

WEATHER DERIVATIVE- A TOOL FOR WEATHER RISK HEDGING

Most of the industries in the world are directly or indirectly affected by weather changes. Due to the adversity of global warming and the burning of fossil fuels, the weather has become quite unpredictable. Every now and then occurrence of drought, heavy and scanty rainfall is seen. As a result agriculture output becomes very irregular and this entails heavy losses not only to the farming community but also to the related industries.

Although there is no way to control weather, there exists a new solution to the financial effect that weather can have on the incomes of economic agents of developed and emerging economies. There are number of instruments and tools available for management of weather risk. Weather risk management is a definitive guide to the rapidly expanding WRM market. It is the most dynamic sector of the financial arena and is drawing the interest of the companies that are seeking to protect against the financial impact of non catastrophic weather. So for hedging weather risk weather derivatives have been developed.

DERIVATIVE TRADING

Like any other derivatives weather derivatives are structured as Future, Option or swaps based on different weather indices. Usually most weather derivative transactions are done on over the SInternational Financial Future Option Exchange (LIFFE) offer standardized weather contracts.

In India derivative instruments are traded both on OTC market and derivative exchanges. OTC contracts such as forward and swaps are bilaterally negotiated between two parties.OTC terms are flexible and customized. In India OTC derivatives are generally prohibited with some exceptions. An exchange traded contract such as future has a standardized format that specifies the underlying assets to be delivered, size of the contract, time period etc. Margin requirement and mark to market of future positions substantially reduces the credit risk of exchange traded contracts.

There are moves in India to launch a weather trading platform. So companies like power, utilities, retail farm, farm product vending business can hedge risk against unfavorable climate conditions. Weather risk management services- a weather insurance company, which is launching the trading platform estimates transactions worth \$10 billion in a year. (Economic times 2008, March 15)

WEATHER DERIVATIVES

Derivative is a financial instrument which derives its value from underlying assets. A financial weather derivatives (WD) contract is a weather contract whose payoff is determined by future weather events. The underlying of WD could be anything related to weather as rainfall, temperature, snowfall or hurricanes etc. The first transaction on WD took place in 1997 in CME(Chicago Mercantile Exchange) which was executed by Aquila Energy of US as a weather option in a power contract. The market has seen potential in WD since then, so CME introduced electronic trading of WD through Globex 2 system. Based on the indices of climate that measure the rainfall, day and night temperature, humidity, wind speed etc two standard indices have been created namely 1.Heating degree days (HDD) 2.Cooling degree days (CDD).

HDD and CDD measure the heating and cooling demand that arises by departures of average daily temperature from a base level. HDD is the number of degrees by which the days average temperature is below a base temperature, while CDD is number of degree by which the days temp. is above a base level.

Based on the indices of climate and weather of 10 major American cities, weather indices are being traded in the CME. An investor can buy the weather derivatives with relation to any of the 10 cities for which the indices are made just like buying an insurance product. For hedging the weather risk, futures and options based on these indices are used. If a company expects the coming month to be hot, it should either sell CDD indices in summer or buy the HDD indices in winter. In case summer in the coming month does not turn to be as hot as expected and the company incurs losses, it should square off the indices by buying them at a lower price and ensure that revenue stream is not affected.

HDD: this index is used during the winter month to measure the cold waves. Higher the index colder the day and vice a versa. Payoff is as follows-

- i) 0, if day's temperature is more than base temperature,
- ii) Base temp less than actual temp, if temp is less than base temp

$$\text{HDD} = (0 \text{ or } \text{base temp} - \text{actual temp})$$

CDD: This index is opposite to HDD and is used in summer months to measure the warmth. Higher the index , warmer the day and vice-versa. Payoff is as follows-

- i) 0, if temperature is below base temperature
- ii) Actual temperature – base temperature, if temperature is above base temperature.

$$\text{CDD} = (0 \text{ or } \text{actual temp} - \text{base temp})$$

Value of weather derivative: As in India, for trading index based future the underlying asset is the cash market index. The minimum lot size to be used for trading and settlement of contract is 50. That means if Nifty future contract is traded at 4000 and lot size is 50, then future contract value would be Rs 2,00,000 . Similarly, the contract value under weather derivative will be the days realized climate which is reflected in HDD or CDD multiplied by the lot size. In CME the lot size for weather contract is US\$ 100. Now let for one week of April, the temperature is (25,26,28,22,21,18,19), then the value of weather index will be \$100 X (25+26+28+22+21+18+19) or \$15900.

