

Mobile broadband: a key enabling technology for entrepreneurship?

Abstract

This paper examines whether mobile broadband can be viewed as an enabling technology for entrepreneurship in developing and developed countries. Evidence shows that mobile telephony is becoming more affordable worldwide. Contrary to fixed broadband, mobile broadband ensures better reach and lower costs and has become the most dynamic platform for bringing ICT benefits to entrepreneurship. A six period panel data analysis, 2007-2012, is estimated for 58 countries. By using the Global Entrepreneurship Monitor's Total Entrepreneurial Activity as the dependent variable, a positive influence of mobile broadband on the entrepreneurial activity is observed. Linking ICT and entrepreneurship is an area in need of more research.

Keywords: entrepreneurship, enabling technologies, mobile broadband, panel data.

1. Introduction

Mobile technology and services are the key drivers of the information society. Mobile phones, smart-phones and tablets, among other devices, are embedded in the daily work of people. They are useful to communicate, upload and share information on the internet or within the personal online network. Together with mobile networks and applications, they have formed an ecosystem that becomes the most dynamic platform for bringing Information and Communication Technologies (ICT) benefits to our economy and society (Tiarawut, 2013; Carayannis et al, 2006). What these benefits are for entrepreneurship and whether mobile broadband penetration facilitate or inhibit the entrepreneurial activity are new questions being asked.

ICT is an enabling technology that can drive radical change in the capabilities of entrepreneurs. The information society has brought the ICT benefits to the newly born firms. Businesses are not only made of processes and products, physical capital and labour. They increasingly use ICT as well. The value of ICT extends far beyond direct economic benefits. ICT is a driving force in the acceleration of entrepreneurship and innovation, making it easier to identify and develop good ideas, and create and

disseminate new products and services (INTEL, 2012). In this context, broadband internet has become an essential part of the business environment.

The creation of conditions for entrepreneurial discovery and action is one major implication of ICT. The use of ICT drives entrepreneurship in virtually every market sector, from farming to computing and government services. Some of the ways in which ICT supports entrepreneurship and innovation include: wider interconnectedness and collaboration; lower cost of entry for new entrepreneurs; enhanced ability of entrepreneurs to develop new business models, products, services, and processes; new tools to create, organize, store, and transmit information; and faster access to regional and international markets. The accessibility of ICT makes it increasingly easier for remote locals to participate in global commerce, diminishing geographic, political, and cultural boundaries (Carayannis et al, 2006). By reducing geographic constraints, firms from all across the countries can run their business despite of location.

Moreover, information access in real time is a critical tool for enterprises competitiveness. Mobile devices increase the speed of management and doing business, since users can immediately respond to market changes and problems, achieving better profits. ICT is sometimes the only medium with which rural businesses can access the market information they need to develop entrepreneurship (Polo Peña et al, 2011). Not only has mobile broadband emerged over the past decade to meaningfully extend the reach of the Internet, it has actually become the primary method of access for people around the world (Bold and Davidson, 2012). Therefore, bringing broadband access to the majority of population attends challenges ensuring coverage while increasing the speed of broadband access is crucial for business development in major cities (Tiarawut, 2013).

Prior academic studies have exerted much effort into studying the effects of ICT on aggregated measures such as economic growth, employment, and productivity. However, there is little literature regarding their effects on entrepreneurship. There are many reasons which justify the analysis of mobile broadband as a determinant of the entrepreneurial activity of a certain country instead of analysing other ICT indicators such as Internet penetration or fixed broadband. First, the number of broadband Internet subscriptions over mobile technologies surpassed the number of broadband subscriptions over fixed technologies in the last years (ITU, 2014). While the growth in mobile-cellular subscriptions is slowing as the market reaches saturation levels, mobile broadband remains the fastest growing market segment, with continuous double-digit growth rates in 2014 and an estimated global penetration rate of 32 per-cent – four times the penetration rate recorded just five years earlier (ITU, 2014).

This information might indicate that mobile broadband is the main Internet access in emerging regions. But it also substantiates the notion that the Internet itself is shifting from a desktop experience to a digital mobile experience for developing and developed nations alike (Bold and Davidson, 2012).

Contrary to fixed broadband services, which are characterized by limited reach and high capital expenditures, mobile broadband services ensure better reach and lower costs. They also provide unprecedented access to highly personalized Internet and computing experiences. In fact, mobile telecommunications deeply affect the way users interact and have significant externalities for the economic activities for which they are used (Gruber and Koutroumpis, 2011). Moreover, mobile internet requires fewer ICT skills and less financial resources compared to computers or laptops (Stork et al, 2013).

On the other side, Internet penetration (an ICT access indicator different from broadband) has experienced important progress rates worldwide, but it is a less dynamic market segment to justify its analysis as a special case.

Therefore, focusing in mobile broadband is considered an advantage since its rate of adoption is exponentially increasing worldwide, contrary to fixed broadband whose rate of adoption shows signs of stagnation as affordability of the service (cost of broadband as a percentage of monthly income) rises, especially in developing countries. On the contrary, mobile broadband has achieved better results in terms of coverage and penetration.

Besides, mobile broadband currently does not seem to represent a substitute for fixed broadband and endanger such investments. In the developing world, mobile broadband services provide a response to the demand for high-speed Internet access in view of the lack of affordable fixed-broadband services, whereas in the developed world both fixed and mobile-broadband uptake is growing continuously (ITU, 2014). The degree of differentiation between mobile and fixed technologies in the long term depends on the capacity and quality differences between the technologies as well as on the availability and demand for bandwidth intensive communication services (Wulf et al, 2013).

The stage and emphasis of mobile ICT differs greatly among countries (Thompson and Garbacz, 2011). This heterogeneity is linked to the development level of the country. Mobile broadband is growing fast, but the difference between developed and developing regions remains large, with 84 per-cent penetration in the former vis-a-vis 21 per-cent in the latter. Mobile broadband appears to be growing exponentially in developing countries relative to developed ones.

In developing countries, mobile technologies are playing a growing role. Subscriptions doubled over the past two years and now outnumber subscriptions in developed countries. Access to mobile broadband allows people who lack Internet access or are isolated from educational tools to develop the skills to compete in the 21st century and provide new economic opportunities. The use of mobile phones has helped several entrepreneurs reduce costs and improve business process (Essegbey and Frempong, 2011). In many developing countries, farmers now use mobile phones to find best prices for their product (Kotelnicov, 2007). In addition, micro loans used to purchase cell phones has led to an important entrepreneurial activity in many developing countries. Recently, the increased penetration of smart phones and tablets has led to the increased role of mobile applications, which become the major drivers of the mobile industry. Mobile application market opens up opportunity for new generation of entrepreneurs. One mobile broadband application known as mobile banking can reduce transport costs. It saves small business owners time and money while also providing more complete and up-to-date information for business decision-making (Wright and Ralston, 2002). In that way, the expenditures of running a business can be reduced.

