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APPLICATION OF FORWARD CONTRACT AND CROP INSURANCE AS RISK MANAGEMENT TOOLS OF AGRICULTURE: A CASE STUDY IN BANGLADESH

Md. Bokhtiar Hasan[1+]
Md. Delowar Hossain[2]
Abu N.M. Wahid[3]

[1]*Assistant Professor, Department of Finance and Banking, Islamic University, Bangladesh*
Email: bokhtiar_bank@yahoo.com Tel: (+88)-01717-755816
[2]*Department of Finance and Banking, Islamic University, Bangladesh*
Email: h.delowarfin@gmail.com Tel: (+88)-01739-984062
[3]*Tennessee State University, USA*
Email: Wahid2569@gmail.com Tel: 615-498-2837

(+ Corresponding author)

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ABSTRACT

The principal aim of the study is to find out a way to effectively manage the agricultural risks like price volatility, weather risks, and fund shortage. To hedge price volatility, farmers sometimes make contracts with agro-traders but fail to protect themselves effectively due to not having the legal framework for such contracts. The study extensively reviews existing literature and find evidence that the majority studies either deal with price volatility or weather risks. If we could address these risks through a single model, it would be more useful to both the farmers and traders. Intrinsically, the authors endeavor in this regard, and the key contribution of this study lies in it. Initially, we conduct a small survey aspiring to identify the shortcomings of existing contracts. Later, we propose a model encompassing forward and insurance contracts together where the forward contract will be used to hedge price volatility and insurance contract will be used to protect weather risks.

Contribution/ Originality: The study contributes to the existing literature through proposing an integrated model comprising of forwarding contract and crop insurance which will support both farmers and traders to cope with the agricultural risks like price volatility, weather hazards, and fund shortage.

1. INTRODUCTION

Agriculture plays an imperative role and is often called as the backbone of the economy in Bangladesh. Post independence of Bangladesh, about half of its GDP would come from this sector. But the achievements of agriculture sector remain veil in Bangladesh. In addition, its contribution to GDP has turned down during the last few years. The possible reasons could be the tremendous growth of other sectors especially the industrial and service sectors' growth (Khatun, 2012). But, the agriculture sector has still significance from the standpoint of its role in employment generation and poverty reduction in Bangladesh. A plurality of Bangladeshis still earns their living from agriculture. However, despite having immense potentiality, the agriculture sector could not greatly contribute to economic development attributable to various risk factors like price volatility, weather risks, fund shortage, and so on. To manage price volatility, farmers occasionally make contracts with agro-traders, but due to not having legal framework the contract cannot protect them effectively. Such contracts are usually called contract farming. Contract farming is an arrangement that refers to production and distribution of agricultural products

under a contract between buyers (traders) and farmers. Here, the traders and farmers discuss between themselves and decide on quantity, delivery, and price of agricultural products at the time of making contract. In many times, the buyers patronize farmers by providing various supports like raw materials, technology, advices, and loan. However, the agricultural sector has recently undergone a noteworthy revolution all over the world thanks to an increasing use of different agricultural contracts (Vavra, 2009). Unlike poultry industry, such type of contract farming is not very common in Bangladesh (Begum *et al.*, 2012). Although not in the structured form of contract farming, different types of agricultural contracts are commonly observed in our country. These contracts are chiefly taken place in commodities like mango, tobacco, banana, potato, paddy, and other crops cultivations. The form of such contracts is mostly unwritten and so has no legal framework. Therefore, when dispute is arisen between them, the traders, in most cases, decline to complete the contract for which the farmers cannot take any legal actions against them (Isimoya, 2014; Mejdoub and Arab, 2017; Okoye *et al.*, 2017).

Another important downside of our agricultural sector is that it is frequently affected by natural disasters. The yearly monetary value of natural disaster in Bangladesh is about USD 2,337.87 million (Islam, 2016). It is noted that the farmers are majorly affected by this mammoth amount of loss. If they have had weather insurance, they could get financial supports from insurance companies. But crop or weather insurance is hardly used in our country. Following disaster, it is very important to resume cultivation as soon as possible. But, farmers cannot do that due to not having sufficient reserve funds. In fact, farmers often face fund shortage in normal condition also. They often are to depend on the government assistances. Although in this regard government spends huge amount of money in the form of subsidy (USD 1,141.99 million in FY 2016-2017), the farmers, in most cases, do not receive the benefits of it owing to corruption. Indeed, government alone has no ability to cope with this situation. It is essential to find a suitable way out so that the stress on government can be lessened.

In view of managing agricultural risks, many studies have already been conducted. The authors extensively review existing literatures and found that these studies either deal with price volatility or weather risks. None of the studies, in isolation, seem to address these two risks in a single model. If we could do that, it would be more useful to both the farmers and traders. However, the main purpose of the study is to manage agricultural risks through using forward contract and insurance policy together. Throughout the paper the authors endeavor to find a solution of how to integrate such risks into a single model. In fact, the key contribution of this study lies in it.

