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# Reputation effect of the moral hazard on contract farming market development: Game theory application on rice farmers in Benin

**Odountan Ambaliou Olounlade[1], Li Gu-Cheng[1], Lacina Traoré[1], N'banan Ouattara[1], François Vihôdé Dossouhoui[2] and Gauthier Biaou[3]**

[1]Department of Agricultural Economics, College of Economics and Management, Huazhong Agricultural University, China.
[2]Department of Economics, Socio-Anthropology and Communication, Faculty of Agricultural Sciences, University of Abomey-Calavi, Benin.
[3]Department of Agricultural Economics, National University of Agriculture of Benin, Benin.

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**A good reputation is the basis for rice farmers to survive and gain trust from buyers in a competitive business environment. However, due to the existence of information asymmetry between buyers and rice farmers, the moral hazard problem is the key obstacle that impedes the benefits of related shareholders and hinders the efficiency of contract farming negotiations. It is crucial to design a control mechanism to avoid the negative impact of the moral hazard. This paper studies the principal and agent relationship between rice farmers and buyer in contract farming negotiation. Because of the influence of information asymmetry, many buyers have suffered from being cheated by rice farmers who fail to comply with the terms of the contract or provide fraudulent products in practice. These frequent cases will function to deteriorate any long-term relationships between rice farmers and buyers. The study focuses on the analysis of the causes of moral risks and the effect of reputation on moral risk utilizing repeated game theory. The purpose of this paper is to help both rice farmers and buyers effectively avoid moral hazards and achieve a win-win situation in contract farming negotiation. The result show that the rice farmer in contract farming practices has the incentive to maintain his reputation in order to gain more profits in the future. That also accounts for the reasons why the rice farmer will invest more to improve the customer's service level, caring about the quality of product and the comments of finished contractor customer, to keep a longer farmer-buyer relationship. The rice farmer in contract farming practices has the incentive to maintain his reputation in order to gain more profits in the future and this means that contract farming can be developed with great success in Benin.**

**Key words:** Contract farming negotiation, moral hazard, reputation model, game theory, rice

## INTRODUCTION

In Benin, rice producers face enormous funding challenges (Odountan et al., 2018). The levying of

*Corresponding author. E-mail: lgcabc@mail.hzau.edu.cn.

customs duties when transporting agricultural products to the market and the payment of market taxes are factors that influence the profitability of production. To address this situation, producers could use contract farming (Arouna et al., 2015). Contract farming is seen as a potential solution to overcome agricultural production constraints for resource-poor farmers (Arouna et al., 2017). Nevertheless, for a long time there has been one serious problem impeding the development of contract farming, that is, the lack of trust between farmers and buyers. There are many factors that influence the relationship between the farmers and buyers in contract farming practice. One of them is the moral hazard, which refers to the egoistic behaviors of farmers after making a deal with the buyers. Buyers do not have any insurance that the contract is flawless. Moreover, the insurance process is not well developed in the agricultural sector in developing countries, particularly in Benin, where buyers depend on farmers as the buyers usually forgo the common sense step of taking some precautionary measures.

In contract farming negotiation, buyers and farmers have a motivating force to take part in social contracts to build up volumes exchanged and to lessen the vulnerability that builds exchange costs which further decreases interest in esteemed included resources (Bezabeh Ali, 2018). This is most obvious among firms giving extension services and ranch input supply to farmers (Anim, 2010). The farmers who will adulterate the agreement and deliberately commit bribery are the root cause of the moral hazard. The underlying reason for the moral hazard is information asymmetry, which means the rice farmers have more information about the quality and cost of the rice, while buyers know less. In the practice of contract farming, the rice farmers usually will exploit their knowledge of the quality of product, production and transportation costs, and so on to take advantage of buyers. There are two types of information asymmetry: The first is adverse selection which occurs before the coalition between buyer and farmers, whereas the other is the moral hazard which happens after the deal.

This paper will focus on defining the problem of the moral hazard between the rice farmers and buyers in contract farming practice and on a potential solution to the problem. One popular way is to introduce the concept of establishing a corporate reputation to track the past behavior of the rice farmers. A corporate reputation is an overall evaluation that reflects the extent to which people see the farming as substantially “good” or “bad” (Dowling, 2004). A good reputation is valuable because it can enhance trust and confidence so that the buyer feels that it is safe to buy products and service from this farmer. This outcome can also benefit the farmers in their markets and various researches have also shown that farmers with good reputations are better able to attain and sustain superior profits over time.

