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THE DIGITAL DIVIDE VS. THE E-GOVERNMENT DIVIDE: DO SOCIO-DEMOGRAPHIC VARIABLES (STILL) IMPACT E-GOVERNMENT USE AMONG ONLINERS?

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Abstract

E-Government brings mutual benefits to both citizens and public administrations. However, there exists a gap between adopters and non-adopters of e-Government services. Most studies in this field explore e-Government acceptance on the basis of the entire population, while investigation of onliners rarely takes place. Against the background that the number of internet users is increasing steadily, we identify the need to differentiate general internet adoption (digital divide) effects and e-Government-specific divide effects. In our study, we thus develop a research framework, where the cumulative effect of e-Government adoption (among all people) is split into a) the digital divide effect and b) the e-Government divide effect (among internet users). We derive three corresponding research models and examine the influence of socio-demographic factors: age, gender, income, and education. We test our research framework using comprehensive survey data (n = 1930). Analysis of our results justifies the separation of the e-Government divide effect from the cumulative effect of e-Government adoption, because the factors influencing e-Government usage among the entire population and among onliners are proved to be different. Implications for theory and recommendations for practice are discussed.

Keywords: e-Government, Technology Acceptance, Digital Divide, Quantitative Study.

1 Introduction

The opportunities provided by information and communication technologies (ICT) in general and the internet in particular are tremendous. In most countries the ways of life and communication have changed massively in the last 20 years. The information revolution is transforming government, just as it is still transforming other aspects of our lives, making the internet an appropriate medium for enhancing government-to-citizen interaction (Thomas & Streib, 2003).

Electronic government (e-Government) services offer numerous benefits to all stakeholders including citizens, government and businesses (e.g. Al-Shafi & Weerakkody, 2009; Choudrie & Dwivedi, 2005). This has motivated public administrations in most developed countries to implement increasingly e-Government initiatives and to try to encourage their usage. Research has shown that ICT and web-based public services can reduce corruption, inefficiency, and ineffectiveness and, therefore, increase public trust (e.g. Welch, 2004). Moreover, unlike organizations in the private sector, government agencies are in charge of making their information and services available to everyone (Bélanger & Carter, 2009). And as e-Government services are usually more cost-efficient than services in-person, administrations need to understand the factors influencing their adoption.

Although e-Government services are aimed to be embraced by all citizens, the uneven distribution of computer access and skills hinders the governments' intentions to make their online services equally accessible and beneficial (e.g. Bélanger & Carter, 2009). The so-called "digital divide" was named as one of the major obstacles for e-Government acceptance (e.g. Bélanger & Carter, 2009; Huang, 2007). Digital divide, which exists in most countries, refers to the gap between people who have access to ICT, as well as knowledge required to use them, and those without such access or skills (Cullen, 2001). Among the most popular, but not always helpful measures for bridging the internet-related digital divide are free of charge computer courses for excluded groups, as well as free internet entry points (e.g. Reffat, 2006).

Contemporary technology acceptance and digital divide research (e.g. Agarwal, Animesh, & Prasad, 2009) shows that the socio-demographic factors (in this article also called the digital divide variables) influence ICT and, in particular, internet acceptance. Research consistently identifies that men are more likely to accept the internet than women, age is negatively related, but income and education tend to be positively related to internet approval (e.g. Demoussis & Giannakopoulos, 2006). Few previous studies, which analyzed the effect of the digital divide variables, such age (AGE), gender (GEN), income (INC), and education (EDU), on another technology, namely e-Government (e.g. Choudrie & Dwivedi, 2005), showed similar results: AGE has a negative influence, GEN has a positive influence in case it is male, both INC and EDU have positive influence on e-Government acceptance. However, the absolute majority of these studies examined entire population making no distinction between internet users and non-users. At the same time, before using e-Government services one first needs to be online. Therefore, the attained findings might be distorted due to existing effect of digital divide variables on general internet acceptance.