The remainder of the study is, therefore, designed as follows. Section 2 discusses about the previous literatures relevant to our subject issue. Section 3 gives details of the data and methodology applied in the study. Section 4 elucidates the results of the analysis of this study. Section 5 concludes the study with some policy implications.

2. LITERATURE REVIEW

Hongyong *et al.* (2018) tried to propose a weather index insurance to transfer weather risks from the production chain of agricultural products. They found that their model is effective in transferring such risks and ensuring stable income for both companies and farmers.

Mishra *et al.* (2018) examined the influence of the application of contract farming on the smallholder lentil farms' yields, profitability, and costs in Nepal. Their findings exposed that unlike very smallholders of lentil farms, no farmers of lentil farms get benefits from using contract farming. Miyata *et al.* (2009) also found the same results from their study undertaken in Shandong Province, China even though it is still unclear that how many farmers need to be included in the contract farming scheme to get such benefits.

Raucci *et al.* (2018) attempted to appraise the impact of weather derivative on reducing the income volatility in the Brazilian soybean market. The results of their study disclosed that it is possible to trim down producers' income volatility substantially while maintaining gross average income. Shi and Jiang (2016) found the same results. They demonstrated that yield risk in rice crops in China can be lessened considerably through applying their proposed weather index insurance model.

Navarra (2017) inspected the effects of contract farming on the smallholders with respect to food security. The study applied a panel data for a period of four years from 2002 to 2005 in Mozambique. Although the study found positive relationship between the contract farming and income of farmers, the impact of contract on farmers in terms of other factors were still vague. In addition, the overall findings of the study pointed out that the choice of contracts is the main driver of the observed differences.

Henningsen *et al.* (2015) conducted a study on contract farming in the Kongwa district of the central agricultural zone of Tanzania. The main purpose of the study was to determine the impacts of contract farming on the technical efficiency and productivity of small-scale sunflower farmers. The results of the study unearthed that the application of contract farming significantly augments the outturn possibility while it lessens technical efficiency. In addition, the contract farming has positive but little effect on productivity of sunflower farmers. The authors justified these positive effects of contract farming by the contractor's provision of extended services and seeds of high-yielding varieties to the contract farmers.

Sokchea and Culas (2015) performed a survey to inspect whether the farmers' income is affected by the contract farming with farmers organizations. Their survey was based on a sample of 75 farmers and was taken place in Kampong Thom province, Cambodia. However, the results of their survey uncovered that contract farming with farmers' organizations tends to raise farmers' returns through enhancing product quality and targeting market position. Besides, it creates opportunity for smallholders to access to contract farming.

Spicka and Hnilica (2013) dealt with weather derivatives as the potentially efficient risk management tools for agricultural enterprise that seeking to lessen their profits exposure to variations in weather conditions. The study used regression analysis taking weather indices as the independent variables and crop yields as dependent variables and the study was taken place in the Czech Republic. The findings revealed that the efficiency of the weather derivatives was trimmed down by the spatial and production basis risks. In conclusion, they suggested that the potential for expansion of weather derivatives remains in the low income countries of Africa and Asia with systemic weather risk

Khan *et al.* (2013) examined weather risk management practices of agriculture producers through the uses of weather derivatives compared to insurance. They observed that weather derivatives are used as complimentary to insurance by farmers. However, the study performed a survey of grain farmers in the province of Saskatchewan, Canada, where farmers are likely to face weather events that are high in frequency but low in severity. The study found that less than 10 percent of the respondents employed weather derivatives. Participation costs, especially lack of awareness, were identified to be the most effectual impediment to the usage of it in weather risk management.

Broll *et al.* (2013) found some new factors; e.g. greater price volatility for inputs and outputs, climate change, international trade restrictions, and new and stricter food safety standards; which were affecting farmers and agro-traders. Their study mainly looked over the risk-averse farmers and observed that how they took their risk management decisions. They also observed that farmers faced various sources of commodity price volatility because their commodities were sold at two different markets at two different prices. One of these two markets has a future market. However, in their study, they showed that the optimal forward position of farmer is an over-hedge, a full-hedge, or an under-hedge strategy, contingent on whether the two randomly selected commodity prices are strongly positively correlated, uncorrelated, or negatively correlated, respectively.

Byerlee and Deininger (2013) unveiled that the presently cultivated land's productivity is considerably beneath potential in case of most of the countries. High returns to farming and cheaper land have made attention for investments into farming and this can perhaps be implemented through large scale production in land-abundant countries. They also added that considerable benefits can be generated in farming by providing access to capital, technology, and new markets, provided that land and other markets perform well and a regulatory framework is available. They presaged that poor land governance and weak institutional capacity can make these ventures economically, socially, or environmentally vulnerable.

