
Individual Determinants of the Fixed Internet Adoption in Romania

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ABSTRACT

The aim of this paper is to analyze the association of internet adoption, represented by having fixed internet services, to relevant sociodemographic variables among Romanian population. The data source is a representative survey with a sample of 1437 respondents undertaken in 2022. Using several specific statistical tests and regression models, the paper has determined the relevant factors affecting the internet adoption in Romania. Our results indicate a positive association between the education level, the income level, the employment and the number of persons in the household and having fixed internet services. In elderly population instead the probability to adopt fixed internet services decreases. Our findings are relevant in identifying the gaps in fixed internet services adoption between several categories of population and designing the configuration of appropriate public policies and commercial strategies for setting incentives to adopt the services.

Keywords: Fixed Internet, Survey, Romania, Logistic regression

JEL Classification: O20, O31, C10

1. INTRODUCTION

The access to internet has come a long way from its incipient form to the scarce resource and then to the everyday fuel of connectivity, productivity and creativity. The internet is an important investment that provides information as data or knowledge, communication between people or between machines and increasing categories of services.

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The digital divide is one concern that is addressed between countries, regions or various categories of population because it reduces the benefits for end users, companies and the internal market. At the European level, the importance of internet availability is best reflected in the Directive (EU) 2018/1972 of the European Parliament and of the Council of 11 December 2018 establishing the European Electronic Communications Code that underlines the benefits across the Union through the connectivity and the participation in the digital economy.

The Romanian situation is particularly relevant because the digital economy indicators are placed at extremes and this raises the questions of what are the relevant factors that might benefit the development and how could these be enhanced in order to obtain better connectivity. The high-level analysis of the internet use by the natural persons in 2022 at European level reveals that Romania has fallen behind other countries, although it has managed to narrow the gap and the divide between countries has reduced. The data produced by Eurostat shows that while the EU average fixed internet utilization at the European level in 2022 was 91.14%, in Romania the percentage was 88.86% (Annex 1).

Although the mobile internet is more widely spread than the fixed internet, the latter is the one that supports more traffic. The data available in the Statistical data report of the National Authority for Management and Regulation in Romania (ANCOM) shows that a bit less than 25% of the internet connections provide almost 90% of the traffic (Annex 2).

The aim of this paper is to analyze the gap within the sociodemographic factors that could impact the adoption of the fixed internet services in the Romanian households. Previous studies have shown that there are differences between sociodemographic groups with respect to the adoption and use of the internet and the devices (Tsetsi, 2017) and even when the internet adoption increases despite those differences, the speed of connections makes a difference in the accessibility of information (DiMaggio et al., 2001).

This paper is a contribution to the scrutiny at the national regarding the incentives for the internet development and utilization. Its results provide the support for public policies aimed at the efficient network development and services provision. Private sector can benefit as well by identifying strategies to increase the adoption of fixed internet by narrowing the gap between the different categories of potential users.

Our study capitalizes on the available data set from 2022 on the attitudes toward the electronic communications that highlights the correspondence between the population characteristics and the adoption of the services. The data has been selected from the user survey undertaken by the

National Authority for Management and Regulation in Romania (ANCOM) and it includes various information related to having fixed internet personally or in the household, as well as socio-demographic characteristics: the age, the gender, the employment status, the income, the education, the number of persons in the household, the number of children in the household and the living area.

The novelty of the paper is specifically related to providing a closer perspective on the Romanian case, less covered by the national or international literature. The analysis of the large set of recent data is based on the representative survey amongst Romanian population and the application of several statistical tests and models to determine the significance of the socio-demographic factors, while identifying in the results the specificities of the Romanian context.

Considering the available data for the Romanian population and the relevant studies, in our analyses we have taken into account the following hypotheses: socio-economic factors have a significant impact on having fixed internet, positive (income, education, family size and employment) or negative (rural and age). We employ statistical methods to capture the influence of individual factors on owning fixed internet services.

2. LITERATURE REVIEW

The research on internet adoption is extensive and rightly so taking into account the impact on the economy of this technology. Many studies focus on the internet from the perspective of an independent variable, as the factor that has a strong influence on the life of the people and on the performance of the businesses.

Our contribution is related to the previous stage that refers to the factors that influence internet adoption where it is the dependent variable. For the purpose of including all the potentially relevant factors, this paper covers both fixed and mobile internet studies and the literature has revealed that the differences between social groups regarding the access to technology are diminishing, but the ones related to the skills and the access to the information remain relevant. This research provides the background for the formulation of our hypotheses and a challenge to determine the validation of previous work for the Romanian market.