The aims of this paper are to examine the influence of socio-demographic factors on the adoption of e-Government services and to check, whether this effect is different when considering all people (Cumulative Effect) and when taking into account only those respondents who are internet users (E-Government Effect). Socio-demographic factors are of great importance to governmental decision makers, as they design e-Government services in a way that they fit specific user groups (e.g. senior citizens). Consequently, we address the following research questions (RQs):

RQ1: What is the impact of socio-demographic variables (age, gender, income, education) on e-Government acceptance [among the entire population]?

RQ2: What is the impact of socio-demographic variables on e-Government acceptance if it is interfered by the digital divide effect (effect of the variables on general internet adoption)?

The RQs reflect our research objectives and focus solely on socio-demographic aspects of e-Government acceptance not considering other prominent predictors, such as citizen trust and security, transparency, perceived risk, perceived usefulness, perceived ease of use etc. (e.g. Carter & Bélanger, 2004; Gefen, Warkentin, Pavlou, & Rose, 2002). In order to answer these questions, a quantitative study was carried out in three German cities resulting in more than 1900 observations. The data for the study was gathered through a structured questionnaire, which was created on the basis of the elaborated research framework. Constructs and items appropriate for the research were defined during an explorative pre-study based on existing literature.

The paper begins with a brief overview of the notion and purposes of e-Government, as well as previous research on the influence of the digital divide variables on the citizens' adoption of e-Government services. Next sections provide detailed descriptions of the created research framework and the applied methodology used for the research followed by presentation of the results. In the concluding section the study limitations are discussed, as well as the implications of the findings for government practitioners and future research.

2 Theoretical background

Literature offers various definitions of e-Government. In this article we follow the one proposed by the European Commission and understand e-Government as "the use of ICT in public administrations combined with organisational changes and new skills in order to improve public services, democratic processes and public policies" (European Commission, 2003). Usually, all e-Government services can be divided into three distinct classes: information, communication, and transaction. The "information" class refers to pure information retrieval (unidirectional, e.g. obtaining information on policies, issues, or opening hours). The "communication" class is related to a bidirectional contact with the government, which involves exchange of messages (e.g. discussion on information about certain applications, expression of opinion or complains, asking specific questions). However, afterwards inquiries from citizens are often being handled via classical channels. Finally, the "transaction" class is related to a bidirectional execution of a complete service (e.g. payment of fees or fines, renewal of licenses). For the purpose of this paper we concentrate on the latter two classes of e-Government services, as mere information retrieval is a matter of static websites, while communication and transaction require an interaction between different (at least two) parties.

E-Government has shown encouraging results in developed countries in the context of delivering electronic information and services to citizens with a great amount of convenience and ease (Al-Shafi & Weerakkody, 2009). Correct implementation of e-Government resulted in shorter queues for citizens in government offices, reductions in the costs for both businesses and governments, and increase in the public sector openness and transparency (e.g. Choudrie & Dwivedi, 2005). The most significant benefits of e-Government, according to the literature, are time savings and flexibility gains due to delivering public services not just online, but from a single point of access available 24/7 (e. g. Reffat, 2006), as well as rebuilding government-customer relationship by providing personalised services to everyone (e.g. Davison, Wagner, & Ma, 2005).

According to the Eurostat statistics (Eurostat, 2011), e-Government usage by individuals in Germany has been growing steadily over the past decade. In 2010 37% of the German population used e-Government services compared to 17% in 2002. Meanwhile, the leading position in European Union holds Iceland with 77% e-Government adopters in 2010, followed by Denmark (72%). Statistics also shows that more males (41%) than females (34%) used e-Government services in Germany in 2010.

Following the purpose of our study, we managed to find four academic studies that specifically deal with the influence of digital divide variables on e-Government adoption (AGE, GEN, INC, EDU). The studies took place in the United States (Bélanger & Carter, 2009; Thomas & Streib, 2003), in the United Kingdom (Choudrie & Dwivedi, 2005), and in the State of Qatar (Al-Shafi & Weerakkody, 2010). In three of them the respondents were not distinguished between internet users and non-users

and the entire sample was examined. Thomas & Streib (2003) presented the only study, where observations with offliners were removed from the dataset before its further analysis.

