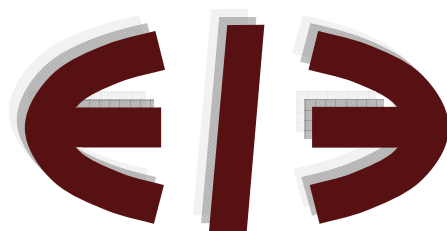# EERI

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**Participation and Contract Choice in the Tenancy Market:
Micro Evidence from Rural Bangladesh**

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Participation and Contract Choice in the Tenancy Market: Micro Evidence from Rural Bangladesh

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Abstract

Though sharecropping remains widespread, its determinants are still poorly understood and the debate over the extent of risk-sharing and moral hazard is far from settled. Moreover, existing empirical study very often plague by selection problem. We address both issues using data from rural Bangladesh. This paper tested a model empirically where the leasing decision and contract choice are simultaneous. A modified Heckman model is estimated which avoids the selectivity bias of observed contracts. Empirical tests reject the hypothesis of pure risk sharing and a wide range of support for the presence of moral hazard problem in the choice of contracts.

Key words: Contract choice, Heckman model, Moral hazard, Risk, Sharecropping

JEL Classification: Q15

Acknowledgement

1.1 Introduction

Empirical literature on finding the determinants of contract choice in the agricultural markets has generally used a single equation model, whereas optimizing operational farm size through the informal tenancy market in the presence of imperfect/ missing markets has been analyzed separately. The recent theoretical literatures on contract farming propose four major hypotheses that explain the choice of a specific contract: optimal risk-sharing, optimal incentives, moral hazard and transaction costs (studied by Allen and Lueck, 2003; Fukunaga and Huffman, 2009). Whereas literature focusing on adjustment through tenancy, recognizes that well-functioning tenancy markets could allow the reallocation of labour from agriculture to the non-agriculture sector, the more productive farmers may increase their operational size and thus income in order to gain access to additional land, (argued by Skoufias, 1995; Jin and Deininger, 2009). Despite the importance of the issue, no studies provide in depth empirical evidence on the simultaneity of participation and contract choice decision. To fill this empirical research gap, this study brings together two separate strands of literature. It provides a joint analysis of optimizing operational land through participation in the lease market, and choosing a particular contract depending on the risk attitude and moral hazard problem. Through this, the sample selection bias due to the non-randomness nature of the decisions that plagues studies on tenancy choice very often can be avoided.

This study makes some economic contribution, particularly for the case of rural Bangladesh where so far no intervention in the tenancy market has been successful. The informal land rental markets are emerging in many parts of the developing world in response to the inability of formal land distribution/administration systems to meet the growing demand for land and correct imbalances in factor proportions at the farm level. The aim of this study is to test the scale of opportunity costs of participating in the land-lease market together with testing the risk-sharing and moral hazard hypothesis in the choice of contract. The underlying theoretical model is based on the principal-agent model where the landlord is considered as the principal and the tenant is considered as the agent. Farmers participating in this informal land lease market share the common objectives of increasing production and income and thereby improving their welfare status although both groups have their own optimization problems. As theory suggests, but overlooked by empirical studies, this research focuses on testing opportunity costs, risk attitude and the moral hazard hypothesis separately for both groups: the tenants and the landlords. This would eventually give some policy guidelines.

About 73 per cent of the 116 million people who live in rural Bangladesh depend on the agricultural activities for their income and employment. Cropland available per capita diminished by about 50 per cent in Bangladesh between 1970 and 1990, to only 0.08ha compared to the world average 0.27ha (World Bank, 1997). Since land is in short supply in

this densely populated agrarian economy, access to land through land rental markets has been an important way to increase operational farm size. About 23 per cent of the total cultivated land is farmed under different tenurial arrangements. The most common form of tenancy relationship in Bangladesh is sharecropping (bargadari), which gives the landlord usually half of the production, while the sharecropper after providing all labour receives the other half. This system is usually known as adhi barga (which represent half of the share). In some areas landowners receive a predetermined amount of money for a specific time period or crop from tenants and this is called a fixed-rent contract. In few areas the tin barga (three shares) system has been introduced, where production is divided into three shares according to land, labour and capital.

This study uses micro-level data for rice farmers in rural Bangladesh. This is done first, by looking at the opportunity costs of leasing-in and leasing out land in the presence of unobserved risk and monitoring problems. Second, using several measures of a household's risk-sharing ability, the research assesses the extent to which risk averseness among the participating farmers affect the contract choice. Here the focus is to evaluate the importance of possession of land assets, working capital, credit and social connections in a locality in determining the choice of contract. Finally, by comparing the landlord's and the tenant household's monitoring ability, the study tries to identify the extent to which constraints for monitoring are important for entering into the informal lease market and picking a particular contract in the absence of any insurance market.

The main findings suggest that, in rural Bangladesh, the extent of availability of family labour and possession of land assets largely affect the tenant farmer's decision to enter into the agricultural tenancy market. A tenant's risk averseness on contract choice is reflected only through his own economic evaluation rather than his possession of other types of land asset and available working capital or credit facilities. Similarly, the landlords increase the amount of land to lease out if they have abundant land and scarcity of available family labour. These results draw attention to two issues: first, it supports the labour-intensive nature of the agriculture system in rural Bangladesh like many other developing countries. Second, it points towards a missing market for the agricultural wage labour. On the choice of contract, a landlord's proxies for risk averseness are insignificant suggesting that they are more or less risk neutral.

The tenants in this analysis face a significant moral hazard problem with female headed households and the number of healthy people in the household. Some empirical results are puzzling. For example, even if theoretically the landlord is supposed to be suffering from a monitoring problem, the estimated results do not show any impact of this on contract choice. However the landlords do face the moral hazard problem when they decide about the amount of land to lease out. It is evident from this research that sharecropping contracts are

more likely to be offered to poor vulnerable tenants, which is in line with the findings of other works. [1]

The empirical evidence in favour of the above hypotheses is mixed and challenging. For example, Holmstrom (1979) showed that in the presence of imperfect markets contract choice is driven primarily by risk-sharing and setting incentives for effort. However, Allen and Lueck (1992, 1993, 1999 and 2003) use wealth as a proxy to represent the effects of key parameters on contract choice and conclude that risk-sharing associated with contract choice is not a major factor in North American agriculture. A similar conclusion was drawn by Laffont and Matoussi (1995). Ackerberg and Botticini (2000) provide a re-examination of the risk aversion in contracting. Their works were the first to test all three hypotheses and suggested that moral hazard and imperfect capital markets are important factors in Tuscan agriculture. Dubois (2002) in his analysis rejects the model of risk-sharing for Philippines farmers and shows that the landlords prefer to use more incentive-based contracts for more fertile plots and less incentive-based ones when crop choices induce land overuse. Huffman and Fukunaga (2004) considered equilibrium in the landlord-tenant relationship where the supply of potential agents is larger than required to meet all contracts offered by the principals. Therefore, it is obvious from the above discussion that the findings of the empirical works, each focused on a particular economy can give reasonably diverse results. So far, Rainey et. al. (2005) and Fukunaga and Hauffman (2009) are the only studies providing some support that the attributes of landlords may also affect tenancy choice. However, their results are somewhat unconvincing. This is because the estimates consider only a group of landlords who lease out land and omits the tenants who lease-in land. The specific reasons for participation vary between the two contracting groups. Why these types of informal contracts (i.e. crop-share or fixed-rent contracts) co-exist within the same locality cannot be fully explained from the existing literature. Therefore, it is worth considering all of them to get a hold of the full picture by using an appropriate econometric model such as the Heckman selection model. Although the Heckman selection model is widely used in labour economics to determine the optimal wage, it also offers interesting insight into the underlying mechanism of the agricultural lease market. For example, the modified Heckman model used in this study is helpful to compare the heterogeneity between the tenants and the landlords in rural Bangladesh. This paper can be viewed as bridging the gap between two strands of literature to get the full picture.

