Who pays for Agricultural Information on Mobile Phones? Evidence from Three Countries in South Asia

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Abstract

We use data from 8,896 rice farmers based on three surveys in Bangladesh, India, and Pakistan, conducted in 2015 and 2016. In the surveys, we asked sample farmers about their use mobile phones to obtain information about weather, agricultural prices, rice seeds, and production practices. We find that more than 13% of all sample farmers received some information about agriculture through operators and SMS messages on their mobile phones from private and extension agencies. The percentage ranges widely across regions and countries. Farmers paid for about half of the calls, often registered to receive them. In India, farmers who live away from the nearest market are more likely to receive paid calls about agricultural information. Better-off farmers in Pakistan are more likely to receive calls on their mobile phones agricultural information. In Bangladesh, only 2% of the sample farmers received agricultural information on their mobile phones.

Keywords: Mobile Phones, agricultural information, South Asia

Introduction

The role of the information and communication technology (ICT) in rural development, particularly for agricultural production and marketing, has been receiving increased attention over the past decades (Muto and Yamano, 2009; Aker, 2010; Mittal et al., 2010). Numerous proposals were made about the possible use of ITC for agricultural extension. In India, mobile phone services and coverage have grown quite rapidly and continue to expand. A study by Mittal et al. (2010) examined the impacts of mobile phone in the Indian agricultural sector and argued that there was potential for greater rural productivity as the mobile industry continued to expand among the farming community. They found a high demand for information about rice seeds (Mittal et al., 2010). The search for information about existing seeds or varieties can be crucial to farmers as they are often compelled to make decision about continuing to grow the same rice variety, replenish it or turn it over.

The results of previous studies on the use of mobile phones for agricultural extension are mixed. Fafchamps and Minten (2012) find that while a mobile phone-based price and weather information system in India increased farmers' access to information and crop grading, it had no effect on other agricultural outcomes, including farm-gate prices. Camacho and Conover (2011) found similar effects of a SMS-based weather and price information system in

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Colombia. Only Cole and Fernando (2012) found that participating in a voice-based agricultural extension system affected farmers' input use and yields for some crops. The first two studies examined impacts of SMS messages, while Cole and Fernando (2012) examined a voice-based agricultural extension. However, the evidence on the effectiveness of SMS-based versus voice-based agricultural extension systems remains thin and need further examination.

This study examines the use of mobile phones among rice farmers in South Asia, where mobile phone ownership is high. We use three large-scale surveys of 8,896 rice farmers conducted in 2015 and 2016, covering Bangladesh, four states in eastern India, and Sindh region of Pakistan. In the survey, farmers were asked about their use of mobile phones to obtain agricultural information on weather, agricultural prices, rice seeds, and production practices. We found that more than 13% of all sample farmers in South Asia received some information about agriculture through operators and SMS messages on their mobile phones from private and extension agencies. The percentage is high in Sindh region of Pakistan and Uttar Pradesh state in India. Farmers paid for about half of the calls, often registered to receive them. In Bangladesh, only 2% of the sample farmers received agricultural information on their mobile phones. To examine the determinants of receiving free and paid calls about agricultural information, we estimate the Multinomial Logit model where the dependent variable is a categorical variable for receiving free and paid calls. Because of rapidly changing mobile phone technology and services, we expect that the use of mobile phones for marketing and extension of agricultural information will increase in the study area. It is important to find a way to benefit farmers in rural areas.

Data and Descriptive Results

Data

The data used in the study come from three surveys conducted in 2015 and 2016 in Bangladesh, India, and Pakistan. The survey in Bangladesh is based on a national representative survey of rice production areas in Bangladesh in 2015. The sampling was conducted by using a village census of 2013 and included three regional clusters: division, district, and village. The total number of sample households was 1,500 (Table 1).

The survey in Eastern India was conducted in 2015 and was based on a simple self-weighting sampling design across states. The total number of villages in each state was determined based on the total rice area in each state, while keeping the total number of target villages to 720. Thus, we have more villages selected in West Bengal because the total rice producing area is largest among the four states. Odisha is the second, followed by Bihar. Eastern Uttar Pradesh (EUP) has the smallest rice area among the four states. A simple random sampling was used to select villages within each state by using the 2001 Village Census. Notably, villages classified in urban areas were excluded from the sampling frame. Out of the 720 targeted villages, 21 villages were not accessible because of heavy floods, occurred in 2015 July. Therefore, the total villages where we conducted the survey is reduced to 699. In each of

the selected villages, 10 households were randomly selected after listing households in the village. The total number of households interviewed is 6,983 (Table 1).

