The Price Sensitivity of Mobile Use among Low Income Households in Six Countries of Asia[1][2]

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Abstract

The private sector in developing countries is increasingly interested in extending mobile telephony services to low income and rural markets that were previously considered unprofitable. Determining the right price is a central challenge in this context. Despite known limitations, the Contingent Valuation (CV) method, which elicits information on the Willingness to Pay (WTP), is a useful guide to pricing decisions. The present study draws on data generated using the CV method to examine whether mobile use is sensitive to small declines in the current per-minute price of use for low income households in six countries of Asia: Bangladesh, India, Pakistan, Philippines, Sri Lanka, and Thailand. A Heckman model is used to correct for the sample selection problem arising from the study of mobile phone owners alone. We find that demographic criteria, including income, are not significant in explaining whether usage is responsive to price fall, although they appear important in determining mobile phone ownership. Instead, subscription to multiple service providers has an important association with the price sensitivity of use: Those with multiple SIM cards are likely to increase usage when price falls whereas those who report that they would not switch service providers are unlikely to do so. The study further finds that consumption would increase among those with a more diversified use of mobile services (to participate in competitions and to access government services) and among more 'limited' users (those who attach a greater importance to the emergency uses of the phone). Overall the findings suggest that there exists a latent demand for mobile minutes among low income households that can be tapped through a small reduction in price. However, given the relatively low profit margins in these markets and the ability of users to switch between service providers quickly and at low cost, competing on price could threaten the long term survival of firms. Non-price strategies would therefore be important for firm survival and sustainable service delivery.

Keywords: Willingness to Pay, Price Elasticity of Demand, Mobile phone, South Asia, Southeast Asia, Bottom of the Pyramid, BOP

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[1] The quantitative and qualitative research reported in this paper is a part of a six-country study, Teleuse@BOP3, conducted by LIRNE*asia* (www.lirneasia.net). This work was carried out with the aid of a grant from the International Development Research Centre (IDRC), Canada and UKaid from the Department for International Development, UK with contributions from Telenor Research & Development Centre Sdn. Bhd., Malaysia.

[2] Please note that an earlier version of this paper was titled 'The Willingness to Pay for Mobile Telephony Services among Low Income Households in Six Countries of Asia'.

[3] I am grateful to Harsha de Silva and Ayesha Zainudeen for detailed comments and participants at the LIRNE*asia* colloquium for helpful feedback. I thank Stefan Dercon (University of Oxford) for invaluable inputs. A special thanks to Rohan Samarajiva and Helani Galpaya for enabling this collaboration. Any errors are solely mine.
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I. Mobile Telephony in Low Income Markets

Mobile phones have received considerable attention in the media, research and policy spheres for their rapid diffusion in developing countries over the past decade. The fastest growth in mobile subscriptions is occurring in the developing world, with the penetration rate more than doubling from 23% to 57% between 2005 and 2010 (ITU, 2010)[4]. There are several reasons cited for such growth. First, regulatory reforms favoring greater competition in the sector have driven down the price of use and increased affordability[5]. Second, the introduction of 'pre-paid' SIM cards[6] has increased the uptake among low income users, as eligibility is based on minimal screening and documentation. Further, pre-paid use reduces financial commitments as there is no monthly fee obligation and incorporates flexibility as usage volumes can be low and staggered based on individual needs. Specific additional features often associated with the prepaid system – such as the Calling Party Pays (CPP) form of billing, where incoming calls are effectively free, the transferability of SIMs (allowing multiple SIM cards to be used with a single phone) and asymmetric inter-connection rates that make calling from a mobile phone to a fixed network cheaper than from a fixed phone to a mobile network - have further encouraged use (Kalba, 2008). In some parts of Africa and Latin America, the mobile has reached areas where fixed line telephones remain unavailable and the absence of a 'fixed line legacy' is argued to have favored adoption (Hamilton, 2003).

While the growth in mobile subscription in developing countries has been remarkable, private actors face a number of challenges in serving low income and rural areas. Among these is the need to balance economic criteria with social objectives: There is an implicit trade off when setting a price or fee for a service in terms of excluding that segment of the population to which it is unaffordable. Organizations therefore necessarily face the task of

[4] We note here that estimates of mobile subscription are not equivalent to mobile adoption: Subscription rates are likely to suffer from double counting due to multiple subscriptions by the same individual, an aspect we explore in further detail in this paper. On the other hand, those who do not own a SIM card are often found to use or 'have used' a mobile phone. The latter arises due to 'shared use' within households and amongst friends and relatives, as well as the use of mobile-based payphones (see Table 3 in the appendix). Non-SIM-card-owning mobile users are therefore adopters who would not be counted among the subscribers.

[5] While there is a general consensus in the literature that competition has increased mobile penetration in developing countries, the welfare implications of increased competition appear more ambiguous. In the traditional model of the past, a monopolist regulator has cross-subsidised service provision in low income and rural areas through revenues from urban and higher income segments. However, competition is argued to introduce 'cream skimming' from the profitable segments, reducing the ability of the regulator to cross-subsidize service provision in low income areas. The implications for meeting 'universal access obligations' (or, ensuring affordable access to telecom services for all) are therefore a source of concern (Choné et al. 2000).

[6] SIMs (Subscriber Identification Modules) are the chips placed in mobile phones, which carry basic information such as the telephone number of the user, the name of the service provider and calling rates. In the case of pre-paid SIM cards, a certain amount of credit (or associated 'talk time') is loaded and drawn down based on usage. Once consumed, a further amount must be 'topped up'. Top ups often have an expiry period.

delineating where they choose to operate in the spectrum between pure profit and a social mission. The difficulty in finding the right price is compounded by the lack of experience in serving low income markets, given that these have traditionally been regarded unprofitable. Further, with products or services that are 'new' to an area, there are often no antecedent price benchmarks to draw upon. An understanding of the Willingness to Pay (WTP) for mobile telephony services would therefore be an important step toward service provision in these markets.

Estimation of the WTP typically involves asking prospective customers whether or not they would be willing to purchase a commodity or service at various hypothetical prices. This approach, known as the 'Contingent Valuation' (CV) method, is controversial because it relies on people's 'stated' preferences rather than their 'revealed' preferences (actual observed choices). While the potential sources of bias associated with the method remain a source of debate[7], its use is arguably inevitable in certain contexts, such as when firms want to learn about the likely adoption of a 'new' product or service or when governments want to estimate the response to proposed policies that are outside the range of variability in existing data (Portney, 1994).

The present study draws from data generated using the CV method to analyze whether the consumption of mobile telephony services among low income or 'Bottom of the Pyramid' (BOP) households is responsive to small declines in the current per-minute price of use. The dataset pertains to six Asian countries: Bangladesh, India, Pakistan, Philippines, Sri Lanka and Thailand. With the growing private sector interest in serving low income markets, an understanding of the price sensitivity of mobile use would be of practical interest to service providers in these regions. Equally, ensuring wide access to mobile telephones has gained significant policy support as mobiles can serve as a platform to extend services that are important for social and economic development in several areas such as agriculture, government, health, banking and general information, besides basic telecommunications. These services are potentially the most valuable in the context of remote and rural areas that are otherwise difficult to access. The findings of the study would therefore also be of policy interest.

The rest of the paper is organized as follows: Section II briefly describes the Contingent Valuation (CV) method and its application in the present study; Section III outlines the 'Teleuse at the Bottom of the Pyramid' project from which the dataset used in this study is drawn; Section IV presents the analytical framework; Section V offers descriptive statistics for the variables used in the analysis and investigates the extent of non-response to the CV

[7] See for example Diamond, P.A.; Hausman, J.A. (1994). Contingent Valuation: Is Some Number better than No Number? The Journal of Economic Perspectives, Vol. 8, No. 4, pp. 45-64.

question; Section VI discusses the results from the estimation and Section VII concludes with a summary of findings.

II. The Contingent Valuation Method & its Application to the Study

The Contingent Valuation (CV) method was first proposed in 1947 as a means to elicit how much individuals might be willing to pay to prevent soil erosion, given that the associated benefits are in the nature of a 'public good' (Carsen and Hanneman, 2005). The majority of the applications that followed were in the field of environmental economics and involved placing a value on non-market resources such as wildlife, environmental quality and recreation. The format of eliciting responses on willingness to pay, however, has evolved since its first use and the range of application of the CV method has increased to include studies in the areas of health, agri-business, telecommunications and risk and insurance.

Zhongmin et al. (2006) outline the major formats associated with the CV method and their relative advantages. Early studies posed an open-ended question to respondents on how much they would be willing to pay for a particular good or service. This was replaced by a payment card or 'ladder' listing a series of prices, where respondents are asked to identify the price at which they would be willing to buy the good or service. The payment card format has been largely superseded by a dichotomous choice question on whether respondents would be willing to pay a specific price for a good. The latter approach is known as the 'single bound method', since a single price is used as a reference point to judge the willingness to pay. An extension of the single bound approach is the 'double bound method' where a further question is posed based on the first response: Those who answered 'yes' to the first price are asked whether or not they would pay a certain higher price and those who answered 'no' are asked about a lower price. The double bound method can be further extended using higher and lower prices in the form of a 'bidding game', and the game is sometimes designed to continue until a 'no' is reached for an upper price and a 'yes' for a lower price. While these are the main approaches within the CV method, studies often use hybrid or innovative formats in practice, depending on the particular commodity or market in question.

