



Usage of Electronic Public Services in Bulgaria

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	ABSTRACT
2022 Research Leap/Inovatus Services Ltd. All rights reserved. DOI: 10.18775/jibrm.1849-8558.2015.73.3004 URL: https://doi.org/10.18775/jibrm.1849-8558.2015.73.3004	<i>The digitalization of services provided by public institutions can substantially reduce the costs of citizens' interactions with these institutions, like travel and waiting times. It can also increase the efficiency of providing these services. Despite the benefits, Bulgaria still lags behind most European Union countries regarding the use of e-government services. Only 36% of the Bulgarian internet users access e-government services, compared to an EU average of 64%. While the supply side of the public e-services is regularly the focus of general discussions, little is known about the demand for e-services in Bulgaria. This paper contributes to understanding the usage patterns of e-services provided by governmental, healthcare, and educational institutions. We link the propensity of using the three different types of e-services to the socio-demographic and economic characteristics of the respondents within a multilevel logistic regression model using data from a sample of Bulgarian internet users. The results show that persons with low educational attainment, low self-reported digital technology skills, and lack of experience with commercial electronic services are less likely to use any of the three types of public e-services. Respondents living in rural areas or small towns were also less likely to access public e-services. Furthermore, the model reveals a regional variation that can help focus information campaigns about e-services.</i>
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1. Introduction

The improvement of information and communication technologies in the past decades has profoundly changed almost every aspect of daily life, including commerce, social interactions, and how citizens interact with their governments. Data Lakes provide a modern approach to persist data with heterogeneous structure for different types of analysis. It offers centralized repository that allows to store all structured and unstructured data at any scale. Automation flows include cloud workloads as well as Robotic process automation (RPA) flows that enables engineers and non-coders alike to automate processes and tasks across desktop and web applications. (Mateev, 2022) The online delivery of services through the web or mobile applications enabled governments to cut the costs of service provision by reducing the need for costly face-to-face interactions. Apart from the more efficient use of taxpayers' money, the online delivery of services can lower the cost of citizens' interaction with the administration by removing their need to travel to a service desk and their dependence on fixed opening hours (Gilbert, Balestrini & Littleboy 2004).

Despite these benefits, the adoption rate of e-government services has fallen behind expectations (Carter, Weerakkody & Phillips *et al.* 2016). Bulgaria is currently lagging behind most European Union (EU) countries with one of the lowest shares of e-government users (34%) compared to an average of 65% for the whole union (European Commission 2022). The low adoption rate is partly due to the comparatively low population uptake of broadband internet connections. In 2022 only 63% of households

in Bulgaria had a fixed or mobile broadband connection, compared to an EU average of 78%. The lack of computer equipment or reliable internet connection in parts of the country partially explains this low adoption rate. Another reason is that the ability to use information and communication technologies (ICT) is spread unevenly between socio-demographic groups in most countries, creating a skill-based digital divide regarding access to online services, including the ones provided by governments (Bélanger & Carter 2009). Further factors impacting the adoption of e-government are varying levels of privacy concerns and citizens' trust in government communication systems' integrity, trust in internet technologies and trust in the government in general (Alzahrani, Al-Karaghoulhi & Weerakkody 2017; Distel 2020; Mensah & Mi 2017).

This paper contributes to the e-government adoption research by analyzing three different types of government services in Bulgaria: administrative services like online tax or fee payments, education-related services provided by schools or universities, and healthcare-related services like online scheduling appointments with the family doctor and access to the personal medical history. We use a sample of internet users collected in June and August 2021 to compare the socio-demographic and economic characteristics of adopters and non-adopters of the three types of services. Within a logistic regression model framework, we find that self-assessed digital skills and educational attainment are strongly associated with the propensity to adopt e-government services in all three areas. Gender differences are present only in education-related services, with women having a higher probability of using these. We observe different adoption rates

between income groups for administrative and education-related services, but not in the case of healthcare-related services.

2. Background

A lot of the research approaches the problem of the varying degrees of adoption of e-government services by applying the technology acceptance model (Davis 1989). According to that model, a person would accept a new technology if he or she believes that the technology would enhance her performance (perceived usefulness). The performance gain is weighed against the effort the person expects to expend to use the technology (perceived ease of use). Empirical research has consistently found a strong link between the perceived usefulness and ease of use and the intention to use e-government services (Horst, Kuttuschreuter & Gutteling 2007; Camilleri 2019; Mensah, Zeng & Luo 2020). Another insight from this research shows that both factors tend to vary between socio-demographic groups as digital skills and attitudes towards ICT are distributed unevenly in the population (Bélanger & Carter 2009).

