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Using Options Futures Derivatives Weather in Hedging

Noor Salah Abdelnaby Al-Ramadan, Mohammed Faez Hasan

Dept. of Financial & Banking sciences, University of Kerbala, Iraq

noor.salah@uokerbala.edu.iq, mohammed.faiz@uokerbala.edu.iq

Abstract. The present investigation is taken into consideration on using options futures derivatives weather in hedging. A weather derivative is considered as the financial instrument that people or firms use to protect themselves from the threat of weather-related losses. In exchange for a premium, the seller of a weather variant concurs to assume the risk of disasters. Weather hedges are regarded as the financial instrument used by businesses or individuals to limit the risk of weather loss. There have been different articles considered based on the given subject area. The findings stated that heating degree days is one climate index for weather derivatives. Each day that the daily average temperature tends to fall under a predefined reference point over a specified time, the deviation amount is recorded as well as decided to add to an accumulated count under HDD agreements. From the above-mentioned information, it has been concluded that there are numerous obstacles to making effective use of and managing weather options. Risk managers should understand options, as well as the risk profile related to the purchase of weather options about their company, can find weather derivatives extremely useful. Adding weather possibilities to the Value at Risk (VAR) calculation is a simple process.

Keywords. Weather variant, derivatives, Weather derivative and Hedging

Introduction

Weather derivate is considered as the financial instrument that is used through the individuals or firms to be a hedge against weather-related loss risk. Weather seller derivate agrees to bear disaster risk in return for a premium. Common ways for considering the derivatives for the hedging consist of the interest risks, commodity, foreign exchange risks, and also interest rate risks. The weather derivatives are regarded as the index-based instrument that mainly uses the observed weather data to develop an index on which payout depends. In this report, there will be a discussion about using options futures derivatives weather in hedging. The information will be collected by considering the different articles to examine the viewpoints and opinions of the authors. To conduct the literature review, secondary sources will be considered such as books, internet sources, scholars, journals, and others[1].

In the article, the qualitative research method has been considered because this gives an in-depth as well as detailed understanding related to using options futures derivatives weather in hedging. In the collection of the information for this specific area, secondary sources have been considered such as books, journals, internet sources, scholars, and articles[2]. The main reason behind considering the secondary method is that it is cost-saving as well as timesaving. The inductive research approach has been considered because it depends on the qualitative

method and provides the theoretical understanding and information regarded to the specific subject area.

Literature review

According to the opinion of Hess (2015), Weather future is a kind of weather derivate where payoffs depend on the difference in measured variable weather mainly recorded temperature and over some time. It enables the business firm to be protecting themselves alongside any losses which are caused through the unexpected shifts in weather situations. In context to this, a weather derivate seller agrees to be bear disasters risk in premium return. If in case, there is no damage to arise before contract expiration then in this case seller will make a profit. Hedging is a better way to think about an insurance firm. When an individual decided to be hedge then they are insuring against the negative impact of the event on finances. It does not mean to avoid all the negative events or actions from happening. If in case, there is any negative event occur then an individual's is hedged properly and event impact is minimized. When it comes to structuring a weather accord, a firm has several options. The first option is most equivalent to purchasing an insurance product as purchasing a cooling degree day option (CDD) in the summer or a heat exchange degree day option (HDD) in the winter [3]. The difference between the everyday average temperature and 65 degrees Fahrenheit is the total cooling degree days on a single day. Heating and cooling degree days can never be negative. In case the daily average temperature is around 65 degrees Fahrenheit, the number of heat degrees day is the difference between the everyday average temperature and 65 degrees Fahrenheit . On the other hand, numerous agricultural regions in the emerging world are experiencing droughts that can have a disastrous impact on household consumption expenditure, particularly among the poor [4]. To safeguard consumption, rural households employ a variety of risk management strategies, many of which are primarily risk-reducing and others of which are simply coping mechanisms to protect consumption even before revenue has been lost [5] . The incapability of these conventional risk management strategies to assure against potential confounders risks is a significant limitation, and also, they are expensive.