At the beginning of 2000 Thomas & Streib conducted 827 telephone interviews in Georgia (the United States). They found it more reasonable to assess the volume of governmental web site visitors as a proportion of internet users only, so they looked at the comparative demographic profiles of three groups: government web site visitors, other internet users, and non-internet users. The two multivariate logistic models were examined for the basic digital divide (internet users, including government web site visitors, as compared to nonusers) and for the secondary digital divide for government web site visitors (those visitors as compared to other internet users). Their findings show that among internet users, ethnicity and education are important predictors of which internet users will also visit government web sites, with those users more likely to be white and better educated (Table 1). The overall conclusion of their study is that digital divide is even more pronounced among government Web site visitors than among internet users in general. They also proved that general internet use increases with both income and education and decreases with advancing age, which is in accordance with other numerous studies in this field.

Author, Year	The study is among internet users only	Age has influence (negative)	Gender has influence (positive in case the gender is male)	Income has influence (positive)	Education has influence (positive)
Thomas & Streib (2003)	✓	✗	✗	✗	✓
Choudrie & Dwivedi (2005)	✗	✓	✓	✓	✓
Bélanger & Carter (2009)	✗	✓	✗	✓	✓
Al-Shafi & Weerakkody (2010)	✗	✓	✓	not studied	✓

Table 1. Previous studies on the influence of digital divide variables on e-Government adoption.

The findings in other studies on the influence of digital divide variables on e-Government adoption, where no distinction between on- and off-liners was made, are fairly different to those showed by Thomas & Streib (2003). According to Choudrie & Dwivedi (2005), the e-Government adopters belong mainly to the higher income group and are educated to the postgraduate and degree levels, males are more bound to drive adoption, at the same time, after 54 years the adoption rate declines considerably. Thereby, AGE, GEN, INC, and EDU have an imperative role in explaining citizens' adoption of e-Government services (Table 1). The results of another survey by Bélanger & Carter (2009) indicate that those more likely to use e-Government services include younger citizens and citizens with higher levels of income, and education; ethnicity and gender were not predictors (Table 1). In the most recent study in this area by Al-Shafi & Weerakkody (2010) it is concluded that the adopters of e-Government are more from male than female gender and that there are differences between adopters and non-adopters in various age groups and levels of education; the influence of income was not examined (Table 1).

3 Research Framework

Our research framework is built upon the research gap identified in previous studies on internet and e-Government acceptance (Table 1), as well as upon the assumption that the factors influencing e-Government adoption among all people and internet users might be different. The variables involved in the framework are informed by digital divide research (e.g. Agarwal et al., 2009) and, as it has already been mentioned in the previous sections, include AGE, GEN, INC, and EDU. Thus, we

specifically exclude non-demographic variables, such as trust, from this early phase of research. The research framework is aimed at identifying the influence of these variables on e-Government acceptance among the entire population, internet users only, as well as on general internet adoption. In other words, in the framework the cumulative effect of e-Government adoption is split into the digital divide effect and the e-Government divide effect (Figure 1). Thus, our research allows us to distinguish whether a lower usage of e-Government services by certain user groups (e.g. by elderly women) is due to the attributes of the services (e-Government divide effect) or due to the usage behaviour of this group towards prerequisite technology internet (digital divide effect) or both (cumulative effect).

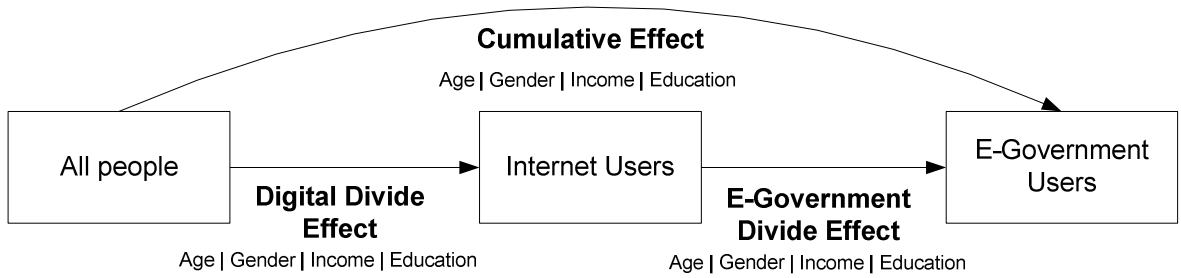

Figure 1. Research Framework.

