Bargaining and contract choice: Evidence from informal groundwater contracts

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Abstract

Informal market arrangements are often in place when the formal institutions are too weak to support a formal market. In this paper we study informal groundwater contracts in India, in particular, we study the bargaining power of sellers and buyers. We conduct an economic experiment with actual buyers and sellers of groundwater contracts, where they make a series of choices between shared and fixed contracts, first individually and then jointly. Shared contracts are more often chosen when the decision is joint, and the likelihood of choosing a shared contract depends on the relative risk preferences of sellers and buyers. Sellers have on average a stronger influence on the choice of contracts, but interpersonal relationship between buyers and sellers like kinship ties and increased length of the contract between them increases the buyers bargaining power in the contract.

Keywords: Groundwater contract, Shared contract, Fixed contract, contract choice, risk preferences, bargaining

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1.   Introduction

Market-based approaches to resource allocation are widely regarded as a mechanism that allocates resources for its best alternative use. When the formal institutional mechanisms are weak or do not exist to enforce the market-based allocation, informal arrangements are often still made (Meinzen-Dick, 1996a, Saleth, 1998). Most commonly seen and well reported informal institutional arrangements for resource exchange are land rental markets and water markets

Sharing and trading of water have become increasingly common in arid and semi-arid tropics of the world due to the scarcity of water. Informal groundwater contracts are agreements between individuals, where a farmer who have surplus water share/trade with a farmer who is in need of it. These contracts are common in southeast Asia and some parts of China, e.g. these contracts cover about 15% of total irrigated area in India (Saleth, 1998). Anecdotal evidence suggests that these trades improve water access for the poor who are unable to install a private irrigation system (Meinzen-Dick, 1996a, Mukherji, 2004). However, studies have also argued that informal sharing mechanisms are imperfect and differ significantly from a competitive market. Firstly, trade is restricted by topographical constraints, since water can be economically delivered within certain deliverable area. This restricts the number of sellers and buyers who can enter into a trade[2]. Secondly, the price charged for delivering water is higher than the cost of extracting water (Jacoby et al., 2004, Kajisa and Sakurai, 2003). The exorbitant price charged by water seller resembles 'water lords'[3] (Janakarajan, 1993, Shah, 1993, Jacoby et al., 2004).

The most commonly observed types of contracts are shared (output sharing), fixed and flat rate/hourly contracts. The price of water is determined by bilateral bargaining processes between buyers and sellers (Kajisa and Sakurai, 2003), and can differ depending the contract type. Shared contracts are frequently observed contract in groundwater markets (Fujita, 2004, Manjunatha et al., 2014) and the price paid for water under shared contract is generally higher than fixed/flat rate contracts (FUJITA and Hossain, 1995, Kajisa and Sakurai, 2003). However, conventional contract theory suggest that shared contracts are inefficient compared to other contracts, as they require output to be shared which reduces agents effort below the optimal rate (Stiglitz, 1974, Otsuka and Hayami, 1988). Thus, it has been argued that shared contracts eventually decrease over time with the development of markets. Efforts have been made to explore the productive use of water and price determination in these contracts, however, little research has been undertaken to understand the preferences for the contract by sellers and buyers, and the implicit bargaining process between

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[2] Usually number of buyers are higher than number of sellers. Since it is constrained locally, sometime it is referred as '*spatial monopoly* (Easter et al., 1999)

[3] Similar to the conventional notion of 'landlord'. The price to cost ratio found to vary from 3 to 1.9, which differs from place to place and depends on whether the study considered total or variable cost in the estimation (Fujita and Hossain, 1995 and Kajisa and Sakurai, 2003)

seller and buyer about the contract decision. Nevertheless, water is a scare resource in many tropics, and particularly in India. As Rosegrant and Binswanger (1994) pointed out that as good become scarce number of issues arises in the establishment of market. One such problem is development of market power due to scarcity of resource which impairs the power balance. Therefore, understanding the relative power of agents in groundwater sharing contracts is important, which calls for law and institutions developed in order to protect the poor from one-sided market power.

In this study we investigate the determinants of the choice of shared contract in groundwater contracts, and explore the relative bargaining power of buyers and sellers. We use buyers and sellers from the existing ground water contracts in Karnataka, India. A field experiment was implemented with 168 matched pairs of buyers and sellers. The participants are matched based on observed contract relationships. In the experiment, the sellers and buyers carry out a series of decisions choosing between shared and fixed contract under various output price risks. Both sellers and buyers make decisions first individually and then jointly. Our experimental design allows us to examine two aspects of the subjects' preferences for contract. First, how the individual and joint preferences for shared contract vary with expected output prices. Second, how buyer's and seller's individual preferences influence the joint decision for contract and if the influence of buyer and seller is related to certain characteristics of the buyers and seller respectively.

We find that the preference for shared contract is high in the joint decision compared to the individual decisions. A joint shared contract is more likely when the buyers are relatively risk averse than the sellers, which provides evidence for risk sharing arguments for the existence of shared contract in groundwater sharing contracts. Using the individual preferences, we constructed the level of disagreement between sellers and buyers for each choice situation to empathise on the relative power of agents to influence the joint contract towards their individually preferred contract. Using binary probit analysis, we find that the sellers have more ability to influence the joint decision in favor of them when the disagreement increases in between them. Interpersonal relationships between buyers and sellers like kinship ties and increase in the length of the contract augment the buyers' relative power to determine the joint decision.

The rest of the paper is structured as follows. Section 2 provides a brief review focused on agrarian contracts. In Section 3, the general groundwater contract characteristics, as well as characteristics of groundwater contracts found in the experimental location are described. Section 4 elaborates on the experimental design and procedural implementation of the experiment. Section 5 outlines the results and Section 6 provides discussion and conclusion of the study.

2.   Contract choice in agrarian contracts

In standard neoclassical contract choice theory, the shared contracts are seen as sub-optimal because of the inefficiency in terms of under-provision of inputs since the tenant (share cropper) receives only part of their marginal product of input (labour), so called Marshallian inefficiency. A shared contract can be seen as a principal-agent problem, where sharecroppers have an incentive to under provide the inputs which are difficult to be observed by the landlord in order to maximize his utility with respect to input applied (Cheung, 1969, Stiglitz, 1974, Otsuka and Hayami, 1988). Therefore, the landlord has to incur costs to enforce and monitor the tenant to bind for the terms and conditions in shared contract (Hölmstrom, 1979). Thus, it has been predicted that in long run shared contracts would be less and less prevalent. The coexistence of different agricultural contracts at a given time and place is puzzling. In the literature various explanations have been investigated, including transaction costs, liquidity constraint and risk sharing between agents.

The transaction cost considered the cost incurred by agent to enforce the terms and conditions of the contract and argued that the shred contract is as efficient as other contracts if the transaction cost is zero (Cheung, 1969). Datta et al. (1986) and Murrell (1983) considered shirking labor inputs under shred contract and mismanagement of land quality and soil fertility exhaustion under fixed contract which are unnoticeable by landlord and require landlord to monitor and enforce the tenent in both contracts. They argued that all the contracts have some form of transaction cost, however, the choice of the contract depends on the relative transaction cost between the contracts. The problem of enforceability was also extended to the tenant by Eswaran and Kotwal (1985), young tenants who are less experienced prefer shared contract in order secure the entrepreneurial inputs from the landlord in the production process..

Considering the time of payments in the contract, the studies have argued that the agent's resource constraints play a major role in the choice of contract. Ackerberg et al. (2002) evidenced the endogenous matching of agents based on resource constraint which determines the choice of contracts. They find that the tenants who are less wealthy have a shared contract with the wealthy landlord in Italian land rental market. Using working capital investment in the production, Laffont and Matoussi (1995) and Tikabo and Holden (2003) found that an increase in the working capital of tenant increases the preference towards fixed contract and increase in working capital of landlord increases the preference for a higher share in the contract. Both transaction cost and resource constraint arguments either stand for one agent's viewpoints or consider the absolute effects of agents in the contract decisions.

On the other hand risk sharing arguments contend that shared contract exists due to the incentive of risk sharing among agents. Stiglitz (1974) and David (1977) concentual model shows that

the choice of the contract depends on the risk preferences of both the agents. They predict that the choice of shared contract is optimal when both the landlord and the tenant are risk averse. It was widely accepted as a positive reason for the existence of shared contract in the contract choice literature (Otsuka and Hayami, 1988). These arguments spurred many empirical inquiries to test the predictions. Allen and Lueck (1999) and Aggarwal (2007) used variance of yield as a proxy measure for the riskiness of crop and found weak evidence to support for the risk sharing arguments for the existence of shared contracts. However, Ackerberg et al. (2002) found high risky crops like vines are more likely to be under shared contract than cereals crops. Bezabih (2009) used experimentally measured risk and time preferences of both tenants and landlords in Ethiopian land rental market. They found risk averse landlords are more likely to prefer shared contract, which seems to be counter intuitive to the prediction of risk sharing arguments. However, empirical evidence on risk sharing arguments are mixed.

There are few studies that have focused on the water sharing contracts. Kajisa and Sakurai (2005) found that the shared and fixed rental contracts are equally efficient in Indian groundwater contracts. They argue that unlike land rental contracts, the buyers and sellers in the groundwater contracts are neighbour farmers due to topographical constraint of water delivery, which enable them to observe and interact closely with low possible cost. In contract, in the land rental contracts, the landlord in most cases is away from the rented plot or lives outside the village which leads to weak ties with the tenant and incurs more cost for monitoring. However, the study do not account for endogenous choice of the contract in exploring the efficiency aspects of contracts.

