Age for learning, age for teaching: The role of inter-generational, intra-household learning in Internet use by older adults in Latin America

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ABSTRACT

Given the accelerated aging of the global population, countries must prepare to assure their older adults’ welfare. The Internet appears to be a means of ensuring that everybody, regardless of age, has access to information and can stay in touch. Data so far show the existence of a digital divide, so the question becomes: Is there a way to accelerate the digital inclusion of older adults? Using microdata from Buenos Aires (Argentina), Lima (Peru) and Guatemala City (Guatemala), this paper focus on the role of younger people in the household in the process of Internet adoption by older adults. Regression analysis confirms that younger people play a pivotal role in the adoption process, but not in intensity of use, in which living with a spouse or partner is important for increasing the number of hours spent using the Internet.

Keywords

Digital divide, elders, Internet, technology adoption, developing countries.

INTRODUCTION

Many countries now have aging populations because of decreased mortality rates and a significant drop in fertility rates. According to demographic estimates for the aggregate global population, the number of older adults aged 60 and over will more than double, from 841 million people in 2013 to more than 2 billion by 2050 (UN, 2013), which is expected to be the first year when the number of older adults exceeds the number of minors in the world. Developed countries are currently experiencing accelerated aging of their populations, while developing countries are following the same trend, but still have a few decades to go before their population pyramids invert.

Given this situation and the need to act quickly and effectively to avoid the potential negative consequences of the inversion of the global population pyramid, information and communications technologies (ICTs) offer ways to improve channels of communication, to facilitate the exchange of information around the world and to ease everyday tasks and administrative procedures, reducing transaction costs. Specifically, the Internet has expanded worldwide, with the promise of providing information to those who are not included and those who have health problems or disabilities (Chu et al., 2009; Eastman & Iyer, 2005). As the population of older adults grows, the Internet emerges not only as a tool for their social inclusion, but also as a means of improving various aspects of quality of life.

Taking an optimistic view, the Internet benefits older adults in the area of health, providing relevant information and enabling them to obtain higher-quality services at lower prices; it enables older adults to remain active and to continue learning through virtual activities that could be more convenient, given their physical and cognitive limitations; and it allows immediate and less-expensive communication with relatives and friends. The services and activities it offers make the

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Internet an effective tool for combating the four plagues identified as characteristics of old age: loneliness, boredom, lack of assistance and decreased mental abilities (Opalinski, 2001).

Despite this potential, there is a clear gap in ICTs (e-inclusion) between age groups in most countries; this is termed the digital divide. It refers to inequalities in access, adoption, use and knowledge of ICTs among different population groups, among which older adults are one of the groups excluded from new technologies.

In this study, we use the Survey about Internet Use: Platforms and Open Data (SIU – 2014), to address the relationship between older adults and ICTs in these three Latin American countries, using a quantitative methodology to explore reasons that explain Internet access among older adults. Our study aims to help fill a gap in the literature, highlighted by Bailey & Ngwenyama (2010), regarding the effect of inter-generational interaction on Internet adoption by older adults.

Following Milligan & Passey (2011) we seek evidence of the impact on ICT adoption of older adults living in the same household as minors, given the possible ambiguity of the effect of inter-generational interaction. It could create positive externalities that facilitate the adoption of ICTs by older adults or the effect could be perverse if it inhibits learning of new technologies because of shame to show the lack of knowledge.

This paper is organized as follows: In the next section, we review the literature about the digital divide and the use of ICTs and Internet, followed by an explanation of the Technology Adoption Model (TAM) that guides the empirical strategy. Then we develop the empirical strategy through an inferential regression strategy to analyze the influence of family structure on Internet adoption by older adults. Finally, we present results and discussion along with the paper conclusions.

LITERATURE REVIEW

Older adults are the fastest-growing group of new Internet users (Eastman & Iyer, 2005); nevertheless, and despite the many benefits identified as resulting from Internet adoption (Opalinski, 2001; Muñoz 2002; Selwyn 2004; Campbell 2005; Kiel 2005; Jiménez et al. 2007; Sum et al. 2008; Gatto & Tak 2008; Milligan & Passey 2011 and Saboor et al. 2015), penetration of Internet use among older adults has been lower than expected in developed countries and lower still in developing countries.