Therefore, the research framework can be divided into three distinct research models. First, we study the cumulative effect. Here, we test the influence of the digital divide variables on e-Government adoption among the whole population (Research Model 1).

RM 1: $$EGovUsage_i = \beta_0 + \beta_{AGE}AGE_i + \beta_{GEN}GEN_i + \beta_{INC}INC_i + \beta_{EDU}EDU_i + \varepsilon_i$$

The derived hypotheses refer to the three studies described in the previous section: Choudrie & Dwivedi (2005), Bélanger & Carter (2009), and Al-Shafi & Weerakkody (2010) (Table 2). Regarding the hypotheses related to gender in all three research models, it should be mentioned that in our study we coded gender as male = 1, female = 0.

Hypothesis	Hypothesis description	Related studies
$\beta_{AGE} < 0$	Older people use e-Government services less often.	Choudrie & Dwivedi (2005); Bélanger & Carter (2009); Al-Shafi & Weerakkody (2010)
$\beta_{GEN} > 0$	Men use e-Government services more often than women.	Choudrie & Dwivedi (2005); Al-Shafi & Weerakkody (2010)
$\beta_{INC} > 0$	People with higher income use e-Government services more often.	Choudrie & Dwivedi (2005); Bélanger & Carter (2009)
$\beta_{EDU} > 0$	Higher educated people use e-Government services more often.	Choudrie & Dwivedi (2005); Bélanger & Carter (2009); Al-Shafi & Weerakkody (2010)

Table 2. Hypotheses on the influence of digital divide variables on e-Government adoption among the entire population.[1]

Second, we study the digital divide effect and examine the influence of the digital divide variables on internet adoption in general (Research Model 2). There are numerous studies on this topic (e.g. Niehaves & Plattfaut, 2010, 2011). The common conclusion is that age has a negative influence, gender has a positive influence in case it is male, both income and education have a positive influence

[1] Corresponding hypotheses could also be built for such demographic variable as ethnicity. However, among obtained observations in all three cities (see below) there are almost no people with a migration background or mixed ethnicities. Therefore, ethnicity was not considered in our study.

on internet acceptance. Thus, a typical internet user is a young or middle-aged man with high education and income.

RM 2: $$InternetUsage_i = \beta'_0 + \beta'_{AGE} AGE_i + \beta'_{GEN} GEN_i + \beta'_{INC} INC_i + \beta'_{EDU} EDU_i + \varepsilon_i$$

Based on the literature, we formulated hypotheses on internet adoption (Table 3).

Hypothesis	Hypothesis description	Related studies
$\beta'_{AGE} < 0$	Older people use the internet less often.	e.g. Bucy (2000); Loges & Jung (2001); McIntosh & Harwook (2002)
$\beta'_{GEN} > 0$	Men use the internet more often than women.	e.g. Demoussis & Giannakopoulos (2006); Ono (2006)
$\beta'_{INC} > 0$	People with higher income use the internet more often.	e.g. Gibbs, Kraemer, & Dedrick (2003); Katz & Aspden (1997)
$\beta'_{EDU} > 0$	Higher educated people use the internet more often.	e.g. Mills & Whitacre (2003); Ono & Zavodny (2007)

Table 3. Hypotheses on the influence of digital divide variables on internet adoption

Third, we analyze the e-Government divide effect (Research Model 3). Here, we again look for the influence of the digital divide variables on e-Government adoption. However, only the observations involving internet users are analysed.

