ACCESS TO OUTPUT MARKET BY SMALL FARMERS: THE CASE OF PUNJAB, PAKISTAN

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ABSTRACT

Transport infrastructure in Pakistan is still a problem for rural people to access output markets. This study aims to identify the ways to improve access of small farming households to output markets. To achieve this aim, specific objectives are: to find out the determinants of small farmers’ access to output markets; and to assess impact of these factors on farmers’ income. For this purpose, primary data from 576 households were collected from twelve districts of the Punjab province. To achieve the first objective, logistic regression was used as the dependent variable is a binary variable. For second objective, the dependent variable was in a continuous variable which guided towards the application of a OLS model. The results of the study revealed that the education, cost of transportation, distance from farm to market and access to market information were the factors which determined the accessibility of farmer to output market. A significant impact of these factors was found on the income of small farmers. The study suggests that the transportation facilities, market infrastructure and flow of market information should be improved.

Keywords: Farm households, Agriculture markets, Market information, Access to market, Transport, Transportation cost, Extension services.

INTRODUCTION

Most of the poor population of the world depends on agriculture in one or the other way especially small farmers. To promote rural development and poverty reduction focus should not only be on improving production capacity of the farmers but also on enhancing their market access (Jayne et al., 2010). Marketing plays a major role in income generation that helps reducing poverty and improves living standard of small farmers (Cai et al., 2012). Small farmers are facing many problems including poor infrastructure and high transaction costs that reduce the chances of getting high incentives for market participation (Barret, 2008: Key et al., 2000). This is true for both input and output markets (Fischer and Qaim, 2012). Poor access to markets is a major reason (Machete, 2004).

In developing countries, small farmers are facing many problems to access markets. This includes capability to acquire basic farm services and farm inputs and the ability to supply farm products to markets (Tilburg and Schalkwyk, 2012). The timely availability of inputs and their good management results in high production but poor access to output markets creates problems for farmers which reduces their profits (Sendal, 2007). Small farmers often lack resources and access to infrastructure, especially roads (Jacoby, 2000) and market infrastructure (Senyolo et al., 2009) to sell their produce in time at different markets. This results in reducing their income which reduces their living standards (Heinmen, 2002) and causes food insecurity (Bashir et al., 2012).

Small farming households usually protect their food security through their own production. To meet their ends, they sell their surplus produce and sometimes assets like animals, vehicles (motor bike, bicycle, etc.), jewellery, etc. (Ahmed et al., 2015). A strong economy ensures established markets, both input and output markets, to the farmers helping them overcome the vicious circle of ‘grow-eat-grow’ that will eventually help the economy to become stronger in international trade (IFAD, 2013). Pakistan’s economy is primarily based on agriculture sector which accounts for about 20.9 percent of the GDP (GOP, 2015). In rural areas, the main activity of the people is farming and related activities. Since 2000, on an average, this sector has grown at about 4.5 percent annually. Despite this decent growth, agricultural sector could not help reduce rural poverty. The access to market by small farmers could be one of the reasons.

Pakistan has a total road structure of about 263,942 kilometers of which 185,063 kilometers are good quality roads (GOP, 2015). From every five villages in Pakistan, 15 percent population still has no access to roads. Beside
this, in three of every ten villages there is a lack of motorized access to markets (Essakali, 2005). The access to markets, both input and output, needs to improve through technology, land holding, assets, level of education, policies and endowment (Amrouk et al., 2013; and Arias et al., 2013); accessibility of physical and institutional infrastructure i.e. road, electricity, communication, markets and rules of law etc.; and policies that effect prices and trade incentives. It has been noted that the supply response by small farmers is considerably improved by reducing the constraints faced by them as compared to provide them trade related incentives (Barrett, 2010).

Small farmers are the majority of world’s poor (Nagayets, 2005) and represents half of the population of the world that are undernourished (Hazell et al., 2007). Enhancing the livelihood is very important to alleviate poverty and food insecurity. Other income sources like labour are important for small farmers and poorest (Mueller and Chan, 2015). Access to output market remain crucial.

Despite heavy investments in research and development for agricultural sector, the benefits seems not translated into improved livelihood of small farmers (Ntale, 2013). The focus of researcher remained on the access to input markets and related issues, the access to output market remained an under researched area (IFAD, 2003). This study aims to identify the ways to improve access of small farming households to output markets. To achieve this aim, specific objectives are to:

1. find out the determinants of small farmers’ access to output markets
2. assess the impact of these factors on farmers’ income.

