similar as possible to objects from other clusters. A cluster is therefore a group of objects whose distance (dissimilarity) is smaller than the distance of objects not belonging to the cluster. This grouping has the property of efficient processing of categorical, numerical and spatial attributes. Using gap statistics, the optimal clusters obtained from the algorithm are then used to compare actual and expected claims in the insurance portfolio.

Key words
Clustering, Gap statistics, Insurance industry, Tracking and Monitoring claims

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Analysis of selected option strategies

Lenka Smažáková

Abstract
The importance of financial derivatives in the world of finance continues to grow. Understanding their characteristics and their potential uses is an essential part of any industry in finance. Among financial derivatives, options are one of the most dynamic and flexible categories, providing traders with a wide range of options for managing risk and exploiting speculative opportunities. In this paper, we construct and analyze appropriate option strategies for a trader in capital markets according to the nature of the underlying asset. We then predict the behavior of the selected strategies through simulations using geometric Brownian motion.

Key words
Financial derivatives, Options, Brownian motion

A tool for applying models generated by means of automatic machine learning implemented as a web application

Pavol Sojka

Abstract
Nowadays, there are many data sources that can bring additional information to their owners. Not many of them are able to analyze these data sources because of lack of knowledge in scientific fields like statistics, mathematics and alike. Our paper aims to partially solve this kind of problem, and we've created a tool that implements steps to facilitate this process. In our previous work, we implemented a data cleaning tool. The second step is to select a suitable model according to the given data in the process of automatic generation a suitable model, and the third step is to apply generated model to our data.

Key words
Python, web app, scikit-sklearn, dataset

Changes in the tax bonus for children in the Slovak Republic

Renáta Stanley

Abstract
Every employee is entitled to a tax bonus for dependent children living with him in the same household, or under other conditions established by legislation, in the form of a reduction of income tax, or tax advances that he would otherwise have to pay. The tax bonus is classified as a variable form of tax benefits, the amount of which varies depending on the currently valid legislation in the country. Changes in its amount are mainly influenced by economic factors such as inflation, the economic state of the country and the like. On October 3, 2024, the Parliament approved in abbreviated legislative proceedings the government's draft law, which amends some laws to improve the state of public finances, and which causes changes to the conditions for entitlement to the child tax bonus from January 1, 2025. The aim of this contribution is to present the development of the tax bonus with the indication of changing factors in the conditions of the Slovak Republic.

Key words
Tax bonus, legislative change, tax benefit

The Use of AR in higher education

Anna Strešňáková, František Slaninka

Abstract
The rapid development in virtual and augmented reality (VR and AR) presents significant opportunities for enhancing university-level education. This technology aids in spatial orientation, manipulation, and analysis by allowing students to interact with complex concepts in a tangible manner. Through VR and AR, students can engage with 3D models, practice procedures, and navigate virtual environments, making learning more interactive and stimulating. The immersive experience, involving visual and physical interaction, fosters engagement, creativity, and intrinsic motivation. However, challenges such as costs, technical requirements, and pedagogical adjustments are important considerations. This article explores the practical applications of augmented reality in universities, analysing its impact on student engagement and learning outcomes through case studies, while also addressing the benefits and limitations of this technology in higher education. The article was developed as part of the KEGA project: The Concept of Constructionism and Augmented Reality in STEM Education.

Key words
Virtual Reality (VR), Augmented Reality (AR), Higher Education, Student Engagement, Educational Technology

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Software support in determining the solvency of an insurance company

Anna Strešňáková

Abstract
To ensure the insurance company's ability to financially cover its obligations arising from insurance contracts, after the introduction of new standards, procedures, scenarios and algorithms using not only narrowly specialized software to process a lot of data are coming to the fore. When it comes to data storage, cloud solutions facilitate access to data outside the office. Clouds are also one of the possibilities for using the capacity of several computers for predictive models. For scenario modelling and verification, insurance companies have their own software or use opensource systems with built-in packages for actuaries. The article focuses on the possibilities of various environments and software packages that insurance companies use for solvency calculations.