The Global Entrepreneurship Monitor (GEM) recognizes that an economy's prosperity depends greatly on a dynamic entrepreneurship sector. This is true across all stages of development. Yet the rate and profile of entrepreneurship vary considerably (GEM, 2011). ICT, along with education/training and R&D, is one of the most important elements in building a platform for entrepreneurship. Since mobile broadband is a different and new telecommunication tool and appears to be growing fast, particularly in developing countries, ideas of how mobile broadband may impact on entrepreneurship should be discussed.

There is little research analysing how entrepreneurship is related to ICT, and especially to mobile technologies. The objective of this paper is to determine whether the mobile broadband penetration contributes to explain the entrepreneurial activity at country level. The main interest is on the determinants of entrepreneurship rather than on the impact of entrepreneurship. To achieve this goal, a panel data analysis is estimated. The paper is organized as follows: section 2 provides an overview of the literature focused on the explanatory factors of the entrepreneurial activity, with special attention to ICT and mobile broadband penetration. Section 3 describes the methodology and highlights the data and variables used in the empirical analysis. Section 4 shows the results of the empirical estimation. The final section discusses the findings and provides some implications.

2. Theoretical framework

During last years, a large body of research has studied entrepreneurship from different disciplines and methodological perspectives (Mc Donald et al, 2015; Karatas-Ozkan et al, 2014; Zahra 2007; Acs et al, 2007; Acs and Audretsch 2003; Shane and Venkataraman, 2000; Wennekers and Thurik, 1999). It appears impossible to produce a single definition of entrepreneurship and most theoretical approaches yield operational difficulties (Spencer et al 2008; Friis et al, 2006).

What constitutes entrepreneurship is widely discussed; this paper considers it to be a process of building new firms and recognizing opportunities to create value in newly firms. This concept will define an entrepreneur economy which requires the availability of economic, human and technological resources and some public institutions to encourage entrepreneurship.

Determinants of entrepreneurship can be understood from the so called push (demand side of entrepreneurship) and pull (supply side of entrepreneurship) factor perspectives. Push factors represent opportunities to engage in the entrepreneurial activity, and are influenced by factors related to the technological development, government regulation, and stage of economic development, for instance. The pull factors are determined by characteristics of the population such as the income level, degree of unemployment, and institutional environment, among others.

ICT is considered an enabling technology for entrepreneurship and it is analysed in what follows. Firstly, since ICT are information and coordination enablers, they are a source of entrepreneurship (Alderete, 2014). Information is necessary to the entrepreneurial process because the richer the information, the better the opportunities that are recognized by the entrepreneur (Shane, 2003), and the better the opportunity recognition process, the better the business success (Ardichvili et al, 2003, Kotelnicov, 2007). The extended use of ICT will help entrepreneurs create advantages, research, and participate for technology transfer, training, collaboration, and development of initiatives at global level (Viju, 2010).

The digital revolution has led to a significant drop in the costs associated with information searching, transport communication and business coordination. Some main characteristics of ICT include low transaction costs (Williamson, 1981) and efficient management of information.

ICT have not only emerged as a new economic sector, leading to new business opportunities, but they have also been extended to other economic sectors where innovation raises the creation of new firms. During the last two decades, the development of new technologies and, consequently, the emergence of new business models have shifted from large corporations to small and new ventures (Audretsch and Thurik 2001; Thurow 2003; Wennekers et al. 2005). The long-term economic relationship between the entrepreneurial activity and ICT investment drives creative destruction through the creation of further small and medium sized enterprises, thus revitalizing the entrepreneurial innovative capacity of the host economies (Leitão and Baptista, 2011).

Only a few studies have analysed the role of ICT in the entrepreneurial activity (Alderete, 2014; Ospina, 2011; Leitao and Baptista, 2011; Viju, 2010; Burnham, 2009; Giaoutzi and Vescoukis, 2006). Burnham (2009) analyses the development of the causal links among economic growth, the climate for innovation and entrepreneurship, and the deployment of technology, with specific reference to telecommunications. Giaoutzi and Vescoukis (2006) examine the role of ICT in building entrepreneurial capacity. The authors recognize that ICT and entrepreneurship are tied together. By building a four class entrepreneurial typology that sorts entrepreneurs from a little to a great deal of experience, they observed differential demands and needs of ICT for entrepreneurial action.

In particular, mobile communications have emerged to offer more opportunities for business. Recent trends on mobile technology represent an emerging opportunity for business entrepreneurs. Mobile phones can enhance business practices, and breaking geographical or even socio-economical barriers. Entrepreneurs can use mobile phones to learn market prices, and contact suppliers, traders, and clients. Mobile phones' ease of use and portability makes them an efficient tool to support entrepreneurship. However, studies on the impact of mobile broadband on entrepreneurship are scarce.

In this paper, it is assumed that no substitution effect exists between fixed and mobile broadband. In developing countries there is no substitution since fixed broadband is difficult to achieve. Otherwise, in developed countries, mobile broadband is often a complement to rather than a substitute for fixed-broadband access (ITU, 2013). Since ICT increases entrepreneurship, a positive relationship between mobile broadband and entrepreneurship is expected.

H1: The higher the mobile broadband penetration, the higher the total entrepreneurial activity.

Secondly, **ICT prices** or tariffs have an indirect impact on entrepreneurship, by affecting ICT use and the innovation rates. An important element in monitoring ICT developments is to examine the cost of ICT services.

To achieve this objective, the Measuring the Information Society (MIS) report identifies recent global and regional trends in ICT deployment and uptake. The MIS report provides two tools for benchmarking the Information Society: The ICT Development Index (IDI) and the ICT Price Basket (IPB) (ITU, 2013).

Countries that do well in terms of ICT affordability are those with low tariffs. High tariffs are often a major barrier to ICT uptake, in particular among poor people. Galperín and Ruzzier (2010) argue that ICT access prices in Latin America are nearly three times higher than in developed countries, even when countries such as Uruguay, México and Chile have average tariffs similar to the OECD countries. Some studies for Brazil and Chile show that the presence of high Internet access tariffs is one of the main reasons of not using Internet (Jordán, 2010).

Hence, the existence of cheaper tariffs of mobile broadband than fixed broadband is a main advantage to access mobile broadband. While mobile-broadband speeds continue to increase, and the price of the service is falling, it is becoming more affordable. A way to measure ICT affordability is taking into account both the prices of ICT services and the income level of users to reflect the financial ability to pay on the demand side (World Bank, 2009; Galperín and Ruzzier, 2010). Since mobile broadband is based on a shared technological resource as the radio electric spectrum, the industry has begun to offer “measured” products where the tariff depends on the volume of data downloaded to control its use (IDAB, 2011).

H2: the higher the ICT price basket, the lower the entrepreneurial activity.

To address the impact of ICT on the entrepreneurial activity, other push and pull factors of entrepreneurship must be examined. This enables an assessment of the relative ICT effect and avoids a biased estimation caused by omitting these variables from the analysis. Prediction of ICT impact on entrepreneurship based solely on a good mobile broadband, does not guarantee success; a multivariate set of factors, as discussed in what follows, affects the results.