A review on groundwater contracts in India showed that price to cost ratio of water ranges from 1.89 to 3.3 depending on the scarcity of water and power tariff structure in the region (Saleth, 1998)[4]. Some evidences have claimed that price charged is exorbitant and exploitative, which represent the monopoly behavior of seller (Shah, 1993, Jacoby et al., 2004). However, FUJITA and Hossain (1995) argued that the price charged is not exorbitant rather it is reasonable if we consider the long run interest rate on tubewell investment. However, evidences are conclusive that water price paid under shared contract is higher than the fixed contract (Kajisa and Sakurai, 2005). It has been argued that marginal increase in the price under shared contract compared to other contracts acts as risk premium paid to seller for sharing the risk. Many evidences have found that the shared contract is most frequently encountered groundwater contract (FUJITA and Hossain, 1995, Manjunatha et al., 2011). Aggarwal (2004) used crop riskiness measure to investigate the choice of contract in groundwater sharing and found no evidence to support the risk sharing argument.

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[4] Saleth (1998) aggregated the price information from different studies in India. She found interesting price patterns. The price charged is higher in hard rock compared to indo-Gangetic region which reflects the scarcity value of the water.

Nevertheless, more effort is needed to understand the effects of relative charactertics of agents on choice of contract. In perticular, how individual agents preference for contract determines the final choice of contract and to understand the implicite bargaining process in choice of contract.

3. Groundwater contracts in India

The property right for water under the ground is linked with the land right in India which increased the investment on privatized irrigation system coupled with subsidized electricity charges. Though the usufructuary rights on groundwater exist, there are no tradable water rights or the organized market set up for trading the water. Therefore, these implicit rights on groundwater water enable trade with those who are unable to invest in the privatized irrigation system (from now referred as 'tubewell'). Informal groundwater contracts are a good alternative, particularly if water to be allocated at the local level (Easter et al., 1999). These are the informal contractual agreements between farmers, where, the seller is the one who owns active tubewell and extracts water from the ground for own cultivation as well as sell it to the buyer for crop production. Buyer is the one who does not own tubewell or has activate tubewell, thus buys water from the seller. These are localized unregulated and verbal contracts, in other words, no third party was involved between sellers and buyers to mediate and enforce the contract terms and conditions. Therefore, monetary transaction cost in these markets are low, however, the monitoring and enforce costs would be high if the trust fails to operate between agents (Otsuka et al., 1992)[5].

There are different contractual agreements that the buyer and seller could agree upon depending on their convenience. Most commonly encountered are shared contracts (SC), fixed contract (FC), hourly payment contract, and land-linked water contracts, and each one differs in the mode of payment of water price. In the shared contract, a fixed share of total crop output is paid as the price for water. In the Fixed contract, fixed amount per season per unit area is paid as the price for water. A fixed amount per hours of water delivered is paid in the hourly contract. In the land-linked contract, the part of buyer's land is given to the seller to use in order to get water for buyer's crop. This agreement is a part of water contract, where the seller is allowed to cultivate in the part of buyers' land until seller delivers water to the buyer[6].

As one can notice, the exact price of water is not known in the shared contract while setting up of the agreement and only to be realized after the harvest of the crop. However, in other contracts, the exact price of water is fixed in the agreement. Therefore, the risk of production is

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[5] Buyer and seller own land nearby in most cases.
[6] Implicitly, the land rent act as the price of water.

shared by buyer and seller in the shared contract, while in other contracts buyer alone faces all the risks.

3.1   Characteristics of groundwater contracts in the study area

A survey on groundwater contract was conducted in in Karnataka state, India. The survey was carried out in April-May 2015 in the districts of Kolar, Chikkaballapura, and Tumkur. These districts were selected based on the intensity of groundwater contracts observed in the previous studies in Karnataka state (Somanathan and Ravindranath, 2006, Manjunatha et al., 2011)[7]. In total 28 villages were selected. All the agents who had groundwater sharing at the previous and present season are covered in the village. The detailed characteristics of water contracts, production aspects of the contracted plot are collected from buyers and sellers.

The characteristics of groundwater contracts observed in the study area are reported in the table1. We observed 199 water sharing contracts. Shared type of contract covers about 87% of total contract observed, followed by fixed contract (9%), land-linked contracts (3%) and hourly contracts (1%). Manjunatha et al. (2011) found 60% of the observed contracts are shared contracts in the study location. Under shared contract one-thirds of the total output produced was paid as water price. The share does not vary within or between villages and district[8]. The share of the output was paid after the harvest of the crop and in most cases (91%) it is paid in terms of the value of the total value of output. In the case of fixed contract, the fixed amount was decided per season or per year unit area by seller and buyer which vary depending on the crop. In most cases (89%), the pre-decided fixed amount was paid in 2-3 installments before the harvest. There is no specification on a number of installments which depends on the conveniences of buyer and seller. In hourly contract, Rs. 40 ($ 0.6) per hour of water delivered was paid, which varies depending on the demand for water in the village[9]. The hourly price of water was paid after each irrigation. In the case of a land-linked contract, no cash or crop output was exchanged between buyer and seller. On an average 1.2 acres of buyer's land was given to the seller to get water for an acre of land. We encountered nearly 20 different types of crops grown under water sharing contracts. Most commonly seen crops are Mulberry (host

[7] The selected districts also come under the critically exploited groundwater zone. No other source of irrigation is available except groundwater. Therefore, water demand for agriculture is high. Drilling new tubewell is risk due to deep and confined aquifer. Sharing groundwater allows reallocation of water for the best alternative use.

[8] Kajisa and Sakurai (2003) found variations in the price within villages from one forth to one third in the state of MadhyaPradesh. However the price of water varies from one third to two third in different parts of India (Saleth, 1998)

[9] Hourly water price in hourly contracts varies with in India, depending on the regions, demand and source of power to lift the water. It is found that in hard rock areas (which includes Karnataka), rate is higher ($0.10 to $0.6) than in Indo-gangetic plans ($0.11 to $0.14) of India.

plant of silk worm), Maize, Tomato and Chrysanthemum, which appears in all types of contracts except Chrysanthemum and China aster (cut flowers) which are grown only under shared contract. We present the water price paid by buyer per crop season per acres of water delivered for the selected crops[10]. The average amount paid in the shared contract is higher than the fixed contract in Mulberry, Tomato and Maize.

It is salient that the shared contract dominates over all other types of contracts, which is in contrast to predictions of neo-classical contract theory. However, many studies have evidenced stable existence of shared contract (Sadoulet et al., 1997, Pender and Fafchamps, 2006, Fujita, 2004). Risk sharing become more efficient under shared contract, since the water price was paid in terms of value of total output which allow buyers to share the production risk as well as output price risk with seller[11]. The crops grown under these contracts are mostly vegetables and flowers which are risky to produce as well as price of these crops fluctuate more in Indian markets. Therefore, total risk carry in the production of these crops are high. Therefore, buyers may find shared contract as good option to choose among the set of contracts. The average water paid in the shared contract is generally higher than the fixed contract which gives concern that seller gets more incentive for water under shared contract than other contracts.

<< Insert Table 1>>

In the survey, both buyers and sellers are asked to state the reason for choosing particular contract over other types of contracts. The survey revealed that 56% of the buyers who are under shared contracts choose shared contract because seller opts for it, 28% of them due to concern over timely irrigation, and 12% of them to share the risk and profit with the seller. Similarly, under fixed contract, 84% of the buyers revealed that they prefer fixed contract because they get more profit. On the other hand, sellers who had shared contract expressed that 50% of them chooses it to have more profit, while 26% of them chooses because buyer opt for it and 21% to share profit and loss with the buyer. Among the sellers who had other than shared contract, 52% of them choose because buyer asked for it and 28% because they do not want to get involved in the risky process. From the stated reasons for their choices revealed that the choice of shared contract is largely due to sellers' preference than the buyers' preference for it. The choice of fixed contract is largely due to buyers' preference for it than sellers'.

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[10] The crops that can be observed under both shared and fixed contract are selected for the comparison.
[11] Allen and Lueck (1992) claimed that the risk sharing in the shared contract is further efficient if the value of total output is shared rather than the share of the total output, therefore, the market risk will be shared between the agents.

At this point, we do not know whether the preference for shared contracts is due to risk sharing motive or due to difference in bargaining power of buyers and sellers. Inorder understand the choice of contract, we need to understand the individual preference of agents given the output price risk. Given the ability, each agent have a preference for a contract which maximises his/her utility. If both buyer and seller have simialr preference for contract individually, it is easy for them to decide the final contract. If the buyer and seller are have different individual preference for a contract, then they have to negotiate to finalize the contract. Each agents have some power to push the contract towards his/her individually prefered contract. Therefore, we hypothesize that i) the seller and buyer have equal bargaining power in deciding about the contract. Considering ability to withstand for risky situation, agents might have convergent or divergent preference for contract depending on their risk preferences[12]. For example, if both seller and buyer are risk averse, seller would prefer a risk-free (other than shared) contract due to the risk involved in it, whilethe buyer would prefer a contract (shared) which share the risk of production and vice verse if both are risk loving. If seller is risk loving and buyer is risk averse, seller would prefer the shared contract and buyer would prefer shared contract. Therefore, final chocie of contract mostly shared contract and the contract is fixed contract when seller and buyer is risk averse ans risk loving respectively. Therefore we hypothesize that ii) choice of coontract depends on the relative risk preference of the sellers and buyers

4. Experimental design

4.1 Experiment location

The field experiment was carried out in the month of December 2015[13]. The sellers and buyers who participated in the survey were contacted again. In total, 199 buyers and 100 sellers participated in the experiment[14] and, we have 177 matched pair of seller and buyer. The experiment involved different stages and carried out at a different stretch (detailed in section 4.3).

