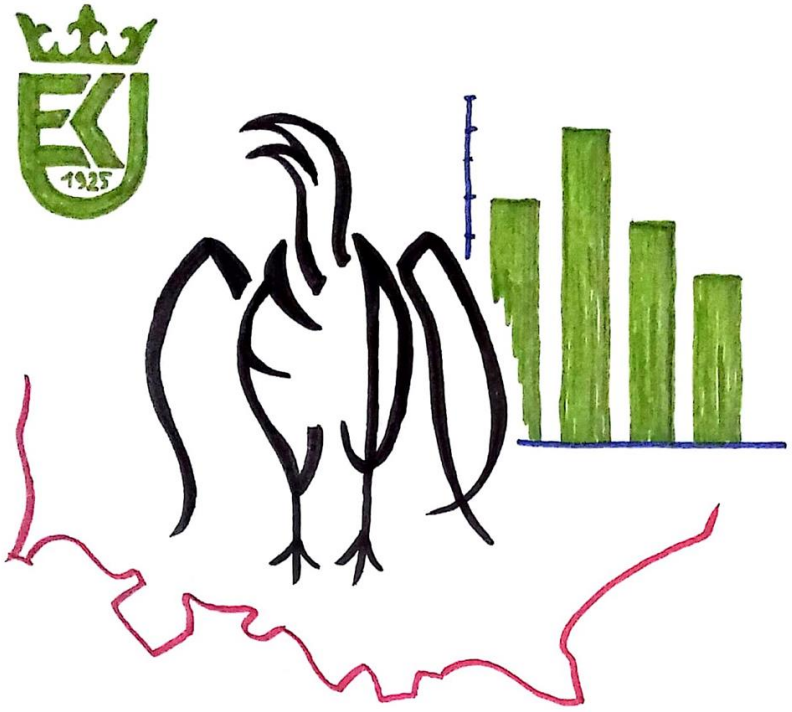

STRESZCZENIA REFERATÓW

LVI Konferencja Statystyków,
Ekonometryków i Matematyków
Polski Południowej
23 – 24 września 2020 r.

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Does the integration always have to be stressful?

The problem of merging populations and its consequences was widely studied by economists. Stark (Stark 2013) showed that merger of populations will always impose an increase in the discomfort of individuals resulting from comparing their incomes with incomes of other members of the group. More precisely, the aggregate relative deprivation of the merged population has to be not less than the sum of aggregate relative deprivation of populations prior to merger, in other words the aggregate relative deprivation is superadditive.

Here we ask whether the superadditivity result is independent of the choice of the relative deprivation measure. We show that in some situations it is sufficient to change the weight the individuals attach to the comparison with the richest individuals in the population to obtain that the social stress decreases after merger.

Keywords: merger of populations, aggregate relative deprivation, income distribution, social distress

JEL classification: D31, D63, I31

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Some improvements of the multivariate generalizations of Chebyshev's inequality

In the paper some improvements of the selected multivariate generalizations of Chebyshev's inequality will be presented. In particular, the improvements of the upper bounds on the probability of a random vector taking values not less distant from the mean vector (in the Mahalanobis distance sense) than sufficiently large ε will be proposed. These improvements will be extended to the case of a random vector with a singular covariance matrix. Then, as an illustration, some multivariate distributions will be considered.

Keywords: Chebyshev's inequality, Mahalanobis distance, random vector, multivariate distribution.

JEL classification: C02, C18

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Debreu economy with intra-sector competition

Schumpeter's theory of economic development is one of the main basis of the evolutionary approach to the relationships among innovations, competition, and growth. However, in a large part of mainstream formalizations of this theory, e.g. the research program on analysis of Schumpeter's theory in the Arrow-Debreu model of general equilibrium, the phenomenon of competition was not taken under consideration.

In this context, the main aim of this paper is to show, that adequate modification of Debreu's economy enables us to include the competitive behavior of producers in neo-Schumpeterian theory of innovative evolution. Moreover, only one concept of the competition will be taken into consideration: intra-sector competition as a process of rivalry between producers in their incessant struggle to increase their market share leading to displacement, absorption or elimination of rival firms. This problem relates to the classification of different kinds of innovative changes and diversification in a set of producers concerning their shares in the market of the given commodity.