First, most studies focus on analysing the **economic determinants** of entrepreneurship. Many authors have examined the relationship between entrepreneurial rate and economic growth (Carree et al., 2002; Carree and Thurik, 2003; Belso, 2004; Stel et al, 2005; Cuadrado el al, 2007). Since the 1980s, per capita

income has shown a positive impact on the entrepreneurial activity in most developed economies (van Stel 2005; Audretsch and Thurik, 2001). Increasing wealth leads to higher consumer needs. Therefore, the demand for a variety of products and services increases leading to the creation and development of small firms to offer them.

Moreover, the economic development of a country tends to be accompanied by the emergence of new industries and technologies creating opportunities for small firms. A country's higher development level can encourage and strengthen entrepreneurial activity (Acs et al, 2005). Hence, it is a main factor to understand the entrepreneurial behaviour throughout time (Audretsch and Thurik, 2001; Porter and Stern, 2002 and Thurow, 2003). The Global Entrepreneurship Monitor, GEM Project provides empirical evidence for that statement by showing that developing economies since year 2001 face high prevalence rates of people involved in entrepreneurial activities.

Secondly, many studies have analysed the relationship between entrepreneurship and **unemployment** (European Commission, 2003; Carree and Thurik, 2003; Thurik et al., 2008). Entrepreneurship has been suggested as a remedy against high unemployment and stagnant economic growth. The occupational choice approach suggests that increased unemployment will lead to an increase in the start-up activity because the opportunity costs of starting a firm have decreased. This effect has been referred to as the 'refugee' effect.

Necessity entrepreneurs are unable to find suitable employment in the waged sector of the economy. Thus, the lack of suitable employment activities is the reason for starting a business. When unemployment rates are high, necessity entrepreneurs' rates will be high (Cowling and Bygrave, 2003). Empirical evidence shows that when the population does not find alternative sources of employment, the entrepreneurship phenomenon arises. This phenomenon is a major factor in Latin American entrepreneurship rates (Llisterri et al. 2006).

However, unemployed people tend to possess lower endowments of human and social capital and entrepreneurial talent which may lead to early exit. High unemployment may also imply lower levels of personal wealth reducing the likelihood of becoming self-employed or the survival in the initial stages of business ownership (Van Stel et al, 2007).

Thirdly, **innovation** is considered one of the main sources of business opportunities, and entrepreneurship. Entrepreneurial activity is not only a consequence of a push effect of (the threat of)

unemployment but may also be the result of a pull effect produced by a prosperous economy full of opportunities (Parker, 2004; Thurik et al., 2008).

Innovation is a process of transforming new ideas and knowledge into new products and services (Schumpeter, 1934). Many authors have analysed the way innovation emerges and the entrepreneurial or business opportunities linked to them (Cáceres, 2005; Shane, 2003; Schumpeter, 2002; Malerba and Orsenigo, 1996; Acs and Audretsch, 1989). According to Schumpeter (1939), business opportunities are more likely to emerge in developing innovations sectors. Acs and Audretsch (1989) examined the net entry of small firms into 247 manufacturing industries in the United States and found a higher rate of entry in those industries where the firms' innovation rate was higher.

Fourthly, **human capital** and entrepreneurship, defined in terms of new venture creation, are linked through a number of channels (Bishop and Brand, 2014): a) Opportunity recognition and exploitation. According to the human capital theory, once engaged in the entrepreneurial process, individuals with more or higher quality human capital should have superior ability in successfully exploiting opportunities (Davidsson and Honig, 2003). b) Enhance knowledge spillovers. Audretsch's (1995) Knowledge Spillover Theory of Entrepreneurship stresses that the start-up rate is the mechanism by which knowledge spillovers are transmitted. Economies intensive in human capital will have skilled individuals interacting and emerging as nascent entrepreneurs. Industries with a greater investment in new knowledge exhibit higher start-up rates while industries with less investment in new knowledge exhibit lower start-up rates (Audretsch and Lehman, 2005).c) Resource acquisition or Substitution. Establishing new firms requires several resources, and knowledge can assist to the acquisition or substitution of them. d) Knowledge accumulation. Human capital theory argues that knowledge increases cognitive abilities resulting in more efficient economic activity; hence, it may embody the skills required to create and implement new ideas and enable individuals to better recognise and exploit entrepreneurial opportunities (Acs and Armington, 2004; Shane and Venkataraman, 2000).

Therefore, individuals with higher educational attainment may be better informed or better able to judge the potential for success as an entrepreneur (Arenius and Ehrstedt, 2008). On the other side, human capital may also impact on entrepreneurship through resource acquisition or substitution as knowledge assists in the acquisition of many of the resources required to establish new firms, such as financial and physical capital (Brush, Greene, Hart and Haller, 2001).

Fifthly, institutional factors, the rules governing the undertaking of economic activities within the environment, guide the nature, rather than the level, of entrepreneurial activity (Bowen and Clerq, 2005). It is the regional milieu of agents and institutions of an economy, region or society that is conducive to the creation of new firms (Audrescht et al, 2008).

Empirical evidence suggests that entrepreneurs could decline their intention to create a firm if they have to follow many rules and procedures, contact different institutions, and obtain licenses (Dana 1990; Grilo and Thurik 2005; Young and Welch 1993; Begley, 2005; Djankov et al, 2002). The **Administrative or entry regulations** of new firms, which consist in laws, regulations and public policies that support new businesses and reduce the risk of losses vary from country to country. For instance, a Slovenian entrepreneur in 2006 spent 60 days to complete nine business start-up procedures to build a firm, while in Australia an entrepreneur required only 3 days.

3. *Methodology*

From a panel data corresponding to the period 2007-2012 and a sample of 58 countries, including both developed and developing countries, the incidence of mobile broadband on the entrepreneurial activity is examined. The countries included in the sample are Arabs Emirates, Argentine, Australia, Austria, Belgium, Bolivia, Brazil, Canada, Check Republic, Chile, Colombia, Costa Rica, Croatia, Denmark, Dominique Republic, Ecuador, Egypt, Germany, Finland, France, Greece, Hong Kong, Hungary, Indonesia, Iceland, India, Iran, Ireland, Italy, Jamaica, Japan, Latvia, Macedonia, Malaysia, México, Netherlands, New Zealand, Norway, Peru, Philippines, Poland, Portugal, Russia, Romany, Singapore, Slovenia, South Africa, South Korea, Spain, Sweden, Switzerland, Thailand, Turkey, United Kingdom, United States, Uruguay, Venezuela, and, Yugoslavia.