<< Insert Table 2>>

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[12] Ability might also leads to endogenous matching of buyers and sellers. Kajisa and Sakurai (2005), argues that in groundwater sharing buyers and sellers do not have many partners to choose according to their ability since water can only be delivered within certain area, therefore the endogenous matching is less prevalent in groundwater contract.

[13] The experiment is a second stage of the big experiment. In the first stage trust experiment was carried out to understand the subjects' trust behavior. Both the experiments were finished with in the day in a village.

[14] We had 199 buyers and 101 sellers in the previous survey. One seller was not available at the time of experiment.

Table 2 represents the socio-economic characteristics of sellers and buyers. Almost all respondents are males and married in both sellers and buyers categories. In terms of education and family size both the groups appears to be same with an average education of 5 years and 5 members per family. On average sellers are older and own more land than buyers, the difference is statistically significant. This indicates a substantial resource gap between sellers and buyers. Sellers on an average have a contract with at least two buyers, while the buyers mostly buy water from a single seller during a season. Sellers have at least a potential buyer and the buyers have almost no potential sellers around their deliverable area, which indicates high demand for water. The average length of contracts observed was 3 years and the average contracted area was 0.64 acre (≈0.26 hectares) and 46% of the contracts have a kinship link between the seller and the buyer (table 1).

4.2 Experimental design

We used the multiple price list method by Holt and Laury (2002), which was modified to fit to the groundwater contract setting. The subjects faced a choice between shared and fixed contract[15]. In order to incentivise the choices, we used the observed groundwater contract characteristics in the previous survey. As a first step, a major crop in each district was selected[16]. The selected crops were mulberry, maize, and chrysanthemum in Kolar, Chikkaballapura, and Tumkur districts respectively. Secondly, the payoff in the experiment was derived by considering the average yield in the area and considering the high and low price for output in the market which was taken from the previous survey. Here we explain the case of the mulberry crop[17]. The subjects are asked to assume that they are planning to have a new groundwater contract for an area of 0.25 acres. In the normal production year, 50 kg of cocoons can be produced per crop season per unit area. The price of the cocoons by the time of harvest could vary between INR 100 to INR 400 per kg, however, not sure about the probability of occurrence. Total earning from the contract will be INR 5000 or INR 20000 depending on whether it is the high or low price. Terms of payments were assumed as one-third of the total value of output in case of shared contract and INR 4000 per season per unit area in case of fixed contract. Therefore, shared contract would yield profit INR 3333 or INR 13333 for the buyer, and INR 1667 or INR 6667 for the seller. The fixed contract would yield Rs. 1000 or Rs. 16000

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[15] Land-linked and hourly contracts have similar characteristics like fixed contract where the price of water pre-decided and denot affected by output price. Therefore we grouped contracts as fixed nature contract.

[16] The crop grown are different in all three districts. The production and marketing aspects differ with crop. Thus subjects would not know the production and market aspects of the crop grown in another district. Use of single crop was not be feasible in terms of convincing the subjects, as well as assuming normal yield, since it varies depending on the fertility of the region.

[17] Other crops are similar in except the price and yield changes correspondingly

for the buyer and Rs. 4000 for the seller. The earning details for other crops can be seen in the appendix.

Table 3 presents the paired choices faced by buyers and sellers in the mulberry crop. We used 11 choices, wherein each choice the subjects are asked to choose between shared and fixed contract. The earnings are same in all the choices, while the probability with which it is earned changes for each choice situation. The probability of high price is for sure to start with and decreases as we move down along the decision rows. For example, in the first row, the probability of market price is high for sure. Therefore for sure buyer earns INR 13333 and the seller earns INR 6667 if they choose shared contract or they earn INR 16000 and INR 4000 respectively if they choose fixed contract. In the subsequent decision rows, the probability of high earnings decreases or probability of low earnings increase with 10 percentage points for each decision row and reaches probability zero in the end of decision row (For sure low earning).

<< Insert Table 3>>

The last column in table 3 shows the difference in the expected earnings between shared and fixed contract (not shown to subjects). In first six rows, the expected earnings from the fixed contract are higher for the buyers. Therefore, a *risk neutral* buyer would choose fixed contract in first six decisions and shift to shared contract. A buyer who shifts to shared contract before to the sixth row are considered as *risk averse* and those who shift after the sixth row are considered as *risk lovers*. In the seller case, the expected earnings from shared contracts are higher in the first six rows. Therefore, *risk neutral* sellers would choose shared contract in the first six decision row and shifts to fixed contract. A seller who shifts to fixed contract before the sixth row are considered as *risk averse* and those who shifts later than sixth row are considered as *risk lovers*.

Two notable features in our experimental design are, firstly, sellers and buyers preferences for contracts become contradictory if they considered maximizing their respective earnings from the contract. That is, in the first six rows the earnings are higher in fixed contract for the buyer, while it is higher in the shared contract for the seller. Secondly, buyer faces the market risk in both the contracts while the seller faces market risk only in shared contract but not in the fixed contract. Thus buyer faces a choice between two lottery situations, while the seller faces a choice between a lottery and a sure payment.

4.3 Experimental procedure:

Experiment was carried out in sequence of steps. Subjects completed each step with the help of instructions and proceeded to next step once the previous step was completed[18]. In step 1, the buyers and sellers were contacted separately at their place. We explained the purpose of contacting them. Once they agreed to participate, we read out the instructions and demonstrated in front of the subject. Subjects were asked to take two series of decisions, one now and other one later in the evening on the same day. Table 3 was shown to the subjects as part of the first series of decisions (without the difference in expected earnings). The instructor presented the task to subjects using their respective decision series depending on whether the subject is seller or buyer. At the end of stage 1, the subjects were asked to come to a common place in the village by evening in order to finish the second series of decisions[19]. Step 2, was carried out in the evening, and the actual sellers and buyers from the contract were matched to take a decisions jointly. The step 1 and 2 are similar, except that both seller's and buyer's earnings were presented (see appendix table A1). That means that the seller and the buyer had to jointly agree contract for each decision situation. In both steps, the subjects are allowed to switch between contracts only once.

In the introduction to step 1, the subjects were informed about the second series of the decisions, however, no clue was given either about their joint decision or matched partner. A decision in one of these two series was randomly selected to pay-out to three sellers and buyers in each district[20]. It was stressed that the selected subjects will be contacted at the end of the experiment in the district which was usually about 6 to 8 days to pay the earnings individually[21]. This discourages the partner's internal agreements to choose the contract in a particular way and induces them to maximize their own earnings.

Great effort and care was taken to ensure the subjects understanding over the probabilities and payoff structure of the experiment. In both step 1 and step 2 the choices were explained orally as well as demonstrated. The probability of high and low earnings was illustrated using green and red

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[18] The present part of the experiment is second phase of a big experiment, in the first phase trust experiment was carried out to elicit the trust behaviour of the subjects.

[19] They are to collect the participation fee of INR 100, as well as their earnings from the first phase of the experiment (trust experiment). Therefore, they have an incentive to attend the second stage in the evening.

[20] Since the task was adapted to the local contract conditions (yield, high and low price, fixed price), the stakes are high. Therefore it was not possible to pay each individual. To incentivise subjects for the task, we reduced the number of payments by randomly selecting three sellers and three buyers in each district. The selected candidates were contacted after finishing the experiment in the district.

[21] In order to build up the trust with lag in payment, we gave our experimenter contact including personal mobile number. In addition, we were not strangers, as we conducted a survey before with the same subjects which had built rapport with us.

slips respectively. Depending on the distribution of high and low earning probabilities we placed number of green and red slips into a bag and told participants to pick a slip from such bags. Drawing a green slip would yield them high price earnings and, a red slip would yield low price earnings. For example, in decision row 2 of table 3, we placed nine green slips and one red slip to represent 90 percent probability of high price earnings and 10 percent probability of low price earnings. In addition, we used an example session where subjects had to place a correct number of green and red slips into a bag for the given probability of high and low price earnings before they took decisions in step 1. Furthermore, to promote the consistent choices the participants were insisted on placing right number green and red slips into the bag before they take each decision.

At the end of the experiment in each district, three buyers and sellers were randomly selected. The selected subjects were personally contracted and paid later to ensure the anonymity. In order to select a decision, first a decision series was selected using a coin toss procedure, where *'head'* represents the step 1 (individual) series of choices and *'tail'* represents the step 2 (joint) series of choices. Then subjects got to draw a card from a deck of eleven numbered cards to determine which decision in the selected series would be paid for real. As explained above, subject drew a slip from the bag which consists of the distribution of high and low price earnings for the selected decision row.

The order in which the subject had faced the decisions was the same for all the subjects, where they first made individual decision followed by the joint decision. The aim of the study is to understand how the individual decisions of seller and buyer influence in the joint decision, therefore, we did not change the order in which the subjects make the decisions. Further, in the real world contract setting, the individual agents first think about his/her preferred contract given their ability and then approach the partner to decide the contract jointly.

5. Results

Table 4 reports the share of shared contract chosen by buyers, sellers, and joint for each decision row. We have 168 matched pairs, who have made consistent decisions in the individual as well as in the joint decision[22]. With a very small risk of a low output price, the proportion of sellers that prefer a shared contract is very high. With an increased risk of a low output price, the proportion of shared contract decreases among the sellers. In contrast, the proportion of buyers who prefer a

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[22] In total we had 177 pairs carrying out the joint decisions. Nine of them made inconsistent choices although their individual choices are consistent. All the buyers and sellers have taken consistent decision in the individual decision.

shared contract is low when the risk of a low price is small. For sellers there is a gradual shift from shared to fixed contract as the probability of a low price increases. For buyers, there is a large shift towards shared contract once the probability of a low price is above 50 percent chance. In the joint decision, we observed 57 percent of the decisions shift from choosing shared to fixed contract and, 23 percent shift from choosing fixed to shared contract as the risk of low output price increases. Remaining, 18 percent and 2 percent of the joint decisions chose shared and fixed contract throughout the decision rows respectively. The preference for the shared contract is high when the low output price risk is very small, and it increases with an increase in risk of low output price. As can be noticed the contract preference pattern in the joint decision is similar to the preferences pattern of sellers than buyers. However, Pearson-chi square test revealed that there exist significant distributional differences in the choice of contract between seller, buyer and joint decisions.[23].