Keywords: competition, Debreu economy, Schumpeter's theory

JEL classification: D11, D50, C6, O10, O30, O31

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Innovations in the two-period equilibrium model with the financial market - axiomatic approach

The studied issues are related to the analysis of economic activity in multi-period models of general equilibrium, in which activity on real markets is coordinated by financial markets. In models with a production system, it is analysed how the supply of goods is created by production activities and, as a consequence, the interaction between the productive activity of firms and financial markets.

The paper defines the extension in two-period financial economy with production based on innovations in the real sector of the economy. The production system consists of firms that have reached the corporate stage, where their ownership shares are traded on a stock market. Hence, the changes introduced in the production sector have a direct impact on the financial market.

This makes it possible to study the influence of innovation on real markets on the basic characteristics of financial economics, including the possibilities of financing production offered by the financial market.

Keywords: financial economics, innovations, equilibrium, extensions of economics

JEL classification: D41, D53, L20

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A tail dependence-based MST and their topological indicators in modelling systemic risk in the European insurance sector

In the present work we analyse the dynamics of indirect connections between insurance companies that result from market price channels. In our analysis we assume that the stock quotations of insurance companies reflect market sentiments which constitute a very important systemic risk factor. Interlinkages between insurers and their dynamics have a direct impact on systemic risk contagion in the insurance sector. We propose herein a new hybrid approach to the analysis of interlinkages dynamics based on combining the copula-DCC-GARCH model and Minimum Spanning Trees (MST). Using the copula-DCC-GARCH model we determine the correlation coefficients in the distribution tails. Then, for each analysed period we construct MST based on these coefficients. The dynamics is analysed by means of time series of selected topological indicators of the MSTs. Our empirical results show the usefulness of the proposed approach to the analysis of systemic risk in the insurance sector. The times series obtained from the proposed hybrid approach reflect the phenomena occurring on the market. The analysed MST topological indicators can be considered as systemic risk predictors.

Keywords: systemic risk, insurance sector, tail dependence, minimum spanning tree topology indicators, deltaCoVaR

JEL classification: G22

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The angle between the 2-dimensional linear regression model lines

Applying the Mean Squares method to vertical and horizontal distances between points observed in a 2-dimentional sample (X,Y) and the relevant linear model we obtain two different straight lines, namely $\hat{y}(x)$ and $\hat{x}(y)$, i.e. the regression of Y with respect to X and the regression of X with respect to Y. The lines intersect at the point $(\bar{X}, \bar{Y})$ at the angle that is obviously the lower, the greater the determination coefficient between X and Y. But it turns out that the angle depends not only on the correlation between features but also on the ratio of their sample dispersions. Based on the fact it will be discussed the region around $(\bar{X}, \bar{Y})$ where the linear model may be reasonably applied.

Keywords: linear regression model, model evaluation, quality of prediction

JEL classification: C18, C30, C52, C53

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Analysis of football players labour market migrations using panel gravity models

Player transfers between different sport clubs are essential and bringing strong emotions part of the whole football industry. Objective of the paper is to evaluate the possibility of use panel gravity models for estimating the size of players movement between pairs of countries and discover factors that are influential for their migration directions. The approach, often used in modelling and predicting trade flows, takes into account spatial and temporal perspective which can be helpful to determine the right career path for football players. The analysis is based on transfer history from selected European leagues.

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Selected credit risk models

The paper is devoted to the credit risk models. Two kind of such models based on the generalized binomial distributions are presented. First, we investigate the dependent credit risk, using the copulas, mainly Archimedean. The influence of the degree of dependence on the number and the value of lost credits is presented. Second, we study the case, when the main parameter of model, the probability of outstanding obligors, is uncertain. We treat such parameter as the fuzzy number and we combine the randomness and fuzziness in this case. We investigate the number and the value of lost credits, too.

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Optimal time-dependent paths in growth model

In the paper we consider Ramsey-Koopmans-Cass growth model where some of the parameters depend on time. The existence of optimal paths is studied. The main focus of the work is on the dependence of the model and its solution to the perturbance of parameters. The conditions, under which the solutions of perturbed models approximate the solution of the original model, are formulated.

Keywords: stability of optimal paths, Γ-convergence, growth model

JEL classification: C02, C61, C62

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Wine as a hedging instrument

We study the dynamics of relationship between the global and Chinese stock markets, fine wine market and exchange rates of CNY/USD and GBP/USD by using VAR-DCC-GARCH framework and daily closing prices of LIVX50, S&P500, FTSE100, Shanghai Composite indices from 2010 to 2019. We find evidence of negative correlation between fine wines market and global stock markets in few periods. Most important results provide empirical evidence that fine wines can be hedge against declines of British currency and can help investors minimize risk to build optimal portfolios. Moreover, results of this study reveal that fine wine could act as hedge against slowdown of the Chinese economy growth and depreciation of the Chinese currency. In addition, risk-minimizing hedge ratios were estimated, and optimal investment portfolios have been created including transaction costs.