The digital divide in terms of the dependence on the smartphones as unique means of access to the internet by different demographic groups (according to race, age, income and education) has been seen in the dependency of the minority, less educated and lower income population, while Caucasian,

more educated and higher income population has been more likely to be multi-modal (Tsetsi, 2017). The differences are widening when it is taken into account the manner of using the smartphones, low-income individuals engaging in less information activities; by the other hand, they use the smartphones mainly for social activities, which might widen the differences between the groups. Broadband adoption at households' level is also dependent on higher level of income and education (Whitacre et al., 2015).

Family income has shown to be one of the most significant factors even by comparison to other demographic characteristics (such as education, age, sex and race/ethnicity), pointing to the highest level of inequality together with nativity/citizenship (Martin and Robinson, 2007).

Even when internet services adoption increases although the differences in income and education persist, lower speed connections and low skills imply more time is needed in order to obtain the necessary information (DiMaggio et al., 2001). There are several dimensions of the online inequalities such as technical capacity, autonomy, skills, social support and goals/purposes. Some differences in payment determined by computer use have been determined, but these could also have been attributed to collateral factors.

A prerequisite for having fixed internet is at least the basic knowledge for accessing it. Considering the internet use skills as a vital resource that can be classified in four relevant categories: operational, formal, informative and strategic (Van Deursen and Van Dijk, 2011), there are significant differences in performance between the categories of the analyzed population that are determined by age and by the level of education. Further sensitivity in internet use by the elderly persons show a high heterogeneity of this group, including gender differences (Ramon-Jeronimo et al., 2013). It would also show an impact on the purpose of using the internet, such as online purchases (Cazacu et al., 2021).

The difference in knowledge is propagated at the gender level, men utilizing the internet more than women, nonetheless, access to the internet being independent of gender (Wasserman and Richmond-Abbott, 2005).

This difference in utilization has been noticed since adolescence, as a research that has included several countries, including Romania, has found that pathological internet use is higher in males than in females adolescents, while for maladaptive internet use this is reversed (Durkee et al., 2012). The authors have mentioned that they have been aware that dependency is more severe in males in general, which might partially explain the results.

In Romania and also for the younger population, the assessment of female and male university students has shown that the skills, the attitude and the use of the internet are higher for males in some studies (Durndell

and Haag, 2002), while in other studies the difference between young male and female participants was not significant, as compared to the age and the education level and subjects studied (Cazan et al., 2016).

Taking into account the higher investment needs in the rural areas in the telecom sector, it is understandable that remote areas have lower internet, including broadband penetration. This is accentuated by lower education levels, aging population, the structure of population in terms of ethnicity, higher unemployment rate and larger primary industry sectors (Sora Park, 2017). A study done for rural Mexico has confirmed that wealth and education are key factors for internet penetration, a positive impact being determined in the households with a greater number of students, while the age and the employment status introduce gaps between categories for internet access and use (Martinez-Dominguez and Mora-Rivera, 2020).

In addition to factors such as age, education level and perceived benefits of internet use, depending on national specificities other significant variables have been noted, such as family support in South Korea (Rhee and Kim, 2017).

In the debate concerning the sources of innovation as either technology push or demand pull, the bibliometric analysis has revealed the role of demand as one important factor (Di Stefano et al., 2012).

3. METHODOLOGY AND DATA

3.1. Data source

The micro data have been collected from the database of respondents obtained during the study undertaken by ANCOM amongst the end users of electronic communication services. It is a tracking study that has as objective to obtain relevant information on the attitude regarding the utilization of the fixed and mobile telephone, fixed and mobile internet and television services by the individuals. This study facilitates the highlighting of the evolution of telecommunication services and the users' attitude regarding relevant aspects such as the problems they meet, reasons for not using the services, the level of satisfaction, the devices owned, the consumption of the services.

The data has been collected during April-June 2022 and it includes 1437 respondents older than 16 years of age, directly involved in the decision to have electronic communications services and who live in Romania. The questionnaire has been filled in by computer assisted telephone interviewing (CATI). The study has used a simple random sample, stratified by locality size. The sample is representative at national level, and the margin of error is +/- 2.59% at a confidence level of 95%.

In order to reach our aim to analyze the factors that influence internet adoption, we have used the variable that shows if the respondents have fixed internet services personally or in the household. The variable has been set to 1 for having fixed internet services and 0 for not having fixed internet services.

The independent variables have been used either in the form that they have been collected from the respondents or in an aggregated form. Age has been measured in years, based on the respondents' direct answers. The family size has been measured by the number of persons in the household and the number of children under 18 years in the household. The gender, the living area and the employment status have been included as dichotomous variables where 1 represents male, urban and employed respectively and 0 represents female, rural and unemployed respectively. For the education the respondents have been offered 10 options increasing from no education to having a PhD and these have been aggregated into 3 categories (primary, secondary and tertiary education). The answers for household income have been in the form of 8 intervals, from no income to income above 10,000 RON and these have been aggregated into 4 categories with values from less than 2,000 RON to above 6,000 RON.

