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of the ISCCRO -
International Statistical Conference in Croatia
-
Opatija, Croatia, 10-11 May 2018

CONFERENCE TOPIC:
„New Advances in Statistical Methods Applications for a Better World“

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of the ISCCRO -
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ISCCRO ’18

The Second International Statistical Conference in Croatia, 10-11 May 2018,
Opatija, Croatia
Conference topic:
“New Advances in Statistical Methods Applications for a Better World“

Vol. 2, No. 1

Editors-in-Chief:
Ksenija Dumičić, Nataša Erjavec, Mirjana Pejić Bach, Berislav Žmuk

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Focus and Scope of the ISCCRO Conference

The ISCCRO - International Statistical Conference in Croatia is a scientific event in the area of statistics organized for the first time by the Croatian Statistical Association (CSA) in 2016 (ISCCRO’16) in Zagreb, Croatia. It become a biannual event important not only for Croatia, but also internationally, attracting scientists and professionals in statistics and related fields from many countries. Invited people gather both data producers and data users, scientists and professionals, educators and students. One should attend this international conference because of the range of theoretical and practical statistical topics, discussed by wider audience, which makes this conference unique in Croatia. Therefore, the conference ISCCRO has been the best place for sharing and exchanging information and building networks, for both domestic and international statisticians, where each learns from the other.

The Second International Statistical Conference in Croatia - ISCCRO’18, with the topic: “New Advances in Statistical Methods Applications for a Better World”, was held from the 10th to the 11th May 2018 in Opatija, Croatia. The conference, covering statistical and related cross and multi-disciplinary fields, topics and areas, provides a platform for international networking and exchange of ideas on various aspects of theory and applications of statistics and related professional and scientific areas.

At the ISCCRO’18 in Opatija 188 authors, coming from 19 countries and Croatia, gave 100 submissions for presentation, half of them as Abstract Only and half of them as Full Papers, split in a variety of sessions in two parallel lines during two conference days of presentations, four of them being Invited Lectures. Croatian Statistical Association co-organized five Special Sessions, as follows: "Spreading out Official Statistics in the Digital World", organized by Maja Pekeč from Croatian Bureau of Statistics; "Econometric Modelling for Fiscal Policy Making in European Union Countries", chaired by Assistant Professor Irena Palić, PhD, University of Zagreb, Faculty of Economics and Business, Zagreb, Croatia; "Economic and Social Effects of Demographic Trends", chaired by Professor Ana Štambuk, PhD, University of Rijeka, Faculty of Economics, Rijeka, Croatia; "Modern Techniques for Handling Large Spatial Data", organized by Professor Taps Malti, PhD, Michigan State University, East Lansing, Michigan, USA & Croatian Statistical Association; and "Quantitative Analysis for Faster Development of the South East European Countries", organized by Associate Professor Blagica Novkovska, PhD, from University of Tourism and Management in Skopje, Republic of Macedonia. Croatian Statistical Association organized the Special Session Young Statisticians in Action, too.

The conference hosted the authors from Austria, Belgium, Bosnia and Herzegovina, Croatia, France, Germany, Hungary, Italy, Luxembourg, Netherlands, Republic of Macedonia, Russian Federation, Poland, Serbia, Slovakia, Slovenia, South Africa, Sweden, Ukraine, United Kingdom and USA.

The Book of Abstracts of the ISCCRO – International Statistical Conference in Croatia (Online ISSN 2584-3850; Print ISSN 1849-9864), contains four Plenary Speech abstracts and 96 contributed abstracts of the talks presented at the ISCCRO’18 Conference. Besides that, the Proceedings of the ISCCRO - International Statistical Conference in Croatia, published after The Second ISCCRO’18, held in Opatija, Croatia, 10-11 May 2018, Volume 2, No. 1, 2018, Electronical ISSN: 1849-9872, includes 24 selected double-blind peer reviewed conference papers.

The International Scientific Program Committee, which is the Editorial Board of the ISCCRO’18, includes 118 scientists and professionals, from all over the World, 60% of them being from outside of Croatia. The ISCCRO’18 International Organizing Committee is comprised of the statisticians from four countries: Croatia, Serbia, Republic of Macedonia and Slovenia, which is the proof of the international importance of the ISCCRO conference.

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Analysis of poverty determinants in Bosnia and Herzegovina

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Abstract:
Reducing and eradicating poverty is an essential mission of societies in the 21st century. In more recent decades, the global struggle against poverty has been particularly emphasized through Millennium Development Goals (2000) and Sustainable Development Goals (2015). Bosnia and Herzegovina, as a country in transition and post-war recovery, faces many problems directly connected to poverty: inadequate and insufficient economic development, high unemployment rate, return of refugees and displaced persons, corruption, the exodus of young and educated people, political instability and many others. The aim of this study is to identify and analyze poverty determinants in B&H and to explore their impact on different approaches of poverty identification. The research is based on the recent available data from Household Budget Survey in B&H. Different households’ characteristics, such as living area, education, labour force participation etc., were used to identify poverty determinants. Three poverty identification approaches were used: unidimensional – headcount index and two multidimensional – fuzzy and Alkire – Foster approaches. Significance of poverty determinants was tested through application of logistic regression and Shapley decomposition. The household head education appears as a significant poverty determinant in all three approaches. Living area, household size, labour force participation are also significant determinants, but with the different contribution to poverty probability in various approaches. Although different approaches of poverty identification are correlated, the findings show that they are defined by different determinants and varying degrees of influence. The creation and more importantly the evaluation of poverty reduction strategies should not be based exclusively on unidimensional poverty measurement.

Keywords: Bosnia and Herzegovina, determinants, measurement, poverty.

JEL code: C25, I32.
Dissemination of statistical data via website as the main channel of online communication

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Abstract:
The NSO website offers access to a larger number of various target groups and it is justifiable to have the same content available in different forms. The development of information technologies has led to the transformation of business operations, increased opportunities and a justified increase in user expectations. The paper aims at selecting and presenting various formats, i.e., methods of publication and availability of statistical data with an emphasis on the technical realisation by drawing a parallel with the European statistics Code of Practice, that is, with the principles that are closely related to this area, such as accessibility and clarity, coherence and comparability, timeliness and punctuality, relevance, impartiality and objectivity. The purpose of the paper is to produce a document with consolidated best practices arising from the analysis of NSO websites and the tacit knowledge acquired through work. A composite part of the paper is also a review of the solutions offered by the Agency for Statistics of B&H relating this area. A part of the paper also treats the habits and practices of users, acquired feedback from the users without imposing to great a burden on them, or measuring and archiving various statistical data on the use of certain website segments or functions. The main conclusion can be drawn from this, mainly that the users and their needs, similarly to the development and availability of modern technologies, actually dictate the future development of the dissemination of statistical data.

Keyword: European statistics Code of Practice, online dissemination, statistical data, website.

JEL codes: Y10, Y90, Y91, Z00.
Improving statistical and financial literacy through a high school competition – experience from Slovenia

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Abstract:
The series of competitions in business mathematics started in Slovenia in 2003 and competitions in statistics started in 2012. Both competitions were and still are organized by The Society of Mathematicians, Physicists and Astronomers of Slovenia (DMFAS) and only the students enrolled into one of the four specific business related secondary school programs are allowed to participate. In 2014 DMFAS organized the first statistics and financial mathematics competition intended for all secondary school students. The competition syllabus extends the basic high school mathematics syllabus and the vast majority of students participating at the competition so far were high school students. The competition is organized on a school and a national level and has become one of the regular yearly activities in several high schools across the country. In this presentation we will outline the aims of the competition, summarize the structure of the problems students were asked to solve in the past, and analyze their performance with respect to topics covered in the competition. Special emphasize will be given to the topics in statistics and elementary financial calculations. The results will reveal an increasing awareness of both topics and a growing interest in further topics in finance will also be justified, especially among students qualified for the competition on the national level. Challenges for the future of the competition will also be presented. Stagnating number of schools and participants will be on top of the list.

Keywords: competition, secondary school, statistical literacy, statistics education.

JEL code: A21.
Applying linear programming in optimizing food consumption: a comparative analysis of Bosnia & Herzegovina and Croatia

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Abstract:
Food consumption surveys are very often used to identify adequate nutrition diet according to some region specification. A budget constraint is certainly uniform specification for all-region and it is definitely connected with food consumption. In poverty analysis, the absolute poverty line is calculated according to minimum food basket daily cost that meets adequate energy criteria. This paper analyses and compares the food consumption and the optimal structure of the food basket in Bosnia & Herzegovina and Croatia. The analysis is done using nutritional modeling with linear programming. The idea is to form and compare food baskets in these two countries, according to different nutrition and traditional constraint. The different food baskets are formed using adequate average adult person daily nutritional needs and specific food consumption in the country. Every formed food basked is connected with different linear programming models. One type of models has objective function expressed as daily cost minimization and other type are connected with minimization differences from mean consumption of observed food type with fixed daily budget. This analysis can help in identify absolute poverty line in these countries and differences between them. The data used for the models consisted of 88 food items from the general consumption of the population of Bosnia & Herzegovina and Croatia, according to COICOP classifications and HBS survey, with average prices in 2015 for these products.

Key words: cost, food basket, linear programming, optimization.

JEL code: C61, C82, I31, I32.
Ingram Olkin: a vocal advocate for women in statistics

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Abstract:
Before he passed away, eminent statistician Ingram Olkin (1924-2016) asked his close colleague at Stanford University, Engineering Professor Richard Cottle, to be the primary author of a Stanford obituary. Cottle wrote the obituary with Olkin’s daughter Julia, associate professor of mathematics at Cal State East Bay, and published it in the Stanford News. It stated that: “Ingram Olkin applied new and innovative statistical models to uncover new insights in behavioral, medical and social sciences, and is best known for developing statistical analyses for evaluating education policies. He was also an ardent supporter of improving the stature of women in the field of statistics…In recognition of this vocal advocacy, Olkin is the first and only male recipient of the Elizabeth L. Scott Award for the Committee of Presidents of Statistical Societies.” Here I used published articles by Olkin and others, interviews with some of Olkin’s collaborators and friends, and my own personal experiences and correspondence with Olkin as his book co-editor and friend, to dig deeper into this statement about Olkin’s vocal advocacy for women in statistics. Olkin used a variety of methods over the course of his career to vocally promote women in the statistics profession. He was a mover and shaker whose affirmative presence and action for talented women in statistics was a constant.

Keywords: biography, Committee of Presidents of Statistical Societies, Elizabeth L. Scott Award, status of women.

JEL codes: B31, J16.
Eco-innovation and economic growth in the European Union: a panel data analysis

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Abstract:  
Eco-innovation, as a new concept, and green technologies are central to the Europe’s future and at the core of the European Union policies. According to the Eco-innovation Action Plan, the EU’s economic prosperity and wellbeing are intrinsically linked to its natural environment, and the global demand for renewable energy and resource-efficient solutions. Additionally, in 2015 the European Commission adopted ambitious Circular Economy Package to boost competitiveness, create jobs and generate sustainable growth for years to come. In this context, eco-innovation is a powerful instrument that combines reduced negative impact on the environment with a positive impact on the society and the economy as a whole. Therefore, this paper highlights the prominent role of eco-innovation and investigates still scarcely explored impact assessment of GDP growth, quality of institutions and recycling rates on the eco-innovation index in 28 European Union member states. Specifically, the authors utilize the system GMM estimator with robust standard errors. Econometric analysis indicates that GDP growth rate, quality of institutions and recycling rate of municipal waste had statistically significant impact on eco-innovation and its thematic areas and indicators in the period 2010-2016.

Keywords: circular economy, eco-innovation, European Union, panel data analysis.

JEL code: C33, O11, O30.
Modelling growth of small and medium sized enterprises in Croatia using panel analysis

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Abstract: Small and medium sized enterprises (SMEs) comprise a big share of the Economy. In Croatia they make up to 99.7 percent of the total number of enterprises, like in most EU countries. They hold over 69% of employees and their share in GDP is around 53%. These numbers are responsible for high interest in research of SMEs. Growing SMEs are also responsible for a large part of employment, so is very interesting to investigate factors related to SMEs – growth. They have usually been understood in three main categories the entrepreneur, the enterprise and the environment collected as cross section data. However, only a small part of research uses panel data analysis, i.e. analysis on data that is cross section as well as time series. Through this technique it is possible to observe what is linked to growth as well as how it changes overtime. The goal of this paper is to develop models that predict growth of SMEs using panel data. Growth is presented through data of sales and number of employees. The data set consists of all small and medium sized enterprises in Croatia that were active in every year in the period from 2001 to 2015. For these enterprises data about size, industry technology and financial ratios covering groups – profitability, turnover, liquidity, indebtedness, investments, and innovativeness as well as export is available. Models were created using pooled OLS and panel data analysis with fixed and random effects. Results suggest that liquidity, turnover and profitability ratios are linked to growth.

Keywords: financial ratios, growth of SMEs, panel data analysis, prediction.

JEL code: C23, C51, C52, C53.
A revisit to the determinants of immigration in the European Union: evidence from count panel data models

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Abstract:
Europe’s history has been shaped by migration. The most recent migration surge has led to a large increase in the immigrant share of population in many nations, which is, combined with European societies’ aging, changing the population structure of Europe. The aim of this paper is to reexamine the common determinants of immigration in 28 member states of the European Union. The examined pull factors consist of three categories: economic, demographic/social and political/institutional variables. Given the cross-sectional and time dimensions of the data, we employ a panel data model for annual data from the period 1995-2016. Two dependent variables, immigration inflow and acquisition of citizenship make an example of count variables that can take on non-negative integer values. Since data followed a Poisson distribution, a negative binomial regression panel model was used. This model is a more general Poisson regression model that allows for overdispersion, which makes it appropriate for the modelling of flows of international migration. Results show that GDP per capita, unemployment rate and life expectancy ratio are the most significant determinants of immigration. However, sign of the determinants depends on the definition of dependent variables used in research and type of the observed migration.

Keywords: count data, immigration, negative binomial regression, panel model.

JEL code: C33, F22, J11.
Exploring connections between researchers and ideas in the European Hardwoods Innovation Alliance using two-mode social network analysis

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Abstract:  
Two-mode social network analysis (SNA) can be applied to data that consists of two sets of units, from analysing persons and societies to authors and papers. The objective of this paper is to evaluate the possibilities of this approach for the analysis of connections between researchers and their future research ideas based on survey data. As a case study we used the data of the 2016 membership survey of the European Hardwoods Innovation Alliance, a transnational collaboration of experts in wood science and related fields. They were asked to propose research programmes dedicated to the sustainable, innovative, added-value use of hardwood species in Europe. 199 different contributors from 38 countries participated and provided 219 validated innovation ideas that were classified into 17 different topic categories. Based on two-mode SNA we found that most ideas belong only to one topic, while a small number of researchers suggested research programmes on more than one topic and thus represent intergroup nodes in the network. However, we also identified researchers and topics isolated from the larger group of respondents. The case study highlights the suitability of SNA as a tool for the exploration and visualisation of research communities. The spotted groups, whose members do not necessarily know each other, suggest an interest for potential exchange and collaboration, which is a basis for the formation of new research consortia in innovative fields.