The design of the CV method in the present study is as follows: Mobile owners are first asked the number of mobile minutes they currently consume per week. A payment card is then presented with five diagrams, each representing a different price point (see Figure 1 in the appendix). The first diagram consists of 5 adjoining circles and respondents are asked to assume that this represents the current per minute price they pay for mobile use. Each successive diagram in the payment card illustrates a hypothetical price point that is below this 'current price':

The second diagram has 4 circles, denoting a price that is 20% below the current price; the third diagram has 3 circles, indicating a 40% fall in price and so on, with the last diagram showing just one circle, representing an 80% price reduction. Against each hypothetical price, respondents are asked to indicate the number of mobile minutes that they would consume per week at the price. The diagrammatic, unit-free depiction of prices is intended to facilitate easier comparison of responses across countries, given the varying 'current' prices and currencies.

A general caveat with the use of the CV method, formally referred to as a 'hypothetical bias', is that the reliability of responses hinges upon a proper understanding of the hypothetical scenarios described (Briscoe et al., 1990)[8]. An advantage of the present survey is that the respondents comprise mobile phone owners alone and can therefore be expected to relate easily to the exercise, which requires that they estimate the volume of mobile use at different prices[9]. A shortcoming with the present study, however, is that respondents might not have precisely understood the price-points represented by the visual diagrams. Indeed the survey, which involves the use of a payment card without intermediation, assumes that respondents are able to independently decipher the price change represented by each diagram (successive reductions of 20% over the current price), calculate the new price, and provide the corresponding expected consumption. Given the profile of the respondents – those belonging to low income households, often with low levels of education – the latter is arguably a strong assumption.

If the price change associated with each diagram were interpreted differently across respondents, the resulting problem is that responses are not comparable as they reflect consumption estimates based on different (perceived) magnitudes of price variation. In these circumstances, binary data on whether or not respondents would change consumption in response to price change is likely to be more reliable, as it assumes only that respondents were able to understand the direction of price change and not the order of magnitude represented by each diagram. Accordingly, the responses have been re-coded in a binary form such that those who would increase consumption in response to the first diagram (a 20% price reduction) are assigned a value of 'one' and others 'zero'. The binary outcome variable can be interpreted as whether or not the individual has a non-zero price elasticity of demand (PED) with respect to a marginal price decline (although in strict terms, the price fall is 20%).

[8] The two other major sources of bias are a 'strategic bias' and a 'compliance bias'. The former implies that respondents answer strategically because they believe they can influence service provision by their response. The strategic bias can be addressed by carrying out the study in different settings with a view to minimize this perception. A compliance bias occurs when respondents try to please the interviewer with their answers. The latter can be minimized through the careful training of enumerators (Briscoe et al., 1990)

[9] In contrast, when the CV method is used to estimate the WTP for a product or service that does not yet exist in a particular region, it is crucial to ensure that respondents understand the nature of the commodity being described. Visual aids, discussions and detailed explanations are often used in these situations (Briscoe et al., 1990).

The next section describes the six-country study titled 'Teleuse at the Bottom of the Pyramid' from which the dataset used in this paper is drawn.

III. 'Teleuse at the Bottom of the Pyramid'[10]

The survey data used in this paper derives from LIRNE*asia*'s third 'Teleuse at the Bottom of the Pyramid' (Teleuse@BOP3) study, involving representative samples of low income telephone users in Bangladesh, India, Pakistan[11], Philippines, Sri Lanka[12], and Thailand[13]. The study follows the socioeconomic classification (SEC) used in market research to define 'Bottom of the Pyramid' (BOP), or those belonging to the lowest economic strata. The SEC comprises five groups – A to E – based on the education and occupational status of the chief wage earner of the households[14][15]. People between the ages 15 and 60 were considered. Of the groups, D and E are together referred to as the BOP. A comparison of the BOP definition and the 'less than USD 2/day' poverty definition in terms of their corresponding population shares in each country is presented in Table 1 in the appendix. The definitions do not differ widely except in India and Pakistan, where BOP corresponds to a smaller population share.

The strategy of sampling used in the study is as follows: A multi-stage stratified cluster sampling by Probability Proportionate to Size (PPS) was used to select the target number of urban and rural centers within each country. Once the number of centers to be selected in each cell (strata in provinces) was determined, urban and rural areas were selected using PPS on a constant population interval on geographically ordered centers within each cell. In each area, a prominent landmark such as a road, park or hospital was chosen as the starting point to contact households using either the right-hand-rule or the left-hand-rule[16]. One respondent was chosen from each household for the survey. In households with more than one valid respondent, a Kish grid (random number chart) was used to select the survey respondent. Within each country, the data has been weighted by gender, province

[10] This section is based on the 'Teleuse@BOP-3' survey methodology description in de Silva et al. (2009).
[11] The sample excludes tribal areas in Pakistan.
[12] The sample excludes the North and East.
[13] The sample excludes Bangkok (since the D & E populations there are very small).
[14] We implicitly address any differences in the country samples that could arise on account of the qualitative basis of classification (occupational status and education) by including a country-level investigation of the variables in our analysis.
[15] In the case of the Philippines, only SEC E was used as the SEC E proportion was found to be more in line with the less than USD 2 per day definition than the SEC D and E taken together.
[16] This is a method of sampling often used in market research where typically every nth household to the right or left of the starting landmark (depending on whether the right-hand rule or left-hand rule is applied) is contacted for the survey.

group (or zone) and urban-rural proportions to correct for over or under-sampling in certain areas and for particular socioeconomic groups.

The dataset comprises 9,540 respondents, surveyed between September and October 2008 through face-to face interviews. Respondents comprised those that had used any type of telephone (ownership was not a requirement) in the preceding three months.

The next section describes the analytical framework used to study the price sensitivity of mobile use among mobile phone owners.

IV. A Probit Model with Sample Selection

We use a probit model with sample selection to analyze whether the quantity of mobile minutes demanded is sensitive to a small decline in the current per-minute price of use. The outcome variable of interest is the 'non-zero PED', which takes on the value 1 for those who would increase consumption in response to a small fall in price (non-zero PED) and 0 for those who would not (zero PED). The Heckman method is used to address the sample selection problem arising from the study of mobile phone owners alone.

The distinction between mobile owners and mobile users is important to note at the BOP on account of the large share of 'non-owning' mobile phone users[17]. As shown in Table 1, while 47% of the sample owned a mobile phone, a much larger proportion (84%) had used one in the preceding three months. Indeed only 55% of those that had used a mobile phone in the past three months personally owned a mobile phone[18]. The various sources of mobile access are listed in Table 2: While personal ownership is the dominant source (reported by 44%), borrowing from within the family and the collective household use of a mobile phone is reported by a quarter of the sample; borrowing from neighbors, friends and relatives by 22% and the use of a mobile-based payphone by 18%[19].

The CV data in our study pertains to mobile owners alone. The potential sample selection bias arises from the fact that non-owners could differ from owners in characteristics that are unobserved or unobservable to the researcher.

[17] 'Ownership' in the present study is defined as those who own either a pre-paid or post-paid SIM card. This is distinct from those who own a mobile handset as it is possible that individuals owning SIM cards borrow handsets for use.
[18] It is interesting to note that non-owning mobile phone users appear to consume fewer telephone minutes from all sources (22 minutes per week) compared to mobile phone users (61 minutes per week).
[19] These sources of use are not mutually exclusive.

The Heckman method, which is used to correct for sample selection, is therefore applied (Heckman, 1979). In general terms, a sample selection problem arises when the outcome variable of interest, y, is only observable if some criterion with respect to another variable z is met. In our case, the data on the price sensitivity of use is observed only if individuals owned a mobile phone.

The selection equation of the Heckman model is described below, where z_i^* is the latent variable for individual i, w_i' is a vector of covariates for individual i, γ is the corresponding vector of coefficients and u_i is the random disturbance for individual i (Greene, 2008). In our case z_i^* represents the propensity to own a mobile phone and z_i is the observed ownership.

$$z^*_i = w_i'\gamma + u_i \qquad \text{---- (1)}$$

where $z_i = 1$ if $z^*_i > 0$ and 0 otherwise;

The outcome equation involves a dependent variable y_i (the observed realization of another latent variable y_i^*), which is observable if and only if z_i^* exceeds a certain threshold. In our case, y_i is the non-zero PED for mobile use, xi' is a vector of covariates for individual i, β is a vector of coefficients for the outcome equation and ε_i is a random disturbance term for individual *i*.

$$y_i^* = x_i'\beta + \varepsilon_i \qquad \text{---- (2)}$$

$y_i = y_i^*$ if $z_i = 1$;

y_i is not observed if $z_i = 0$;

The model assumes that the error terms have a bivariate normal distribution with zero means and correlation rho (ρ). The significance of the rho statistic is used to infer whether there is a sample selection problem. In our case a significant rho statistic would indicate whether there are unobservable factors affecting mobile ownership that are also correlated with the price sensitivity of mobile use.