According to Zickuhr & Madden (2012) only half of the older adults in the United States had Internet access, compared to rates of more than 70% for the rest of the population and over 90% for the youngest cohorts. This global phenomenon has been termed the digital divide, and it has been defined as the existence of inequalities in access to, use of and knowledge of search strategies and connection quality between age cohorts or income quintiles of the population (Eastman & Iyer, 2005).

In addition, Eastman & Iyer (2005) confirm that the digital divide is becoming a “gray gap,” in reference to the divide that is developing between older adults at the higher end of the age spectrum and those who are just entering that category. The existence of the gray gap reveals that age is a determining factor in ICT adoption (Barbosa & Amaro, 2012), and that the divides are also reproduced within the cohort of older adults.

The existence of the digital divide in the older adult population is due to a series of barriers that complicate their access to ICTs. This group of barriers has led to prejudice that older adults are “technophobes” who fear or avoid technology (Barbosa & Amaro, 2012). This stereotype has resulted in stigmatization of and discrimination against older adults regarding their interaction with the Internet and has created preconceived notions about their inability, inferiority and lack of interest in using the Internet, as well as a paternalistic attitude.

The random experiment conducted by White et al. (2002) belies the rumor that older adults are technophobes; after a group of them participated in workshops on ICT use, it was reported that 60 percent continued to use the Internet weekly. Barbosa & Amaro (2012) find that in a sample of older adults in Lisbon, 61% agreed that they should learn to use computers, while 76% acknowledge that computers are essential for the country’s development. Zickuhr & Madden (2012) show that for older adults who learn to use the Internet, it becomes part of their daily routine and they become fervent users. These are clear examples of the positive attitude of older adults toward ICTs, and indicate that they do not perceive themselves as technophobic, but encounter a series of obstacles that make Internet adoption difficult for them.

In identifying and characterizing those barriers, Blaschke et al. (2009) develop a typology of five main groups:

i. Problems characteristic of age.

Such as limited visual capacity, problems with manual dexterity and mobility in general, cognitive and memory challenges, and limitations on everyday activities.

ii. Characteristics of existing technology

1 Unfortunately, there is no information available about levels of use by age group in Latin America.
Complexity of interfaces, small type size, problems of use related to system design, computer jargon and the fact that many technologies are extremely complicated to use or do not work properly.

iii. Attitudinal issues

The lack of benefits perceived the belief that technology is hazardous, expensive, complicated and difficult to learn leads to a lack of interest that becomes a barrier to access.

iv. Training and support

Learning to use the Internet requires knowing how to use a computer and databases, what information is available and how files are saved (Saboor et al., 2015) and the lack of specialized workshops

v. Costs

Costs of new technologies are still prohibitive for households in which older adults live. The lack of a computer and inequality between territories and socio-economic levels are still barriers to Internet access for older adults (Jiménez et al., 2007) more pronounced in developing countries.

Along with the barriers identified above, one obstacle characteristic of age is the strong influence of generational differences on the use of ICTs. As social identity theory indicates, these consist of characteristics such as the person’s social context of origin, age, gender, degree of knowledge and membership in different community groups in which cooperation is more likely when these are shared (Bailey & Ngwenyama, 2010). Mutual assistance can therefore be expected between people who identify as socially similar and will be even stronger in people who share the same social representations that tend to vary between generations.

The question, therefore, is how Internet adoption by older adults is influenced when they interact with young members of the household. As Bailey & Ngwenyama (2010) note, few studies have identified this effect and research on the impact of inter-generational interactions through ICTs will be very useful.

Various authors agree that effective Internet adoption by older adults occurs in contexts in which they find an appropriate reason to be interested in ICTs. One example of this type of motivation for older adults is the possibility of connecting with grandchildren or other relatives when they are geographically dispersed (Vilte et al., 2013).