<<Insert Table 4>>

Risk preferences of buyers and sellers are measured by accounting for number of safe contract made in their individual decision[24]. The buyer faces choice between two contracts which carries risk, therefore, safe option in such case is choice of contract which yeild them less variabile earnigns between high and low output prices. Given the choices sets in table 3, variability in earnings under shared contract is relative low compared to fixed contract. A risk neutral buyer would choose shared contract at least 5 times. If buyer chooses shared contract more than 5 times would considered as risk averse and if buyer chooses shared contract less than 5 times would considered as risk lovers. The seller faces choice between a risky contract and a safe contract, therefore, safe option in such case is choice of safe contract. Fixed contract is the safe contract which does not carry any risk to seller. A risk neutral seller would choose fixed contract at least five times given the choice situations. If a seller chooses fixed contract more than 5 times would considered as risk averse and if a seller chooses fixed contract less than 5 times would considered as risk averse. The last row in table 4 shows the number of safe choices made by sellers and buyers[25]. An average 6 and 5 number of safe choices are chosen by buyers and sellers respectively. The difference in number of safe choices is statistically significant at the 1 percent level (t-test), which indicates that the buyers are relatively more risk averse than sellers.

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[23] Using chi-square test, we compared each decision situation between buyers vs. sellers, joint vs. sellers, and joint vs. buyers. In total, 33 chi-square tests indicated there exist statistical difference in the choice of contract between these groups.
[24] Safe option is number of safe alternatives chosen after shifting from risky alternative without ever shifting back.
[25] The row at which the risk neutral buyer and seller shift is same for all the crop, which allow us to compare the safe option made by sellers and buyers

Next we analyze the determinants of the individual decisions. We use a random parameter binary probit model where the dependent variable is equal to one if a shared contract is chosen. All models are estimated using 500 Halton draws. The estimates coefficients are presented in table 5. In columns 1 and 3, we report results from a model with the difference in expected earnings between shared and fixed contract and crop dummies as explanatory variables. The difference in expected earnings between contracts could take positive and negative values. A positive difference means that the expected earnings from a shared contract are higher than a fixed contract, and vice versa. We allow for different effects for positive and negative differences. In columns 2 and 4, we include socio-economic characteristics of buyers and sellers.

<<Insert Table 5>>

In the buyer's decisions, the alternative specific constant (ASC) is positive and significant, which indicates that the buyers have intrinsic preferences for shared contract. When the expected earnings from shared contract is higher than fixed contract, an increase in the level of earnings difference between shared and fixed contract increases the likelihood of choosing the shared contract and vice versa when the expected earnings from fixed contract is higher than shared contract. The coefficients on crop dummies show that it is less likely to choose a shared contract in Mulberry and Maize crops compared to Chrysanthemum. This is due to high variation in fixed contract earning under high and low output prices in case of chrysanthemum, while it is relatively low in for Mulberry and Maize. Therefore, shared contract is more likely to choose in case of Chrysanthemum. Among the socio-economic variables, increase in the education years and land holding acres, the buyers are less likely to choose a shared contract, which suggests that they are better able to undertake risky contract compared to buyers who are less educated and own less land. If the buyer has shared contract in the previous season it is more likely to choose shared contract compared to the buyer who did not have shared contract.

In the seller's decision, the ASC is negative and not significant which suggests that sellers do not have an inherent preference for either of the contracts. When the expected earnings from the shared contract is higher than fixed contract, an increase in the difference in earnings between contracts increases the likelihood of choosing the shared contract, and vice versa when the fixed contract earning is more than shared contract. With respect to crop dummies, sellers are less likely to choose shared contract in Mulberry and Maize crops compared to Chrysanthemum flower crop, however, significant difference exist between maize and flower crop. Sellers who are educated are more likely to choose shared contract. Increase in the land holding by seller do not show any significant preference for the shared contract, which suggests that when the seller has more land to

cultivate by himself, he may not care much about the high incentive contract such as shared contract. As mentioned before, the seller has on an average have two buyers. Therefore, seller's previous season contract was classified into three categories, i.e., shared contract with all the buyers, other than shared contract with all the buyers and different contract with different buyers. Considering seller who is had different contract with different buyers has a base case, we find that the sellers who had other than shared contract with all the byers are less likely to choose shared contract compared to the base group. This implies that the path dependent preferences for the contract. The estimated standard deviations on difference in earnings between the contracts are significant in both seller and buyer case, which indicates we captured the unobserved heterogeneity in buyers' and sellers' choices with respect to earnings.

In order to analyze the determinants of shared contract in the joint decision, we use the proportion of shared contract chosen jointly given all the choice situations as the dependent variable[26]. We use relative risk preferences, relative observed characteristics of sellers and buyers and some contract characteristics as explanatory variables to explain the choice of shared contract in the joint decision. The linear regression results are presented in table 6. As can be seen, the relative risk preferences of buyers and sellers play a significant role in choice of shared contract[27]. If buyers are relatively more risk averse than sellers the proportion of shared contract chosen in the joint decision increases by 16 percent points compared when buyers and sellers are equally risk-averse. Thus, a relatively risk averse buyer is able to share some of the risk with a less risk averse seller. The magnitude of the coefficient is sizable which suggest prominent effect of relative risk preference of buyers and sellers. Other observed relative characteristics like land holdings, education, and previous contract do not explain the share of shared contract in the joint decision.

<<Insert Table 6>>

In order to understand the choice dynamic in the joint decision with relative risk preference of agents, we plot the proportion of shared contract choice according to relative risk preferences of the sellers and buyers for each decision rows. Figure 1, shows that when buyers are more risk averse than sellers, the proportion of shared contract choices are high compared with the cases where they have same risk preferences or the buyer is less risk averse than the seller. There is no difference in

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[26] We have tried the model with using sellers and buyers preference for shared contract to explain the joint preference for shared contract. The model suffered from multicollinearity, because the individual choices of sellers and buyers are strongly inversely correlated.

[27] Our risk aversion measure is number of safe choices by the sellers and buyers in the individual decisions. Among the matched pairs, 58 percent of the buyers are relatively more risk averse than sellers, 27 percentage of buyers are relatively less risk averse than seller and 15 % of the buyers have equally risk averse as sellers.

the proportion of shared contract choice in the latter two groups. Note that for the first three decisions rows, the proportion of share contract is very high. In the first 3 decision rows, the probability of high price earning is high which benefits sellers more than buyers with a shared contract. This adds to the unexplained component of shared contract choice in the joint decision. The findings suggest the fact that the joint choice of contracts is strongly influenced by sellers than buyers.

<<Figure 1>>

In order to shed light on implicit bargaining process between buyers and sellers, we have to understand how the individual decisions of sellers and buyers are aligned with each other and how the alignments in the individual preference of buyers and sellers affects the outcome of joint decision. The joint outcomes are realized by comparing the joint choice to the choices of buyer's and seller's for each decision rows. The potential joint outcomes are i) the joint decision is identical to the seller's individual decision, ii) the joint decision is identical to the buyer's individual decision, iii) the joint decision is identical to both buyer's and seller's individual decision and iv) the joint decision is different from both buyers and sellers individual decision[28]. The fourth category is called choice shifts in the decision theory (Eliaz et al., 1971)[29]. These joint outcomes are mutually exclusive for an individual pair for given choice situation. We estimate the multinomial probit model (MNP) using the joint outcome categories as dependent variable, and level of preference disagreement between buyers and sellers, contract characteristics and relative socio-economics characteristics of buyers and sellers as explanatory variables. In order to construct the degree of disagreement in the individual preferences, we compare the individual choices of buyers and sellers for each decision rows. We use the predicted probability of choosing a contract by buyers and sellers for each decision rows and take absolute difference between predicted probabilities of buyers and sellers. The degree of disagreement indicates the preference divergence between buyers and sellers for given decision situation. The value ranges from 0 to 1, it is zero, if the buyer and seller have similar preference for a contract and it is 1 if the buyer and seller have contrary preference for a contract. Any value between zero and one indicates the extent of disagreement. Figure 2 in the appendix shows the variation in degree of disagreement between buyers and sellers over the decisions rows. The measure of disagreement decreases as the low and high price risks are close to each other.

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[28] Out of 1848 decision, 47%, 28%, 15%, and 10% of the decisions belongs to category i), category ii), category iii), and category iv) respectively.

[29] Choice shift is a feature of group decision making, where the effect of group decision processes affects the individual members decision making, therefore, within the group individuals make different choice than what they made individually (Eliaz et al, 1971).

