

Investigating Mobile Broadband Affordability in Developing Countries: A Cross-National Comparison

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ABSTRACT

This paper aims to identify and understand whether national policy initiatives, regulatory measures, or governance practices increase a developing nation's mobile broadband affordability. For this purpose, a cross-national multiple regression analysis of non-OECD countries is used. The results revealed that when controlling for wealth, education and other factors, competition to provide mobile services, financial investment in ICTs, and income inequality are all important variables for determining mobile broadband affordability. Findings suggest that service providers and other stakeholders are still recouping the cost of deploying the infrastructure necessary to provide mobile services, and have not yet achieved the economies of scale required for the price of mobile broadband to begin to fall, at least in the developing world. This paper provides contributions to academia, industry, and policymakers.

Categories and Subject Descriptors

H.4.4 [Web Applications]: Internet communications tools. M.2.5 [Commerce Policy]: Antitrust and competition, Governmental regulations

General Terms

Management, Measurement, Performance, Economics, Legal Aspects

Keywords

Government, Governance, Regulation, Telecommunications Policy, Democratic Institutions

1. INTRODUCTION

Broadband is still a relatively new phenomenon. Higher speeds and newer types of networks are being invented at regular intervals, which have led this research to consider the diffusion of innovations (DoI) theory proposed by Rogers [36] as being most suitable for understanding the evolution of broadband. Rogers defines an innovation as: 'An idea, practice or object perceived as new by the individual or unit of adoption' [36, p. 35]. As we commented, broadband is still a relatively new phenomenon, which led us to consider this to be the most appropriate definition

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for the understanding of this research study. To diffuse an innovation (in our case, mobile broadband), the process that is followed revolves around four key elements: An innovation or idea, channels of communication to spread knowledge of the innovation, time during which diffusion takes place, and a social system of potential adopters in which this occurs [36]. In addition to these four key elements, another important factor that we applied to understand mobile broadband diffusion as a global phenomenon is affordability.

Affordability is viewed to be essential to bridging the 'digital divide' that arises within and between both developed and developing nations [18, 30, 33] and thus motivates this study. Associated with broadband are the issues of accessibility and provision that, in part, cause the digital divide. For this reason, it is important to define and describe the 'digital divide'.

There are varying definitions of the digital divide [10, 33, 39, 42], where it is generally viewed to be a distinction between those with and without access to the Internet, or between the users and non-users of the Internet. This research used the definition of those with and without access to the Internet. Accessibility is viewed to be a key issue of the digital divide, where it can be argued that having access to the Internet alone cannot deliver the intended benefits; particularly if the individual is not computer-literate, or perceives the Internet in negative terms [4]. When considering access and the digital divide, findings from van Dijk differentiate between four types of access; namely, motivational, material, skills and usage access [41].

A diverse perspective on the digital divide is provided by Pick and Azari who highlighted three factors used to measure the digital divide: Technology usage, expenditure and infrastructure [35]. Also stressed is the use of traditional measures such as accessibility to the Internet that appear to be only used in developed countries where vast majorities of individuals own computers. Contrary findings emerge for developing or poorer countries, where people have little or no access to technology, are not computer literate, or, are prevented by ethnic group customs and laws [7]. Instead, there is reliance on other communication channels such as radio or television. Therefore, it can be inferred from this argument that income, knowledge, and infrastructure are significant factors for our digital divide research.

When considering the digital divide and diffusion trends, some theorists, 'cyber-optimists,' argue that the spread of Internet access (i.e., fixed or mobile broadband access) follows a *normalization* pattern [36]; i.e., as costs fall and technology becomes more available, the gap closes between the early, middle and late adopters — including the disadvantaged — and the majority gain access to broadband technologies. In contrast, others argue that the poor and less privileged in society do not always catch up with those who can afford broadband access [41].

When diffusion of a technology reaches a saturation point, a *threshold*, or a “wall,” prices do not necessarily drop. Sometimes the technology morphs into more sophisticated, segmented, and costlier versions. In this case, the economically disadvantaged in less affluent countries are still excluded. In this research-in-progress paper, we present findings that suggest strategies that governments can employ to make mobile broadband more affordable before and after the so-called *threshold effect*.