RM 3: $$EGovUsage_i = \beta''_0 + \beta''_{AGE} AGE_i + \beta''_{GEN} GEN_i + \beta''_{INC} INC_i + \beta''_{EDU} EDU_i + \varepsilon_i$$

The only study in this field, which we could find, was done by Thomas & Streib (2003), where the importance of education as an important predictor was proved. Thus, we derive the following hypotheses (Table 4).

Hypothesis	Hypothesis description	Related studies
$\beta''_{AGE} = 0$	Age has no impact on e-Government usage among onliners.	Thomas & Streib (2003)
$\beta''_{GEN} = 0$	Gender has no impact on e-Government usage among onliners.	
$\beta''_{INC} = 0$	Income has no impact on e-Government usage among onliners.	
$\beta''_{EDU} > 0$	Education has a positive impact on e-Government usage among onliners.	

Table 4. Hypotheses on the influence of digital divide variables on e-Government adoption among internet users.

One could argue that in the same way as the internet is a natural prerequisite for e-Government usage, the computer is for the internet. However, we did not include a "computer divide" into our research framework and models respectively due to two main reasons. First, there are many ways to connect to the internet besides computers, e.g. via mobile phones. Second and more important, all respondents had (at least potentially) access to public terminals and, as a consequence, to the internet. Thus, we consider the internet as the only relevant prerequisite for e-Government services usage.

4 Research Methodology

In order to answer our research questions and test the hypotheses presented in the previous section, we conducted a quantitative study using a questionnaire.[2] Besides the questions relevant to this study, the questionnaire included additional inquiries. We executed a small pre-test with seven people, which resulted in positive feedback, so no questions were changed. The questionnaire was used to gather data

[2] Please contact the authors for more information on the questionnaire used in the study.

in three German cities (hereinafter referred to as City1, City2, and City3) between September 2009 and May 2011. More information on data collection and analysis, as well as on the sample demographics is provided below.

4.1 Data Collection Phase

In all three cities our study was supported by local authorities and organizations, so that we were able to employ several different data collection methods.

In City1 we extracted randomly the addresses of 1'500 citizens out of the cities resident registration and contacted them via mail. This mail included the questionnaire itself, a signed letter from the mayor explaining the aim of the study, and a stamped return envelope. Moreover, we placed another set of 1'500 questionnaires in several places of the city. Additionally, we interviewed more than 100 randomly chosen people via telephone. The three data collection mechanisms revealed no differences. To lever the response rate we employed three additional methods: a press conference with the mayor to announce the start of the survey, a second press release in the middle of the data collection phase, and a lottery with three material prizes among all respondents.

In City2 we contacted 5'000 randomly chosen citizens via mail (again offering a stamped return envelope). Moreover, we placed 2'000 questionnaires in several places of the town and raffled prizes among the respondents. Again, the various data collection procedures showed no difference. A press conference was held at the beginning of this study too.

The local authorities of City3 argued for a slightly different focus of the study targeting especially the senior citizens. Hence, we selected two random samples out of the city's resident registration: a) 3'000 citizens aged 50 and above and b) 3'000 citizens of all ages. Thus, we have a slight bias towards elderly citizens. However, as age is one of the independent variables of this study it should not distort our results. Each citizen chosen received a letter signed by a high-ranking government official and a stamped return envelope. Again, several prizes were raffled among the respondents.

In all three cities we conducted non-response analyses, which showed no bias.

4.2 Data Analysis Phase

First of all, we cleansed the data by deleting entries with too many missing values. Second, we carried out regression analyses to test our research models using PASW (SPSS) 18. Here, we treated missing values using listwise deletion. We conducted separate analyses for each of the three cities and one additional for the cumulated data.

4.3 Sample Demographics

Our sample consists of data from three cities. After data cleansing we have 1930 respondents. On average, each dataset has 3.6% missing values. It is notable that the average age of the respondents is higher for City3, which is caused by the pre-defined data collection rules (see above). Moreover, the e-Government usage in City3 appears to be higher, which could occur because the e-Government services offered in the cities differ from each other. City3 is larger and more populated and offers more sophisticated services. As for all other parameters, the three cities are comparable (see Table 5).

