Relationship between ICT Use and Financial Education Levels in Latin America

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***Abstract*—The presence of information and communication technologies (ICT) in different productive, economic and social sectors is not unknown to the educational field. ICT have transformed teaching-learning processes and stimulated innovation. In Latin American, the term financial innovation is being implemented to describe integral solutions in processes, products and services, although leaving aside scarce ICT use and financial education. This paper aims to examine the state of ICT use in Latin America, as well as the state of financial literacy and the importance of education based on technology as a strategy for development and inclusion. Linear regression and bibliometric follow-up are used to determine the incidence of the amount of Internet use in poor financial education, due to low coverage, inclusion, public policies and technological infrastructure.**

***Index Terms*—ICT, finantial education, technology.**

I. Introduction

Constant economic crises have evidenced the need for change in regulation, products and supervision of the financial system as a key piece of economic growth [1]. To help overcome this, the concept of financial innovation and social finance have been popularized as tools of contemporary technology that contribute to globalization and developing markets for the growth of nations [2]. According to the Oslo manual, which seeks to define and clarify the concept, innovation is understood as significant changes in processes and services with the purpose of improving results and involving the use of new knowledge or a new combination of existing knowledge [3]. These innovations have been adapted to the financial system to create new investment, financing and risk transfer instruments, new risk management techniques and new market structures [4], always thinking of companies and greater access and coverage [5]. However, these changes have been thought only for businesses, expecting individuals and communities to adapt naturally, without considering technological penetration or coverage of information systems and thus widening gaps between people who, in addition to not having financial education, do not have access to educational technologies [2].

The Millennium Development Goals have been proposed globally as strategies to obtain benefits from new technologies, especially information and communication technologies [6]. These goals have been truncated, especially in Latin American countries, where the eradication of exclusion or the improvement of education quality had not been possible by 2015 [7]. In these countries, financial education and especially the use of technology in favor of finance continues to be scarce: in December 2014, only 51% of the population had a bank account and only 15% of them used electronic services by means of computers, cell phones or the Internet [8].

The purpose of this research is learning more about the incidence of Internet use in Colombian sectors with poor financial education. The issue is approached through linear regression and bibliometric follow-up.

II. Metodology

The present study uses quantitative data analysis methodology, namely, the statistical technique of multiple linear regression by levels to determine correlation between the variables. Data was sampled from the OECD and the World Bank records from 2014, 2015 and 2016 (last years available to date).

This technique of multivariate analysis with regressions and ordinary least squares is applied based on micro and meso economic models [9], [10]. Formal and graphical tests are applied for the validation of parametric linearity assumptions, variable fixed values to be explained in repeated sampling, homoscedasticity, not self-correlation; no multicollinearity and normality [11], [12]. Likewise, validations of adjusted R2, global significance level from F test, individual significance with t test and a confidence level of 95% are obtained.

As variables in question, variables that gather and approach the use of ICT tools (Internet access from home, computer use, wireless connections) with banking penetration and financial knowledge measurements were used in an empirical process.

Considering that available data records only up to 2016, research is complemented with a bibliographic follow-up from the last year using UNESCO data, as well as scientific articles from Scopus database, a reliable and widely disseminated database [13]. A search equation was

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established linking the terms financial education with ICT and limiting the search to Latin America. Also, an assessment of indicators is made to determine the state of the art and possible trends regarding the proposed topic [14].

III. Results

A. Regression

Based on ordinary least squares, the analysis was carried out separately for each year, carrying out multiple regressions processed in the free license software R. These analyses provide results for standardized coefficients with their respective p value (significance level), and other statistical tests that verify the econometric assumptions of the regression verified with correlational analysis of independent variables and with the assumptions of linearity, homoscedasticity, not self-correlation, normality and not perfect multicollinearity [12].

For this research, the classical model of multiple linear regression was defined as

$$f = n + \sum_{p=1}^{I} \varphi_p X_p + \theta_p \quad (1)$$

where f is the response variable (financial education levels), Xp represents the explanatory variables considered (internet access from home, computer use, wireless connections); and n represents regression intercept. Other non-observed determinants are represented by θ_t. A of a logarithmic adjustment of the model to cancel possible dispersions; the statistical significance of differences between arithmetic means of each group established by Latin American countries is identified with information available in OECD and the World Bank from the last 3 years, given scarce information gathered from previous years.

Following the econometric analysis of assumptions proposed [14], including normality, without detecting problems of multicollinearity or inconsistencies that hinder the application, a non-correlation or explanatory capacity of the technological variables compared to the levels of financial education is established as null hypothesis (H0).

