Determinants of Digital Divide in Polish Households

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Abstract

No access to information and communication technologies and no ability to use them are seen as potential barriers for individuals to participate in the information society what can lead them to the digital divide. The study shows the selected aspects of the problem of digital inequality in Poland. The purpose of this paper is to identify the socioeconomic factors that are conducive of digital exclusion of Polish households. In order to extract the qualitative factors, logistic regression was carried out. Individual, non-identifiable data from a household budget survey conducted by the Central Statistics Office in Poland in the years 2012-2016 were used in the analysis.

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1 Introduction

In the era of the information society, i.e., a society whose existence is largely based on the flow of information and the use of IT solutions, the lack of ability or skill to efficiently use the tools of acquiring information can become the reason of the so-called digital exclusion. According to the definition used by the OECD, the digital divide (digital exclusion) is the difference in access to modern technologies and in the use thereof between persons, households, entrepreneurs and geographic areas at different levels of socioeconomic development (OECD 2001). The problem of digital exclusion has been noted by scientists and government authorities of the USA and the EU in the mid-1990s (Hargittai, 1999).

The concept of the digital divide is linked with the concept of social exclusion. Social exclusion is a multidimensional phenomenon and exceeds the category of poverty, referring also to the non-financial constraints that do not allow the human individual to live at the level acceptable in their country (Panek, 2011; Torraco, 2018). According to the National Strategy of Social Integration for Poland, social exclusion is a situation that prevents or significantly handicaps an individual's or a group's playing a social role within the legal norms, making use of public goods and social infrastructure, gathering resources and earning income in a dignified way (Ministerstwo Gospodarki..., 2004).

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In the literature, four areas in which an individual may be subject to social exclusion are mentioned (Burchard et al., 2002): consumption (the individual is subject to exclusion because of a low level of income), production (an individual is subject to exclusion because of unemployment and lack of opportunities to raise qualifications and find a job), political commitment (an individual is subject to exclusion due to limited active or passive electoral rights) and social integration (an individual is subject to exclusion because of no contacts with other members of the society). In accordance with this approach, digital divide could result in social exclusion in three of the four listed aspects (consumption, production and social integration). No access to the Internet does not cause true restrictions on electoral rights, but it significantly impedes access to the information needed to make an informed political choice.

The digital divide is usually considered is on two levels (Zhao et al., 2014). On the basic level the participation of citizens and businesses in the information society depends on access to information and communication technologies (ICT), i.e., the presence of electronic devices such as computers and the Internet. The digital divide in this aspect is the so-called first order effect implying inequalities in access to technology. The second order effect is the inequality in the use of technology among people who have access to the Internet (Helbig et al., 2009). It is believed that the essence of digital divide does not apply to the use of the Internet only, but rather opportunities flowing from possibilities to participate in social and cultural life and access to educational resources and the labour market (Batorski and Płoszaj, 2012).

The purpose of the article is to know the trends concerning the Polish households' access to information and communication technologies. The research issues include the analysis of access of Polish households to a computer with Internet connection (including broadband) in 2013-2016. Subsequently, an attempt to identify the factors affecting the access of the Polish households to the tools for acquiring information was made. In the study, such characteristics of the households were included as: the biological type of household, socioeconomic groups of households, the level of education of the head of household and the class of the locality where the household is found.

2 Data and research method

For the purposes of this study, individual non-identifiable data from the household budget survey carried in the years 2013-2016 by the Central Statistical Office were used. The subject of research were the households, and the object of the study included the equipment of the home with a computer with broadband Internet access (32,786 observations).

Identification of the factors that affect the use of the Internet was conducted using econometric modelling. In view of the fact that the explained variable—having access to a computer with a broadband Internet connection—is dichotomic (adopts two values: Y = 1 identifies the households with a computer with an Internet access or Y = 0 households without a computer with Internet access) a logit model was used. In the case of this model, depending on certain factors (x_j), probability can be interpreted as the value of the distribution function expressed by the formula (Maddala, 2006):

$$P(Y_{i} = 1) = \frac{\exp(\alpha_{0} + \alpha_{1}x_{i1} + \alpha_{2}x_{i2} + \dots + \alpha_{k}x_{ik})}{1 + \exp(\alpha_{0} + \alpha_{1}x_{i1} + \alpha_{2}x_{i2} + \dots + \alpha_{k}x_{ik})}.$$

The parameters of the above model are usually estimated using the maximum likelihood estimation, maximizing the logarithm function reliability relative to the parameters of the model using the iterative numerical procedures.

