Decomposing the ICT use gender gap for five Latin American countries

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Abstract

Even though women represent more than 50% of the total Latin American population, they face a set of barriers that do not allow them to be in equal conditions with respect to their male peers. The ICT (Information and Communication Technologies) field is not an exception. The possibility to access and use the Internet is not evenly distributed between men and women (Gray, Gainous, & Wagner, 2016)and factors such as education, employment or discrimination could play a fundamental role in explaining gender differences in ICT use (Robinson et al., 2015). However, the existing literature about this topic is scarce, especially in Latin America; moreover, such an analysis becomes more challenging when attempting to include all the different dimensions that ICT use involve). In this sense, our research analyzes the factors that determine the gender ICT use gap, integrating the different dimensions that ICT use involve. The main results indicate that in Paraguay and Argentina factors like occupation, education or age play a more important role in explaining the ICT use gender gap. In contrast, unobserved factors do so in Peru and Guatemala.

Keywords: ICT, gender gap, discrimination, unobserved factors, Latin America

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Introduction

Even tough women represent more than 50% of the total Latin American population,[4] and as in many parts of the world, they face a set of barriers that derive into unequal conditions for them relative to their male peers. Particularly in this region, women are overrepresented in lower income quintiles, in informal labor sectors and in low-payment activities. According to ILO (2016), the unemployment rate of women is around two times higher than the one for men; they receive lower levels of wages in all occupational segments; and they face worse labor conditions.

Regarding education, although there have been significant advances towards gender equality in basic levels, women remain underrepresented in STEM fields (science, technology, engineering and mathematics). Furthermore, these differences are more critical in higher hierarchies (Castillo, Grazzi, & Tacsir, 2014).

Gender disadvantages towards women are also evident in other social and cultural contexts. There are entrenched discriminatory social norms and persistent structural barriers such us early motherhood, gender-based violence, gendered division of household labor, among others (UNESCO, 2015).

The ICT field is not an exception. The possibility to access and use the Internet is not evenly distributed between men and women (Gray et al., 2016) and factors such as the ones mentioned above could play a fundamental role in explaining gender differences in ICT use (Robinson et al., 2015). However, the existing literature about this topic is scarce, especially in Latin America; such an analysis becomes more challenging when attempting to include all the different dimensions that ICT use involve (mobile ownership, mobile use experience, mobile apps use, e-banking and e-commerce, Internet use, type of Internet use, among others). Trying to fill this gap in the literature, we analyze the factors that determine the gender ICT use gap, integrating the different dimensions that ICT use involve.

With this objective in mind, the paper is organized as follows. We first describe the components of the proposed ICT index and estimate its value for each country in the After Access Latin

4 World Bank Indicators (2017).

American sample.[5] Then the quantitative methodology used to identify the factors underlying the ICT gender gap is described, followed by the most important results. Concluding remarks close the paper.

ICT gender inequalities

Information technologies are usually said to be gender neutral, however existing social power relationships determine who benefits and shapes the content, development and use of them (SIDA, 2015). In particular, cultural values and practices tend to exclude women from access and development of these technologies, moreover these entrenched norms constrained women from the benefits that ICT could bring them in different dimensions of their lives, like education, relationship with the government, labor, among others (Rashid, 2016; Spence, 2010). When ICT policy is not designed to revert these tendency, it will be difficult for women to obtain the same benefits as men from the digital paradigm (Hafkin, 2002).

Robinson et al (2015) explain two main mechanisms by which digital gender gaps arise: (1) socio-cultural roles and patterns that favor men; and (2) jobs requiring intensive use of technologies, which are associated with men. Regarding the former, social roles people take on when they use ICTs are an extension of social roles. Women tend to have less confidence in their ICT abilities than men; and even though there is no difference, this tends to have consequences in actual outcomes (Hargittai & Shaw, 2015). About the second mechanism, Robinson et al (2015) state that occupations requiring more intensive ICT use are usually linked to male figures: men far outnumber women in jobs such as digital development or design.

(Gill, Brooks, McDougall, Patel, & Kes, 2010) discuss other mechanisms, or barriers, that exist in developing countries, especially for poor people, which keep women at a digital disadvantage in comparison to men: exclusion from technological education, time constraints, social norms that favor men, and financial limitations. These barriers are explained as follows:

A. *Exclusion from digital education:* men have an advantage in digital technical higher education. Women usually are considered recipients of technologies, but not designers

[5] The After Access Survey (2007) gathered up nationally representative information about individuals' Internet and mobile phone access and use. It was carried out by the DIRSI network in five countries, Argentina, Colombia, Guatemala, Paraguay and Peru, during April and August 2017. For more information: https://olatics.net/wp-content/uploads/2018/01/doc-tecnico.pdf.

or creators. In some cases, they also lack the basic education necessary for using ICT adequately.

B. *Limited free time:* in less-developed countries, women carry a heavy burden of family tasks compared to men, such as cooking, cleaning and childcare. This keeps them from being able to spend time using digital devices, let alone improve their digital skills.

C. *Social norms that favor men*: in some social contexts, there are stereotypes that give men an advantage over women when it comes to acquiring ICT skills. For example, at home, men are the self-appointed regulators of electronic devices (computers, TVs or cellular phones), or at work, ICT-intensive tasks are assigned to men instead of women.

D. *Financial and institutional constraints:* on average, women tend to have fewer resources than men for securing loans. This relative lack of capital keeps women from being able to acquire electronic equipment on credit, which limits their ability to develop digital skills.