The reminder of the paper is organized as follows: the next section outlines a simple principal-agent model of contract choice. Section 1.2 outlines the theoretical basis for the

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[1] See Ackerberg and Botticini (2002), Dubois (2002) and Laffont and Matoussi (1995)

estimation. Section 1.3 focuses on empirical methodology 1.4 deals with the description of data. Section 1.5 presents results of the empirical analysis along with description of the data and preliminary evidence from the data. Section 1.6 concludes.

1.2 Conceptual Model

This section summarizes a simple principal-agent model based on the models of Cheung (1969) and Janvry (2004) where the landlord is the principal and the tenant is the agent and both parties are assumed to be risk averse.

Assume that the production function of a cultivable plot is

$$q = \theta q(L; \bar{A}) ; \quad q'_L > 0; \quad q''_L < 0; \quad q(0) = 0 \tag{1}$$

where L = tenant's effort, $\bar{A}$ = fixed land area, θ is the random term ~$(1; \sigma^2)$; ex-post relative to decision on L (price and output risk)

Landlord's income

$$Y = rq(L)\theta + R \tag{2}$$

Tenant's income

$$y = (1 - r)q(L)\theta - R \tag{3}$$

where r = landlord's output share, $(1 - r)$= tenant.s output share, R = fixed- rent, hence the contract specialized to share if $1 > r > 0$ and $R = 0$; fixed-rent if $r = 0$ and $R > 0$ and a wage contract if $r = 1$ and $R < 0$ Two decisions come from this system - effort L decided by the tenant ; and contract term $(r; R)$ decided by the landlord.

If the landlord and the tenant are both assumed to be risk averse and concerned about each other's unobserved effort, then the tenant's problem becomes:

$$\max_L U_T = EU(y; L) = EU[(1 - r)\theta q - R; L] \tag{4}$$

and the landlord's problem becomes

$$max U_F = EV[rq(L)\theta + R] \tag{5}$$

$$s.t. max U_T = EU[(1 - r)\theta q - R; L] and \ U_T \geq \overline{U_T} \ where \ \overline{U_T} \ is \ tenant's \ reservation \ utility$$

Solving the tenant's problem gives:

$$q'_L = -\frac{EU'_L}{(1 - r)EU'_y \theta} \tag{6}$$

if $EU'_L = U'_L$ = marginal utility of leisure which is not stochastic and with no risk $EU'_y = U'_y$= marginal utility of income.

To analyze the role of risk on L, one can compare U'_y and $EU'_y\theta$. We know that, $cov(x; y) = E(x - \bar{x})(y - \bar{y}) = Exy - \overline{xy}$. Hence, $cov(U'_y ; \theta) = EU'_y\theta - EU'_y E\theta$, hence with no risk $EU'_y\theta < EU'_y = U'_y$.

Solving the landlord's problem gives:

$$r = -\frac{q\dfrac{1 - EU'_y\theta}{EU'_y}\Big/\dfrac{EV'\theta}{EV'}}{q'_L\dfrac{dL}{dR}} \tag{7}$$

In order to approximate V' ; $V'\theta$; $EU'_y\theta, U'_y$ as a function of r, σ^2 and the level of risk aversion and moral hazard problem of the tenants and the landlords. Hence the landlord's share depends on his own risk aversion and his disincentive due to the moral hazard problem as well as the tenant's risk aversion. For the risk neutral tenant and landlord, $r = 0$ and $R > 0$, thus both the parties would choose fixed-rent contract. The value of r increases with the level of risk aversion of the tenant and the landlord. If the contract terms are always chosen by the landlord, depending on his level of risk aversion and moral hazard of unobserved effort, a mixed contract with both the share- and fixed-rent component is possible.

However, it is clear from equation (6) that the tenant also maximizes his returns from the choice of contract depending on his own level of risk aversion, EU'_y and his output share $(1 - r)$. The tenant's output share again depends on the landlord's problem which is solved in equation (6). Therefore, the tenant can also self-select in the tenancy market because the outcomes of the two tenancy contracts are different.

Hallagan (1978) uses a self-selection model where in the presence of asymmetric information, the tenant chooses among the contract alternatives to maximize output, Y , from his effort , L. Let $\underline{W}$ be the fixed quantity of work and w is the wage. The tenant's self-selection model can be interpreted by figure below (Figure 1.1), where fixed wage: $q = w\underline{W}$ share contract: $q = (1 - r)q$; fixed-rent: $q = q - R\bar{A}$.
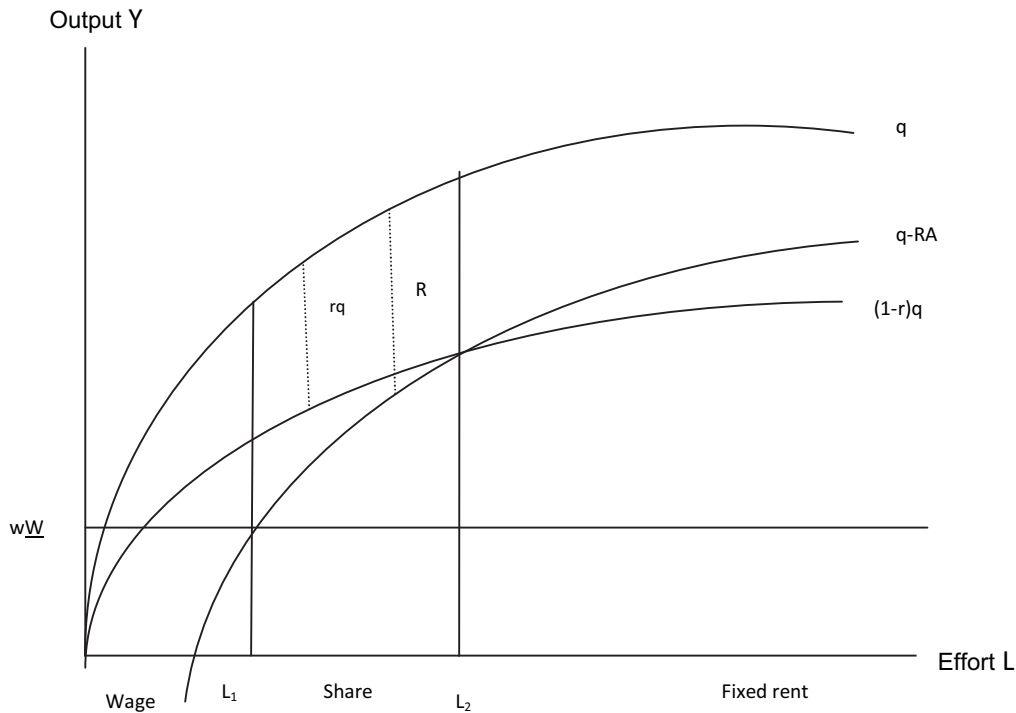
Output Y

Fig. 1.1 Tenant self-selection model (source: Hallagan, 1978)

The tenant self-selection model does not explain sharecropping under certainty since it should never be offered by the landlord. Moreover, if in an economy, it is the landlord who ultimately decides on the choice of contract, the tenant's risk- sharing attitudes would not show any significant role in his choice of contract.

Comparing the basic principal-agent model and the model with self-selection in order to be acquainted with the actual mechanism of the tenancy market and the choice of contracts, one needs to analyse the model with both parties' perspective included. The empirical analysis in this study investigates the significance of unobserved risk and effort on the choice of contracts using two sub-samples:- one for the tenant household and another for the landlord household. It is still possible that there may be considerable variations in the factors between these two groups in choosing either a share cropping contract or fixed-rent contract. The theoretical approach of risk-sharing and testing the presence of moral hazard proposes a couple of predictions that are subject to empirical testing. Firstly, because share tenancy cannot fully motivate the tenant to work, but reduces risk from the tenant, it is predicted to be adopted by the tenant with greater risk aversion and lower moral hazard problem. Theoretically income, assets and tolerance to risk affect the tenant's risk aversion. Practically, the tenants are thought to be more risk averse if they have lower wealth[2]. In this

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[2] See Binswanger, (1981); Rosenweig and Binswanger, (1993).

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sense, having more opportunities of stable employment strengthens the tenant's tolerance to risk and choosing a fixed- rent contract. Secondly, the landlord will consider his capacity to monitor the tenant when he chooses to offer a particular contract.

