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From the Editor

It is with great pleasure that we present our readers the last issue of our quarterly in 2025, consisting of 11 articles covering a wide spectrum of topics discussed by 19 authors from USA, Poland, Iran, India, Slovakia and Nigeria. Let us take this opportunity to wish you Happy Holiday Season and A Happy New Year 2026.

Original Research Papers

In the first paper, ***On using ARIMA model confidence intervals applied to population projections based on the components of change: a case study for the world population***, **David A. Swanson** and **Jeff Tayman** discuss how measures of uncertainty derived from a standard time series model (ARIMA) can be applied to an existing population projection. Specifically, how to apply the uncertainty measures to a world population forecast based on the Cohort-Component Method. The results are compared to the Bayesian probabilistic world forecast developed by the United Nations and found to be similar but showing more uncertainty. The results are followed by a discussion suggesting that this new method is well-suited for developing probabilistic world, national, and sub-national population forecasts.

Agata Girul's paper entitled ***Factors determining the formation of degraded areas in local government units and the effectiveness of revitalisation activities*** focuses on identifying the factors that determine the occurrence of deprived areas requiring revitalization. The article uses data from the survey SG-01 report Municipal Statistics – Revitalisation. The PROFIT (PROperty FITting) multidimensional scaling program for local level territorial units was applied. The program takes into account the delimitation of rural areas based on the typology of Functional Urban Areas. Calculations and figures were made in Statistica 13. The focus on the problematic areas revealed the variety of challenges faced by local territorial units in their respective revitalisation programs. The comprehensive analysis of the causes-and-effects of the degradation and revitalisation processes may prove useful tools in developing effective local development strategies while improving the quality of life of residents of local communities.

In the next paper, ***Bayesian nonparametric model for weighted data using mixture of Burr XII distributions***, **Soleiman Khazaei** and **Soghra Bohlourihajjar** discuss a Bayesian nonparametric approach for analyzing weighted survival data using the Dirichlet Process Burr XII Mixture Model (DPBMM) to estimate the underlying density and survival functions. Parameters are inferred using Markov Chain Monte

Carlo (MCMC) methods, and the Metropolis-Hastings algorithm is applied to obtain de-biased samples from the weighted observations. Numerical illustrations are provided using both simulated and real lifetime data, including the presence of censored observations. The performance of the proposed method is compared with classical kernel density estimates to demonstrate its flexibility in modeling complex and heavy-tailed distributions.

Jitendra Kumar's and **Anuj Nain's** article ***Exploring new mixtures of distribution to model a skewed and heavy tailed data*** presents two distributions – Log-logistic and Inverse Weibull distribution – as an extension of all those proposed by Miljkovic and Grün (2016) due to adding and examining K-component finite mixtures of two more distributions. The EM algorithm has been employed for parameter estimation and then best model has been selected using three model selection criterions, namely NLL, AIC and BIC. The risk measures such as VaR and TVaR have been also computed and compared with their empirical counterparts to assess the goodness of fit of our proposed models at the extreme quantiles. It was found that K-component mixture distribution of Log-logistic and Inverse Weibull works better than competent models. To get more generalized view on the theory of mixture distribution the simulation was carried out providing satisfactory results.

The paper by **Mariusz Kubus**, **Łukasz Mach**, and **Przemysław Misiurski** entitled ***Application of the nonlinear splines model to forecast changes in the construction costs index***, presents an innovative approach to forecast the construction costs index (CCI), which is an important macroeconomic indicator. Due to the long-term nature of the investments in the construction market, the authors tested the model in a ten-month ahead period. Except minor disruptions, which were likely related to COVID-19, they obtained promising results, which definitely outperformed the classical ARIMA and its variant with nonlinear autocorrelation functions modeled with neural network. The achieved forecast results will enable both the demand and supply in the construction market to be in market equilibrium and minimize the formation of speculative bubbles in the market.

In the article entitled ***The truncated Schröter recursive algorithm for the computation of aggregate claim amounts***, **Friday I. Agu** introduces and evaluates the truncated Schröter recursive algorithm for computing aggregate claim amounts in the insurance sector. The algorithm addresses the limitations in the existing methods by incorporating truncation at 1, which is crucial for an accurate modelling of insurance claims where the events leading to a claim are pivotal. Using the AutoCollision dataset, the study compares the truncated Schröter algorithm with the Panjer and Schröter recursion algorithms, focusing on computational efficiency and accuracy. Furthermore, the descriptive statistics revealed substantial variability and risk factors, such as higher claim severity for business-use vehicles and young drivers aged 17–20. The results demonstrate that the truncated Schröter algorithm substantially reduces the execution time while maintaining high accuracy, thus making it a superior tool for risk management and premium setting.

