Social Influence in Mobile Phone Adoption: Evidence from the Bottom of Pyramid in Emerging Asia[1]

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Abstract

This paper attempts to quantitatively measure the various influences on mobile phone adoption at the bottom of the pyramid (BOP) in Bangladesh, Pakistan, India, Sri Lanka, Philippines and Thailand. Based on an existing theoretical framework adoption is modeled by fitting a logit model to a large six country dataset. The study finds evidence for the importance of social influence in mobile adoption in two modes: one that exerts pressure on individuals to adopt; and another that helps generate benefits via social networks that are tied in with economic and business networks. The paper elaborates on the resulting social policy implications for using mobile telephone services to fight poverty at the BOP in these and similar countries.

Keywords: mobile phones, bottom of pyramid, adoption, social influence, networks

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1. Introduction

There have been numerous studies on the positive economic impact of phone adoption. Early studies ranging from Hardy (1980) to the recent Kathuria, Uppla and Mamta (2009) have demonstrated the significant impact of telecom services on economic growth and development. From a more microeconomic angle Donner (2006), Jensen (2007), Abraham (2007), Aker (2008), de Silva and Ratnadiwakara (2008) among others have shown how phones reduce information search costs leading to lower transaction costs. Moving beyond pure economics, others like Bayes, von Braun and Akhter (1999), Goodman (2005), Frost and Sullivan (2006) and Kwaku and Kweku (2006) have shown how mobile phone adoption leads to greater social cohesion and improved social relationships.

The literature generally shows that adoption of (primarily) mobile telephones having significant benefits not just to the adopter but to the community at large. In this context, the objective of the current paper is to examine, from a user-perspective, the various influences and the interplay of these influences on mobile phone adoption by the poor in a selected set of countries in the emerging Asian region. For this purpose we use data from a recent large sample survey by LIRNE*asia* among the poor across Bangladesh, Pakistan, India, Sri Lanka, the Philippines and Thailand.

2. Mobile Phone Adoption: Brief Theoretical and Empirical Background

2.1 Theoretical background

Pedersen and Ling (2002) categorize the literature on adoption in to three schools of thought; diffusion, adoption and domestication. Pedersen (2005) explains diffusion research as describing the adoption process as an S-shaped function of time that may be used to group adopters of different kinds (Rogers, 2003; Kiljander, 2004); domestication research as looking at adoption and use of technology in everyday life with a focus on the social, cultural, political and economic consequences (Silverstone and Haddon, 1996); and adoption research as explaining adoption decision of individuals by applying cognitive and social theories of decision making (Davis, 1989; Fishbein and Ajzen, 1975).

Building primarily on adoption and domestication schools of thought, Van Biljon and Kotze (2008) contextualize mobile phone adoption in an extended technology acceptance model (TAM) framework where perceived usefulness in adoption is encompassed in a multi-dimensional setting in terms of socio-cultural, gender and income criteria. Originally proposed by Davis (1989) the TAM is an adaptation of the theory of reasoned action (TRA) developed by Fishbein and Azjen (1975) using attitude and subjective norms as the two factors that affect behavioral intentions. Davis (1989), Davis et al. (1989) conceptualize TAM as focusing on the attitudinal explanations of intention to use a specific technology or service consisting of six concepts; external variables, perceived usefulness, perceived ease of use, attitudes towards use, intention to use and actual use.[5] While this model is able to explain adoption well from a technical perspective, Malhotra and Galletta (1999) identify the lack of explicit accounting of social influences affecting adoption as a limitation in the TAM. Van Biljon and Kotze's extension identifies a number of determining factors that form the basic construct influencing mobile phone adoption and use. They are social influence, expressed as the pressure exerted on the individual by the opinions of others; facilitating conditions or the necessary infrastructure; perceived

[5] Although the TAM is mainly applied to explaining the adoption of technology within organizations, the constructs of the model are meant to be fairly general (Davis et al., 1989)

usefulness or the extent to which a user believes that he or she will benefit from using the mobile phone; and perceived ease of use. Besides the determining factors the model contains a set of mediating factors that influence the determining factors towards behavioral intention; say a person finds it beneficial to use a mobile phone (determining factor; perceived usefulness) but lack of income (mediating factor) could hold back adoption. As such, mediating factors identified in the model are personal factors, like preference and beliefs about mobile phones (including image), demographic factors like age, gender, education etc. and socio-economic factors such as occupation and income. The model postulates that actual adoption and use is the final outcome of the interplay of the mediating and determining factors.