This study thus empirically examines the following hypotheses using data from rural Bangladesh:

(i) Opportunity cost and factor market imperfection: the higher the opportunity cost (represented by the reservation income) of participating in the land rental market the lower the probability that farmers will participate.

(ii) Risk aversion: if risk-sharing is important, then the more risk averse a tenant is, the lower the likelihood that a fixed-rent contract will be chosen. By contrast, the more risk averse a landlord is, the lower the likelihood that a crop-share contract will be chosen.

(iii) Moral hazard: the higher the marginal cost of evaluating the effort devoted by the tenant to production by a landlord, the larger the probability that fixed- rent contracts are offered since they offer more incentive from the landlord's point of view. It should have the opposite effect for the tenant farmers who largely rely on the available family labour for the cultivation process.

The puzzle with these kinds of standard principal-agent models is that key parameters for risk aversion are not directly observable such as levels of wealth and working capital, experience, credit access etc. The empirical literature uses proxy variables for various parameters of these equations.

1.3 Empirical Methodology

In order to test the three competing hypotheses for participation and contract choice, this research relies on a reduced form approach involving estimation of the modified Heckman selection model[3]. The decision to lease-in to lease out land is represented by the amount of land that is leased. Conditional on these decisions relating to the types of rental contracts chosen are de.ned as dichotomous latent variables. From equation (6) and (7) both groups want to maximize their utility from participating in the lease market. An important assumption here is that these two groups of farmers are distinctly different with respect to their socio-

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[3] The modified Heckman model was .rst used by Plumper et al. (2005) followed by Clatworth et al. (2009) and Tauchman (2010).

economic circumstances[4]. The following sub sections discuss the details of the econometric model and the identification strategy.

1.3.1 Rationale for Simultaneous Choice to Participate and to Choose a Contract

A typical approach to analysing data on social position (e.g. owner, tenant or landlord) and determinants of contract choices is covariance analysis. This approach, based on the theoretical model explained in section 1.2, assumes that, once other measured variables that affect the contract choice dummy are taken into account, the process by which individuals are sorted into positions is independent of the factors influencing the outcome itself. Such strong assumptions are often untenable, however there is no reason to assume that the decisions to enter into the land tenancy market and then to choose a certain contract are independent especially in the tenancy market (like many other markets) with asymmetrical information where individuals choose their position based on the expected outcome from the choice of contracts Thus the two decisions are simultaneously related. While theoretically it is difficult to design, empirically it is possible to account for this simultaneity. This analysis therefore, use a two-stage model based on a tree structure of choice of tenancy contract path, as shown in Figure 2.2. Farmers at the beginning of the cropping season are assumed to follow two sequential decisions. The first decision is, whether he chooses to enter into the lease market or not. If he chooses to participate in the lease market a household then can either lease-in land (termed as a tenant) or lease out land (termed as a landlord) land. The second decision, depending on the outcome of first stage relates to what type of contract a farmer would choose, i.e. if a farmer wants to lease-in some land, then he have to choose between sharecropping contract and fixed-rent contract. Similarly, if the farmer decides to lease out some land, then he has to choose a contract between sharecropping and fixed-rent. There may be also some farmers who both lease-in and lease-out land in the same cropping season. However, in the data set and also in rural Bangladesh, this phenomenon is not commonly observed.

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[4] Most of the literature examining the determinants of land market transactions (e.g. Deininger et al. 2003; Teklu and Remi, 2004; Masterson, 2007; Holden et.al. 2007) also implicitly assumed that the decision to lease-in and lease out land are independent of each other.
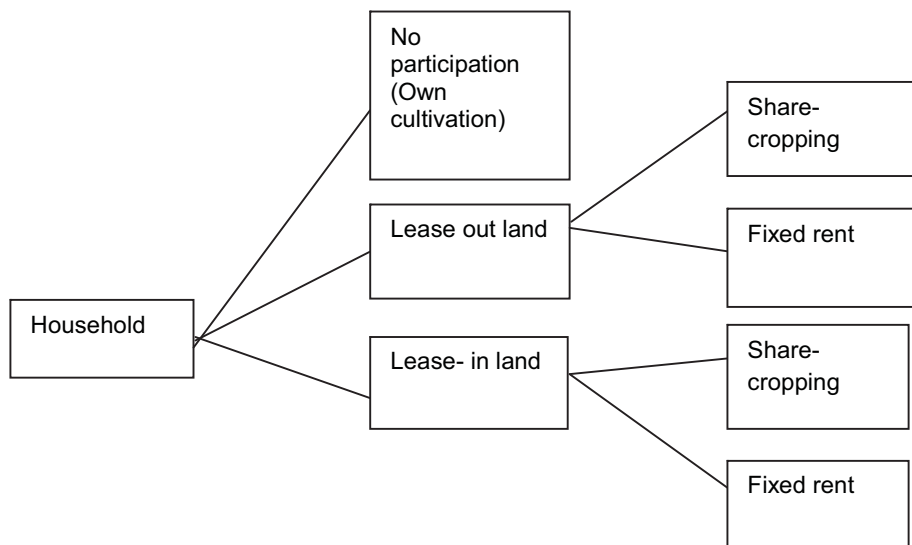
Figure 2.2 Tree for two stages model

There are some decision variables which are specific to each stage and some variables are likely to affect both stages. Moreover, some unobservable variables may affect both decisions. Farmers may also choose not to participate when their reservation income/utility is greater than the expected share/ expected outcome.

A solution of this problem can be identified if there are one or more variables that strongly affect the chances for participation (e.g. reservation income) but not the outcome under study (contract chosen). In these circumstances, the bivariate probit with selection model provides consistent, asymptotically efficient estimates for all the parameters in such a model[5]. The first stage regresses the choice between leasing out (or leasing-in) versus not participating, which allows us to study the determinants of the landowner's decision to lease out (or lease-in) land. The second stage regresses the choice between a sharecropping and a fixed-rent contract conditional upon having decided to participate and allows studying the determinants of the farmers' contract choice. Finally, to provide additional insight into the nature of the joint choices made by individuals, we estimate the marginal effects of covariates on the probabilities of each combination of alternatives. The marginal effects allows us to understand changes in socio-economic characteristics which may affect the final four choices.

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[5] Andrews (1989)

1.3.2 Identification Strategy

From the data one can observe more than in the partial observability model but less than in the full model. In the case of the effects of risk averseness and moral hazard problems on tenancy, contract choice, we assume that there is an underlying regression relationship, so that:

$$contract_j = \beta x_j + \mu_{1j} \qquad outcome\ equation \qquad (8)$$

Where $contract_j$ is a dichotomous variable and is equal to one if share contract is chosen and zero if the fixed-rent contract is chosen; x_j denotes the observable proxies for risk attitudes of the person who decides the contract as well as of the other party and moral hazard of the contractor. This dependent variable, however, is not always observed. Rather, the dependent variable for observation j is observed if the farmer chooses to participate in the land market. Hence j is observed if

$$participation_j = \gamma z_j + \mu_{2j} \quad selection\ equation \qquad (9)$$

The participation variable is the amount of land a participant leases in the tenancy market (hence a tenant or a landlord depending upon the decision to lease-in or lease out, respectively) and zero if he is an owner cultivator.

Where

$$\mu_1 \sim N(0;\ \sigma)$$
$$\mu_2 \sim N(0;\ 1)$$
$$corr(\mu_1;\ \mu_2) = \rho$$

Therefore, $participation_j$ variable is measured by a truncated Tobit equation where the latent variable cannot always be observed while the independent variables are observable. Note that a selection problem does not exist in two types of situations (Achen 1986, 1978-1979). First, it might be the case that the unmeasured factors influencing the selection equation are uncorrelated with the unmeasured factors influencing the outcome equation. Second, there is no selection problem if every variable influencing selection is controlled in the outcome equation. The problem is that most selection processes are complex and the complete list of variables influencing selection is often not measured, cannot be measured, or are unknown. If these two types of situation do not occur, then we have a selection bias problem.