Key words
Solvency, cloud, actuarial softvare

Risk Aggregation in Insurance in the context of Solvency II Regulations: A Machine Learning-Based Approach

Krystian Szczęsny

Abstract
The objective of the Solvency II directive is to protect policyholders against the risk of insolvency of insurance companies. A key component of this aim is the aggregation of capital requirements across various types of risks, leading to the determination of the Solvency Capital Requirement (SCR) and the diversification effect (DE). SCR can be calculated using standard formulas (SF), based on the variance-covariance method (V-C), or through internal models developed by the insurance companies themselves. This study aims at proposing a new method that can be used in the development of these models. A crucial step in this process is identifying the most accurate dependencies among risk factors. We suggest employing copulas estimated through neural networks for modeling dependencies in the context of underwriting and reserve risk. To achieve this, we design two neural networks: one for analyzing marginal distributions and another one for copula estimation. Our research focuses on evaluating indicators for property insurance segments based on solvency reports from Polish insurance companies. We compare the diversification effects obtained using the V-C method, copula cascading approaches, and copula estimation via neural networks. The results indicate significant differences in DE values between copulas estimated using neural networks, parametric copulas, and the V-C method.

Key words
Solvency II, Solvency Capital Requirement, Vine copula, neural copulas

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European Union Small Open Economies during the Pandemics

Karol Szomolányi, Martin Lukáčik, Adriana Lukáčiková

Abstract
The paper estimates the main shocks realised during the COVID-19 pandemic in small open economies of the European Union. The panel cyclical components of GDP and its components, labour, and average product of labour were computed. During the pandemic, the cyclical characteristics of the large European countries are similar to those of other studies. The economic volatility was relatively high; compared with GDP, consumption was more volatile than GDP, while investments were relatively less volatile; the trade balance was procyclical, and the average product of labour was countercyclical. In contrast, in the small European countries, the economic volatility was lower, the consumption was less volatile than GDP at the expense of investments, and the average product of labour and trade balance was acyclical. The paper adopts a real business cycle model with importable, exportable, and tradeable products to explain the pandemic fluctuations in small European Economies. As a result, the main shocks influencing the economies were changes in terms of trade, labour supply, and financial frictions as an increase in investment adjustment costs and debt elasticity of interest spread were more severe than in the big countries.

Key words
RBC Model, Observed Cyclical Characteristics, Calibration

Comparison of changes in the risk of income poverty in Poland and Slovakia as a result of the crises after 2019

Erik Šoltés

Abstract
The stagnation of the EU in the fight against poverty and social exclusion is at least partly caused by several crises at the beginning of the 2020s. The article focuses on the impact of these crises on income poverty in Slovakia and Poland. The aim of the paper is to find out how the risk groups of the population have changed from the perspective of the probability of being at-risk-of-poverty (AROP) in 2022 compared to 2019 and how their riskiness changed. The article compares these changes in Poland and Slovakia and reveals which groups of people have so far been more affected by the crises. For this purpose, binomial logit models are used along with associated analysis of marginal means, contrast analysis and estimation of the probability of AROP for different population groups. Special attention is paid to the mutual effect of several of the most important factors, while their synergistic effect is revealed.

Key words
At-risk-of-poverty, Slovakia, Poland, binomial logit model, estimation of probabilities

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Analysis of the calculation of insurance contract liabilities under IFRS 17

Tatiana Šoltésová

Abstract
The paper focuses on calculating liabilities arising from life insurance contracts by IFRS 17. Its objective is to understand the guidelines set out in the standard and examine their impact on calculating liabilities. The paper analyses and applies two main methodologies, the Building Block Approach (BBA) and the Variable Fee Approach (VFA), to calculate the liabilities under life insurance contracts. It also seeks to assess their advantages, disadvantages and limitations in the context of compliance with the requirements of IFRS 17. The valuation models are further enhanced by including death benefit insurance, which results in a fixed amount of benefit being determined for the client. The objective of calculating the insurance liabilities is to estimate the required capital that an insurance company should have for a given portfolio. This required capital should be sufficient to secure obligations to clients in the event of an insurance claim.