2.2 Empirical Background

While some researchers have concentrated on theorizing technology adoption, others have focused on empirical models, to explain technology adoption by fitting mathematical models to the data. The widely cited Rice and Katz (2003) paper and the recent Chabossou, Stork, Stork and Zahonogo (2009) paper are two of several papers approaching the question from such an angle and are most useful in predicting behavior. There are many ways in which data can be modeled, but at the outset, it must be noted that linear regression models are not appropriate for modeling adoption (a dichotomous outcome) as the dependent variable; thus, logit or probit models which use exponential functions and allow for a dependent variable between 0 and 1 explaining the probability of adoption or discriminant analysis which classifies a set of observations into predefined classes are generally used. Rice and Katz (2003), based on a nationally representative sample of 1,800 adults in the United Sates, used a logistic regression model to explain three types of digital divides in phone and internet use: owner vs. non-owner divide, veteran vs. recent divide and continuing vs. dropout divide. The paper demonstrated that different factors influenced each of these three kinds of Internet and mobile phone divides. For instance, compared to mobile phone owners, non-owners were found to have lower incomes, less education, more likely to be never married, not have children, not work full-time and belong to fewer community organizations. Chabossou et al. (2009) used a probit model to analyse factors that contribute to the probability of an individual adopting mobile telephony based on a nationally representative 22,000

respondent study across 17 countries in Africa.[6] This paper showed income and education vastly enhances mobile adoption in these countries, but gender, age and membership in social networks have little impact. The last finding is interesting from the theoretical construct of earlier analyzed adoption models including Van Biljon and Kotze (2008) where social influence is an important determining factor, which perhaps Chabassou et al. (2009) implicitly attempted to measure through membership in various social networks and clubs.

The debate on the social pressure and impact on mobile adoption as separate from economic pressures and benefits has been going on for a long time. But the debate is taking a new twist with adoption in developing country scenarios where mobile phones are seen as a way out of poverty.[7] In this context, finding social uses (as opposed to business and entrepreneurial uses, as much of the "ICT4D" hype seems to highlight) of the phone as the main use of phones among low income earners, de Silva and Zainudeen (2007) question why such uses should be considered by some as being "frivolous". Similarly, Donner (2009) criticizes over-emphasis of the development angle of mobile phone adoption by questioning how the value of social calls can be ignored when evaluating the drivers of demand. There are two interrelated issues here. One is the benefits of mobile phone adoption from a social angle: described in Van Biljon and Kotze (2008) as perceived usefulness; as benefits measured by social relations in de Silva and Zainudeen (2008); or "blurred" social and business communication implied by Zainudeen, Samarajiva and Abeysuriya (2006) as well as Donner (2009). The other issue not explicitly stated is the societal pressure applied by social or social and business networks towards mobile adoption.

3. Methodology, Data and Descriptive Statistics

This paper is based on data from a 2008 representative study conducted by LIRNE*asia* among poor, or "bottom of the pyramid" (BOP) telephone users aged 15-

[6] This study was conducted by RIA. The 17 countries were: Benin, Botswana, Burkina Faso, Cameroon, Cote d'Ivoire, Ethiopia, Ghana, Kenya, Mozambique, Namibia, Nigeria, Rwanda, Senegal, South Africa, Tanzania, Uganda and Zambia.