This study is based on Alderete (2014)'s sample of countries, who analyses the impact of the ICT development level and fixed broadband internet prices on entrepreneurship. Using a six-period model responds to the availability of data. The time restriction comes from the mobile broadband variable which is a novel indicator (published since 2007). On the other side, the Global Entrepreneurship Monitor (GEM) publishes the TEA indicator based on a sample of countries that yearly changes. While in 2008, 43 economies participated; in 2012 the total number raised to 69. Hence, the sample is not fixed, different

countries are examined. A 58-countries sample is built for achieving a strongly balanced panel data. A43 per-cent of this sample corresponds to developing economies.

The dependent variable is the Total Entrepreneurial Activity (TEA), the number of Adults (18-64 years old) per 100 involved in a nascent firm or young firm or both. Two databases measure entrepreneurship: The Global Entrepreneurship Monitor (GEM) and the World Bank Group Entrepreneurship Survey (WBGES). This paper uses GEM database based on Acs et al (2008) comparison between the two of them. GEM data captures informality of entrepreneurship, particularly in developing countries. Many developing countries host substantial informal sectors. Informality arises from the fact that firm formation does not necessarily mean firm registration. GEM data considers a large set of entrepreneurial activities, from businesses that operate in the formal sector but opt for a different legal status than a limited liability corporations (LLC), to businesses that can be part of the informal economy, and to entrepreneurial initiatives that are at the very early stage and hence, can potentially become businesses operating in the formal sector.

The Independent variable of interest is Active mobile-broadband subscriptions per 100 inhabitants which measures the potential of mobile-cellular subscriptions to access, for example, 3G networks. It includes subscriptions that have been used to connect to the Internet using a mobile-cellular telephone. Since 2011, dedicated subscriptions using a USB modem/dongle have also been added. This variable is one of the ICT use indicators computed by the International Telecommunication Union in more than 150 countries worldwide.

The top ranking economies are primarily high-income countries from the developed world, whereas the least developed countries rank towards the bottom of the index. Despite impressive growth in the uptake of mobile telephony in many countries, the magnitude of the digital divide remains almost unchanged.

Figure 1 shows the relationship between TEA and active mobile subscriptions in a scatter diagram.

(Insert Figure 1)

Figure 1 highlights the evolution of the total entrepreneurial activity and active mobile broadband subscriptions in the last years of the period. While the TEA decreases during the period, mobile subscriptions increase.

The relationship between TEA and active mobile bandwidth subscriptions follows a similar pattern to the relationship between TEA and IDI (Figure 2). A complete analysis of this relationship is in Alderete (2014).

(Insert Figure 2)

3.1. Model Specification

A fixed-effects model with standard errors adjusted is estimated to explore the relationship between TEA and its predictors, with special interest on mobile broadband. The type of model estimated depends on the recognition of structural differences among countries (which are specific to the country such as political or cultural differences). It is assumed that something within the individual country may impact or bias the TEA.

In reference to this individual effect, panel data models have been developed in two directions. On the one side, fixed effects models which are characterized by the correlation between the regressors and the specific effects. On the other side, random effects models with no correlation between them. In this kind of model, where t (number of years) is small and i(number of countries)large, the decision between fixed effects and random effects generates differences in the estimated parameters. According to the Hausman test and based on the characteristics of the phenomenon under study, a fixed effects model is estimated. The Hausman test rejects the null hypothesis of not-systematic differences in the estimated coefficients of the models.

In the fixed effects model, the individual-specific effect is a random variable that is allowed to be correlated with the explanatory variables. An efficient use of the information considers those variables that substantially differ from one country to another. A part from that, the hypothesis that there are time-specific effects affecting all countries in the same way is rejected. A joint test confirms that all years coefficients are jointly equal to zero.

The model is specified as follows:

$$TEA_{i,t} = \beta_1 MobileB + \beta_2 ICTprice + \beta_3 GDPpc_{i,t} + \beta_4 Unemployment_{i,t} + \beta_5 Trademarks_{i,t} + \beta_6 Education + \beta_7 DaysDB + a_i + e_{i,t}$$

Where

i: country

t: year (2007; 2008; 2009; 2010; 2011; 2012)

a_i denote the individual effects (country effects)

e_{it} is the error term

TEA: Total Entrepreneurial Activity (entrepreneurship rate). It is the number of Adults (18-64 years old) per 100 involved in a nascent and/or young firm (in the case of both, it is still counted as one active person). Source: GEM, Global Entrepreneurship Monitor.

MOBILEB: Active mobile-broadband subscriptions per 100 inhabitants. Source: ITU, International Telecommunications Union. This indicator measures the mobile broadband penetration as a determinant of entrepreneurship (H1).

ICT PRICE: The ICT Price Basket (IPB) is a composite basket that includes three price sets, referred to as sub-baskets: the fixed-telephone, mobile-cellular and fixed-broadband sub-baskets. Source: ITU, International Telecommunications Union. It measures the ICT affordability as determinant of entrepreneurship (H2).

GDP: The sum of value added by all resident producers plus any product taxes (less subsidies) not included in the valuation of output plus net receipts of primary income (compensation of employees and property income) from abroad. Data are in constant 2005 U.S. dollars, per capita. Source: The World Bank. The Gross Domestic Product is included to control for economic development differences among countries.

UNEMPLOYMENT: Rate of unemployment as percentage of total labour force. Source: The World Bank. Unemployment refers to the share of the labour force which is not working but is seeking employment. The Unemployment Rate is a push factor. It is expected, *ceteris paribus*, that higher unemployment rates will lead to higher firm formation rates.

TRADEMARKS: Trademark applications filed are applications to register a trademark with a national and regional Intellectual Property (IP) Office. A trademark is a distinctive sign which identifies certain goods or services as those produced or provided by a specific person or enterprise. Source: The World Intellectual Property Organization (WIPO). This variable measures the impact of innovation on the entrepreneurial activity.

EDUCATION: The secondary gross enrolment ratio. The total enrolment in secondary education, regardless of age, expressed as a percentage of the eligible official school-age population corresponding to secondary education in a given school-year. It is one of the ICT skills indicators published by ITU and represents human capital.

DAYSDB: The Number of days for starting a Business, from the World Bank's Doing Business reports, pretends to measure the time spent by starting a business in a country. This indicator examines the regulations that enhance business activity and those that constrain it. It can be compared across 183 economies and over time. Source: The World Bank Doing Business Reports. A high number of days is less conducive to the starting and operation of a local firm.

Besides, there are some differences among countries emerging from a social, cultural and political diversity that are not explicitly included in the model. For instance, a country's entrepreneurial ability is one the key factors of economic success (Lawton et al, 2005). Culture has been proven as an explanatory factor of entrepreneurial orientation (George and Zahra, 2002; Hayton et al, 2002). They are estimated by including a dummy variable specific to each country in the model, so that the error term is decomposed in a traditional error term and a specific error term.

Table 1 shows the descriptive statistics of the variables included in the model. See Table 2 for correlation matrix.