The primary research question in this paper examines the expected profits of the farmers and the buyers that depend on two factors. One is the type of farmers, and the other is the reputation of the farmers with the buyer. For example, does the farmer always benefit from cheating or not? To answer this research question, we will examine the contract farming practice where the reputation mechanism exists and check the influential mechanism. In this paper, we will set the reputation model of the farmer in contract farming practice. We first characterize the situation that the type of farmer is not common knowledge and, then, demonstrate that, even though cheating has a direct benefit to the farmer, it can sometimes hurt the farmer, buyer, or both if the contract continues in the long run. Furthermore, we show the impact of reputation. In addition, we illustrate that the farmer will always choose to be honest when the mechanism of reputation works. In a typical game-theoretic view of the relationship between farmer and buyer, each player acts in order to maximize his own profit (rational player) without taking into account the overall optimal relationship. Thus, incentive is offered to influence the behavior of the other player. Such an incentive is reputation.

## LITERATURE REVIEW

In contract farming, the buyer and farmers commit in advance to exchange the product. In addition, the buyer can provide credit, inputs, monitoring, or is directly involved in part of the production process. Contract farming has been claimed to have a positive impact on local economies by improving the welfare of rural households, but the relationship between farmers and buyer could be switched (Arouna et al., 2017).

Apart from the problem of direct observability of possible frauds by farmers, reputation mechanisms and the activation of bilateral sanctions by individual farmers do not have any chance to deter such abuses (Mazé, 2009). As a potential motivation, reputation could encourage the farmer to improve the quality of his practice during the contract process. Since the time of Adam Smith, reputation has been considered to be a very important mechanism to ensure the implementation of a business contract, but only recently, it has been widely used in combination with game theory (He and Sommer, 2006). In management practice, the motivation of reputation is also very popular and has brought new management thinking to the creation and maintenance of a good reputation. The farmer who cares about his reputation will be responsible for his behavior, even when there is no explicit motivational contract. Farmers would work hard to increase the level of reputation, hoping that they would gain more in the future.

Some researchers have pointed out the important effect of reputation on incentive mechanisms and have begun to associate the farmer’s reputation and incentives

to build a complete model (Cai and Weng, 2014).

According to Watanabe et al. (2017), the assentions in the contract farming may be ensured by trusted and rumored social standards that provide self-enforcement, leading to the desired behavior. Such research points to the idea that the reputation of the agricultural market could be used as a replacement for an explicit contract.

Reputation was first introduced by Fama (1980). Following this, Kreps, Milgrom, Roberts, and Wilson established the KMRW reputation model based on the repeated game (Kreps and Wilson, 1982; Milgrom and Roberts, 1982). When both parties in the game only care about the immediate benefits, the optimal strategy is to not return the product because it is not beneficial for either party. In the setting of the repeated game, reputation provides implicit motivation for contracts; the player would like to compromise by giving up short term benefits to choose coordinate equilibrium.

Zheng (2013) and Lyu et al. (2016) also proves that, when the payoff of one player is not known by the other, this player has incentive to build good reputation to exchange for long run profits.

Thus, we specifically develop a model to investigate the effect of reputation on the profit of the rice farmers.

## CONSTRUCTION OF THE MODEL

Within the context of a repeated game, we consider a market in which both the farmers and the buyers are clients, which is quite popular in the real exercise. There are two probable types of farmers: probability *p* indicates he has a respectable reputation and 1− *p* probability indicates that his reputation is immoral. The selling price of the rice is $P_s$ and the unit cost is *C*; the value of the rice to the buyer is denoted as $V_b$, as $V_b > P_s$; otherwise, the buyer does not have the incentive to buy the product (rice). Moreover, there are two arrangements which the farmers could make regardless of which type it is, which are either to provide an honest deal or a dishonest deal.

