Bottom of the Pyramid Expenditure Patterns on Mobile Phone Services in Selected Emerging Asian Countries

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Abstract

This paper evaluates the importance of mobile telephone expenditure in consumer budgets of the Bottom of the Pyramid (BOP) in Bangladesh, Pakistan, India, Sri Lanka, Philippines and Thailand. We examine if mobile phone services in the selected countries display characteristics of a luxury good or that of a necessity. Upon evaluating the expenditure patterns as a share of total personal income we conclude the service to be a necessity.

Welfare and poverty issues are then addressed with the estimation of Engel curves, as they show how consumption of various goods and services change with variations in the consumer's income. We estimate Engel curves for expenditure on mobile telephone services for the BOP in the selected countries to show that mobile phones are part of everyday lives among the selected consumer group.

Keywords: Consumer, mobile phone, expenditure, access, poverty, BOP, teleuse.

1. Introduction[1]

A particular group of emerging Asian countries have made good progress in reducing poverty. In Thailand, for instance, the population living below the national poverty line is of 10 percent for 2006. For Bangladesh this indicator fell from 49 percent in 2000 to 40 percent in 2005; Pakistan shows a reduction from 65 percent to 23 percent for the 1991-2005 period; Philippines registers 33 percent for 2006; India reports 28 percent for 2004, and Sri Lanka shows a considerable reduction from 25 percent in 1996 to 15.2 percent in 2007.[2]

Poverty is an issue of major concern for population's proper access to utilities such as electricity, water and transportation. Furthermore, not only are there problems regarding adequate income levels to afford these services, but also about adequate infrastructure to provide them. However, this is not the case for telecommunications, in particular, for mobile telephony. It is a well-known fact that mobile telephony has a great potential for improving living conditions in an aggregate level[3] and at a disaggregated level.[4]

In this sense, it is highly relevant to examine the pattern of expenditure in this service. Particularly, we focus in a group of emerging Asian countries (Bangladesh, Pakistan, India, Sri Lanka, Philippines and Thailand), analyzing the BOP. With such an analysis, it is possible to determine if mobile telephone service, in economic terms, is a luxury service or a necessity.

Such a classification is important because it indicates the change in the demand for a good or service when income varies from low to high. As a consequence, determining if a good or service should be classified as a necessity or a luxury becomes important in considering its treatment for taxation.

The paper is organized as follows. Firstly, we briefly describe the Engel's Law and the Engel curve along with some concepts and applications for services in general and for telecommunications in particular. The empirical analysis is then presented, graphically examining the pattern of mobile telephone service expenditures for the six countries under consideration; Bangladesh, Pakistan, India, Sri Lanka, Philippines and Thailand. This dataset contains valuable information that allows studying differences among a number of socio-demographic variables. To complement the findings of the expenditure patterns graphics the paper then estimates Engel curves and calculates income elasticities as part of the empirical analysis. Concluding remarks close the paper.

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[1] We thank Randy Spence, Ashok Jhunjhunwala, Roxana Barrantes, Rohan Samarajiva and Nirmali Sivapragasam, who provided useful comments. The usual disclaimer applies.
[2] Source: Asian Development Bank.
[3] For example, Waverman et al. (2005) note that in a typical developing country, an increase of 10 mobile telephones per 100 people could increase GDP growth by 0.6 percentage points.
[4] See Jensen (2007), Aker (2008), de Silva et al (2008), Esselaarc et al (2007), Bhavani (2008).

2. Engel's law and curve: Concepts and applications

2.1 Origin of Engel's Analysis

Differences in consumption between wealthy families and poor families have been debated for centuries, but according to Stigler (1954), it was in the 1790s, in England, that a quantitative analysis was first done. Two researchers, David Davies and Frederick Morton Eden, looking at working-class poverty at that time, did compilations of workers' budgets, but did not summarize their findings, as they considered them as historical and non-quantitative data.

After almost seventy years, in 1857, Engel classified 153 Belgian families into three socio-economic groups: (1) families dependent on public assistance; (2) families capable of surviving without that assistance; and (3) well-to-do families. Based on that study, he proposed a law of consumption, the Engel law: "The poorer the family, the greater the share of income devoted to food." He also proposed that the wealthier the country, the lower the share of food expenditure relative to total expenditures. This was the first empirical generalization about budget data.

Subsequently, in 1875, Carrol Wright reconsidered and interpreted Engel and concluded that: (1) the higher the income, the lower the relative percentage of expenditure for subsistence; (2) the percentage of clothing expenditure is approximately the same at all income levels; (3) the percentage of housing, fuel or electricity expenditure is the same, regardless of income level; and (4) as income increases, the percentage of expenditure on various items increases. Of these hypotheses, Wright ultimately accepted the first and fourth. He noted that negative savings could be a proof of poverty, and based on this, recommended the implementation of a minimum wage.

2.2 The Engel curve and income elasticity

Besides the Engel's law, the Engel curve, which compares the amount of expenditure on an item with total household income or expenditure, is an important tool for analyzing welfare.

As Haque (2005) reviews, Prais et al (1955) was a pioneering work on Engel curves. Five different forms of these curves were fitted: linear, semi-log, hyperbolic, double-log and log-inverse, and they also estimated total expenditure elasticities for many food and non-food items considering these functional forms.

As the Engel curve and the income elasticity concepts evolve from the theory of demand analysis, a brief review on this is necessary.

One of the main issues in demand analysis is to find out the change in demand for a particular good due to a change in specific explanatory variables. In general, the per capita expenditure on any good can be expressed as a function of a series of variables, including per capita income, prices, time, tastes, preferences, etc.

According to Haque (2005), for choosing a demand model for particular goods or services, some previously used functional form should be taken as a basis for estimation. It is also advised to estimate only a few parameters for each consumption item, to focus on the relationship between expenditure on a specific good and income, considering prices as fixed. This relationship is what defines the Engel curve,[5] and can be expressed as $Y_i = f(X)$, where Y_i represents the expenditure on good i and X is the consumer's total income (expenditure). The estimation of such a curve is based on the assumption that, on average, the differences in consumption patterns between high and low income households can be attributed to their differences in current income (total expenditure).

The relevance of accurate estimates of income elasticities is acknowledged if we consider their usefulness for classifying goods in economic terms. If the income elasticity of a good lies between 0 and 1, it will be considered as income inelastic, i.e., a necessary good, which implies that the demand for it rises as income increases, but a smaller percentage of income is spent on this good. On the other hand, a good is regarded as a luxury if its income elasticity is greater than 1 (income elastic), meaning that the demand rises as income increases, and a larger percentage of income is spent on this good. As Lewbel (2006) mentions, goods with income elasticities below zero, between zero and one, and above one are called inferior goods, necessities, and luxuries respectively.[6]

2.3 Engel curve Applications

In general, the Engel curve evaluates the share of expenditure dedicated to a good or service, mainly food, and its relationship to total household income or expenditure. Using quadratic Engel curves, Girma et al (2002) identify the proportion of urban households in Ethiopia in which food has the characteristics of a luxury item. The main objective of this study is to estimate the total consumer expenditure level beyond which food is no longer a luxury, taking the measurement error into account. Another example is found for households in rural areas of China; Gong et al (2000) find economies of scale in families' consumer expenditure patterns, as well as some differences in consumer patterns that are related to sex differences in children.

There are also several applications for health care. For instance, Freedman (2003) analyzes the case of the US for the years 1966-1998 measured at the state-level, finding income elasticities ranging from 0.817 to 0.844, well below unity, which confirms that health care is a necessity. African countries are also studied in this respect by Okunade (2005). How health care expenditure in Africa responds to changes in the Gross Domestic Product and other variables of interest is considered in his analysis. A comparison between 1984 and 1995 estimations is also made, finding that for the former the GDP elasticity of health expenditure

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[5] Lewbel (2006)'s definition is: An Engel curve is the function describing how a consumer's expenditures on some good or service relates to the consumer's total resources holding prices fixed.
[6] Both necessities and luxury goods are normal goods because their elasticities are above zero.

was roughly unity, while in 1995, a GDP elasticity of 0.65 indicates that this "good" can be considered as a technical necessity.

Evidence for OECD countries on the status of health care is found in Sen (2005). It empirically evaluates the impact per capita income has on trends in health expenditure in 15 OECD countries between 1990 and 1998. Income elasticities in a range from 0.21 to 0.51 show that health care is again a necessary good.

Social protection, defined as public spending on old age cash benefits, unemployment benefits and health expenditure, has also been studied in a similar way for some OECD countries. In this sense, Auteri et al (2004) find that social protection does not seem to have the characteristics of a luxury good, given that it shows an elasticity of 0.837, which is smaller than one.

Hansen et al (2006) have estimated income elasticities for housing services with an alternative methodology, using the American Housing Survey. Their results indicate that the demand for this kind of services is income inelastic at all income deciles as well as for an overall elasticity, both for owners and renters. For the former, demand was found to be more income elastic than renter demand.