**METHODOLOGY**

**Study area and data collection:** Primary data were collected from the Punjab, Pakistan as it is the most populous province of the country providing shelter to more than 54.16% of the total population (GOP, 2015); and contribute about 57% to the national agricultural GDP (GOP, 2011). Following Bashir et al., 2012, one third (12) of the total districts (36) of Punjab were considered to be a good representative sample. At each step, different sampling techniques were used. To select the districts, a stratified sampling technique was used because the province has 5 agro-climatic zones (Pinckney, 1989). These zones were categorized on the basis of cropping pattern. Zone 1 is wheat-rice zone having ten districts, Zone 2 is wheat-cotton zone having nine districts. Zone 3 is mixed zone comprised on seven districts. Zone 4 and 5 are arid and low intensity zones respectively and comprised of four and six districts respectively. The strata were not identical in terms of district numbers, so a proportionate sample was drawn using the formula:

\[ n_i = \frac{n}{N} \frac{N_i}{N} \]

Where \( i = 1-5 \) strata,
\( n_i = \) No. of districts in ith stratum,
\( n = \) Total number of selected districts (12),
\( N_i = \) Total number of districts in ith stratum,
\( N = \) Total number of districts (36).

![Figure 1. Schematic flow of work](image)
According to the proportionate sampling procedure three districts each from Zones 1, 2, and 3, one district form Zone 4, and two districts from Zone 5 were selected. Districts were selected on the basis of high yields of major crops (Wheat, Rice, Sugarcane, Cotton and Maize) in respective strata. The selected districts were: Mandi Bahaudin, Kasur and Nankana Sahib from Zone 1, Sahiwal, Rahim Yar Khan and Pakpattan from Zone 2, Sargodha, Faisalabad and Toba Tek Singh from Zone 3, Jehlum from Zone 4 and Rajan Pur and Muzzafar Garh from Zone 5. Due to high homogeneity in village characteristics, only four villages from each district were randomly selected and from each village, twelve households were selected, randomly. The total sample size was 576 households. A comprehensive questionnaire was designed and data were collected after pre-testing and fulfilling all the requirements of human ethics.

Data Analysis: To address the first objective, data were analysed using a logistic regression model following the work of Awoyinka et al. (2003). The logistic regression directly estimates the probability of an event occurring for more than one independent variable (Hailu and Negatu, 2007). The general form of the model is given below:

\[
logit(y_i) = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \beta_3 x_{3i} + \beta_4 x_{4i} + \beta_5 x_{5i} + \beta_6 x_{6i} + \epsilon_i
\]

For the current study the model can be expressed as;

\[
y_i = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \beta_3 x_{3i} + \beta_4 x_{4i} + \beta_5 x_{5i} + \beta_6 x_{6i} + \epsilon_i
\]  

(2)

Where:

- \(y_i\) is the probability of the \(i^{th}\) household to have access to output market. The output markets of Tehsil and Districts were considered, only (1 for access to these market and 0 otherwise).
- \(\beta_0\) is the constant term,
- \(\beta_{1\sim6}\) are the coefficients of independent variables.
- \(x_{1i}\) is household head’s education level (1 for literate and 0 otherwise).
- \(x_{2i}\) is the distance to output market (Km).
- \(x_{3i}\) is the cost of transportation (PKR).
- \(x_{4i}\) is the influence of extension workers (1 for positive influence and 0 otherwise)
- \(x_{5i}\) is the influence of cooperative societies (1 for positive influence and 0 otherwise).
- \(x_{6i}\) is access to market information (1 for access to information and 0 otherwise).
- \(\epsilon_i\) is the error term

RESULTS AND DISCUSSION

Descriptive Statistics: The results are comprised of summary description of household characteristics, results of binary logistic model and results of multiple linear regression model. The detailed summary descriptive statistics are present in Table 1.

