ACCESS TO INFORMATION, TRANSACTION COSTS AND MARKETING CHOICE OF RURAL HOUSEHOLDS BETWEEN MIDDLEMEN AND DIRECT BUYERS IN BANGLADESH

Shyamal K Chowdhury (YE) [1]
University of Bonn, Germany

Abstract: This paper assesses the impact of information cost and other transaction costs on rural producers' discrete choice between selling to middlemen and direct buyers, and continuous choice of selling intensity to middlemen and direct buyers. Using transaction costs economics as an analytical framework to decompose the different origins of transaction costs, the paper empirically investigates the impact of transaction costs on farm households' marketing behaviour in the context of Bangladesh. Empirical findings of this paper suggest that access to information in the form of access to telephone and other form of transaction costs play a significant role in producers' marketing behaviour. For information cost, a unit change in distance to telephone increases the probability of choosing direct buyer over middlemen by more than 4 percent and sales to direct buyer by more than 8 percent.

JEL classification: C35, D13, D83.
Key words: information, transaction costs, middlemen, direct buyers, small producers, rural households, Bangladesh.

[1]Correspondence: Shyamal K Chowdhury, ZEF, Walter-Flex-Str.3, D-53113, Bonn, Germany. Email: s.chowdhury@uni-bonn.de

ACCESS TO INFORMATION, TRANSACTION COSTS AND MARKETING CHOICE OF RURAL HOUSEHOLDS BETWEEN MIDDLEMEN AND DIRECT BUYERS IN BANGLADESH

Abstract: This paper assesses the impact of information cost and other transaction costs on rural producers' discrete choice between selling to middlemen and direct buyers, and continuous choice of selling intensity to middlemen and direct buyers. Using transaction costs economics as an analytical framework to decompose the different origins of transaction costs, the paper empirically investigates the impact of transaction costs on farm households' marketing behaviour in the context of Bangladesh. Empirical findings of this paper suggest that access to information in the form of access to telephone and other form of transaction costs play a significant role in producers' marketing behaviour. For information cost, a unit change in distance to telephone increases the probability of choosing direct buyer over middlemen by more than 4 percent and sales to direct buyer by more than 8 percent.

1. Introduction

In this paper we study the impact of information cost and other transaction costs on rural producers' discrete choice between selling to middlemen and direct buyers, and continuous choice of selling intensity to middlemen and direct buyers. More specifically, we try to address two questions: first, does access to information bring any change in producers' discrete choice between selling to middlemen vis-à-vis selling to direct buyers? Second, does access to information bring any change in the continuous choice of selling intensity between selling to middlemen vis-à-vis selling to direct buyers? We address these two questions under a transaction cost economics framework while controlling for other possible economic factors. We consider access to telecommunications as a proxy for the access to information and examine the issue of transaction costs for the rural producers of Bangladesh. The presence of transaction cost is widely held responsible to explain the observed market failures and self-sufficiency in agriculture in developing countries.[1]

Transaction can take place directly between buyers and sellers or indirectly through intermediaries. Intermediaries are economic agents who specialize in the activities of buying and selling the same product(s). Better known as middlemen in the context of developing countries, they mediate selling between the seller of a product and its potential buyers. Existence of frictions in trade gives rise to the function of intermediation. In the case of direct transaction, i.e., when transaction takes place directly between buyers and sellers, they share the transaction (trade) surplus. In the case of middlemen negotiated trade, middlemen share the surplus with buyers and sellers. Economic literature rationalizes the intermediation by arguing that intermediaries emerge because they are able to economize on the cost of transactions and information asymmetries.[2]

[1] See Key et. al. (2000) for a recent theoretical as well as empirical analysis on the presence of transaction costs and observed market failure.

[2] See Townsend, Robert M., (1978) for cost of transactions and Freixas and Rochet (1997, page 16) for information asymmetries in the context of financial intermediaries.

One fundamental source of transaction costs is the information cost. Neo-classical economists essentially assume that information is costless and perfect, which does not comply with the reality, particularly of developing countries.[3] When information is not costless has important implications in present and future contracts and transactions. Transactions and contracts, which could be feasible in the presence of perfect information, may not occur.[4] In developing countries, economic agent overcomes this informational problem, whether ex-ante adverse selection, interim moral hazard, or ex-post costly state of verification, through different informal arrangements and institutions. Existence of middlemen can be viewed as one of the arrangements to overcome transaction costs and costly information.

Access to telecommunications has potentials to overcome limitations associated with information imperfection, and a reduction in transaction costs. 'Two key determinants of market emergence are the costs associated with acquiring information, and the cost of negotiating transactions'[5] and the spread of telecommunications is expected to reduce both-acquiring and negotiation costs. Recent expansion of telecommunications services to rural areas in Bangladesh has increased the access of rural households to information. Under this background, we examine the impact of transaction costs of rural households' marketing choice between middlemen and direct buyers where search and information cost appears as part of transaction costs.

We have chosen three agricultural products, eggs, chicken and milk, which are produced by relatively poor rural households in Bangladesh. These products have been used as a source of income generating activities in rural Bangladesh following NGO-led micro credit and poverty alleviation programs. As micro credit usually requires weekly payments, these products generate income streams that fit with the payment requirements of micro credit better than that of other agricultural products, e.g. rice and other staple crops. As a result, both NGOs and their borrowers prefer these products. Although production and consumption separability is an important question for agricultural households, as the production is credit supported, the chosen products are basically produced for the market. In addition, surveyed households that produce these three products participate in the market in one or the other form.