[7] Nobel Laureate Professor Muhammad Yunus told the author that mobile phones were going to change the world as we knew it. "We have not seen the real power of the technology yet" he said, and added that a "digital genie" will appear from the "Aladdin's lamp" (mobile phone) to "empower the poor". http://www.youtube.com/watch?v=9O4BvXG_btI

60 in Bangladesh, Pakistan, India, Sri Lanka, Philippines and Thailand. BOP is defined as those belonging to the lowest socioeconomic classification (SEC)[8] groups, D and E. The survey consisted of a quantitative module and a qualitative module. The quantitative module was made up of 9,540 face-to face interviews among those who had used a telephone (not necessarily owned) in the previous three months.[9] In addition, a diary (log sheet) was placed among half the sample in which the users were requested to record their phone usage for a period of one week.[10] An overview of the sample size and composition is given in Table 1.

Table 1: Sample Size and Composition

	All BOP	Urban BOP	Rural BOP	Margin of error @ 95% CL (%)
Bangladesh	2,050	1,719	331	3%
Pakistan	1,814	899	915	2%
India	3,152	773	2,379	2%
Sri Lanka	924	320	604	3%
Philippines	800	468	332	4%
Thailand	800	400	400	4%
Total	**9,540**	**4,579**	**4,961**	

The qualitative module consisted of 60 protocols in the six countries (not equally distributed) consisting of respondent mini-ethnographies, home visits cum media mapping exercises and focused group discussions.[11]

[8] Defined by the chief wage earner's education and occupation (as well as a few other parameters in certain countries), but closely correlated to an income level of around USD 2 a day in five of the six countries studied.

[9] Phone use in the previous three months included making or receiving a telephone call (but not SMS) on any phone whether owned or not.

[10] The diary technique while imperfect is a work-around given almost all BOP owners are prepaid subscribers without any monthly bills to record calling patterns, while non-owners use phones of others (friends, relations, public phones, etc) and similarly have no records of use. A similar technique was used in a similar survey in 2006, learnings from which have been used to improve the method, since.

[11] Further details can be found at http://lirneasia.net/wp-content/uploads/2008/04/qualitativereport.pdf

4. Statistical Model for Mobile Phone Adoption

Logistic regression model for mobile adoption

As eluded to earlier, Van Biljon and Kotze (2008) explain that adoption and use of mobile phones will be the result of the complex interplay among a number of factors within the determining and mediating categories. In reality, these factors are different for each individual and cannot be observed. What can be observed is whether a person has a mobile phone or not; as Chabassou et al. (2009), explain "One individual might neither be able to afford nor be interested in a mobile phone while another might just be close to getting one and still saving money towards it. For both individuals it can only be observed that they do not have a mobile phone." The process leading to the adoption decision is unobservable and the factors used to model the adoption decision are referred to as the determining and mediating factors. Logit models (as well as probit models) tie the determining and mediating factors to the latent variable (i.e. mobile adoption) through contributions to the probability of the latent variable taking a value above or below a threshold that would lead to the observable outcome: adoption or not. Therefore, the logit model assigns a probability of adoption of mobile phones based on the various determining and mediating factors postulated in the theoretical model.

The general formula of the logit model is:

$$Probability(Y) = \frac{1}{1 + \exp\left(-\alpha - \sum_{i=1}^{n} \beta_i X_i\right)}$$

Where Y is mobile adoption (a dichotomous variable taking the value 1 if the respondent owns a phone and 0 if the respondent does not) and X_i are the factors that impact such adoption (also referred to as determining and mediating factors or influential factors). β_i values are factor sensitivities of each influential factor, X_i. Influential factors, X_i, can be quantitative or qualitative variables; dummy variables are used to represent the 'states' in case of qualitative variables. The influential variables, X_i, used in the study as well as their expected signs are given below in the Table 2.