Each of the two indices only measures the warmth or coolness of the weather. It is essential to have both the indices operating together so that both extreme winter and extreme summer could be covered.

In winter the company that expects the day to be very cold should sell HDD index. If weather does not perform as per expected and winter turn out to be warmer HDD should be lower at that time and can be bought to square off the position. Thus profit earned is the difference of sale and purchase offset the loss incurred in lower revenue due to unexpected weather.

Similarly in case of option a call option on CDD can be bought in summer by company expecting winter night to be cold. If expected weather condition occurs then obviously company earn good revenue else if reverse takes place then company bear the loss in revenue but simultaneously it can exercise the call option as CDD index will be quite high. Hence gain on later transaction offsets the fluctuation in revenue cost by unfavorable weather condition.

SCOPE & APPLICATION OF WEATHER DERIVATIVES IN INDIA

India is basically an agriculture based economy. Agriculture provides subsistence to 60% to 70% population of the country & contributes about 30% of GDP. Almost 50% agriculture depends upon rainwater irrigation. Moreover, we cannot imagine any industry which is not directly or indirectly affected by weather changes. At an estimate 20% of GDP is wiped out in case of bad weather.

At present crop insurance is the only approachable option to hedge the agriculture risk, but it is restricted to few crops and failed, owing to their misestimating of probability of risk. Precisely premium collected are less than claim settled. For success of crop insurance in India, government subsidy on premium is the only way out, but that will mean increase fiscal cliff due to increase in public expenditure. So weather derivatives with temperature or rain index may come handy to the market. It is very cost effective for farmers as they have to shell out fewer premiums to invest in derivatives and hedge their risk. The trading platform will allow one to buy & sell the value of temperature or rainfall index at future date. While power company such as Reliance Power can trade in CDD & HDD contracts in Mumbai & estimate how much electricity could be consumed. Farmer can use WD to hedge against poor harvest caused by draught.

Indian capital market is developed enough to cater technically the derivative instrument. Study shows that there has been tremendous growth of derivatives especially those based on Nifty & Sensex in Indian market. As in March 2011 Futures and options traded on exchange was 1.6 billion contracts. NSE is ranked world's 7th largest derivative exchange by contract volume in 2009. Such instrument can be tailored to the risk bearing capacity of the farmer, as said by ASSOCHAM President Mr. R.N.Dhoot. Weather risk management services which may launch the trading platform estimate transaction worth \$10 billion in a year. Most advantageous thing in such instrument is that they naturally work under efficient form of market. Weather index cannot be manipulated as the outcomes on the underline assets (weather) is natural & beyond the scope of human interference.

CHALLENGE:

CME is successfully running the trading of weather derivatives and YOY growth in volume is worth mentioning. In last few years European and Asian markets have also come out with weather risk hedging instruments. In India bill is still pending in the Parliament for launching weather derivative trading in exchanges. There are certain bottlenecks in Indian context for implementing WD instruments, which need to be addressed.

Firstly, it is important to have a reliable and verifiable data available on weather patterns. Need is to establish tamper proof weather stations and use of sophisticated equipments to eliminate errors caused by direct human involvement.

Secondly, when facing severe weather events, it is difficult to find counterparty with an offsetting exposure.

Thirdly, rainfall pattern varies from region to region. Indian vast land covers number of latitudes. Topography is not similar across the region, so it is important to determine the correlation and other statistical measure for a weather event with in certain region to incorporate them in one index.

Fourthly, for screen/exchange traded derivatives most critical component of risk containment mechanism is the margining system and online position monitoring. Upgraded clearing corporation and risk management system has a role for pre empting market failures.

Fifthly, person whose revenue stream is exposed to weather risk is not well acquainted with exchange trading system. It is a big challenge to make the farmer community participate in weather derivative trading. In India it is a long way to go and achieve the motive of weather risk management instruments.

Sixthly, a study of Rajeev Seth shows that willingness of a farmer to pay is determined to be around 8.8% of the maximum possible payout of a weather derivative contract.

CONCLUSION

India is one of the most successful developing countries in term of a vibrant market for exchange traded derivatives. NSE is ranked world's 7th largest derivative exchange by contract volume in 2009. The bottlenecks highlighted and the systematic natures of weather derivatives need to be addressed. Introducing weather derivative in India seems to be quite feasible. A bill is stuck in Parliament for the past 13 years to amend Forward Contract (Regulation) Act which will enable the regulator to introduce and coordinate the new and innovative hedging product like weather derivative. Such instruments can be tailored to the risk appetite of farmers to hedge risk

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