Factors effecting households’ access to output market:
This section elucidates the results of binary logistic regression and explains the determinants of farming households’ access to output market in the Punjab province. The results are presented in Table 2. The results show that the model predicts with high accuracy in terms of predictive efficiency i.e. about 91.3 percent. The model’s goodness of fit of the logistic regression model can be tested by Hosmer and Lemeshow (H-L) test and pseudo \(R^2\) (Peng et al., 2002). The value of (H-L) test is 8.433 (8 df) which is statistically non-significant (\(P>0.05\)) implying that the model is a good fit. On the other hand, the value of pseudo \(R^2\)’s i.e. Cox and Snell \(R^2\)
and Negelkerke $R^2$ are 0.286 and 0.537, respectively indicating a reasonable model fit. However, the values of Pseudo $R^2$ cannot be tested in an inferential framework and are regarded as poor measures of model fit. (Hosmer and Lemeshow, 2000; Menard, 2000)

Table 1. Summary description of rural farming household characteristics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Dominant indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household Head’s gender</td>
<td>About 98% respondents are male</td>
</tr>
<tr>
<td>Household head’s age</td>
<td>Farmers under study had average age of 47 years</td>
</tr>
<tr>
<td>Education level of household head</td>
<td>About 64% household head are literate</td>
</tr>
<tr>
<td>Household size</td>
<td>Farmers had a household size of between 6 to 8</td>
</tr>
<tr>
<td>Farm Size</td>
<td>Average farm size had 6 acres</td>
</tr>
<tr>
<td>Monthly income of household</td>
<td>Farmers have average monthly income of Rs. 41716</td>
</tr>
<tr>
<td>Distance to output market</td>
<td>Average distance from farm to output market is about 13.7 Km</td>
</tr>
<tr>
<td>Influence of extension workers</td>
<td>Extension workers have positive influence on 62% farmers</td>
</tr>
<tr>
<td>Influence of cooperative societies</td>
<td>80% farmers have negatively influenced by cooperative societies</td>
</tr>
<tr>
<td>Access to market information</td>
<td>About 73% farmers have access to market information</td>
</tr>
<tr>
<td>Medium of sales of farm produce</td>
<td>38% of the farmers sold their produce at the farm gate</td>
</tr>
</tbody>
</table>

Table 2. Results of binary logistic regression

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficients</th>
<th>Standard Error</th>
<th>Exp (B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>0.628***</td>
<td>0.340</td>
<td>1.874</td>
</tr>
<tr>
<td>Distance to output market (Km)</td>
<td>- 0.190*</td>
<td>0.033</td>
<td>0.827</td>
</tr>
<tr>
<td>Cost of transportation (PKR)</td>
<td>-0.000123</td>
<td>0.000021</td>
<td>1.000</td>
</tr>
<tr>
<td>Influence of extension workers (Dummy)</td>
<td>0.040</td>
<td>0.352</td>
<td>1.040</td>
</tr>
<tr>
<td>Influence of Cooperative Societies (Dummy)</td>
<td>- 0.294</td>
<td>0.482</td>
<td>0.745</td>
</tr>
<tr>
<td>Access to Market Information (Dummy)</td>
<td>1.446*</td>
<td>0.377</td>
<td>4.248</td>
</tr>
<tr>
<td>Constant</td>
<td>5.500*</td>
<td>0.701</td>
<td>244.732</td>
</tr>
<tr>
<td>Model Prediction Success (MPS)</td>
<td></td>
<td></td>
<td>91.3%</td>
</tr>
<tr>
<td>Log-likelihood ratio</td>
<td></td>
<td></td>
<td>243.771</td>
</tr>
<tr>
<td>H-L model (df = 8) Significance test results</td>
<td></td>
<td>8.433</td>
<td>(p-value = 0.392)</td>
</tr>
<tr>
<td>Cox &amp; Snell $R^2$</td>
<td>0.286</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negelkerke $R^2$</td>
<td>0.537</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: *, **, *** represent significant at 1%, 5% and 10% respectively

Out of six independent variables, four are statistically significant. The results of significant variables are explained here. Access to market means farmers have an easy approach to tehsil and district markets and sell their produce there. Education has a positive impact on farming households’ access to output market. This implies that the chances of understanding the market importance as well as is functionalities are higher in farmers with literacy level that induces higher rate of market access. The associated odds-ratio of the coefficient indicates that the chances of literate farmers to access output market are about 1.9 times higher than that of the illiterate farmers. Mukwevho and Anim (2014) also reported similar result that education may enhance market access. Distance from farm to output market has a negative impact on farmers’ decision to access the output market implying that long distance from farm to market leads to reduction in the probabilities of market access by small farmers. The associated odds-ratio explains that an increase of one kilometer in the distance from farm to market results in 0.8 times less chances to the access to output markets. These results are in line with the results of Hlongwane et al. (2014) according to their results, one kilo meter increase in the distance travelled to market caused 0.775 reduction in market participation in South Africa.