3.2. Methodology

We have started the data exploration with the descriptive analysis in order to determine the profile of the respondents. Afterwards, we have tested our hypotheses that income, education, employment and family size have a positive impact on having fixed internet, while rural areas and age have a negative impact.

In this process, several non-parametric tests have been done, depending on the nature of the variables, in order to determine the association of the parameters with having fixed internet services. The chi-squared test has been used to determine the extent to which having fixed internet is influenced by employment and by gender respectively, taking into account that the analyzed variables are not normally distributed.

In order to verify whether there is a correlation between having fixed internet services and the education and the income interval respectively (that are ordinal variables in the database) Mann-Whitney tests have been undertaken.

The significance of the age has been assessed with Student's t-test for two independent samples (those who have fixed internet and those who don't have fixed internet).

All the parameters have been afterwards factored into the binary logistic regression model in order to determine the correlation between

sociodemographic factors and having fixed internet services. The dependent dichotomous variable of the model (y) is showing if the respondents have fixed internet services and it takes the value of 1 for the respondents who have fixed internet services and 0 for those who don't have these services.

The general form of the model is (Andrei and Bourbonnais, 2008):

$$\ln\left(\frac{p}{1-p}\right) = \beta_0 + \sum_{i=1}^k \beta_i x_i + \varepsilon, \text{ where } p \text{ is } P(y = 1 \mid x_1, x_2, \dots, x_k) \quad [1]$$

In the equation, when x_i increases by one while other variables are constant, the logit (logarithm of OR) increases by β_i .

The model can be rewritten as:

$$P(y=1/x_1, x_2, \dots, x_k) = \frac{\exp(\beta_0 + \beta_1 x_1 + \dots + \beta_k x_k)}{1 + \exp(\beta_0 + \beta_1 x_1 + \dots + \beta_k x_k)} \quad [2]$$

From the calculation we extract:

$$\exp(\beta_0) = \frac{P(y=1/x_1=x_2=\dots=x_k=0)}{P(y=0/x_1=x_2=\dots=x_k=0)} \quad [3]$$

that is OR when all factors are set to 0.

For the β_i coefficient it results that:

$$\exp(\beta_i) = \frac{P(y=1/x_i=1, x_j=0 \text{ for } j \neq i)}{1 - P(y=1/x_i=1, x_j=0 \text{ for } j \neq i)} \times \frac{1}{OR_{base}} = \frac{OR_{x_i=1, x_j=0}}{OR_{base}} \quad [4]$$

Taking into account the multiplicative nature of the model, we determine:

$$OR_{x_1, x_2, \dots, x_k} = \exp(\beta_0) \times \prod_{i=1}^k \exp(\beta_i x_i) \quad [5]$$

that shows the contribution of the x_i factor in the explanation of the probability (as OR) of the event $y=1$, expressed by β_i .

Therefore, while setting $x_i = 1$, $\exp(\beta_i)$ will be the constant multiplicative factor, regardless of the values of other independent variables.

In case $\beta_i = 0$, there is no effect of the corresponding factor because the multiplication is by 1.

For values of β_i different to 0, the likelihood of the event $y = 1$ is reduced by the presence of the factor (when it is negative) or increased (when it is positive).

4. RESULTS AND DISCUSSIONS

4.1. Sample description

The descriptive analysis of the variables offers a first image of the sample. This shows that the great majority of the respondents (72%) have fixed internet.

With respect to the number of persons in the household, most respondents live in households formed by 2 persons and the highest percentages are the ones of the households formed by one to four persons, the rest of the households being represented in a lower number (less than 10%).

At the same time, most respondents (64.4%) don't have children and the households with one child are 21.78% of total households, which could have an influence on having fixed internet through the way in which the decisions are taken in the household or through taking into account the access to the technology skills of some members of the household.

Regarding the education, most respondents have an average level of education, high-school being the most frequent form (37%). One third of respondents have higher education; according to Bologna Implementation report 2024, the percentage of the persons with higher education in Romania is amongst the lowest in Europe and well below the average. This can be a factor that influences the skills level in internet usage for the jobs and therefore the need to have fixed internet.

Income is a relevant variable for our study, as the households with higher income may have a better internet access. The highest percentage of the respondents falls in the income category 4001-6000 RON per household, below the monthly average total income at national level, which was 6464 RON in 2022 (Source: INS press release no. 136 from 7 June, 2023).

With respect to the other socio-demographic data, such as age and gender, we have noticed that the average age of the respondents is 48 years and the gender is balanced at 52.26% women and 47.74% men. We have looked at gender to test if there is an influence on having fixed internet in Romania or the previous observations that there are no gender disparities is sustained.