As contrary to Ganti (2021), Weather futures allow corporations to hedge over losses resulting from unexpected changes in weather conditions. While companies may have homeowner's insurance policies in place to encompass physical damage done by comparatively rare weather-related events including a high wind or hail, these policies will not encompass economic losses if clients are unable to arrive due to rainfall, or if crops fail to grow in warm weather [6]. Firms whose businesses are based on weather like hydroelectric businesses or those who are managing the events of sports might be considered the weather derivatives as risk management strategy part. In context to this, farmers may use the weather derivatives for the purpose to hedge against poor harvest that caused through too little or too much rain, destructive winds, and swing sudden temperature [7].

Methodology

The Present study will utilize the concept of gathering previous statical and mathematical summaries to prove its point of view. Hence, most of here after listed works will be mentioned with its references. Main reason behind this approach is such type of topics have seldom application amongst countries, therefore it is limited and confined in application.

Results and Discussion

There are many drivers behind the development of the weather derivate market. This process is evidenced through developing catastrophe bonds number issues and introducing catastrophe options traded on the Chicago Board of Trade (CBOT). It has been analysed that in which manner related strip value of monthly basis options of single option value for the multi-month period. There has been considering the 2 months HDD contract such as January and February [8].

Table 1. Value of a Strip of Options

	Average (Mean)	Standard Deviation
January HDDs	400	100
February HDDs	300	80

Besides, Ganti states that Weather future is considered as the weather derivate type where the payoffs depend on aggregate variation in analysed weather variable recorded the temperature over the fixed time. It sprung up in the early 1990s as a way for the organizations to hedge the exposure of the weather depending on the modifications to the index that analyse the alterations in daily temperature.

The findings signify that weather future is mostly obliges customers to buy underlying weather index cash value. The common weather future contract is mainly relevant to the recorded temperature that is analysed in the cooling degree days or heating degree days at a future date [9]. , the increased emphasis on climate-related risks is becoming a significant driver of sales for financial products that protect adverse climate and weather situations change. Credit rating agencies, more companies, and some other bodies are assessing their visibility to climate-related risk in terms of the Task Force on Climate-related Financial Disclosures (TCFD) recommendations. It has been analysed that resurgence in the weather futures of the SME Group and also the complex options coincide with move through CME to consider the weather products consisting of the options for the trading regarding electronic trading platform exchange and trading on the CME exchange [10] which appear in figure (1).

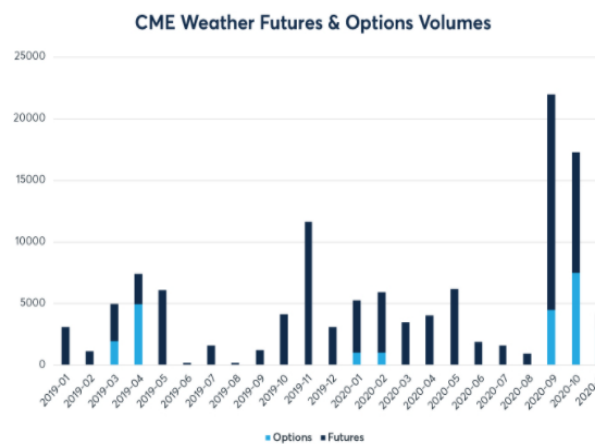


Figure 1: CME Weather futures and options monthly trading volume

Weather derivatives were developed in the late 1990s to assist energy producers in mitigating the effects of extreme weather conditions. The first such contract was signed in July 1996, whenever the presently Aquila Energy organized a dual commodity hedging strategy for New York's Centralized Edison for its needs of electricity in August of that year. It has been analysed from the above-mentioned table that it gives the example about calculating the effective payout for the temperature-related contract of the derivatives. It stated that if the amount per degree was to be agreed on \$10,000 in the given table.2, then in this case holder would pay off \$ 70,000 means 7 times of 10000 in the CDD contract case. The reason is that consumers of derivate would compensate through the amount of which cash flow is impacted adversely through the weather [11].