2.4 Engel curves for telecommunications expenditures

There is not much literature regarding the analysis of telecommunications expenditure relative to total household expenditure, specifically using Engel curves.[7] Ureta (2005) evaluates households' telecommunications expenditure in four countries (Albania, Mexico, Nepal and South Africa), considering the share of family income dedicated to these services and monthly expenditure deciles. In the countries of the sample, Engel's law applies to food: higher expenditure indicates lower relative importance of this item in the family budget (food is a necessity). In the case of telecommunications, on the other hand, the opposite pattern is found: higher expenditure means greater relative importance of communications, so it falls in the category of a luxury service.

Income elasticities for demand for internet services have been calculated by Goel et al (2006), with a simple model and cross-country OECD data for the year 2000. The main conclusion is that internet services may not constitute a necessity, as the income elasticity appears to be unity or larger. Another important finding is that the income elasticity seems to be smaller for users than for subscribers, which indicates that policies intended to encourage internet usage through subscriptions might not seem equity enhancing.

There is also some evidence for two South American countries. For Colombia, for instance, Ramírez (2005) compares households' expenditures in different goods and services for a six-year period. It is a statistical analysis that uses Engel curves, and its objective is to look at the expenditures' changes in magnitude, composition and distribution. Because they are

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[7] In a general level, Foster et al (2004) and Foster (2004) relate expenditure in public services to total household expenditure.

found to have an income elasticity above one for the whole period (1.14 to 1.26), transportation and communications are considered luxury items. In addition, for the specific case of mobile telephony, Gamboa (2007) classifies it as a luxury service, due to an income elasticity of 1.30.

Combining the tools employed by Ureta (2005) and Gamboa (2007), for Peru, Agüero (2008) finds that telecommunications services (mobile and fixed telephony and internet) also show the characteristics of a luxury good, with an income elasticity of 1.97 for 2004.

Mobile telephony expenditures have also been evaluated for a set of 17 African countries[8] by Chabossou et al (2008). In the context of the analysis of mobile telephony access and usage, mobile expenditure is found to be inelastic with respect to income, i.e. the proportion of mobile expenditure to individual income increases less than one percent for each one percent increase in income. As the paper highlights, this indicates that people with higher income spend a smaller share of their income on mobile telephony compared to those with less income.

Finally, Milne (2006) summarizes some empirical regularities in telecommunications expenditure patterns. Among them it is mentioned that in industrialized countries, communications have the characteristics of a necessity (income elasticity less than 1), while on the other hand, communications in developing countries are considered as luxury goods. Furthermore, it is stated that with rapid industry development, it is expected that developing countries will follow the trend of industrialized countries, and that there is anecdotal evidence of middle-income people in the former struggling to pay for using their mobile phones, which have become "an essential luxury" or "an expensive necessity".

The objective of the present study is to examine mobile phone service expenditure patterns, as well as to classify this service in economic terms, focusing in the BOP of six emerging countries of Asia: Bangladesh, Pakistan, India, Sri Lanka, Philippines and Thailand. Expenditure patterns are graphically analyzed at an aggregated and a disaggregated level. Subsequently, to support and complement our findings, we estimate Engel curves and calculate income elasticities for each country.

3. Empirical analysis

3.1 Teleuse at the bottom of the pyramid dataset

This paper is based on data from a multi-country study of ICT use at the "bottom of the pyramid" (BOP) in emerging Asia, conducted by LIRNEasia. The study took place between 2008 and 2009 among those who had used a telephone (not necessarily owned) in the previous three months. The study was carried out in Bangladesh, India, Pakistan, Philippines, Sri Lanka and Thailand.

For the purpose of the study, BOP was defined as the two lowest SEC groups, D and E, with the exception of Philippines, where only SEC group E was considered. Telecom users

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[8] Benin, Botswana, Burkina Faso, Cameroon, Côte d'Ivoire, Ethiopia, Ghana, Kenya, Mozambique, Namibia, Nigeria, Rwanda, Senegal, South Africa, Tanzania, Uganda, Zambia.

between the ages of 15 and 60, in rural and urban locations were studied. Quantitative as well as qualitative methods were used.

The quantitative component constituted 9,540 face-to-face interviews using a structured questionnaire. Both households and respondents were randomly selected. The sample was designed to represent the BOP in each country so that the findings could be projected back to this segment.

With the exception of India (where the majority of states were covered) all regions of each country were covered. Multi-stage stratified random sampling was undertaken, whereby primary sampling units (regions) were randomly selected. Within each selected region urban and rural centers were randomly selected. Within selected urban and rural centers, starting points were randomly selected with a fixed number of interviews conducted around each starting point. The number of starting points selected from each centre was determined in proportion to the population of the selected centre.

One respondent was selected per household; in households with more than one eligible respondent, the Kish grid (random number chart) was used to randomly select the respondent. Within each country, data was re-weighted to reflect the correct SEC D and E population mix in urban and rural areas.

An overview of the sample size and composition is given in Table 1.

Table 1: Sample size and composition

Countries	All BOP	Urban BOP	Rural BOP	Margin of error @ 95% CL (%)
Bangladesh	2,050	1,719	331	2.8%
Pakistan[9]	1,814	899	915	2.3%
India	3,152	773	2,379	1.7%
Sri Lanka[10]	924	320	604	3.3%
Philippines	800	468	332	3.1%
Thailand[11]	800	400	400	3.5%
Total	**9,540**	4,579	4,961	

3.2 Importance of telecommunications expenditure as a share of total personal income

Firstly, the importance of mobile telephone service expenditure (USD) relative to total personal income (USD) is analyzed for each of the countries. Therefore, the variables of interest are the monthly personal expenditure in mobile telephone service, which is available for prepaid owners,[12] and total monthly personal income.

It has to be noted that, as an individual from each household was randomly chosen to be interviewed, there are some cases in which this person did not have any income source. This issue was solved considering the per capita income level of the relevant household.

[9] Excludes tribal regions.
[10] Excludes the North and East regions.
[11] Sample excludes Bangkok because the SEC D and E population in Bangkok is small.
[12] Monthly expenditure on mobile telephone service was constructed considering the value of the last top-up and the number of days the individual considers it will last.

Before introducing the analysis, it is necessary to give some details on the variables' main descriptive statistics for each country. These are shown in table 2, considering income quintiles.

Table 2: Descriptive statistics of monthly personal income and mobile telephony expenditure by country (USD)

Quintiles	*Personal income*				*Mobile expenditure*			
	Mean	**SD**	**Min**	**Max**	**Mean**	**SD**	**Min**	**Max**
	Bangladesh							
1	16.5	5.8	1.4	25.2	4.1	2.7	0.0	12.9
2	36.1	6.4	25.9	43.2	4.0	2.6	0.1	17.3
3	56.2	5.0	46.0	64.7	4.4	2.7	0.0	12.9
4	83.3	11.0	71.9	100.7	5.3	3.0	0.1	17.3
5	170.5	130.4	107.9	1007.2	5.7	3.2	0.2	18.5
	Pakistan							
1	13.2	4.7	1.6	21.0	4.9	4.2	0.1	19.7
2	32.5	6.2	21.9	39.4	5.2	4.7	0.1	19.7
3	57.7	7.5	41.0	65.6	5.6	5.2	0.1	19.7
4	89.5	10.9	72.2	105.0	6.1	5.1	0.2	19.7
5	196.9	177.3	105.0	1181.1	7.9	6.4	0.1	19.7
	India							
1	17.6	5.1	3.8	25.9	3.9	2.5	0.1	16.7
2	38.8	6.5	26.7	44.4	4.3	3.5	0.1	20.0
3	63.5	5.3	46.7	66.7	5.3	3.8	0.1	19.0
4	85.5	5.2	71.1	88.9	4.9	3.7	0.1	18.8
5	135.1	42.7	93.3	333.3	5.6	4.0	0.2	18.5
	Sri Lanka							
1	21.3	7.8	5.5	34.4	5.1	3.4	0.7	13.8
2	48.3	8.3	36.7	61.2	5.4	3.4	0.3	15.3
3	82.3	10.1	63.3	91.7	5.3	3.6	0.1	13.8
4	127.7	13.6	95.0	137.6	5.8	4.1	0.3	13.8
5	199.1	44.1	145.0	367.0	5.8	4.3	0.3	13.8
	Philippines							
1	18.9	5.7	6.5	27.2	9.5	4.4	2.2	19.6
2	37.4	5.5	28.3	43.5	10.5	5.2	2.4	19.6
3	58.9	6.1	47.8	65.2	10.8	5.0	2.1	19.6
4	93.5	12.9	67.0	109.6	10.8	5.0	1.3	19.6
5	165.0	52.8	115.2	434.8	9.6	4.8	1.9	19.6
	Thailand							
1	34.7	9.8	8.7	48.3	7.7	5.0	0.4	17.4
2	73.5	13.3	49.3	87.0	8.0	4.8	0.4	17.4
3	128.0	17.2	95.0	144.9	9.2	4.8	0.9	18.6
4	173.5	8.1	145.0	188.4	9.1	4.5	0.2	17.4
5	264.9	53.8	195.0	347.8	9.5	4.3	1.4	17.4

The highest personal income levels are found for Thailand, while the lowest correspond to Pakistan and India. Mobile telephone service expenditure figures show that the BOP in Philippines spends the highest on mobile phone services while India, in contrast, spends the lowest.