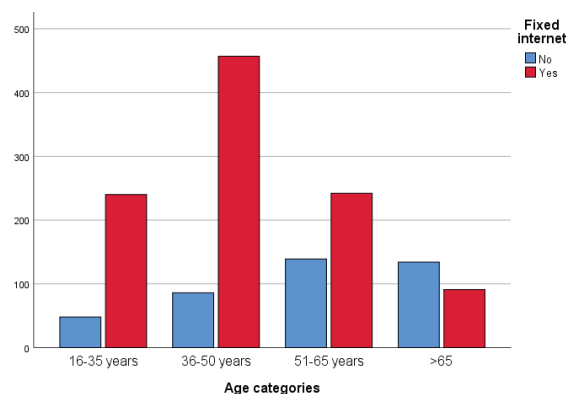
There is also a balance regarding the living area, 57.69% of the respondents being in urban areas.

The percentage of the employed persons is 66.4%. The other respondents are unemployed, retired, students, housewives, on maternity leave or in other situations that are taken into account cumulatively.

4.2. Identifying the factors related to the internet adoption using the statistical hypothesis testing

Looking at the age categories in Figure 1, these are reflected in the percentages in which the fixed internet services are owned, being evident that the respondents of ages 50 and lower enthusiastically adopt these services. After this age, the adoption decreases to the degree that the respondents of 65 years old and older predominantly don't have fixed internet. This is related probably to more specific factors, such as the interest that the respondents of this age show towards new technologies and the skills they have not had the opportunity to develop. The interaction with other age groups and the attitude towards technology could therefore be important factors for the development of the interest for the fixed internet services.

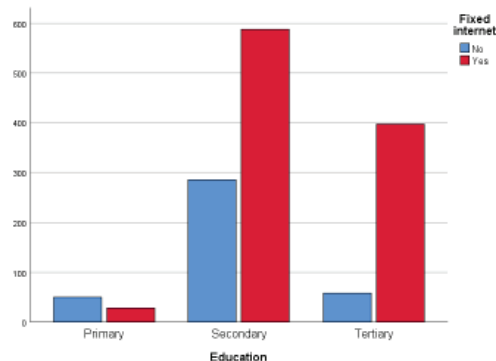
Figure 1. Fixed internet adoption by age



Source: produced by authors based on data from the ANCOM study

The association between education and having fixed internet services can be noticed in Figure 2 by the fact that, amongst the respondents with primary education, the percentage of the ones who have these services is smaller in total. This is reversed for the secondary and tertiary education. The explanation for those who do not have these services although they have tertiary education could be the substitutability with the mobile internet that is more accessible in some areas or maybe that after the completion of the studies the pursued careers do not require internet access in the household.

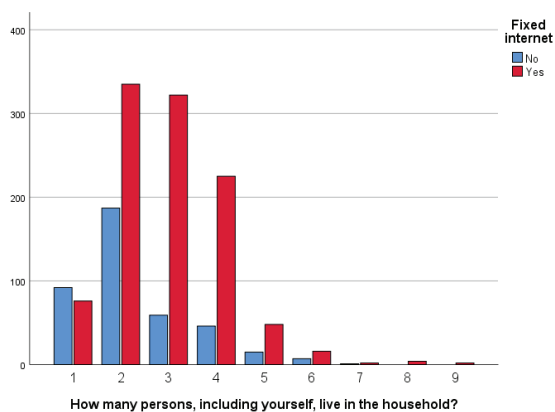
Figure 2. Fixed internet adoption by education



Source: produced by authors based on data from the ANCOM study

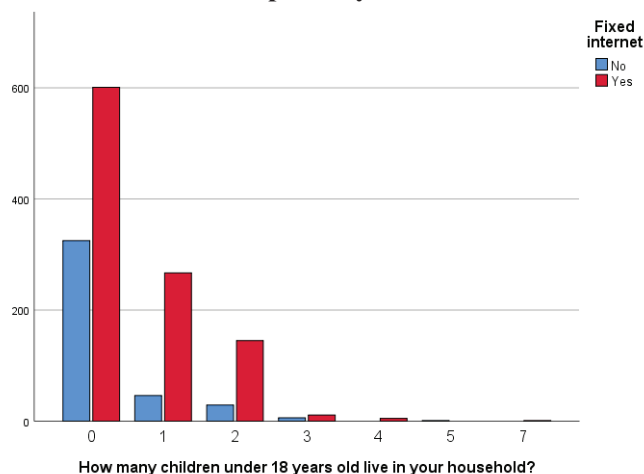
As it can be seen in the household structure in Figure 3 and Figure 4, the number of persons might be associated with having fixed internet services, while the number of children to a lesser extent. This could be a reasonable perspective taking into account suppositions such as the increased pressure from the households members who want internet on those who are less likely to adopt these services or the fact that the increase in the contribution to the expenses related to electronic communications that are fixed costs in nature decreases the individual burden or the need determined by the education process.