(Insert Table 1)

(Insert Table 2)

4. Results

ICT is one of the key factors for entrepreneurship (Alderete, 2014; Ospina, 2011; Leitao and Baptista, 2011; Viju, 2010; Burnham, 2009; Giaoutzi and Vescoukis, 2006). Differently from Alderete (2014) which examines the ICT incidence on entrepreneurship by using the ICT-Development Index (IDI), this paper focus on the role that mobile broadband plays in the entrepreneurial activity. Results obtained show that total entrepreneurial activity raises with mobile broadband penetration, economic development and ICT prices (Table 3).

The fixed effects model (Table 3) supports the main hypothesis (H1), $\beta_1 = 0.038928$, $p < 0.05$. MobileB p-value is below 0.05 which means the variable is statistically significant at a 5 per-cent level. The higher the mobile broadband subscriptions, the greater the TEA will be. Hence, mobile devices have the potential to drive entrepreneurship. They are not only a driving force for economic growth, but they can also promote the formation of new firms. This result follows the findings of the literature revision on the positive relationship between entrepreneurship and ICT (Alderete, 2014; Tiarawut, 2013; Leitao and Baptista, 2011; Viju, 2010; Caceres and Aceytuno, 2008; Velde, 2004). This paper prevents from the bias effect of the mobile broadband on entrepreneurship due to differences in broadband access among countries. Furthermore, it can be proved that the model is robust in the variable of interest; under alternative model specifications, the mobile broadband has preserved its significance.

Besides, the costs of ICT services, measured by the ICT Price Basket, are found significant for the entrepreneurial activity ($\beta_2 = 0.348285$, $p < 0.05$). However, the sign of the coefficient is positive, contrary to Hypothesis 2. A possible explanation for this finding is that the ICT price basket provides data for fixed telephone, mobile cellular, and fixed and mobile broadband prices. Hence, it can be interpreted as a proxy of the cost of living. Evidence shows that less developing countries have higher levels of the ICT price basket than developed countries. Developing countries, which are more expensive to live in than developed countries, are more entrepreneurial. It is likely that the low economic activity of developing countries encourages self-employment. One of the reasons for this is the lack of alternative employment opportunities.

Moreover, the model controls for economic development through GDP per capita. Similar to some authors (Thurow, 2003; Porter and Stern, 2002; and Audretsch and Thurik, 2001), a significant relationship between the level of development of a country and the entrepreneurship rate is obtained ($\beta_3 = 0.000602$, $p < 0.08$), which supports the literature.

The fixed effects model does not identify the regressors' coefficients when they do not change along the time. FE removes the effect of those time-invariant characteristics from the predictor variables so we can assess the predictors' net effect. Mobile broadband penetration is growing so fast worldwide that its impact on the TEA is expected to be significant even if the time-period is short. For some conventional predictors of the entrepreneurial activity, such as unemployment, results are different. Their values are more static in time. This fact could explain unemployment's statistical insignificance in the model. The model cannot confirm unemployment as an explanatory factor of entrepreneurship (p-value > 0.10 for β_4).

The rest of the independent variables: Unemployment, Trademarks, Education and DaysDB, are statically not significant ($p>0.10$). Therefore, hypotheses linking entrepreneurship to these variables are rejected.

(Insert Table 3)

5. *Discussion and implications*

This study examines the explanatory factors of entrepreneurship with special emphasis on the Mobile broadband penetration at country level. It provides some insights to determine whether ICT is an enabling technology for entrepreneurship by examining to what extent differences in mobile broadband penetration contribute to explain differences in entrepreneurial activity across countries. The main contribution of this paper is to show the relevance of mobile broadband to entrepreneurship. Contrary to some existing studies on this relationship, which employ case studies or business models, this paper estimates an econometric model using panel data. To achieve this goal, a fixed effects panel data was estimated based on 58 countries for the period 2007-2012.

In summary, the main purpose of this study is to examine whether mobile broadband, as a special and novelty ICT, plays a significant role in determining the entrepreneurial activity rate of a country. To answer this question, this study develops a theoretical framework which links the mobile broadband penetration to the traditional explanatory factors of entrepreneurship.

This study offers an important contribution to the body of knowledge by demonstrating the role that mobile broadband plays as an enabling technology for entrepreneurship. This has important implication to theory, managerial practice and policy that will now be addressed.

Theoretical implications

The main contribution of this paper is identifying an important area in need of more research in the entrepreneurship literature, linking ICT development to entrepreneurial activity. It complements previous works that show a positive link between ICT and entrepreneurship (Alderete, 2014; Tiarawut, 2013; Leitao and Baptista, 2011; Viju, 2010; Giaoutzi and Vescoukis, 2006). It has been found emerging opportunities for business entrepreneurs (Tiarawut, 2013; Viju, 2010) and differential demands and needs

of ICT for entrepreneurial action have been settled (Giaoutzi and Vescoukis, 2006). Moreover, investment in ICT advances the development of entrepreneurial activity and drives the creation of further SME (Leitao and Baptista, 2011).

However, this study shows some advantages of examining mobile broadband compared to the already mentioned works. First of all, this technology is currently one of the most important ICT indicators worldwide, as it was explained in the introduction. In fact, mobile broadband has achieved better results in terms of coverage and penetration than fixed broadband. Recent estimations show that while mobile telephony is becoming more affordable worldwide, fixed broadband Internet is not affordable for the majority of the world's inhabitants. Besides, mobile broadband is less expensive which enables the reduction of transaction costs which is supposed to significantly increase the entrepreneurial activity.

Moreover, this paper differs from Alderete (2014) which examines the ICT incidence on entrepreneurship by using the ICT-Development Index (IDI), and therefore, it can avoid the disadvantages of using aggregate indicators such as the misleading policy messages if the index is poorly constructed and loss of absolute level information.

Furthermore, the kind of relationship between fixed and mobile broadband, whether they are complements or substitutes with respect to their incidence on entrepreneurship, affect the results interpretation. Although there is a lack of consensus in the subject, some authors have stressed the hypothesis of complementarity between them (ITU, 2013; Wulf et al, 2013). In this case, the entrepreneurial effects are not likely to be limited to mobile broadband but also to fixed broadband. However, since mobile broadband is considered a special technology, findings from this study are not supposed to be generalizable.

Finally, this paper does not pretend to explain causality between entrepreneurship and mobile broadband. Causality between these variables cannot be explained due to the multidirectional nature of the phenomenon. However, using a panel data model has the advantage of eliminating the omitted variable bias problem of modelling.

Managerial implications

This paper emphasizes the importance of mobile broadband in the creation and development of new businesses. The main contribution of mobile broadband consists not only in providing recent and up-date

information about the business and its environment to the entrepreneur, but also in exploiting the opportunities for entrepreneurship.

The increasing use of ICT in the economy has led to the emergence of a digital economy. ICT are composed of several products and services technologies, such as hardware, software and services, and telecommunications. Among ICT, mobile phones have emerged to transform people's way of life. As a multifunctional device, they are useful for entrepreneurship. But, in order to effectively exploit the opportunities offered by mobile phones, mobile broadband internet access is needed.

