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The use of the mobile phone in the rural zones of Peru

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Abstract

Purpose – The main objective of the research is to examine whether the possession and the consumption of the service of a mobile telephone by the families of rural zones has improved their wellbeing in the last 10 years (2007–2016).

Design/methodology/approach – A quantitative analysis of panel data is proposed in order to analyze the effect of the use of the mobile telephone in rural zones by region of Peru during the last 10 years and capture the unobservable heterogeneity during the said period. In this manner, it is hoped to investigate the effect of the increased use of said technology in Peru.

Findings – The results obtained show that the increase in the acquisitions of mobile telephones in rural zones has had a positive impact on the wellbeing of households. Continuous business innovation driven by citizens' needs and the greater accessibility of mobile telephones are the main reasons based on the Peruvian context under study.

Originality/value – In Peru, there has been an explosive increase in users of mobile telephones in the last 10 years. The use of this technology may be arriving in rural households before other basic services, provoking individual and social changes and creating new employment and income opportunities. This would support the recent recognition of the mobile telephone as an essential tool for development, especially in underdeveloped countries.

Keywords Mobile phone, Rural households, Wellbeing, Regional development

Paper type Research paper

1. Introduction

The role played by Information and Communication Technologies (hereinafter ICT) has become an important determinant for economic growth. Specifically, mobile telephony is now one of the tools with the greatest penetration on a global level, surpassing landline telephony within a short time. According to figures of the report regarding the status of broadband in Latin America and the Caribbean of the Economic Commission for Latin America and the Caribbean (ECLAC), the differences in mobile and fixed broadband penetration in the region remain significant, at 77 and 14%, respectively (ECLAC, 2019).

The contribution of ICT to the reduction of poverty comes down to its capacity to offer access to women and men to more information and better communications to be able to accumulate assets that serve as a means of support (United Nations, 2011). In the case of mobile phones, a complementary good of the mobile phone service, ownership has increased, even in regions where most of the population of the rural sector lives and works. This new context has generated new micro-companies in various sectors, new services and new forms of commercializing all types of products (Fredriksson *et al.*, 2010). Knowledge and



information should serve as an important lever of development; therefore, it is essential to promote the capacity for selection and translation of both one's own experiences, information and knowledge, and those of others, to enrich local knowledge (Serrano and Martínez, 2003). Additionally, equally important is the effort to produce local information and systemize experiences in the context of concrete projects and initiatives so that others can also enrich their stocks of knowledge and not have to reinvent them. The vicious circle of poverty and isolation could, in this way, progressively revert into a "virtuous circle" of learning and development (ALADI, 2003).

Mobile phones promote the creation of new types of businesses, thus providing new subsistence economies for people with scarce resources (United Nations, 2011). However, three main barriers block the diffusion of ICT in developing countries: accessibility (sometimes limited by high prices), the lack of electrical service and the coverage, reached by services such as mobile telephony and broadband. What is important in this aspect, therefore, is the Government's contribution through public policies that ensure "adequate" coverage for all types of populations and do not affect the diffusion of ICT (Gallardo *et al.*, 2007).

There is extensive information regarding the use of the mobile phone which permits access to key services, especially those that are out of reach for certain segments of the population (Arese and Hatt, 2014). Peru is the country with the greatest growth in users of mobile telephony in Latin America (ECLAC, 2019). However, the population does not yet recognize that the mobile phone market exercises an economic and social impact on society as a whole (Arese and Hatt, 2014). This is the result of the lack of diffusion for the use of this tool. In this respect, the Asociación GSM (2016), which is an organization dedicated to supporting the normalization, implementation and promotion of the mobile phone system, commented: "Accessibility is also an evident obstacle at the base of the income pyramid in some markets, partly due to the high levels of general socioeconomic inequality and to taxes specifically applied to the mobile industry that increase the access prices" (p. 4).

The affordability problem is reflected, on the one hand, in the price difference between the prepaid (advance payment to access the service) and post-paid method (subsequent payment to access the service) of the mobile phone service. On the other hand, Barrantes *et al.* (2010) determined that in the case of the comparison of landline and mobile services, the difference in tariffs is less than expected if measurement by baskets is considered, instead of only unit prices. In other words, the preference of the users with a lower income level for mobile phone service is not only due to convenience factors and the control of the consumption expenditure but also to the structure of tariffs offered for the service. The economic income of the users of this technology increases in parallel with the development thereof through various indirect effects, such as: "The substitution of landline connections, the increase in mobility, cost reduction, the expansion of the commercial networks, and the facility for the search for employment" (Coca, 2010, p. 57). The ICT have a positive impact on the economy, since they offer greater efficiency to the markets, especially in improved transmission and flow of information. Greater efficiency influences the development of jobs from an individual perspective, which is also transmitted to other sectors, and therefore, to the economy as a whole (Norton, 1992).