Table 2. Calculating the payout for a temperature-related weather

Calculation of CDD Index	
Temperature	Degree
Maximum	83
Minimum	61
Average	72
Base Temperature	65
COD	7

Rainfall derivate is considered as the financial instrument that is mainly used to hedge the risks related to fluctuation in rainfall. This clearly stated that how to settle the payment among involved parties depends on existing weather situations at the time of the contract period. It has been examined from the above mention graph that daily rainfall amount and occurrence differ with the season and this appears to be repeated after year by year [12].

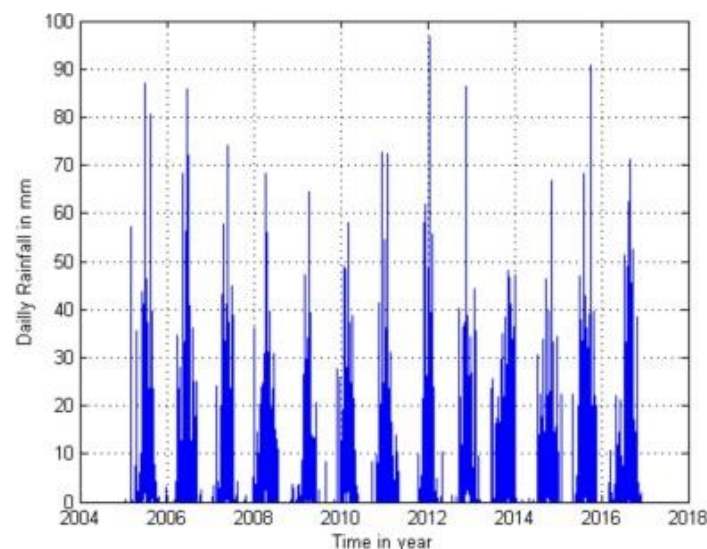


Figure 2: Time series plot of Bahir Dar's daily rainfall data from 2005 to 2017.

Taušer & Čajka (2014) stated that weather derivatives intending to present weather derivatives substance as new financial products by consisting of the benefits and limitations

when used as the main tool to reduce the losses which are coming from weather circumstances. The findings stated that weather derivatives have more potential to be grown further. They allow being fudge against the weather conditions at a reasonable price.

Matsumoto & Yamada (2021) states that electric utilities face the main risks as revenues are based on the maximum volatility factors consisting of the volume and cost of sales. Hedging related to the cost fluctuation risk is a necessary issue for electric use to run a business. It has been analysed from the given graph that JEPX has an upwards market, but this has very liquidity problems, so there are almost no flexible hedging tools related to electricity derivatives. As a result, it is possible to be using energy derivatives that are traded on global commodity exchanges, to hedge the price risk of JEPX. In actuality, the JEPX cost is notable for its strong correlation with crude prices in the global oil market.

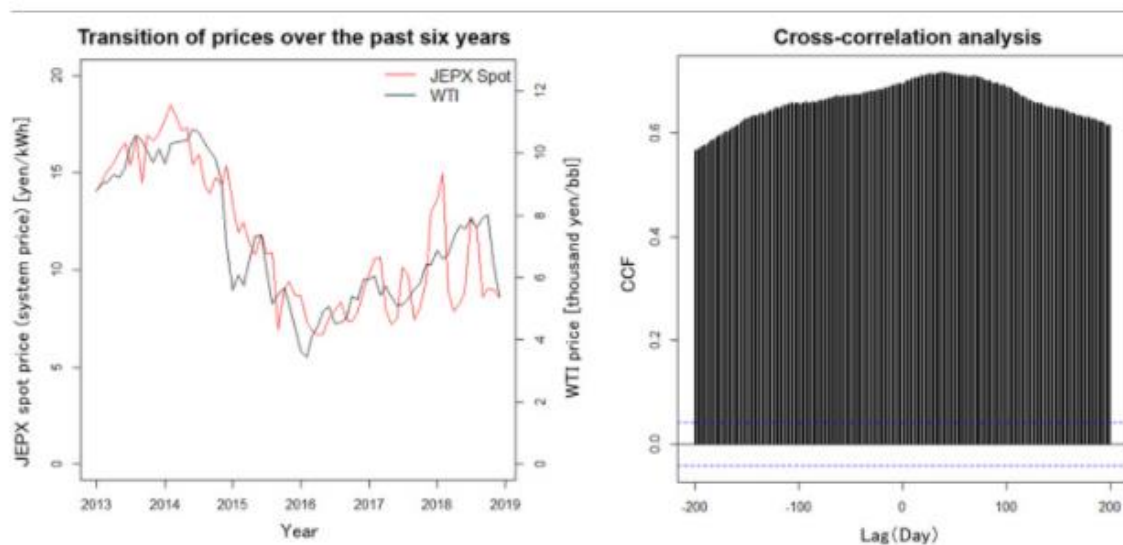


Figure 3: Relationship between JEPX spot price (system price) and WTI (JPY base).