Keywords: innovation, research mapping and clustering, social network analysis.

JEL code: D85, O32.

Acknowledgement: The authors gratefully acknowledge the European Commission for funding the InnoRenew CoE project (Grant Agreement #739574) under the Horizon2020 Widespread-Teaming program.
Business and economics graduate competencies: employers’ perceptions on importance and performance

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Abstract: This manuscript provides an insight into employers’ assessment of the importance and performance of the competencies acquired among business and economics bachelor graduates in Croatia. While this issue is not a new one, it came back into the spotlight after the Global Financial Crisis and the disturbances in the labour market. These disturbances were manifested through increased unemployment rate, with a significant share of highly educated people unable to find paid work. Information-performance analysis is performed and results can be interpreted and used for quality assurance and improvement of the business and economics study programs in Croatia. Long-term depression and other economic problems such as inadequate conditions that employers offer – for instance, small wages in relationship to other EU members – are the main reasons for negative demographic movements in the country. Moreover, findings imply that aside from these reasons, movements of highly educated people could be caused by the level and quality of competences of Croatian bachelor degrees.

Keywords: business and economics, competencies, demographics and finance, IPA.

JEL code: A22, G01, I21, J11.

Acknowledgement: This paper has been financially supported by the University of Rijeka, for the project ZP UNIRI 8/17.
Analyzing different regression methods: the case of predicting text comprehension

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Abstract:
College-level text comprehension is a complex cognitive skill especially for junior undergraduates as novices to the field with little experience in academic reading. Comprehension becomes even more demanding in the international context when foreign language (FL) texts are in question and if readers still have difficulties with grammar or vocabulary. It is therefore interesting to analyse students' comprehension at an early stage of their studies to help find a remedial course of action and remove possible weaknesses which may obstruct academic progress. Methods of statistical regression may be used in such analysis to predict text comprehension taking into account factors such as language competence (e.g. general language proficiency, text-specific vocabulary), prior knowledge of the topic, metacognition or gender. We analyse the use of several regression methods for selecting text comprehension predictor variables: univariate and multivariate (hierarchical, stepwise, and regularization methods - lasso and ridge). The analysis is based on the data on factors of comprehension collected in a business school. Text comprehension was measured by the quality of notes (outlines) business students made while reading a business text in FL (English). Our results show similarities and differences between the methods used. All the regression methods point to the same variables of importance (gender, text-specific vocabulary, prior knowledge of the topic), but different effects are observed depending on the method applied.

Keywords: hierarchical regression, regularization regression methods, stepwise regression, text comprehension.

JEL code: C35.
Analysis of interrelation between financial and performance indicators in higher education in Central East Europe

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Abstract:
The efficiency of the higher education sector is a topic that has been affecting countries that are struggling with national budgetary optimisation in the Central Eastern Europe, over the past decade. The main subject of the paper is the analysis of selected higher education indicators, through interrelation of financial and performance indicators in higher education in selected countries. The main objective is to examine and describe the effect of their interaction, through formulating financial models for prediction of the behaviour of the selected performance indicator, depending on all selected financial indicators, together. Higher education indicators are selected from database of the UNESCO Institute for Statistics, based on mutual correlations, taking into account those that are responsible for the most significant statistical links. Out of 120, a total of 10 were taken into account and were observed in the time period of 10 years. Statistical analysis was based on panel data models. The selection of the best model was based on the Akaike Information Criteria. The significance of the paper is reflected in the importance of applied statistics in higher education research that emphasize predictions in the value of higher education indicators, depending on national public spending.

Keywords: applied statistics, panel data models, national public spending, UNESCO higher education indicators.

JEL code: C30, C33, H52, I23.
Symbolic input-output analysis: an application to the Eurostat data

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Abstract:
Input-output (IO) analysis is, in principle, one of the most commonly used, but a non-stochastic approach to national accounts. Yet, it suffers from several common critiques, not least being fixed input structure in each industry; all products of an industry are identical or are made in fixed proportions to each other; and each industry exhibits constant returns to scale in production (Ten Raa, 2003). To this end, we use symbolic data analysis (following e.g. Billard and Diday, 2003; Verde and Irpino, 2015; Diday, 2015) to construct distributions in the cells of IO tables instead of numerical aggregated values. Using such approach, we are able to include the stochastic component in the modelling with IO tables in a novel way. We derive the confidence intervals of production and employment multipliers, calculated in a novel way and apply the methodology to derive the sectorial multipliers for the EU countries in the period 2008-2015 and study the performance of new method compared to "classically" used IO analysis to demonstrate significant benefits of the new approach. Finally, possibilities of solving the usual limitations of IO analysis using the new approach are addressed, although future work is needed to explore this promising path of future work in this field.

Keywords: input-output analysis, Eurostat, histogram-valued variables, symbolic data.

JEL code: C67, D57, H30, P44.
Modelling discrete transitions in labour status using epidemiological models: an application to SHARE data

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Abstract:
In the article we use classical types of epidemiological models for transitions, which are usually distinct into different types of Markov chain models and a combination of differential and difference equations, to model the transitions among labour statuses for older precarious workers and the effect of precarious work on medical outcomes. We develop a difference equation based model for discrete transitions, controlling for time dependence between states in the model. Finally, we model the causal effects of changes in statuses in the developed model to different medical outcomes: different types of most common chronical diseases for older workers; mental health; and self-assessed health following the commonly accepted US version (developed e.g. for HRS data). To model causality, we use directed acyclic graphs (DAG) and more commonly accepted instrumental variable assessment. Using Survey on Health, Ageing and Retirement in Europe (SHARE) data covering 27 European countries in 6 waves (a longitudinal dataset with unequal panel distances), we confirm the heterogeneity in precarious work, observed in previous studies - clear differences exist in the outcomes for self-employed and "true" precarious (neither employed neither self-employed) workers. We are able to show that the differences depend on geographical heterogeneity on country level and provide the explanation, which is a contribution for the literature on ageing and labour studies which was so far not able to explain the differences between countries in the varieties of precarious work.

Keywords: difference equations, medical outcomes, SHARE, transitions.

JEL code: C33, C36, I12, J14.
The housing wealth effect before and after the 2008 financial crisis: PVAR approach

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Abstract:
In this empirical study, a system estimation of housing wealth effect on personal consumption is analysed by employing panel vector autoregressive model. The research is conducted for a panel of 28 selected European countries. Housing wealth effect appears to be more protuberant than financial wealth effect, therefore in this research note the dynamic relationship between personal consumption and housing wealth is empirically verified using the panel vector autoregressive methodology. The data for unbalanced panel spans from 1990 to 2016 and the estimation is conducted using generalised method of moments. With the objective of exploring the impact that financial crisis in 2008 may have on housing wealth shock on consumption, the analysis is performed by splitting the data set into two sub-panels: first one spanning from 1990-2008 and the second one spanning from 2009-2016. According to the results of the empirical analysis, higher responsiveness of consumption to a housing wealth shock is apparent before crisis, but in the post-crisis sample, housing wealth has no statistically significant impact on personal consumption.

Keywords: European countries, housing wealth effect, personal consumption, PVAR.

JEL code: C23, E21, R30.
Clustering of high dimensional and unbalanced data

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Abstract:
This research is sought to examine the viability and effectiveness of clustering methods in analyzing high dimensional and unbalanced data. The high dimensionality of the data makes it difficult to define a meaningful or effective distance as the average density of points anywhere in the data space is likely to be very low. This coupled with the problem with unbalanced data (i.e., there are highly skewed class distributions among instances of different classes) presents challenges that undermine the performance of cluster analysis. A Nielsen dataset that consists of eleven years of market basket data on 40,000 to 60,000 active consumer panelists in the U.S. will be used in a set of experiments to demonstrate solutions to these challenges of cluster analysis.

Keyword: cluster analysis, high dimensional data, market basket analysis, unbalanced data.

JEL codes: C55, M31.
Public expenditure efficiency in CESEE region

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Abstract:
Due to increased financing needs and various constraints that put pressure on public finance in most European countries efficiency has become a popular topic among economists and general public. As public resources are scarce need for expenditure cuts and more efficient use of available resources is more pronounced every day. This paper analyses the efficiency of public expenditure in 15 CESEE countries. Using Data envelopment analysis (DEA) we estimate the overall public expenditure efficiency as well as efficiency of individual public spending categories: healthcare, education and public administration. The study finds that overall expenditure efficiency of countries in the sample amounts to, on average, 0.84 which indicates that these countries could save 16% of their resources by enhancing their efficiency. Lithuania and Macedonia set the frontier while the worst performers are Slovenia, Hungary and Croatia. In health sector, the average input efficiency score amounts to 0.87 and indicates that countries could attain the same output with, on average, 13% less resources. The results show that Bulgaria, Estonia and Slovenia are the most efficient countries in the sample while Serbia, Croatia and Bosnia and Herzegovina are at the bottom of the sample. In education the results suggest that countries, on average, waste 10% of their resources. Czech Republic, Estonia, Poland, Romania and Slovak Republic set the frontier while the worst performers are Slovenia, Lithuania, and Latvia. Regarding public administration, the average efficiency score of the countries is 0.9 which indicates that countries are wasting on average 10% of their resources. Estonia and Romania are fully efficient while Montenegro, Bosnia and Herzegovina and Serbia are the most inefficient countries in the sample.

Keywords: DEA, public expenditure efficiency, technical efficiency.

JEL code: H11, H50, E60.

Acknowledgement: This work has been supported by the Croatian Science Foundation under project “Public Finance Sustainability on the path to the Monetary Union - PuFiSuMU” (IP-2016-06-4609) and ”Tax Policy and Fiscal Consolidation in Croatia” (IP-2013-11-8174).
Impact of the number of shown questions on response rates in business web surveys

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Abstract:
The response rates in web surveys tend to be low. In order to achieve higher response rates some improvements in the questionnaire design should be done. In the paper it has been investigated if different question quantity, which are shown to a respondent at once per questionnaire page or per questionnaire screen, have statistically significant impact on response rates. For the research purposes, response rates from business web survey, which was conducted on the sample of Croatian enterprises in 2016, were observed. Three question quantity levels were defined: one question per screen, group of questions, and all questions at once. The differences in achieved response rates were observed at overall enterprises level but the analysis according to size, main activity, legal form and place of headquarters of enterprises was conducted also. The analysis has shown that in most cases the lowest response rates were achieved when group of questions was presented to a respondent.

Keywords: business web survey, Croatian enterprises, response rate, statistical methods use.

JEL code: C12, C83.
Estimating a fiscal reaction function for the South East European countries

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Abstract:
The global economic crisis caused a deterioration in the public finances of the South East European countries. Hence, the issue of fiscal sustainability became important not only for the developed EU countries (considering the European debt crisis), but also for the SEE region. The aim of this paper is to contribute to the existing literature on fiscal sustainability in the South East Europe by estimating a panel fiscal reaction function. The paper analyzes how primary government balances adjust to increasing government debt and to the economic cycle. The main goal is to test whether fiscal policy in these countries tends to react to a sufficient extent to increasing public debt in order to ensure long-term fiscal sustainability.

Keywords: fiscal reaction function, fiscal sustainability, South East European countries.

Factors in the Diffusion of Islamic Mathematics in the Mediterranean

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Abstract:
The Islamic Empire, including Persia, the Middle East, Central Asia, North Africa, Iberia, and parts of India, witnessed a Golden Age in mathematics and science from the 9th to 15th Centuries. Some features of this development will be noted in this paper. We focus on the importance of: 1) commerce and merchants per se in the scientific activities of the Islamic Mediterranean, 2) extensive commercial links from Baghdad to Cordoba and other Islamic centers of translation and learning located in Iberia, and 3) literacy and paper manufacture in spreading the powerful Islamic Mathematics between Islamic, Jewish and Christian communities. We use manual and electronic archival approaches. The electronic Mediterranean Seminar has assisted in understanding the role of the Mediterranean culture area in the adoption of the new mathematics and its spread throughout Europe. The massive Islamic economic unit that linked the maritime Mediterranean and Indian Oceans was capable of moving books rapidly, once the translation centers were operational in Spain and Iraq (Skeen 2008). A plethora of major figures in the development of mathematical theory, from Euclid to Al-Khwarizmi to Omar Khayyam, had their work translated. Over 1,000 books in mathematical sciences were translated during this process, which revolutionized science.

Keywords: literacy, numeracy, translation centers.

JEL code: N30, N70, O33, O35.
Census quality control: performance, lessons learned and directions for the next Post Enumeration Survey

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Abstract:  
Croatian Bureau of Statistics decided to carry out the simultaneous coverage control and the quality control of the Census 2011, providing that the quality control covered 10% households out of the number selected in a sample. Soon after the 2011 Census of Population, Households and Dwelling, the Post Enumeration Survey (PES) was carried out in order to estimate the coverage of the Census. In Assessment of census data coverage dual system of estimation has been used. By using certain characteristics CBS wanted to estimate the accuracy of responses in regard to particular questions in questionnaires as well as to control the methodological correctness of responses according to given characteristics. The PES made it possible for CBS to assess errors in the coverage of the Census 2011 as well as the quality of responses that were included in the response quality control. There are certain directions derived from the experiences CBS got in this PES. Applied methods for evaluation Census Error in 2021 will differ from those applied in 2011 and 2001.

Keywords: assessment, coverage, estimate, quality.

JEL code: C80, C81, C82, C83.
Automated data collection of sports data with R

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Abstract:
Gathering data on different sports is not always easy. In our broad research we investigate the relationship between sport results and financial success of sport clubs. For this research we developed an application in the R programming language using some already existing packages (e.g. rvest). The application can automatically collect data from public sources through parsing the website of the data provider (e.g. www.transfermarkt.com). Our application is able to collect three major types of data: results (scores, rankings in leagues in different years, etc.), financial transactions (mostly transfer amounts) and value of players. In this talk we introduce the usage of a set of functions written in R. With the help of these, researchers are able to get large amount of data relatively fast and easy. We believe that this work can be further improved into an R package on CRAN in the future and can be a useful tool for anybody who works with sport datasets from the Internet.

Keywords: R, sports data, web scraping.