Thus, when $\rho \neq 0$, standard regression techniques to the first equation may yield biased results. There are three types of observations in a sample with the following probability:

$$Pr(participation = 0)$$
$$Pr(participation > 0, contract_j = 0)$$

$$Pr(participation > 0, ccontract_j = 1)$$

This is equivalent to Heckman.s selection model except that the problem has a discrete choice variable (choice of tenancy contract) in the outcome equation and a discrete variable (amount of land leased-in or leased out) in the selection equation. The modified Heckman selection model[6] provides consistent, asymptotically efficient estimates for all the parameters. This model would be identified by the exclusion of one or more instrumental variable in the outcome equation which is assumed to have a direct effect on the selection equation. The following section has detailed discussions on this and other variables of interest.

1.3.3 Testable Implications: Variables of Interest

This section focuses on developing a set of intuitions about the coefficients of explanatory variables in both stages. It emphasizes both opportunity costs and risk-sharing incentives.

Selection Equation

In the first stage the study assumes that land tenancy market participation is driven by access to opportunities outside the farm sector and by ability[7]. In order to participate in the land tenancy market the landlord has to offer at least as much as the tenant's reservation utility. Hence, farmers may choose not to participate when their reservation income/utility is greater than the expected share/ expected outcome.

(1) Reservation income/ utility of the farmers: proxied by income from trade and income from service, i.e. non-agricultural incomes, credit from the formal sources such as banks, Grameen Bank and cooperatives, and credit from informal sources such as loans from money lenders, traders, friends and relatives. The framework assumes that the tenant farmers possessing higher reservation income would have a lower likelihood of participating in the land market because of high opportunity costs in the tenancy contract. For landlords, as their utility maximization problem includes the net benefit from renting out the land together with the contract shape, the higher non-the agricultural income may facilitate their shifting from the agricultural sector to the non-agricultural sector, thus, decrease the probability of participating in the land tenancy market.

(2) Factor market imperfections: household characteristics such as the dependency ratio(i.e. the number of dependents in the household relative to the other member of the household), male and female the agricultural labour and bullock power are used to test for the presence of imperfections in the factor markets. Intuition here is that if the household has more

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[6] Clatworth et.al. (2009); Tauchmann (2010)

[7] Deininger and Jin (2005)

competent the agricultural labour and bullock power the likelihood of participating in the land market will increase for tenant farmers and decrease for landlord farmers. On the other hand, higher ratio of female labourers and a high dependency ratio should have the opposite effect. This is because these characteristics may increase the managerial cost of participation due to the moral hazard problem.

(3) Identification: the selection equation in this study is identified by the inclusion of an electricity dummy variable for the access to electricity by a farming household during 2000-04. Availability of electricity identifies the economic status of a rural household. It is rational to assume for rural Bangladesh that access to electricity affects the participation in the land lease market but not the contract choice decision. This variable is assumed to have a negative significant effect on the selection equation for both the tenant and the landlord but for different reasons. The tenant farmer adheres to the belief that poor tenants (thus with no electricity access) will lease-in more land and landlords and rich farmers (with access to electricity) will shift from agriculture and decrease the scale of participation in the land-The lease market.

Outcome Equation

The outcome or contract choice equation includes only those farmers who enter into the land tenancy market. Here the analysis aims to prove the risk-sharing and moral hazard hypotheses. The estimated model examines how differing risk perceptions by both the landlord and the tenant affect contract type selection.

(1) Risk averseness of the tenant and the landlord have been tested through two models in this study: In model 1 risk averseness is proxied by wealth (amount of land assets owned), working capital (income from trees, goat and poultry rearing, etc.), non-the agricultural income[8], self economic assessment and social connection (NGO membership).

Intuition: This approach says that for the tenant the probability of choosing a crop-share contract increase with the tenant's own financial weakness and the landlord's financial strength. For the landlord farmer the intuition would be the opposite.

The more non-the agricultural income a tenant has the less risk averse he is which would increase the likelihood of choosing a share-cropping contract.

In order to test the risk-sharing hypothesis, model 2 uses three new proxies which are all weighted values of farmers' wealth, working capital and income. These variables are: farmers' debt to capital ratio, debt to income ratio, and assets per capita (assets are de.ned as the amount of all types of land assets a farming household has).The intuition here is that

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[8] Here following Deininger (2008) non-agricultural income is assumed to be exogenous. This is a sensible assumption for many agricultural developing countries where the scope of off-farm employment opportunity is very small.

for the tenant farmers, the probability of choosing a crop-share contract should increase with the tenant's own debt burden and the landlord's financial strength. However, more assets per capita should have the opposite effect.

 (2) Presence of moral hazard: An alternative model emphasizing the agency theory or moral hazard problem is estimated. With this approach, each contract may have unique opportunities for morally hazardous behaviour, i.e., the tenant farmers may take advantage of the landlord without detection. Variables describing the experience and managerial abilities are utilized to test the agency problem hypothesis. Among households the following variables are used as proxy variables to test for moral hazard hypothesis: dependency ratio, number of healthy people, experience, and female headed households. Intuitions behind using such proxies are: for a landlord, the more dependent members there are in a household or if the household head is female, that landlord would prefer fixed-rent contract because of higher monitoring costs. The opposite intuition applies for a tenant farmer because a higher dependency ratio would make the tenant farmer more risk averse. By contrast, as the number of adult members' increases in a household, that would decrease the magnitude of the moral hazard problem. This should then lead to the landlord offering a crop-share contract and to the tenant choosing a fixed-rent contract. The tenants with better production backgrounds (proxied by age) are thought to be better managers and to be more able to negotiate better contract terms. Therefore, this will decrease the likelihood of taking crop-share contract.

By contrast, the landlord with more production expertise is more likely to prefer more involvement in the production process which will increase the probability of him choosing crop-share contract. The higher the social connection a farmer has within his locality increases the monitoring ability and decreases the moral hazard problem. This would again increase the likelihood of offering a share-cropping contract by the landlords and the preference for fixed-rent contract by the tenant farmers.

In both stages dummies for different geographical ecosystems such as flood prone, drought prone, favorable environment, irrigated and submergence area, soil types, time dummies, and average rainfall variations among the districts and between years are used as control variables.

1.4 Data and Descriptive Statistics

The data for the analysis are drawn from a repeat survey of a nationally representative sample of households of rural Bangladesh collected by IRRI. The bench mark survey was implemented in 2000-01 for a study of the impact of rice research on poverty reduction in rural Bangladesh sponsored by the International Food Policy Research Institute. A multi-

stage random sampling method was followed for sample selection from 62 unions[9] in 57 districts (out of 64 districts, omitting urban districts). Then one village was selected from each union such that the population density and literacy rate for the village are similar to those for the selected union (this information was collected from the district census reports). A sample of 30 to 31 households from each of the 62 villages (1880 households) was drawn using the stratified random sampling method. At this stage two villages were dropped because of the logistical problems of implementing the survey. The households were then stratified into eight groups on the basis of four landholding and two land tenure categories, and 20 households were drawn at random for each village according to their probability proportion. The stratification was based on the wealth ranking technique of the participatory rural appraisal (PRA) method. The second wave was conducted by IRRI in 2003-04 following the households included in the first wave and their descendents. The sample size of households rose to 1,927 in the last wave. For each selected household, plot-, household- and contract-level data were collected. Definitions of important variables taken from the survey data and are used in the estimation and are reported in Table 1.1.Summary statistics of the variables are given in Table 1.2. The sample unit used in the analysis is individual farmer level data. Therefore, the unbalanced panel data of 2000 and 2004 consists of multiple observations for the same households.