In Peru, the growing demand for mobile phone and data transmission services causes the operating companies to carry out a deployment of infrastructure, as a result, a greater supply of mobile phone services permitted the extension from 45% at the end of 2007 to 92.1% of lines for each Peruvian family at December of 2019 (Instituto Nacional de Estadística e Informática [INEI], 2021). In this context where the use of the mobile phone is envisaged as an engine for development, this study has the following objective: to examine whether the possession and the consumption of the service of a mobile phone by the Peruvian families of rural zones has improved their wellbeing between 2007 and 2019. In particular, an analysis is developed to demonstrate that greater ownership of mobile phones for families in the rural zones of Peru would improve their standard of living.

2. Literature review

Social studies regarding mobile phones began at the same time as their mass diffusion in 1994 and surveys for academic purposes expanded by the end of the decade. As of 1998, it began to consolidate itself as an optional communication medium in society (Rodríguez *et al.*, 2005). In this respect, Geser (2006) explains that the mobile phone promotes social development in four different ways: it increases primary social ties, reduces the need to coordinate pre-established schedules, demands greater institutional control and the modification of the communication systems to personal modalities, and helps maintain the development of role-based activities. The sum of said social factors, in a scenario of global competition, has resulted in the mobile phone being the only technology that has achieved a position in which more than half of the global population possesses it or has access to it as a service, describing a surprising scenario from not only the technological aspect but also the socio-economic aspect (Vacas, 2007). In parallel, the expansion of the mobile phone service, as a service on which the use of the mobile phone depends, is due to a series of factors: diffusion, access, coverage and penetration.

Diffusion is defined as the process through which technological innovation is progressively adopted by a population (Ordóñez, 2007). According to Meade and Islam (2015), it is the process of disclosure of knowledge, news, attitudes, fashion, etc. In the context of this research, diffusion of the use of the mobile phone depends on a series of principal variables: gross domestic product per capita, the use of landline telephony and the power of the market. Access to the mobile phone service, on the other hand, is defined as “the adjustment between the characteristics of the services and of the population” (Penchansky and Thomas, 1981, p. 128). There is an initial focus on access that is centered on the characteristics of the supply (location, availability of services, etc.) and how they adjust to the characteristics of the demand (accessibility, family income, insurance, expenses, age, etc.). In this initial focus, some authors prefer to denominate it more as accessibility. In a second focus, “the conceptual development of access becomes identical to that of the determinants of the use of the service” (Vargas, 2009, p. 41). Coverage is the signal received by the mobile device used to establish communication at a distance. The range of mobile phone works in consideration of the quality, degree of service, relationship to the signal of interference and reliability (Coca, 2010). Coverage differs largely based on the zone of the analyzed household. According to Pasadas *et al.* (2014), the structure of phone coverage differs based on the analyzed zone and age. And penetration refers to the possession and use of a mobile device, “particularly with regard to activities closely related to the habits and practices of the inhabitants” (Francesc, 2006, p. 4). For its adoption, possession is also related to the age of the users, maintaining an inverse relationship with this variable. Additionally, the level of participation of the operators in the market permits the increased use of the devices and the productive capacities of the inhabited areas (Frost and Sullivan, 2006; Navarro *et al.*, 2012).

As a result, the growth and penetration of mobile telephony may have a lesser or greater impact on the expansion of coverage and access. From a strictly economic perspective, mobile telephony compared with landline telephony can be classified depending on their degree of exclusion and rivalry in the market (Urrunaga *et al.*, 2014). Exclusion occurs when it is possible to prevent someone from consuming it, and rivalry occurs when a person who consumes such goods reduces consumption in quantity or quality for another person (Buchanan, 1965). Thus, public goods are not mutually exclusive or rival; mixtures generally occur with private goods (Hindriks and Myles, 2006).