Similarly, SIDA (2015) points out other specific ICT related issues. First poverty: it has a multidimensional impact on women, as they earn less than their male peers and have less opportunities for quality work and access to financial access, this limit their possibilities for access and use of different types of new technologies. On the other hand, women and girls mainly in rural areas often have lower education levels and less social capital. Hence, they face important barriers when using Internet and Social Media where the predominant language is English. In third place, Science and Technology are usually viewed as more suitable to men, this is particularly true when referring to engaging STEM professions and occupations.

Finally, SIDA indicates three dimensions regarding gender safety and related policy: Cyberlaws are often gender blind; women's rights defenders face gender specific risk (e.g. misogynist hate speech or increasingly harassment and threats); and the lack of digital safety for women and women's activists.

The ICT index for five Latin American countries

The ICT index for the Latin American region consists of two sub-indexes and eight indicators. The first sub-index is related to mobile phone use, and includes the following variables: smartphone ownership, mobile use experience, mobile application use and mobile banking and e-commerce. The indicators in this sub-index are mainly related to more modern uses of mobile

phones. For example, it includes only smartphone ownership (excluding "basic phones", with no Internet access). It also takes into account the use of a wide variety of mobile applications (nine different types).

Similarly, the second sub-index includes Internet use, and has the following four indicators: Internet use, Internet use experience, Internet devices and online activities.[6] The definitions of the indicators which are part of both sub-indexes are shown in Table 1.

Graph 1 shows the calculations of the ICT index for each country of the Latin American After Access 2017 survey, including values by gender. In particular, Argentina and Colombia have the highest average values for the index, which means that both countries have a wider variety and higher intensity of ICT use. On the other hand, Paraguay and Guatemala show the lowest levels.

In terms of the differences in the ICT index between men and women, Peru and Guatemala exhibit the largest gaps. In both countries the gap accounts for more than 22% in favor of men (relative to women); in contrast, this gap reaches only 5% for Argentina, Colombia and Paraguay. On average the region has a relative gap of 10%.

6 The ICT index is the simple average of the eight normalized indicators. The normalization process is needed to make sure that all the indicators are in the same scale, and it follows this formula:

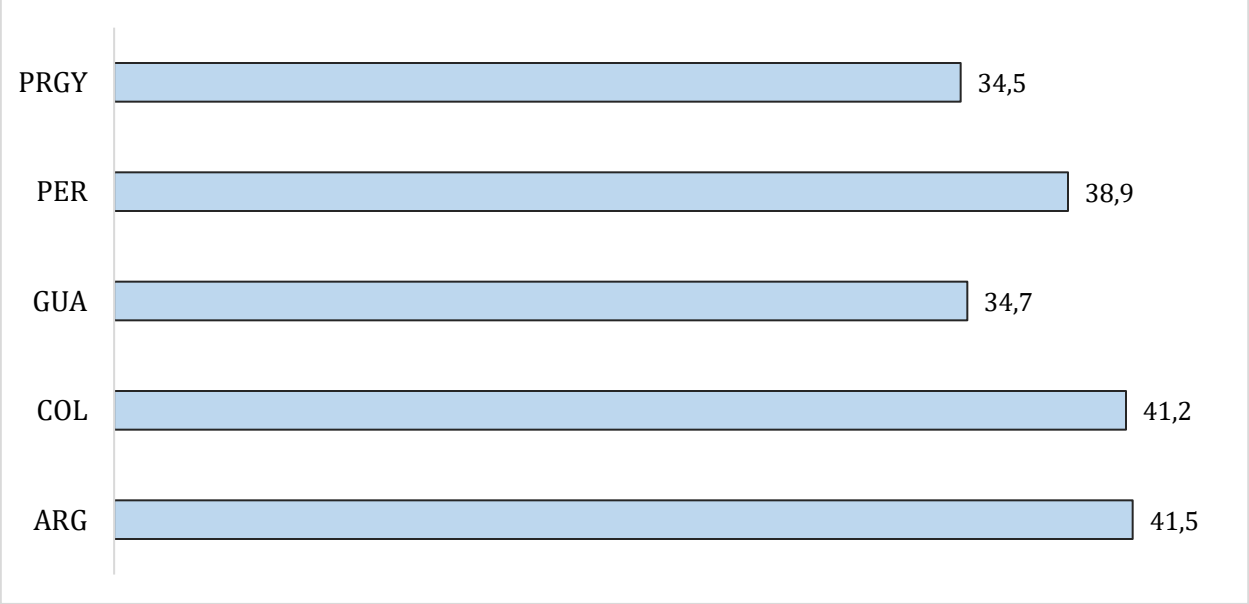
$$\hat{x} = \frac{x - x_{min}}{x_{max} - x_{min}}$$

TABLE 1: THE ICT INDEX

Indicator	Description
Mobile sub-index	
Smartphone ownership	It takes the value of 1 if the respondent currently owns a working mobile phone, otherwise 0.
Mobile use experience	Number of years that the respondent has been using a mobile phone. It takes the value of 0 if the respondent does not own a mobile phone.
Mobile applications use	Average regularity of use of nine mobile applications: Social media, games, transport, business, entertainment, news, educational, search tools applications and voice or messaging applications. Values for regularity are 0, never; 1, occasionally; 2, weekly; 3, daily.
Mobile banking and e-commerce	It takes the value of 1 if the respondent indicates that he/she has used, at least once, mobile banking services, a trading application or mobile money, otherwise 0.
Internet sub-index	
Internet usage	It takes the value of 1 if the respondent has used the Internet, at least once, otherwise 0.
Internet use experience	Number of years that the respondent has been using the Internet; it takes the value of 0 if the respondent has never used it.
Internet devices	Number of devices from which the respondent connects to the Internet; it takes the value of 0 if the respondent does not use the Internet
Online activities	Number of online activities that the respondent performs: Education, job search, government and social media related activities.