The marginal effects of estimated model are presented in table 7. The measure of disagreement is significant in all the four categories, which indicate a strong effect of disagreement on whose preference the joint decision corresponds. Model results implies that for a 10 percentage point increase in the level of disagreement between seller and buyer the likelihood of a joint decision corresponds to the sellers preference increases by 5 percentage points, while it is 1 percentage point more likely to corresponds to the buyer's preference. The marginal effect is larger when the joint decision corresponds to sellers' preference than the buyers', which indicates a stronger effect of the seller's preferences on joint decision. In the case of joint outcome iii) and iv), 10 percentage points increase in the level of disagreement between buyers and sellers it is 4 percentage point less likely to that the joint decision corresponds to preferences of both agents and 2 percentage point less likely that the joint decision being in the choice shift category. These findings suggest that, further the disagreement between buyers and sellers the joint decision corresponds to either sellers or buyers preferences, however, less likely to correspond to both sellers and buyers preferences and less likely to shift away from their individual preference.

<<Insert Table 7>>

Kinship ties between seller and buyer have a significant impact on joint decision outcomes. When buyer and seller share kinship ties, it is 15 percentage points more likely that the joint decision correspond to the buyer's preference compared to non-kin pairs. This suggests that kinship increases the influence of the buyers on joint decision of contract. Furthermore, long-term contractual relationships suggest that it is more likely that the seller and buyer share the same preferences, and that the joint contract choice is the same as the individual ones. If the buyer and seller had a shared contract in the previous season, then the likelihood that the joint decision is the same as the buyer's individual decision is 9 percentage points lower. The presence of potential sellers seems to increase the influence of the buyers in the joint decision. Kajisa and Sakurai (2003) also found a similar result. The presence of a potential seller acts as an alternative option for the buyer to have contract with and thus seller could feel it as a threat for contractual break, thus increases the buyer's bargaining power. Among the socio-economic characteristics of buyer in relation to the seller, few of the coefficients are statistically significant; only if the buyer own more land than the seller it is more likely that the joint decision corresponds to the choices of both sellers and buyers. With respect to crop dummies, the joint decision is more likely to correspond to the seller's choice and less likely to the buyer's choice in Mulberry and Maize crops compared to Chrysanthemum flower. The crop wise number of safe options chosen by sellers and buyers revealed that buyers are risk averse and sellers

are risk lover in the flower crop compared to other crops[30]. Therefore, the sellers are relatively risk lover who have ability to withstand for risky situation which allow buyers to choose the contract according to their preference in the joint decision. In other crops, sellers and buyers have almost similar risk preference, which is difficult for buyer to push the contract in favour of them.

In order to focus on the relative influence of seller and buyer on the joint decision we now therefore restrict the analysis to the case where the joint decision is either corresponds to buyer's or seller's decision. We estimate a binary probit model where the dependent variable is equal to one if the joint decision is identical to the buyer's individual decision. The marginal effects are presented in table 8. As can be seen from the column 1, the degree of disagreement between seller and buyer and kinship ties significantly affect buyer's relative power to influence the joint decision to their corresponding preference. 10 percentage point increase in the degree of disagreement between buyers and sellers decreases the likelihood of joint decision corresponds to the buyer's decision by 2 percentage points. Contrary to this, buyers who have a kinship link with seller are 2.5 percentage points more likely that the joint decision corresponds to their individual preference compare to the buyers who do not have such ties. These results re-assure the strong influence of seller's in the bargaining process when deciding the contract jointly and that the kinship implies to reduce such influences.

<<Insert Table 8>>

Further, it is interesting to see how the buyers and sellers characteristics in interaction with their degree of disagreement would determine the joint decision outcomes. The interaction model suffers from multicollinearity problem. Therefore, with the same spirit, in column 2 and 3 we estimate the model by restricting the level of disagreement more than 0.5 and 0.8 units. The results support the findings in column 1. When the level of disagreement between seller and buyer is more than 0.5, having a kinship tie and increase in the length of contract with seller increases the likelihood of buyer's preference being corresponded in the joint decision. This confirms that interpersonal relationship between seller and buyer through kinship ties and through long term contract increases the buyer relative bargaining power in deciding the contract.

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[30] Average number of safe options chosen by buyers is 5.08 , 5.79, and 7.16 and by seller is 5.12, 6.17, and 4.62 in Mulberry, Maize and Flower crops respectively. The median difference showed that the difference in the number of safe choices made by buyer and seller is significantly different (Prob > |z| = 0.00) in case of flower and the difference is not significantly different in case of Mulberry and Maize crops.

6. Discussion and conclusion

In this study, we examined the determinants of choice of contract and relative power of buyers and sellers in determining the choice of contract in informal groundwater sharing contracts. We carried out a field experiment using matched pair of sellers and buyers from the observed groundwater contracts in India. The experiment considered the production risk as constant and varied the probability of the market price of output. The buyers and sellers take series of decisions choosing between shared and fixed contract under the varied high and low output price risk. Both sellers and buyers have made the decisions, first individually, then jointly. We find more preference for shared contract in the joint decision compared to individual choices of sellers and buyers. Our survey on groundwater contract in the study area indicates that 87 percent of the observed water sharing contracts are under is shared contracts. Joint choice resembles the high shared of shared contract as we observed in the study area.

We analyse the preferences of agents in two steps. Firstly, aim to understand determinants of shared contracts in the joint decision. We evidenced increase in the choice of shared contract when buyers are relatively risk averse than sellers. The contract theory argued that risk aversion plays a major role in choice of contract and argued risk sharing is a positive reason for the existence of share contract (Stiglitz, 1974, David, 1977). Our evidence confirms the risk sharing arguments of contract theory. In the conceptualized model, Stiglitz (1974) considered the relative risk preferences of the landlord and tenant to explain the existence of shared contract. Shared contract has been predicted when the landlord and tenant are equally risk-averse.. These predictions are in contrast with our findings. Our finding confirms that, to a greater extent the buyers are relatively risk averse than the sellers, therefore, buyers are able to share the risk with seller who is less risk averse by choosing shared contract. Therefore the preference for the shared contract persists strongly.

Secondly, we focus on the relative power of buyers and sellers in influencing the joint decision towards their individually preferred contract. We find that seller has more power to influence the joint contract when the individual preferences of buyers and sellers are in contrary. This provides the evidence for seller's monopolistic nature in the groundwater contract. Janakarajan (1993) and Shah and Ballabh (1997) evidenced price charged for water is higher than the cost of extraction in groundwater contracts, which was depicted as the characteristics of a monopoly market. In contrary Kolvalli and Chicoine (1989) found net return from selling groundwater was not exorbitant in Gujarat state, and expressed that the sellers do not exercise full advantage of being in the monopoly position which due to interlinkage of other input markets such as labour and finance

markets. Furthermore they argue that reputational concerned in the close community in villages might induce the seller to charge reasonable price.

In addition, we identified the characteristics of the buyer's which augment their relative power in the contract. We find having long term contract and sharing kinship ties with seller increases the buyers' power in the joint choice of contract. Evolution of strong interpersonal relationship between buyers and sellers through long length of contract and altruistic concern towards kin buyer might be underlying mechanism which allows buyers to exercise their preferences on joint decision. Jacoby et al. (2004) found price discrimination in the groundwater contracts in Pakistan. They found seller charged a lower price for tenant-cum-buyers compared to non-tenant buyers. Similar evidence was found by Janakarajan (1993) and Narayanamoorthy (1991) found seller provide hidden price concession and priority services to large, regular and on–time payment buyers in Tamil Nadu. We partially confirms the evidence of Kajisa and Sakurai (2003), where the presence of potential seller in the deliverable area increases the power of buyer where the seller might feel the possible threat of contractual break, therefore, the seller could not exercise the monopoly power.

By large, the monopoly decision of contract is prominently observed in groundwater contracts. Thus, it was called for some form of regulation mechanisms to combat the over-extraction of groundwater. However, these sharing mechanisms increase access to water and increased the income of small and marginal farmers who are unable to install tubewell (Meinzen-Dick, 1996a, Meinzen-Dick, 1996b). As a long-term solution, the establishment of water right on quantity extraction and allocation based on the resource availability was recommended, so that, it will take care of scarcity value of water and help to reduce the overdrafts (Easter et al., 1999). However, Shah (1993) expressed concerned about the successfulness of these legal or organizational public policy unless the property right on groundwater is reformed drastically by understanding the local institutional settings. Therefore, further effort research is needed to understand the different policy intervention to up bring the present form of resource allocation towards competitive market structure.

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Table 1 : Groundwater contract characteristics in Karnataka					
Particulars of contracts	**Shared contract**	**Fixed contract**	**Hourly payment contract**	**Land-linked water contract**	**All**
No of contract	173	18	2	6	199
Terms of payment	0.33 (0.03)	-	40^a (14.12)	1.2^b (0.66)	-
Time of payment	After the crop harvest	2-3 installments before the harvest	After every irrigation	-	-
Crops observed	Chrysanthemum, Maize, China aster, and Mulberry	Tomato, Mulberry, Maize, and Groundnut	Tomato, and Onion	Mulberry, Tomato, Maize, Finger millet, and Coriander	
Price of water per season per acre					
Mulberry	10364 (4154)	6701 (2258)	-	-	-
Maize	4397 (1387)	2800 (754)	-	-	-
Tomato	12789 (9314)	10611 (5759)	-	-	-
Years of contract	3.18 (3.36)	2.14 (2.05)	2.67 (3.30)	3.50 (3.41)	3.09 (3.26)
Area contracted (Acre)	0.58 (0.40)	1.28 (0.71)	0.50 (0.00)	0.79 (0.46)	0.64 (0.48)
Kin relationship between seller and buyer	0.43 (0.50)	0.67 (0.49)	0.00 (0.00)	0.67 (0.52)	0.46 (0.50)
Parentheses represent the standard deviation, *'a' payment made Rupees per hour of water delivered, 'b' is measured of acre of land given to seller to get water for an acre* *NA : no common measure to have an average, because it depends on the crop type.*					

Table 2 : Descriptive statistics of socio-economic characteristics of seller and buyer of groundwater contracts