Since mobile broadband technologies are also becoming an important means of communication and Internet access, understanding the adoption of these technologies is an emerging area of research [16, 19, 30, 31]. Previous research on the broadband digital divide has focused on developed countries and the role of several factors in bridging this divide; including, different forms of broadband industry competition [9, 11, 18, 22]. Factors that influence mobile broadband diffusion include different forms of competition, effects of income, fixed broadband price, national policy, standards, and infrastructure [3, 5, 16, 19, 30, 31]. While these studies and others provide many insights into fixed line broadband diffusion, there are few such studies relating to mobile broadband. The work by Lee et al. [30, 31], however, presents the most complete assessment of mobile broadband diffusion to date.

The aim of this research-in-progress paper is to identify and understand whether national policy initiatives, regulatory measures, or governance practices increase a nation’s mobile broadband *affordability*. By doing so, the contributions of this study are to provide an understanding of the pertinence of policy initiatives, regulatory measures and governance practices in broadband affordability. For industry, this research contributes to identifying whether the regulatory measures imposed on organizations have an impact on affordability. For policymakers, this study contributes to providing an understanding and explanation of whether the national policy initiatives, regulatory measures, or governance practices pursued in a country increase a nation’s mobile broadband affordability. To address our aim and theoretical understanding, the following hypotheses have been formed:

(H1): National policy initiatives to promote information and communication technologies (ICTs), including competition among service providers and financial investment in ICTs, increase a nation’s mobile broadband affordability;

(H2): Regulatory measures that engage governments in the telecommunication standards process and empower governments to manage licenses for telecommunication service providers increase a country’s mobile broadband affordability; and

(H3): Sound governance in the public sector, including rule of law and control of corruption, increase the affordability of mobile broadband services.

2. RESEARCH METHODS

For this study, most of the secondary data were acquired from the International Telecommunication Union (ITU) [26, 27] as it provides the most detailed and comprehensive cross-national information regarding broadband.

The indicator for mobile broadband affordability is the mobile broadband price sub-basket, as reported by the ITU for 2012 [27]. This mobile broadband sub-basket is calculated as the average of two costs: the price of a 500 MB prepaid handset-based monthly plan and the price of a one GB postpaid computer-based plan,

where each price is divided by the monthly per capita gross national income (GNI) to yield a “normalized” cost. The rationale behind this calculation is that pre-paid mobile broadband plans dominate in less affluent countries, whereas, post-paid mobile broadband plans dominate in more affluent countries. Calculating an average sub-basket cost therefore allows policymakers and practitioners to compare costs between countries. Note also that this average cost measures the cost of mobile broadband services relative to each country’s average income, thus measuring the affordability of mobile broadband Internet access. The large number of countries with expensive mobile broadband services yields a long tail of large values in the distribution of the normalized costs derived from mobile broadband price sub-basket data. We therefore take the natural logarithm of the income-normalized mobile broadband cost to be the dependent variable in this cross-national study.

All independent variables used in the multiple regression analysis described in Section 3 were sampled from prior years (i.e., 2007-2010) [8, 26, 28, 34, 40, 44]; thereby, reflecting the fact that their effects are delayed with respect to their value in a given year.

3. DATA ANALYSIS AND FINDINGS

The results of the regression analysis of the log-transformed value for the mobile broadband price sub-basket was based on three policy variables (**H1**), two regulation variables (**H2**), two governance variables (**H3**), and four control variables. These results are presented in Table 1. The eleven independent variables sampled for the 76 developing countries together explain 79.3% of the variance in mobile broadband affordability.

The first row of data reports the coefficients for the mobile telecommunications competition variable [26]. The coefficients are statistically significant at the 0.01 level, which suggests that countries that encourage greater competition have access to more affordable broadband services in the developing world. Privatization and competition in the computing and communication sectors can create a highly favorable environment for lower prices. In such an environment, mobile service providers deploy more efficient telecommunications infrastructures to connect users to the Internet and consumers are able to purchase superior products and services. The coefficients for the financial investment index [46] are statistically significant at the 0.05 level, but not in the direction that we anticipated. Instead of decreasing mobile broadband cost, we find that more financial investment in telecommunications increases the cost of mobile broadband services. With respect to developing countries, it is clear that greater financial investment in previous years means subscriptions to mobile broadband are more expensive in 2012. This suggests that service providers are still recouping the cost of deploying the infrastructure necessary to provide mobile services, and have likely not yet achieved the economies of scale required for the price of mobile broadband to begin to fall (again, in the instance of developing countries).