In Pakistan, the survey was conducted in Sindh region, which is located in the southern part of Pakistan. Rice is grown mainly in two regions in Pakistan: Punjab and Sindh. In Punjab, sharing a border with Pubjab region in India, mostly aromatic basmatic rice is grown. In contrast, in Sindh region, farmers produce high yielding rice varieties and hybrid.

In the survey, we asked about mobile phone ownership. The survey has been conducted in some regions of Bangladesh, Pakistan and four states in India (Table 1). The results show that in Bangladesh, about 97% of households who own at least one mobile phone. On average they own more than 2 mobile phones per household. Among our surveyed regions and country, Bangladesh households have more mobile phones than others. Among the four states of India, about 92.3% households of Eastern UP and 64.7% households of Odisha hold the highest and lowest number of mobile phones, respectively. The average number of mobile phones owned by sample households in India is about 1.5 units. In Uttar Pradesh, the average number is 2.0, while the same number is equal to or less than 1.5 units in the other three states. In Pakistan, out of 413 farmer households, 78% of them possess at least one mobile phone unit which is comparatively lower amount with Bangladesh and India. The average number of mobile phones owned by sample households in Pakistan was about 1.7 units.

Agricultural Information on Mobile Phones

In the survey, most of the farmers reported that they use mobile phone for communicating socially but also collect agricultural information from seed and input dealers, traders, and public and private institutions such as extension agencies and seed firms (Table 2). Farmers may find convenient to communicate through mobile phones for seeking agricultural information such as weather information, market price information, information on input price, information about new rice varieties etc. Of these the highest usages were observed by Eastern UP (22%) and Pakistan (24.4%) for accessing market price information. While in Bangladesh it was 1.6%. Although highest numbers of people possess mobile phone set but it is not commonly used for gathering agricultural information in Bangladesh. Access to input price information through mobile phone many farmers in Eastern UP (18.8%) and in Pakistan (24.8%) are now connected to the market. In the survey, farmers in Eastern UP (7%), in West Bengal (2.8%) and in Pakistan (6%) also used mobile phones to get weather information. Farmers get benefitted to find information about new rice varieties in Eastern UP (13%), in Odisha (2%) and in Pakistan (9%).

Registration and Payment for Calls

To examine more about famers' behavior about collecting information through mobile phones, we asked farmers more detailed questions regarding their use of mobile phones on specific information about agricultural production (Table 4). About 2.3% in Bangladesh, 3.1%

in Bihar, 9.7% in Odisha, 4.3% in West Bengal, 30.9% in Eastern UP and 30% in Pakistan of sample farmers indicated that they have used mobile phones to gather agricultural information. Interestingly, high portion of farmers in Pakistan got agricultural information through mobile phone, about 49% of those who only paid to receive the information. The results also shows that almost 30.9% of the farmers in Eastern UP who were using mobile phone 72.8% paid and 58.5% of them were registered to receive the information. While in Bangladesh it was 47.1% farmers paid and 8.8% registered for receiving the information. About 71.8% farmers paid and 71.3% registered of such farmers in Odisha. Most of those who received applied the information on their activities. Although the level of the use differs, we find similar patters across different information items.

ho made calls?

In all three countries, input dealers and output traders called farmers providing information about their products, input and output prices, and other agricultural information. In Pakistan, 97% of the calls were made by input dealers and traders, while in Bangladesh they made 56% of the calls. In India, dealers and traders made 38% of the calls. In India, seed and input firms called farmers directly (37%).

In all three countries, extension agencies made calls, but the number of the calls was not as many as others. In Bangladesh and Pakistan, extension agencies made only 2% and 3.3%, respectively, of the calls to farmers. In India, the percentage of calls made by extension agencies was about 16%. Finally, NGOs also made some calls in Bangladesh (2.4%) and India (9.3%) but not in Pakistan.

Estimation Models and Variables

To identify factors associated with receiving calls about rice varieties, we estimate the Multinomial Logit (MNL) model. This model has been used in many studies such as studies on the determinants of chronic poverty (Glewwe et al., 2002; Justino et al., 2008) and the adoption of natural resource management practices over time (Muller and Zeller, 2002; Knowler and Bradshaw, 2007; and Fisher et al., 2015). In our analysis, the dependent variable is a categorical variable for the three groups presented in Table 3. The categorical variable takes 1 for rice farmers who did not receive phone calls on agricultural information listed in Table 2, 2 for farmers who received *free* calls, and 3 for farmers who receive *paid* calls.