Table-1 shows the information source about the product price of rural farm households that we have surveyed in Bangladesh and table-2 shows discrete choice of marketing channels between selling to direct buyers and middlemen. Both tables compare the observations

[3] As put in Stiglitz (1988), 'If information transmission and processing were costless and if there were no incentive problems- so everyone transmitted all of his information accurately- clearly there would be everything to be gained, and nothing to be lost, from the centralization of information. But these assumptions are no more realistic than the assumption that goods are costlessly produced, and drop, freely from the sky, like manna from Heaven'.
[4] See Akerlof (1970).
[5] See Leff (1984).

between villages with telephone and villages without telephone. It appears from table-1 that for all three products, producers that live in villages without telephone rely more on middlemen to get information about the price of their products. Coincidently, as can be seen from table-2, farm households' discrete choice of marketing channels between middlemen and direct buyers seems also to be different between households living in villages with telephone from the households living in villages without telephone. For all three products, the former group of households selects direct buyers over middlemen more often than the later group. It appears from the observed pattern that the difference in access to telephone can lead to a difference in source of information and a difference in choice of marketing channels of rural producers.

Table-1: Source of Information about Price (in percentage): Village with and without Telephone[6]

Information	Egg Producers		Poultry Producers		Milk Producers	
Source	A	B	A	B	A	B
Middleman	28.21	4.35	21.21	8.70	5.71	0.00
Not from middlemen	71.79	95.66	78.79	91.3	94.29	100
Total	100.00	100.00	100.00	100.00	100.00	100.00
No of producers	39	23	33	23	35	10

A: Village without Telephone; B: Village with Telephone

Table-2: Households' Choice of Marketing Channels: Village with and without Telephone

Sell to direct buyers	Village without Telephone		Village with Telephone		Total	
No	38	(33.04)	4	(6.90)	42	(24.28)
Yes	77	(66.96)	54	(93.10)	131	(75.72)
Total	115	(100.00)	58	(100.00)	173	(100.00)

Numbers in the parentheses are the percentage.

To explain the observed relationship between access to telephone and producer's choice between direct selling vis-à-vis mediated selling, we use transaction cost economics (henceforth TCE) developed by Coase as the analytical framework.[7] The usual assumption is that the producer is a cost minimizer and under a given technology and institutional environment, his/her choice between direct selling versus mediated selling is determined by information cost and other transaction costs minimizing motive. For empirical estimation, we estimate a probit model to examine the impact of transaction costs variables on producers' discrete choice between mediated vis-à-vis direct selling. For selling intensity, we estimate a two limits tobit model to examine the observed pattern under transaction costs framework.

The set of articles that are concerned with explaining empirically the existence of middlemen in the context of developing countries is limited mostly to middlemen's margin on transaction.[8] We are not aware of any previous attempt that explains producers' choice

[6] Unless otherwise stated, all the data used in this paper are from a primary survey. For survey coverage and method, see section-4.

[7] Coase (1937) in his seminal paper, 'The nature of the firm' first introduced the term 'transaction costs' to explain why firms exist. Later, economists have incorporated transaction cost framework to explain different economic outcomes. Many economists have subsequently extended the TCE framework. See for example Williamson (1975, 1991). See also Fahlbeck, E., (1996) and the references therein (p.1)

[8] See for example, Minten and Kyle (1999).

between middlemen and direct selling incorporating the role of transaction costs. The other distinguishing feature of the present paper is the choice of products. While previous attempts are mostly concerned with staple crops where production has a high self-consumption motive, products that we consider in this paper are basically produced for the market. This difference in product choice has additional rationale. A problem with staple crops is that the observed price gap between buyer and seller can arise not only due to transaction costs but also due to transfer costs. Middlemen usually add some services in between that turn middlemen's product superior compared to raw farm products. All the three chosen products in context of rural markets in Bangladesh are homogenous and middlemen do not include any explicit transfer value there.

The remainder of this paper is arranged as follows: section 2 describes different origins of transaction costs and formalize the problem, section 3 describes the rural producers and their marketing options, section 4 estimates the impact of transaction costs both on the discrete choice of marketing channels and on selling intensity of rural producers, and section 5 concludes.

2. Transaction Costs and Producers' Choice: An Analytical Framework

Economists have reasoned the existence of middlemen from different perspectives.[9] However, following the literature on financial institutions, we rationalize the functioning of middlemen by arguing that intermediaries emerge because they are able to economize on the cost of transaction.[10] Transaction cost (henceforth TC) is the gap between buying and selling price.[11] Although TC affects both buyers and sellers, we limit ourselves to the impact on sellers.

One standard assumption of neoclassical economics is costless transaction at market clearing prices, which means exchange involves zero transaction cost. However, once we depart from the frictionless world of neoclassical economics, we find that transaction essentially involves search for potential buyers, negotiation with them, and enforcement of transaction/contract. Each of these steps adds costs to the transaction and generates a wedge between buying and selling price. As a result, transaction costs reduce the market size, and in extreme cases, when transaction costs are very high, the market may fail.

Transaction costs have various origins. However, following Hobbs (1997) the different origins of TCs can be arranged under three categories: i) information and search costs, ii) negotiation costs, and iii) monitoring and enforcement costs. It may be noted that these

[9] For example, middlemen reduce the time period that buyers and sellers have to wait for a transaction to take place (Rubistein, A. and A. Wolinsky. 1987), they reduce the moral hazard problem otherwise faced by buyers (Biglaiser, G. 1993), and improve welfare when product quality is not immediately observable by buyers (Li, Yiting. 1998).

[10] See Townsend, Robert M. (1978) in the context of financial intermediaries.

[11] See Hirshleifer, Jack. (1984), page 421-23.

categories are neither independent nor mutually exclusive as one could influence other. We discuss all three categories in brief.

Information and search costs are an important part of transactions costs (though information problems arise in other contexts as well).[12] The role of information enters into the exchange in the form of communication. One characteristic of perfect market is perfect communication. For voluntary exchange to take place, offers must be communicated and alternatives from both the buyer and seller side must be compared. Due to the high cost or absence of information, these two essential preconditions of exchange cannot meet, and that results in either limited/less than equilibrium transaction or in extreme cases, complete absence of certain desired transactions.

In addition to collecting information and the searching for potential buyers and sellers, economic transactions are usually preceded by negotiations. The negotiation cost of a particular transaction depends on market structure, producer's dependency and product knowledge. While a competitive market provide a producer with more certainty about selling the product, producer's dependency on a limited number of buyers decreases his/her bargaining power and increases negotiation costs. It follows that producer's choice of marketing channel changes the negotiation costs as it changes his/her bargaining power. In addition, high dependency on any product and poor knowledge about the product can influence bargaining power negatively; hence a high negotiation cost results. Other sources of negotiation cost include frequency of sale and risk about the product.