The cost of rice farmers with a respectable reputation or an immoral reputation to act honestly or dishonestly is designated as follows: $C_{HR}$ and $C_{DR}$, $C_{HI}$ and $C_{DI}$. “H” denotes the rice farmer who chooses to be honest while “D” denotes the rice farmer who chooses to be dishonest. “R” denotes the type of rice farmer who is respectable, while “I” denotes the type of rice farmer who is immoral. The rice farmer of low reputation will have more management costs and more future risk; additionally, the rice farmer with an immoral reputation is more familiar with cheating the buyer, therefore,

**Assumption 1:** $0 < C_{HR} < C_{HI} < C_{DI}. < C_{DR}$.

The information asymmetry in contract farming application is reflected by the fact that the rice farmer knows his own type, while the buyer lacks this knowledge. As shown in Figure 1, if the rice farmer with a respectable reputation chooses to be honest, and the buyer thinks that the rice farmer will not cheat him, the buyer will, therefore decide to make a deal. The revenue of the rice farmer is: $P_s - C - C_{HR}$, and the revenue of the buyer is $V_b - P_s$. If the buyer thinks that the rice farmer is cheating him, and the buyer decides not to make a deal with the rice farmer, then the rice farmer with a respectable reputation will suffer from loss: $-C_{HR}$. Similarly, we could conclude the payoff of buyer and rice farmer when the type of rice farmer is immoral in Figure 2.

**Assumption 2:** Suppose the unit value of the product provided by the seller within some periods values T, which is a function of rice farmer’s service level λ, the rice farmer’s real strength θ and the uncertainty in contract farming market application, so we have:

$$T = k\lambda + h\theta + \mu,$$

where λ is the private information of the rice farmer, T is the common knowledge of both the rice farmer and buyer, besides θ and μ following nominal distribution, with means equal to 0 and variance equals $\sigma_\theta^2$ and $\sigma_\mu^2$ respectively.

**Assumption 3:** If the times that the buyer makes a contract with the rice farmer is kept at a constant φ, then the profits of the buyer is $\pi^b = \varphi T$.

**Assumption 4:** The sequence is as follows: first, the buyer will decide how many times to contract with this farmer, then the rice farmer will decide the deal level.

The rice farmer mainly profits from the commission from purchasing times φ, which implies that βφ, which is the cost of the service provided by the rice farmer is c(λ), $c'(\lambda) > 0$, $c''(\lambda) > 0$. $c(\lambda) = (b\lambda^2)/2$, while the income of the rice farmer is $\pi^F(\lambda) = \beta\varphi - (b\lambda^2)/2$.

## MODEL ANALYSIS

The introduction of the deal level of a rice farmer aims to diminish the risk of the buyer, to keep the benefits of the buyer and guarantee the efficiency of the contract market. Therefore, the optimal deal level to maximize the total profits in the contract farming market should be:

$$max_\lambda^T = \pi^b + \pi^F(\lambda)$$

$$max_\lambda^T = \varphi T + \beta\varphi - (b\lambda^2)/2 \rightarrow \lambda = \varphi k/b$$

Since the first decision, the buyer is to choose the contract times from a specific rice farmer, and, the next time, the rice farmer will decide the deal level. Rice farmer will take the following arrangements:

$$max_\lambda^T = \beta\varphi - (b\lambda^2)/2 \rightarrow \lambda' = 0$$

$$T = \beta\varphi - b\lambda \rightarrow \lambda'' = 0$$

When the contract deal is a first time contract, and the farmer knows that the probability to sign another contract scheme with the buyer another time is low, the rice farmer will choose dishonesty to maximize his own profits, regardless of whether he is generally honest or dishonest. Moreover, the buyer will not make a deal with the rice farmer after considering that; thus, this contracting market does not exist. Nevertheless, in the case of repeated contract application whereby the rice farmer signs a contract with the same buyer, the buyer will make the decision based on past contract experience. As the repeated game changes the restriction mechanisms, the payoff for both parties will be divergent, so a new equilibrium will exist.

In the first time contracting, when the buyer thinks that the rice farmer has a respectable reputation, the expected payoff of the buyer is:

$$(V_b - P_s)\, P_1 + (-P_s)\,(1 - P_1) > 0,$$

With $P_1$ the probability that the rice farmer was regarded to have a respectable reputation at the first time, only when $P_1 > P_S / V_b$, will