As the explanatory variables, characteristics of the household and the head of the household were assumed:

- quintile group of household's income per capita (five zero-one variables; the reference group was the first quintile group),
- class of place of residence (four zero-one variables; the reference group were households in the countryside),
- education (three zero-one variables; the reference was middle school education or less),
- biological type of household (two zero-one variables; the reference group were households without children),
- socio-economic group of households (five zero-one variables; the reference was the group of households of employed people).

In order to match the model, the McFaddenR² formula was applied (Gruszczyński, 2012):

$$McFadden R^2 = 1 - \frac{lnL_{fit}}{lnL_0}.$$

where: lnL_{fit} is a reliability function of the full model, and lnL_0 is the logarithm of the model reliability function where only a constant term occurs. If the model perfectly forecasts the variable then $lnL_0 = 0$, therefore McFaddenR² = 1. In practice, however, R² McFadden values are small, closer to 0 than 1 (Gruszczyński, 2012).

3 Internet access in Polish households

In 2017, 81.9% Polish households with at least one person aged 16-74 had access to an Internet connection (Central Statistical Office, 2017). This percentage was higher by 1.5

percentage points than in the previous year and 10 percentage points compared to 2013 (see Fig. 1). In comparison with 2016 the share of households using a broadband Internet connection increased by 1.9 percentage points. Internet access both in general and broadband was varied, depending on the type of household, the class of its location, the degree of urbanization and also the part of Poland where it is found.



Fig. 1. Households with access to the Internet and broadband access to the Internet.

Among households with access to the Internet, households with children dominated (see Table 1). Taking into account the class of the location, more households in urban areas had Internet access than in rural ones. Due to the region, the most households with Internet access were located in the central regions of Poland. The level of urbanization implied that more households had access to the Internet in areas with higher population density. The same situation concerned access to a broadband connection.

The reasons for not having Internet most often included the lack of need to use it (70.6%). Another important reason was the lack of appropriate skills (see Table 2). Frequently mentioned reasons also pointed out that the of access and hardware costs were too high. The drop of the share of households that do not have Internet because of their technical capabilities can be regarded as a positive change. Meanwhile, the share of households that point to safety reason for not having Internet has risen.

Specification	Access to th	Access to the Internet		Broadband access to the Internet	
	2013	2016	2013	2016	
Total	71.9	80.4	68.8	75.7	

Table 1. Households with access to the Internet at home.

Household type								
93.1	97.7	89.9	92.8					
61.2	71.9	58.1	67.2					
Domicile								
76.9	82.9	75.1	79.1					
70.8	80.6	68.0	76.6					
67.8	77.8	63.0	71.3					
Degree of urbanisation								
67.4	79.0	62.7	73.3					
71.0	79.6	68.2	74.3					
76.4	82.2	74.6	78.7					
Regions								
70.6	78.0	65.7	74.8					
73.2	81.2	70.3	75.9					
70.1	81.0	67.9	76.0					
	Househ 93.1 61.2 Dom 76.9 70.8 67.8 Degree of 1 67.4 71.0 76.4 Reg 70.6 73.2 70.1	Household type93.197.7 61.2 71.9 $\overline{Domicile}$ $\overline{Domicile}$ 76.9 82.9 70.8 80.6 67.8 77.8 Degree of urbanisation 67.4 79.0 71.0 79.6 76.4 82.2 Regions 70.6 78.0 73.2 81.2 70.1 81.0	Household type93.197.789.9 61.2 71.958.1Domicile76.982.975.170.880.668.0 67.8 77.863.0Degree of urbanisation 67.4 79.0 62.7 71.079.6 71.0 79.668.276.482.274.6Regions 70.6 78.065.7 73.2 81.270.3 70.1 81.067.9					

 Table 2. Households without access to the internet by reasons for not having access to the Internet (in % of households without access to the Internet).