Table 1.1 Variable definitions

Variable	Description
	Selection model dependent variables
d_leasein	Amount of land (ha) lease in by a HH
d_leaseout	Amount of land (ha) lease out by a HH
	Full model dependent variables
contract_leasein	= 1 if HH sharecropping in the plot; = 0 if HH fixed rent in the plot
contract_leaseout	= 1 if HH sharecropping out the plot; = 0 if HH fixed rent out the plot
	Independent variables
	HH characteristics variables
selfeco	Compare to the others households
	1 =rich; 2= high middle; 3= lower middle; 4=
hhsize	Household (HH) size (number)
total_worker	Total active labour force in a HH (16-60 years) (number)
total_agri_male	Total male agri worker (number)
total_agri_female	Total female agri worker (number)
	Socio- economic variables
edu_head	Education of HH head ; =1 if completed primary education; =0 otherwise
healthyp	No. of healthy population in a HH
femaleh	Sex of HH; = 1 if HH head is female; =0 otherwise
age_head	Age of head (number)
prim_occu_head	= 1 if the primary occupation of the head of HH is agriculture; =0 otherwise

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[9] A union usually consists of 15-20 villages.

cow_pp	Market price of bullocks used in cultivation
	Proxies for risk sharing
credit_formal	Amount of credit from formal institutions (tk.)
credit_informal	Amount of credit from informal institutions (tk.)
asset/ wealth	Amount of own cultivable land + homestead and other types of land (ha)
working capital	Income from trees + fruits + fisheries
non-agri_ income	Income from trade and service (tk.)
debt_income	liquidity constraint/ per capita income
debt_capital	liquidity constraint/ working capital
asset_per_capita	Amount of all land/ no. of adult member in a HH

Table 1.2 Means and standard deviation

Variable	Mean	Standard deviation	Min.	Max.
hhsize	5.53	2.22	2	26
active_labor	3.19	1.51	0	14
healthy population	5.14	2.14	0	24
total_agri_male	1.12	0.81	0	6
total_agri_female	0.017	0.13	0	1
cow_no.	1.84	1.91	0	14
own cultivable land	0.35	0.78	0	15.43
rent in	0.34	0.42	0.012	4.37
rent out	0.05	0.64	0	14.82
asset(land)_per capita	0.18	0.32	0	3.17
working capital	52485.65	106088.7	0	1601500
per_capita income	11806.99	13800.09	933.19	210252.4

1.4.1 Preliminary Evidence from Data

Table 1.3 presents an initial comparative study of the three groups of farmers: non participating owner farmers, the landlords and the tenants. From the table, 39.5 per cent of the households lease-in land and 14.7 per cent of the household lease-out land. Nearly 55 per cent of the households take part in some kind of land transaction through land rental markets. Therefore approximately 46 per cent of the households are not participating in the land rental market. One of the explanations for non-participation in the land rental market is the transaction cost (Teklu and Lemi, 2004; Tikabo and Holden, 2004). Bell and Sussangkarn (1988) show that transaction cost would drive a wedge between the costs and the bene.ts of tenancy as a landlord and as a tenant. Non-participation of 46 per cent of the households in the land rental market therefore, is an indication of fixed transaction costs in the market, since in rural Bangladesh, it is highly unlikely that all non-participating households have a perfect combination of land and non-land factors for crop cultivation.

Table 1.3 Differences in farm endowment, socio economic characteristics and extent of land transaction by participation status

Variables	Participating households				Non-participating households	
	Lease in		Lease out			
	mean	SD	mean	SD	mean	SD
Percentage of transacting households	39.5		14.7		45.8	
Household size	5.53	2.21	5.51	2.69	5.3	2.42
Healthy population in a HH(no.)	5.13	2.14	4.97	2.67	4.9	2.34
Age of head (year)	45.61	12.36	49.63	14.39	45.62	13.06
Education of head (school year)	2.9	3.56	6.06	4.6	5.6	4.38
Total worker in HH (no.)	1.7	0.99	1.8	0.97	1.8	0.98
Total male agri .worker in HH (no.)	1.21	0.81	0.77	0.88	1.3	0.87
Total female agri .worker in HH (no.)	0.02	0.12	0.03	0.19	0.03	0.17
Cow (no.)	1.84	1.90	1.45	2.54	1.26	1.81
Homestead land (ha)	0.05	0.07	0.08	0.06	0.06	0.04
Garden and fruit area (ha)	0.02	0.06	0.09	0.18	0.03	0.07
Pond land (ha)	0.008	0.03	0.04	0.11	0.02	0.03
Own cultivated area (ha)	0.34	0.78	1.52	1.50	0.58	0.73
Income from goat (tk.)	4.6	57.09	6.15	85.93	12	202.13
Income from poultry (tk.)	414.86	1005.37	503.94	771.41	327.81	510.02
Income from trees and plants (tk.)	1752.89	3175.51	6504.92	18040.4	1848.45	3551.37
Loan amount from formal lending institutions (tk.)	3183.37	8433.59	3520.4	12009.5	2807.7	14095.3
Loan amount from informal landing source (tk.)	1188.94	9062.04	1997.7	12560.7	1665	14128.72
Per capita income (tk.)	11806.9	13800.1	15978.5	20821.7	11911.5	10952.7
Annual agri. income (tk.)	34231.2	40664.2	36300.6	52891.7	24182.7	29268.9
Annual agri. wage income (tk.)	3939.2	7848.7	1388.3	5330.8	3740.8	10034.7

The summary statistics from the data presented in Table 1.3 somewhat confirms the accumulated evidence of the prevalence of imperfections in markets for labour and non-labour endowments. In rural Bangladesh, the market for hired labour for the agricultural activities is largely missing which is evident from the very low mean the agricultural wage income variable. This may be due to the extreme seasonality of demand for the agricultural labour. Among the three groups per capita income is lowest among the tenant farmers. The farmers relying on hired labour may not have a guaranteed supply of sufficient labour during peak season in the absence of sufficient off-farm labour opportunities. The same explanation is also applicable for non-labour inputs especially, bullock power. Thus, for rural Bangladesh, two inputs other than land that are essential for cultivation are family labour and draft power. Summary of data also shows that marginal/small landowners rent-in land from large landowners. This contradicts the findings of Fujita (2010) who studied land mortgages in the

Tangail district in Bangladesh and found that marginal/small landowners rent land to medium landowners.

Before setting off to estimate the modified Heckman selection model it is worth looking at the distribution of two types of contracts (sharecropping and fixed-rent) in rural Bangladesh, represented by the survey data used here. These distributions are shown in Figure 1.3.
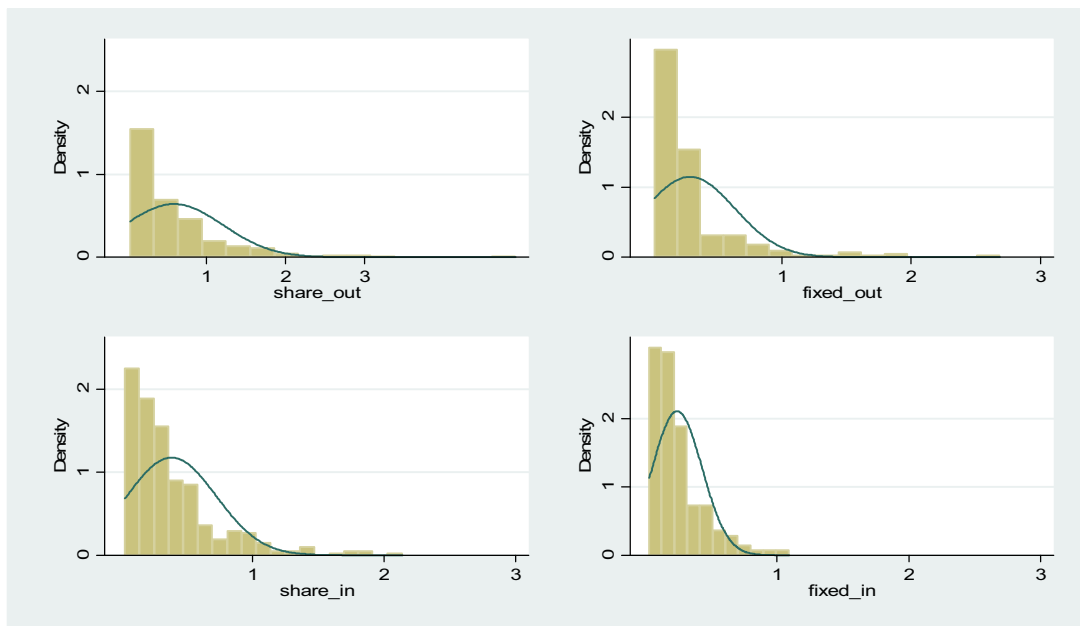
Fig 1.3 Distribution of different contract choice between tenants and landlords

Figure 1.3 reveals that, like most of developing countries, land transactions through the tenancy market in rural Bangladesh are very much skewed. Small pieces of land are cultivated through the tenancy mechanism. The landlords are offered almost the same size of land for both contracts, while for the tenant farmers the average size of land chosen for the fixed-rent contract is smaller than that for the sharecropping contract. Moreover, the average amount of land that a landlord rented out under a sharecropping or fixed-rent is higher than the average amount of land that a tenant rents under either arrangement. The implication is that the land rental markets do not serve well as a mechanism to allocate factors at the farm-level to maximise welfare (consistent with the findings of Taslim, 1989). Hence, there may be other factors like risk averseness and/or moral hazard which affect the contract choice and the landlord may choose more than one tenant farmer to cultivate his land.