By separating the covariates of the selection and outcome equations – vectors w_i' and x_i' - the Heckman method allows a more nuanced theoretical understanding. For example, the same explanatory variable, such as age, might have a differing effect in the two equations: Younger people might be more likely to own a mobile phone as they are more in tune with the latest technology (in the selection equation), but given the sample of mobile owners, those of an older age group might have demand that is relatively less sensitive to price change due to more stable incomes (in the outcome equation). Further, the price sensitivity of mobile use is likely to depend on factors such

as the purposes of existing use (captured in x_i'), which would not be relevant to the determinants of mobile ownership (vector w_i'). While the standard Heckman model assumes that y_i in the second stage is of a continuous form, we consider a special application where the data is binary for the reasons discussed in the previous section.

An important feature of the Heckman model is the exclusion restriction, which requires that there is at least one variable in vector w_i' (of the selection equation) that is not in vector x_i' (of the outcome equation) (Woolridge, 2002). In the present context this implies that there must be at least one variable that affects mobile ownership that does not affect the price sensitivity of use among owners: The decision to own a mobile phone is argued to be a function of the individual's propensity to purchase other forms of Information and Communication Technologies (ICTs) and the selection equation therefore includes variables that capture whether the individual owns a radio and a television. These variables are not expected to influence the responsiveness of mobile use to price change and do not enter the outcome equation. The selection equation also includes the variable 'access to electricity', which is likely to affect the decision to own a mobile phone but not the price sensitivity of use[20].

It is worth noting that a further self-selection arises within mobile users from the decision to opt for either a pre-paid or post-paid payment structure: The pre-paid option is tailored for lower income segments since eligibility is based on minimal screening criteria and documentation. Further, pre-paid use reduces financial commitments as there is no monthly fee obligation for renewal and incorporates flexibility as usage volumes can be low and staggered based on individual needs (Hamilton, 2003). The present study, however, does not take into account this aspect since the respondents in the survey correspond to the lower income strata alone. Indeed we find an extremely small share of post-paid connections in the BOP sample of mobile owners (less that 0.02%).

Section V below discusses the specific variables used in the analysis.

[20] While the excluded variables – ownership of a TV and radio and access to electricity - are possibly reflective of economic status, we do not consider their omission in vector x_i' to be a problem as x_i' captures economic status through income. The excluded variables also do not show a correlation with income that is extremely high. The correlations are TV ownership and income - 22%, radio ownership and income - 17% and access to electricity and income – 17%. All are significant at the 5% level.

V. An Overview of the Dataset

V.I. The Mobile Ownership Equation

Our selection equation draws largely from the set of explanatory variables used in the analysis of mobile ownership based on the same dataset by de Silva et al. (2009). The section below discusses the rationale for the inclusion of the variables in the model and their associated summary statistics, which are presented in Table 6 in the appendix.

(i) Demographic characteristics - age, gender, income and level of education: Mobile owners and non-owners are found to be significantly different along each of these dimensions. Mobile owners are slightly younger (32 years compared to 34 years for non-owners); comprise fewer women (37% against 58% for non-owners); have higher household incomes on average (USD 150 versus USD 109) and greater levels of education (secondary and tertiary rather than primary).

(ii) Perceived benefits: Mobile ownership is more likely among those who perceive greater benefits from mobile use[21]. Perceived benefits are measured in three categories – social, economic and emergency-related. Perceived benefits are found to be higher on average among mobile owners in all the three categories. In absolute terms, the perceived benefits from mobile use at the BOP are the highest in the emergency category (an average score of 92%), followed by the social (77%) and economic categories (57%).

(iii) 'Telecom-connectedness': The number among the top five individuals most frequently contacted by the respondent who own a phone is the variable used to capture likely peer effects in telephone ownership. If a greater number among the top five closest contacts of the individual owns a telephone, the individual is expected to be more likely to own a phone, due to peer effects that influence the ownership decision. The sample of mobile owners reports 78% of their top five contacts owning a phone on average whereas the figure for the non-owning group is 63%.

(iv) Ownership of other Information and Communication Technologies (ICTs): The propensity to own a mobile phone is argued to be related to the propensity to own other forms of ICT – in particular, a

[21] A number of benefits are listed within each category and respondents are asked whether they perceive each specific benefit. The responses within each category are then aggregated and represented on a scale between 0 and 1. The benefits listed in each category are as follows: (1) Emergency-related - (i) ability to act in an emergency (ii) ability to contact others in an emergency; (2) Social - (i) relationships with family and friends (ii) social status/ recognition in the community; (3) Economic - (i) ability to make more money (generally, and not through sale of talk time) (ii) ability to make more money through the sale of calls (iii)ability to find out about employment/work opportunities (iv) ability to access prices or market information (v) ability to save money (vi) ability to save on travel cost (viii) efficiency of day to day work.

television (TV) and a radio. TV ownership is found to be higher among mobile owners (85% versus 60%) and so also the ownership of radios (45% against 31%).

(v) Ownership of a fixed phone: A priori we do not know in what way the ownership of a fixed phone might influence the decision to own a mobile phone. Further, we cannot establish a causal relationship between the ownership decisions for the two types of phones (either as complements or substitutes) from the present analysis. However, the sample averages indicate that the ownership of fixed phones is higher among those who do not own a mobile (11%) compared to owners (9%). It is worth noting that while the overall incidence of fixed phone ownership in the sample is low at 10%, the major outlier is Sri Lanka, which is far ahead at 48% (Table 5 in the appendix).

(vi) Access to electricity in the home: Since the mobile handset requires electrical charging, access to electricity in the home is expected to be conducive to the decision to own a mobile phone. Access among mobile owners is in fact significantly higher (94% compared to 80%).

(vii) Geography: The distance to the nearest town (in terms of walking time in minutes) is the variable used to capture the remoteness of the location. Since mobile penetration in remote areas has been slower, mobile ownership in these areas is likely to be lower. Mobile owners report a walking time of 37 minutes to the nearest town against 47 minutes for non-owners. Country-level dummy variables are introduced for each of the six countries. We note that the ownership of mobile phones is highest in Thailand (close to 90% of the sample); followed by the Philippines (66%); Bangladesh (43%); Pakistan (41%), India (40%) and Sri Lanka (39%). Interestingly, the data shows less variation across countries with respect to whether respondents had used a mobile in the past three months. The figure is upwards of 90% in all the sample countries except India (69%) and Sri Lanka (63%) (see Table 5 in the appendix).

V.II. The Price Sensitivity of Use (Non Zero PED) Equation

The model variables in the outcome equation are briefly discussed below. The corresponding summary statistics are presented in Table 6 in the appendix.

A. Demographic Characteristics (Age, Education, Gender, Income):

Of the demographic variables, the income variable is of particular interest since those with lower levels of income might be expected to increase use when price falls, due to greater affordability. Further, those who are older might have relatively inelastic demand due to more stable incomes. The t statistics indicate that income

levels are not significantly different across the two groups and while age is significant, those in the zero PED are only marginally older (32 years compared to 31 years).

B. Behavioral Characteristics[22]:

(i) Duration of mobile ownership: Those who have been longtime mobile phone users are likely to have a consistent need for the mobile phone and demand that is less responsive to price change. The average duration of ownership in the zero PED group is in fact higher at 2.56 relative to 2.45 years.

(ii) Levels of mobile use: A larger volume of top-up could indicate that the person is in a better economic position[23] or has a sizeable requirement for the mobile phone or both. In these circumstances, the individual would heed less to price changes. Those with zero PED report that their last top-up volume was USD 1.41 versus USD 0.98 in the non-zero PED group.

(iii) Purposes of existing use: Besides basic telephone communication, the mobile can be used as a platform to access services in the areas of health, government, and agriculture and fishing; seek general information and participate in voting and competitions. In general, services in each of these domains that are relevant to lower economic groups are at a fairly nascent stage of development and usage is low. However, the most used service is mobile-based competitions. Users that participate in competitions might therefore have more elastic demand when price falls, given its relative popularity. Indeed the non-zero PED group has a larger share of those who use the phone to participate in competitions.

(iv) The use of cost minimizing techniques: The use of mobiles primarily for receiving calls (insofar as incoming calls are free)[24] or for missed calls are examples of cost minimization strategies. In these cases demand is likely to be more responsive to price cuts, since present consumption appears to be constrained by economic factors. While nearly everybody reports using the mobile for receiving calls, the use of the mobile for missed calls is significantly higher in the group with non-zero PED (48% versus 44%).