Table 2: Influential variables for the mobile adoption model

Variable	Expected sign	Remarks *(Van Biljon and Kotze model factor)*
Gender		Male =0, female =1; expect no gender difference *(demographic)*
Age squared[12]	-	Technology is usually adopted faster by younger people *(demographic)*
Ln(monthly personal income)[13]	+	Natural log of the monthly personal income; lack of income is key barrier to adoption *(socioeconomic).*
Primary Education		Yes = 1, no=0 *(demographic)*
Secondary Education		Yes = 1, no=0 *(demographic)*
Tertiary Education		Yes = 1, no=0 *(demographic)*
Number of top five contacts having a mobile phone	+	The more people in one's close network with phones, greater will be the social (social-economic-business) pressure to adopt (*social influence; social pressure)*
Emergency Perceived Benefits Index (PBI)	+	Phone enables emergency communication *(perceived (safety) usefulness and/or personal)*
Social PBI	+	Phone helps maintain and improve social relationships *(perceived (social) usefulness and/or personal)*
Economic PBI	+	Phone brings economic benefits through lower transactions costs such as less need to travel to obtain business information (*perceived (economic) usefulness and/or personal)*
Access to a fixed phone	-	Yes = 1, no=0; mobile phones are substitute for fixed phones at the BOP *(facilitating condition)*
Walk time to the nearest town	-	Proxy for urban and rural indicator; rural adoption is lower than urban (*demographic factor)*
Access to electricity	+	Yes = 1, no=0; electricity as a facilitating condition for mobile adoption *(facilitating condition)*
Television in household		Yes = 1, no=0; impact of having a television in household on mobile adoption *(socioeconomic)*
Radio in household		Yes = 1, no=0; impact of having a radio in household on mobile adoption *(socioeconomic)*
Pakistan		Country dummy for Pakistan
Sri Lanka		Country dummy for Sri Lanka
Thailand		Country dummy for Thailand
Bangladesh		Country dummy for Bangladesh
Philippines		Country dummy for Philippines
Constant		

The influential variables are self explanatory and the expected signs are logical. Country dummies capture the unique characteristics in each country such as culture, perception, different needs etc. The variable "number of top five contacts

[12] Age^2 has a higher explanatory power compared to Age.

[13] Natural log of monthly income better explains the impact of monthly income on mobile adoption.

having a mobile phone" and the emergency, social and economic "perceived benefit indices" are introduced for the first time in this paper; and explained below.

Understanding social influence or social pressure in technology adoption has a long history. As previously pointed out Malhotra and Galletta (1999), found the lack of accounting for social influences explicitly to be a limitation of the TAM which subsequently resulted in the unified theory of acceptance and use of technology (UTAUT) model of Venkatesh, Morris, Davis and Davis (2003) which placed social influence as a key construct that determine usage intention and behavior. Van Biljon and Kotze (2008) innovated further by segmenting social influence in to human nature influences (inherited) and cultural (learned) influences. At an empirical level, Rice and Katz (2003) implicitly examining this phenomenon in explaining digital divides did not find that belonging to various social groups has any uniform influence on adoption and use of mobile phones and the Internet. Similarly, Chabassou et al. (2009) implicitly attempting to assess the importance of this factor through memberships in any "social network" (church groups and sports clubs, etc) in their model, found that belonging to such networks contributes positively to the probability of mobile adoption in seven of the seventeen study countries, but not the others.

How does the social pressure influence adoption? Chen and Sutano (2007) propose "social coercion, social imitation and social normalization" as key processes by which social pressure is applied. Others have also explained this process (Segrest et al., 1998; Chen and Wong, 2003). In the Harvard Business Review 20 breaking ideas for 2009, Goldstein (2009) explaining how to harness social pressure, shows that people are much more likely to adopt if others who are like them also adopt.

Therefore, the question we have is how to model social pressure or influence in mobile phone adoption in a way that provides some useful and comparable quantitative explanations. Instead of the previously used membership in social or community group proxies, we use a new measure: the adoption status of the respondent's closest circle of contacts (friends, family, business contacts etc). We postulate that the more people in one's circle that have adopted, the greater will be the social influence or social pressure towards his or her adopting. Thus the

expected sign for "number of top five contacts having a mobile phone" is positive. The thinking is along the same lines of Valentene (1996) who creates a social network threshold model based on adopter categories to show how external influence and opinion leadership channel the diffusion of innovation. While Valentene (1996) demonstrated the differences from low network threshold individuals (those who adopt before many others in their network do) to high threshold individuals (those who adopt after most of their network have adopted), and also the level of innovativeness with respect to their 'personal networks' or with respect to the 'social system'; our objective is to ascertain the importance of social pressure or influence of 'personal networks' on adoption of mobile phones.