Please note that the derived numbers for e-Government usage are lower than the official Eurostat statistics, which can be explained by the difference in services implied. In the developed questionnaire we asked about using e-Government for communication and transaction, but not for obtaining information, which was done by Eurostat.

Variable	City1	City2	City3	Cumulated
Respondents, number	462	603	865	1930
Response rate	15%	9%	14%	12%
Missing values, mean	4.8%	3.3%	3.2%	3.6%
Age | AGE (biological age), mean	44.05	45.02	56.37	49.88
Gender | GEN (male = 1; female = 0), proportion of male respondents	40%	45%	49%	46%
Income | INC (1 = <1000€; 2 = 1000€ - 2000€; 3= 2000€ - 3000€; 4 = >3000 €), mean	2.90	2.83	2.81	2.83
Education | EDU (number of years of education), mean	12.8	13.2	13.5	13.2
Internet Use | USE (0 = no, 1 = yes), proportion of users	94%	95%	91%	93%
E-Government Use | EGOVUSE (0 = no, 1 = yes), proportion of users	18%	15%	22%	19%
E-Government Users among Internet Users | EGOVUSE / USE	19%	16%	24%	20%

Table 5. Demographics of the analyzed sample.

5 Results

The regression analysis of our first research model (impact of digital divide variables on e-Government usage among the entire population) shows different findings among the three cities (Table 6). In line with our hypothesis, age has a negative impact on the usage of e-Government services in City3. In all other cities (and in the cumulated dataset) the influence is positive, but not significant. The influence of gender is significant in the cumulated data. Income has a significant positive effect in City3, but no effects in other datasets. Education has a significant positive effect in City2, City3, and the cumulated data.

		City1				City2				City3				Cumulated			
R^2					.006				.019				.023				.017
Var	Hypotheses	b	β	T	p	b	β	T	p	b	β	T	p	b	β	T	p
AGE	$\beta_{AGE} < 0$	.00	.01	.20	.42	.00	.01	.26	.40	.00	-.05	-1.46	**.08**	.00	.00	-.13	.45
GEN	$\beta_{GEN} > 0$	.04	.05	.93	.18	.01	.01	.18	.43	.04	.05	1.25	.11	.03	.04	1.40	**.08**
INC	$\beta_{INC} > 0$	-.01	-.01	-.19	.43	.01	.02	.41	.34	.03	.06	1.59	**.06**	.01	.03	1.19	.12
EDU	$\beta_{EDU} > 0$	.01	.06	1.10	.14	.01	.16	3.42	**<.01**	.01	.12	3.05	**<.01**	.01	.12	4.73	**<.01**
One-tailed test, p-values below .1 are considered as significant.																	

Table 6. Regression analysis of the first research model (impact of digital divide variables on e-Government usage among the entire population).

All the symbols in the Tables 6-8 (R^2, b, β, T, p) have the common meanings widely acknowledged in regression analysis.

The results of the regression analysis of the second research model are quite consistent in all four data sets (Table 7). Apparently, the impact of digital divide variables on internet usage is almost unambiguous in all three cities. Age has a negative influence in all datasets. Male respondents are more likely to use the internet than females, although this relationship is not significant in City2. Income and education both have positive impact on internet usage in all data sets.

		City1				City2				City3				Cumulated			
R^2					.068				.072				.136				.110
Var	Hypotheses	*b*	*β*	*T*	*p*	*b*	*β*	*T*	*p*	*b*	*β*	*T*	*p*	*b*	*β*	*T*	*p*
AGE	$\beta_{AGE} < 0$	.00	-.18	-3.25	**<.01**	.00	-.24	-5.37	**<.01**	-.01	-.28	-7.84	**<.01**	.00	-.26	-1.69	**<.01**
GEN	$\beta_{GEN} > 0$	.06	.15	2.74	**<.01**	.01	.02	.52	.31	.06	.10	2.99	**<.01**	.04	.09	3.63	**<.01**
INC	$\beta_{INC} > 0$	.03	.14	2.48	**<.01**	.04	.17	3.75	**<.01**	.05	.16	4.44	**<.01**	.04	.16	6.43	**<.01**
EDU	$\beta_{EDU} > 0$	.00	.08	1.42	**.08**	.01	.11	2.43	**.01**	.01	.12	3.31	**<.01**	.01	.11	4.57	**<.01**
One-tailed test, p-values below .1 are considered as significant.																	