Monitoring and enforcement costs are incurred by a buyer/seller in order to monitor the performance of the counter party and to execute contracts. Transaction cost related to monitoring and enforcement costs varies depending on the type of contract between buyer and seller, payment type, and enforcement of contract. Transactions that require repeated performance of the parties involved, i.e., performance related to a transaction that does not end at a single point in time but extends over more than one period, usually requires monitoring of one party by the other. Such type of transactions usually involves higher uncertainty and costs. Depending on the legal system, the potential cost to a producer for enforcing a contract can be substantial enough to reduce the incentive of long-term contract.

We now formalize the problem by assuming that under a given institutional and technological framework a seller's decision between middlemen versus direct buyer depends on transaction costs minimization. If p is the market price, tc^m and tc^d are the transaction costs associated with selling to middlemen and to direct buyers, and p^m and p^d are the price that a seller gets

[12] See Dasgupta and Stiglitz (1988)

when he sells to middlemen and direct buyer respectively, then the marketing choice, y, of a seller for a particular product depends on:

$$y = y(p^m, p^d; Z^y) \qquad (1)$$

Here Z^y is the institutional environment. Assuming that each producer is a cost minimizer (or equivalently profit maximizer), under a given institutional environment, a producer will opt for direct selling when $p - p^m > p - p^d$. Alternatively s/he will choose middlemen when $p - p^m < p - p^d$ and s/he will be indifferent between middlemen and direct selling when $p - p^m = p - p^d$. However, as both p^m and p^d depend on transaction costs that the producer face and $p^m = p - tc^m$ and $p^d = p - tc^d$, the seller's decision rule depends on p, tc^m and tc^d:

$$y = y(p, tc^d, tc^m; Z^y) \qquad (2)$$

Assuming that the market price p is exogenous to the model, we find that the seller's supply decision, that means the choice between middlemen and direct selling, given by (2) can be rewritten as:

$$y = y(tc^d, tc^m; Z^y) \qquad (3)$$

3. Rural Producers, Marketing Options and Prices

The rural economy in Bangladesh is dominated by crop production. As a result, the majority of households living in rural areas are involved in crop production either as landlords, farmers and sharecroppers or as agricultural workers. In contrast to crop production, households that produce eggs, chicken and milk for the market are usually both land and labour poor and have limited access to crop production. Table-3 presents some basic characteristics of producers of these three products and compares them with the full sample that does not include these producers (labelled as partial sample) and the full sample that includes them (labelled as full sample).

Table-3: Small Producers vis-à-vis Full Sample (mean & standard deviation)

Characteristics	Egg, Chicken and Milk Producers	Partial Sample	Full Sample
Land ownership (in decimal)	93.64 (68.17)	180.17 (286.41)	154.58 (246.19)
Household size	5.17 (1.41)	5.47 (1.86)	5.38 (1.75)
Income, yearly total (in Taka)	47782.50 (32288.15)	86033.08 (124036.53)	74719.53 (106911.4)
Expenditure, yearly total (in Taka)	54634.11 (45198.67)	92778.40 (111474.22)	81496.29 (98190.44)

As can be seen from the table, the mean amount of land that producers of eggs, chicken and milk own is less than that both of the two other samples. Taking household size as a proxy for family labour supply, these households are relatively labour poor compared to the other two samples' households. The claim of their resource poorness is also reflected in their income and expenditures, which are lower than of their counterparts. In addition, assuming that NGO membership is a source of micro credit for such products promoted by NGOs in Bangladesh, one can see that 38.1% of the producers are NGO members compared to 26.5% in partial sample and 29.9% in full sample.

The different channels that rural producers in Bangladesh utilize in marketing their products are brokers, whole-sellers, direct buyers, and bringing to the nearest market. Assuming that there is no difference between selling to the direct buyer and bringing to the nearest market place and selling, i.e., considering both methods as selling to direct consumers, all these different channels can be arranged under two categories: mediated selling and direct selling. Table-4 reports the choice of marketing channels of rural producers.

Table-4: Market Participation Behaviour of Rural Producers and Marketing Channels

Product Name	Percentage of Households that Sales:		
	Only to middlemen	Only to direct buyers	Both to middlemen and direct buyers
Egg	32.81	34.38	32.81
Poultry	17.54	49.00	33.46
Milk	21.15	36.53	42.32

As seen in table-4, the marketing behaviour of agricultural households is essentially censored in nature. Among the 64 households that produce eggs, 32.81% of them sell 100% of their sales to middlemen, 34.38% of them sell 100% of their sales to direct consumers, and the rest 32.81% sell both to middlemen and direct consumers. Among the 57 households that produce chicken, 17.54% of them sell 100% of their sales to middlemen, 49% of them sales 100% of their sales to direct consumers, and the rest 33.46% sell both to middlemen and direct consumers. Among the 52 households that produce milk, 21.15% of them sell 100% to middlemen, 36.53% sell 100% of their sales to direct consumers, and the rest 42.32% sell both to middlemen and direct consumers.

To explore the impact of information in the form of access to telephone on the choice of marketing channels between mediated and direct selling, we have rearranged the table-4 into table-5. Table-5 reports the selling intensity to direct buyers and compares the producers under two categories: producers from villages with telephone and producers from villages without telephone. It appears that for all three products, the former group of producers choose direct buyers over middlemen more than the later group and the differences between the producers of each of the product are significant.

Table-5: Production Sold to the Direct Buyers (Mean): Village with and without Telephone

Products	Village without telephone		Village with telephone		Mean difference
Egg	42.20	(42.69)	80.43	(33.37)	38.24**
Poultry	56.06	(41.75)	96.88	(9.07)	40.81**
Milk	34.10	(43.75)	90.91	(30.15)	56.81**

Numbers in the parentheses are the standard deviation; **Significant at 1% level.