Reason	2013	2016
No need	64.9%	70.6%
Lack of skills	35.8%	52.0%
Equipment costs too high	28.0%	28.0%
Access costs too high	21.9%	21.3%
Have access to the Internet elsewhere	3.8%	3.6%
Reluctance to the Internet	4.7%	9.9%
Lack of technical possibility to connect to the Internet	1.8%	0.8%
Security concerns	1.4%	3.9%

4 Determinants of Internet access of Polish households

The analysis of individual data from 2016 year showed that having a computer with Internet access is associated with the financial situation of the household, as illustrated in Fig. 2. The empirical distribution curse of the households with a computer and Internet access is visibly shifted right relative to the households with no computer with an Internet access. Average

income per capita in the households with a computer with Internet access is about 24% higher than in those that do not possess such equipment.



Fig. 2. Empirical distributions of household's income per capita in general, households with a computer with Internet access and those which do not have a computer with Internet access from 2016.

Interestingly, the analysis of access to the Internet in quintile groups of income per capita indicates that the percentage of households having access to the Internet is higher in the first quintile group than in the second and third (see Fig. 3). It is worth noting, however, that in the fifth quintile group the share of households having access to the Internet is higher by more than 15 percentage points than in the first group.



Fig. 3. Households by equipping a computer with internet access in quintile groups of household's income per capita.

In order to extract the socioeconomic qualitative factors, logistic regression was carried out. The information contained in Table 3 shows that most of the proposed variance significantly affect the likelihood of having a computer with an Internet access at home. The McFadden determination coefficient indicating the quality of the fit of the binominal model to the data should not be interpreted as R^2 for the linear model, only in accordance with its definition. Taking into account the number of observations and the nature of the data, the obtained factor level it can be considered satisfactory (Gruszczyński, 2012).

The likelihood of having the equipment necessary for the use of information and communication technologies is the most strongly influenced by family type. With the increase in class of the place of residence and income per capita, the threat of the digital divide is diminishing. Those most at risk are the households belonging to retirees and other pensioners, farmers and people living off various benefits. It is a little surprising that the education of the head of the household turned out to be statistically insignificant.

The results are partly consistent with those of other studies found in the literature. Social and economic factors were identified as the main predictors of the digital divide at work (Kiiski et al., 2005). Other studies of the determinants of social exclusion point to the role of GDP per capita, telecommunications infrastructure and the quality of regulations (Chinn and Fairlie, 2006) and gender (Dixon et al., 2014).

Specification	Parameter	Standard	Wald	р-	
Specification		error	statistics	value	
Constant	0.3589	0.0532	45.48	0.0000	
Households with children	2.4437	0.0522	2195.87	0.0000	
Cities with population over 500 000	0.5640	0.0543	107.73	0.0000	
Cities with population between 100 000 and 499 000	0.5106	0.0465	120.42	0.0000	
Towns with population under 100 000	0.3177	0.0382	69.25	0.0000	
Household of farmers	-0.4909	0.0824	35.50	0.0000	
Household of pensioners	-1.8019	0.0358	2532.71	0.0000	
Household maintained from non-earned sources	-1.0277	0.0740	192.86	0.0000	
Secondary education	-0.0148	0.0217	0.47	0.4952	
Higher education	0.0443	0.0422	1.11	0.2928	
Second quintile group	0.2914	0.0519	31.54	0.0000	
Third quintile group	0.5829	0.0520	125.83	0.0000	
Fourth quintile group	0.4777	0.0448	113.60	0.0000	
Fifth quintile group	1.2664	0.0516	602.63	0.0000	
McFaddenR ² =0,3191, Chi ² (14)=12308, p=0.0000					

Table 3. Evaluation of the parameters of the logistic model of equipment of Polish households with computers with Internet access.

Conclusions

Full participation in the information society is not possible without access to the Internet and digital skills at the appropriate level. However, it is the Internet access that is the primary condition to acquire skills in information and communication technologies and their use. In Poland, despite improvements in recent years, ca. 20% of households still do not have access to the Internet. The most at risk are for retirees and other pensioners, as well as other individuals who live off various benefits as well as households located in rural areas.

The research conducted shows the need to increase access to the Internet in rural areas and in households of pensioners. While in some rural areas lack of Internet access can be a problem related to the lack of infrastructure, in the households of pensioners the lack of access to the Internet implies (at least partly) a lack of skills needed to use the Internet. To reduce the risk of digital divide the elderly should be enabled to participate in courses in computer and Internet skill development. Due to the social importance of the problem of digital divide, the analysis of the issue of access to the Internet and the level of digital literacy should be continued in the coming years.

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