Figure 3. Fixed internet adoption by number of persons in the household



Source: produced by authors based on data from the ANCOM study

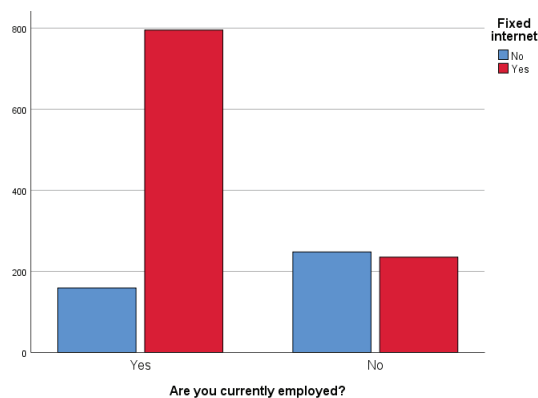
Figure 4. Fixed internet adoption by number of children in the household



Source: produced by authors based on data from the ANCOM study

There are differences between the employed and unemployed persons with respect to the proportion in which they have fixed internet services. Therefore, while there are no significant differences within the unemployed regarding having fixed internet services, within the employed the proportion of the ones who have fixed internet services is higher (figure 5).

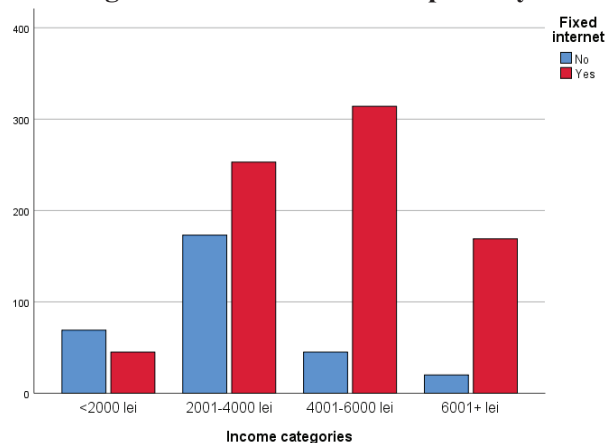
Figure 5. Fixed internet adoption by occupation



Source: produced by authors based on data from the ANCOM study

One possible explanation could be that the unemployed have lower income but, as the percentage of the unemployed respondents who have services is almost as high as the ones who don't, the cost doesn't seem to be an overarching factor, specifically taking into account that in Romania the tariffs are amongst the lowest in Europe. Furthermore, looking at the income categories in Figure 6, it can be noticed that, starting with the income above 2,000 RON, the situation regarding the fixed internet services becomes even and, for larger income categories, the proportion of the ones who have these services is much higher.

Figure 6. Fixed internet adoption by income



Source: produced by authors based on data from the ANCOM study

This observation supports the further investigation of the dependency on the income of the access to the fixed internet, although low income does not completely restrict the access.

Therefore, it could be assumed that the fixed internet is considered a relevant service by the employed individuals and it could influence the labor market specifically in the context of the continued implementation of the work from home during our year of analysis, 2022, that required adequate resources of communication. At the same time, the breakdown on occupation shows that the retired and the unemployed individuals have these services in a lower proportion, which might point to a lower accessibility determined by income levels and the skills needed to interact with the online environment.

In order to determine the extent to which having fixed internet is influenced by employment, a chi-squared test has been used taking into account that the analyzed variables are not normally distributed, as seen in

Table 1. This confirms that the employment has an association with the fixed internet services.

Table 1. The impact of employment on having fixed internet. Results of the chi-squared test

Variables	Pearson Chi-Square	df	P-value	Phi	Cramer's V
Employment	189.957	1.00	0.000	-0.364	0.364

Source: produced by authors based on data from the ANCOM study

During our research, we have undertaken other several statistical tests depending on the used variables with the purpose of identifying the degree to which having fixed internet is determined by certain factors.

In order to verify whether there is a correlation between having fixed internet services and the education and the income interval respectively that are ordinal variables in the database, we have undertaken Mann-Whitney tests.

For all the analyzed data there is a variation determined by having fixed internet services (Table 2). Having fixed internet services increases with the education and the income interval.

Table 2. The role of education and income on having fixed internet. Results of the Mann Whitney test

Variables	Yes (Mean rank)	No (Mean rank)	Z	P-value
Education	762.08	552.50	-10.190	0.000
Income interval	775.17	576.86	-8.319	0.000

Source: produced by authors based on data from the ANCOM study

The Student's t-test for two independent samples (those who have fixed internet and those who don't have fixed internet) for the age shows, in Table 3, that this variable is significantly different in terms of having fixed internet services. Looking further into the data, the average age of those who have fixed internet services is 45 years and for those who don't have these services is 56 years.