The differences among the poorest and richest groups should also be noticed. For instance, regarding personal income, the biggest difference can be found in Pakistan, where the fifth quintile has an average income that is more than 15 times the average income of the first

quintile. On the other hand, in Thailand, this difference is the smallest: the average income of the fifth quintile is 8 times the average income of the first one.

The graphical analysis follows below. The horizontal axis of the graphs shows quintiles of monthly personal income, while the vertical shows the percentage of expenditure on mobile telephone service, relative to monthly personal income. As the graphs show, there is evidence to support the Engel's law in the six countries under analysis: the importance of mobile telephone service expenditure decreases as personal income increases, which indicates that mobile telephone services constitute a necessity for prepaid owners in the BOP of our set of Asian countries.

Graph 1: Share of mobile telephony expenditure relative to total personal income – by country

Bangladesh
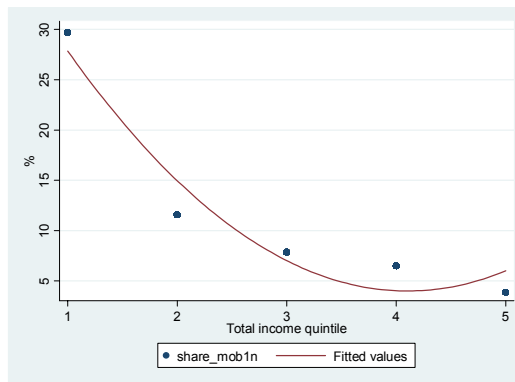
Pakistan
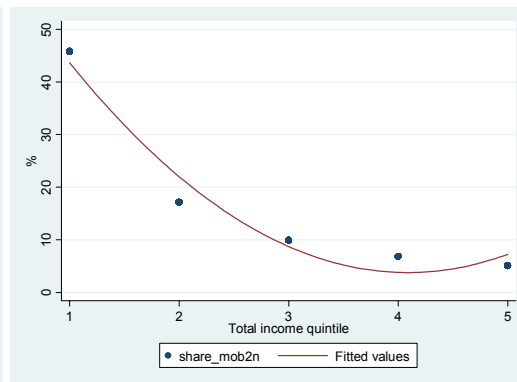
India
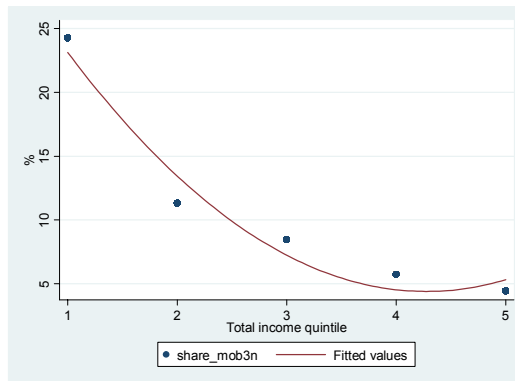
Sri Lanka
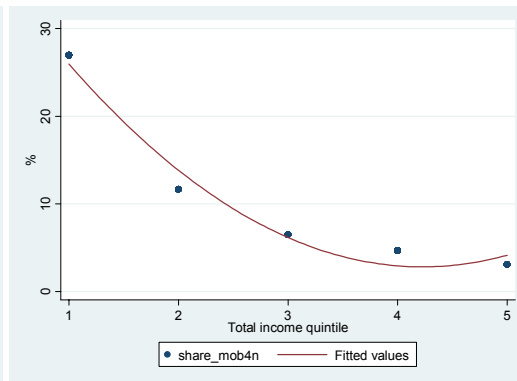
Philippines
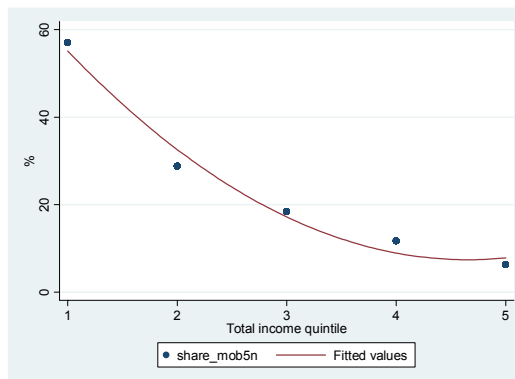
Thailand
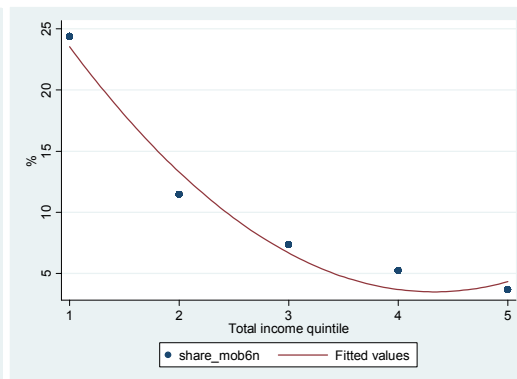
One of the most significant aspects of this study is the possibility of examining the different poverty levels within the BOP, which are reflected in the income quintiles. The poorest quintile of each country's BOP is found to spend more than 20 per cent of its income on mobile telephone services: in India and Thailand the first quintiles spend 24 per cent each, while in Philippines the corresponding figure is of 57 per cent, which is the highest for this income

category among countries. On the other hand, the groups with higher incomes (fifth quintile), show an expenditure on mobile telephony in a range of 3 per cent in Sri Lanka to 6 per cent in Philippines. The figures corresponding to the graphics are summarized in table 3.

Table 3: Percentage of expenditure in mobile telephone services in selected Asian countries – income quintiles (%)

Quintile	Bangladesh	Pakistan	India	Sri Lanka	Philippines	Thailand
1	29.7	45.8	24.3	27.0	57.0	24.4
2	11.5	17.2	11.3	11.7	28.8	11.4
3	7.8	9.9	8.4	6.5	18.4	7.3
4	6.5	6.8	5.7	4.7	11.7	5.2
5	3.8	5.1	4.4	3.1	6.3	3.7

However, we must mention that some of these figures, particularly the ones for Philippines[13], reflect the fact that there are respondents who do not have any income source, and whose income levels were imputed considering the per capita income level of the relevant household. To address this issue, the same analysis was performed for only those respondents whose income levels were not imputed. The expenditure patterns, which are the focus of the analysis, remain the same for all of the countries, in other words, mobile telephone service for this sub-set of respondents is again a necessary service.[14]

A disaggregated analysis has also been performed; this is possible due to the valuable information that is available in the T@BOP dataset (graphs on the Annex 2). Much of the attention will be given to the lowest income groups (first quintile) and the highest income groups (fifth quintile).

Upon rural/urban disaggregation, in Bangladesh, Pakistan and Philippines, we find that the poorest groups spend a higher percentage of their incomes in mobile telephony in rural than in urban areas. In Thailand, India and Sri Lanka, this figure is almost the same in both areas. For the fifth quintiles, the richest ones, the difference among both areas is negligible, and remains below 5 percent.

Gender was also considered. In Thailand, Bangladesh and Pakistan, in the poorest group, males spend a greater percentage than females. The opposite pattern is found for Sri Lanka, India and Philippines. As in the previous disaggregation, no major difference is found among males and females in the highest income groups.

The definition of BOP considers SEC groups D and E, and they were also independently evaluated. Surprisingly, in Pakistan, India, Sri Lanka and Thailand, the first quintiles spend a higher percentage in mobile telephony in SEC group E. The largest

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[13] For Philippines, almost 40% of the observations for personal income were imputed. In addition, the survey considered only SEC group E in this country.
[14] The resulting figure for Philippines, instead of 57%, is of 32% if we consider respondents whose incomes were not imputed (respondents with an income source). For a comparison of the figures, see Annex 1.

differences can be found for the Sri Lankan and Thai cases; in the former, 23 per cent is spent in SEC group D while 32 per cent is spent in SEC group E, in the latter, SEC group D spends 21 per cent and 29 per cent is spent in SEC group E.

The analysis considered two age categories as well, less than 35 years old and more than 35 years old. It is expected that younger owners will spend a greater share of their income on mobile telephony, and this was found for Bangladesh, Pakistan, India and Thailand in the first quintiles. In Philippines and Sri Lanka, people older than 35 spend more, but the difference is not considerable.

The last comparison was made among public phone users and non-users. For the poorest groups, we notice that non-users of public phones spend more in mobile telephony than users in Bangladesh, Pakistan and Sri Lanka. In India and Thailand, there is almost no difference, while in Philippines public phone users spend more than non-users.

3.3 Estimation of Engel curves and income elasticities

As mentioned above, the Engel curve is a useful tool for welfare-related analysis, as it shows how consumption of different goods and services changes with variations in the consumer's income. This provides an idea of income elasticities, or consumer responses to changes in income. For more in-depth analysis of mobile telephony expenditure in Bangladesh, Pakistan, India, Sri Lanka, Philippines and Thailand, it is necessary to estimate Engel curves in order to calculate income elasticities and complement our previous findings.

There are different specifications for Engel curves, and the selection depends on the criteria each researcher prioritizes.[15] For example, the best function can be chosen from many alternatives considering statistical criteria; also, economic criterion may be considered for the selection.

Regarding the properties that should be satisfied by Engel curves, Haque (2005) points out the following:

i.   The possibility for threshold and saturation levels.

ii.   The adding up criterion, i.e. the sum of all expenditures is equal to total expenditure at all levels.

iii.   The best representation of the data on statistical grounds.