[22] This category of variables relates to the mobile usage behavior of mobile owners and captures potentially important associations with the price sensitivity of use. However, given that these are behavioural characteristics, their effect cannot be interpreted as causal.

[23] The correlation between the volume of the last top-up (in USD) and household income (in USD) is 13% and significant at the 5% level.

[24] The 'Calling Party Pays' (CPP) form of billing, often associated with prepaid calling cards, implies that incoming calls are effectively free. This has been cited as an important facilitator of mobile adoption in the developing world (Mariscal, 2007)

(v) Ownership of multiple SIM cards: In the case of 'pre-paid' connections, multiple SIM cards are easy to purchase at a relatively low cost[25], and the ownership of multiple SIMs enables users to switch nearly instantaneously between service providers to take advantage of current offers in price or other service offers. The transferability of SIMs (allowing a single phone to be used with multiple prepaid subscriptions) has been cited as an important reason for the popularity of prepaid use among lower income groups (Kalba, 2008)[26]. The use of mobile minutes among those with multiple SIM cards is therefore expected to be very sensitive to relative price changes. As expected, the number of SIMs owned by the non-zero PED group is found to be higher (1.70 compared to 1.20).

C. Perceptions Toward Mobile Use & Attitude toward Mobile Service Provider:

(i) Unwillingness to switch service providers: Respondents who indicate that they are unlikely to switch service providers even if price were to fall have effectively disregarded outside options and are therefore likely to have demand that is relatively inelastic to price change. The summary statistics indicate that the group with zero PED comprises a greater share of those who would not switch providers (39% against 33%).

(ii) Perceived benefits: Those who perceive greater benefits from mobile use (whether social, economic or emergency related) are likely to use the mobile more if it were cheaper. In particular, however, those who attach a greater importance to emergency-related benefits, which we interpret as greater contingency use of the mobile[27], might be able to extend their range of existing uses to include social and economic purposes if price were to fall. As expected, the non-zero PED group has a significantly higher score for perceived emergency benefits (92% versus 86%).

D. 'Telecom-connectedness':

This variable is captured by the number among 'the top five individuals most frequently contacted by the respondent' who own a phone. Users who are more 'telecom-connected' are more likely to take advantage of a

[25] Less than 3% of those who are unwilling to switch service providers cite financial constraints as their reason (see Table 10 in the appendix). However, nearly 59% point to the 'hassle of getting a new connection' as the reason, suggesting that there is an initial effort involved in acquiring the SIM card that is regarded as inconvenient.

[26] Other reasons cited for the multiple ownership of SIMs include "coverage differences, lack of interoperability (e.g., SMS), anonymity, expense tracking (e.g., personal vs. business use), roaming, functionality (data vs. voice), backup service, etc." (Kalba, 2008)

[27] We find by a t test that those for whom the perceived emergency benefits is larger than the perceived social and economic benefits are more modest users of the mobile (defined in terms of the value of the last top up in USD). This lends credence to our hypothesis that a higher value place on emergency benefits can be interpreted as present contingency use and therefore a greater likelihood of increased use if price were to fall: The average 'last top-up value (in USD)' for the group placing a higher value on emergency use is 1.14 USD against 1.32 USD for the rest (the t statistic is 2.74, p value 0.006).

fall in price to increase use. As expected, within the non-zero PED group, 57% of the five closest contacts of respondents own a phone on average versus 49% in the zero PED group.

E. Ownership of a fixed-line phone:

In general, the demand for mobile telephony is likely to be more inelastic in the absence of alternative sources of telecom access. Therefore the PED for mobile use among those who own a fixed line telephone would be lower. The share of fixed phone owners within the zero PED group is in fact lower at 7% against 11% in the non-zero PED group.

F. Geography:

Geography is captured in terms of a measure of the remoteness of the location of households (the distance to the nearest town) and dummy variables for each of the six study countries. The sample of six countries appears divided with respect to PED: Bangladesh and Philippines are characterized by a significantly greater share of those with non-zero PED, and Pakistan also falls in this category, although less significant. In contrast, India and Thailand have a significantly greater share of those with zero PED, and so also Sri Lanka to a lesser degree. Overall the summary statistics indicate that those with non-zero PED tend to live in less remote areas.

Before proceeding to the analysis, we consider the extent of missing and incorrect responses in the data.

V.III. Non Response to the CV Question

Missing responses refer to cases where the respondent has either not answered or incompletely answered the CV question[28]. Incorrect responses are those that reflect a lack of understanding of the exercise, in terms of violations of the basic law of demand (such as lesser quantities bought at a lower price) or intransitivity within responses (for example, if for a price sequence $p_0 > p_1 > p_2$, the quantities of expected consumption are $q_1 > q_0$, but $q_2 < q_1$). We find that the incidence of missing response in the survey is 4.8% and that of incorrect response is 3.4%. Taken together, the rate of non-response is 8.2%.

[28] In formal terms, this form of non-response is referred to as item non-response rather than unit non-response. The latter refers to the case where a respondent fails to answer the entire survey.

Non response is a familiar problem in the use of the CV method. The incidence of non-response can lead to a non-response bias if respondents and non-respondents differ systematically in observable characteristics that influence the Willingness to Pay, with the implication that the results of the analysis cannot be generalized for the target population (J.C Whitehead et al., 1993)[29].

In the present study, we examine whether non-response is correlated with particular socio-demographic characteristics or geographic areas. Besides testing for non-response bias, this process helps to identify those for whom intermediation by the survey enumerator might be advisable in subsequent rounds of data collection. A large incidence of non response within a specific region could also signal the need for better enumerator training in the area and probing on whether the questions are ill-suited to the particular context. A probit model is used to examine the likelihood of non-response based on a set of predictor variables that capture demographic characteristics, experience and interest in telecom use, and geography. The findings are presented in Table 8 below.

Table 8: Determinants of Non Response – A Probit Estimation

Variables	**Coefficients**	**z statistic**
Years owning mobile	0	0.543
Walk time to nearest town	-0.00***	-2.818
Close contacts owning phone	-0.03***	-2.699
Age (square)	0	0.624
Gender Dummy (Female = 1)	0.03***	3.545
Log HH Income (USD)	-0.02**	-2.318
Secondary education	0	0.542
Tertiary education	-0.01	-0.838
Bangladesh	-0.07***	-8.061
Pakistan	-0.01	-0.986
Sri Lanka	-0.01	-0.624
Philippines	-0.03***	-2.594
Thailand	-0.08***	-7.516
Total number of observations	4,121	

Notes: Coefficients are marginal effects; *** denotes that the variable is significant at the 99% level, ** at the 95% level and * at the 90% level; the total sample comprises mobile owners alone; non response includes missing responses and "incorrect" responses; India is the control group.

As shown, the likelihood of non-response is significantly higher for women and those with a lower level of income. Specifically, being a woman increases the probability of non-response by 3%, holding all other covariates constant

[29] If respondents and non-respondents differ with respect to unobservable characteristics, non-response would lead to a sample selection bias.

at their mean values, and a percentage increase in household income is associated with an improved response rate of 2%. Geographically, response rates are better in Bangladesh, Philippines and Thailand compared to the other sample countries. Locations that are more remote appear less likely to yield non response, although the coefficient of the variable is negligible in size.

The variables 'number of years of ownership of the mobile' and 'number of close contacts who own a phone' capture whether experience with the use of the mobile phone and telecom-connectedness respectively would increase the propensity to respond. While the number of years of ownership is insignificant, response rates rise with telecom-connectedness: With every additional person owning a phone among the five closest contacts of an individual, the likelihood of non-response falls by 3%.

The findings suggest that non response to the CV question does introduce a bias in the sample, although this is reduced in our final regression analysis by including the independent variables in the analysis of non-response in vector x_i' of the outcome equation. From a practical standpoint, response rates might be improved through facilitation by the survey enumerator for certain groups – specifically, those at the lower end of the income distribution, women and those who report that they are less 'telecom-connected'.

VI. Findings from the Analysis

Table 9 reports the results from the analysis. For easier interpretation, the average marginal effects of the variables computed at the mean values of the remaining variables are presented in Table 10 (in the appendix).

As can be seen from Table 10, all the demographic factors (age, gender, education levels and income) appear unimportant in explaining the responsiveness of demand to a marginal price fall, whereas they appear significant in explaining the likelihood of mobile ownership. The marginal effects of the specific variables, computed at the mean values of the other model variables are as follows: women are 25% less likely to own a mobile phone relative to men; secondary and tertiary levels of education are associated with a 9% and 24% greater likelihood of mobile ownership respectively, compared to no education or just primary levels of education; a percentage increase in household income is associated with an increased probability of mobile ownership of 11% (see Table 9).