The other innovative feature of our work is the attempt to disaggregate and capture the perceived benefits of mobile adoption in terms of emergency, social and economic factors. Perceived usefulness has been at the base of technology adoption models since the early days of TAM as the extent to which a person believes using the system can enhance his or her job performance,[14] later generalized to mobile adoption by others (Kwon and Chidambaram, 2000; Kleijnen et al., 2004). Following this logic, Van Biljon and Kotze (2008) place perceived usefulness at the centre of their model. The model also refers to users' beliefs on the benefits of mobile phones (including, inter alia, image and trust) under personal factors. Once again, we consider an alternate approach to the previous models and disaggregate perceived benefits of mobile phone adoption in to emergency (or safety[15]), social and economic-business categories. Respondents evaluated eleven aspects belonging to the three groups on a Likert scale of 1 to 5; with 1 indicating the phone worsening that particular aspect for the respondent, 3 no change and 5 indicating that it had improved. The categorization is given in Table 3.

[14] The original paper focused on technology adoption in organizations
[15] Katz and Aakhus (2001) have shown that safety is the primary motive for women to acquire a mobile phone (in Rice & Katz, 2003).

Table 3: Perceived Benefits

Category	Disaggregated benefit aspects
Emergency	1. Ability to act in an emergency 2. Ability to contact others in an emergency
Social	1. Ability to maintain relationships with family and friends 2. Social status/ recognition in the community
Economic	1. Ability to make more money (generally, and not via sale of calls) 2. Ability to make more money through the sale of calls 3. Ability to find out about work opportunities 4. Ability to access price or market information 5. Ability to save money 6. Ability to save on travel cost 7. The efficiency of your day to day work

Three indices were created to reflect each category of benefits; Social Perceived Benefits Index (SPBI), Emergency PBI (EmPBI) and Economic PBI (EcPBI). SPBI and EmPBI indices reflect the number of benefit aspects (0, 1 or 2) that the respondents perceived to have improved (score of 4 or 5 in the scale for each aspect) as a result of using (whether own or otherwise) a phone; i.e. SPBI would take the value two if the respondent perceives benefits have accrued to both aspects in that category. EcPBI has four levels. The first level is when the respondent sees either no aspects or only one aspect has improved; second is when the respondent perceives two or three economic aspects have improved; third if four or five aspects have improved and finally the fourth level is when the respondent perceives six or all seven aspects have improved.

5. Findings and Discussion

Table 4 provides an easy-to-interpret breakdown of the sample showing the characteristics of mobile phone adopters versus non-adopters (who are users nevertheless, using other's phones).[16] The Chi-Square value given in the table indicates where there are significant associations between the two variables.[17]

[16] Rice and Katz (2003) present a similar table where they dichotomize almost all variables in order to make it easier to interpret the otherwise complex data.
[17] A significant Chi-Square value indicates the existence of a relationship between the concerned variable and mobile adoption.