Table 7. Regression analysis of the second research model (impact of digital divide variables on internet usage).

The results of our third research model (impact of digital divide variables on e-Government acceptance for onliners) are quite interesting. Here, only education has a positive impact on e-Government use (Table 8). This impact is significant for all data sets, but City1. All other variables have no significant influence on e-Government adoption.

		City1				City2				City3				Cumulated			
R^2					.006				.014				.009				.012
Var	Hypotheses	*b*	*β*	*T*	*p*	*b*	*β*	*T*	*p*	*b*	*β*	*T*	*p*	*b*	*β*	*T*	*p*
AGE	$\beta_{AGE} = 0$	.00	.03	.44	.66	.00	.02	.48	.64	.00	-.01	-.17	.87	.00	.03	1.16	.25
GEN	$\beta_{GEN} = 0$	.04	.05	.89	.38	.00	.00	-.02	.99	.02	.03	.64	.53	.02	.02	.86	.39
INC	$\beta_{INC} = 0$	-.02	-.03	-.56	.57	.00	.00	-.07	.95	.02	.05	1.21	.23	.00	.01	.37	.71
EDU	$\beta_{EDU} > 0$	.01	.06	1.04	.15	.01	.15	3.10	**<.01**	.01	.10	2.36	**.01**	.01	.11	4.01	**<.01**
Two-tailed test for AGE, GEN, and INC hypotheses, p-values below .1 are considered as significant.																	

Table 8. Regression analysis of the third research model (impact of digital divide variables on e-Government usage among internet users).

6 Discussion

With respect to our research objectives and the literature reviewed, our results can be interpreted as follows. Taking into account the cumulative dataset only (n = 1930), we observe that the influence of gender and education on e-Government usage among all respondents is significant. Apparently, both males and people with higher education are more likely to use e-Government services. It is noteworthy that the influence of gender is very small (β = .04). In contrast to the literature (Bélanger & Carter, 2009; Choudrie & Dwivedi, 2005), there is no significant effect of age and income. However, as hypothesized, the e-Government usage effect can be split into two distinct effects. First, there is a general digital divide. All four variables studied have an influence on internet adoption among respondents: there are still differences regarding age, gender, income, and education. Here, internet usage rises with being young and male, as well as having high income and education. Our findings here are totally in line with the previous studies (e.g. Demoussis & Giannakopoulos, 2006). Second, considering internet users only, there is only one variable having significant impact on e-Government adoption, which is education. A higher education is a good predictor that onliners also use e-Government services. Such result confirms the study by Thomas & Streib (2003).

Moreover, the findings show surprising differences between the three cities studied. Interpretation of the results with reference to our hypotheses introduced in section 3 is presented in Tables 9-11. For our first research model, it is interesting that gender is not significant for explaining e-Government

usage in all three cities, although its influence is significant in the cumulated dataset. This can be explained by both its small influence and a high number of observations in the cumulated dataset. Furthermore, education is not significant in City1. Here, it has to be noted that the study in City1 had the lowest number of observations (n = 462). It should be also mentioned that in City3 the influence of income is significant. One potential explanation for this could be that City3 offers different e-Government services than both other cities. The services of City3 can generally be considered as more mature. Last, we hypothesized that older people are less likely to use e-Government services. This is only true for City3, as in all other cities the corresponding β-values are around 0, which could also be an indicator that a non-linear relationship between age and e-Government usage exists.