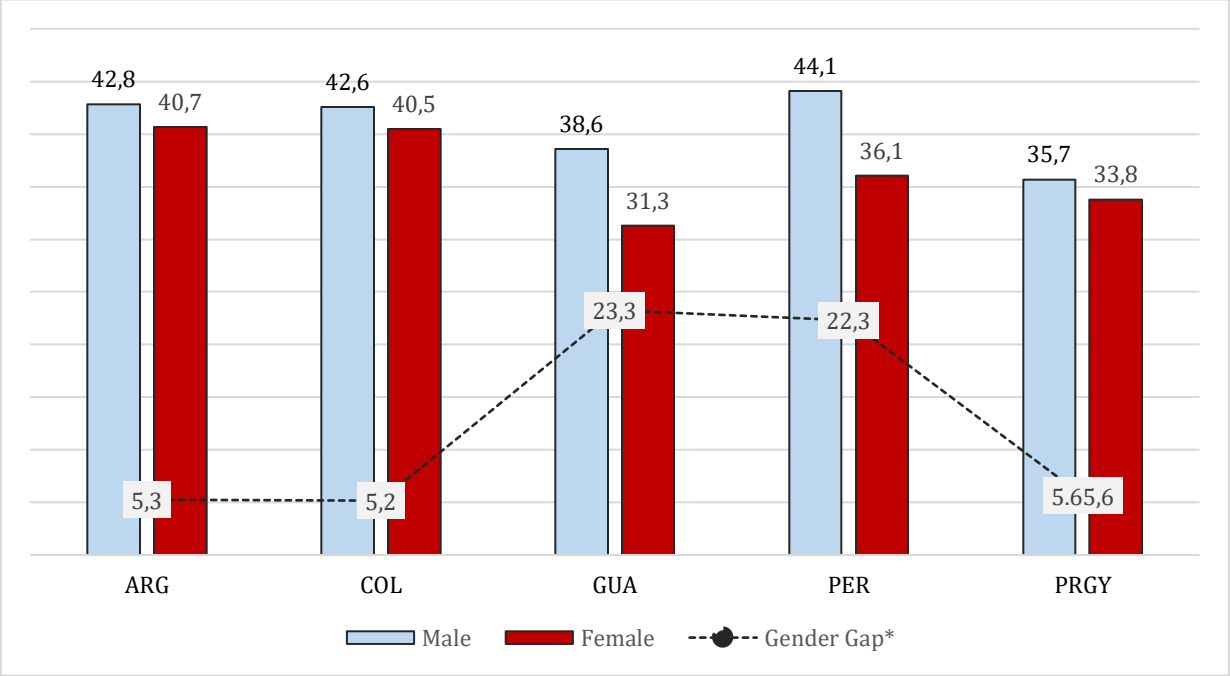
GRAPH 1: THE ICT INDEX BY COUNTRY AND GENDER (AVERAGE VALUES)

Graph 1 (a): By country



Source: After Access Survey 2017. Authors' own elaboration

Graph 1 (b): By country and gender



Source: After Access Survey 2017.

As the figures show, women in all the countries of the Latin American sample show significantly lower levels of the ICT index as compared to men. Therefore, the next step is to understand the factors that explain these gender disadvantages. The following subsection analyses the effect that different factors have on the ICT Gender Gap (IGG), as well as the share of this gap that cannot be explained by the factors taken into account.

Decomposition of the ICT Gender Gap (IGG)

Adapting the methodology used in Ñopo (2008), who analyses gender wage gaps in Peru, we decompose the IGG for each of the five countries under analysis. This methodology is based on a matching exercise between comparable women and men who share the same observed characteristics. Through the mentioned exercise, it is possible to estimate the effect of these characteristics and the effect that is related to other non-observed factors.[7]

According to this author, there are two main components of the gender gap:[8]

1. The explained component: It is the part of the gap that is attributed to differences in the distribution of characteristics of men and women over the common support.
2. The unexplained component: It is the share of the gap that cannot be attributed to differences in characteristics of individuals in the common support.

In addition, there are two other components that refer to incomparability among men and women. Nevertheless, in this case these effects are almost negligible.

More formally and following Ñopo (2008), the overall gender gap, Δ, is broken into four additive components as follows:

$\Delta = \Delta_m + \Delta_X + \Delta_0 + \Delta_f$	(1)

The components Δ_x and Δ_0 are similar to the standard Oaxaca-Blinder decomposition, characteristics effect and coefficient effect, except that these are defined over the common support. The component Δ_x captures part of the gender gap attributable to differences in

7 As the exercise is performed only for those individuals in the common support (comparable individuals considering the observed characteristics), there will also be an effect attributed to the non-comparable part of the sample.

8 For further information, see Ñopo (2008).

covariates in the variables in the model. On second place, the component Δ_0 is the residual part of the gender gap. It is the part of the gap which is unexplained by the differences in observable characteristics. It is the gender gap which remains even if males and females had the same characteristics over the common support.

The component Δ_m represents the part of the gap which can be explained by differences between those males in the common support and those who are not. Thus, this is part of the gender difference that would be eliminated if there were no males with combinations of characteristics X that remain entirely unmatched by females. The component Δ_f is interpreted in a similar way as the previous one, but in this case between matched and unmatched females.

The variables that are considered as determinants of ICT adoption have been documented extensively in the literature, see for example Barrantes (2007); Mendonça, Crespo, & Simões, (2015) and Wang (2015). For this case, the following observed variables are used: age, education level, the presence of children and youngsters in the household, location, language, socioeconomic level and occupation. Particular definitions are presented in Table 2 and average values by gender in Table 3.