At the same time, Haque (2005) mentions that none of the well-known Engel functions satisfy all of these properties simultaneously, and that the researcher makes a decision about the functional form for Engel curve analysis based on his or her own judgments.

As for mobile telephony and for telecommunications in general a particular functional form has already been estimated by Ramirez (2005), Gamboa (2007) and Agüero (2008), we consider the same specification for mobile phone owners for each country:

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[15] Prais (1954) prioritizes the possibility for threshold and saturation levels.

$$s = \alpha + \beta \ln Y + \gamma (\ln Y)^2 \tag{1}$$

where $s = M/Y$. M represents mobile phone service expenditure and Y is monthly personal income. Estimations are run at the individual level.

It must be noted that the logarithm expression intends to correct for heteroskedasticity, which is a common issue in income variables. Also, the squared logarithm expression tries to show that in this case we have a non-linear effect. Therefore, we consider that this functional form gives a good representation of the data on statistical grounds.

Details on the estimations for each country are shown in table 4.

Table 4: Estimation results for the countries under analysis

Country	Variable	Coefficient	Std. Error	Nº of obs.
Bangladesh	Ln Y	-21.4998	3.9493	
	(Ln Y)^2	1.5426	0.4912	797
Pakistan	Ln Y	-34.6939	5.0408	
	(Ln Y)^2	2.7833	0.6162	510
India	Ln Y	-18.7184	2.2464	
	(Ln Y)^2	1.3177	0.2853	1207
Sri Lanka	Ln Y	-21.7034	3.4680	
	(Ln Y)^2	1.5473	0.4128	480
Philippines	Ln Y	-48.9240	6.1688	
	(Ln Y)^2	3.5566	0.7419	457
Thailand	Ln Y	-23.1197	3.6403	
	(Ln Y)^2	1.5582	0.3924	603

Note: Parameters are significant at 0.01 level.

For Colombia, Gamboa (2007) estimated this functional form for mobile telephony and found that this service has the characteristics of a luxury good, as the income elasticity is above one; for telecommunications in general, Ramirez (2005) also employs this specification, obtaining similar findings. Agüero (2008) calculates income elasticities for Peru, for fixed and mobile telephony and internet with the same function. Once again, these services show the characteristics of a luxury good.

With the values resulting from the estimation of the curve described above, income elasticities at country level are calculated as follows:

$$\varepsilon = 1 + \beta/s + 2\gamma \ln Y/s \tag{2}$$

The elasticities for each country are summarized in table 5:

Table 5: Income elasticities for the countries under analysis

Countries	Elasticities
Bangladesh	0.2262
Pakistan	0.2298
India	0.2640
Sri Lanka	0.2075
Philippines	0.1782
Thailand	0.1965

It is clear that mobile phone service, for the BOP sectors of our group of countries, exhibits the characteristics of a necessary service in economic terms, as we find income elasticities in a range of 0.1782 for Philippines to 0.2640 for India. This means that the higher the income, the lower relative importance of mobile telephony in the individual's budget, in other words, mobile telephony expenditure is not very sensitive to changes in disposable income (mobile expenditure is inelastic with respect to income)[16]. These findings, for India in particular, contrast with Moonesinghe's et al (2006) evidence, which suggest that mobile phones are considered as a luxury item, in 2005. Despite the fact that Moonesinghe's methodology and the one applied in this paper differ and comparisons cannot be directly made, we can affirm that this change of status of mobile telephony has undoubtedly occurred in India, due to market conditions improvements (price reductions and new tariff plans).

It has been noted that both the graphic analysis and the income elasticities estimation show the same finding, i.e. that mobile phone service constitutes a necessity, a fact which encourages further development of this service among low-income groups in the selected emerging Asian region. In addition, this pattern of expenditure shows that there is potential in this market for the possible introduction of more services through mobile devices.

We should notice that these results contribute to the literature by adding evidence regarding mobile phone service use of the BOP in the selected countries. Particularly, for the poor, it has proven to efficiently work as an information enabler, to help enhance productivity, to overcome geographic limitations and to maintain and support social relationships or networks.

4. Conclusion

Considering expenditure patterns and personal income, as well as income elasticities, mobile telephone service has been found to have the characteristics of a necessity in the BOP of Bangladesh, Pakistan, India, Sri Lanka, Philippines and Thailand. According to the economic classification of goods, this means that the wealthier the consumer, the lesser the importance of mobile phone services in the consumer's budget.

As of October 2009, the rate of taxation charged in these countries range from 7% in Thailand to 29% in Pakistan. From an economic point of view, luxury goods are to be taxed;

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[16] Elasticities were also estimated for respondents whose incomes were not imputed (respondents with an income source). The same pattern is found. See Annex 1.

hence, having found that mobile phone service is a necessity, it is concluded that the relevant authorities should try to avoid charging more taxes to this service. Given that mobile phones are part of everyday lives and that they represent a need among other needs in modern societies, policies that foster and not hamper investment and industry growth should be designed and implemented.

In previous studies for Latin America, where telecommunications and mobile phone services were found to have the characteristics of a luxury good, however, the conclusion has not been that these services should be taxed. On the contrary, it has been stressed that these results reflect specific market conditions; specially competition and technology along with consumers' income levels. It must be highlighted that in the set of selected emerging Asian countries under analysis, these conditions are quite different, and they do have an impact in the findings that are obtained in this paper.

Particularly, competition has been the main driver that led to the mobile sector growth in our set of countries. As de Silva (2007) mentions, in the Indian case effective competition has been achieved and has been driven by market entry and falling tariffs. For Pakistan, the competition that new entrants offered brought tariffs down which made the service more affordable; along with this, the consistent policy of the Pakistani authorities to sustain competition among operators also played an important role. In Sri Lanka, the mobile sector growth has been driven by competition enabled by wireless technology and disruptive competition. For Thailand, once again, the main factor that enhanced the sector's growth was a fierce competition, leading to price wars. For Philippines, the competition process was basically on value added services, which led to a considerable expansion of the sector.

The different market conditions among Latin American and Asian countries is also acknowledged by Nokia (2009), considering the Total Cost of Ownership (TCO), defined as how much of a consumer's income is required to own and use a phone. An important finding is that a TCO of 5 USD or less per month would be enough for the majority of the world's lower-income consumers to join the mobile community. Clearly, all of the selected Asian countries, except for Philippines (TCO of 8 USD), have a monthly TCO below the threshold of 5 USD. In contrast, countries like Peru and Colombia have TCOs of 21 USD and 11 USD respectively. These results reflect, according to Nokia (2009), the differences in regulatory environments, operator strategies and taxes policies.

Finally, a limitation of the study is the lack of accurate income and expenditure data, which made it necessary to use imputation procedures. As a consequence, it is stressed that more efforts should be made to accurately measure income levels as well as telecommunications expenditures, in order to get better and more precise figures regarding the importance of these services in consumers' budgets.

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Annex 1: Comparison of figures - imputed incomes (all the individuals) and non-imputed incomes (only individuals with an income source)

1.1 Expenditure share

Q	Bangladesh		Pakistan		India		Sri Lanka		Philippines		Thailand	
	All the individuals	Only individuals with income source	All the individuals	Only individuals with income source	All the individuals	Only individuals with income source	All the individuals	Only individuals with income source	All the individuals	Only individuals with income source	All the individuals	Only individuals with income source
1	29.7	21.9	45.8	19.9	24.3	14.2	27.0	15.0	57.0	32.1	24.4	13.7
2	11.5	7.8	17.2	10.1	11.3	8.4	11.7	6.4	28.8	15.2	11.4	7.1
3	7.8	6.7	9.9	7.2	8.4	5.7	6.5	4.4	18.4	11.0	7.3	5.7
4	6.5	4.8	6.8	7.2	5.7	-	4.7	3.2	11.7	7.2	5.2	5.0
5	3.8	3.7	5.1	4.7	4.4	4.3	3.1	2.9	6.3	5.2	3.7	3.4

1.2 Income elasticities

Countries	All the individuals	Only individuals with income source
Bangladesh	0.2262	0.2416
Pakistan	0.2298	0.3879
India	0.2640	0.3076
Sri Lanka	0.2075	0.0833*
Philippines	0.1782	0.0539*
Thailand	0.1965	0.1989

* These results are included only as a reference, but should not be considered, as the number of observations for income elasticities estimations was too small and the coefficients were not significant.