1.5 Results

1.5.1 Risk-sharing Model

This section presents the estimated results using the household-level unbalanced panel data for 2000 and 2004. To investigate the risk-sharing hypothesis, two models have been used. Model 1 includes all direct measures of the tenants' and the landlords' credit, wealth and working capital measures. Model 2 focuses more on indirect calculated measures of credit, wealth and working capital of the two groups.

1.5.1.1 Tenant Sub Sample

Tables 1.4 and 1.5 report the results of the modified Heckman model which deals with the tenant household's decision to participate and choose a specific contract, respectively. The estimated results of the first stage (Table 1.4) reveal that the farmers' likelihood of participating in the land tenancy market decreases with the amount of any kind of land asset they own. This supports the fact that in rural Bangladesh like elsewhere for farmers with no access to land, the motivation to participate is simply to acquire land for cultivation in the absence of a functional land sales market. None of the proxies for reservation income has any significant impact on the participation decision. This might be an indication of the presence of insufficient sources of wage labour and non-the agricultural employment opportunities for the large farming population in rural Bangladesh.

The other three variables that have a significant impact on the amount of land a tenant farmer lease-in are household size, number of male the agricultural workers in the family, and access to electricity. Among these three variables, the first two have a positive impact and the last one has a negative impact as expected. Therefore, a tenant household with more members and more male the agricultural workers will lease in more land than the household that has fewer members or male workers, denoting the labour-intensive nature of the agricultural sector in Bangladesh. As the level of social welfare increases, which is characterized by access to electricity, the tenant significantly reduce his rate of participation in the land-lease market.

Table 1.4: Stage 1: Estimated Risk sharing model: Selection equation

variables	HH decision of leasing in land	
	Model 1	Model 2
credit_formal	0.00002	
	(0.00001)	
credit_informal	-2.09e-06	
	(9.92e-06)	
assest	-22.414*	
	(1.689)	
working capital	3.46e-06	0.00001**
	(5.41e-06)	(8.21e-06)
non-agri_income	-1.47e-06	
	(2.06e-06)	
debt_capital		2.33e-06
		(0.00001)
asset_percapita		-38.283*
		(5.489)
hhsize	0.189*	0.098
	(0.075)	(0.102)
selfeco	-0.141	-0.213
	(0.135)	(0.214)
depen_ratio	-0.902	-1.611
	(0.591)	(1.169)
agri_labour_male	0.498*	1.116*
	(0.141)	(0.247)
agri_labour_female	-1.545*	-5.135
	(0.696)	(21.830)
bullock	0.00004	-1.35e-06
	(0.00002)	(0.00003)
electricity	-0.469*	-0.686*
	(0.214)	(0.278)

* : significance in 95% confidence interval ; ** significance in 90% confidence interval
The regression also include average rainfall in different year and different districts and dummies for different ecosystem (flood prone, draught prone, irrigated, favourable)and soil type (loamy and clay) as control variables; S.E. are in parenthesis

Table 1.5 deals only with the tenant farmers who choose to participate in the land-lease market and choose between crop-share contract versus fixed-rent contract. Similar to the selection equation, for the estimation of the contract choice or outcome equation this study presents two models to observe the effects of proxies of risk averseness on contract choice. As equation (6) illustrated, the tenant's optimization problem involves the marginal utility of income from contract farming which depends not only on his own financial strength but also the landlord's financial strength where there is a issue of cost share and crop-share. The coefficients of the variables representing these two models give some contradictory findings. Model 1 which employs all direct measures of credit, wealth and working capital does not show any significant impact of these proxies for risk aversion on the choice of contract. In model 2 as anticipated, moving from rich to poor (*selfeco*) increases the prevalence of choice towards crop-share contracts. Thus, more risk-averse tenants choose more share tenancy contracts. However, contrary to the hypothesized outcome,

strengthening the tenants' position in terms of assets per capita also makes a crop-share contract more likely. This may be due to the fact that farmers who have some land but still choose to participate in the land-lease market need to employ their available workers to farm their own land. At the same time they choose to exploit other peoples land to optimize their operational land size. This may increase their perception of risks involved with contract farming, and so sharecropping cultivation becomes their primary choice of farming. Note that none of the landlord's financial strength variables are significant for any model. It again suggests that when the tenant farmers are deciding over a tenancy contract, risk-sharing between the tenant and the landlord does not play a significant role.

Table 1.5 Stage 2: Estimated risk sharing model: Outcome equation (tenant sub-sample)

variables	Tenant farming households	
	Contract choice: 1 if share contract, 0 if fixed rent contract	Contract choice: 1 if share contract, 0 if fixed rent contract
	Model 1	Model 2
t_credit_formal	5.21e-06	
	(5.46e-06)	
t_credit_informal	0.00001	
	(0.00001)	
t_assest	1.607	
	(1.089)	
t_working capital	4.54e-06	
	(2.14e-06)	
t_non-agri_income	-5.21e-07	
	(4.50e-06)	
t_debt_capital		-0.010
		(0.024)
t_debt_income		0.029
		(0.028)
t_asset_percapita		3.084**
		(1.764)
t_hhsize	0.005	0.017
	(0.015)	(0.018)
t_selfeco	0.034	0.072**
	(0.035)	(0.043)
t_depen_ratio	-0.019	0.064
	(0.137)	(0.281)
l_credit_formal	-1.55e-06	
	(7.07e-06)	
l_credit_informal	-7.63e-07	
	(0.00001)	
l_assest	0.346	
	(1.464)	
l_ working capital	-6.25e-06	
	(3.26e-06)	
l_non-agri_income	-9.38e-06	
	(2.42e-06)	
l_debt_capital		-0.059
		(0.123)
l_debt_income		0.075
		(0.076)
l_asset_percapita		-1.390
		(2.074)

Inverse Mills ratio		
rho	-0.095	-0.142
sigma	-0.300	-0.461
Wald chi2	0.319	0.308
No of observations	1557.29 (25)	791.33 (20)

* : significance in 95% confidence interval ; ** significance in 90% confidence interval
The regression also includes male, female agricultural labour force information, bullock power variable, average rainfall in different year and different districts and dummies for different ecosystem (flood prone, draught prone, irrigated, favourable)and soil type (loamy and clay) as control variables; S.E. are in parenthesis

In addition to the two equations, Heckman estimates (shown in lower part of table 1.5) *rho* is (actually the inverse hyperbolic tangent of *rho*) the correlations of the residuals and sigma (actually the log of *sigma*) the standard error of the residuals of the outcome equation. Inverse Mills ratio is the *rho _ sigma*. For the tenant sub sample as it is evident from the Table 1.5 that for both model rho is different from zero indicates the presence of sample selection in the data set.

1.5.1.2 Landlord's Sub-Sample

Table 1.6 shows results from the first stage of the Heckman two-stage model where the amount of land leased out is a continuous variable. Controlling for other explanatory variables, in model 1, land leased out is positively related to the total land asset owned and the number of female the agricultural labourers in a household. By contrast, it is negatively related to the non-agricultural income and their self economic evaluation. This result may suggest that land poor farmers and farmers with the capability of shifting to the non-the agricultural sector face high opportunity cost to participate in the tenancy market. Model 2 which includes indirect measures of wealth and working capital shows that, as anticipated, farmers with large households (thus with high opportunity cost in participating) and with more male the agricultural workers (thus with low opportunity cost) lease out a lesser amount of land to others. In model 2 the opportunity cost hypothesis is also supported by the negative significant effect of the landlord's debt to capital ratio on the decision to participate, although, the coefficient is very small supporting the fact that most of the landlords in rural Bangladesh may not be very capital rich.