TABLE 2: DETERMINANTS OF ICT ADOPTION

Indicator	Description
Age	It takes the value of 1 if the respondent is less than 18 years old; 2, if he/she is between 18 and 25; 3, if he/she is between 26 and 39; 4, if he/she is between 40 and 59; and 5 if he/she is more than 60 years old.
Education	It takes the value of 1 if the respondent has incomplete secondary education; 2 if he/she has complete secondary education; and 3 if he/she has higher than secondary education.
Kid	It takes the value of 1 if there is at least one under-aged person in the household, otherwise 0.
Rural	It takes the value of 1 if the respondent lives in a rural location, otherwise 0.
Native Language	It takes the value of 1 if the respondent affirms that the language that he/she speaks in his/her house is a native language, otherwise 0.
SEC	Socioeconomic Level index in quintiles

Occupation	It takes the value of 1 if the respondent is unemployed; 2, if he/she is a student; 3, employee; 4, employer; 5, independent; 6, non-active.

TABLE 3: SUMMARY STATISTICS OF THE DETERMINANTS OF ICT ADOPTION (BY GENDER)

Variables	Total	Male	Female
Age (Average)	3,3	3,3	3,3
Education (Average)	2,0	2,1	2,0
Kid (%)	56,3	46,7	62,3
Rural (%)	30,6	32,3	29,5
Local Language (%)	11,8	12,1	11,6
SEC (Average)	2,9	3,0	2,8
Occupation (%)			
Unemployed	3,9	5,6	2,8
Student	12,4	13,9	11,4
Employee	23,0	27,4	20,2
Employer	3,1	5,7	1,6
Independent	24,9	35,8	18,2
Non-active	32,8	11,6	45,8

Source: After Access Survey 2017. Authors' own elaboration.

Main results

Before explaining the main results, Table 4 shows the effects of the determinants (observed factors) described in Table 2 over the ICT index. This analysis is performed to understand the contribution of each element to the IGG.

In particular, socioeconomic level, education and living with children and youngsters in the household have a positive and statistically significant impact on the ICT index. Whereas, being an older adult, speaking a local language and living in a rural location have negative effects in the level of the proposed index. Regarding occupation, there are different impacts for each

category, but the outstanding ones are related to "employer" with a positive significant impact, and "non-active" people[9] with a negative effect.

TABLE 4: PRELIMINARY ANALYSIS – OBSERVED EFFECTS OF INDEPENDENT VARIABLES

Independent Variables / Dependent variable: The ICT Index	Observed effect
SEC	+
Education	+
Age	-
Occupation: (Employers (+) & Non-active people (-))	¿?
Local Language	-
Rural	-
Kids	+

Based on multiple regression analysis with the After-Access Survey 2017. In all cases, statistical significance is 99%. Authors' own elaboration.

These results show the strong correlation between the variables related to digital disadvantages (low educational levels, rural location or ethnic issues) and those related to social disadvantages in general. As Kularski & Moller (2012) highlights, digital exclusion is caused (and reinforced) by traditional dimensions of inequality such as socioeconomic level or race. Nevertheless, the digital divide is a complex phenomenon, and social and digital inequalities do not always go in the same direction (Bauer, 2016). An interesting example is the fact of having kids in the household. According to Ñopo & Hoyos (2010), having kids could imply a significant negative effect for women in terms of wage and labor status. However, regarding technologies, younger people in the household could have an important role in the process of Internet adoption by other older household members (Barrantes & Cozzubo, 2017). The effects

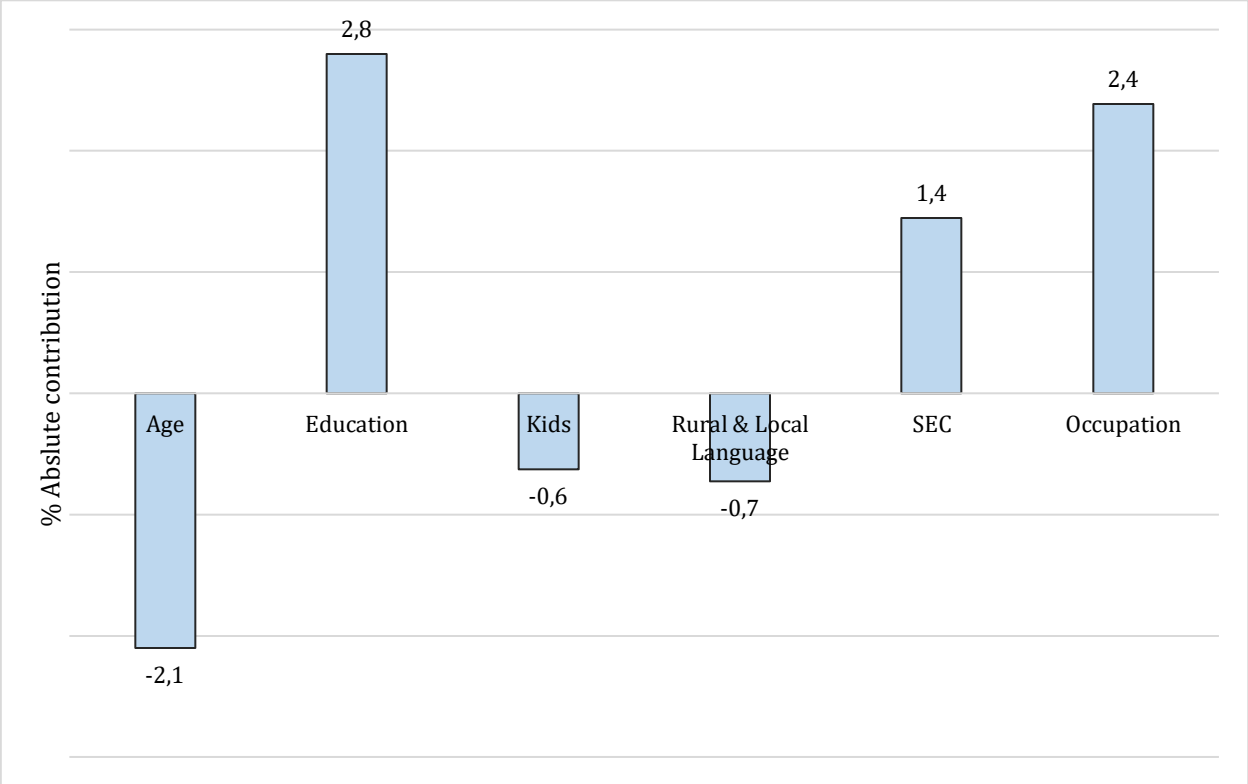
9 The "non-active people" category refers to those who are currently not working, not looking for work and are not studying.