To explore the role of price in selecting marketing channels, we compare the average selling prices that the two groups of producers received when they have utilized only one of the two channels, i.e., we include two polar choices only. Table-6 reports the average (mean) selling price along with the difference in means. With the exception of egg, there is no significant difference between the prices received from two channels; it is only the egg producers that sell their products to direct buyers receive a higher price than those who sell to middlemen.

Table-6: Average Selling Price: Mediated vis-à-vis Direct Selling

Price of:	Only to Direct Consumers		Only to Middlemen		Difference in Means
Egg	11.45	(1.10)	9.40	(1.19)	2.05**
Chicken	68.04	(10.30)	62.00	(12.29)	6.04
Milk	17.05	(4.18)	17.18	(3.16)	-0.13

Standard errors in parentheses; * significant at 5% level; ** significant at 1% level

In addition, we have calculated the difference between the price in the nearest local market and the actual price that the producers received when they sold to middlemen or to direct consumers. Here the nearest Thana town has been taken as the nearest local market. Thana in Bangladesh is the lowest administrative unit and characterized by the presence of direct buyers and intermediaries for agricultural products. Table-7 reports the difference in average selling prices: the first column is the local market price minus direct selling price and the second column is the local market price minus the mediated selling price. As can be seen, none of the differences are statistically significant. It implies that the price that the rural producers receive either from selling to direct consumers or from selling to middlemen is not significantly different from the nearest local market prices. The third column reports the difference of the differences – the difference between column first and second columns; as can be seen, with the exception of chicken, other two price differences are not statistically significant.

Table-7: Difference in Average Selling Price: Local Market vis-à-vis Direct Selling and Local Market vis-à-vis Mediated Selling (Mean and Standard Deviation)

Price of:	Local Market vis-à-vis Direct Consumers		Local Market vis-à-vis Middlemen		Difference in Means~
Egg	2.14	(2.37)	2.25	(2.12)	-0.107
Chicken	3.57	(4.05)	10.0	(9.72)	-6.4286*
Milk	2.16	(2.81)	2.27	(2.05)	-0.1148

~ Calculated as in table-3; standard errors in parentheses; * significant at 5% level; ** significant at 1% level

To relate the difference in price with access to information, we look at the prices of the products received by the producers of the two categories of villages. Table-8 reports the mean price of three different products received by surveyed households and difference in mean prices. As can be seen from the table, though the mean price of milk and chicken producers of villages with telephone is higher than their counterparts, none of the price difference is statistically significant. Prices that the middlemen offer do not seem to be statistically different from the prices that the producers receive otherwise from the direct buyers.

Table-8: Mean Price Received by Producers and Difference in Prices: Village with and without Telephone

Products	Village without telephone		Village with telephone		Mean difference
Egg	10.32	(1.46)	10.75	(2.54)	-0.433
Poultry	70.88	(14.80)	68.13	(10.30)	2.757
Milk	16.54	(2.98)	18.09	(3.11)	-1.554

Numbers in the parentheses are the standard deviation.

To explore the issue further, we have assumed a positive relationship between distance to the nearest telephone and cost of information and we have taken the distance to the nearest telephone as a proxy for the access to the information. To see the impact of access to information on price differences, we have divided all the producers in two usual categories: producers from villages with telephone and producers from villages without telephone. The bivariate correlation shows that the distance to the nearest telephone and the difference in price are positively correlated (the correlation coefficient is 0.232), and the correlation is significant (the level of significance is 0.014). However, in case of the producers from the villages with telephone, the correlation coefficient between price difference and distance to the nearest telephone is not significant.

The explorative type of analysis of this section suggests that the availability of telephone might have some relationship with the rural producers choice of marketing channels between mediated vis-à-vis direct selling. In addition, the distance to telephone might also have some relationship with the observed price differences between the local market and the price that the producers receive. However, the analysis cannot provide any direction of the relationship. In addition, the observed relationship might be a mere correlation and not causation. We explore these issues further in the next section.

4. Empirical Estimation

4.1 *Empirical Specification*

We specify the two observed characteristics of the rural producers: discrete choice between mediated selling vis-à-vis direct selling, and the selling intensity separately.

Discrete Choice: In terms of selecting marketing channels, there are three groups of producers that can be seen from table-1; sell only to middlemen, sell only to direct consumers, and sell

to both middlemen and direct consumers. To see the discrete choice between mediated vis-à-vis direct selling, we consider the last two groups together and form two groups. More specifically, we form these two groups based on whether a producer sales to direct buyer or not.

Econometrically, the specification problem follows a latent regression model:

$$y^* = \beta' tc + \varepsilon \qquad (4)$$

Where y^* the latent variable is unobserved. What we observe is a dummy variable y defined by

$$y = 1 \quad \text{if } y^* > 0$$
$$y = 0 \quad \text{otherwise} \qquad (5)$$

Here tc is the vector of transaction costs variables. We use probit method to estimate this equation. The likelihood function of this model can be written as:

$$L(\beta, \sigma | y_i, tc_i) = \prod_{y_i=0} \Phi(-\beta' tc_i) \prod_{y_i=1} [1 - \Phi(-\beta' tc_i)] \qquad (6)$$

The marginal effects of this model can be written as:[13]

$$\frac{\partial}{\partial tc_{ik}} \Phi(tc_i' \beta) = \phi(tc_i' \beta) \beta_k \qquad (7)$$

Selling Intensity: To account for the intensity, we use a two limits tobit model to specify the behaviour of rural producers. The model choice is motivated by the fact that the observations on dependent variable are censored both at the upper and lower ends. Though there are other alternatives, it was Tobin who first discussed this problem of censored data in the regression context (Tobin, 1958). Later, economists have applied tobit models in different context, e.g., household expenditure, labour force participation, to mention a few.[14]

The use of a particular marketing channel by a producer has a maximum limit, L_i^u, a minimum limit, L_i^l, and values in between. Now if q_i^* is the latent variable and q_i is the observed counterpart, the model can be defined as follows:

$$q_i^* = \beta' tc_i + \varepsilon_i \qquad (8)$$

[13] See Maddala (1983), page 22-23.
[14] See Greene (2000), page 905-906.