Variables	Seller				Buyer				t-test
	Mean	Std. Dev	Min	Max	Mean	Std Dev	Min	Max	(p-value)
Gender	0.97	0.17	0	1	0.98	0.14	0	1	0.6108
Age	50.74	8.07	28	74	48.26	8.43	24	70	0.014
Education	5.43	4.55	0	16	5.58	4.01	0	15	0.7793
Marital status (Married =1, 0 Otherwise)	0.99	0.1	0	1	1	0	1	1	0.3173
Family size	5.25	2.61	2	20	5.05	1.37	2	10	0.472
Land owned (acre)	3.31	2.16	1	10	2.13	1.4	0.1	9	0
No. of buyers (sellers) per sellers (buyers)	1.89	1.09	1	5	1	0	1	1	0
Potential buyers/sellers	1.01	1.24	0	4	0.1	0.37	0	3	0
No of observation	101				199				

Decision row	Buyer decision				Seller decision			Diff. expected earnings (SC-FC)	
	Shared contract (SC)		Fixed contract (FC)		Shared contract (SC)		Fixed contract (FC)	Buyer	Seller
1	For sure you earn Rs. **13333**		For sure you earn Rs. **16000**		For sure you earn Rs. **6667**		For sure you earn Rs. **4000**	-2667	2667
2	10% chance you earn Rs. **3333**	OR	90% chance you earn Rs. **13333**	10% chance you earn Rs. **1000** OR	90% chance you earn Rs. **16000**	10% chance you earn Rs. **1667**	OR	90% chance you earn Rs. **6667**	For sure you earn Rs. **4000**	-2167	2167
3	20% chance you earn Rs. **3333**	OR	80% chance you earn Rs. **13333**	20% chance you earn Rs. **1000** OR	80% chance you earn Rs. **16000**	20% chance you earn Rs. **1667**	OR	80% chance you earn Rs. **6667**	For sure you earn Rs. **4000**	-1667	1667
4	30% chance you earn Rs. **3333**	OR	70% chance you earn Rs. **13333**	30% chance you earn Rs. **1000** OR	70% chance you earn Rs. **16000**	30% chance you earn Rs. **1667**	OR	70% chance you earn Rs. **6667**	For sure you earn Rs. **4000**	-1167	1167
5	40% chance you earn Rs. **3333**	OR	60% chance you earn Rs. **13333**	40% chance you earn Rs. **1000** OR	60% chance you earn Rs. **16000**	40% chance you earn Rs. **1667**	OR	60% chance you earn Rs. **6667**	For sure you earn Rs. **4000**	-667	667
6	50% chance you earn Rs. **3333**	OR	50% chance you earn Rs. **13333**	50% chance you earn Rs. **1000** OR	50% chance you earn Rs. **16000**	50% chance you earn Rs. **1667**	OR	50% chance you earn Rs. **6667**	For sure you earn Rs. **4000**	-167	167
7	60% chance you earn Rs. **3333**	OR	40 chance you earn Rs. **13333**	60% chance you earn Rs. **1000** OR	40% chance you earn Rs. **16000**	60% chance you earn Rs. **1667**	OR	40% chance you earn Rs. **6667**	For sure you earn Rs. **4000**	333	-333
8	70% chance you earn Rs. **3333**	OR	30% chance you earn Rs. **13333**	70% chance you earn Rs. **1000** OR	30% chance you earn Rs. **16000**	70% chance you earn Rs. **1667**	OR	30% chance you earn Rs. **6667**	For sure you earn Rs. **4000**	833	-833
9	80% chance you earn Rs. **3333**	OR	20% chance earn Rs. **13333**	80% chance you earn Rs. **1000** OR	20% chance you earn Rs. **16000**	80% chance you earn Rs. **1667**	OR	20% chance you earn Rs. **6667**	For sure you earn Rs. **4000**	1333	-1333
10	90% chance you earn Rs. **3333**	OR	10% chance you earn Rs. **13333**	90% chance you earn Rs. **1000** OR	10% chance you earn Rs. **16000**	90% chance you earn Rs. **1667**	OR	10% chance you earn Rs. **6667**	For sure you earn Rs. **4000**	1833	-1833

Table 3: Decisions faced by the buyers and sellers in mulberry crop

| 11 | For you earns Rs. **3333** | For sure you earn Rs. **1000** | For you earns Rs. **1667** | For sure you earn Rs. **4000** | 2333 | -2333 |

Table 4 : Proportion of shared contract choices in buyer, seller, and joint decision

Decision row	Relative frequency of shared contract choices		
	Buyer	Seller	Joint
1	0.00	1.00	0.74
2	0.11	0.93	0.74
3	0.18	0.88	0.73
4	0.27	0.84	0.66
5	0.37	0.69	0.63
6	0.67	0.56	0.58
7	0.84	0.42	0.54
8	0.93	0.27	0.49
9	0.95	0.16	0.43
10	0.98	0.09	0.40
11	1.00	0.00	0.41
No of observation	168	91	168
Average no. of safe choices	6.30 (2.12)	5.15 (2.52)	NA

parentheses represent the standard deviation,
(NA) indicates not attended

Table 5 : Results random parameter binary probit model for the buyers and sellers preference for shared contract

Variables	(1)	(2)	(3)	(4)
	Buyer		Seller	
Constant	2.415 ***	3.588***	-0.086	-0.187
	(0.105)	(0.189)	(0.120)	(0.189)
Difference in earning	5.982 ***	6.752***	2.347***	2.368***
if earning from SC> FC	(0.630)	(0.630)	0.236	(0.237)
Difference in earning	-1.141 ***	-1.278 ***	-0.812***	-0.845***
if earning from SC< FC	(0.069)	(0.075)	(0.138)	(0.142)
Crop : Mulberry	-2.902 ***	-2.250***	-0.194*	-0.102
	(0.113)	(0.141)	(0.110)	(0.149)
Crop : Maize [a]	-2.588 ***	-2.842***	-0.696***	-0.767***
	(0.113)	(0.133)	(0.116)	(0.122)
Socioeconomic characteristics				
Education		-0.120***		0.030***
(years)		(0.013)		(0.009)
Land holdings		-0.126***		0.034
(acres)		(0.032)		(0.022)
Previous contract: SC		1.304***		-0.144
		(0.157)		(0.136)
Previous contract: Other than SC [b]				-0.640***
				(0.164)
Standard deviation of the random variables				
Difference in earning	2.703 ***	3.561***	1.514***	1.554***
if earning from SC> FC	(0.288)	(0.319)	(0.150)	(0.155)
Difference in earning	0.665 ***	0.745***	0.553***	0.576***
if earning from SC< FC	(0.050)	(0.054)	(0.089)	(0.092)
Pseudo R-squared	0.31	0.33	0.23	0.23
No. of observation	1848		1001	
No. of buyers/sellers	168		91	

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

a- Base is chrysanthemum flower crop, b – Base is when seller has both sc and other- than-sc with buyers

Table 6: Determinants of proportion of shared contract in joint decision

Variables	Proportion of shared contract
Constant	0.578***
	(0.109)
Buyer more risk averse than seller	0.159**
	(0.065)
Seller relatively risk averse than buyer	0.029
	(0.071)
Buyer more education than seller	-0.061
	(0.047)
Buyer has more land than seller	0.079
	(0.052)
Buyer elder than seller	-0.038
	(0.049)
Previous contract : SC	-0.075
	(0.076)
Crop: Mulberry	-0.046
	(0.069)
Crop: Maize	-0.016
	(0.053)
No of pairs	168
R-squared	0.087
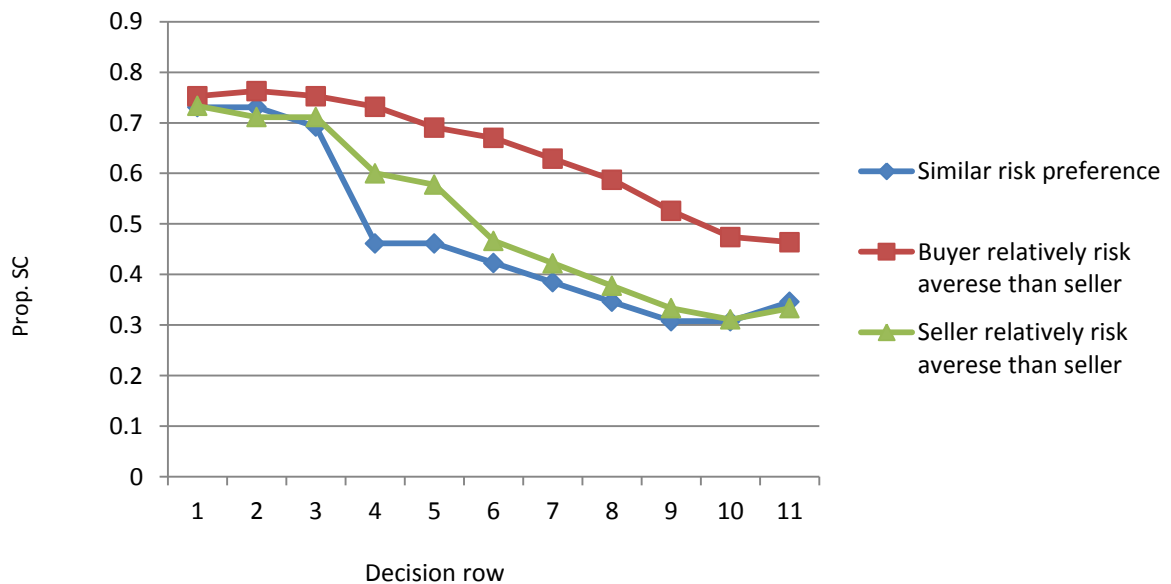
Figure 1: The proportion of shared contract choose according to risk preferences of buyers and sellers