shown in Table 4 are relevant to better understand how one of each personal and household characteristics contributes to increase or reduce the IGG.

Graph 2 shows the contribution of each independent variable to the observed component of the IGG in favor of men. Therefore, if the percentage shows a positive value, it means that the particular factor positively contributes to increase the difference between men and women (in favor of men). Conversely, the negative sign means that the independent variable reduces the explained component.

In this context, education, socioeconomic level (SEC) and occupation have a positive impact in the observed IGG. Considering the effects described in Table 4, on average, women have lower education levels than their male peers; they are in lower SEC; and work in sectors requiring less digital skills. In particular, education and occupation have the highest positive effect in the IGG, while age, having kids, living in rural areas and speaking a local language, tend to be factors that reduce the IGG in favor of men.

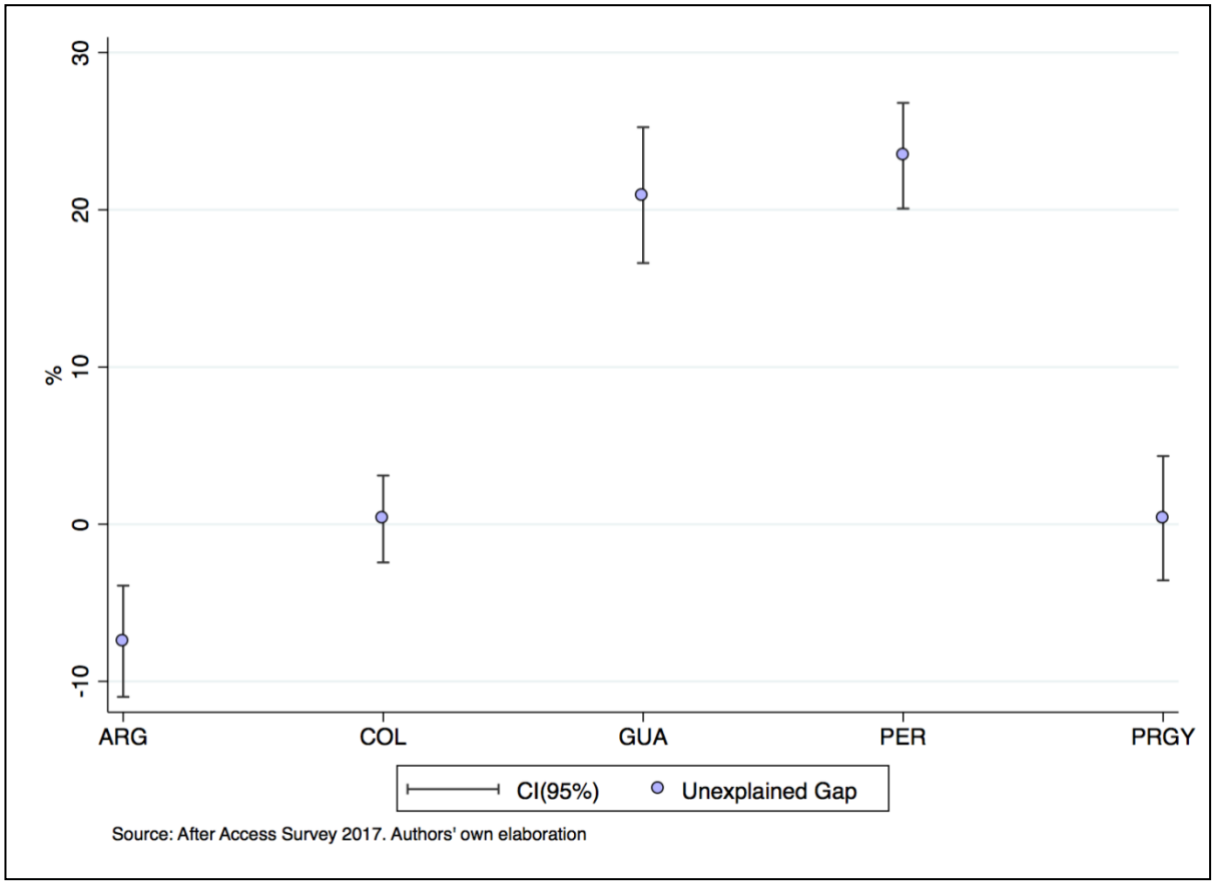
GRAPH 2: INDEPENDENT VARIABLE CONTRIBUTION TO THE EXPLAINED ICT GENDER GAP



Source: After Access Survey 2017.

On the other hand, Graph 3 shows the unexplained IGG by country, in other words, the share of the total gap that cannot be explained by gender differences in measured variables. In particular, we could say that in Argentina, Colombia and Paraguay, the ICT gender gap could be explained entirely by factors like education, SEC level and occupation, whereas in Guatemala and Peru (countries with a greater variety of languages and ethnic groups), the unexplained component of the IGG represents almost the total gap observed in Graph 3. This unexplained component is usually described in the literature as related to culture, stereotypes, sexism, among others.