Paul (2013) focused on the feasibility of weather derivatives in the agricultural sector in India. Weather derivatives deal with the risks not only for the front leaf events such as cyclones, but also for the slow long term causes of deviations from average temperature, precipitation, rainfall, and so on. Finally, the study identified a set of issues that need to be settled before launching weather derivatives. Begum *et al.* (2012) examined the competency of Bangladeshi poultry farms and the role of contract farming system on it. The study conducted a survey of 75 commercial poultry farms, which consists of 25 and 50 independent and contract farms respectively, and applied a data envelopment analysis. The analysis uncovered that the contract farming system has positive impact on the farm's efficiency in terms of technical efficiency, allocation efficiency, and economic efficiency.

Manorom *et al.* (2011) carried out a study that examine the variations and implications of contract farming agreements based on their three case studies, such as cabbage, sugarcane, and maize in the Lao People's Democratic Republic. Diverse contracts farming produced diverse implications in terms of types of agreement, degree of flexibility, amount of material supports, and strength of relationships between the contracting farmer and the firm. The results of the study advocated that a single contract farming model is not capable of performing best in each situation, rather contract farming model is effective in addressing certain production and marketing downsides that avert efficient functioning of industries and markets. To the end, they concluded that engaging in contract farming is an effective way to go into commercial, cross-border agriculture.

Cell (2009) carried on a study regarding risk management strategy for farmers in Bangladesh through applying crop insurance. The study used both primary and secondary data and applied content based analysis. After having rigorous review of literature and gaining much experiences of crop insurance around the world, the study proposed a pragmatic outline and concrete guideline for launching crop insurance as a risk management strategy for the farmers in Bangladesh. The study also reviewed the previous experiences of crop insurance in Bangladesh and identified the problems to be solved. However, the study spotted some challenges which are basically raised during the survey.

Jones (2007) looked over the background of the weather derivatives market and endeavored to identify its uses and merits in managing agricultural risks. He revealed that since about 20 percent of the US economy is somehow affected by the weather, some types of financial protections from weather related losses are obviously desired. They proposed to use weather derivatives for such protection.

French and Silver (2007) investigated the prospect of crop micro-insurance from the supply side viewpoint in Bangladesh. The prospect is viewed looking into four viability criteria: governance, contribution to risk reduction, affordability, and financial robustness. Using SWOT analysis the study revealed that a crop micro-insurance scheme can be viable in Bangladesh.

Paul *et al.* (1976) investigated different agricultural contracts. They observed the merits and shortcomings of applying cash forward and future contracts in the farming business. Here, they judge on suitability of such contracts in the application of agriculture.

3. DATA AND METHODOLOGY

The chief objective of this study is to manage agricultural risks; e.g. price volatility, weather risks, and fund shortage; through proposing a model consisting of forward contract and insurance policy. This main objective has three folds associated objectives. *First*, a survey is conducted where we interview 200 different people pertinent to agricultural contracts. These different people basically comprise of two types of entities, i.e. farmers and traders. 100 farmers and 100 traders are randomly selected for interview. However, this survey intends to get overall thought regarding the terms and conditions of existing agricultural contracts in Bangladesh. The interview takes place in Khulna, Rajshahi, and Rangpur divisions of Bangladesh. The questionnaires used for this study are mostly unstructured. Face to face interview technique is applied to collection data for the study.

Second, we shall effort to identify the shortcomings of existing contracts from the interview. In addition, agricultural risks will also be spotted here. *Finally*, a model with combination of forward contract and insurance policy will be proposed so that the deficiencies of existing agriculture contract can be overcome side by side the spotted risks can be hedged.

4. ANALYSIS

The analysis is designed to have three different phases to serve the three different objectives. At the outset, the analysis will proceed with examining the survey results. Here, we summarize the results of the survey.

4.1. Survey Results

4.1.1. Common Features of Existing Agricultural Contracts:

The common features of existing agricultural contracts are attempted to be spotted from the survey. However, the following features are manifested here:

- Similar to other general contracts, it has also two parties. One is seller (farmer) and another is buyer (trader).
- The terms and conditions of such contracts are set by mutual consent of both parties.
- The contract price is fixed usually considering spot price.
- Contracts are made for certain season, but there is no specific maturity date.
- The payment process of contract amount varies across contracts. For instance, sometimes the payment is made at the beginning of contract, sometimes it happens at the end of contract period, and in other time, there is a combination of the earlier two payment modes, i.e. certain portion is paid at the beginning of period and the remained portion is paid at maturity.
- Contracts are mainly made verbally, written document are hardly used for such contracts.
- In most cases, buyers bear all sorts of risks.
- Contract can be expired before maturity by the consent of both parties.
- Contract buyers can resell their contract to third parties.

Therefore, it is evidenced from the survey that there are several flaws in the existing agriculture contracts. These flaws disrupt in the smooth flows of transaction between farmers and traders. Prior to moving on to any solution, we need to circumspectly identify the downsides of existing contracts.

4.1.2. Loopholes of Existing Agriculture Contracts:

The shortcomings of prevailing agriculture contracts as identified by the respondents during the interview are exhibited in Figure-01. The interpretations of the shortcomings are put subsequent to the figure-01.