Table 3. The role of age on having fixed internet. Result of the Student' t-test

Variables	t	df	P-value
Age	12.103	631	0.000

Source: produced by authors based on data from the ANCOM study

Another non-parametric test done taking into account that the analyzed variables are not normally distributed is chi-squared (table no.4).

Table 4. The role of gender on having fixed internet services. Result of the chi-squared test

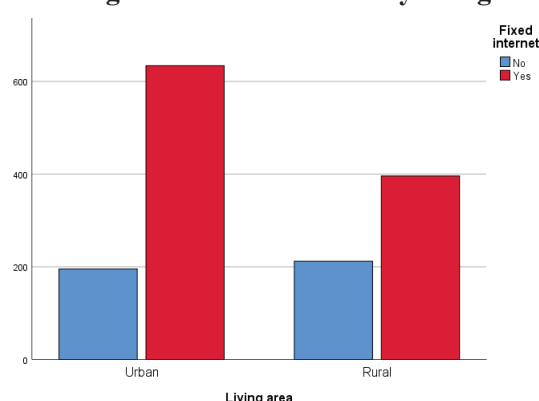
Variables	Pearson Chi-Square	df	P-value	Phi	Cramer's V
Gender	2.218	1.00	0.136	0.039	0.039

Source: produced by authors based on data from the ANCOM study

Based on the probability to reject the null hypothesis, it can be noticed that there is no association between the gender and having fixed internet.

Based on the received answers, there seems to be an association of having fixed internet services with the living area; the number of the individuals who don't have fixed internet is close in urban and rural areas, but the number of those who have fixed internet in the urban area is 3 times higher than for those who don't have these services (figure 7).

Figure 7. Fixed internet by living area



Source: produced by authors based on data from the ANCOM study

4.3. Explaining the fixed internet adoption with binary regression

The information provided by our sample can be better integrated by understanding the specific characteristics of the Romanian electronic communications and particularly fixed internet services. By one hand, according to the Digital Economy and Society Index (DESI) indicators 2023 (that refer to previous years 2022 or 2021, according to the availability of the data), the internet use in Romania was below the European average and basic

skills were almost half the European average and the lowest in the European Union. By the other hand, the percentage of the IT specialists women (as % in total specialists) was 25.2% compared to 18.9% in the European Union and the ITC graduates were 6.9% of the graduates compared to 4.2% in the EU.

Furthermore, Romania ranked first places in terms of fixed very high capacity networks, being the first in fibre to the premises coverage. In Romania, the alternative operators have the highest market share which is an indication that there are competitive conditions for their development. This aspect is reflected in the most competitive prices in the EU.

In this context, our analysis provides an explanation based on the population's attitude toward fixed internet services by using a regression analysis that is appropriate to the variables. The explained variation in having fixed internet services based on our model is 30%. The results in Table 5 show that our assumptions are confirmed for most of the variables.

Results from the binary logistic regression

Table 5

Variables		B	S.E.	Sig.	Exp(B)	95% C.I. for EXP(B)	
						Lower	Upper
Age	Age in years	-0.026	0.007	0.000	0.974	0.962	0.987
Gender	Female						
	Male	-0.047	0.158	0.764	0.954	0.700	1.300
Employed	No						
	Yes	0.684	0.192	0.000	1.981	1.360	2.885
Number of persons in the household	Number of persons	0.182	0.092	0.047	1.199	1.002	1.435
Number of children in the household	Number of children	-0.148	0.142	0.299	0.862	0.653	1.140
Living area	Rural						
	Urban	0.240	0.161	0.137	1.271	0.927	1.744
Income interval	<2000 lei			0.000			
	2001-4000 lei	0.302	0.250	0.227	1.353	0.828	2.209
	4001-6000 lei	1.374	0.298	0.000	3.951	2.203	7.086
	6001+ lei	1.253	0.366	0.001	3.503	1.710	7.174
Education	Primary			0.018			
	Secondary	0.500	0.339	0.140	1.648	0.849	3.200
	Tertiary	0.968	0.383	0.011	2.634	1.243	5.580

Source: produced by authors based on data from the ANCOM study

We have found age to be a significant factor in having fixed internet services, with a negative impact; the difference between average ages of those who have fixed internet and those who don't is almost 10 years. The general literature highlights the age gap is the result of the lack of interest and lack of skills, while few other studies have identified a further divide of the elderly depending on the gender. In one of the previous studies, family support has been identified as a significant factor and we have also determined that the number of persons in the household is statistically significant in the analysis of the adoption of the fixed internet services and it increases the probability to have fixed internet services by almost 20%.

The income and the education have a positive impact on internet adoption. Higher levels of income increase significantly the probability to have fixed internet services. The education is also important and the increase in the level of education is reflected accordingly in having fixed internet services, as it has been assumed and as it was reflected in our previous figure.

