

# Commodities Case Study

MANAGING AUSTRALIAN WHEAT PRICE RISK WITH KC HRW WHEAT OPTIONS

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## PURPOSE OF THE CASE STUDY

The objective of this case study is to examine four different pricing strategies available to a procurement manager from an Australian food manufacturer, two of which involve the use of CBOT KC (Kansas City) HRW (hard red winter) wheat Options. The aim is to find a pricing solution for the company which will maintain its competitiveness at the same time safeguarding product supply and customer relationships.

A real company was used in the study based on actual product procurement and pricing decisions, but with the company name changed to "Tortilla". The study includes the company profile, an analysis of the situation and risks involved, the four identified strategies, the strategy outcomes based on actual market conditions and a summary discussion. A number of questions at the end provide readers with practical insights on other issues around the case.

### Tortilla Company Profile

Tortilla is a multinational food pastry manufacturer based in Australia. Tortilla buys flour from a private flour mill, produces pastries from the flour, and sells the pastries to domestic fast food chains.

Due to intense competition, the fast food retailers have difficulty passing on cost increases to their end customers. Hence their supply contracts with Tortilla are on a fixed price basis for a 12-month period, negotiated before the start of each calendar year. The fast food chains also expect Tortilla to make its flour purchases at the lowest reasonably achievable prices, and that these may not always be possible at wheat harvest time in Australia.

Tortilla has a 12-month supply contract with the private flour mill, for the mill to deliver flour to Tortilla on a weekly basis. Contract negotiation between Tortilla and the mill starts in August, and has to be concluded by October every year, before the domestic wheat harvest begins.

### Risk Analysis

Tortilla has some price flexibility in its contract terms with the mill. Tortilla can elect to fix the price for the whole year's requirement in October, fix the price for half its requirements in October and fix the spot price for the other half the following June, or fix the spot price for the whole requirement the following June.

The mill itself would price its wheat purchases accordingly, to manage its own cost risks. Since the focus of the study is on Tortilla, the mill's risk management strategy is not relevant to this study.

Tortilla could manage its flour price risks by using the CBOT KC HRW futures and options market. There can be price differences (basis) between Australian domestic prices and US futures prices, as the seasons in the northern hemisphere are opposite to those in the southern hemisphere. Nevertheless, the CBOT KC HRW futures prices are closely correlated with Australian

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wheat prices. As the wheat or flour forward market in Australia is not very liquid, the CBOT KC HRW contract is the most suitable liquid instrument available.

Tortilla has a close yet delicate supply-chain relationship with its key customers (the fast food chains). The expectation is that Tortilla will anticipate any supply shortfall and will lock in its purchase prices of flour early if necessary, or delay fixing its purchase prices if it expects flour prices to fall. Customers would be concerned by any perceived attempt by Tortilla to profit opportunistically by passing rising flour costs to them whilst having internally hedged its own flour costs.

Tortilla has the opportunity to use [KC HRW Futures](#) to establish a fixed price for their customers. However, it prefers to use KC HRW Options as these give Tortilla more flexibility. By using [KC HRW Options](#), Tortilla can establish a fixed cost ceiling should wheat prices rise, and can pass on the cost benefits to its customers should wheat prices fall.

## Situation Analysis

It is now August 2012. Tortilla's management needs to decide its flour/wheat procurement strategy between October 2012 and June 2013. Major risks include supply, product, price, basis, and currency. The worst-case scenario is when suitable domestic wheat is unavailable at the time when imported flour prices are high.

Tortilla's procurement manager is aware that there might be a supply shortage of Australian east-coast milling wheat. There had been a lack of rainfall in the northern regions, and increased frequency of frost damage in the southern regions which could downgrade milling wheat to animal feed. On the other hand, the global wheat markets are expecting near record harvests in the northern hemisphere (for example, in the US).

CBOT KC HRW futures are correlated with domestic Australian wheat prices, and could feasibly be used to protect against potential rising prices of local wheat. As previously explained, Tortilla's management could have used KC HRW futures to hedge against the price movements of flour. However, they decided to use KC HRW Options instead, as Options give Tortilla the additional flexibility of fixing a price ceiling should prices rise, while enabling its customers to benefit from cost savings should prices fall.