JEL code: C81, Z20.
Network researchers in Russia: collaboration and scientific citation

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Abstract:
In recent years, we can observe the growing number of scientists who implement the instruments of network analysis into their studies in different disciplines, such as sociology, economy, political studies, management, etc. Mapping the emerging community of Russian network researchers can identify the main active clusters and groups of knowledge exchange. The aim of this project is to study the structure of a research community of Russian scientists involved into network studies. This structure is reconstructed by the analysis of articles in network topics published in Russian scientific journals. These articles are obtained from the electronic library of Russian-language scientific periodicals eLibrary.ru. On the first step, using the key words corresponding to network studies, the initial data set (5,000 + articles) was collected. On the second step, we collect all the references that were mentioned in the bibliography lists in the initial articles (65,000 + descriptions). From the data obtained we constructed a set of one- and two-mode networks (citations between works and authors, networks of works and authors, works and keywords, authors and institutions). The procedures of network multiplication and transformations allowed us to analyze one-mode networks and look both at the thematic agenda of network studies in Russia and the models of scientists’ cooperation (collaboration) in the field. This research contributes to the researches in the field of sociology of science and to the studies focused on the SNA development in different national scientific traditions.

Keywords: citation analysis, collaboration in science, references analysis, social network analysis.

JEL code: C18, C19.
A note about the validity of purchasing power parity in selected Asian economies

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Abstract:
By applying a variety of panel unit root tests, we examine the validity of purchasing power parity (PPP) in ASEAN+3 economies, including Brunei, Cambodia, China, Indonesia, Japan, Korea, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam. The observed period ranges from January 2000 to June 2017. To take into account the structural break due to the economic crises, we tested first the period as a whole and then using the pre-crisis period (up to December 2007) and post-crisis period (from July 2009 on). The methodology covers Levin, Lin and Chu test, Breitung test, Im, Pesaran and Shin test, ADF-Fisher test and PP-Fisher test, which are applied for EUR and USD exchange rates for all observed economies. Whether the unit root is rejected, this provides proof for validity of PPP. However, our results are ambiguous and depend on the selection of base currency, the time period observed as well as on the methodology employed.

Key words: ASEAN+3, panel unit root tests, purchasing power parity, real exchange rates.

JEL code: C33, F31, P22.

Acknowledgement: The authors acknowledge the financial support from the Slovenian Research Agency (research core funding No. P5-0027).
Challenges in organization of city statistics – case study Zagreb

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Abstract:  
City of Zagreb has a long tradition in organization and conduction of statistical activities for the needs of city administration, citizens and business sector. In last decades, city department for statistics operated as a supporting part of national official statistical system as well as an expert body for statistics within the city administration. With technological changes and growing need for statistical data within city administration and business sector, city department for statistics faced the need for a significant shift in its work. Focus of department’s work is changing from classical data collecting and processing to a new vision of modern city statistics. In that path, department of statistics is facing several challenges – coordination of users and producers of statistical data within city administration, companies and institutions, development of technological platform for gathering, processing and dissemination of statistical data for the area of the city, agglomeration and city districts and also benchmarking of city indicators on European and global scene. Precondition for such a step forward is improved business relationship with national bureau of statistics and development of human resources and technological solutions within city department for statistics.

Keywords: challenges, city statistics, organization, Zagreb.

JEL code: C1, C10, C19.
The SPDE approach for Gaussian random fields with general smoothness

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Abstract:
A popular approach for modeling and inference in spatial statistics is to represent Gaussian random fields as solutions to stochastic partial differential equations (SPDEs) \( L^\beta u = \mathcal{W} \), where \( \mathcal{W} \) is Gaussian white noise, \( L \) is a second-order differential operator, and \( \beta > 0 \) is a parameter that determines the smoothness of \( u \). However, this approach has been limited to the case \( 2\beta \in \mathbb{N} \), which excludes several important covariance models such as the exponential covariance on \( \mathbb{R}^2 \). We demonstrate how this restriction can be avoided by combining a finite element discretization in space with a rational approximation of the function \( x^{-\beta} \) to approximate the solution \( u \). For the resulting approximation, an explicit rate of strong convergence is derived and we show that the method has the same computational benefits as in the restricted case \( 2\beta \in \mathbb{N} \) when used for statistical inference and prediction. Several numerical experiments are performed to illustrate the accuracy of the method, and to show how it can be used for likelihood-based inference for all model parameters including \( \beta \).

Keywords: Gaussian random fields, Matérn covariances, spatial statistics, stochastic partial differential equations.

JEL code: C31, C60, C63.
Residential property price index in Croatia: from experimental to official statistics

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Abstract:
The official statistics framework within which national and international statistical agencies conduct regular statistical work based on internationally agreed quality standards, taking into account the core principles of impartiality, objectivity, professional independence, cost effectiveness, statistical confidentiality, minimisation of the reporting burden and high output quality, including reliability and the definitions of these principles. Since the appearance of the last 2007 global economic crisis and following consequences, a growing demand for more, better and timelier data under limited resources for compilers and reporting agents is observed. The concept of experimental statistics becomes more relevant and recognised as a new way of increasing the efficiency of official statistics production, despite of the somewhat lower quality in terms of coverage, data sources, harmonised definitions and sometimes heavily use of estimation techniques and expert assumptions. In this sense, dissemination of experimental statistics data usually distinguished from official statistics data, using a clearly visible logo and accompanied by detailed methodological notes. The main aim of this paper is to present methodological development of residential property price index in Croatia from experimental to official statistics, as well as to show corresponding changes in time series occurred due to the changes in methodological framework, institutional responsibility for compilation, coverage and data sources. Hedonic regressions were used for construction of property price index in both cases, but we can conclude that change in data source made the most significant impact in terms of improving the quality of Croatian residential property price index.

Keywords: experimental statistics, hedonic regressions, residential property price index, residential real estate.

Application of semi-deviation as a proxy for the expected return estimation in the Croatian equity market

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Abstract:
The main focus in the field of portfolio management has been on the out-of-sample estimation of covariance matrix mainly due to the fact that estimation of expected return is much more challenging. However, recent research efforts have not only tried to improve the estimation of risk parameters by expanding the analysis beyond the mean-variance setting but also by testing if risk measures can be used as a proxy for the expected return in the stock market. Following Martellini (2008) and Amenc et al. (2010) we test semi-deviation as a measure of downside risk as a proxy for the expected market return in the illiquid and undeveloped Croatian stock market. For the 2005-2016 period we conduct multiple out-of-sample estimations of expected market return by randomly choosing stocks from the market universe and for the CROBEX index constituents alone. As expected in an illiquid and undeveloped environment the application of proposed methodology yielded poorer results. However, results help explain the failure of out-of-sample estimation of maximum Sharpe ratio portfolio by Dolinar et al. (2017) and propose further testing in order to fully assess the potential use in the analysed environment.

Keywords: expected return estimation, illiquid and undeveloped equity market.

JEL code: G11, G12.
Applied panel data analysis in the field of corporate finance – analysis of stock returns and capital structure of Croatian companies

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Abstract:
The purpose of this paper is to analyse a possibility of applying panel data analysis in the field of corporate finance. With that aim, we have chosen two different areas of financial analysis that are of great interest for both researchers and practitioners: (1) stock returns and (2) capital structure decisions. One of the main purposes of the stock return analysis is identification of systematic risk factors that affect stock market, ie. factors that bear significant risk premiums. For that purpose, we focus on 34 stocks listed on Zagreb Stock Exchange in the 2007 – 2014 period. Second research is focused on simultaneous testing of the two predominant capital structure theories, the Trade-off and the Pecking Order Theory. Using a sample of nearly 3000 companies for the period from 2004 to 2015, we investigate the performance of these theories on Croatian companies. More specifically, we investigate the applicability of one-way time fixed-effects panel model as a most suitable method for statistical analysis and economic interpretation.

Keywords: capital structure theories, fixed-effects model, panel data analysis, stock returns.

JEL code: C33, G12, G32.
Application of Luenberger shortage function on the Zagreb Stock Exchange: analysis of efficient market portfolio

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Abstract:
In order to apply the Capital Asset Pricing Model (CAPM) in practice, the estimation of the market portfolio presents one of the biggest challenges. Even more so after the work of Haugen and Baker (1991) and Grinold (1992), who pointed out that the stock market capitalisation-weighted indices are mean-variance inefficient. In the paper we perform in-sample optimisation for the CROBEX index constituents in order to test its efficiency ex post. Selected CROBEX index revisions in the period 2005-2017 are analysed. We find the index to be inefficient just as its' developed market counterparts; and as suggested in earlier research for the Croatian equity market by Zoričić et al. (2014). Based on the results we calculate indifference level of transaction costs for selected efficient portfolios in order to compare improvement in efficiency to increase in turnover in relation to the cap-weighted benchmark index. Instead of limiting research efforts to maximum Sharpe ratio and minimum variance portfolios, we further test other efficient portfolios obtained by using the Luenberger shortage function in order to provide a more detailed assessment of the efficient frontier portfolios for the analysed data samples. Also, since mean-variance optimisation often yields extreme portfolio weights thus reducing the effective number of stocks in portfolio, the possibility of improving the efficiency while maintaining the diversification level was tested. Results show that imposing the required constraints significantly reduces in-sample efficiency which has considerable implications regarding the attempts to estimate efficient portfolios out-of-sample in an undeveloped market.

Keywords: Croatian stock market, efficient frontier, efficient market portfolio, shortage function.

JEL code: C61, G11.
Network of transfers in European football

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Abstract:
The transfer market of European football can be classified as a system. In this system the effectiveness of participant teams can depend from the activity in players’ transfers and can be represented by networks. This article assesses the utility of network analysis to analyze connections. Our hypothesis is that there is causality between the clubs' activity in the transfer market and theirs profitability. This research is based on empirical transfer datas of the major soccer teams which have significant role for last 10 years in Europe. We assume that the most active clubs in transfer system have more financial power, while that teams which are not active in transfers have less profits. In the network analysis the teams can be defined a set of nodes and connected by edges (interactions). The thickness of the edges and the size of the nodes are depend from the volume of transfers between the clubs. This volume can be measured by the number of interactions and the amount of transfer price also. Considering the results of nodes and edges we have reviewed the relationships between the two phenomena. In order to explore these relationships (synchronicity and causality) between the two indicators, we constructed a VAR model based on the panel data. This model allows the further exploration of cross correlations, Granger-causality, and the impulse response functions.

Keywords: profitability of sports firms, sport economy, transfer network, VAR-model.

JEL code: C23, C31, Z21, Z23.

Acknowledgement: This research was partially supported by the Human Resource Development Operational Programme, grant No.: HRDOP-3.6.2-16-2017, Cooperative Research Network in Economy of Sport, Recreation and Health.
Challenging key activities in data modelling with interactive charts

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Abstract:
Prescriptive data modelling using interactive charts may comprise the following six key activities: Asking questions, Preparing data, Visualizing data, Answering questions, Validating modelling, and Recommending changes. This study examined which of these activities would be the most challenging for upper secondary students who are novice to this kind of modelling. The study used a sample of thirty-five technology-minded educators from about fifteen countries across Europe. These colleagues, all CASIO experts who had participated in the Pan-European Educational Conference “Exploring Mathematics with Technology” (Budapest-Hungary, 13–15 October 2017), anonymously completed a paper-and-pencil survey in which they had to indicate one or two key activities that would, in general, be the most difficult for novice students. The survey revealed that Preparing data and Visualizing data seemed, on average, to be less difficult than Asking questions, Answering questions, Validating modelling, and Recommending changes (13% < 37%, p < .05). This means that two activities that rely more on technology use may, on average, be less challenging than the remaining four activities that rely more on contextual and conceptual clarifications. This finding implies that instruction on data modelling with interactive charts should primarily provide novice students with carefully designed support to help them understand and improve knowledge of contextual and conceptual issues regarding phenomena being modelled.

Keywords: data modelling, interactive charts, upper secondary education.

JEL code: C2, C3, C6, Y1.
Model based methods for fault diagnostics at engine test beds

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Abstract:  
The increasing cost and time pressures in the field of engine development lead to constantly growing requirements for the quality of measurement data. Since the systems at engine test beds become more complex and hence the number of sensors increases, monitoring measurement data manually becomes impossible. Nowadays a review of data quality with an automated diagnosis method immediately on the test bench is essential. Besides known methods as plausibility and limit checks, one way to solve this is a regression approach. Therefore we establish regression models based on the so-called training data to describe the relations of that fault free data. In the test case we apply this models to the new data set: predicted values are compared to the observed values to get the residuals. The main scheme of this system is to detect faults in the data through investigating the residual structure and detecting certain patterns in it. The method has been evaluated with data from a single cylinder research engine including various measurements as temperatures, pressures and engine specific data. On this data different kinds of faults were simulated. Already these preliminary studies show that errors at an early stage and errors over a short time period are hard to detect. Furthermore, at measurements with a high coefficient of variation systematic errors are overlaid by random errors, so that the system is not able to detect them. After all, the method yields good results which could be improved by further optimizations of its components.

Keywords: fault detection, forecasting, quality monitoring, regression model.

JEL code: C15, C53.
Sensitivity analysis of population structure dynamics: the case of Croatia

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Abstract:
In recent years significant number Croatian people decided to emigrate. Emigration population is mostly of younger age. Main reason were better opportunities at the labour market. Migration, with fertility and mortality, is one of the most significant determinants of future population structure. Purpose of our research is to assess effect of those determinants on population structure of Croatia. In our research, we used cohort-component analysis to create population projections. Change of Croatian population components are projected separately for each birth cohort (one-year groups) using past trends of fertility rates. For each year, up to 2045, the population is aging using age-specific mortality rates, estimated migration population. Main source of the data is Croatian bureau of statistics (DZS), specially their publications: Census of population, households and dwellings in 2011 and Population projections of the Republic of Croatia, 2010 – 2061. Results of the analysis demonstrate impact of change in negative migration change, fertility rates and mortality rates on structure. i.e. quantification of the impact. Emigration, previously underestimated, has significant impact to the population structure. From the perspective of sensitivity analysis, this determinant is potentially has the largest negative impact on population. Official Projections can give misleading information about the future. The impact can be viewed from economic perspective, as a loss of highly trained workers, or also from social perspective, e.g. children left behind grow up without parents or in other case without a wider family circle. Awareness about the demographic changes is first step to make appropriate policy actions.

Keywords: modelling with demographic variables, population aging, population migration, sensitivity analysis.

JEL code: C53, J11, O15.
Industry level real effective exchange rates: evidence from Croatia and other European Union countries

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Abstract:
In light of the interest in measuring changes in the relative competitiveness, this paper focuses on the calculation and the descriptive analysis of real effective exchange rates across particular manufacturing industries in order to gain a better insight into the changes of price competitiveness in the economy. The sectoral approach, which implies the grouping of activities according to their technological intensity, is used to examine the trends in real effective exchange rates. The results show that the price competitiveness conditions in the economy are quite diverse. In Croatia for instance, price competitiveness, measured by the changes in industry level real effective exchange rates in the manufacturing sector, improved in the medium-low-technology sector and deteriorated in the high-technology sector in the 2000–2016 period. At the same time, it saw no significant changes in the low-technology and medium-high-technology sector. Trends in price competitiveness across different manufacturing sectors varied in other EU countries as well, particularly in the new member states. Among new members, Poland improved price competitiveness the most in the low-technology and the medium-high-technology sector, Croatia witnessed the largest gains in the medium-low-technology sector, while the price competitiveness of the high-technology sector improved the most in Slovenia. It seems however that changes in price competitiveness across different manufacturing sectors in the majority of the observed EU member states were not accompanied by the expected changes in the share of exports on the global market. This, among others, indicates the relevance of non-price export competitiveness factors.