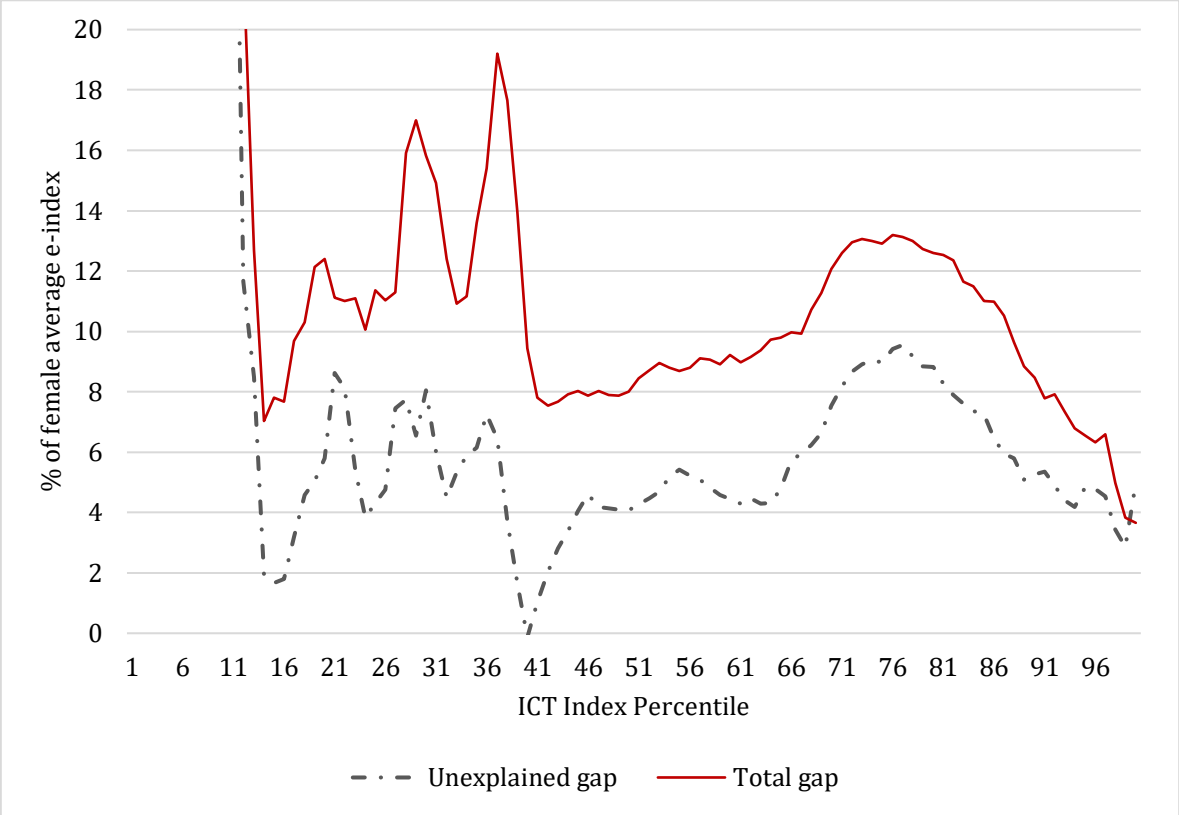
GRAPH 3: CONFIDENCE INTERVALS FOR THE UNEXPLAINED GAP BY COUNTRIES (FULL SET OF INDEPENDENT VARIABLES)



Graph 4 shows the distribution of the gender gap alongside the ICT index percentiles for the aggregated sample. In general, what can be seen is that the total IGG and the unexplained part

of the gap does not go in the same direction along the different levels of the individuals' technologies access and use. In particular, at lower levels of the ICT index, the differences between men and women can be mainly explained by unobserved factor, while at intermediate-levels the differences can be explain mainly by characteristics like education and occupation. At the upper-levels of the ICT index distribution, the differences could be attributed mainly to non-observable characteristics.