$$
\begin{aligned}
q_i &= L_i^l \ \ if \ \ q_i \le L_i^l \\
&= q_i^* \ \ if \ \ L_i^l < q_i^* < L_i^u \\
&= L_i^u \ \ if \ \ q_i^* \le L_i^u
\end{aligned} \qquad (9)
$$

Here, tc_i is the vector of transaction cost related variables, β' is the vector of estimated parameters, and ε_i is the vector of error terms. Following Maddala (1983), the likelihood function of this model can be written as:

$$
L(\beta,\sigma|q_i,tc_i,L_i^l,L_i^u) = \prod_{q_i=L_i^l}\Phi\left(\frac{L_i^l-\beta' tc_i}{\sigma}\right)\prod_{q_i=q_i^*}\frac{1}{\sigma}\phi\left(\frac{q_i-\beta' tc_i}{\sigma}\right)\prod_{q_i=L_i^u}\left[1-\Phi\left(\frac{L_i^u-\beta' tc_i}{\sigma}\right)\right] \qquad (10)
$$

Denoting $\Phi\left[(L_i^l-\beta' tc_i)/\sigma\right]$ and $\Phi\left[(L_i^u-\beta' tc_i)/\sigma\right]$ by Φ_i^l and Φ_i^u respectively, with corresponding definitions for ϕ_i^l and ϕ_i^u, the conditional and unconditional expectations of q_i can be written as:[15]

$$
E(q_i|L_i^l < q_i^* < L_i^u) = \beta' tc_i + \sigma\frac{\phi_i^l-\phi_i^u}{\Phi_i^u-\Phi_i^l} \qquad (11)
$$

$$
E(q_i) = \Phi_i^l L_i^l + \beta' tc_i(\Phi_i^u-\Phi_i^l) + \sigma(\phi_i^l-\phi_i^u) + (1-\Phi_i^u)L_i^u \qquad (12)
$$

Assuming that ε_i is a continuous random variable with mean 0 and variance σ^2, and $f(\varepsilon|tc) = f(\varepsilon)$, we find the marginal effects in our two limits tobit model as:[16]

$$
\frac{\partial E[q|tc_i]}{\partial tc} = \beta \times \Pr ob[L_i^l < q^* < L_i^u] \qquad (13)
$$

4.2 *Data and Summary Statistics*

We use data from a household survey conducted in six different regions in Bangladesh during January and February of 2001. The survey consisted of three villages from each region with a total sample size of 284 households. It followed a two stage stratified random sampling process; at the first stage selecting the strata, and at the second stage selecting the households from each strata. The survey assumed each administrative district as a region, considered each region as a cluster and arranged all the clusters according to the availability of access to

[15] See Maddala (1983), page 160-161.
[16] For a formal proof, see Greene (2000), page 909-910.

telecommunications. At this stage, the survey selected six clusters randomly. Once the clusters were decided, the next step was to select households from each cluster. In order to improve the efficiency of statistical inference, a stratified random sample design was chosen: the households were stratified on the basis of ease of access to telecommunications infrastructure. Access was defined in terms of distance that needs to be travelled to access telecom services. Thus, three strata were created where villages represent strata, and from each village an equal number of households was sampled. Households were selected using systematic random sampling procedure.

The survey contained questions on the households' production and marketing behaviour, the choice of marketing channels, and the variables related to transactions costs. In addition, the survey also collected respondents' personal and family characteristics. Table-9 provides summary statistics of dependent and transaction costs variables. Before proceeding further, we discuss the dependent and TC variables in brief.

Table-9: Summary Statistics

Variables	Variable Name	Mean	Std. Dev.
Dependent Variables:			
Discrete choice between middle and direct buyer	MKT_1	0.757	0.430
Sales to direct consumer as a % of total sales	MKT_2	58.688	44.080
Independent Variables:			
Price difference	P_DIF	2.9118	4.3770
Search and Information			
Price discovery cost	INF_DIS	4.249	4.982
Information availability	INF_SPILL	28.884	21.130
Negotiation			
Dependency on product	PRO_DEP	7.686	9.972
Dependency on buyer^{+}	BUY_DEP	2.572	1.483
Sales frequency^{+}	SAL_FRE	4.488	0.813
Market structure	MKT_STR	19.659	12.822
Knowledge about product quality^{+}	KN_QLTY	4.607	0.980
Risk about the product^{+}	PRO_RSK	3.272	1.585
Monitoring and enforcement			
Type of contract with the buyer^{+}	CON_TYPE	2.376	1.556
Payment type^{+}	PAY_TYPE	1.821	1.010
Enforcement of contract^{+}	CON_ENF	2.867	0.988

The first dependent variable, MKT_1, is the bivariate state between selling to direct buyers vis-à-vis selling to middlemen. Here selling to direct buyers assumes the value one and selling to middlemen assumes zero. The second dependent variable, MKT_2, is the sales to direct consumer as a percentage of total sales.

The first independent variable, the difference between the local market price and the actual price received by the producers denoted by P_DIF has already been discussed in section 3. Two variables related to search and information costs are price discovery cost (INF_DIS) and

information availability (INF_SPILL). For price discovery cost, the distance of nearest publicly accessible telephone in kilometers has been taken as a proxy assuming a positive correlation between distance and cost of information. To capture the information spill over within a village that may reduce search and information cost, the users of a particular village as a percentage of sample size of that village has been taken as a proxy. For this, we have assumed that while there is a positive intra-village information spill over, there exists no such inter-village information spill over. That information flow within a village is higher than between villages is based on the assumption that due to social ties and traditions villagers share information among them through different economic and social interactions.[17] As expected, both information and search costs variables, INF_DIS and INF_SPILL, are highly correlated and the correlation coefficient is significant at 1% level. To avoid this collinearty, we include only the INF_DIS in our estimation.