Keywords: hedging, fine wine, portfolio, MGARCH

JEL classification: C58, G11

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Predictive power comparison of Bayesian homogenous *vs* Markov-switching heteroskedastic VEC models

For already two decades, vector autoregressions (VAR) with Markov switching (MS) have been widely used in modeling macroeconomic data. In particular, due to their attractive stochastic properties, the MS-VAR models have gained quite a popularity in their applications to business cycle modeling as well as in statistical identification of structural shocks. However, fairly scarce is the literature on such model specifications being utilized under non-stationarity of modeled data, with the latter being commonly featured by most macroeconomic time series. Apparently, this can be attributed to the fact that the estimation and statistical inference in such models (with the VAR structure in its vector error correction, or VEC, form) may pose quite a challenge. In this research, we compare the predictive (rather than in-sample) performance of homogenous VEC models with the ones in which the conditional covariance matrix is allowed to switch between two regimes according to a homogenous discrete Markov chain, so as to account for conditional heteroscedasticity, commonly encountered in macroeconomic data. The analysis is performed within the Bayesian statistical framework, which appears natural for probabilistic (rather than only point) forecasting.

Keywords: probabilistic forecasting, regime switches, cointegration, predictive Bayes factor

JEL classification: C11, C53

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Properties of a stationary stochastic cycle model with multimodality of spectral density function

The major aim here is to construct a stationary stochastic cycle model with multimodality of spectral density function, within the linear innovations state-space framework. The main properties in time domain and frequency domain for proposed stochastic cycle model will be shown. Our proposition gives an alternative for popular stochastic cycle model, which is generally based on singular frequency or few frequencies by utilizing the idea of structural time series models. We show that this generalized model can be reduced to non-zero mean seasonal ARIMA model with equality restrictions on parameters. Extensions to multivariate case are passible.

Keywords: stochastic cycle, multimodality of spectral density function, innovations state space model, ARMA models

JEL classification: C22, E32

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The role of creative destruction within economic evolution

The research is inspired by Schumpeterian vision of economic evolution in which innovations create the economic development and imitations generate process of diffusion of innovations. In scientific researches different roles within evolution of the economy were assigned to creative destruction understood as the synthesis of two opposite processes: introducing innovations and processes of elimination of existing, outdated solutions, commodities, firms, technologies etc. Schumpeter maintained that, within the diffusion, creative destruction leads the economy to the circular flow, while Aghion and Howitt took the view that creative destruction generates the economic growth.

In this context, the research aims at the analysis of consequences of creative destruction within evolution of the economy by the use of Hurwicz concept of economic mechanisms in the suitably modified Arrow and Debreu model taking into account empirical outcomes.

Keywords: economic evolution, innovation, mechanism, destruction, equilibrium

JEL classification: D41, L20, O12

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The technical efficiency of Polish crop farms: a Bayesian hierarchical modelling approach

This study uses the stochastic production frontier function and farm-level data to measure the technical efficiency and to derive the characteristics of the production process of Polish crop farms. Panel data on individual farm's production and four inputs are taken from Farm Accountancy Data Network.

This investigation applies stochastic frontier models with several approaches to modelling the unobserved heterogeneity, for example translog model with constant coefficients or Cobb-Douglas function with individual parameters varying over farms.

The model's parameters are estimated using the Bayesian techniques (Monte Carlo Markov Chain methods). Moreover, the performance of the alternative models is assessed by Bayes factor and posterior odds.

The results show that the highest production elasticity is with respect to materials, while the lowest with respect to capital. The mean technical efficiency of the analysed farms is 0.87.