Jones (2011) asserted weather derivatives are a rapidly expanding derivatives industry. The article aims to investigate the history of the weather derivatives market and all its advantages related to agricultural risk management. Furthermore, it is representative of the advantages and applications of weather derivatives those who may not elsewhere be revealed to this market. The findings stated from this article is that structure of Cooling Degree Day and Heating degree day contract with weather derivative's agricultural hedging uses, consider uniqueness in market and volumetric risk hedging.

As per this article, Weather derivatives are regarded as a promising tool for agricultural risk management. The data underlying these tools are typically provided by the station-depending on meteorological index values. The primary drawback of these weather derivatives is an incomplete correlation among the weather index as well as the insured crop yield, known as basis risk. It has been analysed by the Figure .4 that distribution of the contracts number by the different regions such as Europe, NA south, Asia, NA east and others [16].

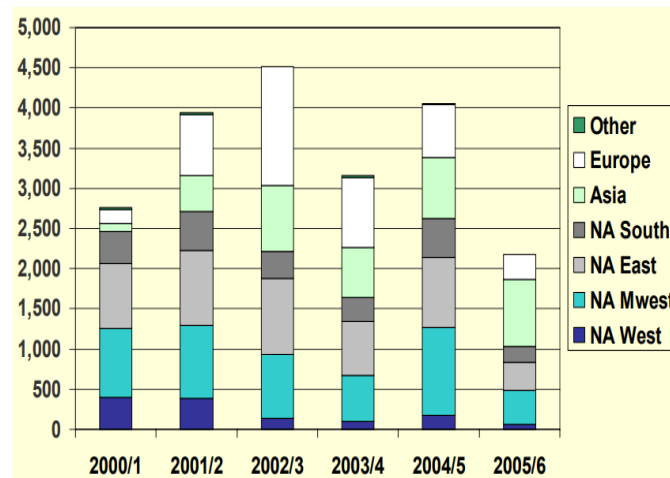


Figure 4: Distribution of Number of Contracts by Region

Weather derivatives varied from the conventional derivatives in that there is a negotiable underlying that mainly forms based on derivative. Thus, the main goal of weather derivatives is to hedge capacity risks instead of price risks resulting from a change in consumer spending caused by a change in weather. Thus, the main objective of weather derivatives would be to hedge capacity risks instead of price risks resulting from changes in demand for consumer spending caused by differences in weather. Even though changes in demand can affect the cost of these products, the cost risk of these products can be hedged more efficiently using futures or alternatives based on commodities cost. It has been analysed that the logical consequence is that a better hedge requires the cost risk through conventional commodity derivatives and also volume risk through weather derivatives risk [17].

Gyamera et al. (2019) stated that agriculture continues to be the main industry that contributes to exports of Ghana earnings, revenue generation for the population. Weather variables are hard to reduce, particularly for small-scale farmers in most underdeveloped and developing countries and have a significant impact on these farmers' farming activities.

It has been analysed that this industry is susceptible to climate shocks, so a dependable and productive insurance product for farmers as well as stakeholders is required. However, owing to excessive basis risks inside the product design and pricing, most farmers are hesitant to purchase these goods.

Conclusion

It has been concluded from the above-mentioned information that an effective method to hedging in investment work is by the derivatives. Weather derivative seller is agreeing to bear disasters risk in return for a premium. There has been information collected by considering secondary sources such as articles, scholars, journals, and others. The qualitative research method has been used because it gives a detailed understanding of the specific subject area. This method is effective in collecting the information and data within less period.

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