GRAPH 4: THE ICT GENDER GAP DISTRIBUTION – TOTAL GAP VS UNEXMPLAINED GAP



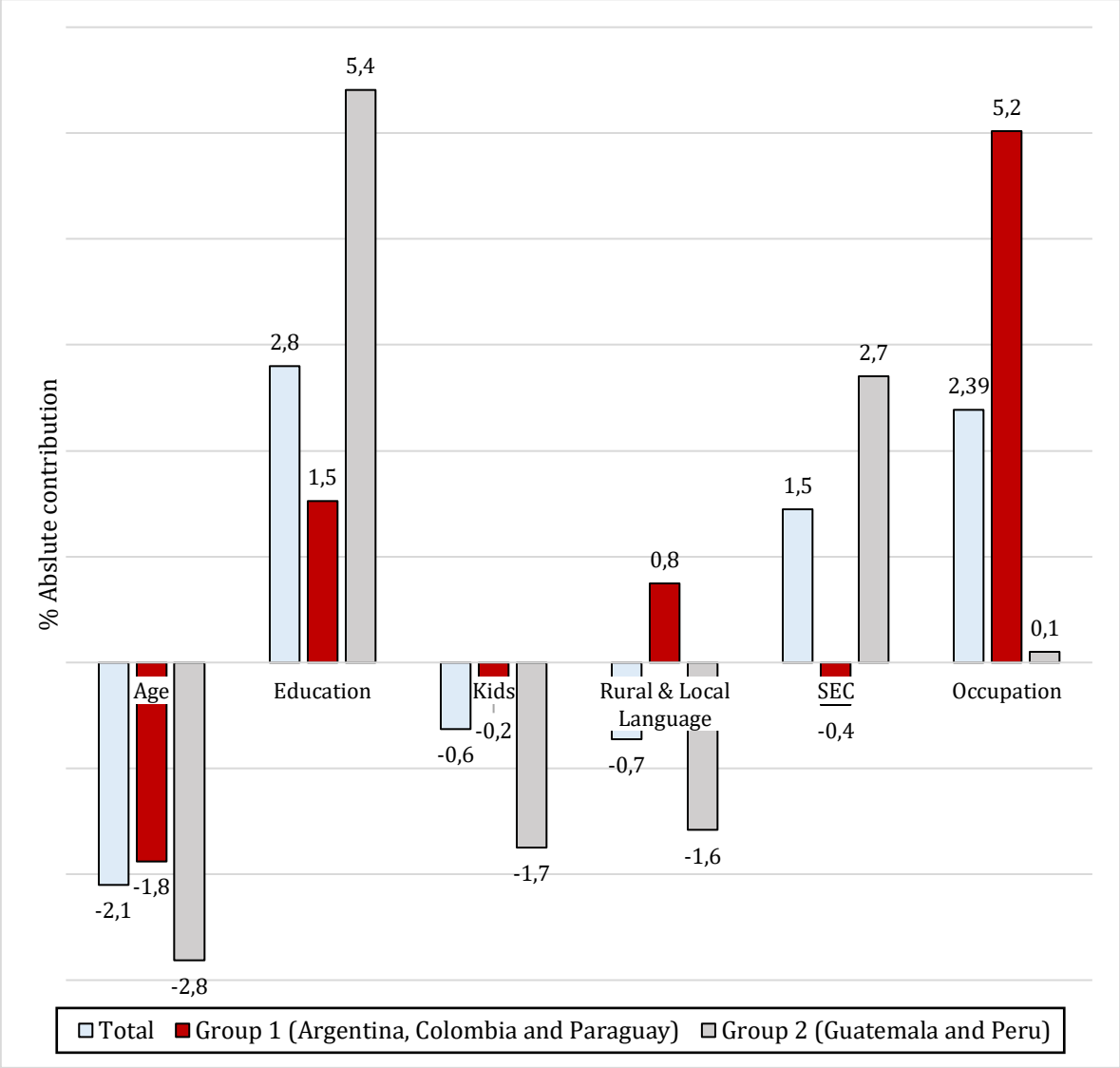
Source: After Access Survey 2017.

Returning to Graph 3, it indicates different patterns in the decomposition of the ICT index for the five countries, particularly we could clearly identify two similar groups. The first is compounded by Argentina, Colombia and Paraguay where the observed factors (age, education, location or occupation) are the predominant elements in the explanation of gender inequalities. Whereas in countries like Guatemala and Peru, the unexplained part of the gap is the one that accounts for most of the gender disadvantages against women. These differences highlight the

necessity of a more disaggregated analysis, particularly, regarding the independent variables contribution (Graph 2) and the distribution of the gap (Graph 4). For this reason, Graphs 5 and 6 are included, where the same analysis is done but for the two group of countries.

Graph 5 indicates the contribution of each control variable in the explained ICT gender gap, but disaggregated by group of countries. Particularly, for most variables, the direction of the effect of each independent variable remains constant between each group, but there are significant differences in terms of the magnitudes. While education is one of the most important factor in explaining gender inequalities in both groups, it seems to be much more important for the second group than for the first one, where occupational inequalities are the most important factor. Another relevant difference between groups is the effect of living in a rural area and speaking a native language, in this case, the difference is not only in terms of the magnitude but also a change of direction. In the first group, this factor represents a disadvantage against women, while in the second it goes against men. It is also important to highlight that these variables in aggregate represent relatively a more important issue for the first group (they explain almost all the gap), than for the second one.

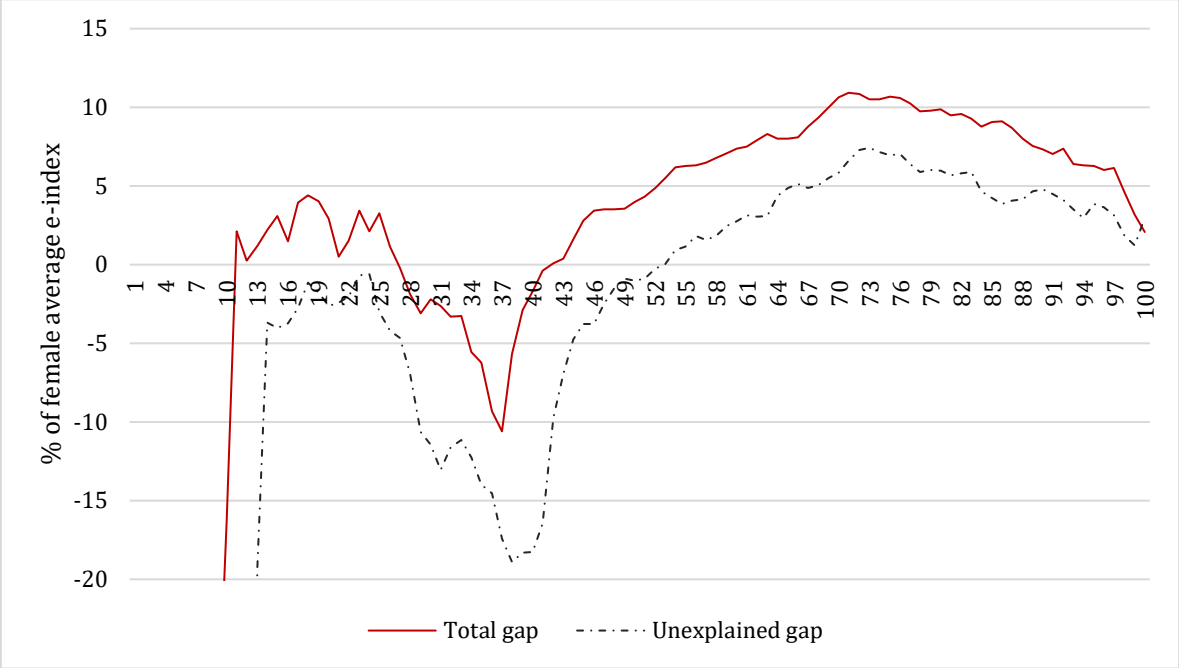
GRAPH 5: INDEPENDENT VARIABLE CONTRIBUTION TO THE EXPLAINED ICT GENDER GAP – BY GROUP OF COUNTRIES