Table 4: Mobile adopters versus non-adopters

	Mobile adopter (% of sample)	Non adopter (% of sample)
Overall	45.9	54.1
N	4,382	5,158
Gender (Chi-Square=401.30)***		
Male	63.9	43.4
Female	36.1	56.6
N	4,382	5,158
Age (Chi-Square=33.32)***		
Less than 35 yrs	65.3	59.6
More than 35 yrs	34.7	40.6
N	4,381	5,158
Monthly Personal Income (Chi-Square=363.16)***		
Less than the median [USD 26.25]	37.7	60.9
More than the median [USD 26.25]	62.3	39.1
N	4,277	4,901
Education (Chi-Square=291.0)***		
Primary	35.1	51.1
Secondary	52.0	43.7
Tertiary	12.9	5.2
N	4,123	4,245
Number of top five contacts with mobiles (Chi-Square=801.52)***		
0	0.9	2.7
1	6.4	11.9
2	12.2	23.5
3	15.3	24.0
4	14.7	13.1
5	50.5	24.8
N	4,381	5,155
Emergency Perceived Benefit Index (PBI) (Chi-Square=20.49)***		
0	2.5	3.0
1	9.9	12.6
2	87.6	84.3
N	4,318	4,800
Social PBI (Chi-Square=176.15)***		
0	4.0	6.2
1	30.9	46.2
2	65.1	51.3
N	4,230	4,720
Economic PBI (Chi-Square=197.76)***		
1	10.1	18.1
2	27.6	33.1
3	30.8	23.4
4	31.5	25.4
N	4,256	4,693
Access to fixed phone (Chi-Square=23.09)***		
Yes	7.9	10.8
No	92.1	89.2
N	4,382	5,158

	Mobile adopter (% of sample)	Non adopter (% of sample)
Walk time to nearest town (Chi-Square=125.76)***		
Less than the median [20 minutes]	57.1	46.6
More than the median [20 minutes]	42.9	53.4
N	4,469	5,071
Access to electricity (Chi-Square=569.14)***		
Yes	91.8	77.3
No	8.2	22.7
N	4,382	5,159
Television in household (Chi-Square=569.14)***		
Yes	80.9	57.1
No	19.1	42.9
N	4,381	5,158
Radio in household (Chi-Square284.11)		
Yes	48.3	31.4
No	51.7	68.6
N	4,382	5,158

Note: *** Chi-Square is significant at 95%

The table shows that at a high level, mobile phone adaptors (or owners) at the BOP in the study countries are more likely to be younger males, with higher relative income, with mainly a secondary education with most of their closest contacts already having mobile phones of their own.[18] They perceive that their phones have improved their social and economic aspects of their lives and helped their capabilities to communicate in emergencies. It is found that they also live somewhat closer to a town with relatively better access to electricity and with a television set in the household. The profile for non-adopters, in contrast to adopters, is mainly younger females in a relatively lower income bracket and only a primary education living somewhat further away from town. We also find that less of their closest contacts have their own phones. In terms of perceived benefits we find non-adopters not very different from adopters in terms of placing value on benefits from mobile phones. While emergency benefits seem to be the same there is a slight drop in perceived social and economic benefits. This is perhaps due to the fact that they anyway have access to phones even though they do not own their own.

[18] The mean is USD 47.75 per month. The adoption profile is the same even dichotomized at USD 50 per month: adopters, less than USD50, 48.6%; more than USD 50, 51.6%; non-adopters, less than USD 50, 73.3%; more than USD 50, 26.5%.

We now consider the results of the logit model to assign probabilities of adoption of mobile phones to correspond to, as much as possible, the mediating and determining factors postulated in the theoretical model in Van Biljon and Kotze (2008). Expected signs for the variables along with brief remarks for same were provided in Table 2. The logit model showed a good fit with an R-square (Nagelkerke R-square) value of 0.34. The signs of the coefficients of the variables are as expected except in the case of gender where we pre-supposed no gender difference.[19] Coefficients of variables in a logit model can have either positive or negative values; a positive value indicates that that particular variable has a positive impact on adoption and vice versa. Odds ratios allow for interpretation of the size of the impact as coefficients cannot be directly interpreted due to their non-linear relationship with the dependent variable. The odds of success are defined as the ratio of the probability of success (mobile phone adoption) divided by the probability of failure (non-adoption); i.e., odds increase as the probability of success increases and vice versa. Here an odds ratio of X would mean that the odds of mobile adoption are X to 1. Therefore, an odds ratio of greater than 1 implies a positive impact on mobile adoption and less than 1 indicates a negative impact for each unit increase in the particular variable. Higher odds ratios of greater than 1 imply greater positive impact and an odds ratio closer to zero imply greater negative impact. Odds ratios for variables in logit models can be calculated by taking the exponent of each the coefficient.[20] Table 5 contains the results.