The variables included in the MNL model include variables on household characteristics; a dummy variable for caste and religious groups; the distance to the nearest market in km; and state dummy variables. Variables on household characteristics include the total land size, including both own and rented-in land, in ha, the total value of assets and livestock in natural Logarithm, education level of the household head, and age of the household head.

Results

India

Table 5 presents the estimated results of the MNL model on receiving free or paid calls about rice varieties in India. In the table we find that farmers who are located in remote areas are more likely to receive paid calls about agricultural information. The estimated coefficient of the distance to the nearest market (in 10 km) is positive and significant at the one percent level with an estimated coefficient of 0.002. This, if a farmer is located 10 km away from the nearest market, the probability of receiving paid calls about rice varieties increase by 0.2 percentage points. This result shows that farmers in remote areas have a high demand for information about rice varieties and are ready to pay for such information.

The results on other household variables indicate that relatively better-off farmers are more likely to receive free or paid calls about rice varieties. One percent increase in the total asset value increase the probability of receiving calls about rice varieties, both free and paid, by 1 percentage point. Both free and paid calls are made to households who belong to SC and OBC caste groups. As we have shown in Table 4, extension agents and NGOs are making phone calls about rice varieties. They might have targeted farmers in low caste groups.

Finally, as we discussed earlier, farmers in Eastern UP have a higher probability to receive calls about rice varieties. Interestingly, they are more likely to receive paid calls than free calls. They are a 33% more likely to receive paid calls than farmers in Bihar. At the same time, they are a 6% more likely to receive free calls than farmers in Bihar. Outside of Eastern UP, farmers in Odisha are more likely to receive paid calls than farmers in Bihar. In West Bengal, farmers are more likely to receive both free and paid calls from agricultural information than farmers in Bihar, but the differences in the probability are small.

Pakistan

In Pakistan, we find that the large farmers are more likely to receive free or paid calls about agricultural information. If the own land size increases by one hectare, the probability of receiving free calls about agricultural information increases by 0.4 percentage point, and the probability of paid calls increases by 0.7 percentage points. The results also indicate that farmers who own more assets, have access to electricity, and are more educated are more likely to receive free calls, not paid ones, about agricultural information.

Bangladesh

The estimated results of the MNL model on receiving calls about rice varieties of Bangladesh are presented in Table 5. The results on other household variables show that educated farmers are more likely to receive calls about rice varieties. One percent increase in the education level increases the probability of receiving calls about rice varieties by 0.0012 percentage points at 5 percent level of significance.

Conclusion

In this paper, we examined farmers' use of mobile phones to obtain information about agriculture: weather, input and output prices, and agricultural technology and practices. Mobile phones have become common items owned even by farmers in South Asia. We find that more than 85% of the farmers in Bangladesh, India, and Pakistan own at least one mobile phone unit. The average number of mobile phones per household is about 1.7 units. In Bangladesh, farmers own more mobile phones than farmers in India and Pakistan. Farmers receive operator assisted calls and SMS messages on their mobile phones about agricultural information. Extension agencies, input dealers, traders, seed firms, and NGOs have made calls to our samples households. Obviously, dealers and other private agencies have incentive to contact farmers to sell their products. Traders want to buy farmers' products. However, interestingly, more than half of the calls and SMS messages were paid by farmers. Often farmers registered to receive such information. Thus, it seems that farmers also have incentive to receive information about products of seed and input dealers, input and output prices, and other agriculture information such as weather information and new agricultural practices.

In the regression analysis, we find that Indian farmers in remote areas are more likely to receive paid calls, suggesting that farmers in remote areas are willing to pay for agricultural information. In India and Pakistan, we find that better-off farmers with more land and assets tend to receive both free and paid calls. Because better-off farmers are likely target of dealers and traders, it is not surprising to find that they receive more calls. But mobile phones could be used for extension. In India, some extension agencies are contacting farmers through mobile phones, but their share is only 16%. In Bangladesh and Pakistan, less than 4% of the calls were made by extension agencies. Extension workers can physically visit only a small number of farmers in a given period. However, they can contact many farmers through mobile phones. They can obtain agricultural production environment by locating farmers' address in digital maps and recommend agricultural practices and input use. The use of mobile phones for disseminating agricultural information for commercial as well as extension purposes has become reality as we have shown in this paper and is likely to expand in coming years.

