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Risk analysis of impacts of a cyclone disaster on rice-fish farms in Bangladesh

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Scale expansions and route changes of cyclones are part of extreme events caused by global warming. The simulation analysis of overflows of dikes using exceedance probability is a typical example of impact analyses of high tides by cyclones on infrastructures. In this research, risks of cyclone disasters on rice-shrimp cultivation farms and rice-open fish farms are analyzed by Value at Risk (VaR). If a person owns a portfolio for a certain period, the VaR is the maximum loss value of the portfolio under a given probability.

Cyclone Aila landed near the border between India and Bangladesh causing a major catastrophe for residents in the region. Farm surveys were conducted in the Koyra upazilla of Khulna region in Bangladesh for evaluation of impacts of cyclone disasters on rice farmers. The data of costs and quantities of rice cultivation in the dry season (Boro) and incomes of side-jobs in 2009 were collected through the farm surveys. The total number of surveyed farms was 84 and 23 of these farms were damaged by the cyclone. Farms which were not damaged by the cyclone also have not cultivated rice by the dike breaks since rainy season in 2009.

First, basic statistics such as averages, standard deviations and correlation coefficients of incomes of in the rice and fishery sectors are calculated. Furthermore, VaR of 95% of the rice-shrimp cultivation farms and the rice- open fishing farms are calculated based on the standard deviation of the portfolio, i.e., joint income, of the two sectors. These statistics and economic indices show that average income of rice-shrimp cultivation farms is negative, and the risk of the rice-shrimp cultivation farms evaluated by VaR is greater than that of the rice-open fishing farm.

Second, weighted averages, standard deviations, correlation coefficients, and VaRs are calculated due to considering the case without the cyclone disaster on the farms. The production is the weight of the rice sector and the income is the weight of the fishery sector in this calculation under the data limitation. The ratios of the simple value of the VaR by the weighted value of the VaR are 3.69 for the rice-shrimp cultivation farm and 5.16 for the rice-open fishing farm respectively.

The absolute value of the VaR of the rice-shrimp cultivation farm is larger than that of the rice-open fishing farm; however, the joint income risks faced by the rice-open fishing farm evaluated by the VaR expanded under the impacts of the cyclone disaster due to the higher correlation between rice and fishing sectors. Currently, some NGOs are promoting shrimp cultivation to rice farmers which incurred damages by from the cyclone. The further dissemination of shrimp cultivation in the coastal region is important for the dispersion of the risk caused by climate changes.

Keywords: Cyclone, Risk, VaR, Rice-fish farm, Bangladesh