Access to market information has a positive relationship with market access. Farmers having market information have a higher probability of market access by 4.3 times than those of who have no or little access to market information. This implies that that better access of farmers to market information can enhance the probabilities of farmers’ access to markets. Onoja et al. (2014) also showed similar results in Nigerian small-scale fishery sector. A study carried out by Apind et al. (2015) also showed that market information had positive impact on market access and participation. Cost of transportation had a negative impact on access to output
markets by small farmers. High transportation cost leads to farmer’s reluctance to market participation. These results are in line with the findings of Agbola et al. (2010).

Relationship between farm income and market related factors: The causal relationship between farm income and market related factors were estimated using linear multiple regression analysis. The results are presented in Table 3. The values of $R^2$ and F statistics show that the model is a good fit.

Table 3. Results of multiple regression

<table>
<thead>
<tr>
<th>Variables</th>
<th>Unstandardized Coefficients (B)</th>
<th>t-value</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-79824.60*</td>
<td>-4.157</td>
<td>0.000</td>
</tr>
<tr>
<td>Education (Dummy)</td>
<td>14261.69**</td>
<td>1.810</td>
<td>0.071</td>
</tr>
<tr>
<td>Distance to output market (Km)</td>
<td>-9867.80*</td>
<td>17.999</td>
<td>0.000</td>
</tr>
<tr>
<td>Cost of transportation (PKR)</td>
<td>-10.207*</td>
<td>1.713</td>
<td>0.026</td>
</tr>
<tr>
<td>Influence of extension workers (Dummy)</td>
<td>22609.87*</td>
<td>1.565</td>
<td>0.018</td>
</tr>
<tr>
<td>Access to market Information (Dummy)</td>
<td>349.50***</td>
<td>2.025</td>
<td>0.081</td>
</tr>
</tbody>
</table>

F-statistics 67.396 (p-value = 0.000)

$R^2$ 0.672

Note: *, **, *** represent significant at 1%, 5% and 10% respectively

All of the five variables are statistically significant (education, distance to output markets, cost of transportation and access to market information). The coefficient of literacy (education) explains that an educated farmer can earn about Rs. 14261 extra as compared to an un-educated farmer. This is because of the fact that education provides more knowledge about agricultural practices as well as about the importance of their products and their markets.

Distance from farm to output market had a negative relationship with farm income. When distance from farm to market increases by 1 kilometer, farm income decreases by Rs. 9868. This is because of the fact that most of the farm produce is perishable and small farming households’ lack the storage facilities and poor transport system. These results are in line with the results of Adejobi et al., (2006) who reported that distance to market has negative effect on farm income. Furthermore, it was found that an increase of Rs. 1 in the cost of transportation reduces farmers’ income by Rs. 10. Taiwo and Kumi, (2013) described in their study that cost of transportation had negative effect on farm income.

Extension workers play a major role in enhancing the incomes of farmers, as they provide valuable suggestions and information about new technologies to the farmers. A positive influence of extension officers was observed on farmers’ income. As the help from extension workers is increased, the income of small farmers may increase by about Rs. 22600. Xuan et al. (2014) described that extension services has positive impact on tea farmer’s income. Farmers’ having access to extension services earn about 30 percent more than the farmers that have no access to these services. Similar result also reported by Owens et al. (2001) that farmers who receive the extension services have 15 percent more crop production. Agricultural market information is also a major component in enhancing income of the farmers. The results show that increasing access to market information cause about Rs. 1549 increase in income. Agbola et al. (2010) also stated that access to market information had positive impact on farmers’ income.

Conclusion: This study explored various factors that affect farming households’ access to output market within Punjab province and analyzed their impact on their incomes. The study inferred that the market accessibility is threatened due to long distances from farm to market, high transportation cost and lack of market information. Furthermore, these variables along with other market related variables tend to increase transaction costs for small farming households which then have an inverse impact on their farm incomes. To improve the living standard and welfare of small farming households in general and in the study area in particular, the focus should be on improving and enhancing the scope of extension services from production side to marketing side. Furthermore, it is suggested that the transportation costs should be reduced for small scale farming households.

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