In case of negotiation costs, all the variables, except dependency on product and market structure have been measured in intervals, 1 to 5 scales. The dependency on the product (PRO_DEP) measures income from the sale as a percentage of total household income. The dependency on buyer (BUY_DEP) measures the dependency on a single buyer where dependency is measured from no dependency to high dependency at a scale of 1 to 5, respectively. The sales frequency (SAL_FRE) is defined as how frequent a producer sells the product and measured from less frequent 1 to high frequent 5. The market structure (MKT_STR) is the number of available buyers for one of the particular products. The knowledge about product quality (KN_QLTY) is defined as whether a producer is aware about the quality of the product and is measured from no to yes at a scale of 1 to 5, respectively. The risk about the product (PRO_RSK) is the risk of damage or spoilage due to non-selling and is measured from no risk 1 to high risk 5.

In case of monitoring and enforcement costs, all the variables have been measured in intervals. The type of contract with the buyer (CON_TYPE) is defined as whether there is any contract between buyer and seller and is measured from no contract to clearly specified written contract at a scale of 1 to 5, respectively. The payment type (PAY_TYPE) is the type of payment and is measured from immediate cash payment to uncertain payment at a scale of 1 to 5 respectively. The enforcement of contract (CON_ENF) is the cost required to enforcing contract and is measured as no cost to high cost at a scale of 1 to 5, respectively.

Before proceeding further it should be noted that some of the variables as mentioned above are measured in 1 to 5 scales. However, for the present estimation purpose, we treat them here

[17] Among the surveyed households, about 19 percent of them reported their neighbour from the same village as a source of information about prices of all the products on an average, which shows the presence of a strong intra-village information spill over.

as continuous variables. In fact one of the reasons for not considering them as dummy variables is the small size of the present sample.[18]

4.3 *Estimation Results*

Table-10 and table-11 report the value of the estimated coefficients along with their respective standard errors and marginal effects. Both tables contain the same set of explanatory variables described in summary statistics. Variables that have been dropped for high correlation with other regressors are INF_SPILL, BUY_DEP, MKT_STR, CON_TYPE, and PAY_TYPE. In order to be more tractable, we discuss the findings under three different types of transactions costs.

Table-10: Estimation Results: The Discrete Choice between Middlemen vis-à-vis Direct Selling. Dependent Variable: Middlemen=0, Direct Selling=1. Method: Probit

Regressors	**Coefficients**	**Marginal Effects**
P_DIF	-0.0431	-0.0098
	(0.0387)	(0.0088)
INF_DIS	-0.1412	-0.0323
	(0.0272)**	(0.0073)**
PRO_DEP	-0.0372	-0.0085
	(0.0146)*	(0.0034)*
SAL_FRE	0.3591	0.082
	(0.2444)	(0.0534)
KN_QLTY	-0.3756	-0.0858
	(0.1913)*	(0.0429)*
PRO_RSK	0.1656	0.0378
	(0.0891)	(0.0201)
CON_ENF	-0.5893	-0.1346
	(0.1891)**	(0.0444)**
Egg dummy	-0.4461	-0.1086
	(0.3384)	(0.0889)
Chicken dummy	1.1255	0.2121
	(0.5710)*	(0.0803)
Constant	3.1088	
	(1.7016)	
Observations	169	169
Log likelihood	-53.392	-53.392
Probability > chi2	0.0000	0.0000
Pseudo R2	0.4298	0.4298

Standard errors are in parentheses; * significant at 5% level; ** significant at 1% level

[18] For a full treatment of this issue, see Robinson (1988) that describes the method of consistent semiparametric regression.

Table-11. Estimation Results: Selling Intensity
Dependent variable: Percentage of production sold to direct consumers, Method: Tobit

Regressors	**Coefficients**	**Marginal Effects**[1]
P_DIF	-2.065	-0.4347
	(1.5844)	(0.3335)
INF_DIS	-8.7053	-1.8323
	(1.3999)**	(0.2947)**
PRO_DEP	-5.4253	-1.1422
	(0.7538)**	(0.1587)**
SAL_FRE	17.7652	3.7400
	(9.484)~	(1.9966)~
KN_QLTY	-6.3908	-1.3455
	(5.9991)	(1.26297)
PRO_RSK	11.2544	2.3694
	(3.9133)**	(0.8238)**
CON_ENF	-18.8789	-3.9745
	(6.7174)**	(1.4142)**
Egg dummy	-51.9093	-10.9341
	(16.0413)**	(3.3771)**
Chicken dummy	22.1838	4.6395
	(20.0578)	(4.2227)
Constant	132.7862	
	(64.3057)*	
No of Observations[2]	169	169
Log likelihood	-392.8642	-392.8642
Probability > chi2	0.0000	0.0000
Pseudo R2	0.1442	0.1442

[1] Conditional on being uncensored; [2] 41 left-censored observations, 60 uncensored observations and 68 right-censored observations. Standard errors are in parentheses; ~significant at 10% level; * significant at 5% level; ** significant at 1% level

Search and Information Costs: Search and information cost has a significant impact on the marketing behaviour of rural producers. Access to information in the form of access to telephone has significant positive impact on the discrete choice of selling to direct buyers and on selling intensity. There exists a negative relation between selling to direct consumers and information costs, and as the search and information costs increase, rural households sell more of their products to middlemen instead of selling to direct buyers.

Negotiation Costs: In case of negotiation costs, the product dependency has a significant impact both on the discrete choice and on the selling intensity to direct buyers; the more dependent a producer on a single product is, the less the probability of selling to direct buyers. As expected high sales frequency has positive effect on the amount of selling to direct buyers. However, it does not have any impact on the discrete choice of marketing channels. The knowledge of producers about product quality affects the amount of direct selling negatively. It implies that as producers become aware of the quality of their products, their bargaining power relative to middlemen and intermediaries increases and reduces the transaction costs

related to negotiation. The other source of bargaining power that has a significant positive impact on the selling intensity is product risk; as risk increases, producers tend to choose direct selling over mediated selling.