Table 9: Analysis of Non-Zero PED (A Probit Model with Sample Selection)

	Outcome Equation (Non-zero PED)		Selection Equation (Mobile ownership)	
X Variables	Coefficient	z statistic	Coefficient	z statistic
Use mobiles to receive calls	-0.38	-1.191		
Use mobiles for missed calls	-0.09	-1.125		
Years owning mobile	-0.02	-1.572		
Not likely to switch providers	-0.23***	-3.438		
Number of SIM cards owned	0.13*	1.939		
Walk time to nearest town	-0.00***	-2.835	0	-1.18
Last top up value	-0.02	-0.69		
Social benefits	-0.07	-0.548	0.1	1.199
Emergency benefits	0.56***	3.21	-0.22**	-2.064
Economic benefits	0.05	0.351	0.47***	5.329
Close contacts owning phone	0.20	1.109	1.04***	12.053
Use m-banking services	-0.12	-0.6		
Use m-government services	0.58**	2.085		
Use m-health services	-0.38	-1.632		
Use m-competition services	0.30**	2.026		
Use m-general info services	0.25	1.536		
Use m- agri/fishing services	-0.77	-1.534		
Age (square)	0	0.194	-0.00***	-2.634
Ownership of a fixed phone	-0.07	-0.509	-0.52***	-6.426
Gender (dummy)	0.08	0.747	-0.64***	-13.508
Secondary education	-0.01	-0.077	0.22***	4.43
Tertiary education	-0.03	-0.262	0.61***	7.043
Log HH Income (USD)	0.08	1.044	0.28***	6.34
Bangladesh	0.55***	4.672	0.09	1.12
Pakistan	0.56***	5.388	-0.35***	-6.056
Sri Lanka	0.14	1.178	-0.31***	-3.489
Philippines	0.50***	4.403	0.18**	2.227
Thailand	-0.2	-1.111	1.22***	10.404
Access to electricity			0.15*	1.844
TV in household			0.35***	5.971
Radio in household			0.23***	4.397
Constant	-1.04	-1.441	-2.52***	-11.532
Total observations:				7782
			Censored observations	4128
			Uncensored observations	3654
Rho: - 0.05; Wald test of independent equations: (rho = 0): chi2(1) = 0.04; Prob > chi2 = 0.83.				

The ownership of multiple SIM cards is found to be associated with non-zero PED[30]. Specifically, the average marginal effect[31] of a unit increase in the number of SIM cards owned increases the probability of non-zero PED by 5%, holding all other variables constant at their mean values. In contrast, those who report that they would not switch service providers even if it represented a cheaper option are 9% more likely to have zero PED relative to those who would consider changing service providers.

The perceived benefits of mobile use also appear to have an important association with the non-zero PED for mobile minutes. Mobile owners who perceived greater emergency benefits are associated with greater price sensitivity or non-zero PED, suggesting that a fall in price would allow them to go beyond limited emergency uses. Specifically, for a small increase in the perceived emergency benefits score, the likelihood of non-zero PED increases by 22%, holding all other variables constant at their mean values. This interpretation is supported by the fact that those who perceive greater emergency-related benefits are also found to be significantly less likely to own a mobile phone: A small increase in the perceived emergency benefits score decreases the likelihood of mobile ownership by 9%. Therefore a perception of greater emergency benefits appears to be a potentially important indicator of latent demand both in terms of mobile ownership and levels of use. In contrast we find that while the perception of higher economic benefits of mobile use is associated with a greater likelihood of mobile ownership, it does not significantly affect the responsiveness of demand to a marginal price fall: A small increase in the perceived economic benefits score is found to increase the likelihood of mobile ownership by 19%.

Mobile owners who report a more diversified use of mobile services - although only a small share of the total mobile-owning sample – also appear to have a greater price sensitivity of use. Specifically, those that use the mobile for participating in various kinds of voting and competitions are 12% more likely to have non-zero PED and those that use the mobile to access government services are 22% more likely to have non-zero PED. Further, users who are more 'telecom connected' are found to be both more likely to own a mobile phone and also more likely to have non-zero PED, given mobile ownership. For every additional person among the top five individuals most frequently contacted by the respondent who owns a phone, the likelihood of mobile ownership increases by 41%. Among the mobile owning sample, a unit increase in 'telecom connectedness' increases the likelihood of non-zero PED by 9%, calculated at the sample means of the other variables.

[30] 15% of the sample of mobile users reports owning more than one SIM card.
[31] Marginal effects for the outcome equation are reported as averages, conditional on selection (mobile ownership).

The variables included in the mobile ownership equation and excluded in our final analysis in order to satisfy the exclusion restriction – access to electricity, TV and radio ownership – are all significant: TV owners are associated with a 14% higher likelihood of mobile ownership and radio owners with a 9% greater likelihood of mobile ownership, calculated at the mean values of the model variables. Access to electricity is associated with a 6% greater likelihood of mobile ownership[32].

Overall the results suggest that there exists a latent demand for mobile minutes across a varied profile of mobile owners, which can be tapped through a small reduction in the current per-minute price of use - the more 'limited users' (who place a higher value on the emergency uses of the phone) and those with a more diversified use of the phone (to access mobile-based government services and competitions). This is consistent with the findings of a large number of studies that pricing strategies have been among the most important drivers of mobile adoption among lower income groups.[33] Simultaneously, the ownership of multiple SIM cards and its association with a greater likelihood of non-zero PED indicates that small changes in relative prices are likely to motivate mobile owners to 'switch' providers (specifically, switch between SIMs of different providers) to take advantage of better prices. With the rising competition in the mobile telephony sector and in markets characterized by relatively low profit margins, however, competing on price could lead to price wars that threaten the survival of firms. Non-price strategies would therefore appear important for firm survival and sustainable service delivery.

A particular factor in the mobile telephony sector that enhances the propensity of users to switch service providers is Mobile Number Portability (MNP). MNP allows users to retain a single number when changing providers and is regarded as especially convenient among those who value their unique mobile contact numbers. While MNP in the six countries was virtually absent during the study period[34], it is reasonable to assume that, if introduced, it would enhance the propensity of some users to engage in 'switching' in response to price or service incentives. This assumption is substantiated by the fact that over a quarter of those who assert that they would definitely not switch providers or are unlikely to do so, even if offered a cheaper package[35], cite their reason as attaching a high value to

[32] We note, however, that while there is a conceptual basis for sample selection in the analysis, the 'rho' statistic is insignificant by a Walt test.
[33] Gruber (2005) cited in Mariscal (2007).
[34] Pakistan is the only country among the six study countries where MNP is currently being implemented.
[35] 17% of the mobile owning sample reports that they would not switch service providers or are unlikely to do so, even if offered a cheaper package.

their present mobile number (see Table 12 in the appendix). Therefore, insofar as MNP could enhance the effect of switching in low income markets, its potential effect at the BOP merits careful policy attention[36].

Additionally, we note from our analysis that the country dummies for Bangladesh, Pakistan and the Philippines are significant. Therefore we test whether the general findings would differ at the country-level with respect to some of the key behavioral variables of interest, by including country interaction terms in our model. Table 11 in the appendix reports the results from the estimation in terms of marginal effects[37].

The results indicate that for Bangladesh the marginal effect of the use of the mobile to receive calls on the non-zero PED is greater and that of the use of the mobile for missed calls is lower, compared to the other sample countries. In contrast the marginal effect of the use of the mobile for missed calls is higher in Pakistan and Sri Lanka compare to the rest of the sample.

The marginal effect of the ownership of a greater number of SIM cards on the non-zero PED is found to be significantly higher in the Philippines whereas that of the unwillingness to switch service providers is significantly lower in Bangladesh. The marginal effect of the perceived benefits of mobile use on non-zero PED is notably lower in Pakistan for the category of social benefits, higher in the Philippines for the category of emergency benefits and lower in Bangladesh for the category of economic benefits. The marginal effect of telecom-connectedness on non-zero PED is significantly higher in Pakistan relative to the other countries.

In terms of the use of the mobile for other services, the marginal effect on the non-zero PED of the use of the mobile for competitions and health related services are significantly lower in Bangladesh, but higher in the category of information seeking.

The following section summarizes the findings of the study and their implications.

[36] For a discussion of the suitability of MNP for the BOP in Asia, see: Iqbal, T. (2010), Mobile Number Portability in South Asia. Retrieved: October 11, 2010. URL: http://lirneasia.net/wp-content/uploads/2010/02/Mobile-2.0_MNP.pdf

[37] In general, the significance of an interaction term (behavioral variable X * country N) in the table is interpreted as follows: The (conditional) marginal effect of X on the non-zero PED (outcome) variable is significantly different in country N from the (conditional) marginal effect of X in India (the control group) (Frondal et al., 2009). The marginal effects are referred to as 'conditional' because the outcome variable is observed conditional on 'selection' in the model.