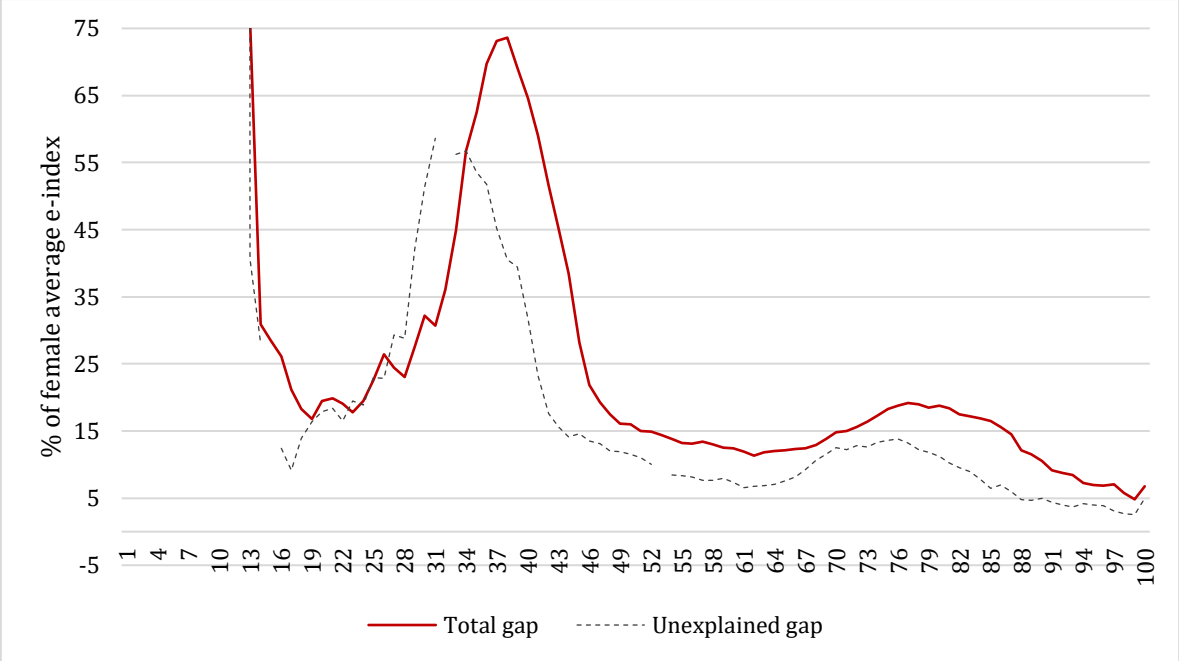
Source: After Access Survey 2017.

GRAPH 6: THE ICT GENDER GAP DISTRIBUTION BY GROUP OF COUNTRIES – TOTAL GAP VS UNEXMPLAINED GAP

Panel (a) Group 1: Argentina, Colombia and Paraguay



Panel (b) Group 2: Guatemala and Peru



Source: After Access Survey 2017.

Finally, Graph 6 describes the distribution of the total ICT gender gap and the unexplained part of it but by the two different groups of countries. In particular, the two graphs are significantly different from one another (Panel (a) referring to group 1 and (b) to group 2): while in the first group the unexplained gap goes against men, at least in the first part of the ICT index distribution, in the second group of countries the unexplained gap represents, alongside all the ICT index distribution, a disadvantage against women. An interesting effect is that the unexplained part of the gap grows within the last part of the distribution (around the 50th percentile) in the first group. On the other hand, a critical element is shown in the second group of countries (Guatemala and Peru) where the ICT gender gap against women in some segments of the distribution represents over 70%: this is critical and requires urgent attention from policymakers.

Conclusion and recommendations

Although not as stark as this in all countries, what the main results show is that even when those currently marginalised from services –disproportionately women in most countries surveyed - are connected, digital inequality will not be overcome. From a policy perspective, it is clear that demand side interventions, that address not only affordability but also e-literacy and education more widely, are as critical to digital inclusion as supply-side connectivity measures. Moreover, as the Latin-American cases have shown, there are deeply entrenched factors such as social and cultural norms, as well as attitudes towards women that do need to be taken into account when analysing women's access and use of ICT.

Although further research is needed, technology adoption and diffusion through commercial models reflects early adopters being highly educated, high income users with low levels of gender variance in societies and economies that are not too constraining on the participation of women. As more users come online, the disparities in ICT access and use may reflect disparities between women and men in relation to education and income (employment) but as prices of devices and services come down and poorer people come online, who are disproportionately women, and markets begin to saturate the figures for men and women tend to equalise. Initiatives that make Internet use more affordable and thus lower the income barrier for men and women would reduce the gender gap in Internet access. Effectively redressing the digital inequality will require transforming the structural inequalities that

perpetuate economic and social exclusion and that are simply mirrored, and sometimes amplified in the digital world.

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