Keywords: competitiveness, exports, manufacturing industry, real effective exchange rates.

JEL code: F10, F30, F31, F40.
Role of economic statistics in the 21st century

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Abstract:
Good statistical practice is fundamentally based on transparent assumptions, reproducible results, and valid interpretations. Above all, professionalism in statistical practice presumes the goal of advancing knowledge while avoiding harm. The phenomena, processes to be measured by business, economic statistics have been changing over the decades, but the science, technology, environment supporting statistical work have been also changing. In order to provide reliable picture on the given country’s economy the statistical legal background, professional standards, methodologies to be applied need to follow the changing world of statistics. The globalization, the digitalized world, information explosion represent nevertheless a much greater challenge for statisticians than those of the previous decades. Nowadays traditional approaches are not satisfactory any more, the selection, integration, processing of data sources, the selection of methodology to be applied, quality assurance do require a paradigm shift in producing economic statistics. What is more; economic statistics is an integrated system of micro and macro statistics, the most important decisions are based on that. Therefore - due to the leading role of economic statistics - their responsibility goes beyond other statistics and the challenge is much greater. The history of Hungarian Statistics – thus economic statistics – dates back 150 years, the goal of my paper is going to represent the Hungarian view on how to solve the problems we are facing.

Keywords: economic statistics, methodology, paradigm shift.

Detecting earnings management with discretionary accruals

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Abstract:
Depending on the anticipated consequences of the annual financial statements published, a firm has the possibility of purposefully shaping them with legally permissible accounting instruments. Here, discretionary accruals play an important role in detecting of the earnings management strength, thereby influencing the users’ and auditors’ understanding of financial statements. Firstly, I model total accruals, using an industry-specific linear regression framework taking into consideration key balance sheet and income statement variables. Then, discretionary accruals are estimated as a function of the obtained regression model parameters. Based on the data of selected German companies in the period from 2010 to 2016, I show that the used regression model is appropriate for approximating the managing effect and discuss the similarities among the companies analyzed. Finally, the results highlight the importance of measuring accuracy in accounting strategies and decision-making.

Keywords: accounting strategies, discretionary accruals, earnings management, industry-specific regression analysis.

JEL code: C20, M10, M41, M42.
The short-term turnover estimates in Bosnia and Herzegovina based on the Value Added Tax data

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Abstract:
National Statistical Institutes (NSIs) strive to produce short-term business statistics indicators with the high quality estimates in a timely manner. Beside the benefits of using administrative data for statistical purposes, NSIs are usually faced with the challenges like differences in definitions, incompleteness of administrative data, periodicity and timeliness, coverage issues, etc. Administrative Value Added Tax (VAT) turnover data can be used to partially or completely replace survey data for the estimation of short-term turnover indicators in Short-Term Statistics (STS). Different countries have different experiences in using administrative data for statistical purposes. In this paper, main characteristics of administrative VAT turnover data in Bosnia and Herzegovina (BiH) will be examined through cleaning of administrative VAT turnover data and matching of survey data with administrative VAT turnover data. The Monthly Retail Trade Turnover Indices (RTI) for BiH will be estimated by using administrative VAT turnover data. Also, comparison of results (indices) gained by using survey and administrative VAT turnover data will be made. Based on the results of analysis, future challenges and perspectives for expansion of using administrative VAT turnover data will be identified.

Keyword: administrative data, business statistics, estimation methods, Value Added Tax.

JEL codes: C81, C82, C13, H20.
Special demand curves in the sports economy

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Abstract:  
Based on previous research it can be stated that modelling sport economics related demand curves (e.g. demand for sport events and athletes) is different from others. The difference lies in the fact that some parts of the demand curves are nearly horizontal in case of sport goods and nearly vertical in case of athletes, because the price of sport events is inflexible and at the same time salaries of top athletes are extremely flexible. In this talk we are investigating the Engel-function (shape) and parameter estimation method appropriate for the relevant demand functions of sport economics. We show that the generally used generalized method of moments (GMM) estimator is less robust so we propose the use of weighted least squares (WLS) estimators to estimate the demand curve parameters that are able to handle heteroscedasticity. In case we furthermore assume a (typically asymmetric) known distribution of the variables (event prices, wages) the Maximum Likelihood (ML) estimates give even stronger result. In our empirical study we analyse extreme footballer salaries in top European leagues and identify a threshold where the traditional supply-demand functions are not appropriate anymore in explaining salaries. We investigate if the salary cap approach widely used in the North-American top leagues is efficient in a sense that it keeps player-wages below the mentioned threshold where traditional economic concepts apply.

Keywords: demand curves, robust estimation methods, sports economy.

JEL code: C21, C23, C52, Z22.

Acknowledgement: This research was partially supported by the Human Resource Development Operational Programme, grant No.: HRDOP-3.6.2-16-2017, Cooperative Research Network in Economy of Sport, Recreation and Health.
Goodness-of-fit compilation in structural equation modelling

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Abstract:
This paper reviews existing methods used for assessing model fit in structural equation modelling (SEM). A summary of the most frequently used fit indices provides a basis to select indices for inclusion in a linear combination index. The fit indices are evaluated using a simulation assessment and the newly constructed linear combination compared to traditional methods in a frequentist manner. The results of the simulation study reveal interesting insights into the difficulty researchers can expect when attempting to use observable and unobservable constructs in the social science modelling domain.

Keywords: goodness-of-fit indices, model fit, structural equation modelling.

JEL code: C15, C63.
A new statistical method to choose the best innovative initiatives

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Abstract:
Companies, which profitably analyze the competitive market, are more able to determine and discover opportunities for innovation in their sector. Therefore, knowing which methods of investment lead to better levels of innovation is essential in a global and very competitive economy as the current one. Frequently the transfer of the technological knowledge takes place among different sectors so as to make their comparison indispensable. In the global world, understanding the market situation both in own sector and in that of the others is essential to find out how the market is progressing and to determine own market position, improving so own business and development. In this study, in order to define the position of companies belonging to one or more sectors in the evolutionary process of innovation, I propose a statistical-mathematical method which orders them using publicly available data and therefore without cost. I analyze innovative efforts of the firms by considering 11 different initiatives, including accelerators, incubators and innovation labs, in a prolonged time frame. To prove my method concretely, I use a dataset composed of 80 firms operating in emerging markets, identifying which types of investment are best, and which companies and sectors are more innovative. The goal of my method is to provide every single firm with the opportunity to understand which innovative initiatives are more profitable for its expansion in the market and its level of innovation in comparison with the others, so that it can apply and orientate profitably its investments.

Keywords: innovation investments, latent variable models, statistical reduction methods, time series.

JEL code: C22, C38, G30, M10.
A new link function for the prediction of binary variables

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Abstract:
If no heavy sanctions are provided, for healthcare facilities the problem of the cancellation of the appointments can lead to huge economic losses and have a significant impact on their under-utilized resources. A good model to predict the appointment cancellations determines an effective solution to this problem. Therefore, I propose my new Bayesian method to estimate accurately the probability of the cancellation of the health visits based on specific factors such as age. This model uses the regression for binary variables, linking with a new function the explanatory variables to the probability of being present at the health appointment and estimating the parameters with the Bayesian method. In this my work, the probability is a weighted sum of two functions of the regressors so as to consider some essential characteristics to determine the possible deletion. I demonstrate the goodness of my method by applying it to a real case, based on data collected at a medical center in the second quarter of 2016, and by comparing it with other methodologies such as the traditional Bayesian logistic regression and that proposed by Gelman et al. (2008) which uses a weakly informative prior distribution. Therefore, I expose the advantages of my proposed method and I describe possible real-world applications.

Keywords: Bayesian inference, binary variables, cancellation prediction, link function.

JEL code: C11, C50, C51, I11.
Measuring of export market concentration for largest European regional economic integrations: various concentration measures performance

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Abstract:  
Aftermath of the Bretton Woods Conference and Second World War, alongside with the process of multilateral trade liberalisation, preferential trade liberalisation took place. Preferential trade liberalisation was conducted through the accession of countries to different regional economic trade integrations. Although this process was in conflict with the Most Favoured Nation (MFN) principle of General Agreement on Tariffs and Trade (GATT), the creation of these preferential trade agreements was allowed if it encourages international trade. There are four main types of regional economic agreements in the world today: free trade area, customs union, common market and economic and monetary union. Goal of this paper is measurement of export market concentration for largest European regional economic integrations in the period between 1995 and 2016 using various concentration measures. The emphasis is given to standardized Herfindahl-Hirschman’s index as the basic measure of trade concentration. Other concentration measures used in the analysis are concentration ratio, Gini coefficient, Rosenbluth index and Hall-Tideman index. Results of the analysis have shown that the highest concentration level of trade with countries worldwide is at EFTA countries whereas the lowest concentration level seems to have EU15 countries. On the other side, the highest concentration level of trade with countries from the same group have CEFTA countries and again the lowest concentration level have EU15 countries.

Keywords: export market concentration, intra-regional trade, regional economic integrations, standardized concentration measures.

JEL: C43, F15.
Optimization of commodity stocks the enterprise by means of statistical methods

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Abstract:
Purpose of the research is process of formation a commodity stocks the enterprise and definition of an optimum volume of commodity resources for sale. Objective of the research are analysis the structure of commodity stocks the enterprise, determination of turnover commodity stocks, grouping of commodity stocks for different signs of clustering. Data and methods are statistical information about the commodity resources of enterprises, statistical methods (grouping, structure analysis, evaluation of dynamic series), tools for assessing the efficiency of use commodity stocks, HML clustering, FMR clustering. Using the statistical information of 25 enterprises it was established that only 10 (40%) of them effectively used commodity stocks. Using HML clustering allowed to determine the volume of commodity stocks the enterprise at high, medium and low cost in accordance with the needs of consumers and their effective demand. Calculations show that most of commodity resources the non-food group are represented by products that have a relatively low cost (57.8%), goods with an average cost of 36.7%, and expensive – 5.5%. Using FMR clustering made it possible to form three groups of clusters, which show that commodity resources with fast turnover occupy the largest share in the overall structure – 64.3%, medium – 33.2%, slowly realized – 2.5%. The calculations allow the enterprise to determine the optimal volume of commodity resources in accordance with the needs of consumers and their effective demand, plan financial resources for the formation of commodity stocks, develop an assortment policy in accordance with the demand for products and its implementation.

Keywords: commodity stocks, efficiency, FMR clustering, HML clustering.

JEL code: C40, C46, L81, P42.
The impact of selected labour market indicators on personal income taxation in Federation of Bosnia and Herzegovina: evidence from error correction model

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Abstract:
The concept of equitable income distribution is related to labour market policy as well as income taxation. Income inequality concerns indicators such as wages, transfer payments, taxes, social security contributions and geographical mobility. The aim of this paper is to analyse the impact of selected labour market indicators on personal income taxation in Federation of Bosnia and Herzegovina. The econometric analysis of the impact of selected labour market indicators on personal income taxation in Federation of Bosnia and Herzegovina is conducted using error correction modelling. Trace test and maximum eigenvalue test have pointed to the existence of one cointegrating relation at 5% significance. Furthermore, the error correction model is estimated and the cointegrating equation indicates that there is statistically significant positive impact of average monthly wage and number of employed persons on personal income taxation in Federation of Bosnia and Herzegovina in long-run. The estimated impacts are in line with public finance theory and previous research. Additionally, forecast errors variance decomposition of estimated error correction model is analysed. After two years, selected labour market indicators explain considerable part of forecasting error variance of personal income tax revenues. The implementation of reforms in labour market and tax policies of Federation of Bosnia is suggested. To achieve necessary reforms, the efficient governance and general stable political environment are required.

Keywords: error correction model, Federation of Bosnia and Herzegovina, labour market indicators, personal income taxation.

JEL code: C22, C51, H24, H71.
Impact of land tenure on the participation in factor income in agriculture of Slovenia

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Abstract:
The purpose of the article is to present agricultural land tenure in Slovenia and its impact on the division of the factor income on the part intended for the production factor of land and the improvement by the introduction of the rent statistics. The analysis is based on the data of Economic Accounts for Agriculture (EAA). The article presents the structure of the agricultural land incorporated in the agricultural production, data sources and the methodological approach for rent calculation, rent costs in the framework of the entrepreneurial account and the division of the factor income by the individual production factors in Slovenia in comparison with the EU Member States with the emphasis on the share concerning the part of the agricultural land. According to the methodology, the rent corresponds to the owner of land in return for the use of rented land. The land, together with the labour force and capital, cooperates in the income generation and it is also one of the production factors that participate in the income division. The paper presents the activities and the results from the introduction phase of the annual rent statistics in Slovenia. Methodological progress of the Statistical Office of the Republic of Slovenia (SURS) in the field of the annual rent statistics is the result of active cooperation with Eurostat in preparing the common European methodology and cooperation in three successive projects. The data on rents will be the input for Economic Accounts for Agriculture when the regular survey on rents is established.

Keywords: agriculture, entrepreneurial account, factor income, land tenure.

JEL code: E25, Q15.
Demographic and socio-economic profile of the oldest-old in Croatia

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Abstract:
Population ageing is one of the greatest societal challenges in present and coming decades in Croatia. Increasing heterogeneity of the older population put a special emphasis on the increasing number of oldest old (often defined as population aged 80 or 85+ and older). Today, large differences can be noted in the health and socioeconomic characteristics of the population aged 65-79 compared to the oldest old. Oldest-old are population group with a high prevalence of long-term care needs. The higher increase of the oldest population might add to the burden of relatively declining population of working ages, who are supposed to take care of the oldest people. In this paper we will explore socio-economic status of the oldest-old in Croatia, their living arrangements, their social network, health care provision and need, morbidity, diseases and chronic conditions prevalence. In analyzing oldest-old in Croatia, we use the Survey of Health, Ageing and Retirement in Europe (SHARE), a database of micro data on health, socio-economic status and social and family networks in the population aged 50 and older. Croatia participated in the SHARE Wave 6 for the first time. The fieldwork of the SHARE wave 6 was completed in November 2015. Descriptive statistics results are derived from weighted data. Using limited dependent variable techniques, we will further explore a possible difference between oldest-old and younger elderly population in the sample.

Keywords: Croatia, demography of ageing, oldest-old, SHARE.