VI. A Summary of Findings & Conclusion

There is growing private sector interest in providing mobile telephony services in low income and rural areas of developing countries, which were previously considered unprofitable markets. The task of finding the right price is a central challenge for firms in this context. Despite limitations, the Contingent Valuation (CV) method, which, in its simplest form, asks respondents to state whether they would be willing to pay a certain price for a product or service, is a useful tool to assess the Willingness to Pay (WTP) and guide pricing decisions.

The present study draws on data generated using the CV method to analyze the factors associated with a non-zero Price Elasticity of Demand (PED) for mobile telephony services among low income households in six countries of Asia. The study countries are Bangladesh, India, Pakistan, Philippines Sri Lanka and Thailand. Specifically, mobile owners are asked how their present consumption of mobile minutes would change if the current per-minute price of mobile use were to fall by a 'small amount', although in strict terms the amount is 20%. Since the respondents comprise mobile owners alone, a variant of the Heckman model is used to correct for sample selection.

The findings of the study and their implications are as follows: Demographic criteria, including income, are not significantly associated with the price sensitivity of mobile use, although they appear important in determining mobile ownership. Instead, the ownership of multiple SIM cards has a significant positive association with non-zero PED and the unwillingness to switch service providers, a significant negative association. The study further finds that demand is sensitive across a varied profile of mobile owners: those who place a higher value on the emergency uses of a phone (associated with contingency use) and also those with a more diversified use of mobile services (to participate in various types of competitions and to access government services) and those who are more telecom-connected (with a greater number of close contacts owning a phone).

Unbundling the effects country-wise we find that the marginal effect of the ownership of a greater number of SIM cards on the non-zero PED is higher in the Philippines whereas that of the unwillingness to switch service providers is lower in Bangladesh. Perceived emergency benefits are found to have a notably higher effect in the Philippines; perceived social benefits a lower effect in Pakistan; and perceived economic benefits a lower effect in Bangladesh. The marginal effect of telecom-connectedness on non-zero PED is significantly higher in Pakistan relative to the other countries.

Overall the findings suggest that there exists a latent demand for mobile minutes at the BOP, which can be tapped through a small reduction in the current per minute price of use. Simultaneously, the findings indicate that the ownership of multiple SIM cards is associated with a greater price sensitivity of use. Given the relatively low profit margins in these markets and the ability of users to switch between service providers quickly and at low cost, competing on price could lead to price wars that threaten the long term survival of firms. Non-price strategies would therefore be important for firm survival and sustainable service delivery.

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Appendix Section: Tables and Figures[38]

Table 1: SEC Classification Versus 'Less than USD 2 per day' By Country

Percent (%) population	Bangladesh	Pakistan	India	Sri Lanka	Philippines	Thailand
SEC D+E (% of population)	73	59	69	44	38*	33
< USD 2/day** (% of population)	84 2000	80 2004	74 2002	43 2003	42 2002	25 2002

Source: SEC data provided by The Nielsen Company; poverty data from WRI et al. (2008; p.206).
* Only SEC E was used in the Philippines country sample;
** The corresponding years are presented in the rows below; time-comparable data are not available.

Table 2: Mobile Ownership versus Use in the Sample

	Own a Mobile Phone		
Used A Mobile in the Last 3 Months	**No**	**Yes**	**Total**
No	1,453	78	1,531
Yes	3,618	4,391	8,009
Total	5,071	4,469	9,540

Table 3: Sources of Mobile Use

Source of mobile use in past three months	Number of users	% of Total Sample
Own phone	4,154	0.44
Public access phone	1,728	0.18
Family member's phone	2,077	0.22
Neighbor's phone	1,141	0.12
Friend/relative's phone	981	0.10
Shared 'household' phone	271	0.03
Workplace phone	56	0.01

[38] All tables are compiled by the author based on the T@BOP3 dataset unless otherwise indicated.

Table 4: Mobile-based Telephone Use as a Share of Total Telephone Use

Source of telephone access in past three months	% of total sample using this source	% of access that is mobile-based
Own phone	0.45	0.96
Public access phone	0.41	0.45
Family member's phone	0.25	0.86
Neighbor's phone	0.14	0.83
Friend/relative's phone	0.12	0.83
Shared 'household' phone	0.11	0.26
Workplace phone	0.02	0.37

Table 5 Country-wise mobile ownership* & use, fixed phone ownership* and non-response to CV question

Country	% Own a mobile	% Used a mobile	% Own a fixed phone	% Non response to CV question
Bangladesh	42.68	99.85	1.32	2.86
India	39.63	69.38	8.19	13.29
Pakistan	40.63	93.11	6.39	12.62
Philippines	66.13	93.25	2.13	7.75
Sri Lanka	39.29	63.42	47.73	9.92
Thailand	89.5	94.25	11.63	0.98

*Note: The 'Teleuse@BOP3' sample comprises those that had used any type of telephone in the past three months (ownership was not a requirement). Therefore the figures on mobile and fixed phone ownership do not correspond to the entire BOP but rather to the study sample, which includes those in the BOP that had used some form of telecom in the past three months. It is conceivable therefore that the ownership figures in both categories are in fact larger for the BOP.

Table 6: Summary Statistics: Ownership Equation (Part 1/2)

Variables	Sample	Mean	SD	Min	Max	N	t value	p
Age	Do not own	33.70	12.19	15.00	60.00	5071.00	8.02	0.00
	Own	31.95	11.12	15.00	60.00	4469.00		
	Total sample	32.88	11.74	15.00	60.00	9540.00		
Gender_D	Do not own	0.58	0.49	0.00	1.00	5071.00	21.47	0.00
	Own	0.37	0.48	0.00	1.00	4469.00		
	Total sample	0.48	0.50	0.00	1.00	9540.00		
HH Income (USD)	Do not own	109.00	99.51	5.00	2223.67	4665.00	27.18	0.00
	Own	149.86	109.71	5.00	2589.93	4141.00		
	Total sample	128.22	106.40	5.00	2589.93	8806.00		
Primary edu	Do not own	0.42	0.49	0.00	1.00	5071.00	13.06	0.00
	Own	0.29	0.46	0.00	1.00	4469.00		
	Total sample	0.36	0.48	0.00	1.00	9540.00		
Secondary edu	Do not own	0.36	0.48	0.00	1.00	5071.00	14.33	0.00
	Own	0.50	0.50	0.00	1.00	4469.00		
	Total sample	0.43	0.49	0.00	1.00	9540.00		
Tertiary edu	Do not own	0.05	0.21	0.00	1.00	5071.00	16.28	0.00
	Own	0.14	0.35	0.00	1.00	4469.00		
	Total sample	0.09	0.29	0.00	1.00	9540.00		
Close contacts owning phone	Do not own	0.63	0.29	0.00	1.00	5059.00	26.99	0.00
	Own	0.78	0.27	0.00	1.00	4468.00		
	Total sample	0.70	0.29	0.00	1.00	9527.00		
Social benefits	Do not own	0.74	0.30	0.00	1.00	4690.00	11.51	0.00
	Own	0.81	0.28	0.00	1.00	4336.00		
	Total sample	0.77	0.29	0.00	1.00	9026.00		
Emergency benefits	Do not own	0.92	0.22	0.00	1.00	4775.00	2.65	0.01
	Own	0.93	0.21	0.00	1.00	4387.00		
	Total sample	0.92	0.21	0.00	1.00	9162.00		
Economic benefits	Do not own	0.53	0.31	0.00	1.00	4666.00	12.50	0.00
	Own	0.61	0.28	0.00	1.00	4347.00		
	Total sample	0.57	0.30	0.00	1.00	9013.00		
Own a fixed phone	Do not own	0.11	0.31	0.00	1.00	5071.00	1.85	0.06
	Own	0.09	0.29	0.00	1.00	4469.00		
	Total sample	0.10	0.30	0.00	1.00	9540.00		
Walk time to nearest town	Do not own	47.02	78.74	0.00	840.00	5071.00	8.99	0.00
	Own	34.19	57.43	0.00	800.00	4469.00		
	Total sample	41.01	69.86	0.00	840.00	9540.00		

Table 6: Summary Statistics: Ownership Equation (contd. Part 2/2)

