

WHEAT HEDGE

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The Wimmera District of the SE Australian State of Victoria is located in the heart of that State's wheat belt. Horsham is the District's major regional centre and the town services an extensive rural hinterland.

Suppose that a wheat grower has experienced an extended period of drought and that if rain doesn't fall next month, a substantial financial loss will be suffered. How might our wheat grower protect against exceptionally dry weather during the coming month?

One approach, utilising weather derivatives, could be to purchase a *Monthly Rainfall Decile 4 Put Option*. We shall assume that our wheat grower decides only to take this action when there is already a risk of a dry month, that is, the current month's Southern Oscillation Index (SOI) is substantially negative - indicative of a possible El Nino. For the purpose of the determining what might be the option's *fair value*, the example is applied only to the cases when the current month's Southern Oscillation Index (SOI) is in the lowest 10% of possible values, that is, below minus 12.9.

Firstly, let us define our weather derivative contract thus:

- Location: Horsham
- Type of asset: Rainfall (Decile)
- Strike: Decile 4
- Expiry: 1 Month
- Notional: \$100 per Decile below Decile 4

If, at the expiration of the option contract (that is, in one month), the actual Rainfall is less than the strike price (Decile 4), the seller of the option pays the buyer \$100 for each Decile that it is below Decile 4. This is illustrated in the pay-off diagram at Figure 1.

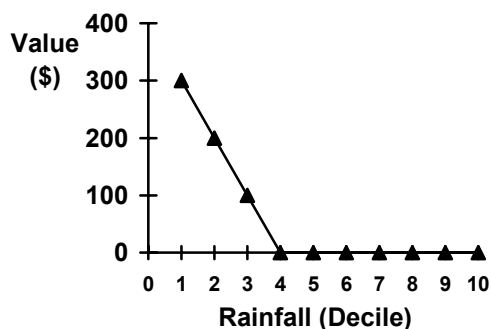


FIGURE 1 Pay-off chart for a *Monthly Rainfall Decile 4 Put Option*.

We now determine the price of our put option contract by employing historical simulation of the outcomes. We note that, since SOI records began in 1876, there were 1517 months with rainfall records at Horsham, of which 155 were preceded by months with an SOI below minus 12.9.

The frequency distribution of historical outcomes for those 155 cases is presented in the graphic at Figure 2, and illustrates the enhanced chance of dry weather associated with a strongly negative SOI (for example, a 15.5% chance of Decile 1 in contrast to an 8.4% chance of Decile 10).

From the data presented in Figure 2, it may be seen that the contributions from the historical outcomes to the price of the Decile 4 put option contract are

- 15.5% x Decile 1 = $\$(4-1) \times .155 \times 100 = \46.50
- 16.8% x Decile 2 = $\$(4-2) \times .168 \times 100 = \33.20
- 8.4% x Decile 3 = $\$(4-3) \times .090 \times 100 = \9.00
- The other cases (Decile 4 or above) contribute nothing

...leading to a total contribution of **\$88.70**
So, **\$88.70** is the price of our put option.

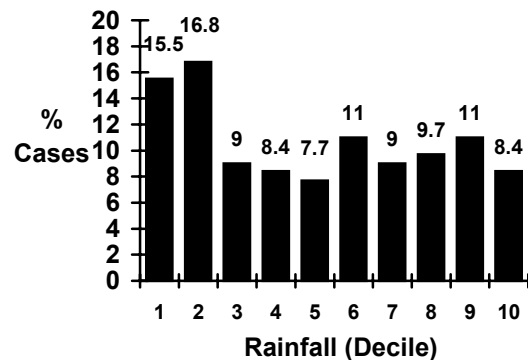


FIGURE 2 Historical Outcomes for a *Monthly Rainfall Decile 4 Put Option*.