Weather Certificates and their use to mitigate adverse weather conditions

Jonathan Barratt
CelsiusPro Pty Ltd., Level 14, 309 Kent St Sydney NSW 2000. www.celsiuspro.com.au

Abstract

The purpose of this paper is to introduce weather derivatives. Weather derivatives are generally used throughout the world in top end, capital-intensive projects. The energy sector is a prime example where projects range from $50 to $100 million plus. Through technology and financial engineering we can now adopt those principals learnt in the energy sector and apply them to other industries, which are on a smaller scale. Little financial engineering up until now has been done in the Agricultural sector to develop products that can meaningfully be used by Farmers to cover risks associated with weather. Although weather certificates cover a wide range of applications the focus of the paper is on Agriculture and rain where too much rain during the harvest period (April for cotton, November to January for wheat) can cause significant downgrades in quality of the crops. For simplicity, focus is on the area surrounding Trangie, NSW (BOM Station 1281). The weather statistics for the area during April and then the December – January harvest period have been examined on an accumulative and day event basis. Analysis of the rainfall during this period provides the basis for the best harvest strategy to use. A strategy engineered to hedge against downgrades caused by too much rain over harvest is then developed. Anecdotal evidence in 2011 suggests that downgrades in wheat where widespread and varied from between $30 to $100 as the grade spread widened. The effects of the downgrades have downstream effects on the income of the farmer and thus the community and rural life as a whole.

Key Words

Weather, derivatives, climate, rain, hedge, wheat, community, government

Introduction

Adverse weather conditions so far this year, have cost the Australian agricultural market approximately $1 billion dollars in lost production and under capacity. Weather volatility is on the increase and global food security is becoming questionable. This volatility has an immediate impact on yield and return, which ultimately feed through to questions on the farms profitability. Any loses on the farm have a flow on effect downstream to the whole rural economy. Anecdotal evidence suggests that 70% of the risk farmers have is related to weather. Last year's wheat downgrades due to rains over harvest, in some regions, cost farmers from between $30 to $100 per ton. This downgrade to many represented a breakeven year on income. For those that used weather certificates the loss was covered. The focus of the discussion is to show that weather certificates are important financial products that can be used to help transfer the risks associated with adverse weather; away from the framer and local community and onto financial organisations that can absorb it. The focus here is on the district surrounding Trangie NSW where successful pilot programs have been established in the last 24 months. The historical weather index is first constructed to cover most weather related concerns. The weather risks growers have, which are primarily over the harvest and germination periods are then examined. During harvest the main concern is where rain has affected grades. The use of Weather Certificates over the last few years has successfully been used to placate these downgrades.

The stakeholders in this discussion are Farmers, Grain buyers, Agronomists, local communities/businesses and the Government.

Materials and Methods

Understanding the Risk and Solutions

Australia has significant weather records, in some case up to 100 years of data. Through an understanding of previous weather patterns and current moisture related analysis, provided by the agronomist for a region, we can arrive at simple solutions to help transfer the affects of adverse events in weather away from the farmer.

For instance, planting on a low moisture profile requires more rain over the life of the plant to develop a good yield. Planting on a high moisture profile and receiving less rain during germination will also have an effect on yield. Rain during different times in the growing season affects yield, so through an active consultation with the agronomist and the weather certificate provider we can develop strategies to protect the grower against these adverse effects. Solutions such as Rain Day and Rain Season Certificates can be used to help reduce or mitigate this risk for growers and financiers. In addition, to rain certificates we can design weather certificates that cover dry periods, heats days and frosts, all of which can affect yields.

All certificates work with the grower's individual requirements and risks throughout the season rather than traditional products that just cover tail events should they occur. In the examples used here we build several weather indexes for Trangie and then relate these indexes to the most appropriate risks that the farmer has. In example 1 April rainfall is used, as this is important for Cotton growers. In example 2 wheat harvest at the end of the year is used.