Two variables that we could not include here due to high collinearity are market structure and dependency on buyers. As market structure is highly negatively correlated with product dependency and buyer dependency is highly positively correlated with product dependency (the correlation coefficients are -0.509 and 0.564 respectively and both are significant at 1% level), it can be expected that market structure has a positive impact and product dependency has a negative impact on selling to direct buyers.

Monitoring and Enforcement Costs: Transaction costs related to monitoring and enforcement costs have a significant impact on the choice of marketing channels and on selling intensity. Contract enforcement is negatively related with selling to direct buyers and as the cost of contract enforcement increases, producers chose to sell their products to middlemen over direct buyers. Two other variables related to monitoring and enforcement costs that we could not include due to collinerity, contract type and pay type are highly correlated with contract enforcement and product dependency respectively (correlation coefficients are 0.727 and 0.448 respectively and they are significant at 1%). Due to this high correlation, one can predict that formal contracts of households with middlemen reduce selling to direct buyers, and payment uncertainty also reduces selling to direct buyers.

4.4 *Causation or mere Correlation*?

The empirical findings described above suggest that access to information in the form of access to telephone has significant impact on the rural households' discrete choice of marketing channels and it also has significant impact on selling intensity as well. Although both estimates imply that access to telephone significantly reduces transaction costs and increases selling to direct buyers, both estimates assume that the match of a household to the distance of telephone is exogenous. However, if a household's unobserved propensity to sell to a direct buyer is correlated with the distance to telephone, then our estimates will be subject to an omitted variable bias. To address the issue of omitted variable bias, we control for more observed characteristics. In particular, we control for local market and market-leading physical infrastructure that can influence direct selling.[19]

To control for other form of marketing infrastructure other than access to telecommunications, we have added access to the nearest market. For physical infrastructure, the distance of the village from the nearest paved road has been chosen as a proxy. As we are primarily concerned with market reaching physical infrastructure, due to the dominance of road in

[19] Controlling for more observed characteristics as a remedy of omitted variables has been discussed in Evans et al. (1999).

transportation services in Bangladesh, this is a reasonable choice. For proximity to the physical market place, the distance of the village from the nearest Thana head quarter has been chosen as a proxy. The rationale behind choosing Thana as a proxy for the local market has been described in section-3. However, distance to the local market is significantly correlated with the distance to the paved road (the correlation coefficient is 0.151 and significant at 5% level). To avoid possible collinearity, we drop the distance to the nearest local market (Thana), and include only the distance of the village to the nearest paved road.

Table-12: Effects on Marketing Infrastructure on Households' Marketing Behaviour

Dependent variable:	Discrete Choice (Direct buyer=1, Middlemen=0)		Selling Intensity to direct buyers as a % of total production	
Regressors	Probit Coefficients	Marginal Effects	Tobit Coefficients	Marginal Effects
Road	-0.2365 (0.0989)*	-0.0511 (0.0206)*	-16.288 (4.0220)**	-3.6902 (0.9112)**
Information	-0.1456 (0.0285)**	-0.0315 (0.0075)**	-8.6343 (1.3866)**	-1.9562 (0.3141)**

Standard errors are in parentheses; * significant at 5% level; ** significant at 1% level

Table-12 reports the coefficients and marginal effects of road and information on households' marketing choice. Table-13 and table-14 provide the coefficients and related statistics of other regressors. The estimation results show that physical infrastructure has significant impact on rural producers' choice of marketing channels. In addition, as this variable is significantly correlated with the proximity to the nearest market, the local market may also play a significant role. However, though access to road has a significant impact on households marketing behaviour, inclusion of this additional variable does not change the significance of the effects of access to information on households marketing behaviour. The results imply that access to information in the form of access to telephone has significant impact on household's choice of marketing channels between middlemen and direct buyers.

Table-13: Estimation Results: The Discrete Choice between Middlemen vis-à-vis Direct Selling. Dependent Variable: Middlemen=0, Direct Selling=1. Method: Probit

Regressors	Coefficients	Marginal Effects
P_DIF	-0.0575	-0.0124
	(0.0411)	(0.0088)
INF_DIS	-0.1456	-0.0315
	(0.0285)**	(0.0075)**
ROAD	-0.2365	-0.0511
	(0.0989)*	(0.0206)*
PRO_DEP	-0.0409	-0.0088
	(0.0152)**	(0.0033)**
SAL_FRE	0.4007	0.0866
	(0.2629)	(0.0534)
KN_QLTY	-0.3249	-0.0702
	(0.1933)~	(0.0417)~
CON_ENF	-0.6162	-0.1332
	(0.1927)**	(0.0431)**
Egg dummy	-0.3996	-0.0918
	(0.3413)	(0.0847)
Chicken dummy	1.1737	0.207
	(0.5991)*	(0.0777)*
Constant	3.8236	
	(1.6828)*	
Observations	169	169
Log likelihood	-52.1182	-52.1182
Probability > chi2	0.0000	0.0000
Pseudo R2	0.4434	0.4434

Standard errors are in parentheses; ~significant at 10% level; * significant at 5% level; ** significant at 1% level

Table-14. Estimation Results: Selling Intensity
Dependent variable: Percentage of production sold to direct consumers, Method: Tobit

Regressors	**Coefficients**	**Marginal Effects**[1]
P_DIF	-2.8975	-0.6564487
	(1.5684)~	(0.3553357)~
INF_DIS	-8.6343	-1.956163
	(1.3866)**	(0.3141422)**
ROAD	-16.288	-3.69018
	(4.0220)**	(0.911224)**
PRO_DEP	-5.3794	-1.218746
	(0.7280)**	(0.1649255)**
SAL_FRE	15.8861	3.599133
	(9.4524)~	(2.141521)~
KN_QLTY	-3.3305	-.7545441
	(5.8804)	(1.332245)
CON_ENF	-18.1304	-4.107602
	(6.4646)**	(1.464619)**
Egg dummy	-47.4054	-10.7601
	(15.4106)**	(3.49140)**
Chicken dummy	16.9887	3.827046
	(19.6164)	(4.444257)
Constant	192.6541	
	(61.3582)**	
No of Observations[2]	169	169
Log likelihood	-388.249	-388.249
Probability > chi2	0.0000	0.0000
Pseudo R2	0.1542	0.1542

[1] Conditional on being uncensored; [2] 41 left-censored observations, 60 uncensored observations and 68 right-censored observations. Standard errors are in parentheses; ~significant at 10% level; * significant at 5% level; ** significant at 1% level

5. Conclusion

Accesses to information and transaction costs have important impact on rural producers' choice of marketing channels between middlemen and direct buyers of agricultural products in Bangladesh. The empirical findings of this paper suggest that transaction costs, particularly information cost has significant influence on the farm households' discrete choice of marketing channels and continuous choice of selling intensity to direct buyers over middlemen. Apart from information costs, transaction costs related to negotiation, and monitoring and enforcement are also important.