When households include young members, older adults are more interested in ICTs when they see how younger people use them and inter-generational transfer of knowledge occurs despite the digital divide (Bailey & Ngwenyama, 2010). We can classify this phenomenon as older adults taking advantage of positive externalities related to ICTs when there are younger relatives who act as “warm experts,” because they are friends or relatives who are knowledgeable about ICTs and are familiar with the situation of the novice user (Bakardjieva, 2005 and Fernández-Ardèvol, 2014).

Intra-family relationships therefore may play an important role in Internet adoption by older adults, because many begin to use it as a result of relatives’ efforts to stay in touch and to include them in the information society. As Vilte et al. (2013) and Barbosa & Amaro (2012) point out, young people encourage and explain the use of ICTs to older people and as the children grow up, they typically give their used devices to the elders to facilitate access (Gatto & Tak, 2008). Another key characteristic of the environment is older adults see that their peers are already using new technologies (Opalinski, 2001). Gatto & Tak (2008) show that older adults who have spouses or partners are more likely to use computers.

The literature review in Milligan & Passey (2011) shows two possible effects of this inter-generational interaction. First, they note that many older adults have learned to use ICTs indirectly, by seeing how they are used by relatives and friends. In the report on Older Adults and Digital Inclusion prepared for the United Kingdom (Age Concern & Help the Aged, 2009), it was found that most elderly people have learned what the Internet has to offer them thanks to their children, grandchildren or partners, and by watching how those people use devices. The authors note, however, that the presence of younger family members may inhibit older people’s learning and their relationship with the technology. It was found that older adults in the United Kingdom are embarrassed about their lack of computer and Internet skills, especially when they are with young members of their families, because the younger people become impatient with their lack of knowledge of ICTs, while the older adults blame themselves for feeling that they “have to know” how to use the devices (Age Concern & Help the Aged, 2009).

Given this ambiguity in inter-generational relationships about ICT use and adoption, Milligan & Passey (2011) add to the research agenda the task of finding evidence of the impacts and influences of children and grandchildren on the adoption of technology by their parents and grandparents.
CONCEPTUAL MODEL

We used the Technology Acceptance Model (TAM) of Lee et al. (2014), following the recommendation by Niehaves & Plattfaut (2014) to aggregate socio-demographic variables. We operationalized the model using variables from the SIU survey, as detailed in the matrix in Table 1.

Figure 1. TAM model with socio-demographic variables

According to Lee et al., the most significant factors in Internet use are the person’s educational level and economic resources, considered approximations of socio-economic level. In second place is the potential user’s perception of the net’s usefulness, which will determine expectations of the gains expected from potential adoption and, therefore, the decision about whether to invest time in learning to use ICTs. Related to usefulness, the older adult’s expectation of ease of use is also a factor, taking this population’s characteristics into account, as physical and mental impediments can make using a computer more complicated. Fourth, they consider expected enjoyment of ICT use, as older adults also become frustrated during the process of learning. Finally, Internet stress, understood as frustration and lack of control over situations (Lee et al., 2014), and the “subjective norm” are included as explanatory variables. In the case of the former, older adults may become discouraged quickly, while the subjective norm refers to the encouragement that older adults receive from relatives or peers to adopt ICT.

EMPIRICAL STRATEGY

Our hypothesis is that, after controlling for demographic and socio-economic variables, family structure influences Internet adoption and degree of use by older adults. We specifically postulate that the presence of minors in the household promotes Internet access, as it is a positive externality that enables older adults to learn to use the Net, as well as an intrinsic motivation for them that promotes effective adoption (Vilte et al., 2013). We also postulate that the presence of other older adults in the household will have a positive impact on their relationship with new technologies.

We employed the Survey about Internet Use: Platforms and Open Data (SIU 2014) which main objective was to analyze the use of ICTs and their potential for development in metropolitan areas of the capitals of Argentina, Peru and Guatemala.

The population studied consists of men and women over age 13 from all socio-economic levels in the metropolitan areas of Buenos Aires, Lima and Guatemala City, using a two-stage probabilistic sampling by conglomerates. The sample contains 3,600 surveys (1,200 households in each city), and only one randomly selected person in each household was surveyed about patterns of use of and access to ICTs; we refer to this person as the “informant.”

Data analysis was performed for members who were age 60 or over, since this is the cutoff frequently used in the literature (Barbosa & Amaro, 2012), and selected as informants.