Numerous studies report that younger persons are more prone to interact with online services than the elderly. This finding appears consistently in different contexts: the USA: Bélanger & Carter (2009), Scotland: Camilleri (2019). Inkinen, Merisalo & Makkonen (2018) find age closely associated with e-government usage of various services ranging from electronic tax forms to social insurance e-notices. A notable exception is Taipale (2013), who found no age differences in e-government usage behavior and explained the lack of an effect with reduced availability of offline services in Finland that make face-to-face interactions costlier for the citizens.

The results in the extant literature disagree on the effect of gender on e-government usage. Bélanger & Carter (2009), Moreno, Molina & Figueroa *et al.* (2013), Inkinen, Merisalo & Makkonen (2018), Camilleri (2019), and Rodríguez-Hevíá, Navío-Marco & Ruiz-Gómez (2020) find no significant differences between the adoption behavior of men and women. In a different context (Dubai), Sarabdeen & Rodrigues (2010) discovered that men were more likely to use e-government services.

A person's educational attainment may be an important determinant of his or her ability to use e-government services. Highly educated persons tend to be more experienced with digital technologies, which puts them in a better position to interact with complex services. Bélanger & Carter (2009) and Mensah, Zeng & Luo (2020) find a strong association between education, perceived ease of use, and perceived usefulness. A study of e-government adoption in European countries (Rodríguez-Hevíá, Navío-Marco & Ruiz-Gómez 2020) reports a higher likelihood of being an e-government adopter for highly educated persons. In the context of Finland, Inkinen, Merisalo & Makkonen (2018) report that the connections between education and usage are not uniform and depend on the particular type of e-service.

High equipment costs in the early days of the internet created a divide between persons who could afford a computer and an internet connection and those who were unable. Although the access divide has been diminishing in the past decades (Martin & Robinson 2014), e-government adoption research reports that income is still a significant predictor of e-government use, with higher income associated with a higher rate of e-government adoption (Bélanger & Carter 2009). As in the case of gender and

age, the association between income and e-government use may be country-dependent, as other authors find no relation between income and adoption (Colesca & Dobrica 2008) (Romania) or a negative association (Taipale 2013) (Finland). The effect of income on service adoption may also differ depending on the particular type of service. Inkinen, Merisalo & Makkonen (2018) (Finland) found that higher average income was associated with a higher will to prioritize e-services over face-to-face interactions, but the effect differed by service type. Higher household income was associated with a lower tendency to use e-employment services targeted at the unemployed but with a higher probability of accessing e-tax services.

The research has reached different conclusions regarding the people's experience with the internet in general and with commercial services like online shopping as a predictor for e-government adoption. Bélanger & Carter (2009) that the frequency of internet use and a prior experience with online shopping are not significant predictors for e-government adoption. Taipale (2013) report an interaction effect between experience with the internet and gender. Women spending more time online were more likely to take up e-government services, but this relationship was not present for men.

3. Data and Method

The data for this analysis was obtained between June and August 2021. Trained interviewers polled Bulgarian internet users in tablet-assisted face-to-face interviews. The minimum age for participation was 15 years. The main questionnaire contained questions about the use of e-government services in the past twelve months. ($n = 1039$) participants had not accessed any e-government service in that period, and ($n = 385$) had used at least one service. The participants in the non-users sample were selected at a higher rate in the large cities in Bulgaria.

The e-government services fall into three broad categories: administrative, education-related, and healthcare-related services. The administrative services include electronic renewal of identity documents, driver's licenses, tax declarations, tax and fines payments, electronic receipts of payment from governmental entities like pensions and social security payments, and access to one's social security status. Searching for information about employment opportunities or social security assistance in online government sources is also included in this category.

The healthcare-related services refer to online access to medical information, personal medical status, and a service that allows citizens to schedule appointments with their family doctor and to consult online with their doctors. The education-related services include access to school or university online courses or other materials, electronic access of grades, online enrollment in schools or universities, online information about learning schedules, and online payment of enrollment fees. The respondents also gave information about their gender (male, female), occupational status (student, employed, unemployed, or retired), educational attainment (primary, secondary, or higher), type of residence (rural, small town, or city), and monthly income in BGN,

Table 1: Distribution of socio-demographic variables, ICT skills, and online shopping by sample.

Variable	Value	Nonusers	Users	Total
City	City	215	728	943
	Rural	91	142	233
	Small town	79	169	248
Education	Primary	23	57	80
	Secondary	235	465	700
	Higher	127	517	644
Gender	Male	163	374	537
	Female	222	665	887
Income	<650	19	59	78
	650-1250	34	359	393
	1251-1850	46	193	239
	1850-2450	37	102	139
	2451-3000	37	54	91
	>3000	27	30	57
	Missing	185	242	427
Labor status	Employed	275	816	1,091
	Student	21	138	159
	Retired	67	47	114
	Unemployed	22	38	60
Online shopping	Never	225	166	391
	Rarely	143	623	766
	Often	17	250	267
Technical skills	Low	102	54	156
	Middle	152	310	462
	High	131	675	806

measured in six groups. Among the respondents who had used at least one type of service 65.54% had used at least one of the administrative services, 42.06%, and at least one of the education-related and 42.06% at least one of the healthcare-related services. 12.42% of the users had accessed all three types of services in the past year.