Table 1.6 Stage 1: Estimated risk sharing model: Selection equation (landlord sub-sample)

variables	HH decision of leasing out land	
	Model 1	Model 2
credit_formal	-2.93e-06	
	(3.85e-06)	
credit_informal	-1.90e-06	
	(2.83e-06)	
assest	0.145*	
	(0.061)	
working capital	7.93e-06	-1.06e-06
	(5.18e-06)	(9.88e-06)
non-agri_income	-1.13e-06*	
	(5.72e-06)	
debt_capital		-0.00001*
		(3.95e-06)
asset_percapita		-2.184*
		(0.239)
hhsize	-0.013	-0.116*
	(0.022)	(0.035)
selfeco	-0.570*	-0.288*
	(0.043)	(0.069)
depen_ratio	-0.147	0.256
	(0.172)	(0.372)
agri_labour_male	-0.202*	-0.399*
	(0.048)	(0.079)
agri_labour_female	0.498*	-0.046
	(0.166)	(0.263)
bullock	-0.00002*	-0.00001
	(5.29e-06)	(8.74e-06)
electricity	-0.197*	-0.209**
	(0.071)	(0.104)

* : significance in 95% confidence interval ; ** significance in 90% confidence interval
The regression also include average rainfall in different years and different districts and dummies for different ecosystems (flood prone, drought prone, irrigated, favourable) and soil type (loamy and clay) as control variables; S.E. are in parenthesis

Similar to the finding for the tenant farmers, the second stages of models 1 and 2 focusing on the landlord's contract choice problem do not have much support for the risk-sharing hypothesis (Table 1.7). Results suggest that among the farmers who do participate, the probability of choosing a share contract decreases with their own economic evaluation as being poor which should also make them more risk averse. In model 1 the tenant's access to credit from informal sources has a significant positive effect on the likelihood of offering a fixed-rent contract. The value of the coefficient is very small suggesting that only few tenants have access to a sufficient amount of credit from informal sources that is needed for the cultivation process. Apart from these two variables none of the coefficients of the proxies for risk averseness or risk-sharing variables have any significant effect on the decision to choose a particular contract. Therefore, even for the landlords' in rural Bangladesh, risk-sharing may not be an important issue when at the beginning of the cropping season they offer a particular contract to the tenant farmers.

Table 1.7 Stage 2: Estimated risk sharing model: Outcome equation (landlord sub-sample)

variables	landlord farming households	
	Contract choice: 1 if share contract, 0 if fixed rent contract	Contract choice: 1 if share contract, 0 if fixed rent contract
	Model 1	Model 2
l_credit_formal	8.35e-06	
	(2.48e-06)	
l_credit_informal	2.33e-06	
	(1.86e-06)	
l_assest	-0.023	
	(0.039)	
l_working capital	3.79e-06	
	(3.05e-06)	
l_non-agri_income	-3.85e-07	
	(3.49e-06)	
l_debt_capital		0.002
		(0.002)
l_debt_income		0.004
		(0.029)
l_asset_percapita		0.025
		(0.043)
l_hhsize	-0.002	0.011
	(0.010)	(0.014)
l_selfeco	-0.068	-0.071**
	(0.094)	(0.040)
l_depen_ratio	0.041	0.245
	(0.095)	(0.180)
l_agi_male	-0.090*	-0.125*
	(0.040)	(0.042)
t_credit_formal	-1.20e-06	
	(4.58e-06)	
t_credit_informal	-8.86e-07**	
	(5.47e-06)	
t_assest	-0.083	
	(0.075)	
t_ working capital	-3.62e-06	
	(7.28e-06)	
t_non-agri_income	1.85e-06	
	(1.33e-06)	
t_debt_capital		0.079
		(0.128)
t_debt_income		-0.076
		(0.056)
t_asset_percapita		-0.122
		(0.079)
Inverse Mills ratio	-0.044	-0.020
rho	-0.098	-0.046
sigma	0.449	0.436
Wald chi2	274.02 (25)	223.83 (20)
No of observations	526	526

* : significance in 95% confidence interval ; ** significance in 90% confidence interval
The regression also include male, female agricultural labour force information, bullock power variable, average rainfall in different year and different districts and dummies for different ecosystem (flood prone, drought prone, irrigated, favourable) and soil type (loamy and clay) as control variables; S.E. are in parenthesis

The correlation coefficient (*rho*) for the landlord group is also different from zero and negative suggesting that the factors (unobserved) that make participation more likely tends to be associated with offering fewer crop-share contracts to the tenants (Table 1.7).

1.5.2 Monitoring Problem/ Moral Hazard Model

Tables 1.8 to 1.11 report the coefficient estimates for the moral hazard model with asymptotic standard errors reported in the parentheses.

1.5.2.1 Tenant Sub Sample

From the participation equation (Table 1.8), it is evident that the age of the people in the household has a significant non-linear relation with the decision to participate. The negative effect of age and a positive effect on age squared means that as tenant farmers get older the effect of age on participation are lessened. The presence of social connection (*ngo_membership*) has a positive significant effect on the amount of land are tenants willing to lease-in, as it is assumed that any social connection will reduce the opportunity cost and moral hazard problem. Furthermore, like the risk-sharing model, a higher number of female the agricultural workers compare with the number of male workers in a household decrease the amount of land a household wants to lease-in, thereby reflecting the gender discrimination in the agricultural land tenancy market.

Table 1.8 Stage 1: Moral hazard model: Selection equation (tenant sub-sample)

variables	HH decision of leasing in land
	Model 1
age_head	-0.057*
	(0.019)
age_head2	0.0006*
	(0.0002)
female_head	-0.101
	(0.221)
healthy_popu	0.076
	(0.059)
primary_occup_head	0.091
	(0.106)
edu_active_labour	-0.006
	(0.005)
ngo_membership	0.283*
	(0.086)
hhsize	0.004
	(0.061)
selfeco	0.018
	(0.063)
depen_ratio	-0.204
	(0.252)
agri_labour_male	0.065
	(0.072)
agri_labour_female	-0.785*
	(0.386)
bullock	0.00001
	(5.17e-06)
electricity	-0.141**
	(0.087)

* : significance in 95% confidence interval ; ** significance in 90% confidence interval
The regression also include average rainfall in different years and different districts and dummies for different ecosystem (flood prone, draught prone, irrigated, favourable)and soil type (loamy and clay) as control variables; S.E. are in parenthesis

Stage 2 (Table 1.9) of the outcome equation dealing with choice of contract by the tenant farmers shows strong support for the presence of the moral hazard problem. As predicted, from Table 1.9 it is evident that a household with a female head faces the moral hazard problem, which decreases the likelihood of choosing a share cropping contract. Opposite significant effects are evident for the size of the household and number of healthy people in the household. Both of these characteristics reduce the moral hazard problem within a tenant household.

Table 1.9 Stage 2: Moral hazard model: Outcome equation (tenant sub-sample)

variables	Tenant farming households
	Contract choice: 1 if share contract, 0 if fixed rent contract
t_age_head	0.013
	(0.008)
t_age_head2	-0.0001
	(0.00009)
t_female_head	-0.344*
	(0.134)
t_healthy_popu	-0.046**
	(0.026)
t_primary_occup_head	0.054
	(0.047)
t_edu_active_labour	-0.002
	(0.002)
t_ngo_membership	-0.021
	(0.037)
t_hhsize	0.043**
	(0.026)
t_depen_ratio	0.077
	(0.111)
l_age_head	-0.007
	(0.009)
l_age_head2	0.00007
	(0.0001)
l_female_head	0.443
	(0.293)
l_healthy_popu	0.192*
	(0.106)
l_primary_occup_head	0.633
	(0.161)
l_hhsize	-0.159
	(0.101)
Inverse Mills ratio	0.034
rho	0.079
sigma	0.429
Wald chi2	958.53 (26)
No. of observations	595

* significance in 95% confidence interval ; ** significance in 90% confidence interval
The regression also include male, female agricultural labour force information, bullock power variable, average rainfall in different years and different districts and dummies for different ecosystem (flood prone, drought prone, irrigated, favourable)and soil type (loamy and clay) as control variables; S.E. are in parenthesis

1.5.2.2 Landlord's Sub-Sample

Table 1.10 deals with the monitoring problem of farmers who wish to participate in the land market through leasing out land. Participation in the informal land market is positively correlated with female headed households. In most of the developing countries the agricultural occupations are male-dominated. Thus, it is predicted that a household primarily run by a female would face a monitoring problem with managing family labour in farming. This would enhance the rate of land leased out to others for cultivation.