Example 1

The first step is to build an Index to get a good understanding of the how the weather during April works. The Historical Weather Index for Trangie from 1988 to 2012 for April (Figure 1) shows the total amount of rain that Trangie received during April over the last 24 years. (y axis is in mm and x axis is years)

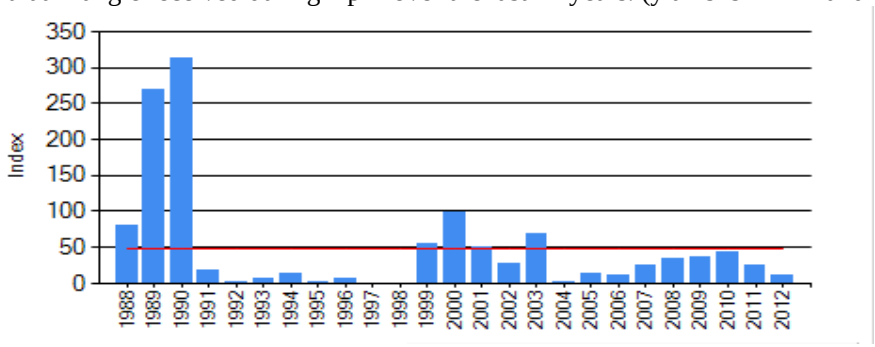

Figure 1. Historical Weather Index for Trangie from 1988 to 2012

In analysing the above data it can be seen that events over 50 mm need to be covered because with cotton harvest rain over this period may affect quality which is subject to downgrades or the rain may impair the ability to harvest. In both cases it represents a lost opportunity. When looking at weather certificates protection can be built where payment is made on a gradual basis. For instance if any further rainfall above 50 mm occurs compensation can be claimed on a per millimetre basis ie the more rain the more payment received (up to a maximum) or a certificate can be designed by an event. For instance knowing that the crop can absorb so much water before harvest and if it gets too much then the product will be downgraded. In the examples the days that have >9 mm are identified and if there are several days of rain some form of loss will potentially occur. The data is arranged to show this as shown in the Historical Weather Index for Trangie on shown in Figure 2.

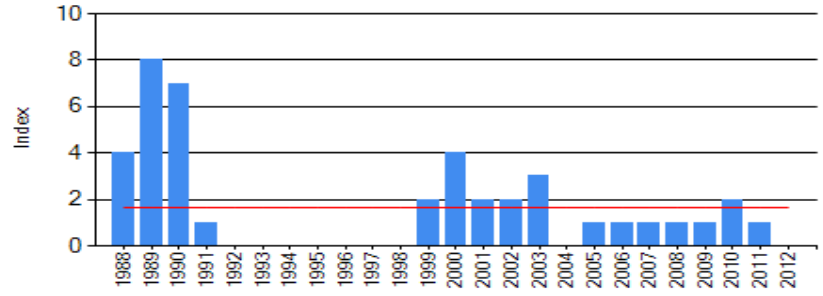

Figure 2. Historical Weather Index for Trangie showing days >9 mm.

In summary, it can be seen that the 25-year average is 1.64 days and the standard deviation is 2.14. So since 1988 there have been 5 occasions, where during the period 15-03 to 15-04 we have had days of rainfall over 9 mm. For example in Trangie in 2000 we had 4 days or 100 mm of rain. In analysing the data it would be prudent to cover any event over 3 days of greater than 9mm of rain. In this case we take out a rain day event,

which pays out after our nominated days. In this case we will receive a nominated amount on the 4th day of greater than 9mm of rain. Continual rain on cotton affects the colour with discounts occurring on the crop. So it makes sense to hedge this. The grower estimates their overall loss and covers this with a weather certificate. All the information can be found at www.celsiuspro.com.au.