Although the literature indicates that cognitive age should be considered a better measure for this socio-demographic variable, Eastman & Iyer (2005) state that this is strongly correlated with chronological age and can therefore be used as a highly valid proxy variable.

The technical specifications and univariate analysis for each capital can be found at http://dirsi.net/web/web/es/noticias-y-eventos/noticia/dirsi-publica-estudio-sobre-uso-de-internet-en-america-latina
Identification Strategy

We employed a count model to explain the number of days per month that an older adult uses the Internet, emphasizing the role of family composition. As Greene (2003) notes, dependent variables (y) measured as positives whole numbers can be analyzed with Ordinary Least Squares but the predominance of zeroes as small values and the discrete distribution makes us inclined to use more efficient techniques that take these of the variables into account; since \( y \in \mathbb{N}_0 = \{0, 1, 2, \ldots \} \).

We chose to estimate a Hurdle model, because it differentiates the process that generates data for all observations—which include zero and positive whole numbers—from the process that generates information for positive values of the dependent variable. The Hurdle model relaxes the assumption that the initial decision about whether to use the device and the subsequent decision about the number of days the older adult decides to use the Internet, given that he or she previously decided to do so, stem from the same data-generation process. It therefore becomes a model with two independent stages: first, considering the decision about whether or not to use the Internet; and then, given that people have decided to connect to the Internet, they indicate the amount of time they wish to devote to that activity.

We believe that the explanatory values, show differentiated effects and significance for each decision process, where we seek to determine the effect of the family on whether or not older adults use the Internet and whether they use it for a longer time.

Because the two parts of the model are independent, the Hurdle model can be estimated using Maximum Likelihood (ML), maximizing the two terms of likelihood separately, where one will correspond to zeroes and the other to positive values in the distribution (Cameron & Trivedi, 2009). The first part therefore will use the entire sample of observations, while the second part of the estimate will use only the observations with positive count values. For that first stage of the estimate, it is possible to use any discrete choice model; we chose a probit model over the logit model because of the AIC and BIC information criteria.4

The variables included in the reduced model were selected through the operationalization of the TAM model. Descriptive statistics are showed in Table 1. The \( \beta \) vectors estimated for each stage are shown in Table 2, while Table 3 shows the average marginal effects (AME) for each of the explanatory variables.

### Table 1. Regression variables

| Conceptual Variable | Empirical Approximation | Average | Std. Dev. | Median | Minimum | Maximum |
|---------------------|-------------------------|---------|-----------|--------|---------|---------|
| Use of Internet     | Number of days of internet use | 7.45    | 11.42     | 0      | 0       | 30      |
| Family structure    | Number of children in household | 0.23    | 0.63      | 0      | 0       | 4       |
| Family structure    | Married or cohabiting    | 0.55    | 0.50      | 1      | 0       | 1       |
| Socioeconomic status| Years of education      | 9.52    | 4.22      | 11     | 0       | 18      |
| Socioeconomic status| Total average monthly spending | 1202.8  | 1077.1    | 976.8  | 106.5   | 15577.4 |
| Perceived usefulness| Agrees: Internet is a need | 0.62    | 0.49      | 1      | 0       | 1       |
| Perceived enjoyment | Agrees: Internet to be integrated | 0.85    | 0.36      | 1      | 0       | 1       |
| Internet stress     | Agrees: Internet is waste of time | 0.23    | 0.42      | 0      | 0       | 1       |
| Subjective norm     | Learned to use with family / friend | 0.17    | 0.38      | 0      | 0       | 1       |

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4 A detailed explanation of the model can be found in Barrantes, R. & Cozzubo A. (2015) Edad para aprender, edad para enseñar: el rol del aprendizaje intergeneracional intrahogar en el uso de la internet por parte de los adultos mayores en Latinoamérica. Documento de trabajo 411. Lima: PUCP.
RESULTS

We operationalize socio-economic status in two ways: through the older adult’s educational level and the household’s average monthly spending. Perceptions of usefulness, enjoyment and ease of use are operationalized using different dichotomous variables that reflect whether older adults agree that having Internet in the household is a necessity, if they agree that new technologies are important for keeping oneself integrated, and whether he or she has a job at the time, respectively. The latter variable is used as a proxy for ease of use, because for older adults, being employed tends to be associated with being active and alert. Finally, the categories of Internet stress and subjective norm are reflected in variables that indicate whether the older adult agrees that the Internet is a waste of time and whether he or she learned to use the Internet from family or friends, in that order.