The amount of land leased out decreases with the increasing number of educated, healthy people in the household, together with the increasing number of the agricultural male members and bullocks used in crop cultivation. The signs of the coefficients are consistent with what we expect. Farm households in rural Bangladesh are more likely to transact in the land market where they are not able to operate it by themselves. In addition Table 1.10 shows that land rich farmers are joining in the land-lease market more than the land-poor farmers. Therefore, it can be said that in rural Bangladesh land-poor farmers optimize their amount of land for cultivation through leasing in land where land-rich farmers optimize their amount of cultivable land by leasing out the rest.

Table 1.10 Stage 1: Moral hazard model: Selection equation (landlord sub-sample)

variables	HH decision of leasing out land
	Model 1
age_head	0.016
	(0.017)
age_head2	-0.00008
	(0.0002)
female_head	0.087*
	(0.038)
healthy_popu	-0.104*
	(0.034)
primary_occup_head	0.048
	(0.091)
edu_active_labour	-0.154*
	(0.052)
ngo_membership	-0.109
	(0.084)
selfeco	-0.254*
	(0.049)
depen_ratio	-0.335**
	(0.196)
agri_labour_male	-0.142*
	(0.059)
agri_labour_female	0.074
	(0.201)
bullock	-0.00002*
	(4.36e-06)
electricity	-0.176*
	(0.075)

* significance in 95% confidence interval ; ** significance in 90% confidence interval
The regression also include average rainfall in different years and different districts and dummies for different ecosystems (flood prone, drought prone, irrigated, favourable)and soil type (loamy and clay) as control variables; S.E. are in parenthesis

The results of the contract choice decision focused on the moral hazard problem of the landlord farmers are presented in Table 1.11. Keeping other factors constant, the landlords whose primary occupation is not agriculture are more likely to offer fixed-rent contracts. As the household's head primary occupation shifts from agriculture to non-agriculture, the monitoring cost tends to increase. This increases the incentive for the landlords to offer fixed-rent contracts where there is no such monitoring cost involved.

The only other factor that significantly increases the probability of offering a fixed-rent contract is the increasing numbers of male the agricultural workers in the household. The sign of this coefficient is unexpected. It is predicted that increasing the number of male workers will increase the monitoring ability which in turn should have a positive effect on offering crop-share contracts. However, put another way, farming households with surplus male the agricultural workers are more likely to opt for better-paying non-the agricultural activity which in turn increases the monitoring cost.

Table 1.11 Stage 2: Moral hazard model: Outcome equation (landlord sub-sample)

variables	Landlord farming households
	Contract choice: 1 if share contract, 0 if fixed rent contract
l_age_head	-0.012
	(0.008)
l_age_head2	0.0001
	(0.00007)
l_female_head	-0.075
	(0.079)
l_healthy_popu	-0.003
	(0.019)
l_primary_occup_head	-0.121*
	(0.056)
l_edu_active_labour	0.0005
	(0.002)
l_ngo_membership	-0.073
	(0.050)
l_hhsize	-0.006
	(0.020)
l_depen_ratio	0.080
	(0.095)
l_agri_male	-0.056*
	(0.332)
t_age_head	-0.002
	(0.006)
t_age_head2	0.00005
	(0.00009)
t_female_head	0.182
	(0.258)
t_healthy_popu	-0.056
	(0.051)
t_primary_occup_head	-0.025
	(0.120)
t_hhsize	0.049
	(0.049)
Inverse Mills ratio	-0.228
rho	-0.504

sigma	0.452
Wald chi2	609.25 (29)
No. of observations	526

* significance in 95% confidence interval ; ** significance in 90% confidence interval
The regression also include male, female agricultural labour force information, bullock power variable, average rainfall in different years and different districts and dummies for different ecosystem (flood prone, drought prone, irrigated, favourable)and soil type (loamy and clay) as control variables; S.E. are in parenthesis

In summary, for both the tenant and the landlord farming households, the moral hazard problem plays a vital role in the decision of whether to enter into the informal lease market rather than after entering choosing a particular contract. Nevertheless, a tenant farmer faces a more habitual monitoring problem for controlling his workers in crop cultivation than a landlord.

1.6 Conclusion

This study aims to contribute to the empirical literature about agrarian tenancy contracts and the landlord-tenant relationship. It provides evidence from rural Bangladesh by comprehensively considering the effects of opportunity costs of entering into the tenancy market and the risk-sharing and moral hazard problems in choosing a specific contract. In particular, results from the preliminary studies show that in rural Bangladesh, although more than 80 per cent of the farmers live below poverty line, 46 per cent of the farmers do not participate in the informal land market. Substantial non-participation in the land rental market indicates the presence of considerable transaction costs and opportunity costs in this market. Results also showed that land rental transactions are motivated by the need to adjust land area cultivated to the size and number of healthy people in the household when the farmers do not have sufficient off-farm activities available for alternative sources of income.

Between the risk-sharing hypothesis and moral hazard hypothesis, the presence of the monitoring problem is supported for both groups in the decision of optimizing the operation's land size. However, there is no such significant empirical support for the risk-sharing hypothesis, for the tenant or for the landlord households. Although for the tenants their asset per capita has a positive significant impact on the probability of choosing a crop-share contract, the coefficient is very small. This result is somewhat confusing, especially in the light of the fact that at the beginning of the cropping season to buy inputs, the level of working capital should have a positive effect on the choice on contracts while the level of non-productive assets will not. In rural Bangladesh, highly unstable yields, lack of income diversification and extreme poverty among farmers should make them risk averse. Similarly for the landlords none of the proxies for risk averseness is significant. This is also somewhat

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puzzling as in rural Bangladesh almost half of the landowners are absentee farmers (Hossain, 2004). This puzzle can be explained through the threat of eviction hypothesis in the presence of abundant labour and insufficient employment opportunities in the market. Estimates from selection models support the presence of the moral hazard problem for the landlord. These models show that if the household has fewer the agricultural male labourers or is headed by a female, then the probability of offering a fixed-rent contract increases. Hence, the monitoring capacity of the landlord is an important factor in choosing a particular contract offered to the tenants in rural Bangladesh. The landlords are concerned about their valuable asset, whereby they lease out land and participate in the land rental market when they can ensure a minimum level of monitoring capacity. Therefore, a landlord household with less subsistence pressure and more female labour tends to offer fixed-rent contracts. At the same time, a landlord will offer a share cropping contract only when he has sufficient other land assets, irrigation facilities in his land for lease and the capacity to monitor tenant farmers.

These preliminary studies and empirical results are important. The fairly high degree of non-participation in the land rental market may indicate that there is room for policy intervention to improve the markets and the efficiency of resource allocation. It is recognized by the Bangladesh government that the agricultural wage employment and non-agricultural employment opportunities are insufficient especially for the poor, non-skilled farmers. This is also supported through findings of this study. Therefore, this study may provide insights into issues currently debated in Bangladesh (also in many other developing countries) over the function of informal land-lease markets in substituting for o¤-farm markets, insurance and capital markets. The land rental market in rural Bangladesh is completely informal and to date has not been stimulated by any policy. The analysis of this paper is a stepping stone to understand the mechanism of the informal land tenancy market. However more comprehensive analysis is still needed in future due to the fact that this paper does not focus on the issue of possible non-random matching between the tenant and the landlord or the crop choice. It may be important for rural Bangladesh where internal migration is not very popular, particularly in rural areas.

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