In the next paper, ***Inverse Power Lomax Poisson distribution: properties and applications in modelling negatively-skewed reliability data***, **Adebisi A. Ogunde** and **Emmanuel F. Nymphas** propose a new, four-parameter distribution with increasing, decreasing, bathtub-shaped and a unimodal failure rate, called the Inverse Power Lomax Poisson (IPLP) distribution. The new distribution combines Inverse Power Lomax (IPL) and Poisson distributions along with several properties of the new distribution: its probability density function, its reliability and failure rate functions, the quantiles, the stress-strength parameter, complete and incomplete moments, the moment generating function, the probability weighted moment, Rènyi and q-entropies, and order statistics were derived. The study presents the estimation of the model's parameters based on the maximum likelihood method. The applications of the new distribution are presented using two real data sets, showing its flexibility and potential in modelling lifetime data.

In the paper entitled ***Exploring variation in data on income inequality across databases and measures in post-socialist countries***, **Monika Wesołowska** examines the consistency of income inequality data in post-socialist countries in Central and Eastern Europe and Central Asia across common measures and databases. Such analyses were carried out for single measures, databases, or selected countries, aimed at identifying the research gap for a selected group of countries. The study indicates a high level of consistency in income inequality trends over the long term and highlights strong correlations between different data sources for the same measures. However, they are inflated by the high consistency of data for EU countries, which is why only for this subgroup it would be possible to truly confirm the existence of consistent trends. The ranking of countries is most consistent in the context of extreme equality or inequality, and between measures from the same database, while the occurrence of full consistency in the values of individual measures practically does not occur.

Conference Papers

XXXXII Multivariate Statistical Analysis 2024, Lodz, Poland

Grzegorz Kończak's article ***On a new goodness-of-fit test for multivariate normality with fixed parameters based on David-Hellwig test idea*** presents a proposal for a goodness-of-fit test for multivariate normality. The idea of this test is based on the concept of empty cells. In conducting an empty cells test, it is crucial to partition the area of variation into disjoint cells, which is particularly significant in multivariate analysis. In the proposed testing procedure, cells are defined by confidence ellipsoids and are further segmented along the eigenvectors of the variance-covariance matrix.

This division of the area of variation ensures equal probabilities of observations in the cells under H0. The proposed test validates the conformity of the empirical distribution to a preset, precisely specified, multivariate normal distribution. Accordingly, it reacts not only to changes in the parameters of the distribution, but also to deviations from normality, in particular to the occurrence of a distribution type other than normal.

XV Scientific Conference MASEP 2024 – Measurement and Assessment of Social and Economic Phenomena, Warsaw, Poland

In the paper ***The concept of behavioral model of decision-making under risk*,** **Ewa Falkiewicz** outlines the decision-making process under risk and considers the psychological aspects of the decision-maker. The aim is to construct a principle of optimal decision choice for a single decision-maker. A finite, discrete set of acceptable decisions, a set of possible world states, and a system of probabilities of these states, whose probabilities are either known or subjectively estimated by the decision-maker, and a utility matrix are considered. A process of optimizing the decision-making is suggested, taking into account not only the rationality of the decision-maker but also emotional aspects. Taking into account two emotions important to decision-making – regret at making a decision bringing less utility than possible in given conditions and satisfaction with a choice that is better than the weakest – constitute the behavioral part of the model.

Research Communicates and Letters

In the paper entitled ***Mean estimation based on the factor-type estimator under an adaptive cluster sampling design*** by **Narendra Singh Thakur**, **Shubhangi Chaurasia**, and **Unnati Bhayare,** some estimators are discussed with their properties using the concept of large sample approximations in adaptive cluster sampling. This manuscript emphasizes the use of the factor-type estimator designed for population mean of the variable under study using the data of highly correlated auxiliary (supplementary) variable under adaptive cluster sampling. The bias, mean squared error and optimum mean squared errors up to the first order are obtained and a simulation study is performed for comparison purpose. The condition of optimality is derived as well.

Włodzimierz Okrasa
Editor