For people in many parts of the world, mobile broadband represents the first-ever means of accessing the Internet. In many emerging regions, mobile telephony will likely be the only device to connect Internet. Meanwhile, in more developed countries it is rapidly becoming integral to modern life for people, continuously opening up new Internet experiences and unlocking new opportunities. This shift provides unprecedented opportunities and benefits for entrepreneurship.

Mobile broadband devices present several intrinsic advantages that support entrepreneurship: they reduce transaction costs allowing entrepreneurs an easily interaction within and between sectors; improve communications; and identify and develop new markets. As a result, mobile broadband Internet access enables individuals to become entrepreneurs. By exploring the advantages of mobile devices for performing the organizational activities of newly born firms, this study brings managerial implications to entrepreneurs.

Besides, as the number of applications continuous to grow and the number of people joining the information society rises, there will be a space for building entrepreneurship. For instance, mobile application market promotes the generation of new entrepreneurs.

Political implications

Entrepreneurship is still an issue in the policy agency; policy research priorities go from measuring entrepreneurship to fostering the entrepreneurial activity through appropriate policies. This paper suggests the important role mobile broadband plays to promote entrepreneurship. Results suggest that mobile broadband is a research area in need of more in-depth investigation. Governments need to compel to innovation-related investments, including mobile broadband, education/training, and R&D.

It also offers some political implications in order to ensure the right conditions for expanding business start-ups, on the one side, and to contribute to mobile broadband universalization, on the other. In resume, micro and macro level ICT policies to promote entrepreneurship should be applied.

Governments and public administrations can exploit these new technologies by flourishing e-government and endorsing applications to transform public services. By doing so, entrepreneurs could access to government information, biddings, and contacts saving time and reducing transaction costs by means of the mobile applications.

The desire to foster entrepreneurship highlights the new advantages emerging from the mobile broadband networks, and adds new reasons to the reduction of the digital divide. This political implication is especially useful in emerging countries, and eventually developed countries, to perform initiatives for rural wireless broadband access and deploy the recent wireless technology networks, such as 4G and 5G. The better the technological wireless network, the greater the entrepreneurial opportunities to be exploited.

Among other policies, governments can promote competition in the mobile sector increasing the number of operators and reducing barriers to entry. This policy is needed to reduce tariffs and expand the mobile broadband infrastructure.

Limitations and Future contributions

One of the limitations is the size of the sample. Although this limitation is in part due to unpublished data of TEA for certain countries, a suggestion is extending the sample as much as possible to obtain more precise estimates due to efficiency gains brought by more data. Besides, future contributions could examine if ICT skills are a less critical challenge in the mix of entrepreneurship and mobile broadband in most entrepreneurs than fixed internet. Moreover, they could deepen on the difference between developed and developing countries. Although the literature on the subject is recent, this paper should encourage future investigations for a better comprehension of the ICT incidence on entrepreneurship.

Conclusions

Empirical studies about how information and communication technologies impact on entrepreneurship are scarce. Especially rare are studies investigating the impact of mobile broadband. This paper

emphasizes on the role that mobile broadband plays in the entrepreneurial activity in order to address this research gap.

This study demonstrates that mobile broadband is an enabling technology for entrepreneurship. First, this paper is one of the first attempts to empirically validate the impact of mobile broadband on entrepreneurship. Secondly, it uses public data, published by international organisms, that allow for replication and testing. Thirdly, important managerial and political implications arise from the findings. Researchers, entrepreneurs, managers and practitioners are directly implicated. Results suggest some mobile services recommendations that would ease the emergence and sustainability of entrepreneurship. Lastly, implementation of solutions for entrepreneurship based on mobile broadband leads to new trends and challenges in the areas of management, technical solutions, and mobile services.

References

Acs, Z; Desai, S. and Klapper, L. (2008). What does “entrepreneurship” data really show?. *Small Business Economics*, 31, 265-281.

Acs, Z., O’Gorman, C., Szerb, L., Terjesen, S. (2007). Could the Irish miracle be repeated in Hungary, *Small Business Economics*, 28 (2-3), 123-142.

Acs, Z., and Armington, C. (2006). *Entrepreneurship, geography and American economic growth* Cambridge: Cambridge University Press.

Acs, Z; Arenius, P; Hay M. and Minniti, M. (2005). Global Entrepreneurship Monitor: 2004 Executive Report. Babson Park, MA, London, UK: Babson College and London Business School.

Alderete, M.V. (2014). ICT incidence on the entrepreneurial activity at country level. *International Journal of Entrepreneurship and Small Business* 21 (2), 183-201.

Ardichvili, A., Cardozo, R., Ray, S., (2003). A theory of entrepreneurial opportunity identification and development. *Journal of Business Venturing* 18 (1), 105– 123.

Arenius, P. and Ehrstedt, S. (2008). Variation in the level of activity across the stages of the entrepreneurial startup process-evidence from 35 countries. *Estudios de Economía* 35 (2), 133-152.

Audretsch, D.B. and Lehmann, E.E. (2005). Does the knowledge spillover theory of entrepreneurship hold for regions?. *Research Policy* 34, 1191-1202.

Audretsch, D. and Thurik, R. (2001). What is New about the New Economy? Sources of growth in the managed and entrepreneurial economy. *Industrial and Corporate Change*, 10(1), 267–315.

Arzeni, S. (1998). Entrepreneurship and Job Creation. *The OECD Observer* 209, 18-20.

Belso, J. (2004). Tasa óptima de empresarialidad y desarrollo económico. Evidencias para el caso español. *Estudios de economía*, 2(31), 207-225.

Bishop, P. and Brand, S. (2014). Human capital, diversity, and new firm formation. *The Service Industries Journal* 34 (7), 567-583.

Bold, W. and Davidson, W. (2012). Mobile broadband: redefining Internet access and empowering individuals. In Dutta, S. And Bilbao-Osorio (eds). *The global information technology report 2012*. World Economic Forum and INSEAD.

Burnham, J. (2009). Economic growth, entrepreneurship, and the Deployment of Technology. Chapter 2, in Neslihan Aydogan (eds). *Innovation policies, business creation and economic development. A comparative approach*, pp 13-37. Springer.

Cáceres, F. R. (2005). *Oportunidades para crear empresas*, Expandora Sur, Sevilla.

Carayannis, E., Popescu, D., Sipp, C. and Stewart, M. (2006). Technological learning for entrepreneurial development (TL4ED) in the knowledge economy (KE): Case studies and lessons learned. *Technovation* 26, 419-443.

Carree, M., Stel, A, Thurik, R. and Wennekers, S. (2002). Economic Development and Business Ownership: An Analysis using Data of 23 OECD Countries in the period 1976-1996. *Small Business Economics*, 19, 271-290.

Carree, M.A. and A.R. Thurik, (2003). The impact of entrepreneurship on economic growth, in: D.B. Audretsch, D.B. y Acs Z.J. (2003): *Handbook of Entrepreneurship Research*, Boston/Dordrecht: Kluwer Academic Publishers, 437-471.