Concerning the above, mobile service has a certain degree of exclusion, as a result of the price charged to gain access to its use. Additionally, in the mobile phone market there is no concept of rivalry because when a person consumes such goods, it should not generate a reduction in the quality or quantity of another person who uses another mobile telephone. Nevertheless, the possession of a mobile device depends on the service offered by the

operators to be able to satisfy the demand of the client. In other words, goods, the phone and the mobile phone are perfect complementary goods. On the other hand, it could be considered that mobile phone services are semi-private or club-type mixed goods since they have an exclusion in prices and geography (based on the coverage), but there is no rivalry. Furthermore, it can be theoretically concluded that mobile telephony can be able to generate externalities in society. Externalities are positive or negative effects external to the price system, which affect third parties upon carrying out a production or consumption process (Urrunaga *et al.*, 2014). In the case of mobile phones and mobile phone services, they should produce positive externalities, due to their economic and social impact on society as a whole.

In the Peruvian context, increased use in recent years has originated a series of changes in the legal and regulatory framework, which have had a direct and indirect impact on the actions of the mobile operators in the country. Additionally, there were other mergers in the market and new mobile phone operators have entered. The current context has energized competition, causing commercial strategies to be in constant renewal, provoking new modalities and improvements in the service so that more clients can have access to them and in this way, they can have a greater market share (Loaiza and Jáuregui, 2015). Likewise, in the Peruvian legal framework for the Telecommunications sector, the following stand out: the Law for the Promotion of Private Investment in the Telecommunications Sector (DL 702), which allows the determination of rules for the management and operation of the different telecommunication services, thus promoting investment, at the same time eliminating monopolistic practices and practices which restrict free competition; the General Telecommunications Law (DS 0132-93-TCC), Law N°26285, which progressively seeks to de-monopolize the public telecommunication services of local landline telephony and of long-distance operator services; and lastly, Law 30083, the objective of which is to strengthen competition, energize and expand the market of mobile public services through the insertion of so-called virtual mobile operators and rural mobile infrastructure operators.

Governments can employ measures and carry out interventions in the market, which perform an important role in the diffusion of new technologies. For example, government policies toward the standardization process and market competition, for which we can identify two standardization practices that involve the formulation of government policies related to the diffusion of new technologies: market-mediated policies and a regulated regime. A country that employs a market-mediated policy does not impose specific mobile phone standards to which the operators must adapt (Kauffman and Techatassanasoontorn, 2005; Castells *et al.*, 2011; Navarro *et al.*, 2012).

Given this, during recent years a series of changes have developed in the legal and regulatory framework, which have had a direct or indirect impact on the actions of the mobile operators (OSIPTEL, 2019). There have also been two mergers in this market, and three new mobile phone brands have been launched, two of them corresponding to new economic groups that have recently entered the Peruvian mobile telecommunications market. This has permitted the sector to be more competitive, generating a constant renewal of the commercial strategies of clients and benefiting consumers with a more varied supply and at more affordable prices.

Although in Peru, where the increase in the number of users of the mobile phone service between 2007 and 2019 has been formidable, the panorama changed in recent years due to the economic situation, deficient service, and because it entered its maturity stage; faced with this situation, the regulating entity of the sector has implemented measures to energize the sector with the creation of virtual mobile operators, mobile operators with network and rural mobile operators through the enactment of Law 30083 (Asociación SGM, 2016).

According to the National Rural Development Strategy of the Presidency of the Council of Ministers (PCM) (2004), although the rural zones have been characterized by “low income of the rural families, low productivity of labor in the economic sectors that operate in the rural

territories, inadequate economies of scale of various productive processes, discoordination of the markets, high financial costs, volatility of the prices of the domestic market of the products of internal consumption, among others”, a relatively different reality can be observed in the development of mobile telephony. The rural zones are considered a challenge for the service operators since the infrastructure is affected and is insufficient to generate greater access of the population to ICT (ALADI, 2003). In other words, the incorporation of ICT does not occur uniformly in the various geographical environments, since it depends on the degree of urbanization and the residence area, which present very marked differences on a national level (INEI, 2020). Therefore, it can be seen certain heterogeneity in the use of the service of mobile telephony in the different regions of the country.

Okeleke and Strijak (2016) state that until now the market-based business model has proved effective for the expansion of coverage to its current levels. However, in-depth expansion in the rural and remote areas is an even greater challenge, which has generally been shown to be anti-economic. This is due to three factors, namely, the lower population density of the remote areas which, by definition, causes the cost per capita of covering these zones to be greater, the land in these areas obstructs and increases the cost of implementation of physical infrastructure and the lower family income levels restrict consumers’ purchasing power and, therefore, the demand for mobile devices, services and commerce (Galperin and Mariscal, 2007). The net result is a high investment cost with limited profitability potential. Although various studies state that the rapid expansion of mobile telephony, especially in the rural zones, has been able to improve opportunities such as the generation of employment and the setting up of various businesses due to easy access to information, communications and lastly even the access to financial services, which are being developed, there are still multiple challenges to strengthen the rural zones with regard to the living conditions of their population (Ontiveros *et al.*, 2009).