Variables	Sample	Mean	SD	Min	Max	N	t value	p
Access to electricity	Do not own	0.80	0.40	0.00	1.00	5071.00	19.15	0.00
	Own	0.94	0.24	0.00	1.00	4469.00		
	Total sample	0.87	0.34	0.00	1.00	9540.00		
TV in HH	Do not own	0.60	0.49	0.00	1.00	5071.00	28.23	0.00
	Own	0.85	0.36	0.00	1.00	4469.00		
	Total sample	0.71	0.45	0.00	1.00	9540.00		
Radio in HH	Do not own	0.31	0.46	0.00	1.00	5071.00	17.16	0.00
	Own	0.48	0.50	0.00	1.00	4469.00		
	Total sample	0.39	0.49	0.00	1.00	9540.00		
Bangladesh	Do not own	0.23	0.42	0.00	1.00	5071.00	4.27	0.00
	Own	0.20	0.40	0.00	1.00	4469.00		
	Total sample	0.21	0.41	0.00	1.00	9540.00		
India	Do not own	0.38	0.48	0.00	1.00	5071.00	9.80	0.00
	Own	0.28	0.45	0.00	1.00	4469.00		
	Total sample	0.33	0.47	0.00	1.00	9540.00		
Pakistan	Do not own	0.21	0.41	0.00	1.00	5071.00	5.90	0.00
	Own	0.16	0.37	0.00	1.00	4469.00		
	Total sample	0.19	0.39	0.00	1.00	9540.00		
Sri Lanka	Do not own	0.11	0.31	0.00	1.00	5071.00	4.85	0.00
	Own	0.08	0.27	0.00	1.00	4469.00		
	Total sample	0.10	0.30	0.00	1.00	9540.00		
Philippines	Do not own	0.05	0.22	0.00	1.00	5071.00	11.50	0.00
	Own	0.12	0.32	0.00	1.00	4469.00		
	Total sample	0.08	0.28	0.00	1.00	9540.00		
Thailand	Do not own	0.02	0.13	0.00	1.00	5071.00	26.15	0.00
	Own	0.16	0.37	0.00	1.00	4469.00		
	Total sample	0.08	0.28	0.00	1.00	9540.00		

Table 7: Summary Statistics: Price Elasticity of Demand (PED) Equation (Part 1/3)

Variables	Sample	Mean	SD	Min	Max	N	t value	p
Mobile_receive calls	PED = 0	0.99	0.11	0.00	1.00	2485	0.45	0.65
	Non-zero PED	0.99	0.10	0.00	1.00	1794		
	Total sample	0.99	0.11	0.00	1.00	4469		
Mobile_missed calls	PED = 0	0.44	0.50	0.00	1.00	2473	2.87	0.00
	Non-zero PED	0.48	0.50	0.00	1.00	1788		
	Total sample	0.45	0.50	0.00	1.00	4447		
Years owning mobile	PED = 0	2.56	2.55	0.00	20.00	2478	1.43	0.15
	Non-zero PED	2.45	2.34	0.00	18.00	1788		
	Total sample	2.50	2.45	0.00	20.00	4447		
Would not switch providers	PED = 0	0.39	0.49	0.00	1.00	2485	4.35	0.00
	Non-zero PED	0.33	0.47	0.00	1.00	1794		
	Total sample	0.36	0.48	0.00	1.00	4469		
Number of SIMs owned	PED = 0	1.17	0.45	1.00	3.00	2485	2.64	0.01
	Non-zero PED	1.20	0.48	1.00	3.00	1794		
	Total sample	1.18	0.46	1.00	3.00	4469		
Last top up value	PED = 0	1.41	1.61	0.13	14.49	2397	9.39	0.00
	Non-zero PED	0.98	1.23	0.13	14.49	1756		
	Total sample	1.25	1.49	0.13	14.49	4330		
Social benefits	PED = 0	0.65	0.48	0.00	1.00	2401	0.81	0.42
	Non-zero PED	0.67	0.47	0.00	1.00	1747		
	Total sample	0.65	0.48	0.00	1.00	4336		
Emergency benefits	PED = 0	0.86	0.35	0.00	1.00	2434	5.74	0.00
	Non-zero PED	0.92	0.28	0.00	1.00	1766		
	Total sample	0.88	0.32	0.00	1.00	4387		
Economic benefits	PED = 0	0.63	0.48	0.00	1.00	2485	2.21	0.03
	Non-zero PED	0.66	0.47	0.00	1.00	1794		
	Total sample	0.63	0.48	0.00	1.00	4469		
Close contacts owning phone	PED = 0	0.49	0.50	0.00	1.00	2485	5.13	0.00
	Non-zero PED	0.57	0.50	0.00	1.00	1794		
	Total sample	0.52	0.50	0.00	1.00	4469		
Use m-banking	PED = 0	0.02	0.14	0.00	1.00	2485	1.14	0.26
	Non-zero PED	0.02	0.15	0.00	1.00	1794		
	Total sample	0.02	0.14	0.00	1.00	4469		
Use m-government	PED = 0	0.00	0.10	0.00	1.00	2485	1.59	0.11
	Non-zero PED	0.01	0.12	0.00	1.00	1794		
	Total sample	0.01	0.10	0.00	1.00	4469		
Use m-health	PED = 0	0.02	0.14	0.00	1.00	2485	0.05	0.96
	Non-zero PED	0.02	0.14	0.00	1.00	1794		
	Total sample	0.02	0.14	0.00	1.00	4469		

Table 7. Summary Statistics: Price Elasticity of Demand (PED) Equation (contd. Part 2/3)

Variables	Sample	Mean	SD	Min	Max	N	t value	p
Use m-competitions	PED = 0	0.04	0.20	0.00	1.00	2485	1.73	0.08
	Non-zero PED	0.05	0.23	0.00	1.00	1794		
	Total sample	0.05	0.21	0.00	1.00	4469		
Use m-gen info	PED = 0	0.05	0.21	0.00	1.00	2485	0.17	0.86
	Non-zero PED	0.05	0.21	0.00	1.00	1794		
	Total sample	0.04	0.21	0.00	1.00	4469		
Use m-agri fish	PED = 0	0.00	0.06	0.00	1.00	2485	0.97	0.33
	Non-zero PED	0.01	0.08	0.00	1.00	1794		
	Total sample	0.00	0.07	0.00	1.00	4469		
Own a fixed phone	PED = 0	0.11	0.31	0.00	1.00	2485	3.78	0.00
	Non-zero PED	0.07	0.26	0.00	1.00	1794		
	Total sample	0.09	0.29	0.00	1.00	4469		
Age	PED = 0	32.43	11.26	15.00	60.00	2485	3.62	0.00
	Non-zero PED	31.17	10.89	15.00	60.00	1794		
	Total sample	31.95	11.12	15.00	60.00	4469		
Gender_D	PED = 0	0.37	0.48	0.00	1.00	2485	0.64	0.52
	Non-zero PED	0.36	0.48	0.00	1.00	1794		
	Total sample	0.37	0.48	0.00	1.00	4469		
Primary education	PED = 0	0.30	0.46	0.00	1.00	2485	1.83	0.07
	Non-zero PED	0.27	0.45	0.00	1.00	1794		
	Total sample	0.29	0.46	0.00	1.00	4469		
Secondary education	PED = 0	0.14	0.35	0.00	1.00	2485	0.10	0.92
	Non-zero PED	0.14	0.35	0.00	1.00	1794		
	Total sample	0.14	0.35	0.00	1.00	4469		
Tertiary education	PED = 0	0.50	0.50	0.00	1.00	2485	1.23	0.22
	Non-zero PED	0.51	0.50	0.00	1.00	1794		
	Total sample	0.50	0.50	0.00	1.00	4469		
HH Income (USD)	PED = 0	151.16	104.66	17.27	1726.62	2283	0.86	0.39
	Non-zero PED	150.87	115.71	5.00	2589.93	1693		
	Total sample	149.86	109.71	5.00	2589.93	4141		
Walk time to nearest town	PED = 0	38.80	66.15	0.00	800.00	2485	4.82	0.00
	Non-zero PED	28.43	44.12	0.00	600.00	1794		
	Total sample	34.19	57.43	0.00	800.00	4469		
Bangladesh	PED = 0	0.12	0.33	0.00	1.00	2485	15.32	0.00
	Non-zero PED	0.31	0.46	0.00	1.00	1794		
	Total sample	0.20	0.40	0.00	1.00	4469		

Table 7. Summary Statistics: Price Elasticity of Demand (PED) Equation (contd. Part 3/3)

Variables	Sample	Mean	SD	Min	Max	N	t value	p
India	PED = 0	0.33	0.47	0.00	1.00	2485	11.17	0.00
	Non-zero PED	0.18	0.39	0.00	1.00	1794		
	Total sample	0.28	0.45	0.00	1.00	4469		
Pakistan	PED = 0	0.15	0.36	0.00	1.00	2485	1.60	0.11
	Non-zero PED	0.17	0.37	0.00	1.00	1794		
	Total sample	0.16	0.37	0.00	1.00	4469		
Sri Lanka	PED = 0	0.09	0.29	0.00	1.00	2485	1.53	0.13
	Non-zero PED	0.08	0.27	0.00	1.00	1794		
	Total sample	0.08	0.27	0.00	1.00	4469		
Philippines	PED = 0	0.10	0.29	0.00	1.00	2485	5.89	0.00
	Non-zero PED	0.15	0.36	0.00	1.00	1794		
	Total sample	0.12	0.32	0.00	1.00	4469		
Thailand	PED = 0	0.21	0.41	0.00	1.00	2485	8.59	0.00
	Non-zero PED	0.11	0.31	0.00	1.00	1794		
	Total sample	0.16	0.37	0.00	1.00	4469		

Note: Total sample here refers to the total sample of mobile owners.