[19] While theoretically that may be the case, gender neutral, many studies have found that males are more likely to adopt mobile phones over females (Katz, 2003, Chabassou, 2008).

[20]

$$Probability(Y) = \frac{1}{1 + \exp\left(-\alpha - \sum_{i=1}^{n} \beta_i X_i\right)}$$

$$Odds\ Ratio = \frac{Probability(Y)}{1 - Probability(Y)} = \exp\left(-\alpha - \sum_{i=1}^{n} \beta_i X_i\right)$$

Table 5: Logit Model Results

Variable	Coefficient	Odds Ratio	P-value
Age^2	-0.03	0.97	0.03
Gender	-0.43	0.65	0.00
Ln (monthly personal income)	0.48	1.61	0.00
Primary Education	0.34	1.41	0.00
Secondary Education	0.80	2.23	0.00
Tertiary Education	1.40	4.06	0.00
Number of top five contacts having a mobile phone	0.32	1.37	0.00
Emergency Perceived Benefits Index (PBI)	0.20	1.22	0.07
Social PBI	0.16	1.18	0.01
Economic PBI	0.10	1.10	0.00
Access to a fixed line connection in household	-0.63	0.54	0.00
Walk time to the nearest town	0.00	1.00	0.01
Access to electricity	0.38	1.47	0.00
Television in household	0.90	2.46	0.00
Radio in household	0.29	1.33	0.00
Bangladesh	-0.05	0.65	0.96
Pakistan	-0.42	0.00	0.66
Sri Lanka	-0.82	0.00	0.44
Philippines	-0.23	0.12	0.80
Thailand	1.27	0.00	3.58
Constant	-4.21	0.02	0.00

Starting with the demographics of the model, it is observed that age[21] is likely to have negative impact on mobile adoption; younger people are more likely than older people to purchase a mobile phone. The gender variable has a significant impact on adoption; being a woman decreases the probability of owning a mobile phone by a fair amount; odds of female mobile adoption is 35 percent less than odds of male mobile adoption. As expected, income increases the probability of adoption, with the natural log of monthly personal income having an odds ratio of 1.61. The results also show that assumptions about education can be accepted with the odds ratio of mobile adoption increasing significantly with more years of education.

[21] Age-squared gives more explanatory power to the model compared with the Age. As Tegegne (1999) and Chabossou et al. (2009) point out differences of the impact of the age in mobile adoption can be better modeled by using Age-squared instead of Age.

Social pressure or influence on mobile adoption was found to be a very important factor in increasing the probability of adoption, with an odds ratio of 1.37. This means that the likelihood of a respondent's adoption of a mobile phone increases with each additional member (at the margin) among the closest five members of his or her personal network adopting a mobile phone. More specifically, holding other influential variables fixed, the odds of adopting a mobile phone increases by 37 percent for each additional member in the network having adopted. It was also found that the likelihood of adoption increases quite dramatically, with an odds ratio of 4.86, when the number of persons owning a mobile among the closest five contacts increases from none to five. Table 6 depicts the relationship between the top five contacts owning a mobile phone and the respondent's mobile adoption status.

Table 6: Influences of personal network on mobile adoption

No. of members of top five contacts that own a mobile phone	Mobile adopter (% of sample)	Non adopter (% of sample)
0	22.0	78.0
1	31.5	68.5
2	30.6	69.4
3	35.1	64.9
4	48.9	51.1
5	63.3	36.7

Another significant finding is that, as per Valentene (1996) the poor in emerging Asia seem to belong to high to very high threshold categories where adoption is taking place after most of the others in the personal network have adopted. It may also be the case in terms of the social system, but data for outside SEC D and E are not available for such a comparison.