At the same time, being employed doubles the odds to have fixed internet. The association between having fixed internet and the employment could be seen in both ways: by one hand the persons who are employed have the necessary income to cover the expenses with communications services and they use the fixed internet services to work from home; by the other hand, as it has been identified in one of the analyzed studies, the access to the internet is the one that determines the increase in employment related both to the higher opportunities to seek and to select the candidates and to the better skills of the candidates.

There is a wide consensus that the rural areas are a challenge and this paper also shows that the urban areas include more persons with access to the fixed internet than rural areas, but this is not significant in our model. One of the reasons identified in previous studies could be the low satisfaction with the quality of the services, but this aspect is applicable to a lower degree in Romania where the respondents declare that they are mostly satisfied and very satisfied with the fixed internet, with low percentage differences between urban and rural.

The gender of the respondents is not a significant variable and therefore it doesn't influence having fixed internet services. In Romania, where the percentage of female ITC specialists is above the European average, the expectations regarding such a difference were even lower.

5. CONCLUSIONS

While the fixed internet deployment has advanced considerably in the latest years, there are still barriers to the access to these services that could be in both sides of the market (the offer and the demand). Our work has focused on the demand side and on the investigation of the relevant sociodemographic factors because in the end the population is the one who uses the services. The adoption of fixed internet services is a complex process that depends on circumstances such as availability, interest, skills, income and support from the family. Our results have clarified the association between the analyzed variables and having fixed internet services, but in some cases it is limited with respect to the underlying reasoning. Additional research could be employed in order to identify the cross-references between the variables or maybe the national or cultural specificities. The research advances constantly with the availability of the data and finds additional evidence to support or to revise previous assumptions.

Our analysis has confirmed the positive impact of the income, the education, the family size and the employment on having fixed internet services and the negative impact of the age, while there is no significance related to the living areas and to the gender.

Taking into account the high relevance of the fixed internet services for the decision factors in Romania determined by the fact that the digitalisation is a driver for the development of other economic sectors, it is utterly important to understand the areas where public policies could improve the adoption of the fixed internet services and what are the measures that can be employed to incentivize its development. The aim should be in fact to make some of the factors irrelevant in the future, while setting appropriate incentives for others. A suitable approach could be to ensure the affordability of the services for all the users and indifferent to the living area. The measures could be aimed at a wide availability of the services that decreases the unit cost or at appropriate subsidies. Additionally, taking into account that previous studies have shown that the behavioral intention is not the underlying factor for the use of internet services by the elderly population, the incentives to adopt the internet could be oriented towards factors such as the increase usefulness, ease of use and even enjoyment by manners that could circumvent the reluctance to embrace innovation. This is the more relevant considering the education has been found to be a significant factor in adopting fixed internet services. Being a long term investment, timely action is advisable in order to keep the pace with technology developments.

The private sector actors can also benefit from the results of the study and identify the possible strategies that could be applied in order to increase

the adoption of these services by narrowing the gap between the different categories of potential users.