JEL code: J14, J19.
Simulation study of parameter estimators for Fisher-Snedecor diffusion

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Abstract:
The problem of parameter estimation for a non-stationary ergodic diffusion with Fisher-Snedecor invariant distribution, to be called Fisher-Snedecor diffusion, is considered. We propose method of moments estimator of unknown parameter, based on continuous-time observations, and prove its consistency and asymptotic normality. The explicit form of the asymptotic covariance matrix in asymptotic normality framework is calculated according to the new iterative technique based on evolutionary equations for the point-wise covariations. Results are illustrated via simulations.

Keywords: asymptotic normality, Fisher-Snedecor diffusion, method of moments, P-consistency.

JEL code: C13, C22.
Modelling heterogeneity in trail users’ perception of crowding in a peri-urban nature park

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Abstract:
Crowding is an important factor that affects visitors’ experience in green areas. Existing nature parks and outdoor recreation surveys rely heavily on single-item scales to measure visitors’ perception of crowding. However, such scale ignores the complexity of crowding phenomenon, which varies with various social, psychological and situational factors. To deal with this issue, the discrete choice experiment (DCE) and BWS (best-worst scaling) methods were used to simultaneously address various factors that affect trail users’ (n=249) preferences and perception of crowding in the Medvednica Nature Park. The results of mixed logit model indicated that crowding on trail is more important characteristic of trail experience than trail condition, intensity of road traffic, forest landscape and educational signage; however, trail users were willing to tolerate relatively high levels of crowding. A significant unobserved preference heterogeneity was found for the very crowded situation on trail. The possible sources of this heterogeneity were investigated within an additional BWS experiment. The occupancy of mountain huts, number of other hikers on the trail and amount of litter along the trail contributed most to the trail users’ perception of crowding. However, the latent class analysis identified large heterogeneity in their perception; one group of trail users was more disturbed by the direct social impacts, and other by the secondary impacts of other visitors. Identifying the factors that affect visitors’ perception of crowding the most and the heterogeneity in the perception of crowding offers a valuable information to park management in dealing with increased recreation use.

Keywords: best-worst scaling, discrete choice, perception of crowding, preference heterogeneity.

JEL code: C18, C25, Q26, Q53.
A new approach for dealing with multivariate stratification in agricultural surveys in Croatian Bureau of Statistics

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Abstract:
In agricultural sample surveys conducted in Croatian Bureau of Statistics one stage stratified random sampling design is applied. The stratification aims to divide the population into non-overlapping subpopulations called strata using stratification variables in a way that a precision of estimation, in terms of sampling errors, for variables of interest is minimal. The stratification variables are chosen from the variables available in the sampling frame, the more the auxiliary variables are correlated with the target variables the higher will be the benefits in using them for stratification purposes. Use of categorical variables such as geographical regions does not pose a problem for stratification, while continuous auxiliary variables (some measures of farms’ size, size of areas with crops, livestock, etc.) need to be categorized. The aim of this paper is to determine optimal stratification of a sampling frame in a multivariate case on the example of Farm Structure Survey conducted in 2016 using the SamplingStrata R-package. This approach is proposed by Ballin and Barcaroli (2013) and is based on the use of the genetic algorithm: each solution is considered as an individual in a population and the fitness of all individuals is evaluated applying the Bethel-Chromy algorithm to calculate the sampling size which will satisfy precision constraints on the target estimates.

Keywords: agricultural survey, genetic algorithm, multivariate stratification, sampling design.

JEL code: C61, C83, C87.
Integration in global value chains: case of Croatia

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Abstract:
This paper examines Croatia's integration in global value chains, and offers comparison to its main trading partners and the peers. The results show that the GVC participation index did not increase much in Croatia in period from 2000 to 2014, which is also the case in most of the comparable countries. However, other countries significantly increased their backward and decreased forward participation, while the structure of integration in Croatia stayed almost same. The paper also shows that the share of domestic value added in gross exports in 2014 was highest in production of food, beverages and tobacco industry, pharmaceutical products, and computers and electronics. Finally, according to the VAX matrix, the highest final demand for Croatian goods and services comes from Germany and Italy, Austria, Slovenia, China and the USA.

Keywords: backward and forward participation, global value chains, GVC participation index, VAX matrix.

JEL code: F14, F60, P52.
On generalizing the c index for survival data

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Abstract:
The c index, as defined for survival data, has been, somewhat surprisingly, used a lot in applications where time to event is the outcome of interest. Its original definition proved to be sensitive to censoring, but also couldn't be used for models with time-dependent effects or covariates. This led to quite some generalizations of the index, including the measure RE, introduced by Stare et al (Biometrics, 2011). In this talk I will first define what a generalizations of the c index is (and explain that modifications should be distinguished from generalizations) and then show that other generalizations are inferior to the above mentioned measure since they are less sensitive to changes in values and effects of the covariates occurring in time.

Keywords: c index, generalizations, survival analysis.

JEL code: C14, C53.
On computation of quartiles – the differences among methods do matter!

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Abstract: 
We provide examples showing that the choice of method for computation of quartiles may have a direct impact on practical decisions. As the differences among the methods tend to vanish with growing sample size, a common belief is that the methods are practically equivalent. To the contrary, we have shown on several experiments with various sample sizes that in some examples, the differences may be very likely. For discrete underlying distribution, some exact estimates of differences between expected values of sample quartiles, given by two different methods, are derived. We strongly believe that it is therefore crucial that in any application, the choice of the method for computation of quartiles (or, percentiles) is explicitly given.

Keyword: percentiles, quantiles, sample quartiles.

JEL codes: C02, C19.
Classification of textual documents represented in lower dimensional space by supervised Reduced k-means method

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Abstract: The aim of our research is to perform reparameterization of original representations of textual documents in bag of words model in order to enhance performance of their automatic classification. We have used a variant of the Reduced k-means method for a supervised setting which aims at reduction of variables by capturing the clustering structure present in the data. Experiments on Reuters21578 data set show that by representation of documents by this method the same level of precision of classification can be achieved on the higher level of recall as the representation by the benchmark method of the latent semantic indexing.

Keywords: classification, Reduced k-means method, reduction of dimension, textual documents.

JEL code: C38, C55.
Business performance and ownership types: evidence from Croatia

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Abstract:
The main objective of this research paper is to examine whether there is a positive influence of a particular type of ownership on the business performance of a company measured by Tobin’s Q depending on the analysed sectors i.e. the activity defined by the National Classification of Activities, 2007 (NKD, 2007) for the observed period from 2012 to 2016. The research was conducted on Croatian companies whose shares are quoted on the Zagreb Stock Exchange continuously from 2012 to 2016, and selected according to the stock liquidity criteria calculated as the average of monthly rankings by trade turnover in the observed period. In this research, types of ownership are primarily divided into 5 categories, according to the shares held by the government, private investors, banks, legal entities i.e. other companies and institutional investor. As a performance indicator, Tobin’s Q was used as a modern measure of business performance calculated as an approximation of the origin form, specifically calculated as the natural logarithm of market capitalization divided by the bookkeeping value of the equity capital. Therefore, the aim of this research was to establish simple linear regression models of dependability of the type of ownership and business performance of the analysed companies using the data and information from the official annual financial reports of the analysed companies and official data obtained by the Central Depository & Clearing Company (cro. SKDD). Results obtained in the research indicate that the ownership of institutional investors has positive and significant impact on company’s business performance particularly in sector C (Processing industry), while the private ownership has positive and significant impact on company’s business performance particularly in sector I (Accommodation and food service activities).

Keywords: business performance, regression model, stock liquidity, Tobin’s Q, type of ownership.

JEL code: C20, C25, G12, G32.
Modernization of official statistics and implications for users

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Abstract:
Continuously progressing technologies have been challenging official statistics to adapt its performance and services to the changing landscape of user needs and to progressively competitive environment with new data producers. In a modern advanced statistical organisation, there is hardly an area, which has not been affected by modernisation measures. New phenomena are being operationalised, and new indicators introduced; alternative data sources supplement and substitute traditional sample surveys; powerful data processing methods and tools increase efficiency and quality of statistical products disseminated mainly as open data; and each performance step is relying on well-defined quality standards. But are the advantages of official statistics in comparison to new players adequately communicated to users? And: are the users ready for absorbing statistical wealth marked by big data, open data, rich data, data visualisation? In data revolution era, data users need new skills and competences beyond traditional statistical literacy. Along with modernisation of official statistics, data revolution forces statistics educators to adapt curricula to the features of data-rich society. In this paper, general trends and potentials for modernising university curricula of statistics in relation to data revolution and official statistics are discussed and selected illustrative examples provided.

Keywords: data revolution, data science, official statistics, statistical skills and competences.

JEL Code: E00, O33.
Electoral observation: experiences from Kenya, Tunisia, Kosovo, Nigeria, Honduras and Peru - implementation, methodological and ethical issues

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Abstract:
The European Union Electoral Observation Missions observe democratic elections all over the world (extra EU). In the last years, EU has been focusing on data collection complying with the procedures during the Election Day in polling stations. In Kenya, Tunisia, Kosovo, Nigeria, Honduras and Peru, the challenges are the logistic and security issues, in addition to the limited time of the opening hours of the polling stations. Despite of the context, the ‘quick count’ or ‘parallel vote’ can reach accurate forecast of the electoral results. This sensitive data can create dramatic ethical problems.

Keywords: conflict area, ethical issue, quick count, security.

JEL code: C8, C81, C82, C83.
Artificial neural networks implementation potentials – a literature review

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Abstract:
The significant worldwide growth of the tourism sector in the two past decades resulted in an increased number of researches and studies of tourism industry determinants. In analysing and modelling core tourism components, mostly using secondary data, different methods and technique are applied; different forecast models are constructed and compared using different forecast error measures. The aim of this research is to provide a detailed outline of different quantitative methods and techniques, both the traditional ones as well as some emerging most sophisticated methods used in modelling and forecasting tourism. Beside the various methods, there is a large variety of explanatory variables selection in constructing forecast models and explaining some core tourism industry components. This paper reviews the published researches and studies that use the Artificial Neural Networks in modelling and forecasting tourism industry. The most significant finding that resulted from the detailed desk research is that, beside their great implementation potentials, Artificial Neural Networks are underused in tourism analysing, although their forecast efficiency excel the usual traditional models.

Key words: Artificial Neural Networks, modelling and forecasting, tourism.

JEL code: C10, C18, C20, C40.

Acknowledgment: This paper has been financially supported by the University of Rijeka, for the project ZP UNIRI 4/17.
Can National Statistical Institutes solely initiate the change in the area of statistical literacy?

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Abstract:
Statistical literacy is not all about understanding theoretical and applied statistics. It is much more and should be observed as an interdisciplinary ability based on statistical and mathematical, but also on educational and pedagogical field. In recent years, mainly statistical institutions have undertaken initiatives, but the question is, have they obtained concrete and substantial results and reached the objectives? The ESS Vision 2020 puts the responsibility on National Statistical Institutes (NSIs) to deliver information to the public in a comprehensible way, but at the same time, to improve statistical literacy. These two tasks are complementary and should be seen as a long-term investment. Enhancing statistical literacy as ability to read and interpret statistical data should have clear and visible results in reducing the misuse of data, improper use of statistical data as well as reducing fake news effect. Statistical institutions can make some improvements on their own, but to make the essential change in the area of improving statistical literacy, synergy between educational, academic and governmental institutions should be generated. The Eurostat and voluntary EU NSIs have organised the European Statistics Competition (ESC) with the aim of promoting statistical literacy as well as curiosity and interest in official statistics among students and teachers. The results will show how much undergraduate students from 12 EU countries that are taking part in this contest are interested in statistics as well as the level of their statistical literacy abilities. For the Croatian national phase of the ESC, the Croatian Bureau of Statistics managed to establish connections with the educational sector, which was the key milestone for the success of the both national and European phase of ESC. Such and similar projects and the expected results could motivate NSIs to think about additional activities aimed at light users and non-users and to plan further actions in the area of improving and promoting statistical literacy.

Keywords: European statistics competition, national statistical institutes, statistical literacy.

JEL code: L31, M14, M31, P36.
The impact of stress of older employees on their work engagement

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Abstract:
The ageing of the population in Slovenia represents one of the biggest challenges for managing older employees in a company. The first step towards the adequate management of older employees is to create an appropriate working environment that dictates the successful result of ageing for employees and thus the achievement of goals, performance and competitiveness of the company. The main objective of the paper is to determine the impact of stress at the workplace on the work engagement of older employees in Slovenia. In the research on the management of older employees in Slovenia, 1086 older employees were included in the sample by random selection. We used a closed-type questionnaire as the research instrument. We used the existing measurement instruments, which we adjusted to our situation and needs, and the 5-level Likert scale. The research is based on the implementation of a factor analysis by which we wanted to reduce the large number of variables into a smaller number of factors with which we performed a simple linear regression. We found that there is a statistically significant negative interaction between the stress at the workplace and work engagement of older employees, which means that the lower the level of stress at work, the greater the work engagement of older employees. Based on the results, we confirmed the hypothesis that stress at the workplace has a negative impact on the work engagement of older employees. The work performance of older employees depends to a large extent on the characteristics of the workplace; therefore, an individual approach of human resource management to each employee is important, thus increasing the emphasis on the well-being of an individual at the workplace. Stress is a possible trigger of mental illness which is the cause of long-term sick leave and premature retirement of employees. From this point of view, organisations should seriously address the problems of preventing and managing stress at work.

Keywords: factor analysis, human resource management, older employees, stress in the workplace, work engagement.

JEL code: J24, I19, C38.
Importance of the non-financial sector accounts in the macroeconomic statistics

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Abstract:
Non-financial sector accounts as one of the main parts of macroeconomic statistics can be used for great deal of conclusions on how economy works. They are important sources for EU's economic governance, since they are used for the European Semester (a framework for the coordination of economic policies across the European Union). GDP and beyond is well known Stiglitz Report about measuring economic development and not forgetting well-being. Non-financial sector accounts are also in a sense “GDP and more”. They are giving complex picture on economy although they are just one part of even bigger system called national accounts. If we restrict ourselves on non-financial sector accounts we will still have much better picture about economy than if only use GDP. Main reason for this is that accounts have so many dimensions. One of the most important dimensions is the sequence of accounts; informing us about the production, distribution, redistribution and use of income and at the end they are telling us were we are, compared with others, are we borrowing or lending resources. For example saving as one of the most popular aggregate used in different macroeconomic models, is not as simple as relationship might suggest. It is very different depending on the sector, demographic composition, economic cycle etc. Having in mind importance of accounts the quality reports are part of EU legislation (Commission Implementing Regulation (EU) 2016/2304), mostly since accounts are base for making EU economic policies.

Keywords: ESA 2010, institutional units, non-financial sector accounts, quality reporting.