Finally, related to social wellbeing, the distributive allocations have been a subject of research since the times of David Ricardo, and this debate has attracted increased interest, with which the variables that affected income distribution were discovered, but, as commented by Dalton (1920): “A point that is usually overlooked is that income distribution is not relevant *per se*, but as a proxy of wellbeing”. This comment has battled against the effects of the great majority of distributive studies, postulating that if we take the distribution of consumption –from the theoretical point of view, that it is a better indicator of wellbeing than current income – we obtain a distribution of wellbeing, and evolution of said distribution, notably different from that of income (Arias, 2006). From a Keynesian viewpoint, income is balanced with the expense (which can be seen in all production, which generates income for the different economic agents equivalent to the expenses of other agents), this is why they both jointly shared the option of being proxies of wellbeing.

3. Methodology

In order to validate the hypothesis of the research, the quantitative method was used due to the access to data and statistics available in the National Household Survey (ENAH) of the National Institute of Statistics and Information (INEI, for its Spanish acronym) and in the Supervising Entity of Private Telecommunications Investment (OSIPTel, for its Spanish acronym). Additionally, the work is correlational so that the characteristics, properties and traits of the analyzed phenomenon can be specified, and on the other hand, the impact of mobile telephony in the rural zones of Peru can be evaluated. The analysis is longitudinal and transversal (data panel) since it analyzes the national context between the years 2007 and 2019 of the country’s 24 departments.

The target population of the research is the rural zones of Peru during the years 2007–2019. A probabilistic method is used per random sample since the information obtained is

from an official statistical source. According to the INEI, the Peruvian rural zone is one that does not have more than 100 houses grouped contiguously nor is the capital of a district; or having more than 100 houses, these are located in a scattered way without forming blocks or centers. About 240 observations are made for each variable under study, grouping the research into three variables: the percentage of the families in rural zones with possession of a cellular device, the average expenditure in mobile telephony per family in rural zone and the average of basic expenses per family in the rural zone for each department (Table 1).

The data analysis used a linear panel model, which consists of linear regression with one endogenous and two exogenous variables, based on the model used by Beuermann (2013) and Runsinarith (2015). The methodological objective is to show that there is an impact between the indicators of the use of mobile telephony and the wellbeing measured by basic consumption. Therefore, in this study, the following function is developed:

$$FE_{it} = \alpha_0 + \alpha_1 FMR_{it} + \alpha_2 MAE_{it} + \varepsilon_{it}$$

Where $i = 1, \dots, 24$; $t = 1, \dots, 10$.

In other words,

$$GB_{it} = f(FMR_{it}, MAE_{it})$$

Where the dependent variable “*FE*”, is the average basic consumption (in soles) per family in rural zones and the independent variables are “*FMR*”, which is the number of families in rural zones with at least one mobile phone (in percentage) and “*MAE*”, which is the average mobile expense (in soles) per family in the rural zone.

The limitations due to lack of access to and availability of consistent data and from prestigious transparent sources that support their credibility are the main factor for using a simplified and linear model. With the help of statistical software, the model was estimated through the least-squares panel method, and tests were carried out for the validation of the regression assumptions; in the cases in which the assumptions were not stated, the re-estimation of the model is derived, correcting the assumptions that are not made.

4. Results

Two assumptions were not fulfilled in this study: homoscedasticity and autocorrelation, to correct it, the model was re-estimated through an EGLS Panel (cross-section weights). Additionally, since this study is carried out by a data panel, statistical tests are carried out to determine the absence or presence of random or fixed effects in the model, both in cross-section (by departments of Peru) as well as longitudinal (by years) section. In this model, it

Variables		Definition
Wellbeing indicator (dependent variable)	<i>Family basic expense (FE)</i>	Household expenditure on basic needs: education, housing, health, transport and leisure (PEN). Proxy variable of family wellbeing
Indicators of mobile phone use (independent variables)	<i>Families mobile use in rural areas (FMR)</i>	Percentage of households in the rural area having at least one mobile device
	<i>Mobile average expenditure (MAE)</i>	Average expenditure of families in rural areas to use mobile phone service (PEN). Proxy variable of consumption of mobile phone service

Source(s): Own elaboration

Table 1.
Definition of the
variables

was determined the presence of fixed effects in cross-section and no effect in time, with which the presence of random effects in the model was discarded.