Surprisingly, the presence of a universal service policy for broadband did not have an effect on mobile broadband costs. As evident in the third row of data, the coefficients for the universal broadband service variable are not statistically significant. It was expected that in countries where there is such a policy in place, there would be greater material access to mobile broadband. In sum, there is mixed support for hypothesis (**H1**). More affordable mobile broadband is associated with competition to provide mobile broadband services. However, more costly mobile

broadband is associated with greater financial investment in ICTs in previous years.

Table 1. Multiple regression analysis explaining mobile broadband affordability in developing countries

	Unstandardized Coefficients		Std. Beta	[Ref's]
	<i>b</i>	<i>Std. Err.</i>		
Mobile telecom competition (H1 1=full or partial competition)	-0.742***	.226	-.192***	[26]
Financial investment index (H1) [22]	.417**	.174	.139**	[44]
Universal broadband service (H1 1=present)	.010	.159	.004	[26]
Technical standards development (H2 1=present) [15]	-.199	.238	-.046	[26]
Telecom licensing (H2 1=present) [20]	.330	.233	.089	[26]
Rule of law & control of corruption (H3) [43]	-.109	.147	-.059	[28]
Independent telecom regulator (H3 1=present)	-.208	.177	-.075	[26]
Affluence (UN Income Index)	-5.95***	.748	-.737***	[40]
Education (UN Education Index)	-1.52**	.703	-.164**	[40]
Democratic political structure (UDS)	-.050	.112	-.029	[34]
Income inequality (Gini coefficient [12])	.024***	.008	.181***	[8, 40]
(Constant)	5.79***	.711		

Dependent variable: Natural log of income-normalized broadband cost. N = 76; Adjusted R Squared = 0.793; Std. Error of the Estimate = 0.572. Bold entries are unstandardized (*b*) & standardized (*Beta*) OLS regression coefficients; standard errors are in italics; *** p < .01, ** p < .05, * p < .10.

Even though previous research suggests that regulation and governance might be important determinants of mobile broadband affordability [15, 20, 32], rows four through seven provide no support to the hypotheses designed to test the effects of regulation (H2) and governance (H3).

When considering the control variables, the findings in rows eight and nine are examined together. From these findings, it is confirmed that the two factors that are central in van Dijk's theory of the digital divide [41] are important determinants of mobile broadband affordability; namely, material access (as measured by the UN Income Index) and skills access (as measured by the UN Education Index) [40]. Even though there are sound theoretical

reasons for expecting broadband to be more affordable in democratic regimes [33], the coefficients for political structure are not statistically significant. This finding is consistent with previous work that analyzed the relationship between broadband diffusion and democracy in the developed world [29]. As the coefficients in the eleventh row show, there is a strong and statistically significant relationship between income inequality and the price of mobile broadband subscriptions in the developing world. These results are consistent with work by Fuchs [14], which showed that income inequality is a significant factor in determining diffusion of narrowband Internet. However, our study, to our knowledge, is the first to show a relationship between income inequality and the affordability of a technology that is so important to human and economic development [45].

4. CONCLUSIONS AND FUTURE WORK

It was learned that developing countries encouraging greater competition also provide access to more affordable broadband services. Countries that made greater financial investment in ICTs; however, have higher mobile broadband service prices. Two surprising findings that emerged in our study are, first, that neither regulation, governance nor a universal service policy for broadband had an effect on mobile broadband affordability. Second, and more importantly, this study is the first to show a relationship between income inequality and the affordability of a technology that is so important to human and economic development [45]. Alsop and Heinsohn applied Sen's Capability Approach (CA) [38] to argue that ICTs can enhance people's capacity to make the right choices and this empowerment can lead to improved development outcomes [2]. However, it can be said that if insufficient average income or sufficient income inequality exist [8, 40], then development outcomes might not improve since the individual choice might be made, that if mobile broadband is too expensive, to do without it rather than to pay for it [41].

These conclusions have been formed using select sources of reference for secondary data. To ensure that a bias did not arise, future research will identify additional sources, acquire data from them and achieve triangulation. Another limitation of the application of our secondary data is that local context and also special offers and promotions are amiss; thus, this could lead to an erroneous price comparison. Other future directions include considering diverse contexts within different countries, both to check uniformity of data and to identify ideal dummy variables. Furthermore, future research will consider diversities that could emerge by including different mobile operators and their pricing strategies. Also of interest would be the dimensions of financial investment, where lags between different forms of investment and lower prices and greater adoption of mobile broadband will be considered.

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