Table 7: Marginal effects of multinomial probit model with 4 categories of choices

Variables	(1) Joint=Seller	(2) Joint =Buyer	(3) Joint=Seller=Buyer	(4) Choice shift case
Disagreement b/w buyer and seller $|Bprob - Sprob|$	0.469***	0.149***	-0.375***	-0.243***
	(0.047)	(0.049)	(0.031)	(0.027)
Kinship ties	-0.146***	0.151***	0.007	-0.013
	(0.036)	(0.037)	(0.024)	(0.020)
years of contract (years)	-0.011**	0.006	0.007**	-0.003
	(0.006)	(0.005)	(0.003)	(0.003)
Previous contract: SC	0.098	-0.095*	-0.055	0.052
	(0.064)	(0.056)	(0.048)	(0.035)
No. of potential sellers	-0.027	0.075**	0.049	-0.097**
	(0.052)	(0.038)	(0.033)	(0.049)
Buyer has more land than seller	-0.031	-0.003	0.052*	-0.019
	(0.044)	(0.042)	(0.028)	(0.024)
Buyer more edu than seller	-0.046	0.040	0.005	0.000
	(0.040)	(0.039)	(0.026)	(0.020)
Buyer elder than seller	0.061	-0.033	-0.001	-0.027
	(0.043)	(0.039)	(0.028)	(0.022)
Crop: Mulberry	0.134**	-0.125**	-0.026	0.018
	(0.057)	(0.050)	(0.043)	(0.032)
Crop: Maize	0.187***	-0.112***	-0.063**	-0.012
	(0.043)	(0.042)	(0.025)	(0.022)
No. of observations	1,848	1,848	1,848	1,848
No. of pairs	168	168	168	168

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8: Estimates of conditional model for buyers bargaining power

Dep variable : Buyer decide	(1)	(2)	(3)
		Disagreement>0.5	Disagreement>0.8
Disagreement b/w buyer and seller |Bprob – Sprob|	-0.218***	-	-
	(0.0630)		
Kinship ties	0.250***	0.250***	0.330***
	(0.0739)	(0.0872)	(0.107)
years of contract (years)	0.0153	0.0233*	0.0260*
	(0.0109)	(0.0129)	(0.0150)
Previous contract: SC	-0.158	-0.194	-0.154
	(0.125)	(0.143)	(0.168)
No. of potential sellers	0.133	0.166	0.210
	(0.110)	(0.129)	(0.145)
Buyer has more land than seller	0.00270	-0.0629	-0.0319
	(0.0834)	(0.0988)	(0.113)
Buyer more education than seller	0.0669	0.107	0.0789
	(0.0770)	(0.0906)	(0.104)
Buyer elder than seller	-0.0338	-0.0478	-0.0756
	(0.0793)	(0.0928)	(0.107)
Crop: Mulberry	-0.177*	-0.134	-0.209
	(0.108)	(0.130)	(0.149)
Crop: Maize	-0.247***	-0.256***	-0.317***
	(0.0776)	(0.0868)	(0.100)
No. if observations	1,378	1,203	974
No. of Pairs	168	168	167

Standard errors in parentheses
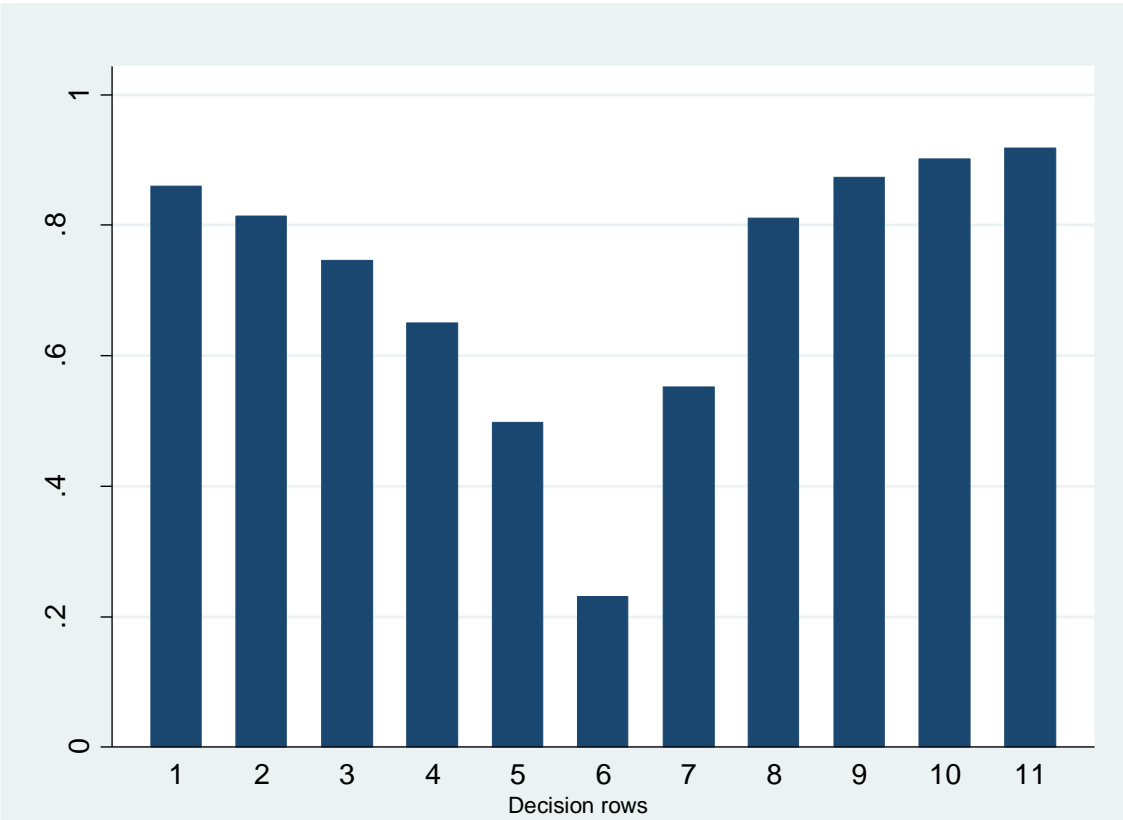*** p<0.01, ** p<0.05, * p<0.1

Appendix

Figure 2: Degree of disagreement between buyers and sellers preferences

Table A1 : Joint decision faced by seller and buyer in mulberry

Decision row	Earnings in SC		Your choice		Earnings in FC
			SC	FC	
1	For sure seller earn Rs. **6667** and, buyer earns Rs. **13333**				For sure seller earns Rs. **4000** and, Buyer earns Rs. **16000**
2	With 10% chance seller earns Rs. **1667** and, buyer earns Rs. **3333** OR With 90% chance Seller earns Rs. **6667** and buyer earn Rs. **13333**				Seller earns Rs. **4000** and, Buyer earns Rs. **1000** with 10% chance or Rs. **16000** with 90% chance
3	With 20% chance seller earns Rs. **1667** and, buyer earns Rs. **3333** OR With 80% chance Seller earns Rs. **6667** and buyer earn Rs. **13333**				Seller earns Rs. **4000** and, Buyer earns Rs. **1000** with 20% chance or Rs. **16000** with 80% chance
4	With 30% chance seller earns Rs. **1667** and, buyer earns Rs. **3333** OR With 70% chance Seller earns Rs. **6667** and buyer earn Rs. **13333**				Seller earns Rs. **4000** and, Buyer earns Rs. **1000** with 30% chance or Rs. **16000** with 70% chance
5	With 40% chance seller earns Rs. **1667** and, buyer earns Rs. **3333** OR With 60% chance Seller earns Rs. **6667** and buyer earn Rs. **13333**				Seller earns Rs. **4000** and, Buyer earns Rs. **1000** with 40% chance or Rs. **16000** with 60% chance
6	With 50% chance seller earns Rs. **1667** and, buyer earns Rs. **3333** OR With 50% chance Seller earns Rs. **6667** and buyer earn Rs. **13333**				Seller earns Rs. **4000** and, Buyer earns Rs. **1000** with 50% chance or Rs. **16000** with 50% chance
7	With 60% chance seller earns Rs. **1667** and, buyer earns Rs. **3333** OR With 40% chance Seller earns Rs. **6667** and buyer earn Rs. **13333**				Seller earns Rs. **4000** and, Buyer earns Rs. **1000** with 60% chance or Rs. **16000** with 40% chance
8	With 70% chance seller earns Rs. **1667** and, buyer earns Rs. **3333** OR With 30% chance Seller earns Rs. **6667** and buyer earn Rs. **13333**				Seller earns Rs. **4000** and, Buyer earns Rs. **1000** with 70% chance or Rs. **16000** with 30% chance
9	With 80% chance seller earns Rs. **1667** and, buyer earns Rs. **3333** OR With 20% chance Seller earns Rs. **6667** and buyer earn Rs. **13333**				Seller earns Rs. **4000** and, Buyer earns Rs. **1000** with 80% chance or Rs. **16000** with 20% chance
10	With 90% chance seller earns Rs. **1667** and, buyer earns Rs. **3333** OR With 10% chance Seller earns Rs. **6667** and buyer earn Rs. **13333**				Seller earns Rs. **4000** and, Buyer earns Rs. **1000** with 90% chance or Rs. **16000** with 10% chance
11	For sure seller earns Rs. **1667** and, Buyer earns Rs. **3333**				For sure seller earns Rs. **4000** and, Buyer earns Rs. **1000**

Table A2 : Expected and difference in earnings between SC and FC for seller and buyer in Mulberry crop