Keywords: production function, stochastic frontier models, hierarchical Bayesian modelling, crop farms

JEL classification: C23, C51, D24, Q12

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Identification of the growth cross-market comovement with using Bayesian tCopula-GARCH models

Modelling volatility and dependence structure of financial time series is one of the most interesting areas of research for both theorists and practitioners of financial markets. The models use in the field are different types of Multivariate GARCH or SV models and hybrid models e.g. MSF-SBEKK. Another approach is to use copulas as functions which capture dependence structure. After the intensive shocks on the one financial market the dependence structure between the markets may change. This work presents a concept of identifying the contagion effect consists in comparing a posterior probabilities of the two VAR(1)-tCopula-tGARCH(1,1) models, with and without modification of the formula for time-varying parameter of tCopula. In this work the contagion effect means that the cross-market comovement increases significantly after the shocks.

Keywords: Copula-GARCH model, Bayesian inference, the contagion effect

JEL classification: C52, G15

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Educational Efficiency of High Schools of Lesser Poland Voivodeship – Comparative Analysis

The purpose of the speech is presentation of modelling and measuring the educational efficiency of high schools in Lesser Poland Voivodeship. First, the categories selected for the study and the set of used data will be described. Next, two alternative methods of measuring the efficiency will be presented. In the first one, based on the Cobb-Douglas production function model, the efficiency is modelled using a one-sided random term. The parameters of this model and the measure of efficiency are estimated using the corrected least squares method. In the second method – Data Envelopment Analysis, the efficiency is measured using the optimal value of the objective function of an appropriate linear program. The results obtained from both methods will be presented as a comparative analysis.

Keywords: efficiency, education, DEA, COLS, production function

JEL classification: C21, C67, D24, I21

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MCMC method for the IG-MSF-SBEKK model

In the paper a Markov chain Monte Carlo simulation tool used in the hybrid IG-MSF-SBEKK is described. The MCMC method is developed in order to obtain a sample from the posterior distribution of parameters and latent variables. The Gibbs sampler with Metropolis-Hastings steps is used. The proposed numerical method is applied to estimate the hybrid IG-MSF-SBEKK model for daily exchange rate returns.

Keywords: Markov chain Monte Carlo, stochastic volatility, Bayesian inference

JEL classification: C11, C15

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Estimating Model Risk of VaR under Different Approaches: Study on European Banks

This work presents an approach for estimating the risk of the choice of the model used for computing Value at Risk, i.e. the risk of the risk model. We propose comparing the accuracy and precision of the risk models for different parametrizations of the input variables. The accuracy helps determine the systematic bias (shortcoming) of the model and is used to denote model performance. The precision provides an estimate of the reproducibility of the model (variability) and we propose using functions of the precision to represent the risk of the outcome of the model. We provide an empirical study on European banks, where we demonstrate a quantitative estimation of these metrics for various configurations of Value at Risk under different approaches.

Keywords: VaR, Historical Simulation, Monte Carlo, model risk, European banks

JEL classification: C15

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Diversity and innovation in economic evolution

The basic idea of the paper is to apply a multi-attribute notion of diversity proposed by Nehring and Puppe to technological changes appearing as a consequence of innovations in Schumpeter's sense of the term in the production sphere of the economy modeled by the use of the Arrow and Debreu topological apparatus. We show that, under certain conditions, nondecreasing multi-attribute diversity in the production sphere of the private ownership economy is a necessary and sufficient condition for the occurrence of innovation in the economy under study.

Keywords: Diversity, Innovation, Technological change.

JEL classification: C02, O12, O30

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Statistical learning methods as tools of socio-economic investigations

The presentation gives a review of theoretical problems and applications of the statistical learning methods in socio-economic investigations. The following problems and methods are discussed: the classical scheme of statistical investigations in area of economics, limitations of the classical scheme of statistical research, data analysis as a remedy to such limitations, supervised learning methods in socio-economic investigations, linear methods for data analysis, (ridge regression, Lasso method), linear methods for classification (linear discriminant analysis, logistic regression), kernel smoothing methods, classification trees, boosting methods, neural networks, support vector machines, k-means clustering and k-nearest neighbor classifiers. Limitations of the supervised learning are discussed on the end of presentation.

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Pricing-hedging duality for convex options under model uncertainty

We investigate the robust approach to pricing and hedging in discrete time financial models with nonlinear transaction costs. Model uncertainty arises due to the lack of any probabilistic assumptions on the dynamic of the risky asset. We only assume that the absolute value of the stock price returns is bounded. According to the semi-static setup, we consider the dynamic trading in the risky asset and the static trading in co-maturing call and put options with various strikes. This setting leads to better hedging the risk of trading. We show that the pricing problem for (possibly exotic) European options with convex payoff profile can be reduced to the analogous one in the binomial model with maximal volatility.