Example 2

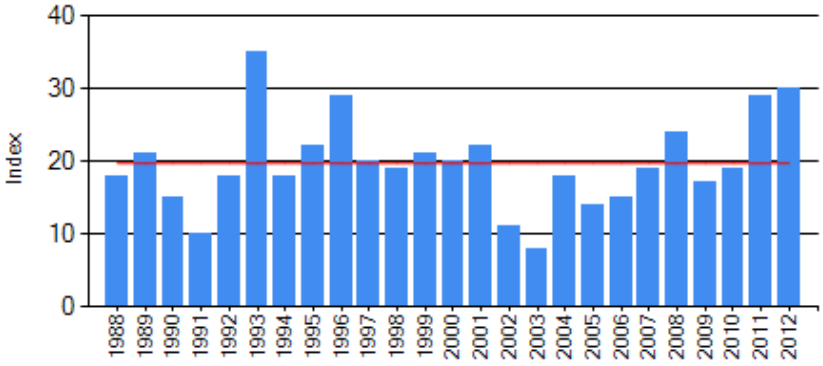

Figure 3. Historical Weather Index for Trangie from 1 November to 31January

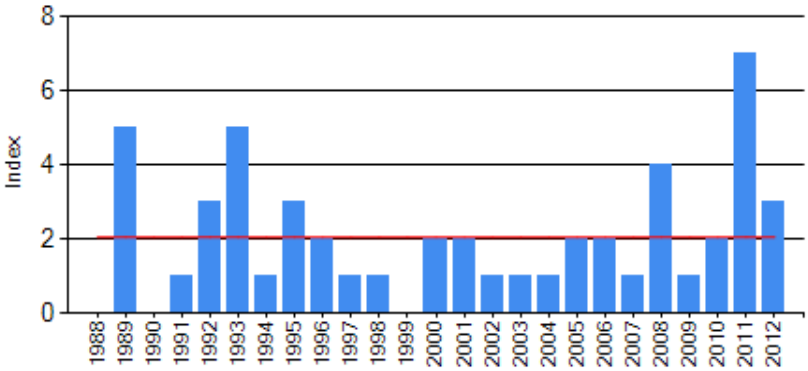

Figure 4. Historical Weather Index for Trangie from 1 November to 31 January on day events >20mm

In this case (Figure 4) the 25year average is 2.04 days and the standard deviation is 1.72. Where there is missing data a predefined formula is used to arrive at a measure. Since 1988 there have been 7 occasions where during the period 1 November to 31 January there has been greater than 2 days of rainfall over 20 mm. For example in 2008 Trangie had 4 days or 80 mm of rain in this period. These days do not need to be in succession.

Depending on the wheat grown downgrades can vary from between $20 to $100 a ton so it makes sense to hedge this loss. If the grower produced 1000 tons and the spot prices for APH1 was $240, then 4 days of rain greater than 20mm over harvest could cost him $40 per ton or $40,000. For between approximately $5 and $15 a ton using a Weather Certificate the grower can mitigate this risk. Further, as the conditions continue to deteriorate and the grower chooses to be paid per event the payout can increases and further compensate him as the conditions deteriorate, up to a maximum amount chosen.

Weather Certificates

Weather Certificates are simple financial derivatives, which are fast becoming important tools used throughout the world to help in mitigating the risks associated with adverse weather. They have already been used in NSW in a two-year pilot program and saved growers who participated millions of dollars annually in lost revenue. Being online, they can be tailored to meet individual needs and pricing and execution can done by the individual. Weather Certificates are different to traditional insurance products in that the event does not need to be assessed and payout is automatic after the event occurs. The arbitrator is BOM who provides

all the weather data used in building the indexes. Once a weather certificate has been issued the risk is transferred to a re-insurer.
Details of the content and types of Weather Certificates can be found at www.celsiuspro.com.au

Conclusion

Weather Certificates are being used in a variety of industries to help mitigate the risks of adverse weather. Online functionality and a greater understanding of the risks have allowed the development on use of weather certificates for all businesses and not just traditional high end users. In Agriculture the mitigation of weather risk is paramount to a successful year, anecdotal evidence suggest that weather accounts for 70% of the risk associated with growing a crop. The examples above tin the use of Weather Certificates to offset downgrade exposures have already successfully been used throughout the parts of the pilot program in the northwest region. The use of Weather Certificates in conjunction with an agronomist's analysis of the farmer's soil and moisture profiles should provide the basis of a reduction in risk not only for the farmers but traditional stakeholders in the agricultural society.

Most of the material is of a propriety basis.

Reference

Parker DH (2005). Wheat proteins and nutrition. CSIRO Publishing, Melbourne.