The model for each year studied is shown in Table I. The 2014 model demonstrates a remarkable explanatory capacity rejecting H0 with a low p-value (0.000) and an adjusted R2 of 0.593. Therefore, the set of independent variables has an important explanatory capacity for financial education levels for all countries considered. Likewise, φ_ coefficients for that year showed outstanding characteristics in the model: (a) Internet access from home showed a positive coefficient of 0.793, meaning a maximum explanatory contribution to financial education levels with 95% confidence, followed by (b) wireless connections (0.266), (c) and computer use (0.133).

The year 2015 shows similar conditions with explanatory capacity given by a p-value of 0.000 and an adjusted R2 level of 0.631. The coefficients for each explanatory variable show relevant values, especially for Internet access from home with a 95% confidence level. Lastly, the 2016 model is shown in the same table. Its empirical analysis also renders a remarkable explanatory capacity (p-value = 0.000) and adjustment (adjusted R2 = 0.872) rejecting the H0.

TABLE I: Proposed Model

Coefficients:			
	2014 Estimate	2015 Estimate	2016 Estimate
(Intercept)	-3.56	2.74	1.48
Internet-Acc-Home	0.793	0.748	0.654
Wireless_conex	0.266	0.310	0.341
Computer-use	0.133	0.157	0.203
Signig. codes	0.000	0.000	0.000
Adjusted R-squared:	0.593	0.631	0.872
F-Statistic:	89.769	13.653	15.921
P-value	.000	.000	.000

Source: Own elaboration with OECD and WB data

Moreover, φ coefficients show significant results with a confidence level of 95%, though lower than those obtained for previous years.

In general, when variables related to ICT were used to explain levels of financial education, important correlations were obtained indicating explanatory capacity.

B. Bibliometric Follow-Up

Research trends from public policies and non-governmental organizations regarding the use of technology as a tool for financial literacy and as an innovation strategy in education are identified through a bibliometric search, bearing in mind that available information is limited, as some refers only to 3 or 4 Latin American countries.

A search equation was determined by an exploratory literature consultation. The terms "financial education" and "information and communication technologies" limited to Latin American resulted in 260 results in a ten-year time frame (2007-2017). The equation was as follows:

(TITLE-ABS-KEY (financial AND education) AND (TITLE-ABS-KEY (information technology) OR (ITC) AND TITLE-ABS-KEY (latin)) AND (LIMIT-TO (PUBYEAR , 2017) OR LIMIT-TO (PUBYEAR , 2016) OR LIMIT-TO (PUBYEAR , 2015) OR LIMIT-TO (PUBYEAR , 2014) OR LIMIT-TO (PUBYEAR , 2013) OR LIMIT-TO (PUBYEAR , 2012) OR LIMIT-TO (PUBYEAR , 2011) OR LIMIT-TO (PUBYEAR , 2010) OR LIMIT-TO (PUBYEAR , 2009) OR LIMIT-TO (PUBYEAR , 2008) OR LIMIT-TO (PUBYEAR , 2007))*

The search equation yielded articles, reports and conferences that contained some of the established terms in its title or keywords, regardless of their relative location. The time frame was restricted to a period of 10 years in order to gather recent information.

Some quantity indicators are obtained, such as document amount per year (Fig. 1), which evidences a growth in public interest for publications related to financial education based on technological tools. The productivity shows a growth of 103%: while there were 12 publications related to the topic in 2007, there were 28 publications throughout 2017.

Regarding publication type (Fig. 2), 59% are obtained from scientific articles, while 22% are published in Reviews, mainly from NGOs and private entities reflecting on the importance of this topic or showing scarce financial inclusion and technification of learning.

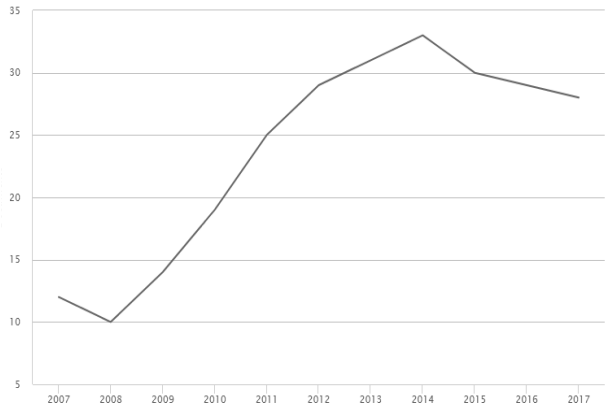

Fig. 1. Document amount per year. Source: Own elaboration based on Scopus data.