Table 10: Conditional Marginal Effects (MEs) of Non-Zero Price Elasticity of Demand & Marginal Effects (MEs) of Mobile Ownership

Variables	Probability of Non-Zero PED		Probability of Mobile Ownership	
	Conditional MEs	z	MEs	z
Use mobiles to receive calls	-0.15	-1.19	0.00	
Use mobiles for missed calls	-0.03	-1.13	0.00	
Years owning mobile	-0.01	-1.57	0.00	
Not likely to switch providers	-0.09	-3.45	0.00	
Number of SIM cards owned	0.05	1.94	0.00	
Walk time to nearest town	0.00	-2.89	0.00	-1.18
Last top up value	-0.01	-0.69	0.00	
Social benefits	-0.03	-0.53	0.04	1.20
Emergency benefits	0.22	3.22	-0.09	-2.06
Economic benefits	0.03	0.50	0.19	5.33
Close contacts owning phone	0.09	1.91	0.41	12.05
Use m-banking services	-0.05	-0.60	0.00	
Use m-government services	0.22	2.30	0.00	
Use m-health services	-0.15	-1.72	0.00	
Use m-competition services	0.12	2.07	0.00	
Use m-general info services	0.10	1.56	0.00	
Use m- agri/fishing services	-0.28	-1.89	0.00	
Age (square)	0.00	0.14	0.00	-2.63
Ownership of a fixed phone	-0.03	-0.73	-0.19	-6.99
Gender (dummy)	0.02	0.78	-0.25	-13.99
Secondary	0.00	0.01	0.09	4.44
Tertiary education	-0.01	-0.15	0.24	7.60
Log HH Income (USD)	0.04	1.41	0.11	6.34
Bangladesh	0.22	4.98	0.03	1.12
Pakistan	0.21	5.88	-0.14	-6.28
Sri Lanka	0.05	1.06	-0.12	-3.61
Philippines	0.20	5.02	0.07	2.23
Thailand	-0.07	-1.48	0.43	14.62
Access to electricity	0.00	0.22	0.06	1.86
TV in household	0.00	0.21	0.14	6.10
Radio in household	0.00	0.21	0.09	4.41

Table 11. Marginal Effects of Model Variables with Country Interaction Terms (Part 1/3)

Variables	Marginal Effects (Dy/Dx)	z	p
Use mobiles to receive calls	-0.18	-1.45	0.15
Interaction - Bangladesh	0.76	2.43	0.02
Interaction - Pakistan	0.36	1.48	0.14
Interaction - Sri Lanka	-0.24	-0.53	0.60
Interaction - Philippines	-0.15	-0.66	0.51
Interaction - Thailand	-0.25	-0.97	0.33
Use mobiles for missed calls	-0.04	-0.86	0.39
Interaction - Bangladesh	-0.22	-2.38	0.02
Interaction - Pakistan	0.26	3.54	0.00
Interaction - Sri Lanka	0.18	2.04	0.04
Interaction - Philippines	-0.15	-1.47	0.14
Interaction - Thailand	0.01	0.17	0.86
Years owning mobile	-0.01	-1.91	0.06
Not likely to switch providers	-0.11	-2.71	0.01
Interaction - Bangladesh	0.17	1.68	0.09
Interaction - Pakistan	-0.02	-0.30	0.77
Interaction - Sri Lanka	0.09	1.11	0.27
Interaction - Philippines	0.02	0.32	0.75
Interaction - Thailand	-0.10	-1.32	0.19
Number of SIM cards owned	0.01	0.30	0.77
Interaction - Bangladesh	0.06	0.55	0.58
Interaction - Pakistan	-0.04	-0.59	0.56
Interaction - Sri Lanka	0.07	0.63	0.53
Interaction - Philippines	0.12	1.64	0.10
Interaction - Thailand	0.07	0.94	0.35
Walk time to nearest town	0.00	-3.01	0.00
Last top up value	0.00	-0.27	0.79
Interaction - Bangladesh	0.08	1.32	0.19
Interaction - Pakistan	-0.04	-0.90	0.37
Interaction - Sri Lanka	0.02	0.32	0.75
Interaction - Philippines	-0.07	-1.48	0.14
Interaction - Thailand	-0.01	-0.60	0.55
Social benefits	-0.02	-0.32	0.75
Interaction - Bangladesh	-0.13	-0.68	0.49
Interaction - Pakistan	-0.22	-1.65	0.10
Interaction - Sri Lanka	0.26	1.61	0.11
Interaction - Philippines	0.05	0.38	0.71
Interaction - Thailand	0.13	0.89	0.37

Table 11. Marginal Effects of Model Variables with Country Interaction Terms (Part 2/3)

Variables	Marginal Effects (Dy/Dx)	z	p
Emergency benefits	0.22	2.69	0.01
Interaction - Bangladesh	-0.18	-0.82	0.41
Interaction - Pakistan	-0.27	-1.36	0.17
Interaction - Sri Lanka	-0.27	-0.68	0.50
Interaction - Philippines	0.40	2.15	0.03
Interaction - Thailand	-0.09	-0.50	0.62
Economic benefits	0.15	1.79	0.07
Interaction - Bangladesh	-0.41	-2.32	0.02
Interaction - Pakistan	-0.09	-0.70	0.49
Interaction - Sri Lanka	0.14	0.66	0.51
Interaction - Philippines	-0.17	-1.14	0.26
Interaction - Thailand	0.01	0.04	0.97
Close contacts owning phone	0.01	0.08	0.94
Interaction - Bangladesh	-0.08	-0.40	0.69
Interaction - Pakistan	0.36	2.73	0.01
Interaction - Sri Lanka	0.17	0.93	0.35
Interaction - Philippines	0.04	0.28	0.78
Interaction - Thailand	0.15	1.07	0.29
Use m-banking services	-0.15	-0.99	0.32
Interaction - Bangladesh	-0.03	-0.11	0.92
Interaction - Pakistan	0.34	1.42	0.16
Interaction - Sri Lanka	0.16	0.61	0.54
Interaction - Philippines	0.19	0.64	0.52
Interaction - Thailand	0.11	0.54	0.59
Use m-government services	0.11	0.20	0.84
Interaction - Bangladesh	-0.43	-0.42	0.67
Interaction - Pakistan	-0.18	-0.31	0.76
Interaction - Sri Lanka	0.13	0.23	0.82
Interaction - Philippines	0.33	0.59	0.55
Interaction - Thailand	-1.77	-3.34	0.00
Use m-health services	-0.25	-1.64	0.10
Interaction - Bangladesh	-0.51	-1.52	0.13
Interaction - Pakistan	-0.01	-0.04	0.97
Interaction - Sri Lanka	0.15	0.76	0.45
Interaction - Philippines	-0.04	-0.14	0.89
Interaction - Thailand	0.04	0.15	0.88

Table 11. Marginal Effects of Model Variables with Country Interaction Terms (Part 3/3)			
Variables	**Marginal Effects (Dy/Dx)**	**z**	**p**
Use m-competition services	0.24	1.91	0.06
Interaction - Bangladesh	-1.18	-1.66	0.10
Interaction - Pakistan	0.18	0.53	0.60
Interaction - Sri Lanka	-0.46	-2.61	0.01
Interaction - Philippines	0.10	0.62	0.53
Interaction - Thailand	-0.25	-1.42	0.16
Use m-general info services	0.38	1.63	0.10
Interaction - Bangladesh	1.59	3.01	0.00
Interaction - Pakistan	-0.32	-1.13	0.26
Interaction - Sri Lanka	-0.26	-0.95	0.34
Interaction - Philippines	-0.12	-0.36	0.72
Interaction - Thailand	-0.34	-1.36	0.18
Use m- agri/fishing services	-0.34	-1.51	0.13
Age (square)	0.00	0.54	0.59
Ownership of a fixed phone	-0.12	-1.44	0.15
Interaction - Bangladesh	-0.22	-0.89	0.37
Interaction - Pakistan	0.09	0.71	0.48
Interaction - Sri Lanka	0.09	0.83	0.40
Interaction - Philippines	0.27	1.23	0.22
Interaction - Thailand	0.18	1.38	0.17
Gender (dummy)	0.04	0.96	0.34
Secondary	0.00	-0.04	0.97
Tertiary education	-0.03	-0.61	0.54
Log HH Income (USD)	0.04	1.26	0.21

Table 12: Reasons for Unwillingness to Switch Mobile Service Providers (MSP)

Reason for unwillingness to switch providers	Number	% of sample
Hassle of getting a new connection	427	58.57
It is important that I keep my present mobile number	191	26.2
I am happy with the service provided by my current MSP	92	12.62
Due to the financial cost involved in getting a new MSP	19	2.61
Total sample size	729	100

Note: This table pertains to the sample who state that they would categorically 'not switch' or are 'unlikely to switch' service providers even if offered a cheaper package.

Figure 1. Payment Card (used in the survey) - Price Decreases from the Current Price