JEL code: C82, E01, M41.
Sample coordination of statistical business surveys in Serbia

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Abstract:
Business surveys in official statistics are conducted with the aim to collect data about employment history, operating income, costs, expenses and other reportable characteristics of the population of interest. These data are used for estimating the level and dynamics of the economy of the country. Significant number of surveys is sample based. Sample coordination system is introduced to control the overlap of samples in order to enable precise estimate of change, improve comparability of data from different statistical surveys, increase the efficiency of data production and at the same time reduce the burden on respondents. In Statistical Office of the Republic of Serbia, the methodology on sample coordination for business surveys based on random sample was implemented in 2013. This system is based on the system for coordination of frame populations and samples from the Business Register at Statistics Sweden (SAMU). In this paper, after presenting JALES method for positive and negative sample coordination, system of sample coordination in SORS will be presented. The achieved results and suggestions for further work on coordination and reduction of statistical burden of enterprises will be also discussed.

Keywords: JALES method, response burden, sample coordination.

JEL code: C83.
Application of the technology acceptance model in the field of Internet banking acceptance in the City of Split

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Abstract:
The aim of this research is to determine whether the motivation for using Internet banking in the city of Split can be explained by perceived ease of use and perceived usefulness, as the main elements of the technology acceptance model (TAM). This model explains the intent of using information systems through these two elements from psychological theory. Previous research has shown that perceived ease of use and perceived usefulness significantly affect the acceptance of Internet banking. Some extended TAM versions included additional influential variables, such as openness of the potential user, social pressure, perceived risk, etc. The research is focused on the influence of individual characteristics of users on the acceptance and use of Internet banking in Split. For the purposes of the research, a survey analysis was applied, with questions related to both the main TAM elements and the individual characteristics of each respondent. The sample includes 282 working residents of Split. Gender and age structure of the sample was harmonized with the population to make the results more credible. Considering the hypothesis formulation, non-parametric tests were used in the study, which confirmed the applicability of TAM in the context of Internet banking over the working population of Split. As expected, it is concluded that both elements of TAM influence the acceptance of Internet banking. These results can help bank managers to understand the factors of Internet banking acceptance and to develop expansion strategy, especially among older citizens.

Keywords: non-parametric tests, survey analysis, technology acceptance model.

JEL code: C12, C83, G29.
Cluster analysis and artificial neural networks in predicting energy efficiency of public buildings as a cost-saving approach

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Abstract:
Although energy efficiency is a hot topic in the context of global climate change, in EU directives and in national energy policies, methodology for estimating energy efficiency still relies on standard techniques defined by experts in the field. Recent research shows a potential of machine learning methods that can produce models to assess energy efficiency based on available previous data. In this paper, we analyse a real dataset of public buildings in Croatia, extract their most important features based on correlation analysis and chi-square tests, cluster the buildings based on selected features, and then create a prediction model of energy efficiency for each cluster of buildings using the artificial neural network methodology. The main objective of this research was to investigate if a clustering procedure improves the accuracy of a neural network prediction model or not. For that purpose, the mean average percentage error (MAPE) of an initial prediction model obtained on the whole dataset is compared to the MAPE of separate models obtained on each cluster. The results show that the clustering procedure has increased the prediction accuracy in one of the building clusters, while for the other cluster the accuracy did not improve. Those preliminary findings can be used to set directions for future research which can be focused on estimating clusters using more features and testing more machine learning algorithms to obtain more accurate models.

Keywords: artificial neural networks, clustering, energy efficiency, machine learning, prediction model

JEL code: C52, C53, C55, F64.
Private forest owners’ conceptualisation of forest management: a Multiple Indicators and Multiple Causes (MIMIC) model

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Abstract:
Political changes and policy reforms from 1990 brought processes of restitution and privatization on Croatian territory and changed forest ownership structure. Such changes coupled with altered ecological, socio-economic and market conditions shaped diverse forest owners’ management objectives. Private forest owners play a significant role in sustaining forest ecosystems by providing wood and other goods and services. Their interpretation of forest management is seen as “hands of” management. To understand this perception between the official message what forest management should be and forest owners’ interpretation we conducted a survey among private forest owners in Croatia (n=1007). The owners were asked to indicate their level of agreement with 19 statements defining forest management on a five-point Likert scale. We applied a Multiple Indicators Multiple Causes (MIMIC) approach to investigate the effect of age, income, gender, property size and distance from forest property on the structure of a hypothesised three-factor model consisting of “maintenance forest management” (MAINT), “ecosystem-centred management” (EM) and “economics-centred management” (ECON). Private forest owners conceptualised forest management as a multidimensional system emphasizing EM as the most important dimension. The most agreed definitions were “Preserving the forestland for future generations” and “Taking care of the forest health and disease prevention” while “Work in the forest, e.g. using a chainsaw, doing forest operations” was less important. Distance from the forest property was the most important predictor of EM. Forest owners living more than 20 km from their property value ecosystem management more. This can be explained by pronounced depopulation of rural areas and changing forest owners’ values. When it comes to private forest management planning and designing forest policies these facts have to be taken into account.

Keywords: ecosystem management, forest management conceptualisation, MIMIC model, private forest owners.

JEL code: Q23.
Experimental statistics on income inequality and poverty indicators

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Abstract:
Policy makers in the EU have an increasing demand for a social scoreboard to better monitor the changes in social conditions, especially during periods of economic crisis. EU Survey on Income and Living Conditions indicators on poverty and income inequalities are a key part of the toolkit for the European Semester, the yearly cycle of economic policy coordination among EU member states. However, income data for year N is only available in the autumn N+2 which comes too late for the policy agenda. The strategy for providing more timely data on income is based on two pillars: a) flash estimates about income N if possible available in June N+1 and b) final EU-SILC data on income N during the European Semester (end N+1 / early N+2). This paper presents the figures for the flash estimates for the Republic of Croatia relating to the income year 2016. They refer to the following key income indicators: at-risk-of-poverty (total population) and income inequalities; and evolution of income deciles (D10, D30, median, D70 and D90), which provide useful information on the developments within different parts of the income distribution. These positional indicators are more sensitive to income changes and therefore suitable as early warnings. Conditional on their quality, these figures are labelled as "experimental statistics". More timely indicators are essential for informing the users and feeding the monitoring of social policies in due time. Moreover, household income based on microsimulation provide a valuable tool for evaluating the impact of tax and benefit policies.

Keywords: experimental statistics, flash estimates, income, poverty.

JEL code: C15, C53, C63.

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Abstract:
Extensive regulation of official statistics increased comparability and improved reliability of statistical results but reduced flexibility of statistical research. The aim of the paper is to investigate the influence of international (primarily EU) statistical regulation on development of national statistical systems. The paper analyses the effects of changes in statistical legislative environment that were result of the EU response to Global economic crisis and European debt crisis. Effects of the Regulation (EU) 223/2009 on European statistics and changes and development of area specific statistical regulations in the EU are analysed in their relation to National statistical systems. Paper analyses changes in priorities for national statistical offices and offers an overview of key legislative priorities that are debated thought the official statistical community. The paper argues that legislative measures, together with international non-legislative instruments, such as European Statistics Code of Practice, European Statistics Quality Assurance Framework and UNECE’s Generic Law on Official Statistics have changed the perception of official statistics in the general public, but have also made statistical governance more difficult and the production of official statistics more resource intensive. Paper also argues that international legislative and non-legislative instruments have also changed the priorities of official statistics, forcing National statistical offices to switch their focus from ensuring quality of results to ensuring quality of statistical processes.

Keywords: development of statistical systems, European statistical legislation, statistical systems governance.

JEL code: C19, C49, F02, F53, K33.
Determinants of the size of fiscal multipliers: new empirical evidence for EU countries

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Abstract:
During the Great Recession, the majority of EU countries experienced severe and prolonged fall in economic activity. Ineffectiveness of monetary policy and weak output dynamics in these countries revived the role of fiscal measures in spurring real output growth. With overview of basic empirical literature we put into perspective some reference values of fiscal multipliers estimated under consideration of different macroeconomic conditions. Our study contributes to the debate about the output effects of fiscal spending in two ways. First, a panel vector autoregression model is applied to estimate the size of fiscal multipliers for the sample of 28 EU countries using a new annual data sample for the period 1995-2016. Second, we scrutinize how public debt and level of economic development affect the size of fiscal multipliers in European economies. We report positive fiscal multipliers at least over a part of the horizon but values of multipliers do not exceed 1 in all cases. Our results indicate that fiscal incentives are less effective during periods of high public debt and are dependent upon the level of economic development. The empirical findings suggest an active and selective use of fiscal policy among different EU countries for the purpose of stabilizing business cycle.

Keywords: fiscal multiplier, fiscal policy, panel VAR.

JEL code: C23, E60, E62.
Parallelized boosting machine

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Abstract:
Tree boosting is a highly effective and widely used machine learning method. We use the connection between boosting and optimization and focus on the Gradient Boosting Machine. In this paper, we propose to enhance existing boosting methods by adjusting the size of the sequential trees in a novel fashion. We also present a novel way of distributing Friedman's general boosting machine (gbm) across multiple cores and multiple servers. We observe substantial speedups without any loss in classification accuracy. Our method combines bagging and boosting in a unique fashion and is particularly suited for large data sets as memory is shared across CPUs. We demonstrate improved performance in various prediction and classification benchmarks.

Keywords: boosting, machine learning, randomized algorithms.

JEL code: C4, C55, C87.
Multivariate Gaussian data clustering and its application in macroeconomics

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Abstract:
Clustering multivariate Gaussian random variables via standard clustering algorithms (such as k-means algorithm) has been thoroughly researched and discussed when addressing the issue of clustering data taken from a single sample form multivariate Gaussian. Over the past years, however, further research was made to develop clustering data taken from a multiple sample, drawn from multivariate Gaussian. The need for improvement was simply based on the fact that multivariate Gaussian from multiple sample are present every day, as measurements of fitness trackers (heart rate, speed, distance and such at the same time) or movie grading on numerous internet sites and polls by different users, and so on. In this paper, we gather results from research done so far on the subject of clustering multivariate Gaussian, using information theory and its main tools for measuring distance between multivariate Gaussian random variables. An information theoretic approach offers a possibility of clustering multivariate Gaussians not only by mean parameter, but assigning volatility (second moment parameter) as a component of distance. Key measurements used with implementation of the augmented k-means algorithm are Mahalanobis distance and Burg-Matrix-Divergence. Characterizing cluster representatives with their mean vector and covariance matrix provides possibilities in determining various intertemporal co-movements between multivariate Gaussian components within a cluster. Based on those ideas, we evaluate this method using synthetic, generated data, and, most importantly, include empirical macroeconomic data on 37 different countries around the world. Using most common macroeconomic indicators, such as Unemployment rate, Consumer Price Index, proxy-variable for GDP - Industrial Production Index, we assign our collected data to algorithm. Next, we present members of each cluster, by obtaining plots by corresponding variable, for every country within it. Also, by observing correlation matrices of every cluster, we put to test basic macroeconomic theory on co-movement between unemployment, GDP and inflation rate (Phillips curve).

Keywords: data clustering, macroeconomics, multivariate Gaussian.

JEL code: C38, C55, C82.
Economic effects of the budget deficit in the Republic of Macedonia: analysis from the view point of its European Union membership aspirations

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Abstract:
Although the global financial and economic crisis of 2008 is far behind us, in the Republic of Macedonia we can still feel the expansive fiscal policy of the Government, especially through the increased level of public expenditures aimed at stimulating the growth of the economy. From 2008 onwards, Republic of Macedonia has continuously recorded negative budget balance, which affects the economy and resources allocation. The question that arises is whether such interference by the Government in the functioning of the market economy has positive or negative impact on the growth rate of the Macedonian economy. Without going into the structure of the public expenditures and their effectiveness and efficiency, as well as in the tax and customs policy of the country, this paper examines the impact of the budget deficit in the Republic of Macedonia on the GDP per capita in the country. In this regards, multiple regression model for the period 1994-2015 is estimated by using the ordinary least squares method. The results show that budget deficit is not statistically significant determinant of GDP per capita in Macedonia, instead it is mainly determined by other factors. The purpose of this research is to see where Republic of Macedonia is regarding this issue, in terms of its aspirations for EU membership and in line with the EU requirements in this area.

Keywords: budget deficit, GDP, ordinary least squares, public debt.

JEL code: C30, C50, H62.
Maternity support policies: a cluster analysis of 22 European Union countries

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Abstract:
Maternity support varies among the European Union countries but with shared goals like improving natality, gender equity, fostering employment and maintaining incomes. Objective of the research is to identify clusters of countries regarding the maternity support policies on the trail of Esping-Andersen’s categorisation of welfare states. Twelve indicators are used to capture the following three dimensions of the variety of the maternity support: design of public policies, their generosity and national context (economic performance, education and poverty levels, inequality etc.) of countries. Data for the indicators in 2014 are collected from Eurostat, OECD Family Database, UN and the International network on leave policies and research. Using clustering methods in combination with principal component analysis, the results reveal four regional/cultural clusters: (1) Western Europe, comprising of developed countries with lower parental leave support; (2) Central and Eastern Europe, lower economic standard cluster with well-paid leaves and lowest formal child-care; (3) Southern Europe, with low support and highest female poverty, (4) Nordic countries with France and Germany, as a generous support cluster. Additionally, the proposed clusters are used to analyse the differences among countries in fertility levels, mothers’ employment rates and gender gap in human development. The outcomes between clusters are assessed by applying the Tukey-Kramer test for difference between means. Results are not definite, but do reveal that fertility levels are higher in economically stronger clusters, while lower gender gaps could be attributed to longer and better paid parental leaves.

Keywords: cluster analysis, fertility, gender equality, maternity.

JEL code: C38, I38, J13, J16.
Diffusion processes for modeling brain parameters

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Abstract:
Diffusion processes are well known continuous-time stochastic models for describing various natural and economic phenomena, e.g. motion of molecules and fluctuation of stock prices. In this talk we present diffusion processes constructed according to the prescribed marginal distribution, motivated by continuous-time modeling of some brain parameters measured on a large sample of individuals.

Keywords: diffusion process, marginal distribution, parameter estimation, student diffusion.

JEL classification codes: C13, C22.
Sampling frames construction using the Hidiroglou algorithm

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Abstract:
When conducting a sample survey on enterprises the main purpose of the sample is to come to a conclusion without having to collect data on all unit of the population. In usual sample surveys (in Official Statistics) stratification sample design is adopted. Units are divided in disjunctive subsets aka. strata and a simple random sample is selected from each strata. The common stratification variables in business surveys are economic activity according to NACE Rev 2., size according to the balance sheet and territory. Still in the case of highly skewed population, it is hard to stratify the sampling frame without conducting a cut-off. In this paper the proposal is to apply Hidiroglou (1986) algorithm for dividing the population into a take-all stratum and a take-some stratum. Applying this algorithm on a highly skewed population the stratification boundaries can be determined in order to divide the population into take-some and take-none strata. This way the resulting sample frame is smaller but still have almost full population coverage. This paper aim to show how applying Hidiroglou algorithm when constructing sample frames the resulting set of units cover the main total of the target variable. The sampling frame contain noticeable less units but still have almost full population coverage.