When regression with fixed effects is carried out, a change in the model intercept (initial wellbeing) will be generated for each of the departments of Peru; the effects will have to be added to the model intercept to obtain the particular intercept in the department. Finally, Table 2 shows the estimates of the panel model regarding the impact of the use of mobile phones in rural zones.

A greater expense in the mobile phone (*MAE*) would cause a positive effect on wellbeing, with the number of persons in rural zones who use the mobile phone remaining unchanged; on the other hand, the increase of a percentage point in the number of families in rural zones with at least one mobile phone (*FMR*) would cause a positive effect on the wellbeing of rural families, with the expense on mobile phones remaining unchanged. This means that there is a positive relationship between the possession and use of the mobile phone about wellbeing.

The presence of autocorrelation indicates the existence of a cycle or trend in the model, in which the presence of a stationary ARMA (1,0) type autocorrelation process was detected; in order to correct it, the AR (1) variable was incorporated in the estimate of the model. Next, it was verified that there is no statistical evidence that suggests the non-compliance of another assumption in the regression model.

Additionally, Table 2 shows that all the variables of the models are significant for it. The indicator denominated determination coefficient (R^2) indicates a high adjustment in the model (0.89). This means that the independent variables (mobile expense and possession) are very efficient for determining the behavior of the dependent variable (wellbeing).

5. Discussion and conclusions

The use of the mobile phone is causing individual and social changes and fostering new employment and income opportunities, supporting its importance as an essential tool for development, especially in underdeveloped countries. The results of this investigation are interpreted as the change in the wellbeing of rural areas of Peru that occurs when consumption is made in mobile telephone service, or when the level of penetration of telephone networks in the area is expanded. Following this idea, it is necessary to take into account that the absence of homoscedasticity in the methodology of the investigation does not apply all to the other departments because given the diversity of behaviors in Peru it is impossible to affirm that a rural area of the Amazon behaves in the same way as another one of the Andes. In this manner, it seeks to verify the need to increase or improve the access and use of mobile phones generally in these regions to later improve as well income opportunities in rural areas.

Dependent variable	FE
<i>Explanatory variables</i>	
_Cons	408.684** (20.70)
FMR	33.120*** (16.55)
MAE	0.150*** (0.05)
AR(1)	0.663*** (0.03)
Observations	288

Note(s): Standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$

Source(s): Own elaboration

Table 2.
Final result

In relation to this, Escobal and Torero (2005) find studies that allege that access to telephones as the main information and communication technology available in rural Peru had a significant positive effect on the wellbeing of households in these areas. It also mentions that the complementarity of assets in traditional infrastructure (transport, sewerage, water, electricity), in public services (education, health), and Information and Communication Technologies (telephone, Internet) show a positive effect on the wellbeing of households in rural areas because access to or ownership of a combination of two or more assets tends to have a greater impact on wellbeing than the sum of individual impacts.

After reviewing the bibliographic material and analyzing the results, it has been possible to conclude that the impact of spending on mobile phone services and coverage on the wellbeing of families in rural areas is positive, that is, an extension in the average spending on the mobile telephone as well as greater possession of mobile telephone in each rural area studied would generate an increase in the wellbeing of the families. In this manner, the mobile telephony supports the change in the productive structure of an economy, joining production and trade practices, where information asymmetries are reduced, decision-making is facilitated in the market and create greater opportunities for advancement and entrepreneurship for citizens.

Furthermore, it is important to point out that, for the Peruvian context, it is necessary to incorporate ICT access and use variables that include significant aspects to obtain additional information on the possession and/or application of said technologies in society, either in national households surveys or as part of future field studies. This is because the great limitation in this research was due to the scarcity of long and complete time series related to the penetration and coverage of mobile telephone service in rural areas of Peru, which is why we proceeded to use proxy variables.

Finally, according to ECLAC (2019), digital technologies became essential for the functioning of the economy and society during the pandemic crisis and, on the other hand, networks and communications infrastructure are being used increasingly more intensive for productive, educational, health, and relationship and entertainment activities. Advances that were expected to take years to materialize have occurred in just a few months. Therefore, in order to give a greater scope of the results obtained, it is recommended that future studies evaluate the chosen variables including data in times of pandemic and post-pandemic in order to analyze how this event on a global scale has influenced household wellbeing in rural areas.

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