Decision row	Expected earning in SC		Expected earning in FC		Diff (FC-SC)		Risk aversion parameter	
	Seller	Buyer	Seller	Buyer	Seller	Buyer	Seller	Buyer
1	6667	13333	4000	16000	2667	-2667	> 3.25	> 1.15
2	6167	12333	4000	14500	2167	-2167	3.25	1.15
3	5667	11333	4000	13000	1667	-1667	2.18	0.76
4	5167	10333	4000	11500	1167	-1167	1.44	0.49
5	4667	9333	4000	10000	667	-667	0.81	0.27
6	4167	8333	4000	8500	167	-167	0.20	0.07
7	3667	7333	4000	7000	-333	333	-0.42	-0.14
8	3167	6333	4000	5500	-833	833	-1.13	-0.37
9	2667	5333	4000	4000	-1333	1333	-2.04	-0.65
10	2167	4333	4000	2500	-1833	1833	-3.47	-1.08
11	1667	3333	4000	1000	-2333	2333	> -3.47	> -1.08

Table A3 : Joint decision faced by seller and buyer in Maize

Decision row	Earnings in SC			Your choice SC	Your choice FC	Earnings in FC
1	For sure seller earn Rs. **3000** and, buyer earns Rs. **6000**					For sure seller earns Rs. **2000** and, Buyer earns Rs. **7000**
2	With 10% chance seller earns Rs. **1200** and, buyer earns Rs. **2400**	OR	With 90% chance Seller earns Rs. **3000** and buyer earn Rs. **6000**			Seller earns Rs. **2000** and, Buyer earns Rs. **1600** with 10% chance or Rs. **7000** with 90% chance
3	With 20% chance seller earns Rs. **1200** and, buyer earns Rs. **2400**	OR	With 80% chance Seller earns Rs. **3000** and buyer earn Rs. **6000**			Seller earns Rs. **2000** and, Buyer earns Rs. **1600** with 20% chance or Rs. **7000** with 80% chance
4	With 30% chance seller earns Rs. **1200** and, buyer earns Rs. **2400**	OR	With 70% chance Seller earns Rs. **3000** and buyer earn Rs. **6000**			Seller earns Rs. **2000** and, Buyer earns Rs. **1600** with 30% chance or Rs. **7000** with 70% chance
5	With 40% chance seller earns Rs. **1200** and, buyer earns Rs. **2400**	OR	With 60% chance Seller earns Rs. **3000** and buyer earn Rs. **6000**			Seller earns Rs. **2000** and, Buyer earns Rs. **1600** with 40% chance or Rs. **7000** with 60% chance
6	With 50% chance seller earns Rs. **1200** and, buyer earns Rs. **2400**	OR	With 50% chance Seller earns Rs. **3000** and buyer earn Rs. **6000**			Seller earns Rs. **2000** and, Buyer earns Rs. **1600** with 50% chance or Rs. **7000** with 50% chance
7	With 60% chance seller earns Rs. **1200** and, buyer earns Rs. **2400**	OR	With 40% chance Seller earns Rs. **3000** and buyer earn Rs. **6000**			Seller earns Rs. **2000** and, Buyer earns Rs. **1600**with 60% chance or Rs. **7000** with 40% chance
8	With 70% chance seller earns Rs. **1200** and, buyer earns Rs. **2400**	OR	With 30% chance Seller earns Rs. **3000** and buyer earn Rs. **6000**			Seller earns Rs. **2000** and, Buyer earns Rs. **1600** with 70% chance or Rs. **7000** with 30% chance
9	With 80% chance seller earns Rs. **1200** and, buyer earns Rs. **2400**	OR	With 20% chance Seller earns Rs. **3000** and buyer earn Rs. **6000**			Seller earns Rs. **2000** and, Buyer earns Rs. **1600** with 80% chance or Rs. **7000** with 20% chance
10	With 90% chance seller earns Rs. **1200** and, buyer earns Rs. **2400**	OR	With 10% chance Seller earns Rs. **3000** and buyer earn Rs. **6000**			Seller earns Rs. **2000** and, Buyer earns Rs. **1600** with 90% chance or Rs. **7000** with 10% chance
11	For sure seller earns Rs. **1200** and, Buyer earns Rs. **2400**					For sure seller earns Rs. **2000** and, Buyer earns Rs. **1600**

Table A4 : Expected and difference in earning between SC and FC for seller and buyer in Mize crop

Decision row	Expected earning in SC		Expected earning in FC		Diff (FC-SC)		Risk aversion parameter	
	Seller	Buyer	Seller	Buyer	Seller	Buyer	Seller	Buyer
1	3000	6000	2000	7000	-1000	1000	> 5.15	> 2.02
2	2820	5640	2000	6460	-820	820	5.15	2.02
3	2640	5280	2000	5920	-640	640	3.47	1.35
4	2460	4920	2000	5380	-460	460	2.33	0.90
5	2280	4560	2000	4840	-280	280	1.38	0.53
6	2100	4200	2000	4300	-100	100	0.49	0.19
7	1920	3840	2000	3760	80	-80	-0.41	-0.15
8	1740	3480	2000	3220	260	-260	-1.40	-0.53
9	1560	3120	2000	2680	440	-440	-2.64	-0.99
10	1380	2760	2000	2140	620	-620	-4.54	-1.68
11	1200	2400	2000	1600	800	-800	> -4.54	> -1.68

Decision row	Earnings in SC		Your choice		Earnings in FC
			SC	FC	
1	For sure seller earn Rs. **19000** and, buyer earns Rs. **38000**				For sure seller earns Rs. **10000** and, Buyer earns Rs. **47000**
2	With 10% chance seller earns Rs. **3400** and, buyer earns Rs. **6800**	OR With 90% chance Seller earns Rs. **19000** and buyer earn Rs. **38000**			Seller earns Rs. **10000** and, Buyer earns Rs. **200** with 10% chance or Rs. **47000** with 90% chance
3	With 20% chance seller earns Rs. **3400** and, buyer earns Rs. **6800**	OR With 80% chance Seller earns Rs. **19000** and buyer earn Rs. **38000**			Seller earns Rs. **10000** and, Buyer earns Rs. **200** with 20% chance or Rs. **47000** with 80% chance
4	With 30% chance seller earns Rs. **3400** and, buyer earns Rs. **6800**	OR With 70% chance Seller earns Rs. **19000** and buyer earn Rs. **38000**			Seller earns Rs. **10000** and, Buyer earns Rs. **200** with 30% chance or Rs. **47000**with 70% chance
5	With 40% chance seller earns Rs. **3400** and, buyer earns Rs. **6800**	OR With 60% chance Seller earns Rs. **19000** and buyer earn Rs. **38000**			Seller earns Rs. **10000** and, Buyer earns Rs. **200** with 40% chance or Rs. **47000** with 60% chance
6	With 50% chance seller earns Rs. **3400** and, buyer earns Rs. **6800**	OR With 50% chance Seller earns Rs. **19000** and buyer earn Rs. **38000**			Seller earns Rs. **10000** and, Buyer earns Rs. **200** with 50% chance or Rs. **47000** with 50% chance
7	With 60% chance seller earns Rs. **3400** and, buyer earns Rs. **6800**	OR With 40% chance Seller earns Rs. **19000** and buyer earn Rs. **38000**			Seller earns Rs. **10000** and, Buyer earns Rs. **200** with 60% chance or Rs. **47000** with 40% chance
8	With 70% chance seller earns Rs. **3400** and, buyer earns Rs. **6800**	OR With 30% chance Seller earns Rs. **19000** and buyer earn Rs. **38000**			Seller earns Rs. **10000** and, Buyer earns Rs. **200** with 70% chance or Rs. **47000** with 30% chance
9	With 80% chance seller earns Rs. **3400** and, buyer earns Rs. **6800**	OR With 20% chance Seller earns Rs. **19000** and buyer earn Rs. **38000**			Seller earns Rs. **10000** and, Buyer earns Rs. **200** with 80% chance or Rs. **47000** with 20% chance
10	With 90% chance seller earns Rs. **3400** and, buyer earns Rs. **6800**	OR With 10% chance Seller earns Rs. **19000** and buyer earn Rs. **38000**			Seller earns Rs. **10000** and, Buyer earns Rs. **200** with 90% chance or Rs. **47000** with 10% chance
11	For sure seller earns Rs. **3400** and, Buyer earns Rs. **6800**				For sure seller earns Rs. **10000** and, Buyer earns Rs. **200**

Table A 5 : Joint Decision face by seller and buyer in Chrysanthemum

Table A 6: Expected and difference in earning between SC and FC for seller and buyer in Chrysanthemum

Decision row	Expected earning in SC		Expected earning in FC		Diff (FC-SC)		Risk aversion parameter	
	Seller	Buyer	Seller	Buyer	Seller	Buyer	Seller	Buyer
1	19000	38000	10000	47000	-9000	9000	> 2.83	> 0.83
2	17440	34880	10000	42320	-7440	7440	2.83	0.83
3	15880	31760	10000	37640	-5880	5880	1.97	0.58
4	14320	28640	10000	32960	-4320	4320	1.38	0.40
5	12760	25520	10000	28280	-2760	2760	0.87	0.25
6	11200	22400	10000	23600	-1200	1200	0.38	0.11
7	9640	19280	10000	18920	360	-360	-0.12	-0.04
8	8080	16160	10000	14240	1920	-1920	-0.69	-0.20
9	6520	13040	10000	9560	3480	-3480	-1.41	-0.41
10	4960	9920	10000	4880	5040	-5040	-2.56	-0.74
11	3400	6800	10000	200	6600	-6600	> -2.56	> -0.74