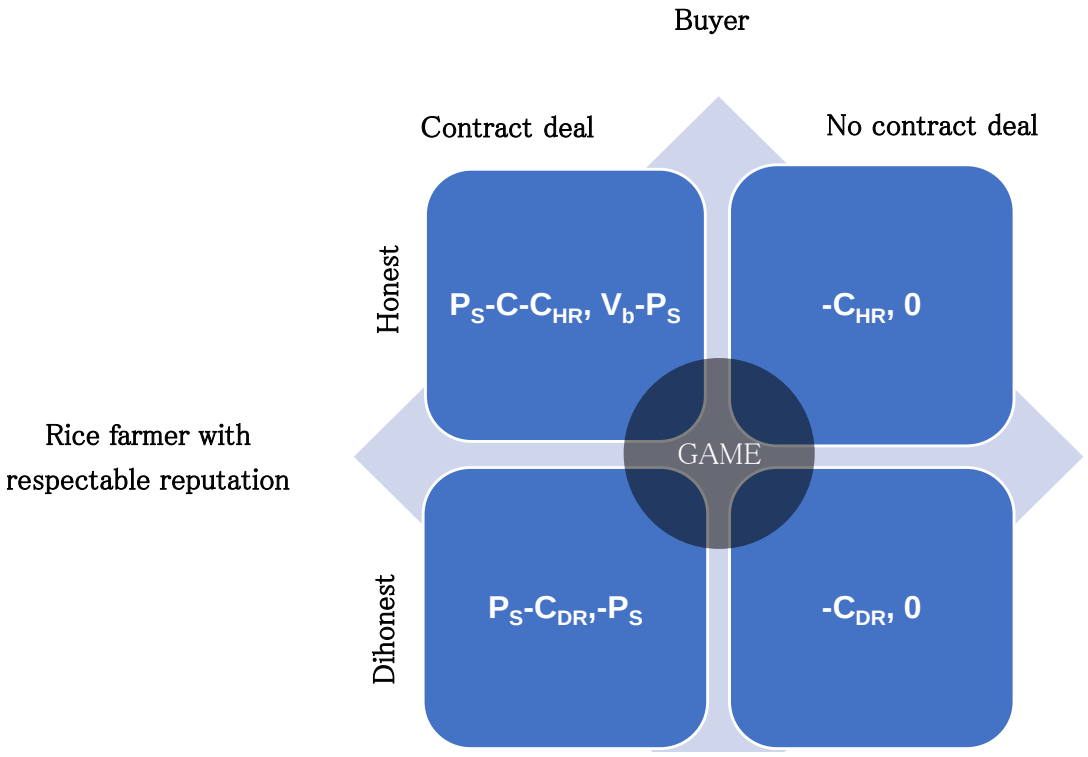


**Figure 1.** The payoffs of the rice farmer with respectable reputation R.

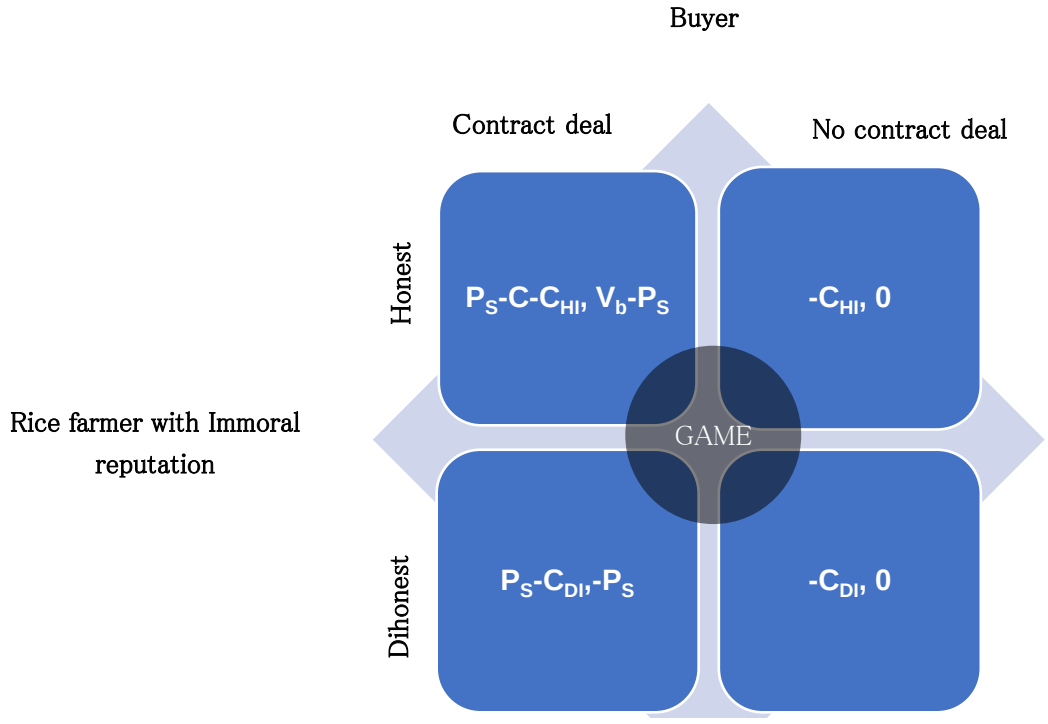


**Figure 2.** The payoffs of the rice farmer with the immoral reputation I.

the buyer decide to make a deal with rice farmer.