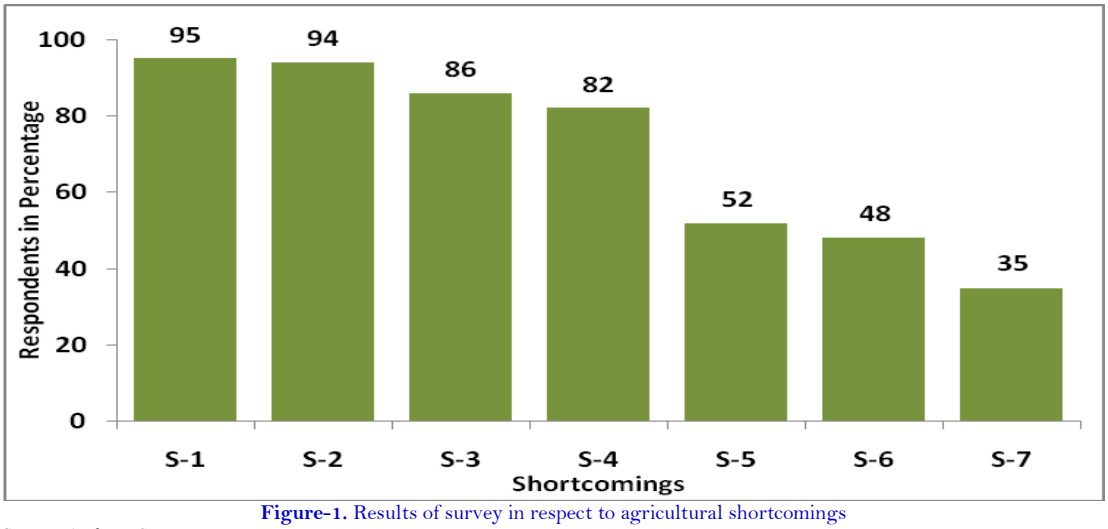

Figure-1. Results of survey in respect to agricultural shortcomings

Source: Authors' Survey 2018

S-1: 95 percent of the sample farmers said that verbal form of contract is a big problem. Neither party is legally obligatory to complete the contract. If the market price falls, the buyers attempt to terminate the contract prior to maturity. Since there is no legal binding, the buyers can easily quit from executing their contracts. Eventually, the risk falls on the farmers.

S-2: 94 percent of the sample traders felt that different natural catastrophes are the main downsides of such contracts. Natural catastrophes are very much common in Bangladesh and its effect is severe. Therefore, when it happens it destroys crops and consequently the contract buyers (i.e. traders) face huge amount of losses.

S-3: 86 percent of the sample farmers informed that they often face shortage of funds for cultivation. Farmers in our country are mostly poor and they have no sufficient funds. Thus, they very often cannot manage fund by themselves and even become failed to manage from external sources, because they have no collateral. As a result, their cultivation gets interrupted.

S-4: 82 percent of the total respondents felt that price fluctuation is a problem. Products are freely priced in Bangladesh and government, in most cases, has no control over it. In addition, syndicate (group of intermediaries) always manipulates price in favor of themselves. Moreover, any adverse effect in the cultivation leads to price fluctuation also. If price changes unfavorably, traders are unlikely to execute the contract, which lead to conflict between traders and farmers.

S-5: 52 percent of the sample traders claimed that the robbery and theft of orchards are big challenges for them. Sometimes it becomes difficult for traders to protect the orchards from robbery and theft. Traders have to employ people for looking after their orchards. After that if any such incidence happens, traders confront of huge amount of losses.

S-6: 48 percent of the sample farmers said that there is no systematic way of fixing contract price. Since the traders are assuming all risks of contract, they always determine price along with other terms and conditions in favor of themselves. In fact, farmers have little voices in this regard. Sometimes the price is unfairly fixed at below market price.

S-7: 35 percent of the sample traders claimed that the entire risk of contract is shifted to them. Although their risks are being compensated through offering lower contract price, this compensation is not sufficient enough to make them comfortable.

From the results of survey and discussions, it seems that the existing agriculture contracts have several shortcomings among these three to four problems like oral form of contract, natural catastrophes, fund shortage, and price volatility are more important to deal with. Majority farmers claim oral form of contract as the weakest side of their existing contracts whereas natural disaster is identified by the majority traders as the weakest side of their contracts. Consequently, the main purpose of such contracts used by farmers in managing price volatility of their commodity is not achieved. On the other hand, the traders are being affected severely by the frequent natural disasters. Therefore, the existing contract is getting failed to protect either of the counterparties. Here, we endeavor to find remedies from the perspectives of both counterparties through proposing a model amalgamating forward contract and insurance policy.

