STATEMENT

On dissertation work

„Application of Data Analysis Algorithms "

Submitted by Boyko Moisov Amarov

for obtaining a scientific-educational degree "Doctor" in professional field 3.8 Economics

by Jury member Prof. Dr, Georgi Chobanov

1. General presentation of the dissertation work

Widespread access to the Internet enables the provision of a wide range of government electronic services (e-services) that can significantly facilitate the interactions between citizens and government bodies and reduce the costs associated with these services. Instead of waiting in queues at government or municipal offices, citizens can submit applications, such as tax returns, from their homes or mobile phones. In the years of the pandemic caused by COVID-19, e-services have proved vital to enable schools and universities to continue operating despite lockdowns by switching to online forms of teaching. In other areas, the e-government services also helped reduce face-to-face meetings. Despite the significant benefits of using government e-services, the uptake has been slower than expected. This is particularly true for Bulgaria, which lags behind most of the European Union (EU) countries in the use of government e-services, despite having a good Internet infrastructure (Eurostat 2021). Research on the diffusion of government e-services points to three main barriers to their use. To use e-services, citizens need a computer or a mobile phone and a reliable internet connection. Access to government websites or mobile applications is only a prerequisite for effective use of e-services. In order to make full use of them, citizens must also possess a degree of skills for working with information and communication technologies (ICT). Several studies in the area of government e-services point to weak ICT skills among some citizens as a significant barrier to greater use of e-services. The present doctoral thesis contributes to filling this gap by systematically analyzing the usage of government e-services in Bulgaria based on data from a survey of internet users in Bulgaria in 2021.

Another important area where new technologies can reduce time and cost is voting technology in elections. Replacing the traditional paper ballots with electronic voting machines (EVM) in Bulgaria's July and November 2021 general elections has sparked a heated public debate.

The main arguments for introducing machine voting and automatic vote counting include faster reporting of election results and a more limited scope for human error in counting ballots. An additional advantage of machine voting is automatic ballot verification, preventing voters from casting blank, erroneous, or spoiled ballots (invalid ballots). The invalid ballots, as well as votes for "None of the Above" (NOTA), are discarded from the election result (uncounted votes). The latter advantage may be significant in Bulgaria, where in the last two elections for municipal councils in 2015 and 2019, uncounted votes exceeded 15 percent of all votes.

In this dissertation, the term "invalid ballots" includes all ballots that are not counted in the final election result and are not NOTA votes. Introducing compulsory machine voting after April 2021 coincided with a sharp decline in turnout in Bulgaria from 50.6 percent in April 2021 to 42.2 percent (July) and 40.2 percent in November. The decline in voter turnout continued in the following year's elections, reaching a level below 40 percent in October 2022 (39.4 percent). Low turnout can call into question the legitimacy of elected political representatives, and when turnout declines unevenly across different groups in society, groups with lower turnout remain politically underrepresented. This observation forms one of the main arguments against compulsory EVM voting. If specific groups of voters do not go to the polls because of concerns about the operation of EVM or because they have doubts about their vote being counted correctly, this behavior will lead to a

selective decline in voter turnout, disenfranchising these citizens. These concerns find support in research that shows differences in turnout when using different voting and vote-counting technologies, including electronic voting machines. This dissertation examines three aspects of machine voting in Bulgaria.

In Chapter 3, the thesis examines three forms of non-participation (invalid voting, NOTA voting, and abstention) during the local elections in 2019, when the share of uncounted votes reached 18 percent. The shares of these forms of non-participation are modeled within a multilevel regression framework with socioeconomic and demographic, institutional, and political characteristics as explanatory variables. The analysis uses data with different levels of aggregation – municipality, locality, and polling station. The analysis shows evidence of the protest character of some of the invalid votes. This result motivates the analysis in Chapter 4, which explores whether the option of voting with a machine voting is associated with lower levels of uncounted ballots. This analysis uses data from the 2019 European Parliament (EP) and April 2021 parliamentary elections. The statistical model reveals a tendency towards a redistribution from invalid ballots to NOTA and votes for

marginal (small parties with only a slight chance to obtain a mandate in the elections) parties when using a machine, but also a positive net effect on the probability of valid votes for non-marginal parties.

Chapter 5 of the thesis analyses two aspects of introducing EMV voting in Bulgaria. The study's first aim is to assess the selectivity of machine voting by examining associations between the propensity to use an EMV and voters' socioeconomic and demographic characteristics. Furthermore, the study assesses the effect of previous experience with machine voting on the propensity to use EMV. The analysis employs data from the April 2021 general election, the 2019 EP election at the polling station, and the 2011 census data at the locality and municipality levels.

The dissertation's final chapter examines the variation in turnout differences in the July and November 2021 parliamentary elections compared to April 2021 by socioeconomic and voter demographic characteristics. The analysis uses the proportion of voters who voluntarily chose to vote with a machine in the April 2021 election to measure voter willingness to adopt the new technology. The study uses polling station-level data at the three general elections in 2021 and models the difference in turnout within a two-stage linear regression model. The statistical model shows a weak positive association between the proportion who voluntarily used machine voting and turnout differences.

2. Contributions

The dissertation contributes by applying statistical modeling in five areas:

1. The doctorand systematically analyzes the propensity to use e-government services in administration, education, and healthcare according to socioeconomic characteristics, level of ICT skills, and experience with Internet technologies. This part of the dissertation is the first systematic study of the demand for government e-services in Bulgaria.

2. The doctorand systematically analyzes the propensity of voter non-participation (abstention, invalid voting, and NOTA voting) in the 2019 local elections according to municipalities' and localities' socioeconomic and demographic characteristics. In addition, the dissertation examines the propensity of non-participation according to institutional and political characteristics at the municipality and polling station levels. This part of the study contributes to scholarly literature on invalid voting and turnout research.

3. The doctorand explores the effect of the availability of an EVM on the propensity to abstain, vote invalidly, vote with NOTA, and vote for marginal parties in the 2019 EP elections. In addition, the dissertation explores the association between the propensity for these four forms of voter behavior and the proportion of voters using machine voting in the

2019 EP elections and the April 2021 general election. This part of the thesis contributes to research on adopting electronic voting technologies in elections and unconventional voter behavior.

4. The doctorand explores the propensity to use electronic voting machines in the 2019 EP and April 2021 parliamentary elections according to socioeconomic and demographic characteristics measured at the municipality and locality levels. In addition, the dissertation examines the effect of experience with machine voting on the propensity to vote by machine. This part of the dissertation contributes to research on the digital transformation of voting technologies.

5. The doctorand investigates differences in turnout in the November and July 2021 elections relative to the April 2021 elections as a function of the proportion of voters who volunteered to vote by machine in April 2021, as well as as a function of political preferences at the polling station level and socioeconomic and demographic characteristics at the municipality and locality level. The last part of the dissertation contributes to research on voter turnout and voting technology types.

3. Significance of the contributions for science and practice

The doctorand demonstrates skills for making research, formulating thesis, and proving them using methodologies and achieving significant theoretical results which could be practically applied in Bulgaria.

4. Critical remarks and recommendations.

Some critical remarks and recommendations can be made but they cannot reduce the significance of the results achieved. These remarks have been discussed with doctorand Boyko Amarov.

CONCLUSION

The submitted doctoral dissertation has enough scientific and practical contributions which allow me to propose Boyko Moisov Amarov to be awarded with scientific degree Doctor in professional field 3.8 Economics.

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