We propose that $P_1 > P_S/V_b$, represents the payment at the first-time contracting scheme of rice farmers to collect the rice by the buyer, in which he may introduce a discount rate Z, which will be

counted in the next contract scheme application. This is especially true if the rice farmer has an immoral reputation, and will cheat the first time, then his payoff is high as $P_s - C_{DI,}$ yet this also induces the buyer to confirm the type of rice farmer. Now, if at the next contracting scheme, the rice farmer will choose to be honest after considering the behavior of the buyer, then $- C_{DI} < - C_{HI.}$

The total payoff of the rice farmers is:

$X_1 = (P_s - C_{DI}) (1+Z) + (-C_{HI})$

Considering the case when the seller of immoral reputation first tries to hide his type to gain the credibility of the buyer, in order to garner more profits in the following contract scheme, then the strategy of the buyer is (Contract deal, Contract deal), and the total payoff of the rice farmer is:

$X_2 = (P_s - C - C_{HI}) (1+Z) + (P_s - C_{DI})$

When the rice farmer chooses to not cheat at the first deal contract, then $X_2 > X_{1,}$ and we have:

$X_2 - X_1 = (C_{DI} - C - C_{HI}) (1+Z) + (P_s + C_{HI} - C_{DI}) > 0,$

then the threshold value $\psi_I$ of rice farmer with immoral reputation when deciding which strategy to take is:

$$\psi_I = \frac{P_S - C}{C + C_{HI} - C_{DI}}$$

We could also calculate the corresponding threshold value $\psi_R$ of the rice farmer with a respectable reputation when he decides which strategy to follow.

From the assumption that $C_{DR} - C_{HR} > C_{DI} - C_{HI}$, we could conclude that $\psi_R > \psi_I$. As long as there exists one $\psi_I > \psi$ , whatever the type, the rice farmer will choose to be honest in order to gain long term profit.

## DISCUSSION

The study inferred that the rice farmer in contract farming practices has the incentive to maintain his reputation in order to gain more profits in the future. That also accounts for the reasons that the rice farmer will invest more to improve the customer's service level, caring about the quality of product and the comments of finished contractor customer, to keep a longer farmer-buyer relationship. If a farmer has to continue with contractual rice production and marketing relations, this will depend on his attitude and reputation. Bad behavior reflects a bad reputation and has an effect on the survival of the contractual relationship. These results confirm Bartling et al. (2008) study. The author explores in his study how an agent's record, that is, his performance with other principals in the past, affects the actual and optimal design of contracts in one-shot interactions; and have shown that information about past behavior can have a crucial effect on optimal contract design.

Jackson and Kalai (1998), in the study titled "False reputation in a society of players", lead to the conclusion that the agents can observe the play in all previous periods. This would mean that previous behaviors in a previous relationship are determinative in future decisions and the preservation of trust. Kim and Park (2013) concluded in their study that only good reputation can win the trust of buyers. According to these two authors, trust had significant effects on purchase and word-of-mouth intentions; and depends on the reputation of agricultural companies. The rice farmer in contract farming practices has the incentive to maintain his reputation to preserve the trust of the buyers.

## Conclusion

As there is lack of a well-designed evaluation system targeted at the contract farming practice market, the problem of the moral hazard cannot be avoided or resolved. The integrity between trade partners is the basis of contract item, so it is necessary to appeal to all partners participating in contract farming, both buyers and rice farmer, as well as the government, to work methodically to push for the development of an evaluation system based on reputation to connect the profits of farmers with their reputations, and to increase the cost of irregular actions in the contract farming practice market. The rice farmer in contract farming practices has the incentive to maintain his reputation in order to gain more profits in the future and this means that contract farming can be developed in Benin with great success.

## CONFLICTS OF INTEREST

The authors have not declared any conflict of interests.

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