For hypothesis variables, family structure was considered through the number of minors in the house, taking 18 as the cutoff age, and whether the older adult is married or cohabiting, to reflect the presence of a partner. Control variables added to the model were the country of residence, the number of devices per capita in the household and the number of devices belonging to the older adult informant. Those suggested by Niehaves & Plattfaut (2014) were also included: age and gender.

The marginal effects represent the change in the probability of Internet access by the older adult, given a change in a unit of the independent variable of interest. For the second stage, with the negative binomial regression (NB2) truncated to positive values (TNB2), the values of the β vector are interpreted as semielasticities. Marginal effects are interpreted in levels.

| VARIABLES | (1) Probit | (2) TNB2 REG |
|-----------|------------|-------------|
| Number of children in household | 0.34739*** | 0.00010 |
| Married | 0.13148 (0.12028) | 0.24036*** (0.05240) |
| Years of education | 0.10699*** (0.17458) | 0.01171 (0.08466) |
| Total average monthly spending | 0.00007 (0.02442) | 0.00002 (0.01438) |
| Agree: Internet is a need | 0.76194*** (0.19484) | 0.25639** (0.12967) |
| Agree: Internet to be integrated | -0.37538 (0.23514) | 0.30683 (0.19930) |
| Agree: Internet is a waste of time | -0.53883** (0.22811) | 0.25820** (0.11668) |

Source: SIU 2014.

Table 2. Hurdle regression by ML – Number of days of Internet use per month
### Table 3. Marginal effects, Hurdle regression

| VARIABLES                          | (1) AME Probit | (2) AME TNB2 REG |
|------------------------------------|----------------|-----------------|
| Number of children in household    | 0.07299***     | 0.00203         |
|                                    | (0.02464)      | (1.06266)       |
| Married                            | 0.02760        | 4.76547***      |
|                                    | (0.03646)      | (1.61642)       |
| Years of education                 | 0.02248***     | 0.23754         |
|                                    | (0.00487)      | (0.29186)       |
| Total average monthly spending     | 0.00002        | 0.00033         |
|                                    | (0.00002)      | (0.00037)       |
| Agree: Internet is a necessity     | 0.16318***     | 4.79870**       |
|                                    | (0.04121)      | (2.24503)       |
| Agree: Internet to be integrated   | -0.07928       | 5.51531*        |
|                                    | (0.04986)      | (3.12063)       |
| Agree: Internet is a waste of time | -0.11357**     | 5.83036**       |
|                                    | (0.04787)      | (2.91081)       |
| Has job                            | 0.15224***     | 0.89975         |
|                                    | (0.04013)      | (1.70492)       |

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
DISCUSSION

As noted above, the Hurdle model that we used consists of two stages: the first, in which the regression is conducted using a probit, the dichotomous variable that represents whether or not the older adult accessed the Internet (we consider that there has been access when the number of days of Internet use per month has a positive value), while in the second stage, we used a negative binomial regression, which allows us to relax the assumption of equidispersion and in which the dependent variable will be the number of days per month that the older adult accesses the Internet. We chose this methodology because we understand that each part of the decision about ICT use has a different nature: First, is the decision about whether to use the Internet, and second is a decision about the intensity of monthly use.

Probib

Altogether, we find that most of the explanatory variables have a high significance since only four showed no explanatory power. Analyzing the goodness of fit (count and pseudo R2), we can confirm that the TAM model has a strong explanatory power for the decision by older adults to access the Internet. Evaluating the variables that operationalize the TAM model, we find that—except for perceived enjoyment—they are all strongly significant and with the expected sign; which places another probe of the predictive power of the TAM model and of the choice of the probit discrete choice model for this first stage.

