Report on the 38th ECMS International Conference on Modelling and Simulation

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The 38th ECMS conference (ECMS International Conference on Modelling and Simulation) took place between June 4th and 7th, 2024, in Krakow, a historic city in Poland. This annual conference is interdisciplinary in nature, with the Finance, Economics, and Social Sciences (FES) section being hosted by the Institute of Finance at Corvinus University of Budapest. Alongside two plenary sessions, more than 80 scientific presentations were held in parallel sessions, with participants from approximately 20 countries. The methodology of modeling and simulation served as a tied link for these talks. The conference addressed numerous economically significant topics, with participants delving into macro and micro-level issues. Several presentations in the sections also focused on common economic phenomena among the Visegrád Group, sparking lively discussions among Hungarian, Polish, and Czech participants.

Real Estate and Hoteling Markets

The first major thematic block focused on the analysis of real estate and hotel market data, along with modeling predictive forecasts of market processes. The first paper was presented by Grażyna Suchacka, Assistant Professor at the Institute of Informatics, University of Opole, Poland. The authors aimed to capture the dynamics of Poland's housing construction market, dividing the process into three stages: building permits, houses under construction, and completed houses. They applied a nonlinear autoregressive exogenous model (NARX) on a monthly dataset covering 17 years. By testing several model specifications and calibrations, they managed to point out exciting differences between the market segments

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of individual investors and professional developers. The audience initiated a discussion about whether the model is suitable for predicting market trends (Suchacka et al., 2024).

Daria Wotzka, lecturer and research fellow at the Opole University of Technology, Poland, presented a paper that also examined Poland's housing sector but put different questions. On a quarterly dataset from 2010 to 2022, the authors analysed the relationship between the market prices and the number of apartments released. Besides calculating conventional correlation measures (Pearson, Kendall, Spearman), they also conducted wavelet coherence analysis. This sophisticated approach allows us to uncover complex, nonlinear relationship patterns and to detect phase and amplitude relationships between time series. The authors found notable cyclical patterns in the data. In the presentation, Daria Wotzka completed the paper's results by separately carrying out the wavelet analysis for all 16 Polish regions. As a possible further research direction, examining the apartments' area instead of their number was suggested (Wotzka et al., 2024).

Łukasz Łabanowski, manager of DeSilva & Mercure Hotels in Opole, analysed the Polish hotel industry processes with his colleagues, using also the method of wavelet coherence analysis. Their main research question was to analyse whether there is a relationship between different hotel industry specific parameters - such as hotel occupancy, availability of swimming pools, etc. – and hotel performance, measured by gross operating profit. Their research concluded that the USALI (Uniform System of Accounts for the Lodging Industry) database, which is the basis of their studies and which is mandatory for all hotel industry operators to report to, provides a good basis for drawing valuable conclusions about the performance of hotels, i.e. it is important to analyse and monitor the evolution of these hotel industry specific data (Łabanowski, 2024a). The presentation by Łukasz Łabanowski was followed by a presentation by Daria Wotzka, also on modelling of the Polish hotel industry processes, using the same data as her colleague in the previous presentation. However, she used the NARX method mentioned earlier to predict the expected performance of hotels (Łabanowski, 2024b).

Macroeconomic Factors

Eszter Boros, Senior International Expert at the International Relations Directorate of the Central Bank of Hungary (MNB) analysed China's economic policy through the lens of the Mundell trilemma. According to Mundell (1963), among the three main monetary policy objectives (financial openness, exchange rate stability and monetary policy independence), one is inevitably compromised when the other two are pursued. Xi Jinping, President of China, has recently emphasized in his communications the country's ambition to become a financial "superpower" alongside the USA. Achieving this goal critically depends on increasing the international circulation of the Chinese currency, the renminbi (RMB). So far, China's economic policy has pursued a balanced path towards internationalizing the RMB, prioritizing exchange rate stability and sovereign monetary policy over financial openness. However, the

expert presented that this combination may not facilitate a rapid transition towards RMB internationalization in the future without sacrificing stability, potentially leading to losses in terms of inflation outcomes (Boros & Sztanó, 2024).

Ágnes Vaskövi, assistant professor at the Macrofinance Department at Corvinus University of Budapest, examined the potential incentive of atypical (or non-standard) forms of employment (temporary and part-time employment) for women's labour force participation. She sought to identify specific personal characteristics of women who choose non-standard forms of employment over inactivity. Using microdata from the EUROSTAT Labour Force Survey for 10 Central and Eastern European countries, she analysed responses from approximately 54,000 female respondents aged 18-64. Based on a multivariate logistic regression model, she concluded that women with higher education and living in urban areas are more likely to opt for non-standard employment. In terms of age, those in their early forties (40-49 years old) are more inclined towards non-standard employment as an alternative to inactive, household roles (Vaskövi & Horváth, 2024).

Erzsébet Teréz Varga, assistant professor at the Corvinus University Macrofinance Department, investigated the impact of family tax allowances in the Visegrád countries on the risk of poverty among families. She analysed single-parent and dual-earner households separately. Her simplest regression model showed that tax allowances influenced poverty rates, but the results were not uniformly positive across all examined countries. When expanding her model, she included time as a trend variable, revealing that only dual-earner families in the Czech Republic showed a poverty-reducing effect of family tax allowances (Varga, 2024).