Hypothesis	Hypothesis description	Results interpretation
$\beta_{AGE} < 0$	Older people use e-Government services less often.	Partially validated (valid only in City3)
$\beta_{GEN} > 0$	Men use e-Government services more often than women.	Partially validated (valid only in the cumulated data)
$\beta_{INC} > 0$	People with higher income use e-Government services more often.	Partially validated (valid only in City3)
$\beta_{EDU} > 0$	Higher educated people use e-Government services more often.	Partially validated (valid in City2, City3, and the cumulated data)

Table 9. Results interpretation for the first research model (impact of digital divide variables on e-Government usage among the entire population).

In the second research model, there is only one difference in the results of four datasets: The influence of gender is not significant in City2, which might be due to good internet courses for women offered by the government of this city.

Hypothesis	Hypothesis description	Results interpretation
$\beta'_{AGE} < 0$	Older people use the internet less often.	Validated
$\beta'_{GEN} > 0$	Men use the internet more often than women.	Partially validated (valid in City1, City3, and the cumulated data)
$\beta'_{INC} > 0$	People with higher income use the internet more often.	Validated
$\beta'_{EDU} > 0$	Higher educated people use the internet more often.	Validated

Table 10. Results interpretation for the second research model (impact of digital divide variables on internet usage).

In the third research model, we can again observe only one difference between datasets. Here, the influence of education on e-Government usage among onliners is not significant in City1, which is totally in line with the results for the first research model.

Hypothesis	Hypothesis description	Results interpretation
$\beta''_{AGE} = 0$	Age has no impact on e-Government usage among onliners.	Validated
$\beta''_{GEN} = 0$	Gender has no impact on e-Government usage among onliners.	Validated
$\beta''_{INC} = 0$	Income has no impact on e-Government usage among onliners.	Validated
$\beta''_{EDU} > 0$	Education has a positive impact on e-Government usage among onliners.	Partially validated (valid in City2, City3, and the cumulated data)

Table 11. Results interpretation for the third research model (impact of digital divide variables on e-Government usage among internet users).

Our findings have implications for theory. In future studies on technology adoption, scholars should indicate whether the technology studied requires knowledge of or access to a different technology. As an example, when studying the usage of social networks one should also discuss usage of the internet as a prerequisite. Effects can originate from the prerequisite and only be mediated by the technology in focus. Our study shows that it is necessary to consider the digital divide effect of variables on general internet acceptance when examining the factors influencing adoption of a specific online service.

Governmental practitioners, at least at a municipal level, might find it engaging that the usage of e-Government services, once a person is online, depends on education only. One reason for this might be that contemporary e-Government services are designed to suit educated people. On the other hand, the fact that age has no influence here indicates that once elderly people are online they use e-Government services as well, which means that governmental web-sites with regards to age are already on a good level in Germany. Thus, with current trend of diminishing digital divide, there will be no age-related barrier to e-Government services in the future. Hence, government institutions will not have to design their online services specifically for the elderly.

Our study has limitations in several aspects. First, the question arises whether our results are transferable to other countries. So far, we only studied Germany. It can be doubted that the results hold true in other non-European countries, due to differences in culture, services offered, level of development, and so on. Second, the study is limited by the data analysis method used. Especially the nature of the relation between age and e-Government adoption should be further discussed, as with high probability it can appear to be non-linear. We can imagine that both younger and older people tend to be non-users of e-Government services, while the middle-aged group shows higher usage rates. Moreover, the results of regression analyses when using binary variables (as gender) are limited, too. Third, we did not distinguish between different e-Government services. These limitations are, at the same time, a matter for future research. Future research could also focus on other online services, such as e-Health, e-Banking, or e-Commerce. In line with our research we assume the existence of a cumulative effect for these services too. From an interdisciplinary perspective, the study on the differences between online and offline behaviour seems to be of value. The fact that the amount of internet non-users decreases will bring everyone online in the future. In this case, we could hypothesize that people will use the same volume of e-Government services, as offline governmental services in the past. Thus, in the future the focus of studies could shift from answering the question "Do people use e-Government services?" to "How many of their governmental transactions do people perform using e-Government?" The underlying question here is: "Does online behaviour differ from offline behaviour and, if yes, why?"

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