The usage probability for each service type is modeled in a logistic regression with main effects for the socio-demographic variables, the level of ICT skills, and the frequency of online shopping. Each equation also includes normally distributed random effects for the respondent's administrative region of residence (28 regions). The region-level intercepts account for e-government adoption effects not captured by the fixed effects in the model, such as ethnic composition, cultural differences, and different levels of support for services delivered by local providers like municipal authorities, universities, and schools. Furthermore, the regional effects account for the sampling design that emphasized large cities in for e-government non-users. All three equations are estimated simultaneously, and the correlation between the region-level effects is estimated within the model. The model uses weakly informative normal priors for the fixed effects centered at zero with a standard deviation equal to 2 and exponential distribution

priors with $\lambda = 1$. For the correlations between the random effects, the model uses a LKJ(1) prior that expects correlations close to zero. A robustness analysis showed that the main results of the analysis do not depend substantially on the choice of priors. The model was estimated using a NUTS sampler with four chains with 6000 iterations.

4. Results

Table 2 presents the posterior means and standard errors of the fixed effects of the logistic regression models. The coefficients with a 95% central credible interval not containing zero are shown in boldface. Positive coefficients imply a greater probability of using a service type. Contrary to some previous findings (Sarabdeen & Rodrigues 2010), the model shows no evidence of a greater propensity of men to use e-government services than women for administrative and healthcare-related services, and women were more likely to use education-related services than men. A detailed analysis of the use of electronic education services (Amarov & Netov, 2022) reveals that this finding reflects traditional roles in Bulgarian families, where women tend to be more involved in the education their children education compared to men.

Although we expected respondents in rural areas to be less likely to use e-government services due to poorer internet coverage and less experience with digital technologies, the model does not indicate a difference between rural dwellers and residents of big cities. However, residents of small towns tended to be less likely to use administrative and healthcare-related services than residents of big cities. The model likely underestimates this effect because the non-users sample emphasized the large cities in Bulgaria.

The association between income and the propensity to use varies for the three types of services. For the administrative services, the highest and the lowest income groups have similar coefficients that are lower than the middle-income groups. Regarding education-related services, the highest income category has the lowest usage probability. At the same time, there appears to be no substantial variation between income groups in usage rates in healthcare-related services.

As the model does not directly include the respondents' age, the occupational status variables capture age differences between the respondents, with students generally being the youngest and retired persons: the oldest. Students were more likely to use electronic educational services than employed persons, as most education-related services specifically target younger persons. Another factor was the switch to remote learning methods during the COVID-19 pandemic. Students were less likely to engage with electronic administrative services, as most of these are only relevant for economically active persons.

The same applies to the low predicted probability of retired persons using education-related services. An unexpected result is the predicted greater probability of retired persons using

Table 2: Fixed effects of the logistic regression model: posterior means and standard deviations. Coefficients with 95% credible interval that do not including zero are bolded.

Variable	Level	Admin.		Education		Healthcare	
		Mean	SD	Mean	SD	Mean	StdDev
Gender (Male)	Female	-0.19	0.13	0.47	0.16	0.00	0.14
Residence type (City)	Rural	-0.08	0.19	-0.13	0.24	0.17	0.20
	Small town	-0.45	0.18	-0.13	0.22	-0.65	0.20
Income (<650)	650-1250	1.02	0.32	-0.28	0.35	0.04	0.32
	1251-1850	1.07	0.34	-0.46	0.37	-0.05	0.35
	1850-2450	0.94	0.37	-0.67	0.42	0.75	0.39
	2451-3000	0.32	0.39	-0.48	0.44	0.02	0.41
Labor status (employed)	>3000	-0.20	0.43	-1.37	0.54	-0.49	0.48
	Missing	-0.35	0.35	-0.82	0.40	-0.67	0.36
	Student	-0.73	0.32	4.16	0.40	-0.29	0.36
	Retired	0.78	0.31	-1.42	0.57	0.33	0.34
Education (higher)	Unemployed	-0.20	0.36	-0.04	0.41	-0.13	0.38
	Middle	0.83	0.40	0.23	0.43	0.45	0.41
ICT skills (low)	High	1.17	0.42	1.19	0.46	0.97	0.43
	Middle	0.51	0.24	0.88	0.43	1.11	0.29
Online shopping (never)	High	1.08	0.25	1.49	0.43	1.02	0.30
	Rarely	1.03	0.16	1.01	0.23	0.69	0.19
Often	Often	1.38	0.22	1.39	0.27	0.51	0.23

administrative services compared to the employed. This is a consequence of the survey design that did not collect income data from retired respondents and students. Refitting the model without the income variable (not shown) reveals a lower propensity of retired persons to interact with administrative services.