4.2. Proposed Model

At first, the government will propose a law regarding agriculture contract, which will be enacted by the parliament. The proposed law can be named as contract farming act or agricultural contract act. This act will provide legal framework, which will include all the possible terms and conditions of the said contract. A minor flexibility can be given in fixing terms and conditions, provided that the both parties have agreed on it. In addition, the act will also include a provision for buying insurance policy by that counterparty which will bear weather risk. This provision must be compulsorily imposed. However, the whole model is presented in a graph (Figure: 02) with clarifications.

Firstly, two counterparties (farmer and trader) agree to make contract, i.e. agree to buy or sell agricultural commodities. Next, they will decide on the terms and conditions of contract like period of contract, price, delivery, payment, obligation, and others. The terms and conditions can be set by the following ways:

- The tenure of contract will be fixed for certain period, e.g. two or three or four months, depending on the span of cultivation.
- The contract price can be fixed on the basis of last five years average price, although ultimate decision will be taken through their mutual consents. If the price is fixed in this way, the commodity price will remain stable, which, in turn, help government in checking inflation too.
- The delivery of products will be made during or at the end of contract period.
- Traditionally, the payment of forward contract is made at maturity when the delivery of products is completed. Here, the authors suggest that a certain portion (25% to 30%) of the total contract amount can be paid to the farmers at the time of making contract. This will at least partially resolve the fund shortage of farmers in cultivating their land properly. As a result, the farmers do not need to borrow funds from other parties such as, banks, financial institutions, or any pawnbroker, which will further reduce their costs of borrowing.
- The contract will create full obligation to both counterparties to execute their contracts. The farmers will be obligated to deliver the agreed quantity on due time, whereas the traders will be obligated to buy the same at the price fixed at the time of contract.

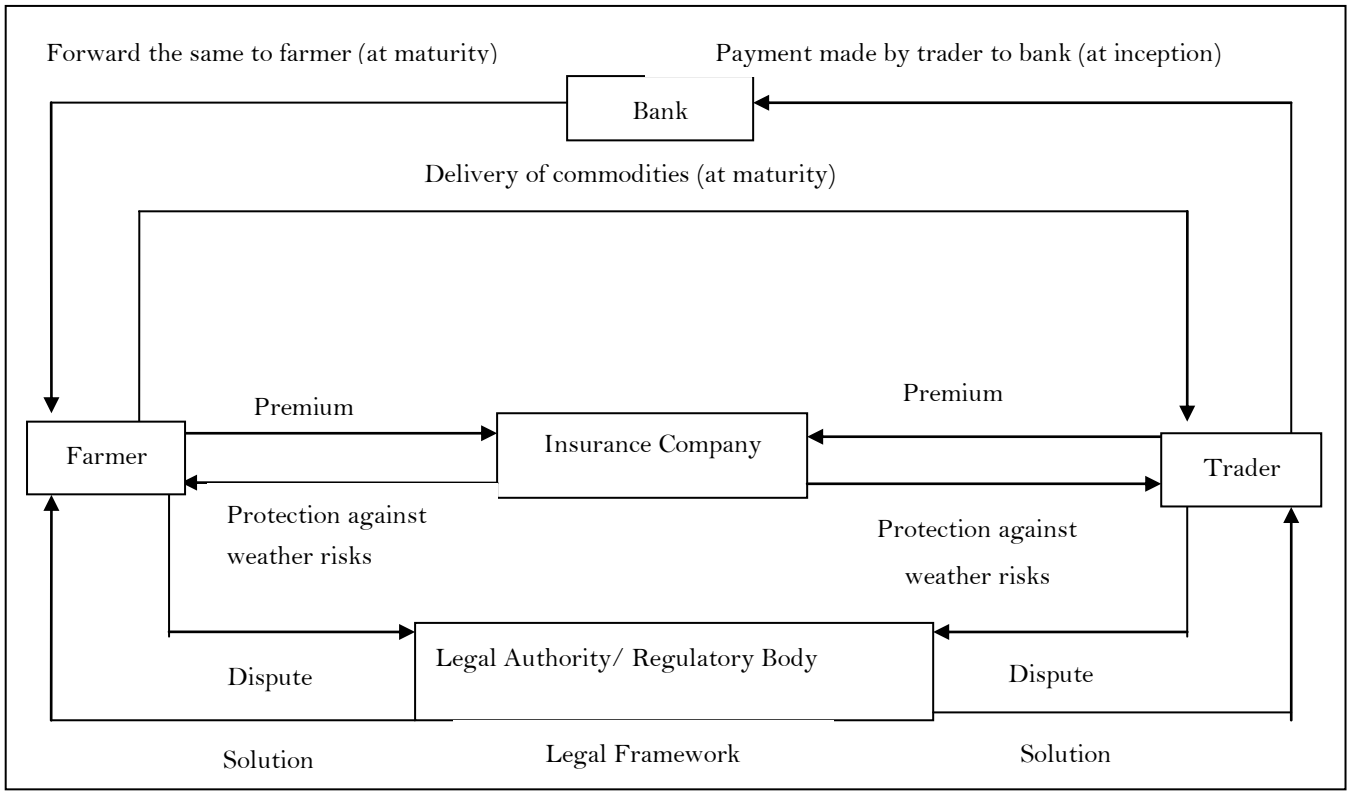

Figure:-2. Proposed Model

Source: the authors' proposed model

Secondly, after fixing all the terms and conditions, the contract will be made between the counterparties. It will obviously be made in written form on a legal paper. There must have a third party, who will act as a witness as well as trustee of the contract. Financial institutions especially banks can be apposite in this regard as banks are the most trustworthy institutions and are generally accepted by all. The bank can charge a very minimum fee or not for acting as a trustee of the contract, because the traders will deposit the full contract amount with bank at the beginning of contract. Therefore, the bank can use that fund until forwarding it to farmers at maturity.