Annex 2: Disaggregated analysis
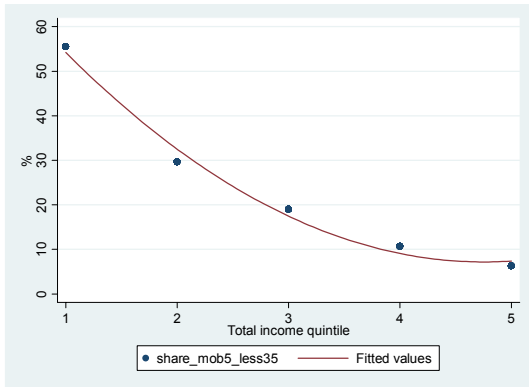
1. *Rural – urban*

<u>Bangladesh</u>
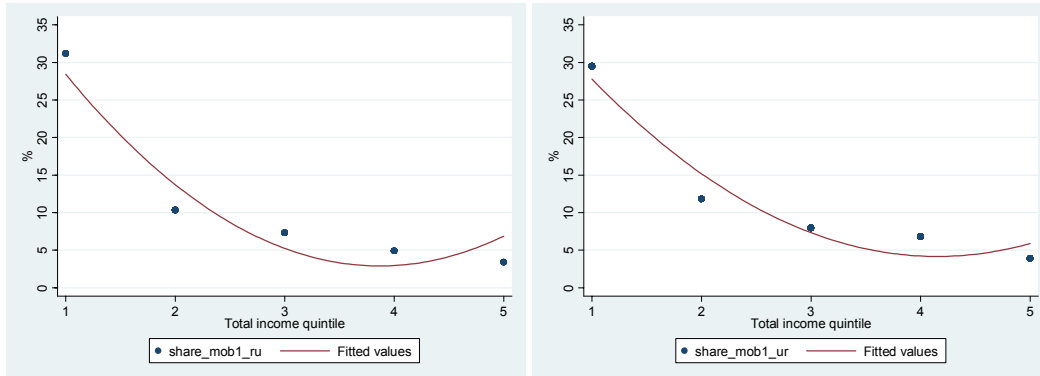
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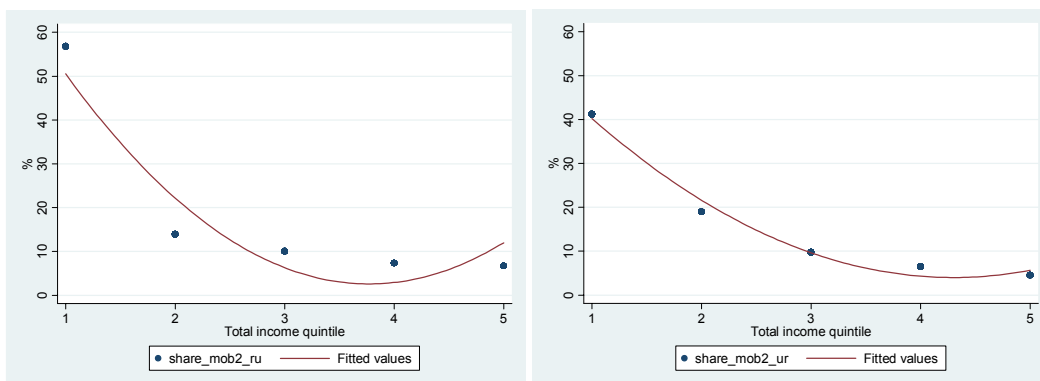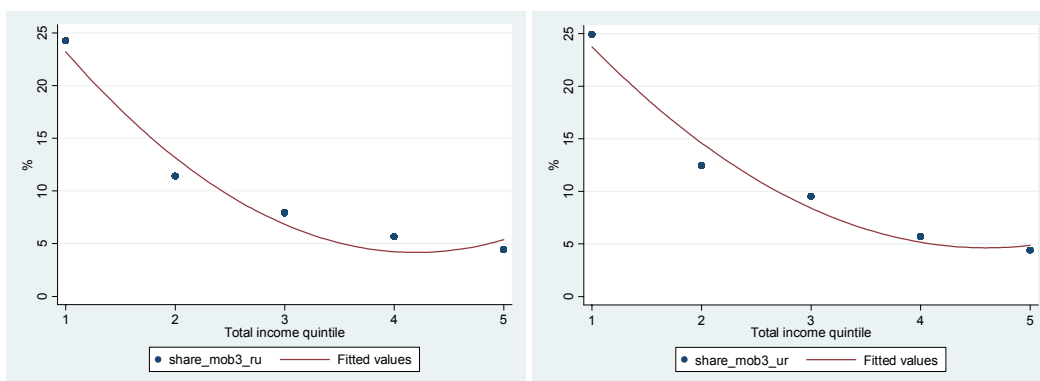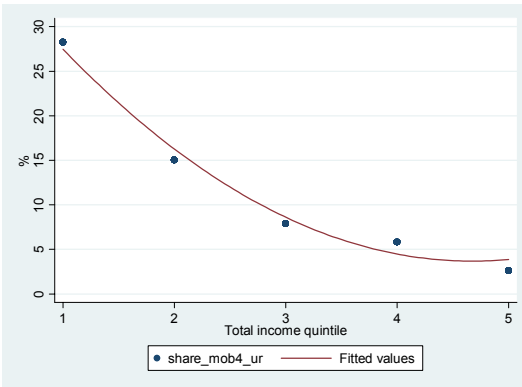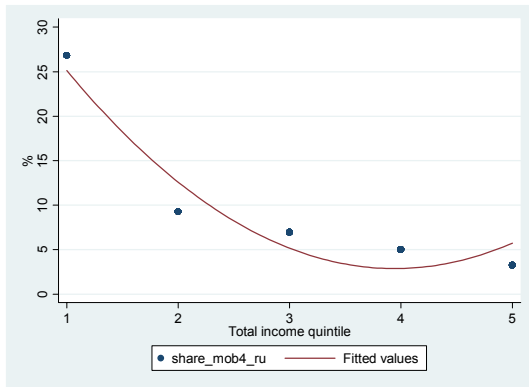
<u>India</u>

Sri Lanka
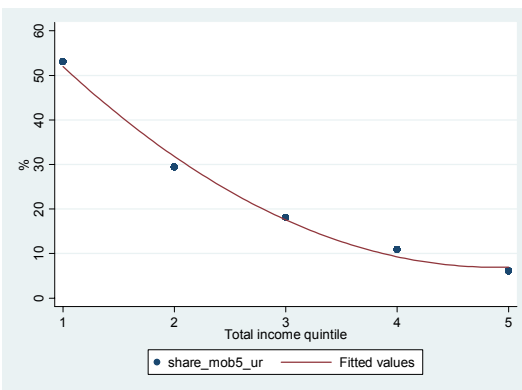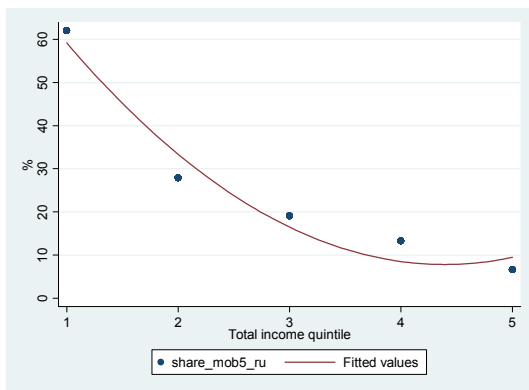
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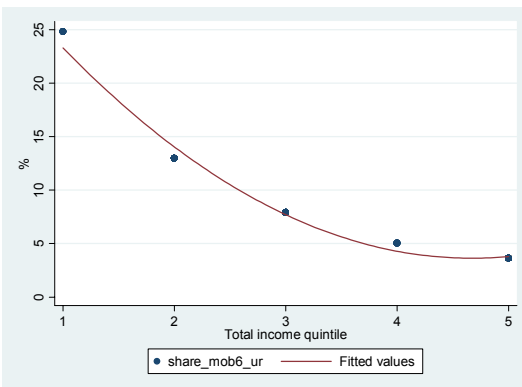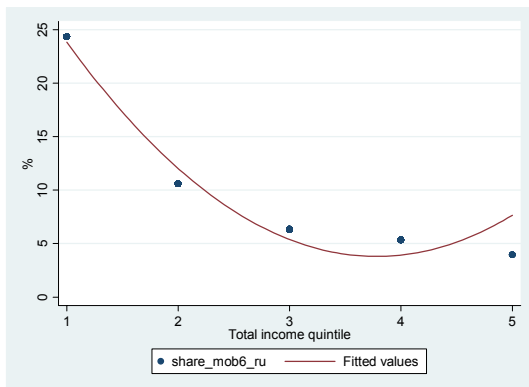
Thailand