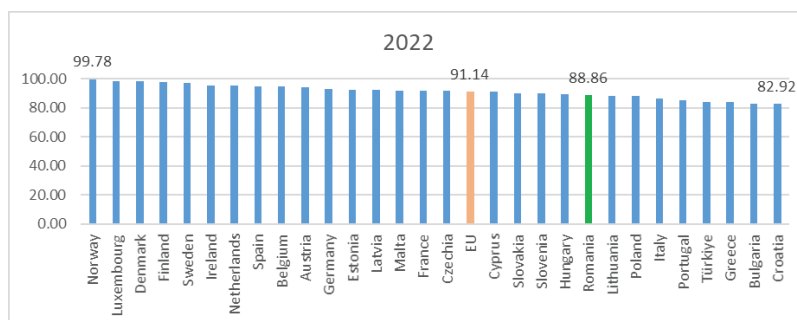
References

1. Alam, K., Mamun, S. (2017) "[Access to broadband Internet and labour force outcomes: A case study of the Western Downs Region", Queensland, Telematics and Informatics, 34(4): 73–84
2. Andrei, T., Bourbonnais, R. (2008) "Econometrie," Editura Economica
3. Bhuller, M., Kostol, A., Vigtel, T. (2019) "How Broadband Internet Affects Labor Market Matching." Available at SSRN: <https://ssrn.com/abstract=3507360>
4. Cazacu, M., Țițan, E., Manea, D., Mihai, M. (2021) "Offensive Strategy Approach of Aging Population in the Context of a Digital Society", Romanian Statistical Review nr. 3/ 2021
5. Cazan, A-M., Cocoradă, E., Maican, C. I. (2016) "Computer anxiety and attitudes towards the computer and the internet with Romanian high-school and university students", ScienceDirect,
6. <https://doi.org/10.1016/j.chb.2015.09.001>
7. DiMaggio, P., Hargittai, E., Celeste, C., Shafer, S.(2001) "From Unequal Access to Differentiated Use: A Literature Review and Agenda for Research on Digital Inequality", Report prepared for the Russell Sage Foundation
8. Di Stefano, G, Gambardella, A., Verona, G. (2012) "Technology push and demand pull perspectives in innovation studies: Current findings and future research directions", ScienceDirect, <https://doi.org/10.1016/j.respol.2012.03.021>
9. Durkee et al. (2012) "Prevalence of pathological internet use among adolescents in Europe: Demographic and social factors", PubMed
10. Durnell, A., Haag, Z. (2002) "Computer self efficacy, computer anxiety, attitudes towards the Internet and reported experience with the Internet, by gender, in an East European sample", ScienceDirect, [https://doi.org/10.1016/S0747-5632\(02\)00006-7](https://doi.org/10.1016/S0747-5632(02)00006-7)
11. Martinez-Dominguez, M., Mora-Rivera, J. (2020) "Internet adoption and usage patterns in rural Mexico", ScienceDirect, <https://doi.org/10.1016/j.techsoc.2019.101226>
12. Steven, P.M., Robinson, J.P.(2007) "The Income Digital Divide: Trends and Predictions for Levels of Internet Use", Social Problems, vol. 54, no. 1, 2007, pp. 1–22
13. Park,S.(2017) "Digital inequalities in rural Australia: A double jeopardy of remoteness and social exclusion", Journal of Rural Studies, Volume 54, 2017, Pages 399–407, ISSN 0743-0167, <https://doi.org/10.1016/j.jrurstud.2015.12.018>.
14. Ramon-Jeronimo, M. A., Peral-Peral, B and Arenas-Gaitan, J. (2013) "Elderly Persons and Internet Use", Social Science Computer Review, <https://doi.org/10.1177/0894439312473421>
15. Kyung Yong Rhee, Wang-Bae Kim (2004) "The Adoption and Use of the Internet in South Korea", *Journal of Computer-Mediated Communication*, Volume 9, Issue 4, 1 July 2004, JCMC943, <https://doi.org/10.1111/j.1083-6101.2004.tb00299.x>
16. Tsetsi, E., Rains, S. (2017) "Smartphone Internet access and use: Extending the digital divide and usage gap.", Mobile Media & Communication. 5. 205015791770832. DOI: 10.1177/2050157917708329
17. Van Deursen, A., Van Dijk, J. (2011) "Internet skills and the digital divide", Sage Journals
18. Wasserman, I., M., Richmond-Abbott, M. (2005) "Gender and the Internet: Causes of Variation in Access, Level, and Scope of Use", Social Science Quarterly, <https://doi.org/10.1111/j.0038-4941.2005.00301.x>

19. Whitacre, B., Stover, S., Gallardo, T. (2015) "How much does broadband infrastructure matter? Decomposing the metro–non-metro adoption gap with the help of the National Broadband Map", Government Information Quarterly, Volume 32, Issue 3, 2015, Pages 261-269, ISSN 0740-624X, <https://doi.org/10.1016/j.giq.2015.03.002>
20. The European Higher Education Area in2024 - Bologna Process Implementation Report

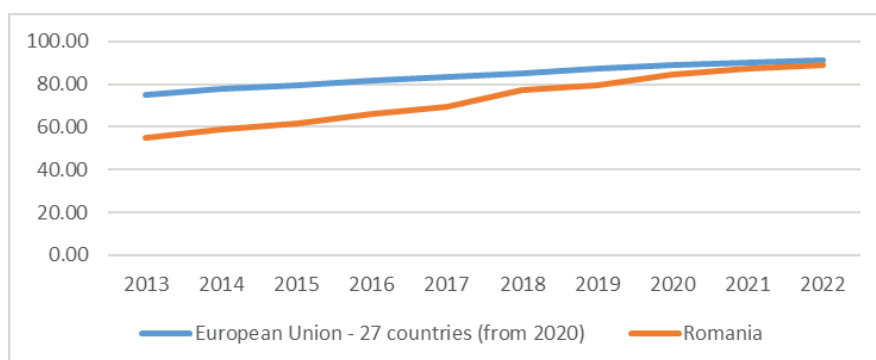
Annex 1

Figure 8. Fixed internet utilization at the European level in 2022



Source: produced by the authors based on Eurostat data

Figure 9. Fixed internet utilization evolution



Source: produced by the authors based on Eurostat data

Annex 2

Table 6. Internet data for Romania for 2022

Internet	Number of connections (millions)	Annual traffic (thousands PB)	Average monthly traffic per inhabitant (GB)	Connections in total	Traffic in total
Fixed internet	6.36	15.7	69	23%	89%
Mobile internet	21.37	1.85	8.1	77%	11%
Total	27.73	17.55	77.1	100%	100%

Source: produced by authors based on data from the ANCOM study