Thirdly, since the farmers take the risk of delivering the commodity at maturity, they are subject to weather risk. Thus, according to agricultural contract act, the farmers will compulsorily buy weather insurance policy against weather risk. If the frequency of weather hazards is high, but severity is low, the farmers might use weather derivative to protect such risks. On the contrary, if the severity of weather hazards is high, weather derivative will lose its usefulness as it will become tough for an individual to bear such risks. In this circumstance, the farmers suppose to use weather insurance rather than derivative to manage weather risk (Linnerooth-Bayer and Mechler, 2009). Furthermore, since weather derivative is not available in Bangladesh, weather insurance is suggested to use. The premium for the insurance policy will primarily be paid by farmers as they will buy it, but they might collect a part of it from the traders through charging higher contract price. If the weather risk is shifted to traders, the traders will buy the insurance policy and pay the premium for the same, but they might also collect a part of it from the farmers through discounting their contract price. Government has to obligate insurance companies to accept weather insurance, because in general they show disinterest to sell weather insurance attributable to its high severity of loss (Cell, 2009). Government has to give subsidy to insurance companies otherwise they might charge high premium, which will make it unaffordable to the farmers.

Since most of the farmers in Bangladesh are illiterate, they may feel harassed conforming formalities. Hence, formalities can be reduced through attaching insurance policy to forward contract as complementary. When the forward contract is made, the insurance policy will automatically be forwarded to insurance company.

Finally, all the activities of contract will be monitored by a regulatory body as set up by government according to the agricultural contract Act. This regulatory body will act as a watchdog and ensure that all things relevant to agricultural contracts take place pursuant to Act. If any dispute or breach of the terms of contract happens, it must be forwarded to the regulatory body. The regulatory body will take care of it and endeavor to resolve the dispute within the jurisdiction of the Act.

For regulatory purpose, the government can either set up a new institution or assign any existing government office like upazila nirbhahi officer's office[1] (upazila executive officer) or upazila agriculture office[2]. However, the authors suggest assigning any government office as a regulatory body rather than establishing a new one, because it will save money for government. Upazila office can further assign union council office[3] to co-ordinate the activities relevant to contract. If any dispute arises between the farmers and traders, it should first be forwarded to union council. If the union council gets failed to solve the matter, they will further forward it to upazila office.

4.2.1. Illustration of Model with Mathematics

Now, we illustrate the effectiveness of our proposed model in managing both price volatility and weather risks with the help of tentative examples.

Price Volatility: Suppose, Mr. Ali Hasan is an owner of a mango yard. His mango yard's average annual production is approximately 12,000 kg; annual average production cost is 384,000. For the ease of understanding, we assume that the annual production and cost will remain same. Only the market price will vary subject to change in economic situation. Here, three economic situations are considered. The profit of farmer without and with forward contract is exhibited in the Table-01 and Table-02 respectively.

Table-1. The profit of farmer when contract is absent

Economic Condition (1)	Market Price (2)	Production (Kg) (3)	Production cost (Tk.) (4)	Sales Revenue (Tk.) (5)=2×3	Profit (Tk.) (6)=5-4
Good	40	12,000	384,000	480,000	96,000
Normal	35	12,000	384,000	420,000	36,000
Bad	30	12,000	384,000	360,000	-24,000
Expected Profit					**36,000**

Source: the authors' computation based on hypothetical data

Table-2. The profit of farmer when contract is present

Economic Condition (1)	Market Price (2)	Contract Price (3)	Production (Kg) (4)	Production cost (Tk.) (5)	Sales Revenue (Tk.) (6)=3×4	Profit (Tk.) (7)=6-5
Good	40	36	12,000	384,000	432,000	48,000
Normal	35	36	12,000	384,000	432,000	48,000
Bad	30	36	12,000	384,000	432,000	48,000
	Expected Profit					**48,000**

Source: the authors' computation based on hypothetical data

From the Table-01 and 02, it is observed that without agricultural contract the profit of farmer changes when economic situation changes and produce an expected profit of Tk. 36,000. On the contrary, with contract the profit remains same at Tk. 48,000 regardless of the state of economy and produces an expected profit of Tk. 48,000, which is more than that of earlier situation (without contract). Therefore, the proposed model checks not only price volatility but increases the expected profit also.