2. Female – male

Bangladesh
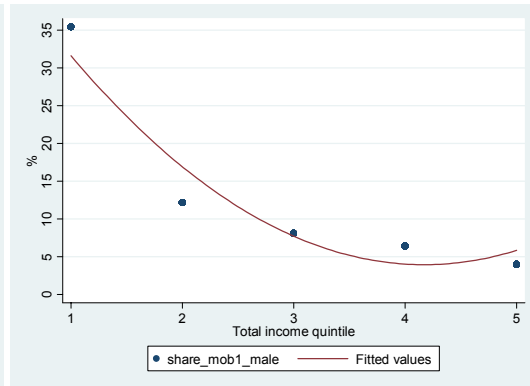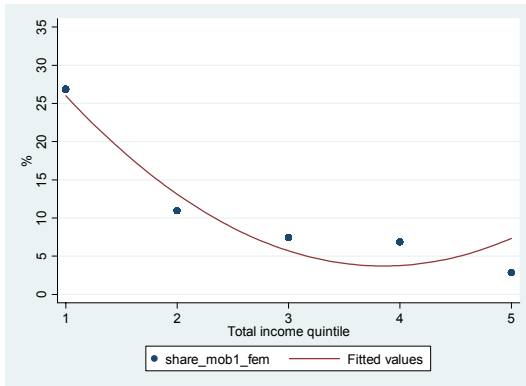
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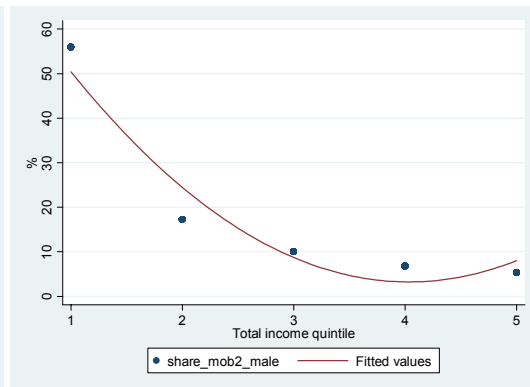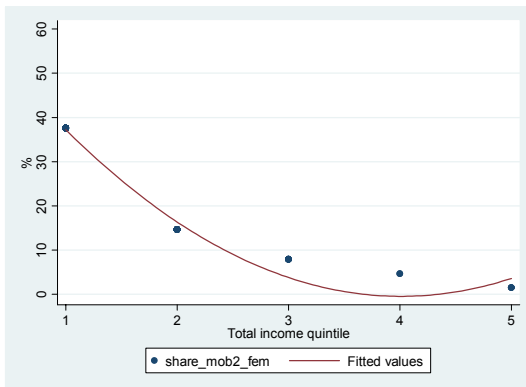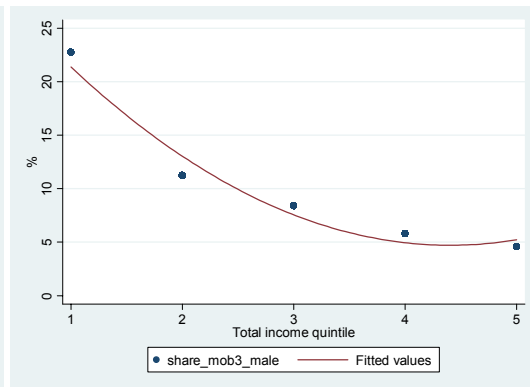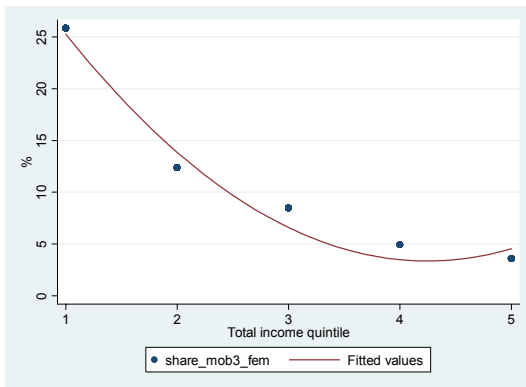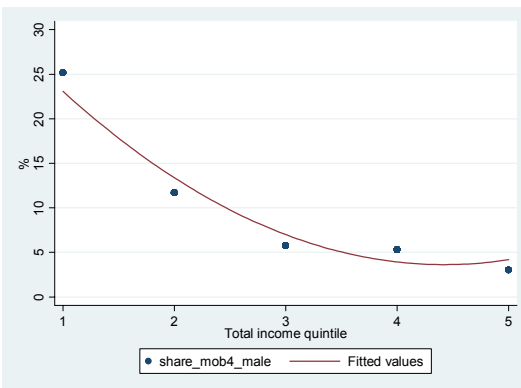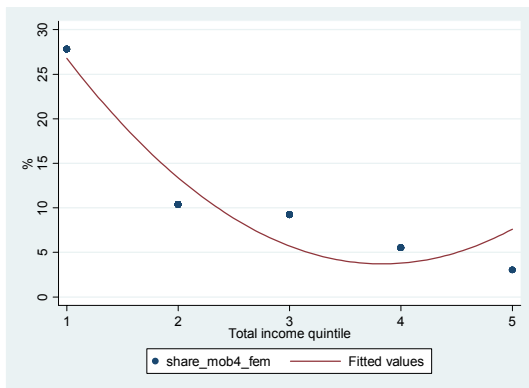
India

Sri Lanka
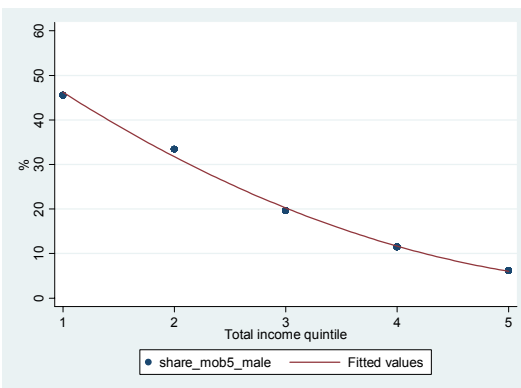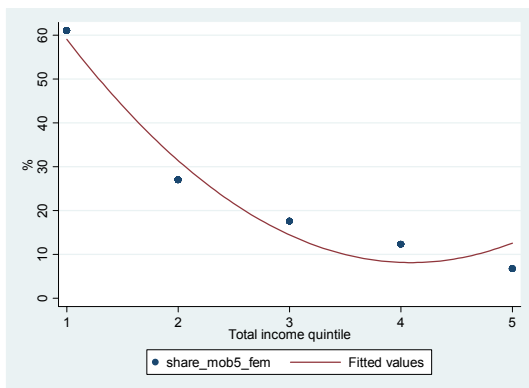
Philippines
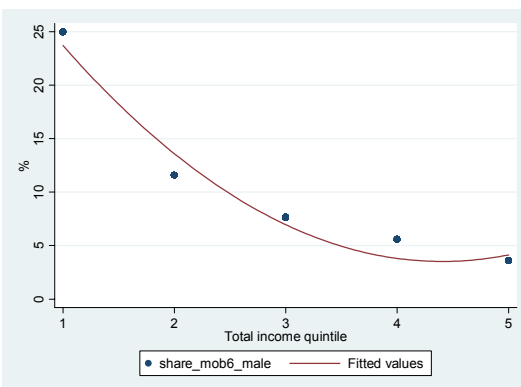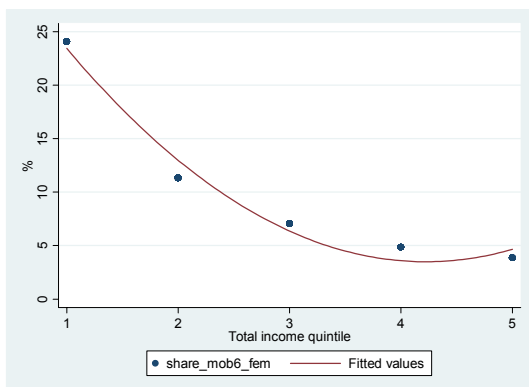
Thailand

3. SECs D and E

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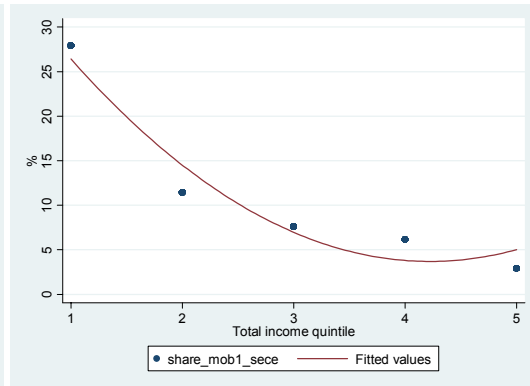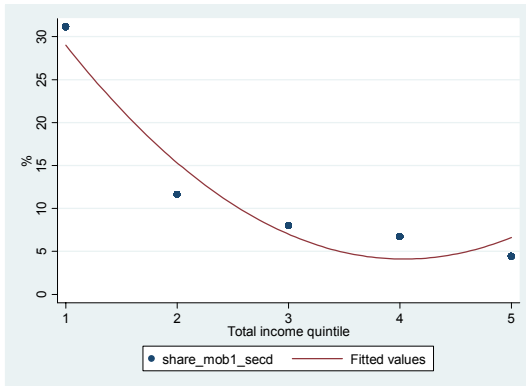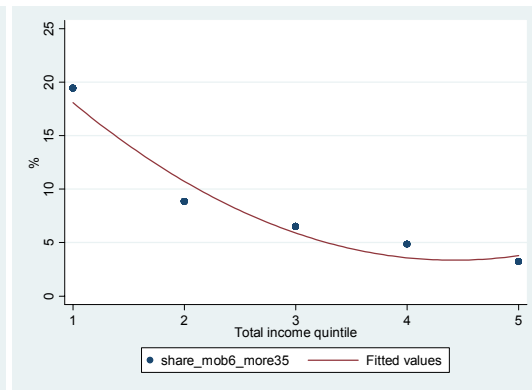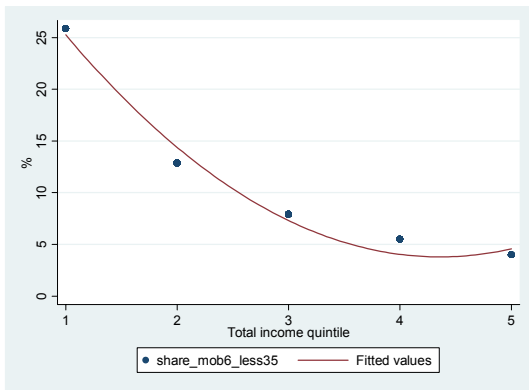