Cowling, M. and Bygrave, W. (2003). Entrepreneurship and unemployment. Relationships between unemployment and entrepreneurship in 37 nations participating in the global entrepreneurship monitor (GEM) 2002. *Frontiers of entrepreneurship research* 2003, 544-555.

CuadradoRoura, J.R., García Tabuena, A., and Crespo, J. (2007). Entrepreneurship, creative industries and regional dynamics in Spain. 47^o ERSA Congress, Paris.

Davidsson, P. and Honig, B. (2003). The role of social and human capital among nascent entrepreneurs. *Journal of Business Venturing*, 18, 301-331.

Djankov, S., La Porta, R., de-Silanes, F., and Shleifer, L. A. (2002). The regulation of entry. *Quarterly Journal of Economics*, 117, 1–35.

Essegbey, G.O., and Frempong, G.K. (2011). Creating space for innovation-The case of mobile telephony in MSEs in Ghana. *Technovation* 31 (12), 679-688.

European Commission (2003), Green Paper Entrepreneurship in Europe, Brussels: European Commission.

Freytag, A. and Thurik, R. (2007). Entrepreneurship and its determinants in a cross country setting. *Journal of Evolutionary Economics*, 17 (2), 117-131.

Friis, C; Karlsson, C. and Paulsson, T. (2006). Relating entrepreneurship to economic growth. In B. Johansson, Karlsson, C. and Stough, R. (eds). *The emerging digital economy. Entrepreneurship, clusters and policy*. Springer, New York.

Galperín, H. and Ruzzier, C. (2010). Las tarifas de banda ancha: benchmarking and analysis. Chapter V in Jordán, V; Galperín, H. and Peres, W. *Acelerando la revolución digital: banda ancha para América Latina y el Caribe*. Naciones Unidas, Santiago de Chile, 2010.

Galperín, H, Mariscal, J. and Vieceis, F. (2012). Análisis de los planes nacionales de banda ancha en América Latina. Documento de trabajo N°11. Universidad de San Andrés.

George, G. and Zahra, S.A. (2002). Culture and its consequences for entrepreneurship. *Entrepreneurship: Theory and Practice*, 26, 5-7.

Giaoutzi, M; and Vescoukis, V. (2006). The role of ICTs in building entrepreneurial capacity in the regions of the future. *Int. J. of Entrepreneurship and Innovation Management* 6(3), 191 – 204.

Global Entrepreneurship Monitor-GEM (2011). 2011 Global Report. Donna J. Kelley, Slavica Singer, Mike Herrington, and the Global Entrepreneurship Research Association (GERA).

Grebel, T. (2007). Neo-Schumpeterian perspectives in entrepreneurship research. In H. Hanusch and A. Pyks (eds), *Elgar comparison to neo-Schumpeterian economics*, pp. 147-158, Cheltenham, UK: Edgar Elgar.

Hayton, J.C, George, G. and Zahra, S.A. (2002). Global Entrepreneurship Monitor. Informe Ejecutivo 2004. Extremadura. Trujillo (Cáceres). Fundación Xavier de Salas.

ITU (2014). Measuring the Information Society. The International Telecommunication Union. Geneva, Switzerland.

ITU (2013). Measuring the Information Society Report 2013. International Telecommunication Union, Switzerland.

Jordán, V. (2010). Banda ancha: la nueva brecha digital. Chapter 3 in Jordán, V; Galperin, H. and Peres, W. *Acelerando la revolución digital: banda ancha para América Latina y el Caribe*. Naciones Unidas, Santiago de Chile, 2010.

Klyver, K., Hindle, H., and Meyer, D. (2008). Influence of social network structure on entrepreneurship participation—A study of 20 national cultures. *International Entrepreneurship and Management Journal* 4, 331–347.

Kotelnicov, V. (2007). Small and Medium Enterprises and ICT. Asia Pacific development research programme. United Nations Development Programme, UNDP-APDIP.

Lawton, H., Glasson, J. and Chadwick, A. (2005). The Geography of Talent: Entrepreneurship and local economic development in Oxfordshire. *Entrepreneurship & Regional Development*, 17(6), 449-478.

Leitão, J. and Baptista, R. (2011). Inward FDI and ICT: are they a joint technological driver of entrepreneurship?. *Int. J. of Technology Transfer and Commercialisation*, 10 (3/4), 268 – 288.

Llisterri, J. J., Kantis, H., Angelelli, P., and Tejerina, L. (2006). Is youth entrepreneurship a necessity or an opportunity? A first exploration of household and new enterprise surveys in Latin America. Washington, DC: Sustainable Development Department Technical Papers Series, Inter-American Development Bank.

McDonald, S., B. C. Gan, S. Fraser, A. Oke, and A. R. Anderson (2015). Towards a Multiple Perspective View of Entrepreneurship. *International Journal of Entrepreneurial Behaviour & Research* forthcoming.

Malerba, F. and Orsenigo, L. (1996). Schumpeterian Patterns of Innovation are Technology-Specific. *Research Policy* 25, 451-478.

OECD (2003). ICT and economic growth. Evidence from OECD countries, industries and firms. OECD, France.

Parker, S.C., (2004). *The Economics of Self-employment and Entrepreneurship*. Cambridge: Cambridge University Press.

Polo Peña, (2011). Impact of Market Orientation and ICT on the Performance of Rural Smaller Service Enterprises. *Journal of Small Business Management* 49(3), 331–360.

- Porter, M. and Stern, S. (2002). Innovation: location matters. *MIT Sloan Management Review*, p 28-36.
- Reynolds, P. (2009). New firm creation in the United States: APSED I overview. In *Foundations and trends in entrepreneurship*. Hanover, MA: Now Publishers.
- Schumpeter, J. (1934). *Entrepreneurship as innovation*. Oxford: Oxford University Press.
- Shane, S., and Venkataraman, S. (2000). The promise of entrepreneurship as a field of research. *Academy of Management Review* 25, 217–226
- Shane, S.(2003). *A General Theory of Entrepreneurship*. Edward Elgar Publishing, Massachusetts.
- Spencer, A., Kirchoff, B., and White, C. 2008. Entrepreneurship, innovation and wealth distribution: The essence of creative destruction. *International Small Business Journal*, 28 (5), 9 –26.
- Stel, A; Storey, D. and Thurik, R. (2006). *The effect of business regulations on nascent and actual entrepreneurship*. Discussion papers on entrepreneurship, growth and Public policy, edited by Group Entrepreneurship, Growth, and Public Policy. Max Planck Institute of Economics, Jena, Germany.
- Stork C; Calandro, E. And Gillwald, A.(2013). Internet going mobile: internet access and use in 11 African countries. *Info* 15 (5), 34 – 51.
- Tiarawut, S. (2013). Mobile Technology: Opportunity for Entrepreneurship. *Wireless Personal Communications* 69, 1025–1031.
- Thurik, A.R., Carree, M.A., Stel, A.J. van, and D.B. Audretsch (2008).Does Self-Employment Reduce Unemployment?..*Journal of Business Venturing*, 23(6), 673-686.
- Thurow, L. (2003). *Fortune favours the bold: What we must do to build a new and lasting global prosperity*. New York: Harper Collins.
- vanStel, A., Carree, M. and Thurik, R. (2007). The Effect of Entrepreneurial Activity on National Economic Growth. *Small Business Economics*, 24(3): 311-321.
- Velde, T. R. (2004). Schumpeter's theory of economic development revisited. Chapter 5 in *Innovation, entrepreneurship and culture: The interaction between technology, progress and economic growth*. Terrence. E, Brown y Ulijn, Jan (Eds). Edward Edward, 103-130.
- Viju, M. (2010). Women entrepreneurship in Middle East: understanding barriers and use of ICT for entrepreneurship development. *International Entrepreneurship and Management Journal*, 6(2),163-181.
- Wennekers, A.R.M. and Thurik,A.R. (1999). Linking Entrepreneurship and Economic Growth. *Small Business Economics*, 13(1), 27-55.