[1]In Bangladesh, the Upazila Nirbahi Office is the office of the chief executive of a sub-district (mid-level office of administration of the country).

[2] In Bangladesh, the Upazila agriculture office is the agriculture office of sub-district.

[3] Union council offices are the smallest rural administrative and local government units in Bangladesh,

Weather Risks: Further suppose that Mr. Ali purchased weather insurance policy amounting to 432,000, which is equivalent to his sales revenue when contract is present. The premium for the same is assumed to be 10 percent of the insurance contract amount, i.e. Tk. 43,200.

Table-3. Weather Risks Protection Through Insurance Policy

State of Nature	Contract Amount (Tk.)	Premium (Tk.)	Outcomes	
			Without Insurance	With Insurance
Weather Hazards Occur	432,000	(43,200)	(432,000)	388,800 or (432,000-43,200)
Not Occur	432,000	(43,200)	432,000	388,800 or (432,000-43,200)
Expected Outcomes			(-432,000+432,000)/2=0.00	(388,800+388,800)/2 = 388,800

Source: the authors' computation based on hypothetical data

Without Insurance Policy: The table–03 reveals that if the weather hazards do not happen, the farmer will not lose anything. Conversely, if the weather hazards happen, the farmer will lose full amount that is Tk. 432,000. Hence, the expected outcome from the contract without insurance policy is Tk. zero.

With Insurance Policy: If the weather hazards do not happen, the farmer will lose only 43,200 taka in the form of premium. On the other hand, if the weather hazards happen, the farmer will receive full compensation that is Tk. 432,000 from insurance company. Thus, the expected outcome from the contract with insurance policy is Tk. 388,000. Therefore, the benefit of insurance is clearly visible in managing weather risks through reducing volatility of income from cultivation. Thus, the proposed model hedges weather risks along with increasing the expected profit from cultivation.

5. CONCLUSION

Agriculture sector in Bangladesh is regularly threatened by various risk factors. Among them three risk factors; such as price volatility, weather risks, and funds shortage; have been documented as the most critical ones in the survey. To manage price volatility, Bangladeshi farmers often make contract with agro-traders, but due to not having legal framework the contract cannot protect them effectively. On the other hand, they seldom buy insurance policy to protect weather risks. The study mainly deals with these two issues together with a little care about fund shortage. The study reviews existing literatures extensively and finds that each of these studies either deals with price volatility or weather risks. It seems that neither of these studies has proposed a model which can cope with such agriculture risks collectively. Hence, there is still pretty scope to conduct research pertinent to these issues. However, the main objective of this study is to effectively manage agricultural risks particularly price volatility, weather risks, and fund shortage. At the instigation, the study performs interviews of 100 people (farmers and traders) in order to obtain overall idea regarding existing agricultural contracts. Later, we propose a model comprising of forward contracts and insurance policies together where forward contract will be used to protect price volatility and insurance contract will be used to shield weather risks. Another important problem that our farmers commonly face is fund shortage, which is also taken care of by the proposed model. This model will work under legal framework where a regulatory body will be appointed by government, whose role is to monitor the overall activities of the contract. If any dispute arises between the counterparties will be sent to the regulatory body, which will endeavor resolving the same.

Thus, the proposed model offers couples of benefits to agriculture. First, the model resolves the price volatility of agricultural commodity and ensures fair price for the same to farmers. Second, the fund shortage of farmers is mitigated by ensuring 25% to 30% advance payment of the contract amount to farmers. Third, the weather risks of agriculture are also tackled. Lastly, the model provides a legal framework, which ensures that no one can escape from their obligations. In addition, both farmers and traders get released from their anxieties regarding relevant

risks, which will certainly extend their efficiencies. If our proposed model is implemented successfully, the farmers will become financially independent and stronger. Therefore, government's subsidy in agriculture sector can be reduced substantially, which in turn will save government revenue. Developing countries like Bangladesh cannot achieve sustainable development goals (SDGs) unless developing their agriculture sector. Since the model endeavors to develop the agriculture sector, it will indubitably play a very important role for Bangladesh in achieving their SDGs.

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REFERENCES

Begum, I.A., M.J. Alam, J. Buysse, A. Frija and G. Van Huylenbroeck, 2012. Contract farmer and poultry farm efficiency in Bangladesh: A data envelopment analysis. Applied Economics, 44(28): 3737-3747. Available at: https://doi.org/10.1080/00036846.2011.581216.

Broll, U., P. Welzel and K.P. Wong, 2013. Price risk and risk management in agriculture. Contemporary Economics, 7(2): 17-20. Available at: https://doi.org/10.5709/ce.1897-9254.79.

Byerlee, D. and K. Deininger, 2013. Growing resource scarcity and global farmland investment. Annual Review of Resource Economics, 5(1): 13-34. Available at: https://doi.org/10.1146/annurev-resource-091912-151849.