Keywords: Hidiroglou algorithm, sampling frame, stratification, take none.

JEL code: C83.
Deficiencies of the concept of the gross domestic product calculation

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Abstract:
GDP aggregate has the key position in the system of national accounts. In its calculation are accepted conventions which deviate from the theoretical definition of this aggregate. In the imaginary examples, GDP is calculated according to the concepts and method calculation. We have focused on three conventions which in largest extent have impact on its size. From the given calculation it is clearly noted that no concept of the calculation of value added reflects the real measure of the accounting period. For this reason it would be desirable to redefine the aggregate gross value added in order to presents the measure the agreed calculation (convention) is adjusted to the theoretical definition of the measure of the precaution of the society. Due to the accepted conventions of the GDP calculation, this aggregate is inconsistent to the basic identity in the economy which is expressed by the equality of the sum of prices of products and services and the size of this aggregate in the accounting period. According to the UN concept GDP is overestimate by the amount: tax income which is used to finance non-market production, dwelling services for owner-occupied dwellings, software service for own consumption. So, GDP and macro-categories derived from it does not reflect the real life. The new created value is overestimated, so all those who participate in its distribution and consumption spend more than they create. The consumption which is higher than production is reflected on the decrease of assets or borrowing. There is no other possibility.

Keywords: gross domestic product, input/output, market/non-market production, services of dwelling.

JEL code: C82, E01, P43, P44.
Clustering approach to the Composite I-distance Indicator methodology: The case of the Doing Business Index

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Abstract:
The World Bank (WB) acknowledged the importance of business regulatory environment and therefore created a metric which will rank countries based on their level of business regulation for domestic firms: Doing Business Index (DBI). The index itself consists of 41 indicators which make 10 topics which are later aggregated into the DBI. However, the issues surrounding the process of composite index development are complex. The question which attracted our attention is should all the observed entities be given the same weighting scheme? The approach we propose as an answer is two-fold. First, we would cluster the 190 countries covered by the DBI. In the next step, we would apply the statistical multivariate Composite I-distance Indicator (CIDI) methodology to determine new, data driven weights for each of the retained clusters. By the majority of the indexes used to determine how many clusters to retain, two-cluster structure was chosen. The obtained results show that there is difference between the two weighting schemes proposed by the CIDI methodology. One can argue that one weighting scheme does not fit all the observed countries, meaning that additional analysis on the DBI are suggested to explore its stability and its weighting scheme. The presented approach and results can be a foundation for further academic research on weight assignment procedures, especially on combining clustering methods and data-driven weighting schemes.

Keywords: CIDI methodology, Clustering, Doing Business Index, International Business.

JEL code: C43, C38, F23, M16.
Digital readiness for new industrial development: European leaders and followers

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Abstract:
Digital readiness is fostered by the European Union under the i2010 agenda through a supply, usage and impact framework. Through the efficiency gains in the production of ICT, lower costs are realized due to the falling prices of ICT goods and services, which represent the “supply”. In addition, lower prices positively influence usage of ICT by individuals, businesses and the public sector, which represents the “usage”. Finally, higher usage of ICT adds value to the economic growth, higher employment and greater efficiency of public sector, and finally well-being of whole society, which represents the “impact”. Goal of the paper is to review and discuss digital readiness of European countries as a prerequisite for new industrial development. Hypothesis of the paper is that digital readiness leads to differences among the European countries. For that purpose, cluster analysis is conducted on the sample of European countries, based on the i2010 framework. Cluster analysis based on the following groups of indicators has been conducted: (i) Broadband and Connectivity, (ii) ICT usage by individuals, (iii) ICT usage by enterprises, and (iv) ePublic services. Data on 31 European countries were divided into four clusters. Considering different characteristics of countries regarding i2010 indicators, the most developed countries are placed in the first cluster. The second cluster consists of developed western-European countries, and the third consists of the southern European countries. The final group consists of the eastern European and candidate countries to the European Union. Conclusion is that there is still a significant difference between European countries according the digital readiness. Therefore, strong concern should be made towards fostering balanced development of European countries regarding digital readiness.

Keywords: cluster analysis, digital readiness, Europe, industry.

JEL code: C38, F63, O1.
Higher educational policy based on statistical analysis

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Abstract:  
Serbia has started with accreditation of higher educational institutions and study programs in 2007. Since then higher educational system in the country has been transformed significantly but educational policy is still not entirely evidence based because of poor data infrastructure. The goal of this paper is to demonstrate the implementation of several statistical methods on accreditation data in order to support decision process in development of educational policy. Accreditation of higher educational institutions and study programs is specific procedure where large number of raw data on education was collected and new information was generated. In our research we have developed methodology for data collection, data editing and statistical analysis of accreditation data. We have implemented several techniques of statistical analysis, like time series analysis, parametric and nonparametric test etc., in order to answer several important questions about higher education policy in Serbia, regarding competition on higher educational market in the country, number of study programs in specific fields, efficiency of Commission for Accreditation and Quality Assurance (CAQA), share of private higher educational institutions, structure of accredited study programs across different scientific fields, across universities, spatial distribution, comparison with official population data etc.

Keywords: accreditation, analysis, data, higher education, policy.

JEL code: C89, I28.
The width of a uniform distribution: estimation in additive error models

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Abstract:
In an additive error model \( X = Y + \varepsilon \) we are usually interested in estimating the unknown density \( f_Y \). The typical assumptions are that random variables \( Y \) and \( \varepsilon \) are independent, error variable \( \varepsilon \) has a known density \( f_\varepsilon \) and only an i.i.d. sample \((X_1, X_2, ..., X_n)\) on \( X \) is available. This issue is known as the deconvolution problem and some estimators of \( f_Y \) are proposed in nonparametric settings. For the purpose we have in mind (like estimating an object size from a noisy image) we impose a uniform model for the signal variable, namely \( Y \sim \mathcal{U}(-a, a) \). The main task in such a parametric additive error model is estimating the half-width \( a \). The assumption of normally distributed error seems natural, but estimators based on this model are shown to be non-robust. For improving robustness we need some heavier tails error distributions (such as Laplace or logistic distribution). In particular, we think that Student t distributions with small number of degrees of freedom are good candidates for error. In such a model we can adjust the number of degrees of freedom to the amount of outliers in the data. We suggest ML and MM (provided that enough moments of \( \varepsilon \) exist) estimators of \( a \). We will discuss some conditions on the error density for the ML to be well behaved. Construction of the confidence intervals and tests about \( a \) could be based on Wald, score or likelihood ratio statistics. These approaches are asymptotically equivalent, but using simulations we can suggest computationally the most tractable one.

Keywords: additive error model, confidence intervals, testing hypotheses, uniform distribution.

JEL code: C12, C13, C15.

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Messages in official statistics visualizations

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Abstract:
Data visualization is becoming one of the prominent communication tools in the field of official statistics, enabling national statistical offices to reach a wider audience. While the ubiquity of data visualization might imply that the recognition goal is nearly fulfilled, some crucial issues persist. Advancements in data visualization go beyond perception and interpretation of the chart display. Instead, they bring the message we are communicating into focus. This study calls for the evaluation of data visualization solutions offered in the area of official statistics from user perspective. The focus of the study is on testing concrete examples of official statistics data visualizations from business and economic statistics with different groups of users. Preliminary findings suggest that messages in current visualisations do not reach all users. The presentation will indicate the main obstacles for a successful communication of the message and propose possible improvements.

Keywords: charts, communication, dissemination, visualization.

JEL code: C93, Y10.
Income inequalities in the European Union: a cluster analysis

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Abstract:
This paper analyzes income inequality, GDP per capita and unemployment in the European Union member states. Namely, the recent financial and fiscal crisis has increased income inequality and unemployment as a consequence of drop of GDP growth. Because of differences in macroeconomic imbalances, the crisis had a wide range of impacts throughout the European Union. In response, the member states have adopted a wide range of policies, which were strongly connected to their individual macroeconomic and fiscal conditions. Most member states have been trying to consolidate in order promote economic growth but at a cost. By using cluster analysis we analyze how countries of the EU performed given GDP per capita, unemployment and GINI coefficient. From this analysis we conclude that when we use GDP per capita and GINI coefficient countries cluster in a predictable way where richer countries (Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Luxembourg, the Netherlands, Sweden and the UK) are one cluster with above average GDP per capita and below average GINI coefficient. Another cluster is with below average GDP per capita and above average GINI coefficient (Bulgaria, Cyprus, Estonia, Greece, Italy, Latvia, Lithuania, Portugal, Romania and Spain). The third cluster is one with countries exhibiting below average GDP per capita and below average GINI coefficient (Croatia, Czech Republic, Hungary, Malta, Poland, Slovenia and Slovakia). When we introduce unemployment into our analysis we get different results, where we get four clusters in which Greece became its own cluster.

Keywords: cluster analysis, European Union, income inequality.

JEL code: C38, O15.
Estimating low-frequency risk measures by high-frequency data

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Abstract:
Weekly, quarterly and yearly risk measures are crucial for risk reporting according to Basel III and Solvency II. For the respective data frequencies, simulation and backtest suggest that the number of data points is not sufficient in order to estimate Value at Risk and Expected Shortfall sufficiently, given confidence levels of 99.9% and 99.5%. Accordingly, this paper presents a semi-parametric estimation method, rescaling data from high- to low-frequency in order to obtain significantly more data point for the estimation of the respective risk measures. The presented methodology in the α-stable framework is able to mimic multifractal behavior in asset returns.

Keywords: high-frequency, risk management, stable distribution, value at risk.

JEL code: C13, C46, C61, C73.
Let the real world in statistics classes

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Abstract:
In order to understand social- and economic phenomenon use of real data and visualization tools have key importance in statistics classes. Under the ProCivicStat project, which is a strategic partnership of six universities new methods are developing for statistics instruction for high schools and universities that will contribute to young people’s ability to understand quantitative evidence about key social phenomena, for instance on ageing society, poverty, social networks, financial literacy. The mail goals of the presentation are to show statistical course materials which are using real statistical data and newer interactive visualization tools for instance ageing society, population pyramids, networks and online tools, datasets and to summarize experiences from classes.

Keywords: ageing society, teaching statistics.

JEL code: A29.
Determinants of tax morale in Croatia: an ordered logit model

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Abstract:
A lower tax morale leads to an increased readiness to become active in the unofficial economy and causes the lack of public revenues. The aim of this paper is to investigate determinants that shape tax morale of Croatian citizens, i.e. an individual’s intrinsic willingness to pay taxes. To analyse this, data are reported from 2,000 face-to-face interviews conducted in Croatia in late 2015. In this dataset, there were a considerable number of missing values and answers (i.e., refusal and ‘don’t know’). To predict these values, a multiple imputation procedure is used. As the dependent variable is an ordinal variable with four categories (low, mid low, mid high and high tax morale), to analyse the determinants of tax morale we use an ordered logit model. The descriptive analysis illustrates that 52 percent of respondents reported that tax evasion is never justifiable (high level of tax morale), 26 percent of respondents have low tax morale, while 8 and 14 percent have mid low and mid high tax morale, respectively. Ordered logit analysis reveals that gender, age, financial situation, settlement size, region, participation in the informal economy on both the supply-and demand-side and expected size of sanctions when someone is engaged in informal activities have an impact on the tax morale. Furthermore, marginal effects show that those perceiving the expected sanctions for participation in informal activities as "normal tax or social security contributions due, plus a fine or prison" have by 6.3 percentage point higher probability of reporting the highest tax morale than others.

Keywords: Croatia, ordered logit model, tax evasion, tax morale.

JEL code: C25, H26, K42, O17.
Using the discreet choice model in the questionnaire

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Abstract:  
Discrete choice models are very popular and used in a variety of areas - marketing, research, medicine, transportation, economics. These models are based on the theory of random utility that each individual maximizes their usefulness. We focused on the analysis of logit model and their application on real databases. We obtained the database from a questionnaire survey conducted from 05/01/2017 to 25/02/2017. The questionnaire survey contained 13 questions, of which 6 were classification, age, gender, residence, completed education, socio-economic status and net income. The questionnaire was attended by 267 respondents. We have edited and converted the data to binary variables. We created seven logit models, the dependent variable of which constituted questions about the services and products offered by banks operating in Slovakia. Of these seven models, we decided to present the impact of demographic factors on the form of the savings system because of the limit of the case.

Keywords: discrete choice model, logit model, questionnaire.

JEL code: C25, C35, C83.
Probabilistic sampling strategy as a means for improving quality of price indexes

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Abstract:
Monitoring the accuracy of price indexes is a demanding activity because of complexities of index numbers methodologies resulting from complex index numbers concepts framed by economic theory, of complex surveys and complex schemes of index compilation. Errors which impact the accuracy could occur at any stage of production process of price indexes. In practice, majority of statistical institutes follow only non-sampling errors, while option to control sampling errors of price indexes is not explored due to predominantly non probabilistic sampling techniques used in price surveys. Main disadvantage of non-probabilistic sample design is that the risk of biased results is increased. This paper will present advancement at Croatian Bureau of Statistics of production of service producer price indexes (SPPI) by introducing probability proportional to size (PPS) sample design for professional services, where heterogeneous markets augment risk of bias price indexes in the case of non-probabilistic sampling. The paper will point respective methodological upgrading of SPPI compilation developed at CBS, including also methods for variance estimation. Impact of probabilistic sampling on SPPI for activities of professional services will be analysed by comparison of SPPI compiled at CBS for these activities by traditional purposive sampling surveys. The quality of SPPI for professional service activities will also be examined by coefficients of variation as the measure of its precision. Overall analysis covering also some practical aspects will highlight the points of consideration when introducing probabilistic sampling into price surveys as a means for enhancing quality of price indexes.

Keywords: accuracy, price index, probability sampling, weights design.

JEL code: C43, C83.
Analyses of the impact of internal migration on population redistribution in Slovenia

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Abstract:
It is well known that internal migration shapes human settlement patterns in the country. In most countries, data on migration refer only to flows between administratively or statistically defined areas that are changing in a time. When different numbers, sizes, and shapes of areas are chosen for analysis of internal migration, different results are generated. This problem is widely recognised as the Modifiable Areal Unit Problem (MAUP). MAUP is defined by a scale component relating to the different number of regions and a zonation component relating to how the boundaries of zones have been defined. We analyse the impact of inter-municipal migration on population redistribution in Slovenia in 2000–2014. In this period, the number and shape of Slovenian municipalities changed three times: in 2002 one new municipality, in 2006 seventeen new municipalities, and in 2011 two new municipalities were established. We analysed the MAUP effects and estimated internal migration statistics by producing a large number of aggregations using IMAGE Studio software (Stillwell et al., 2014). We calculated several statistics that measure the direction and pace of population concentration as well as the correlation between measures of population distribution and national development as suggested by Rees et al. (2016). The results show that the effect of internal migration in redistributing population in Slovenia is above the average on the world scale, but the migration efficiency decreases with the development process.