Ilia Chernenko, associate professor at the Graduate School of Economics and Management, Ural Federal University, presented a paper on human capital performance. In the research, the authors investigated the differences in the performance of basic and advanced digital competencies within the context of Industry 5.0. Based on questionnaires, they collected a sample of 1798 and used a multi-group comparison of structural models across three regions in Russia. The results show that the characteristics of the three regions and their differences in the initial level of digitalization do not significantly affect the accumulated human capital performance in the production systems. However, the more digitalized the region, the greater the impact of basic digital competencies on the specific human capital of Industry 5.0 (Ilia & Zemzyulina, 2024).

Quantitative Finance

Ágnes Vidovics-Dancs, associate professor at the Department of Macrofinance, Corvinus University of Budapest, presented her research about some problems emerging in financial risk management. She emphasized that hedging might not (and usually does not) mean simply eliminating or minimizing risk in general. In her paper, she showed a specific situation where the portfolio manager aims to hedge the foreign exchange risk of a foreign stock investment. She showed that the traditional

asset of hedging such risk (i.e. short forward position) may not reduce but deteriorate the risk measures of the portfolio. In this sense, the correlation between the stock price and the foreign exchange rate is a crucial factor. The Monte Carlo simulations of the paper illustrated that the hedging feature of a derivative product is far from trivial to detect, and hence, regulators should initiate and apply more sophisticated definitions in this topic (Vidovics-Dancs, 2024).

Kata Váradi, associate professor at the Department of Corporate Finance, Corvinus University of Budapest, gave a presentation on option pricing. In a joint research with her co-authors, they showed how the intrinsic value of an option that gives the right to exchange two options is determined. They named this option structure ComEx, short for "Compound Exchange". ComEx options are based on two families of options, compound options (options with an option as their underlying) and rainbow options (options with multiple underlying). In addition, their research focuses on a special type of rainbow options, the Margrabe options. The Margrabe option gives the rigth to exchange one underlying asset to another. In thier research they compare the value of the Margrabe option to the ComEx options. Their main finding was that the ComEx option is better from a funding liquidity point of view, as it typically has a lower value than the Margrabe option and also there is no need to buy one of the underlying assets, just one of the underlying options, which price is lower. They also explained that the underlying assets' standard deviation values and the correlation between the underlying assets has a significant impact both on the Margrabe and the ComEx options (Becsky-Nagy et al., 2024).

Green Finance

Emília Németh-Durkó, assistant professor at the Corporate Finance Department of Corvinus University, examined the innovation-stimulating effect of green bond issuance. She sought evidence that green bonds increase the short-term green innovation potential of the economy, measured by the number of green patents. Two hypotheses were presented: (1) there is a statistical relationship between green bond issuance and green innovation development, and (2) green bonds encourage the spread of low-carbon technological innovations. However, her analyses did not confirm these hypotheses, likely due to the short time series of available data on green bonds. She concluded that achieving the impact of green bonds requires more time (Németh-Durkó, 2024).

In recent years, the analysis of Environmental, Social, and Governance (ESG) factors has gained increasing attention in the economic and financial literature. Concurrently, these factors have become integral to corporate processes. Zsuzsanna Tamásné Vőneki, Head of the Macrofinance Department at Corvinus University, examined the annual risk and sustainability reports of 26 major banks in the Visegrád countries using content analysis based on ESG factors. Her research aimed to create an ESG disclosure index framework to investigate how banks integrate these factors into their risk management systems. She found that the index is positively and

significantly influenced by GDP per capita, as well as by the size of the bank and its capital adequacy ratio (T.Vőneki & Lamada, 2024).

Physical and Mental Health

Maria Hajłasz, a researcher at the Wrocław University of Science and Technology, showcased a simulation framework for preventing childhood dental caries at the conference, demonstrating how modeling and simulation methodology can even address health issues. As an active presenter in the FES section for several years, Dr. Hajłasz allowed participants to track the progress of her research. In her presentation this year, she outlined the dimensions of the simulation framework for preventive programs, emphasizing the need for appropriate input data to assess the process of dental caries and identify necessary intervention points (Hajłasz & Mielczarek, 2024).

In addition to physical health, machine learning simulation is also suitable for modeling mental health. Khulood Alharbi, a researcher at the University of Durham's Department of Computer Science, along with her co-author, modeled the relationship between classroom disruptive behavior and math-performance among children. Their experiment focused on the correlation between deviant behavior (ADHD traits: inattentiveness, hyperactivity, impulsiveness) and mathematical performance among approximately 2000 British primary school students. The simulation revealed a strong correlation between mathematical performance and disruptive behaviours, suggesting that this relationship can be effectively influenced by frequent modifications to seating arrangements (Alharbi & Cristea, 2024).

In summary, the studies presented at the Finance, Economics, and Social Sciences section of the conference demonstrate that modeling and simulation can be effectively utilized as a research methodology across all areas of economy and society. These methods have enabled a deeper understanding and even prediction of complex economic, financial, and social phenomena. By sharing experiences from various disciplines and countries, the conference speakers enriched the common knowledge base, contributing to the exploration of synergies and relationships between different topics.

On the annual ECMS conferences, an award is given by the Best Paper Award Committee for a contribution which is outstanding in its scientific quality. In 2024, two papers were given the Best Paper Award: Ágnes Vidovics-Dancs, for her paper in the field of financial risk management, and for Barczek et al. in the area of mathematical modelling. Congratulations to them! ■

The studies are available in the 38th ECMS conference proceedings book (pp. 43-142): https://scs-europe.net/conf/ecms2024/ecms2024proceedings.pdf.

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