Considering the contribution of the perceived benefit indices towards the probability of mobile adoption, all three indices are significant; as expected each exerts a positive impact on adoption indicating that higher likelihood of mobile adoption by the people who perceive higher level of benefits from phone access in terms of emergency, social and economic criteria.[22] The odds ratios are 1.22, 1.18 and 1.10; meaning that holding other influential variables fixed, odds of adopting a mobile

[22] Emergency perceived benefit index is significant at 90% while social and economic perceived benefits indices are significant at 95%.

phone increases by 22 percent, 18 percent and 10 percent, for every one unit increase in the perceived emergency, social and economic benefit index respectively. Perceived usefulness has been considered an important influence in mobile adoption from the earliest technology adoption theories and models. The desegregation of perceived benefits in to the above three categories and measuring their impact on the probability of adoption of mobile phones among the BOP in this manner now adds flavor to the discussion on how best to leverage on this aspect to further enhance adoption.

Tables 7 through 9 provide category-wise disaggregated data on the respondent's adoption status by the number of perceived benefits accrued from a mobile phone.

Table 7: Emergency Perceived Benefits index and mobile adoption

No of perceived emergency benefits accrued due to use of mobile phone	Mobile adopter (% of sample)	Non adopter (% of sample)
0	42.1	57.9
1	41.4	58.6
2	48.3	51.7

Table 8: Social Perceived Benefits index and mobile adoption

No of perceived social benefits accrued due to use of mobile phone	Mobile adopter (% of sample)	Non adopter (% of sample)
0	36.8	63.2
1	39.4	60.1
2	53.2	46.8

Table 9: Economic Perceived Benefits index and mobile adoption

No of perceived economic benefits accrued due to use of mobile phone	Mobile adopter (% of sample)	Non adopter (% of sample)
1	31.6	68.4
2	43.5	56.5
3	53.7	46.3
4	54.1	45.9

These results indicate that adoption is linked to the level of perception of benefits (or usefulness as in the theoretical adoption literature) accrued due to use of mobile phones particularly with social and economic factors; the higher the perceived

benefits, the higher the adoption. While the adopter percentage is higher than non-adopter percentage at the highest level of perceived benefit (highest index number) for social and economic benefit categories it is not so for the perceived emergency benefit category. Perhaps the importance of emergency benefits (ability to contact others in an emergency) is subsumed in the "blurred" social-economic network and cannot be easily isolated.

6. Concluding Thoughts

This paper attempted to determine and measure the various influences on mobile phone adoption at the BOP in Bangladesh, Pakistan, India, Sri Lanka, Philippines and Thailand. Based on the Van Biljon and Kotze (2008) theoretical framework adoption was modeled by fitting a logit model to a six country dataset. In addition to several other important variables, evidence for the importance of social influence in mobile adoption was found in two modes: one that exerts pressure on individuals to adopt; and another that helps generate benefits via social networks that are tied in with economic and business networks.

Mobile phones, now increasingly affordable and widespread in the developing world, have significant potential to extend social policy initiatives to the most rural and/or excluded groups in society, and thus have a direct impact on poverty and inequality. Mobiles provide a direct channel to provide services (for example telemedicine, election information, hazard warnings, etc) directly to BOP-type markets which can further social policy objectives.

This paper has shown that network effects play a key role in mobile adoption; those with a larger share of their closest contacts who already have a mobile are more likely to adopt; this means that people tend to get connected in groups. From a social policy perspective, policies that encourage network marketing (by operators; that is, “friends and family” type packages and promotions, or offering benefits to users who bring others onto the network) will therefore help to further social policy objectives. While from a competition policy perspective, network marketing is not seen as desirable (making customers “sticky”), one could argue that such marketing only reflects consumer behavior.

Further research is needed to ascertain whether or not such network effects also play a role in the adoption of individual services, however it is likely that the same "groups" that come onto a network together will encourage service adoption within their networks too.

The study however has a several limitations; particularly it only models adoption and not usage and does not attempt to link the social pressure with the three benefit categories to assess, for instance opinion leadership and the Katz (1957) two-step flow hypothesis of adoption influence. Further research could also help fill these gaps. Notwithstanding these drawbacks, this study has been able to isolate what seem to be some very powerful influences of mobile adoption that will be useful in understanding and influencing the adoption process of mobile 2.0 services among this population.

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