For the small producers of rural regions, access to information appears to be important to link them with direct buyers. Under the given circumstances in Bangladesh, access to information in the form of access to telecommunications can reduce the transaction cost related to search and information costs of small producers significantly, and induce direct selling over mediated selling. However, other market reaching physical infrastructures, for instance paved road, and proximity to physical market are also important to link the rural producers with the direct buyers.

Aspects of transaction costs related to negotiation costs and hence bargaining power are either intrinsic with the products or broad and difficult to capture. For example, with the absence of any storage and processing facility, high sales frequency of eggs and milk is a necessary precondition due to the intrinsic nature of those products. As a result, producers of such products would like to sell to a regular buyer. As can be predicted a priori, a higher number of buyers are associated with a higher amount of direct selling, which support the lower transaction costs linked to a competitive market structure.

The monitoring and enforcements costs are primarily to do with the contractual arrangements and legal framework. Producers seem to link with middlemen with formal contractual arrangements that reduce the likelihood of selling to direct buyers. As it is expected, formal contracts with middlemen and intermediaries reduce selling to direct buyers.

Findings of the paper also suggest that the existence of middlemen in rural areas ensures price equality. As the empirical findings suggest, price does not work as a significant incentive to show any discrete shift in producers' choice between mediated vis-à-vis direct selling or in selling intensity. That means, once we control for possible sources of transaction costs, the different channels that the rural producers use in Bangladesh do not result in significant price differences, neither between different channels nor between the local market and channels.

References

Akerlof, G.A. (1970). 'The market for lemons: qualitative uncertainty and the market mechanism', *Quarterly Journal of Economics*, vol. 84, pp. 488-500.

Biglaiser, G. (1993). 'Middlemen as experts', *Rand Journal of Economics*, vol. 24, pp. 212-23.

Coase, R.H. (1937). 'The nature of the firm', *Economica*, vol. 4, pp. 386-405.

Dasgupta, P., and Stiglitz, J. (1988). 'Learning-by-doing, market structure, and industrial and trade policies', *Oxford Economic Papers* vol. 40, pp. 246-268.

Evans, W.N., Farrelly, M.C., and Montgomery, E. 1999. 'Do workplace bans reduce smoking?', *The American Economic Review*, vol. 89, pp. 728-747.

Fahlbeck, E. (1996). *Essays in Transaction Cost Economics*. Swedish University of Agricultural Sciences (SLU), Uppsala 1996.

Freixas, X. and Rochet, J-C. (1997). *Microeconomics of Banking*. The MIT Press, Cambridge.

Greene, W. H. (2000). *Econometric Analysis*. 4th Edition. Prentice-Hall Inc., New Jersey.

Hirshleifer, J., and Hirshleifer, D. (1984). *Price Theory and Applications*, 3rd edition. Prentice-Hall, NJ.

Hobbs, J. E. (1997). ,Measuring the importance of transaction cost in cattle marketing', *American Journal of Agricultural Economics*, vol. 79, pp. 1083-1079.

Key, N., Sadoulet, E., de Janvry, A. (2000). 'Transaction costs and agricultural household supply response', *American Journal of Agricultural Economics*, vol. 82 (2), pp. 245-269.

Leff, N.H. (1984). 'Externalities, information costs, and social benefit-cost analysis for economic development: an example from telecommunications', *Economic Development and Cultural Change*, Vol. 32, pp.255-76.

Li, Y. (1998). 'Middlemen and private information', *Journal of Monetary Economics*, vol. 42, pp. 131-159.

Maddala, G.S. (1983). *Limited-Dependent and Qualitative Variables in Econometrics*. Cambridge University Press, New York.

Masten, S.E., Meehan, J.W., and Snyder, E.A. (1991). 'The costs of organization,' *Journal of Law, Economics and Organization*, vol. 7, pp. 1-25.

Minten, B. and Kyle, S. (1999). 'The effect of distance and road quality on food collection, marketing margins and traders' wage: evidence from the former Zaire', *Journal of Development Economics*, vol. 60, pp. 467-495.

Robinson, P.M. (1988). 'Root-N-Consistent Semiparametric Regression,' *Econometrica*, vol. 56, pp. 931-954.

Rubistein, A. Wolinsky, A. (1987). 'Middlemen', *Quarterly Journal of Economics*, vol. 102, pp. 581-593

Stiglitz, J. E. (1988). 'Economic organization, information, and development', in: H. Chenery and T.N. Srinivasan (eds.), '*Handbook of Development Economics' Volume 1: 92-160.* Elsevier Science Publishers

Tobin, J. (1958). ,Estimation of relationship for limited dependent variables. *Econometrica*, vol. 26, pp. 24-36.

Townsend, R. M. (1978). 'Intermediation with costly bilateral exchange', *Review of Economic Studies*, vol. 55, pp. 417-45.

Williamson, O.E. (1975). *Markets and Hierarchies: Analysis and Antitrust Implications*. The Free Press, New York.

_____1995. 'Comparative Economic Organization: The Analysis of Discrete Structural Alternatives', In: Williamson, O.E and Masten S.E (eds.), 1995. *Transaction Costs Economics*, vol. 1: Theory and Concepts. Aldershot: Edward Elgar Publishing.