## Note on the Measurement Units Used

Metric units are used in Australia, and Imperial units are used in the US. The differences in convention do not affect the narrative, but they have to be aligned in the calculations. We have adopted the US convention wherever it is required.

For every 700 metric tons of flour to be produced, 1,000 metric tons of wheat has to be used in Australia. In the US, flour is priced in hundred pound units (cwt) and wheat is priced in bushels. To minimize confusion with the conversion of these units, it is assumed that Tortilla needs to price the equivalent of 1 million bushels of wheat to manage the price risk of its flour purchases.

## Strategies Identified

A decision was made to procure all wheat for the 2013 delivery contract in October 2012 because of the real possibility of shortages of milling wheat after harvest. Having decided upon the physical product procurement, the private flour mill then offered three pricing alternatives to Tortilla – to price 100 percent in October 2012, to price 50 percent in October and 50 percent in June 2013, or to price 100 percent in June 2013. From these three pricing alternatives, Tortilla established four possible strategies.

## STRATEGY 1

**OCTOBER 2012:** Price 1 million bushels of wheat at the spot market price.

**OBJECTIVE:** To lock in price, and fix the cost for its customers.

## STRATEGY 2

**OCTOBER 2012:** Price 1 million bushels of wheat at the spot market price, and buy out-of-the-money July 2013 KC HRW wheat put options.

**OBJECTIVE:** To establish a maximum (ceiling) cost of flour, and be able to pass on the lower price to the customer if prices fall.

## STRATEGY 3

**OCTOBER 2012:** Price 0.5 million bushels of wheat.

**JUNE 2013:** Price 0.5 million bushels of wheat.

**OBJECTIVE:** To provide an average price to the customer over the nine month period. This strategy has basis and currency risk on 0.5 million bushels of wheat.

## STRATEGY 4

**OCTOBER 2012:** Buy out-of-the-money July 2013 KC HRW wheat calls.

**JUNE 2013:** Price 1 million bushels of wheat.

**OBJECTIVE:** To establish a maximum (ceiling) purchase price, and benefit from any downside in price movement. This strategy has basis and currency risk on 1 million bushels of wheat.

## KC HRW Options Premiums in August 2012

In August 2012, the spot month (September 2012) KC HRW wheat futures price was \$9.06, whilst the July 2013 KC HRW wheat futures price was \$8.70. Table 1 lists the options premiums for the July 2013 KC HRW puts and calls for the various strike prices, in USD per bushel as at August 2012. There were no market quotes for Puts above \$9.00 strike price, nor for Calls below \$7.00 strike price at that time.

**TABLE 1. KC HRW WHEAT JULY 2013 PUTS AND CALLS IN US DOLLARS PER BUSHEL AS AT AUGUST 2012**

Strike prices	Put premium	Call premium
10.50	–	0.31
10.00	–	0.42
9.50	–	0.57
9.00	0.93	0.76
8.50	0.67	0.99
8.00	0.45	1.27
7.50	0.28	1.60
7.00	0.16	1.98
6.50	0.08	–
6.00	0.04	–

Data source: Bloomberg, August 2012; Actual values

**TABLE 2. AUSTRALIAN PORT SPOT PRICE (AU) AND US CBOT KC HRW SPOT MONTH FUTURES PRICE OF MILLING-HARD WHEAT JUNE 2012 TO JULY 2013**

Month	AU Price (AUD per MT)	AU Price (in USD per bushel)	KC HRW Futures Price (USD per bushel)	Spot Basis (USD per bushel)
<b>2012</b>				
June	244	6.75	7.56	- 0.81
July	295	8.40	8.93	- 0.53
August	305	8.59	9.06	- 0.47
September	320	8.97	9.28	- 0.31
October	322	9.06	9.04	+ 0.02
November	294	8.33	9.13	- 0.80
December	291	8.18	8.31	- 0.13
<b>2013</b>				
January	293	8.29	8.38	- 0.09
February	292	8.11	7.53	+ 0.58
March	281	7.92	7.27	+ 0.65
April	279	7.84	7.90	- 0.06
May	298	7.76	7.51	+ 0.25
June	308	7.63	6.91	+ 0.72
July	281	6.87	7.07	- 0.20

Data source: ASX & Premium Data

### Analysis of Market Conditions

The commencement of the US new wheat crop year is 1st June. In contrast, the start of the new wheat crop year in Australia is 1st October. Table 2 details the spot monthly milling wheat east-coast Australian port prices and the CBOT KC HRW futures prices from June 2012 to July 2013.

