



## О P I N I O N

by: Prof. Dr. Teodor Sedlarski, Sofia University "St. Kliment Ohridski", Faculty of Economics and Business Administration, Department of Economics, Professional field: 3.8 Economics, Scientific specialization: 05.02.01 "Political Economy (Microeconomics and Macroeconomics)"

**Regarding: Dissertation for awarding the educational and scientific degree "doctor" in the professional field 3.8 Economics, doctoral program "Data science" at the Department of Statistics and Econometrics at the Faculty of Economics of the Sofia University "St. Kliment Ohridski".**

PhD candidate: Boyko Moisov Amarov, doctoral student in correspondence form of preparation at the Department of "Statistics and Econometrics", Faculty of Economics and Business Administration, Sofia University "St. Kliment Ohridski"

Dissertation title: "Applications of Algorithms for Data Analysis"

### **I. Phd student information**

Boyko Moisov Amarov was enrolled as a doctoral student in the Department of Statistics and Econometrics by order of the Rector No. 20-1187 / 27.07.2018. The deadline for completing the doctoral studies is 01.08.2022, extended to 01.02.2023 by order No. 20-1990/ 23.10.2022.

The doctoral student has successfully passed all examinations required by the doctoral program.

Boyko Amarov was a research assistant at the Free University - Berlin from 2008 to 2012, and since 2017 he has been a full-time assistant at the Department of Statistics and Econometrics at the Faculty of Economics of the Sofia University "St. Kliment Ohridski", where he teaches seminar classes.

The PhD candidate completed his bachelor's degree in "Statistics" in 2008 and a master's degree in "Business Administration" at the Free University - Berlin (Germany). In 2018, he was enrolled as a part-time doctoral student in the Department of Statistics and Econometrics by Industry at the Faculty of Economics of the University of St. Kliment Ohridski".

Boyko Amarov took part in 3 national and 7 international scientific conferences in the country and abroad from 2005 to 2022. He speaks fluently German, English and Spanish.

**The total number of accumulated points within the phd education, the scientific results of the doctoral student and the publications, covers the required number by the internal regulations of Sofia University and the Faculty of Economics and Business Administration.**

## **II. General assessment of the dissertation**

The dissertation "Applications of Data Analysis Algorithms" is 149 pages long, of which 127 pages are main text, seven pages are appendices and 174 bibliographic sources. The text contains 30 figures and 30 tables.

The propensity of Internet users in Bulgaria to use electronic government services in three broad areas: administration, education and health care was analyzed. The research uses data from a face-to-face survey conducted between June and August 2021. The main results show that there is a divide among internet users regarding the use of government e-services in all three areas according to ICT skills, education and experience with the use of other online services (online shopping). A detailed analysis of services in the field of education according to the type of service provider (schools, universities, administration and private educational institutions) also shows the existence of a division according to ICT skills and education among the economically active population, but not among high school and university students. The dissertation contributes to existing research on the demand for government e-services and the variation of that demand across socio-economic and demographic groups in the population.

The results of the statistical modeling indicate a strong dependence of the probability of using e-services according to ICT skills and experience with Internet technologies. Internet users with low level of ICT skills, low level of education, as well as residents of small settlements demonstrate lower propensity to use government e-services. These results describe a barrier to the consumption of e-services for some citizens who do not have the necessary skills to take advantage of the convenience of these services. In this regard, Bulgaria is no exception to other countries.

The effect of machine voting on the shares of non-counted votes and votes for marginal parties in elections is studied. The results of the statistical modeling show evidence of a lower overall share of uncounted votes in machine voting sections, but also a higher probability of voting with SNO ("supporting no one") or for marginal parties. Also taking into account the difference in votes for marginal parties, the model indicates a strong tendency towards redistribution of votes from invalid ballots, SNO and marginal parties. However, the net effect of machine voting on support for non-marginal parties remains positive.

The dissertation can be defined as an innovative application of the used methodological tools in the chosen research field within the Bulgarian scientific literature. The productive development of the behavioral aspect ranks the work among the serious applied statistical studies on specific social and political problems in modern Bulgarian science.

### **The following can be highlighted as the main contributions of the dissertation:**

- The systematic study of the propensity to use e-government services in administration, education and health depending on socio-economic characteristics, level of ICT skills and experience with Internet technologies. The work is a pioneering systematic study of the demand for government electronic services in Bulgaria.
- The study of the propensity for non-participation of voters (non-voting, invalid voting and vote for SNO) depending on the socioeconomic and demographic characteristics of municipalities and settlements. In addition, the dissertation examines the propensity for non-participation as a function of institutional and political characteristics at the municipality and constituency level. This part of the study contributes to the scholarly literature on invalid voting and turnout research.
- The analysis of the effect of the presence of an electronic voting machine on the propensity to not vote, invalid voting, SNO voting and voting for marginal parties in the 2019 EP (European Parliament) elections. In addition, the dissertation examines the interdependencies between the propensity for these four forms of voting and the proportion of voters who used machine voting in the 2019 EP elections and the April 2021 parliamentary elections. This part of the dissertation is a contribution to research related to the introduction of electronic voting technologies in elections and non-conventional voter behaviour.
- The study of the propensity to use electronic voting machines in the EP elections in 2019 and the parliamentary elections in April 2021 depending on socioeconomic and demographic characteristics measured at the municipality and settlement level. The dissertation also examines the effect of past machine voting experience on machine voting propensity. This part of the dissertation contributes to research on the digital transformation of voting technologies.
- The study of differences in voter turnout in the November and July 2021 elections compared to April 2021 according to the proportion of those who voluntarily voted by machine in April 2021, as well as according to political preferences at the polling station level and socio-economic and demographic characteristics at the municipality and settlement level. The final part of the dissertation contributes to research related to voter turnout and types of voting technologies.

The dissertation examines current social issues, and the results of the conducted studies would inform the work and decisions of governments, businesses and civil society both in Bulgaria and in other democratic countries for the development of relevant policies and legislative decisions in the field of electoral law.

### **III. Notes and Recommendations**

The dissertation can be used as a basis for the development of educational content, which will contribute to the understanding of theoretical and empirical approaches, as well as the current state of the research field by students in specialized master's programs in the country.

### **IV. Publications Related to the Dissertation**

In connection with the public defense procedure, the doctoral student has submitted two publications in English in international scientific journals and one in a collection of doctoral

papers. The journal publications and the discussion paper analyze the same problems as the main dissertation text.

## V. Conclusion

Taking into account the balance between the doctoral student's contributions, their significance and the recommendations put forward by the reviewer, I give a positive assessment to the dissertation "Applications of algorithms for data analysis" by Boyko Moisov Amarov. It meets the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria, the Regulations for the Implementation of the law and the internal rules of Sofia University, which gives enough reasons to propose to the respected members of the scientific jury to vote for awarding the educational and scientific degree "doctor" in the scientific field 3.8 Economics (Analytical studies on data /Data Science/) to Boyko Moisov Amarov.

16.06.2023  
Sofia

Member of the Scientific Committee

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/Prof. Dr. Teodor Sedlarski/