Key words
Life insurance, liabilities, IFRS 17, Building Block Approach (BBA), Variable Fee Approach (VFA)

Application of paragraph 190 of act No. 200 /2005 Col. of Laws (Criminal Code) for corporate and public sector practice

Miloš Tumpach

Abstract
We have been analyzing the impact of provisions of the Criminal Code in Slovak republic on legal status of any order of an employer forcing the employees to consume service in exchange for a consideration. The paragraph promulgates: „Whoever {e. g. employer} forces another person {e. g. employee} … to provide assets or other form of consideration, for themselves or for a third party, in exchange for services of their own or services of a third party, which are imposed upon the victim against their will … shall be punished by imprisonment for a period of four to ten years“. Based on the textual analysis of this provision and legal analysis of the former and ongoing judicial processes, we conclude, that even though the employer has certain level of power over employees, it´s not a power without boundaries. In fact, such practice is strictly prohibited by actual law and thus illegal, even if its aim is for a good case.

Key words
Criminal code, rights of employees

The influence of income poverty on household consumer behavior in the Slovak Republic

Mária Vojtková

Abstract
One of the functions of the household in the economy is to act as a final consumer. The overall behavior of households therefore depends not only on income, but above all on expenditure. The aim of this paper is to compare the structure of equivalent consumption expenditure of Slovak households depending on the degree of poverty risk using exploratory analysis as well as Gatev's index of dissimilarity of structures. An additional goal is the verification and quantification of the influence of selected factors on the consumption expenditures of households in the Slovak Republic, while one of the factors that we will try to point out is the classification of the household into a group based on the income poverty line. To assess the influence of selected factors, we apply the methods of general linear models through the GLM procedure in the statistical tool SAS Enterprise Guide 8.1.

Key words
Consumption Expenditures, Household Budget Survey, Income Poverty, General Linear Models, Gatev's Index of Dissimilarity

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Longevity Risk Costs and the Clustering of Selected OECD Member Countries

Stanisław Wanat, Grzegorz Korbela

Abstract
The aim of this paper is to assess the impact of different clustering methods on the accuracy of life expectancy forecasts. The study employs stochastic multi-population mortality models that allow for modeling future trends in mortality rates for coherent populations of multiple countries. To identify the optimal clustering strategy for finding similarities between different countries, various clustering methods were used. The results show that appropriate population clustering can improve forecast accuracy. More accurate forecasts contribute to reducing costs arising from longevity risk, which is primarily caused by underestimating forecasts. Furthermore, the results demonstrate the importance of the way social policy is conducted, resulting from the adopted welfare state model.

Key words
Population aging, demographic forecasts, life expectancy, multi-population mortality models, welfare state

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Utilizing R Programming for Capital Allocation in Catastrophic Risk Coverage through Risk-Based Models

Michal Závodný

Abstract
This paper explores the application of R programming language in modelling capital requirements for covering catastrophic risks. Catastrophic risks pose unique challenges due to their low frequency but high impact, necessitating advanced risk models to ensure sufficient capital allocation. Using various R-based statistical techniques and simulations, the study demonstrates how risk-based capital models can be effectively implemented to estimate capital reserves. It also examines the application of extreme value theory within R to capture tail dependencies in multi-risk scenarios. The findings highlight the flexibility and accuracy of R in creating customizable solutions for risk managers and insurers, facilitating better decision-making in catastrophe coverage. This research contributes to the field by showcasing a practical approach to mitigating financial losses and enhancing risk management strategies.

Key words
Risk-based models, catastrophic risk, R programming language

Analysis of the Contractual Service Margin in life insurance products

Silvia Zelinová

Abstract
The aim of the paper is the analysis of the Contractual Service Margin (CSM), which is a basic concept in IFRS 17. CSM almost under all circumstances represents the undeserved profit that the insurance company expects when providing insurance services. IFRS 17 is based on determining procedures and principles that also serve to determine CSM. In the paper is performed the initial recognition of the assets of 4 life insurance products – term insurance with constant sum insured, term insurance with decreasing sum insured, term insurance with additional disability insurance and unit linked insurance, using the GMM and VFA methods on 1300 contracts of each portfolio. Both methods have the same procedure for calculating the initial recognition. CSM analysis consists in determining coverage units, which we calculate in different ways and evaluate them at the same time. A positive CSM result indicates the correct selection of all product parameters. Future cash flows as the main component of the CSM are calculated using the Prophet program and show how such a calculation process takes place in an insurance company.

Key words
IFRS 17, CSM, Life Insurance, GMM method, VFA method, Coverage Units

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