Fears of lower global wheat production caused prices of both Australian spot wheat and KC HRW spot month futures to rise significantly after 1st June 2012. Australian spot prices rose by US\$2.31 per bushel until October 2012, while KC HRW spot month futures prices rose by US\$1.72 per bushel until September 2012 (Table 2). During this period, Australia was suffering from some

frost and dry weather, while the US incurred some drought and heat waves. The Basis (AU spot price minus KC HRW spot futures) remained weak during the period.

As harvesting in Australia neared towards the end of 2012, the weather improved. Fears of a global wheat shortage subsided and futures prices declined faster than spot local prices. Even as both AU spot prices and KC HRW spot month futures prices trended down, the Basis strengthened from +US\$0.02 in October 2012 to +US\$0.72 by June 2013.

### Outcome of Using KC HRW Options

In the above strategies, Tortilla would have bought July 2013 options in August 2012, when the July 2013 futures traded at \$8.70. When the options were exercised in June 2013, the futures were at \$6.91.

**TABLE 3: KC HRW OPTIONS VALUES IN JUNE 2013**

KC HRW Values	August 2012	June 2013	Difference
Jul 2013 Futures	\$8.70	\$6.91	-\$1.79
Put – Strike \$8.50	\$0.67	\$1.59	+\$0.92
Call – Strike \$9.00	\$0.76	\$0	-\$0.76
6.00	0.04	–	

Data source: Bloomberg June 2013

### Procurement Strategy Outcomes

The actual outcomes of the four strategies are indicated as follows.

#### STRATEGY 1

Priced the 1 million bushels of AU wheat in October 2012 at US \$9.06 per bushel

**WHEAT COST = US \$9,060,000**

#### STRATEGY 2

Priced the 1 million bushels of AU wheat in October 2012 at US \$9.06 per bushel

**WHEAT COST = US \$9,060,000**

Bought July 2013 KC HRW wheat puts in August 2012 at a strike price of US \$8.50 per bushel for US \$0.67. KC HRW wheat puts were exercised in June 2013 when futures price was at US \$6.91.

*Profit from buy put options*

$$\begin{aligned} &= \text{Intrinsic value } (8.50 - 6.91) - \text{premium } (0.67) \\ &= \text{US } \$0.92 \text{ per bushel} \times 1 \text{ million bushels} \\ &= \text{US } \$920,000 \end{aligned}$$

<b>WHEAT COST</b>	<b>= US \$9,060,000 - \$920,000</b>
	<b>= US \$8,140,000</b>

### STRATEGY 3

Priced 0.5 million bushels of wheat in October 2012 at US \$9.06 per bushel

<b>WHEAT COST (i)</b>	<b>= US \$4,530,000</b>
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*Priced 0.5 million bushels of wheat in June 2013 at US \$7.63 per bushel*

<b>WHEAT COST (ii)</b>	<b>= US \$3,815,000</b>
<b>TOTAL WHEAT COST</b>	<b>= US \$8,345,000</b>

### STRATEGY 4

Bought July 2013 KC HRW wheat calls in August 2012 at a strike price of US \$9.00 per bushel for US \$0.76 per bushel

*Loss from buy call options*

$$= \text{Premium (no intrinsic value)} = \text{US } \$760,000$$

Priced 1 million bushels of wheat in June 2013 at US \$7.63 per bushel = US \$7,630,000

<b>WHEAT COST</b>	<b>= US \$7,630,000 + \$760,000</b>
	<b>= US \$8,390,000</b>

### Scenario Analysis – What If Prices Had Risen

Before the results are discussed, consideration is now given to rising Australian and KC HRW futures prices in June 2013. A scenario where both the AU spot and KC HRW prices rose to US \$12 in June 2013 is now considered.

#### STRATEGY 1

Priced the 1 million bushels of wheat in October 2012 at US \$9.06 per bushel

<b>WHEAT COST</b>	<b>= US \$9,060,000</b>
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#### STRATEGY 2

Priced the 1 million bushels of wheat in October 2012 at US \$9.06 per bushel

<b>WHEAT COST</b>	<b>= US \$9,060,000</b>
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July 2013 KC HRW wheat puts expired worthless in June 2013 when the futures price was US \$12 per bushel.