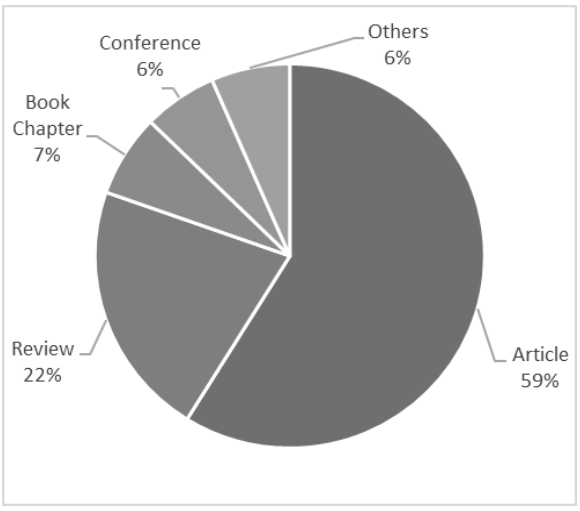

Fig. 2. Publication type. Source: Own elaboration based on Scopus data.

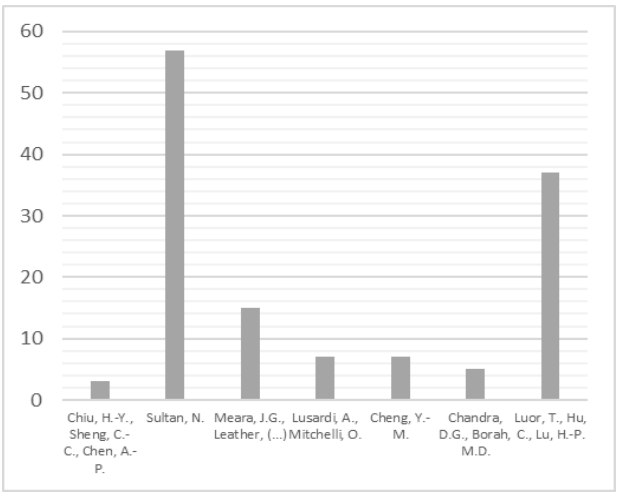

Fig. 3. Citation by author. Source: Own elaboration based on Scopus data.

These high numbers point to a rising interest in the matter on behalf of NGOs (UN, UNESCO, OECD, Latin American Development Commission) and local government entities, such as the central banks of countries like Colombia, Ecuador, Mexico and Chile. Most of these documents seek to diagnose and reflect on ICT use in education and particularly on the importance of building knowledge on basic financial issues such as banking, savings and investment.

Additionally, an analysis of most cited authors as an indicator of quality that measure the frequency and importance of these was carried out [16]. As the Fig. 3 shows, Sultan L. is the most cited. This work emphasizes education based on the cloud and virtual systems as innovation tools that allow accelerated learning based on multimedia. The work of Luor *et al.* is also considerably cited. They study the gap between the intention and use of e-learning programs in the financial industry, showing the importance of ICT in the presentation of transactional systems and dematerialized financial products.

IV. Conclusions

This study adds a theoretical-empirical contribution to ICT use as a primary tool for the development of education in finance, aiming towards inclusion and expansion.

Results show that there are great inefficiencies in Latin America regarding the use and application of ICT. Throughout information review, a priori comparisons were made with developed countries and marginal uses were found in all indicators for most of the countries analyzed. It is important to point out that statistical data available regarding financial penetration and on ICT use and development in the region are very recent and there are no reports from previous years or there are data from very few countries and without continuity.

The study expresses the possibility of explaining poor financial education and banking from technological variables such as Internet access from home and the use of mobile internet. These indicators show slow progress in the region due to insufficient existing technological infrastructure and to few government efforts regarding the importance of digital technologies that involve financial issues as a basis for economic development [17].

The growing concern from state entities to develop and include ICT as a fundamental and innovative tool in financial education, as well as understanding these technologies as a nucleus of productive, social and economic transformation is important. This points to the impossibility of regional growth without a generalization of basic financial skills necessary to improve productivity levels.

Literature on ICT use as an e-learning strategy, and specifically on financial education, is mostly qualitative, oriented to reflect and critique political issues. Very few aim to develop platforms, strategies, methodologies or applications that improve the situation.

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