Keywords: binomial model, model uncertainty, super-replication, transaction costs

JEL classification: C02, G13, G14

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Functions with separated variables in economic sciences

Elements of the theory of functions with variables separated by group operation are specified. The relationship between the independence of (continuous and discrete) random variables and multiplicative separation of probability density function are discussed.

Keywords: functions of separated variables, multiplicative separation, independence of random variables

JEL classification: C02, C19

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Properties of some simulation-based point estimators

The design-based estimation of finite population parameters such as totals usually relies on the knowledge of inclusion probabilities characterizing the sampling design. They are used in sampling weights and estimators. However for some useful sampling designs these probabilities may remain unknown. In such a situation they may often be estimated in a simulation experiment. It is carried out by repeatedly generating samples using the same sampling scheme and counting occurrences of individual units. By replacing unknown inclusion probabilities with such estimates, the design-based population total estimates may be computed. In this paper the properties of point estimators of parameters of finite and fixed population were investigated. These estimators were calculated by using inclusion probabilities established in the simulation experiment.

Keywords: point estimators, inclusion probabilities, simulation-based estimation

JEL classification: C15, C83

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Monetary poverty in a fuzzy approach in Poland

Poverty is still a current social issue in Poland and other countries. Due to the lack of one universally accepted definition of poverty, there are many ways to understand, identify and measure poverty. In addition to the classic approach to identifying poor units (individuals, households), a fuzzy approach is also used, in which the risk of poverty is usually determined in the range from zero to one. The most known way of assessing the risk of poverty is IRF (Integrated Fuzzy and Relative) approach evolving since the late 1980s by Betti, Cerioli, Cheli, Lemmi, Verma and Zani.

The aim of the article is to analyze the problem of monetary poverty in Poland in the above-mentioned IFR approach using data from the household budget survey. In this approach, the risk of poverty is assessed on the basis of the cumulative distribution function of the income or expenditure and the value of Lorenz's function. In the article, these two functions will be determined on the basis of one of the theoretical distributions modeling the empirical distribution of household income or expenses. This approach allows the estimation of parameters of the conditional theoretical distribution due to the characteristics of households, which will translate into a conditional assessment of the risk of poverty for specific social groups (groups of households due to their characteristics). It will give the opportunity to determine the factors determining the risk of poverty in Poland.

Keywords: poverty, theoretical distribution, fuzzy approach

JEL classification: C51, D31, I32

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Self-perceived financial situation of indebted households: evidence from Poland

The standard of living of households does not only depend on their income. The subjective financial assessments are primarily associated with day-to-day concerns. Therefore self-perceived financial well-being can provide more detailed information about living conditions. It is particularly considerable for indebted households, which may report difficulties to make ends meet even though income level seems to be enough high. We used the questionnaire survey administered to Polish indebted households in 2018. The relationship between self-perceived assessment of financial situation and commonly used, objective measures of over-indebtedness was examined by using ordered probit model. The subjective financial situation of one's own household depends on – among others – the level of debt and over-indebtedness risk. Regardless of the debt burden, the self-assessment of own financial situation among the youngest household cohorts is generally better than people aged 45+.

Keywords: indebtedness, standard of living, household, financial situation

JEL classification: D12, D14, I31

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On some extensions of the matrix angular central Gaussian distribution

The matrix angular central Gaussian (MACG) distribution is defined for the orientation of a random real matrix. In this paper we investigate the extension of MACG for the complex case. Additionally, the distribution of the linear transformation of the complex random matrix is analyzed.

Keywords: Sitefel manifold, Grassmann manifold, distribution of orientations of complex random matrices, matrix angular central Gaussian distribution

JEL classification: C46

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On influence of clustering population on accuracy of population total estimation

The paper compares the accuracy of using cluster samples and using stratified samples to estimate a population total. Several clustering algorithms are used to partition a finite population into strata or clusters. Several variants of stratified sampling designs and one-stage cluster sampling designs, including those dependent on various inclusion probabilities, are taken into account. The accuracies of the estimators are compared using simulation experiments. The results of this paper let us conclude that partitioning a population into clusters could significantly improve the accuracy of estimating the total using sampling dependent on inclusion probabilities proportional to the aggregated auxiliary variable. Moreover, the considered estimators based on cluster sampling designs could be easily used in practice.

Keywords: sampling design, auxiliary variable, aggregated data, inclusion probabilities, strata, clustering algorithm, estimation efficiency