*Loss from buying put options = US \$670,000*

<b>WHEAT COST</b>	<b>= US \$9,060,000 + \$670,000</b>
	<b>= US \$9,730,000</b>

#### STRATEGY 3

Priced 0.5 million bushels of wheat in October 2012 at US \$9.06 per bushel

<b>WHEAT COST (i)</b>	<b>= US \$4,530,000</b>
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Priced 0.5 million bushels of wheat in June 2013 at US \$12 per bushel

<b>WHEAT COST (ii)</b>	<b>= US \$6,000,000</b>
<b>TOTAL WHEAT COST</b>	<b>= US \$10,530,000</b>

## STRATEGY 4

Bought July 2013 KC HRW wheat calls in August 2012 at a strike price of US \$9.00 per bushel for US \$0.76 per bushel

*Profit from buy call options*

$$\begin{aligned} &= \text{Intrinsic value } (12.00 - 9.00) - \text{premium } (0.76) \\ &= \text{US } \$2.24 \text{ per bushel} \times 1 \text{ million bushels} \\ &= \text{US } \$2,240,000 \end{aligned}$$

Priced 1 million bushels of wheat in June 2013 at US \$12 per bushel = US \$12,000,000

$$\begin{aligned} \text{WHEAT COST} &= \text{US } \$12,000,000 - \$2,240,000 \\ &= \text{US } \$9,760,000 \end{aligned}$$

### Strategy Discussion

The first scenario with falling prices was what factually happened in the Australian and CBOT wheat markets. \$670,000 was paid for the Put options under Strategy 2, while \$760,000 was paid for the Call options under Strategy 4.

The pricing outcomes of the four strategies are depicted in Table 4, which compared the results of falling prices against rising prices.

**TABLE 4. STRATEGY PRICING OUTCOMES WITH DIFFERENT PRICE TREND SCENARIOS**

KC HRW Values	August 2012	June 2013
1 – buy spot early	9.06 (4th)	9.06 (1st)
2 – long put	8.14 (1st)	9.73 (2nd)
3 – buy spot stagger	8.35 (2nd)	10.53 (4th)
4 – long call	8.39 (3rd)	9.76 (3rd)
6.00	0.04	–

*Outcomes quoted in US\$ million (or cents per bushel)*

Strategies 1 and 3 either managed price risk by locking in a price early, or attempted to manage price risk through risk spreading, but without the protection and flexibility of using KC HRW options.

Strategy 1 overcame Tortilla's pricing concerns by locking in price for the whole year. However, Tortilla's competitiveness could have been threatened by competitors buying more cheaply, and by not having any price flexibility after pricing the product. Strategy 3 is similar to Strategy 1, but in this case Tortilla would have partially mitigated price risks by accepting the average price over this pricing period.

Even though Strategy 1 had the best outcome under a rising price scenario, it had the worst outcome under a falling price scenario. Conversely, Strategy 3 had the worst outcome under the rising price scenario. This illustrated the potential risk Tortilla would have taken without the use of KC HRW Options for risk management.

Strategies 2 and 4 had greater elements of risk management with the use of derivatives. Strategy 2 achieved the best overall result for Tortilla – lowest cost when prices fell, and second lowest when prices rose. The strategy had no basis risk.

In contrast, Strategy 4 which used KC HRW Call options ranked third under both price trend scenarios, and had added risks of basis and currency. The KC HRW prices had changed more than the local AU spot prices over the period. The basis risk reflected the fact that, while KC HRW was an appropriate risk management tool for AU spot wheat, it carries basis risk and is not perfect.

The overall difficulty for Tortilla was to determine its pricing strategy when the decision had to be made 10 months in advance. Ranking the potential outcomes of alternate pricing strategies under different price movement scenarios thereby assisted management decision making.

## Conclusion

The case highlights the importance of testing potential outcomes for strategies and ranking them, especially when using puts and calls. When transaction costs and basis movements are taken into account, the actual results could differ from an idealized market situation.