Regarding the healthcare-related services, we expected retired persons to exhibit a higher usage probability because of their higher demand for such services in general and because the COVID-19 outbreak rendered visits to healthcare institutions both dangerous and cumbersome. The model shows only weak evidence that this is the case. Although the coefficient of the retirement indicator variable is positive, the posterior probability that it is greater than zero is only 0.84.

Even though the sample consists of internet users, the propensity to use all three service types varies with the respondents'

Table 3: Summary of region-level random effects: posterior means and 95% credible intervals (CI).

Term	Estimate	l-95% CI	u-95% CI
SD: Administration	0.62	0.37	0.96
SD: Education	0.80	0.49	1.20
SD: Healthcare	1.31	0.93	1.83
Corr.: Admin., Education	0.16	-0.38	0.62
Corr.: Administration, Healthcare	0.37	-0.08	0.72
Corr: Education, Healthcare	0.38	-0.06	0.72

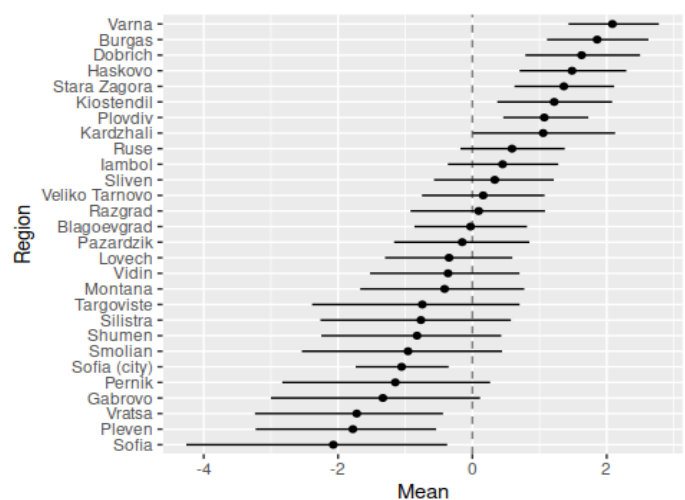


Figure 1: Estimated regional random effects for healthcare-related services. Posterior means and 95% credible intervals.

education and the self-reported degree of ICT skills. Low educational attainment and low ICT skills are associated with a low probability of using all three types of e-services. In contrast to Bélanger & Carter (2009), the model suggests that prior experience with commercial electronic services, measured by the online shopping frequency, is positively associated with the propensity to engage with all three types of e-government services.

Table 3 presents a summary of the posterior distribution variance parameters of the region-level intercepts. All three standard deviations have 95% credible intervals bounded away from zero, pointing to regional heterogeneity in e-government adoption even after accounting for the other explanatory variables in the model. The heterogeneity is largest for healthcare-related services: the estimated effects (Figure 1) show that residents in the regions of Varna and Burgas, which contain two of the largest cities in Bulgaria, had a higher adoption propensity than the rest of the regions. This finding is noteworthy because non-users were

oversampled in these two cities. The correlations between the regional intercepts across service types (Table 3) are all positive, but the evidence of non-zero correlations is weak. The 95% credible intervals of all correlations include zero, implying that respondents living in a region with high adoption propensity for one service type were not necessarily more prone to use the other services types as well.

5. Conclusion

The analysis shows a continuing digital skill divide in Bulgaria concerning e-government adoption. Highly educated persons with high-level ICT skills and experience with commercial online services are more likely to adopt e-government services. This result may point to complexities in the online delivery of these services that discourage lower-skill individuals. Many e-government services in Bulgaria require a personal electronic signature that may be difficult to handle for citizens with low ICT skills. About 40% of the respondents not using any e-government mentioned access restrictions to these services as the reason for abstaining.

Furthermore, the analysis indicated that elderly internet users are not more likely to access electronic healthcare-related services than persons of active age, despite their tendency to use the healthcare system disproportionately more than younger persons. This behavior can be explained by a persisting digital divide where the older generation is more hesitant to switch to digital technologies, especially in areas where they have well-established habits. For example, an information campaign about the availability and benefits of healthcare-related services by family doctors and easier-to-use online applications may open the door for these digital services to the elderly.

The adoption rates of e-government services vary between the 28 administrative divisions of Bulgaria, even after accounting for the respondents' socio-demographic and economic characteristics and digital skill levels. This result may inform policy decisions about informational and educational campaigns in low-adoption regions and encourage further research into success factors in the better-performing regions.

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