Wennekers, S., van Wennekers, A., Thurik, R. and Reynolds, P. (2005). Nascent Entrepreneurship and the Level of Economic Development. *Small Business Economics*, 24(3): 293-309.

Williamson, O. (1981). The Economics of Organization: The Transaction Cost Approach. *American Journal of Sociology*, 87(3), 548-577.

World Bank. Information and Communication for Development: Extending reach and increasing impact. The World Bank, Washington DC.2009.

Wright, A. and Ralston, D. (2002). The lagging development of small business internet banking in Australia. *Journal of Small Business Management*, 40 (1), 51-57.

Wulf,J; Zelt, S. and Brenner, W. (2013). Fixed and mobile broadband substitution in the OECD countries. A quantitative analysis of competitive effects.43th Hawaii International Conference on System Sciences.

Tables

Table 1: Descriptive Statistics

	Obs	Mean	Std.Dev	Min	Max
TEA	246	9.683415	6.047538	2.4	38.6
MobileB	290	28.31897	27.92015	0	124.9
ICTprice	280	2.100143	2.052781	0.03	14.3
GDP	336	2.48E+10	1.66E+11	863.4626	1.29E+12
Unemployment	342	8.038889	5.258187	0.7	34.9
Trademarks	315	39939.1	52147.59	1711	313641
Education	348	95.09023	14.66608	57	149.3
DaysDB	348	24.94828	27.75449	0.5	149

Source: The author.

Table 2: Correlation matrix

	TEA	GDP	Unemployment	Trademarks	Education	DaysDB	MobileB	ICTprice
TEA	1							
GDP	0.0701	1						

Unemployment	-0.0276	-0.0197	1					
Trademarks	0.0028	0.0045	-0.1773*	1				
Education	-0.3476*	-0.017	0.0201	-0.0613	1			
DaysDB	0.4068*	-0.1047	-0.0347	0.0857	-0.2482*	1		
MobileB	-0.3944*	-0.0153	-0.1187*	0.1163	0.3947*	-0.3366*	1	
ICTprice	0.6361*	-0.0736	0.2046*	0.0451	-0.3182*	0.4607*	-0.5424*	1

Source: The Author. *significance level at 5 percent.

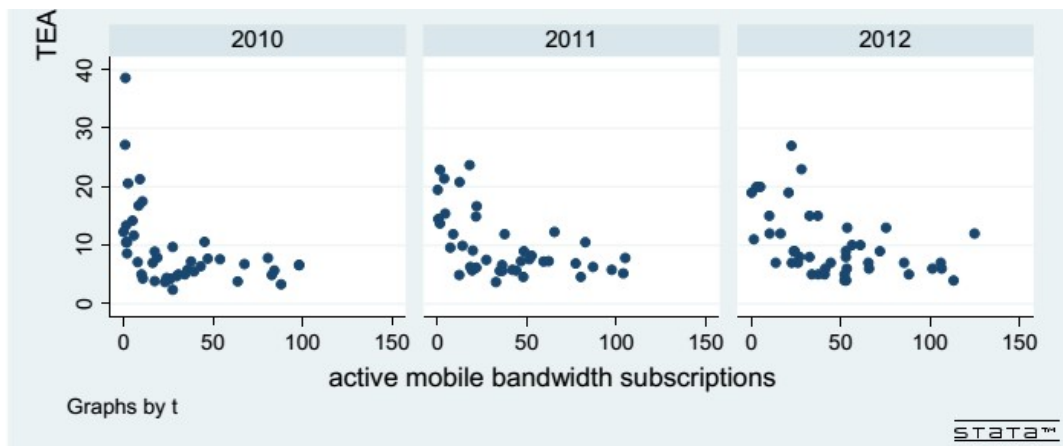
Table 3: Estimation output.Fixed effects regression.

	Coefficient	Robust St. Error	t	p-value
MobileB	0.038928	0.0170662	2.28	0.027
ICTprice	0.348285	0.1381362	2.52	0.015
GDP	0.000602	0.0003338	1.8	0.078
Unemployment	0.0467376	0.0908395	0.51	0.609
Trademarks	0.0000422	0.0000355	1.19	0.239
Education	-0.0135052	0.0509754	-0.26	0.792
DaysDB	0.0165379	0.0214523	0.77	0.445
_cons	-627592.4	348076.4	-1.8	0.078
Number of obs	145	Corr (ui, xb)	-1	
Number of groups	48	F(7, 47)	7.62	
R-sq within:	0.1857	Prob>F	0	Rho=1
R-sq between	0.0039	Sigma u	13134688	
R-sq overall	0.0007	Sigma e	1.8084577	

Source: The author using Stata 12.

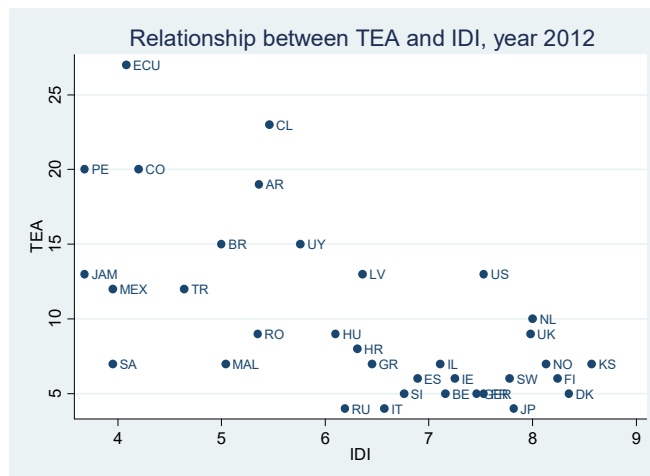
Figures

Figure 1 : Relationship between TEA and Active mobile broadband



Source: The author based on STATA

Figure 2. Relationship between TEA and IDI



Source: The author based on STATA