Pakistan
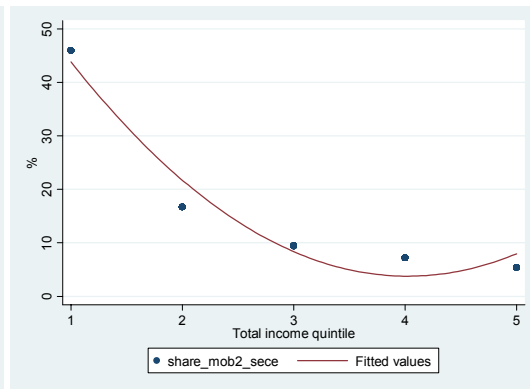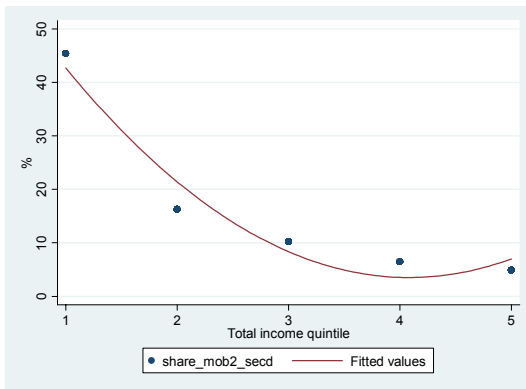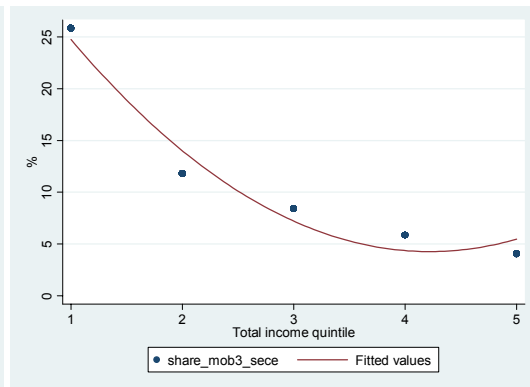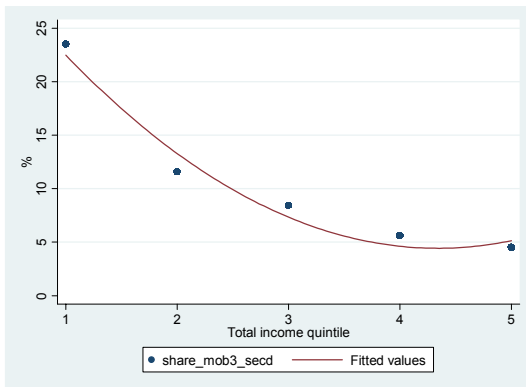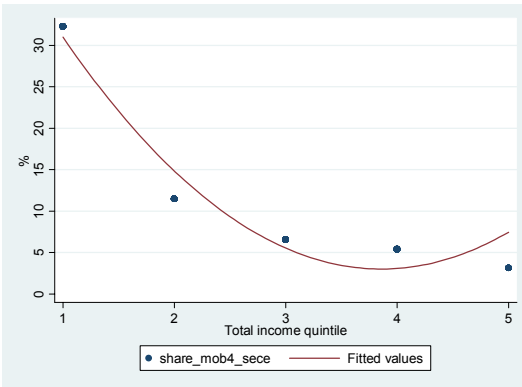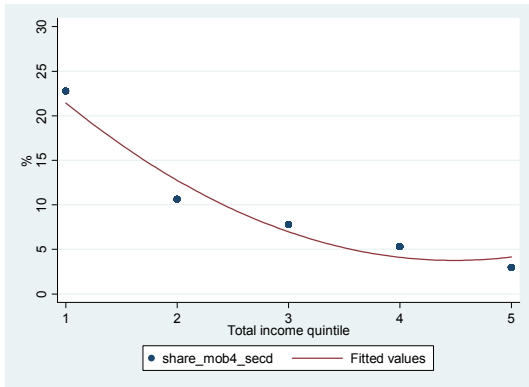
India

Sri Lanka

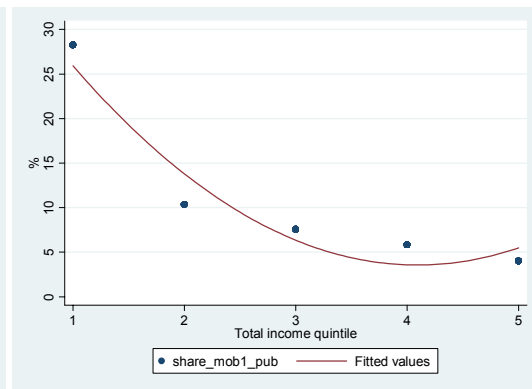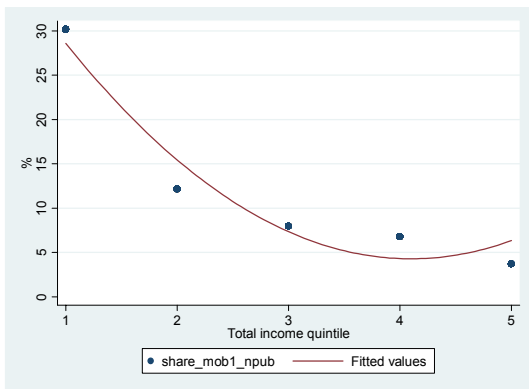Thailand
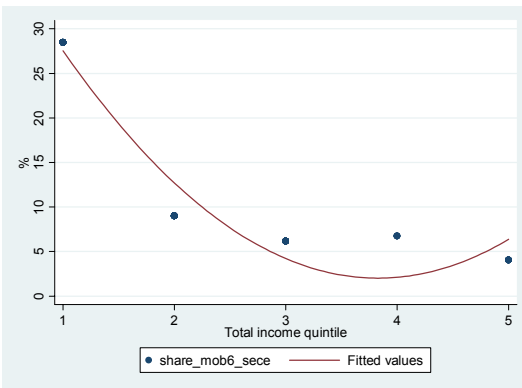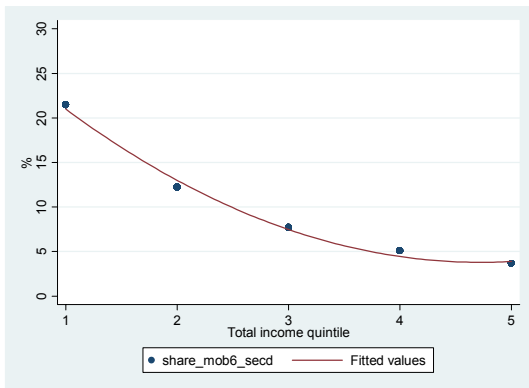
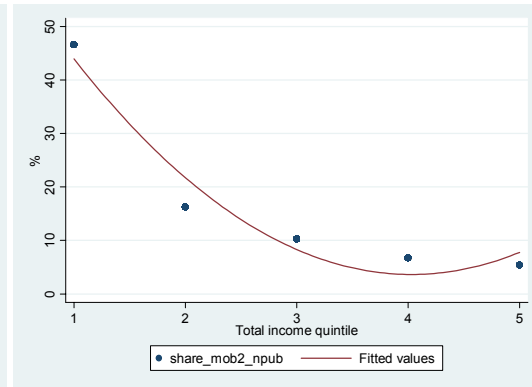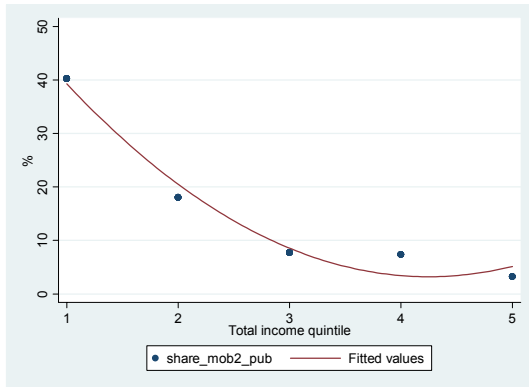## 4. Age categories