Analyzing the specific influence of the hypothesis variables for the older adult’s initial decision about whether or not to access the Internet, we see that cohabiting with a spouse or partner do not affect this decision, which we could interpret as both being in a situation where they seek access to the Internet or both being disinterested given the characteristic of households in which we found where older adults usually live alone or accompanied by another elderly person. In contrast, the number of children living with older adults in the household does have a significant effect at all confidence levels for explaining the decision to access the Internet. This indicates that the inter-generational transfer of knowledge within the household is a positive externality, which tends to occur among older adults when they receive support and instruction from family members who are minors. We thus prove our hypothesis concerning the probability of older adults’ access to the Internet, because adding a child to the household could increase by 7% the older adult’s probability of accessing the Internet.

Negative Binomial Regression

In the second stage of the regression, the dependent variable was the number of days per month that the older adult uses the Internet, as long as it is greater than zero. In this count model, the point estimators are interpreted as semi-elasticities, while the marginal effects, calculated as AME, are interpreted in levels.

We found three significant variables: married, Internet as a waste of time and Internet as a need. Analyzing the hypothesis variables related to family structure for this stage of the regression analysis, we find that the significance is the opposite of what we found in the probit segment. The number of children in older adults’ households does not have a significant influence. On the other hand, currently living with a spouse or partner does have a positive and significant effect at all levels.

Older adults who lives with a spouse or partner show an average increase of 24% in the monthly number of days they use the Internet, which translates into 4.76 additional days considering the AME. These results could indicate that minors in the household encourage older adults to access the Internet through inter-generational learning but they have no effect regarding intensity of the older adults’ use. In contrast, the spouse or partner may affect intensity of use, which suggests two possible interpretation. Older adults who already adopted Internet could be the “warm expert” for the older adult who has not adopted yet, by being a person in the household with whom to discover the Internet, but who would not influence the primary
decision about whether or not to use the Internet. Alternatively, the effect could be related to the partners’ need for space as searching their own space and setting aside interaction with the partner for another type of activity.

To sum up, contrasting the hypothesis about the influence of family structure on Internet access and intensity by older adults, we can consider that the presence of a partner and minors has a sort of objective norm effect, because close family members are the ones who influence both the intensity of use and the decision to access the Internet, respectively, in older adults. The results indicate that minors play an initial role of support and transmission of knowledge for older adults in the household, while the role played by the spouse or partner is related to the amount of time spent using the Internet.

CONCLUSION

This study is an effort to contribute to the literature about older adults and their adoption and use of ICTs in Latin America. The global phenomenon of population aging, which is also occurring in this region, poses a new challenge for developing countries while ICT use by older adults offers a series of potential benefits in areas such as health, learning, activity levels, entertainment and hobbies, personal well-being, communication and everyday activities.

Despite those benefits, older adults in the region are excluded from the information society due to a set of barriers caused by age-related problems, difficulties in operating technologies technology characteristics, attitudinal barriers on the part of older adults, lack of training and support and financial barrier.

One strategy for overcoming barriers of lack of support and attitudinal barriers arises from the family structure, which influences older adults’ adoption and use of ICTs. Through a positive externality that exists when there are minors in the household, children could promote older adults’ Internet use through inter-generational learning in the use of new technologies, serving as warm experts.

Using the TAM model, based on data from the SIU 2014, we conducted a regression analysis to probe the potential effects of minors in the households. We employed a count model in two independent stages, with two data-generation processes: the decision by older adults to access the Internet and the number of days per month that they use the Internet. The estimation was performed with a set of explanatory variables that operationalize the TAM model for both stages.

The results of the statistical analysis show that our hypothesis variables related to family structure in households with older adults were significant. The presence of minors in older adults’ households encourages their access to the Internet, although it had no significant effect on intensity of use. On the other hand, living with a spouse showed an increase in intensity of Internet use, but had no effect on the initial decision to use the Internet.

These results show evidence of the transfer of knowledge between children and older adults in the household, which we have called inter-generational intra-household learning. We believe this represents a positive externality for older adults when they live with minors. The results of the study therefore support the possible importance of interaction regarding ICTs, through the role of warm experts, which could enable older adults to overcome barriers that cause the digital divide.

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