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Tables and Figures

Table 1 Ownership of Mobile Phones, Bangladesh, India, and Pakistan

Region	Number of interview files available	Percentage of households who own at least one mobile phone	Average number of mobile phones owned
	(A)	(B)	(C)
	number	%	Average
Bangladesh	1,500	97.0	2.3
India			
Bihar	1,514	90.5	1.4
Eastern UP	1,199	92.3	2.0
Odisha	1,868	64.7	1.3
West Bengal	2,402	91.5	1.4
Total - India	6,983	84.8	1.5
Pakistan	413	78.0	1.5
Total	8,896	85.7	1.7

Table 2 Use of Mobile Phones: Information on Agriculture

Information source	Weather Information	Market Price information	Input price	How to mitigate crop damage	Information about new rice varieties	Ag. practices
	(A)	(B)	(C)	(D)	(E)	(F)
	%	%	%	%	%	%
Bangladesh	0.6	1.6	0.5	0.3	0.1	0.0
India						
Bihar	0.5	1.2	0.8	0.3	0.5	0.1
Eastern UP	7.0	22.1	18.8	6.4	13.1	1.2
Odisha	1.2	1.7	2.8	3.2	2.1	2.0
West Bengal	2.8	1.9	0.8	1.7	0.1	1.0
Pakistan	5.8	24.4	24.8	7.3	6.8	1.0
Total	3.0	8.8	8.1	3.2	3.8	0.9

Table 3 How to use mobile phones to access information on agriculture

Information source	Have you ever received information on mobile phones (any)?	Did you pay for the information (at least one item on ag)?	Did you register to receive the information (at least one item on ag)?	Did you use the information (at least one item on ag)?
	(A)	(B)	(C)	(D)
	%	% among those who received information		
Bangladesh	2.3	47.1	8.8	88.2
India				
Bihar	3.1	40.4	19.1	80.9
Eastern UP	30.9	72.8	58.5	95.7
Odisha	9.7	71.8	71.3	86.7
West Bengal	4.3	54.8	55.8	76.0
Pakistan				
Sindh Region	30.0	48.5	-	100.0
Total	13.4	55.9	42.7	87.9

Table 4 Source of Operator-assisted Marketing Call

	Bangladesh	India	Pakistan
	(A)	(A)	(C)
	%	%	%
Extension	2.4	15.7	3.3
NGOs	2.4	9.3	-
Seed firms	-	37.2	-
Dealers / Traders	56.1	37.9	96.7
Mobile companies	39.0	-	-
Total	100%	100%	100%
Number of calls	41		270

Table 5 Determinants of Receiving Agricultural Information on Mobile Phones

	India		Pakistan		Bangladesh
	Received phone call but didn't pay	Received phone call and paid	Received phone call but didn't pay	Received phone call and paid	Received phone call
Variables	(A)	(B)	(C)	(D)	(E)
Distance (house to the nearest market in kilometers)	-0.0013*** (-2.73)	0.0018*** (4.214)	0.0024 (0.90)	0.0022 (0.78)	0.0010 (0.77)
Household Characteristics					
Own land (ha)	0.00004 (-0.03)	0.0043*** (3.03)	0.0043** (2.31)	0.0068*** (3.37)	0.0014 (1.04)
Log (asset value)	0.0106*** (8.27)	0.0086*** (5.34)	0.0284* (1.93)	-0.0201 (-1.54)	0.0024 (0.68)
Access to electricity	-0.0043 (-0.73)	-0.017*** (-2.42)	0.0806** (2.10)	0.0169 (0.36)	-0.0050 (-0.50)
Age of member	-0.0001 (0.43)	-0.0004** (2.41)	-0.0011 (-0.76)	-0.0022 (-1.40)	-0.0002 (-0.49)
Education level	-0.0002 (0.61)	-0.0001 (0.31)	0.0079** (2.38)	0.0029 (0.78)	0.0012** (2.02)
Male adults in HH	-0.001 (0.36)	0.0011 (0.60)	-0.0070 (-0.74)	-0.0052 (-0.45)	0.0009 (0.24)
Female adults in HH	-0.002 (1.29)	-0.0060*** (2.69)	0.0171* (1.67)	-0.0009 (-0.08)	-0.0068 (-1.44)
Caste/Religion category					
Scheduled Caste	0.0014 (0.26)	0.0413*** (4.12)			
Scheduled Tribe	-0.0063 (-1.15)	-0.0066 (-0.93)			
OBC	0.0073* (1.68)	0.0230*** (3.55)			
Non-Muslim					0.0058 (0.52)
Eastern Uttar Pradesh	0.060*** (3.99)	0.3270*** (7.63)			
Odisha	0.029*** (2.93)	0.1254*** (5.28)			
West Bengal	0.0173** (2.19)	0.0476*** (3.21)			
Pseudo R-squared					
Number of observations	6,968		413		1,500

Note: Absolute values of z-statistics are in parentheses. *, **, and *** indicate the statistical significance at the 10, 5, and 1 percent level, respectively.