Cell, C.C., 2009. Crop insurance as a risk management strategy in Bangladesh. Department of Environment. Ministry of Environment and Forests. Government of the People's Republic of Bangladesh, Dhaka.

French, L. and E. Silver, 2007. Crop insurance to mitigate loss from flooding in Bangladesh-A viability assessment. MSc Environment and Resource Management Module VI – Traineeship: 1-84.

Henningsen, A., D.F. Mpeta, A.S. Adem, J.A. Kuzilwa and T.G. Czekaj, 2015. In: The effects of contract farming on efficiency and productivity of small-scare sunflower farmers in Tanzania. International Conference of Agricultural Economists (ICAE).

Hongyong, F., L. Jiawen, L. Yujie, S. Huang and X. Sun, 2018. Risk transfer mechanism for agricultural products supply chain based on weather index insurance. Complexity, 2018: 1-17. Available at: https://doi.org/10.1155/2018/2369423.

Isimoya, O., 2014. Business ethics in insurance industry in Nigeria. International Journal of Management and Sustainability, 3(6): 341-359.

Islam, M.R., 2016. Bangladesh disaster-related statistics 2015: Climate change and natural disaster perspectives. Impact of Climate Change on Human Life (ICCHL) Program, BBS.

Jones, T.L., 2007. Agricultural applications of weather derivatives. International Business and Economics Research Journal, 6(6): 53-60. Available at: https://doi.org/10.19030/iber.v6i6.3377.

Khan, S., M. Rennie and S. Charlebois, 2013. Weather risk management by saskatchewan agriculture producers. Agricultural Finance Review, 73(1): 161-178. Available at: https://doi.org/10.1108/00021461311321375.

Khatun, F., 2012. Proposals for agriculture sector. Forum, A monthly Publication of The Daily Star, 6(6).

Linnerooth-Bayer, J. and R. Mechler, 2009. Insurance against losses from natural disasters in developing countries. UN Department of Economic and Social Affairs (DESA) Working Papers, 85, UN, New York. Available from https://doi.org/10.18356/ddba5e66-en.

Manorom, K., D. Hall, X. Lu, S. Katima, M.T. Medialdia, S. Siharath and P. Srisuphan, 2011. Cross-border contract farming arrangement: Variations and implications in the Lao people's democratic Republic. Asian Development Bank.

Mejdoub, H. and M.B. Arab, 2017. A multivariate analysis for risk capital estimation in insurance industry: Vine copulas. Asian Development Policy Review, 5(2): 100-119. Available at: https://doi.org/10.18488/journal.107.2017.52.100.119.

Mishra, A.K., A. Kumar, P.K. Joshi and A. D'Souza, 2018. Impact of contract farming on yield, costs and profitability in low-value crop: Evidence from a low-income country. Australian Journal of Agricultural and Resource Economics, 62(4): 589-607. Available at: https://doi.org/10.1111/1467-8489.12268.

Miyata, S., N. Minot and D. Hu, 2009. Impact of contract farming on income: Linking small farmers, packers, and supermarkets in China. World Development, 37(11): 1781-1790. Available at: https://doi.org/10.4073/csr.2017.13.

Navarra, C., 2017. Contracts between smallholders and private firms in Mozambique and their implications on food security. WIDER Working Paper, 197. pp: 1-19.

Okoye, N.F., O. Egbo, O.M. Okeke and E. Nwankwo, 2017. An analysis of the relationship between insurance risk management and growth of the Nigerian economy. International Journal of Economics and Financial Modelling, 2(1): 25-36. Available at: https://doi.org/10.20448/811.2.1.25.36.

Paul, A., R. Heifner and J. Helmuth, 1976. Farmer's use of forward and futures markets. Washington, DC: US Department of Agriculture, National Economics Analysis Division. Economic Research Service Agriculture Economics Report. pp: 320.

Paul, J., 2013. A study on the feasibility of weather derivatives in India. PARIPEX-Indian Journal of Research, 2(1): 14-15.

Raucci, G.L., R.L.F. Silveira and D.H. Capitani, 2018. Development of weather derivatives: Evidence from Brazilian Soybean market. Agricultural & Applied Economics Association Annual Meeting at: Washington, D.C, 2018. pp: 1-16.

Shi, H. and Z. Jiang, 2016. The efficiency of composite weather index insurance in hedging rice yield risk: Evidence from China. Agricultural Economics, 47(3): 319-328. Available at: https://doi.org/10.1111/agec.12232.

Sokchea, A. and R.J. Culas, 2015. Impact of contract farming with farmer organizations on farmers' income: A case study of Reasmey Stung Sen agricultural development Cooperative in Cambodia. Australasian Agribusiness Review, 23.

Spicka, J. and J. Hnilica, 2013. A methodical approach to design and valuation of weather derivatives in agriculture. Advances in Meteorology: 1-8. Available at: https://doi.org/10.1155/2013/146036.

Vavra, P., 2009. Role, usage and motivation for contracting in agriculture. OECD Food, Agriculture and Fisheries Working Papers, 16, 1-36.