Bangladesh
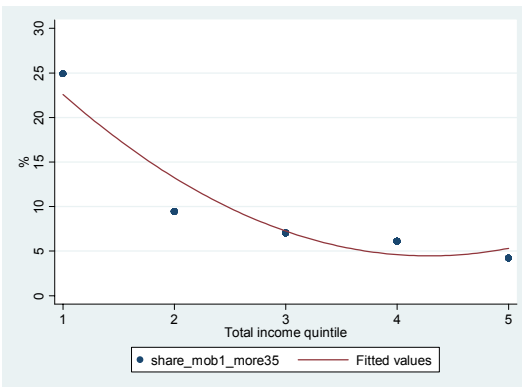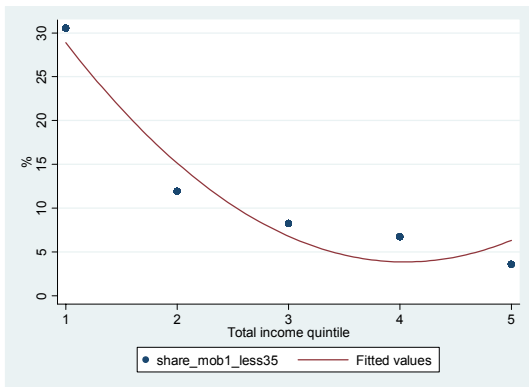
Pakistan
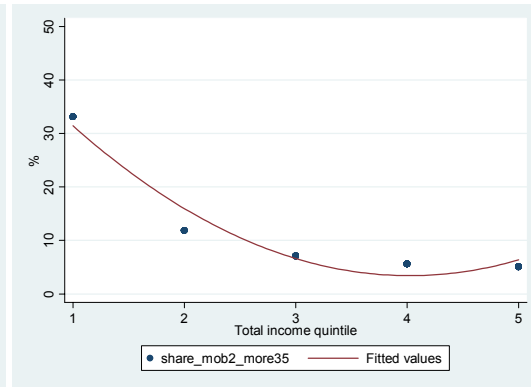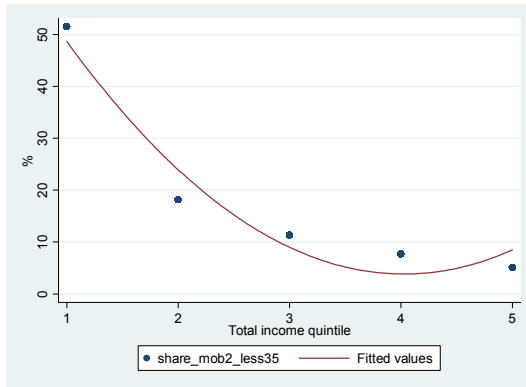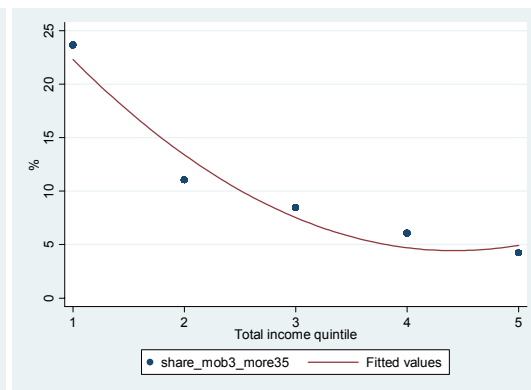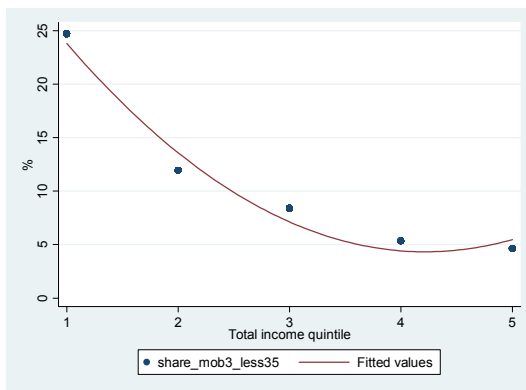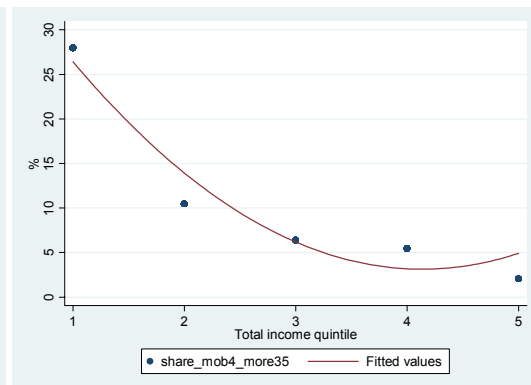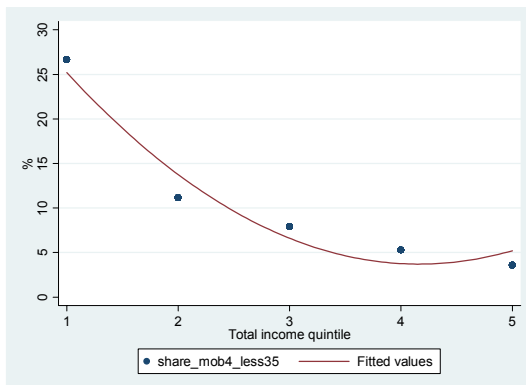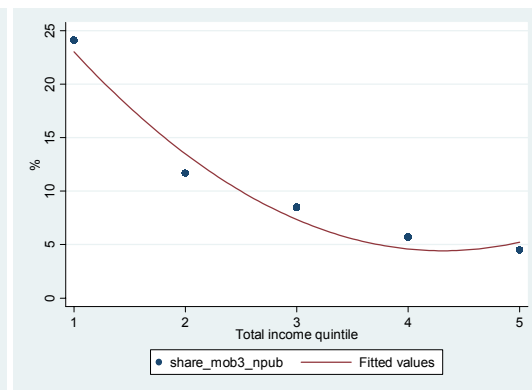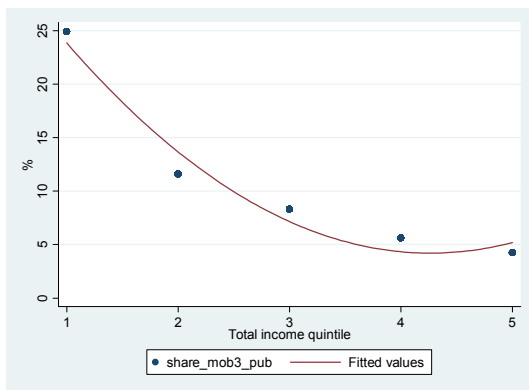

India

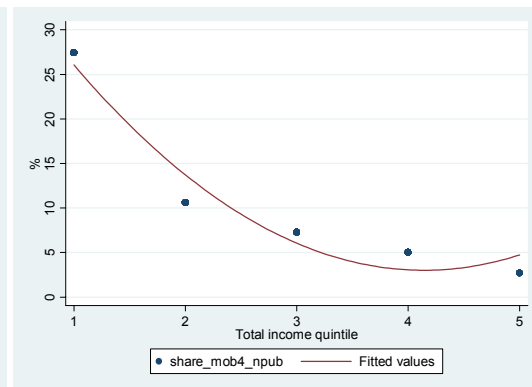Sri Lanka
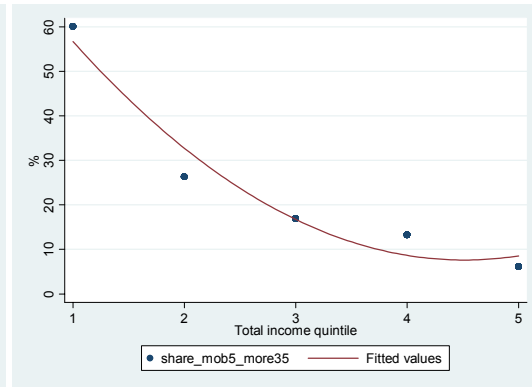
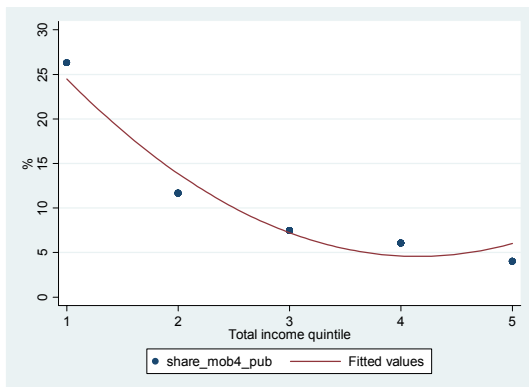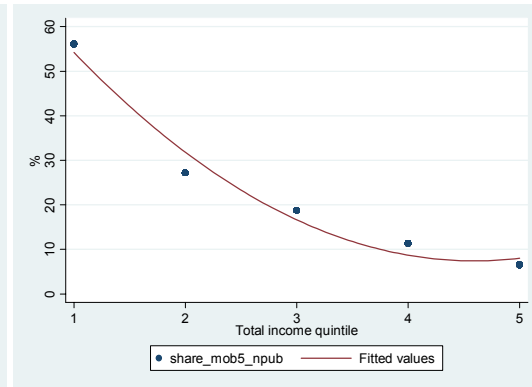Philippines

Thailand
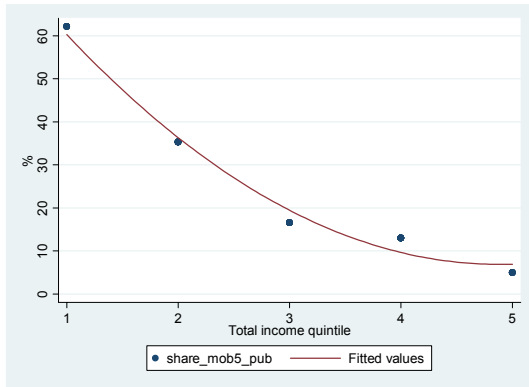

5. *Users – non-users of public phones*

Bangladesh

Pakistan

India

Sri Lanka

Philippines

Thailand