Keywords: internal migration, MAUP, population redistribution, zonal aggregation.

JEL code: C10, C21, O15.

Acknowledgment: The authors acknowledge the financial support from the Slovenian Research Agency (research core funding No. P2-0227, Geoinformation infrastructure and sustainable spatial development of Slovenia).
Developing Social Accounting Matrix methodology for regional analysis of the SEE countries

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Abstract:
Integrated policy impact assessment at national, regional (SEE) or global scale requires large-scale consolidated databases to feed socio-economic and environmental components of the macroeconomic analysis. A key data set for economic analysis are Social Accounting Matrices (SAM) which represent the monetary flows between productive sectors and institutions and, thus, may serve a large variety of quantitative tools, especially different types of macroeconomic models. As a starting point, this paper makes an attempt to foresee and recommend the most urgent measures necessary to create a Social Accounting Matrix network of the State Statistical Offices in the SEE region, for developing SAM methodology adjusted to the SEE countries specifics, needs and requirements. In addition, having in mind the current level of development of the national accounts statistics of the relevant countries, this paper seeks to contribute to defining the methodological basis required to build and use SAM approach for regional analysis of the SEE region. Lessons learned from the use of SAM in EU-28 countries have to be used as a reference point. Particular attention is to be paid to case of Slovenia, having developed system and similar past with SEE countries. As expected outcome of these activities, compilation, analysis and use of SAMs in setting up projection tools will allow penetrating into all sophisticated socio-economic processes, while regulating such processes from the perspective of principles of economics. Such powerful analytical capacity can play a great role not only in terms of governing problems of economic regulation within one country, but also managing inter-country economic cooperation in the SEE region. In this context, it is important for the SEE countries to compile SAM and use it for creation and implementation of the respective countries macroeconomic and strategic policy documents. Using such tools in the SEE countries is expected to play a crucial role in defining areas of cooperation and in raising efficiency of mutual benefits.

Keywords: regional analysis, SEE, social accounting matrix, sustainable development.

JEL code: C54, C55, C82, O21.
Reconstruction of the research field development: complementarity of the traditional and network approaches

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Abstract:
Traditional approach to the reconstruction of the scientific field development is based on the wide used technique called literature review. The quality control of the such approach is associated with certain difficulties - general direction of traditional review is set by key publications -therefore, researcher may not pay attention to an important, but isolated debate or, on the contrary, lose sight of the “central tendency”; very often researcher describes most obvious interconnections that are manifested in the texts of the publications found. The purpose of this study is to show how traditional approach can be complemented by the results of a network analysis of the ties between publications selected for certain keywords. The paper compares results of the review and network analysis of literature sources on mass behavior studies. The basis of the first consists from books and articles that were founded in various sources through the traditional search. Publication data set for network analysis was collected from the scientific citation indexing service Web of Science. The results of the comparison show that the traditional approach better helps to find and describe important topics “hidden” in low-cited publications. In addition to this, the network approach illustrates the overall "map" of the research field, highlights the "Main Path" of its development and allows to evaluate the quality and completeness of the traditional review.

Keywords: citation analysis, literature review, network approach.

JEL code: C18, C19.
Patterns of health across age groups of the population 50+ in Croatia

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Abstract:
In this paper, we analyse health status and the role of socioeconomic predictors in self-reported health and morbidity status across different age groups of the population 50+ in Croatia. We use the latest set of data from the SHARE Wave 6 (The Survey of Health, Ageing and Retirement) study to explore the self-assessment of health status among the elderly, prevalence of chronic illness, limitations, disability, depression problems and the quality of life. We expect substantial differences in health status between age groups and genders. Findings from this paper should be addressed properly because they could indicate a great potential for the improvements in health status of elderly in the future. Faced with demographic ageing and the prevalence of chronic diseases, rising burden of mental illness and disability, Croatian health care system should experience grate adjustments in the near future. These adjustments will mainly be in the sphere of the delivery of healthcare services to the population 50+.

Keywords: analysis, Croatia, health, SHARE.

JEL code: I12, I18, J18.
Non-structural approach to implied moments extraction

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Abstract:
Moments of the future prices and returns are not observable, but it is possible to measure these unknown parameters indirectly. Moreover, a set of option prices with the same maturity but with different exercise prices are used to extract implied probability distribution of the underlying asset at the expiration date. Implied probability distribution is risk-neutral in the absence of arbitrage. The goal of this paper is to extract market expectations from option prices and to investigate which of the non-structural models for estimating risk-neutral density (RND) give the best fit. Non-structural models assume that only dynamics in prices is known. Mixture of two log-normals (MLN), Edgeworth expansions and Shimko’s model, i.e. the representatives of parametric, semiparametric and nonparametric approaches respectively, are compared. Previous researches are inconclusive about the superiority of one approach over the others. This paper contributes to finding which approach dominates. The model that fits data better than the others is used to describe moments of the probability distribution. The sample covers one-year data for DAX index options. The results are compared through models and maturities. All models give better short-term forecasts. In pairwise comparison, MLN is superior to the other approaches according to mean squared errors and Diebold Mariano test.

Keywords: Edgeworth expansions, implied moments, mixture of two log-normals, Shimko’s model.

JEL code: C14, C58, G1.
Exploring herding investment behaviour on Zagreb Stock Exchange

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Abstract:
Herding investment behaviour is a concept discussed in the frame of behavioural financial economics. Behavioural theory tries to explain some financial market movements as a result from investors’ decisions which are not based upon some rational model or explanation. If it is found present on a financial market, herding behaviour affects the asset pricing modelling. It can be defined as following and mimicking actions of others on the financial market, while ignoring own beliefs and expectations. In the last fifteen years, the interest to explore such behaviour has risen. Different types of markets have been explored, as well as different types of investors. However, these kinds of studies are not familiar in the Balkan area and Croatia. Thus, this research will be the first attempt to combine theoretical overview with basic empirical tests for presence of herding effects in Croatia. Two measures of herding will be used in order to test for robustness of results. The methodology used to explore herding effects will be regression models, some of which will include binary variables. In that way, we can test for extreme market movements, effects of bull and bear markets, volatility changes, etc. 26 models in total will be estimated, by using maximum likelihood method of estimation and Newey-West correction of coefficient covariance matrix. The sample consists of daily data on return series for five sector indices in Croatia and the stock market index CROBEX, as well as trading volume and realized volatility, for the period from January 2nd 2012 to October 31st 2017. The initial results indicate that increase of market return leads to increase of market dispersion. However, changes of extreme values of market returns do not lead to herding behaviour, especially when the market is bearish.

Keywords: herding behaviour, market efficiency, non-linear return effects, return dispersion.

JEL code: C22, C58, G12.
Application of Adaptive Annealing method to generalized incremental algorithm

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Abstract:
We present an idea behind a stochastic optimization method known as Adaptive Annealing algorithm. Further on, we focus on the algorithm of searching for an optimal partition as a natural generalization of different incremental algorithms. More precisely, we observe algorithm for solving following problem: The given data point set A, should be partitioned into 2 nonempty disjoint subsets (clusters). Conversely, for two given centers, by applying the minimal distance principle, we can join appropriate clusters, and therefore obtain partition of set A. Therefore, the problem of finding an optimal partition of the set A can be reduced to the global optimization problem of finding optimal cluster centers. This problem will be solved by generalized incremental method. We discuss and compare solutions of upper global optimization problem in cases where DIRECT method and Adaptive Annealing algorithm are used for finding 'good' initial approximation of new cluster center within generalized incremental method.

Keywords: adaptive annealing, clustering, incremental algorithm, stochastic optimization.

JEL code: C61.
Identifying the determinants that cause the value movements of currencies Denar, Kuna and Dinar

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Abstract:  
This paper aims to evaluate the relationship of real exchange rates of domestic currencies with macroeconomic variables in Macedonia, Croatia and Serbia by using econometric approaches. Macedonia is characterized by a regime of fixed exchange rate, Croatia is characterized with managed floating exchange rate, while Serbia is characterized by a regime of floating exchange rate. We live in interdependent world economic system, which interdependence arise from international trade in goods and services that is continuously growing and the second aspect is the integration of financial markets in the world, which provides borrowers and savers to choose any place of the world where they want to borrow or to invest their money. Movements in exchange rates between currencies may have profound effects on sales, costs, profits and etc. Hence the choice of exchange rate regime is an important aspect of economic management, in order to ensure competitiveness, macroeconomic stability and development. The most appropriate choice of a particular exchange rate regime should be in line with the economic interests of the country (the size and openness of the country's trade and financial flows, the structure of its production and exports, the extent of its financial development, its inflationary history and nature of exports and the shocks that it faces), the preferences of policymakers on trade as one of the main political goals, the political situation in the country and the credibility of its policymakers and institutions. There is no single exchange rate regime that is ideal and appropriate for all countries.

Keywords: exchange rate, flat currency, real exchange rate.

JEL code: C01, E41.
Data science and digital society

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Abstract:
Data Science looks at raw numbers and informational objects created by different disciplines. The Digital Society creates information and numbers from many scientific disciplines. The amassment of data though makes it hard to find structures and requires a skillful analysis of this massive raw material. The thoughts presented here on DS2 - Data Science & Digital Society analyze these challenges and offers ways to handle the questions arising in this evolving context. We propose three levels of analysis and lay out how one can react to the challenges that come about. Concrete examples concern Credit default swaps, Dynamic Topic modeling, Crypto currencies and above all the quantitative analysis of real data in a DS2 context.

Keywords: data science, digital society, herding, sentiments, social networks.

JEL code: C01.
Measures of complexity of stock returns

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Abstract:
Numerous studies have shown that the dynamics of financial time series are complex and cannot be fully modeled by financial econometric models such as family of GARCH models, models of stochastic volatility, Black Scholes model. The aim of this research is to explore three approaches in complexity analysis in order to quantify the randomness degree in fluctuations of daily returns time series. The first approach is based on Information theory, where as the measures of uncertainty (complexity) or disorder in time series we use the Kolmogorov complexity based on the Lempel-Ziv algorithm, maximum Kolmogorov complexity, sample permutation and Shannon entropy. The second approach is based on fractal dimension, which we estimate using Hurst exponent applying R/S method. The third approach investigates the existence of chaos by computing largest Lyapunov exponent. Developed market indices (Dow Jones, NASDAQ), market index of EU new state (CROBEX-Croatia) and market index of candidate state (BELEX-Serbia) are considered and compared in empirical analysis. The sample period is 2007-2015, and three sub periods 2007-2009, 2010-2012 and 2013-2015, as well. The relationship between measures of variability (standard deviation, median of absolute deviations from the median), measures of risk (Value of risk-VaR, Expected Shortfall) and measures of complexity are also analyzed.

Keywords: complexity analysis, daily returns, financial time series.

JEL code: C58.
A note on some statistical notions with fuzzy integration

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Abstract:
During recent years, the Decision Making Theory, especially the part that deals with imprecise data, has established itself as one of the highly developing theories. Both Probability Theory and Statistics are providing useful tools for addressing problems of the decision making. Since the concept of fuzzy events has proved to be very successful for modelling uncertainty, the focus of this paper is on some statistical notions for fuzzy events. The main results presented in this paper concerns construction of the mean value and variance for some specific fuzzy quantities based on Sugeno and Choquet integrals.

Keywords: fuzzy integral, fuzzy set, mean value, variance.

JEL code: C02, C65.

Acknowledgment: This work was supported by the Ministry of Science and Technological Development of Republic of Serbia, projects 174009 and 174019, and by Provincial Secretariat for higher education and scientific research, project 142-451-2838/2017-01.
A contingent valuation of public goods in tourism: estimating the preservation value of bottlenose dolphins in the Cres-Lošinj archipelago

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Abstract:
Marine habitat degradation raises concerns for the population of vulnerable marine species. A Contingent Valuation Method (CVM) was applied to estimate the value of environmental amenities associated with the preservation of a bottlenose dolphin population that lives in the Cres-Lošinj archipelago in Croatia. As the CVM is based on stated rather than observed behaviour, a comprehensive survey was conducted to estimate willingness to pay (WTP) as well as to identify the main predictors of WTP. The population of interest was nautical tourists having berth/moored in two marinas in the archipelago. A stratified quota sample was used. The data were collected by personal interviews with nautical tourists using a highly structured questionnaire as a survey instrument. Following a detailed description of the bottlenose dolphin preservation scenario, an environmental tax per mooring/berth day was used as a payment vehicle for eliciting the WTP. The survey was conducted in August and September 2016. A total of 210 questionnaires were collected. The nautical tourists were on average willing to pay 1.8 Euro per day in order to better preserve the dolphin population. Application of Tobit regression revealed that loyal nautical guests, i.e. those with more previous visits to the Cres-Lošinj archipelago, those who would like to learn about dolphins, those with a mooring/berth at the island of Lošinj, as well as female guests were willing to pay significantly higher day tax for the dolphin preservation. On the other hand, guests staying longer in the area as well as domestic nautical tourists were willing to pay less.

Keywords: contingent valuation method, tobit model, tourism, willingness to pay

JEL code: H23, L83, Q50, Q57.

Acknowledgment: This work has been fully supported by Croatian Science Foundation under the project STRENGTHS (Project no. 9402).
Big data analytics and synergism

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Abstract:
Big data and analytics play a major role in mathematical modelling in social sciences and economy. Its development is due to advances in computer science and cloud computing. Analytics of big data is challenging problem and is developed based on principles of artificial intelligence and machine learning. However, inferences from big data models require rigorous classical statistical methodology, and based on very effective advanced computing supported by cloud clusters, new development of new statistical methods based on simulation enable new age of statistical inference in computer age. In this work is presented methodology for inference of synergism among features of big data based on variance analysis and Monte Carlo simulation. Methodology is illustrated by numerical example from big data analytics in market analysis.

Keywords: boosted trees, elastic nets, gig data, global sensitivity, Monte Carlo.

JEL classification: C15, C38, G22.
Application of principal components analysis and I-distance method in the process of ranking countries by level of development

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Abstract:
The paper presents a method for ranking and classification using method of I-distance. Method I-distance is a method of classification and multidimensional ranking, based on the distance values between selected indicators. The choice of indicators was carried out using Principal Components Analysis, where we use the statistical software SPSS (Statistical Package for Social Sciences)-the latest version of 21th PASW Statistics. Application of I-distance determines the relative efficiency indicators. Classification and ranking is formed by economic development on the basis of macroeconomic indicators.

Keywords: classification, I-distance, principal components analysis, ranking, SPSS.

JEL code: C44.
APPENDIX:

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