For more information on the products and incentive schemes available, please contact Nelson Low ([Nelson.Low@cme.com](mailto:Nelson.Low@cme.com)) or Tina Liao ([Tina.Liao@cme.com](mailto:Tina.Liao@cme.com)). John Williams can be reached at [comm.trade@bigpond.com](mailto:comm.trade@bigpond.com).

## Contracts at a Glance

### CBOT KC Hard Red Winter Wheat Futures

Contract Code	KE (Globex); KW (ClearPort)
Contract Unit	5,000 bushels of deliverable
Minimum Fluctuation	1/4 cents per bushel (US\$12.50 per contract)
Settlement Type	Physical

### CBOT KC Hard Red Winter Wheat Option

Contract Code	OKE (Put code P, Call code C)
Contract Unit	One KE contract (5,000 bushels)
Underlying Contract	KC HRW Futures (KE)
Minimum Fluctuation	1/8 cent per bushel (US\$6.25 per contract)
Settlement Type	Exercises into underlying
Exercise Style	American

## QUESTIONS & ANSWERS

**1. Could Tortilla have achieved product supply security at the same time as retaining downside pricing opportunities?**

**ANSWER:** Yes – Strategy 2 secured the paramount need for product procurement, and also had the potential to benefit from price declines. It therefore provided the best of both worlds – product security and pricing flexibility. It ranked first when prices fell and ranked a close second when prices rose, suggesting that it was the overall best strategy under conditions of price uncertainty.

**2. Strategy 1 provided the best outcome when prices rose, it secured product when future supply could be uncertain, and it is the most transparent to all supply chain partners when negotiating price in supply chain agreements with final product customers. Given the positive product attributes in Strategy 1, was the addition of buy put options in Strategy 2 justifiable?**

**ANSWER:** Strategy 2 should be perceived as the risk management tool for maintaining competitiveness against rivals. Strategy 2 required both the diligence to budget for outlays and commitment to manage price. There is a cost in risk management, which in this case was the cost of the put option premiums. This premium was lost when prices rose, but provided rewards when prices fell, which in this case amounted to procurement cost savings of \$920,000.

**3. What would have been the result from Tortilla's Strategy 4 if it had used Futures instead of Options?**

**ANSWER:** Assuming that a long futures hedge had been established in August 2012, when the July 2013 futures price was \$8.70, and closed out in June 2013 at \$6.91, then a futures margin loss of \$1.79 would have been made. Tortilla would have priced the AU wheat in June 2013 at \$7.63 plus the futures loss of \$1.79, realizing a price of \$9.42 per bushel.

If the futures price had risen to \$12, then the futures hedge profit would have been \$3.30, which when subtracted from the physical purchase price of AU wheat (which we had also assumed was at \$12) would have resulted in a realized price of \$8.70 per bushel.

Hedging AU spot price with KC HRW Futures was an imperfect hedge and there would be potential basis risk. In the rising price scenario, we had assumed that both KC HRW and AU spot were at \$12 so the basis was zero. This resulted in a realized price of \$8.70. In the original scenario, the basis strengthened against Tortilla's strategy 4, and widened to \$0.72. The realized price was hence higher by that amount ( $\$9.42 = \$8.70 + \$0.72$ ).

**4. Would the options premiums in Strategies 2 and 4 be considered unacceptably high?**

**ANSWER:** The strategy rankings against different price trends provide the answer. Using options generally achieved better rankings. Choosing a strike price further out of the money would have lowered premium costs. However, there was still the opportunity cost of foregoing the initial price movement until the strike price was reached.

There is a risk-reward tradeoff when using options. At-the-money options would be more likely to provide more profit compared to an out-of-the-money strike price, but at a higher premium.

**5. Tortilla received cash inflow when prices fell in Strategy 2 and when prices rose in Strategy 4. Is Tortilla obligated to pass on such cash flow to its customers?**

**ANSWER:** It depends on Tortilla's relationship with its customers, and any clauses that might exist in the supply chain contractual agreement. If there were no such clauses in the contract specifically on cash flows arising from pricing, then there would be no legal obligation to disclose any such cash flow.

**6. What other major risks would Tortilla face, besides the price and basis risks discussed?**

**ANSWER:** Major risks include actual supply and delivery, product quality, price, basis, and currency.

Currency risk is a multi-dimensional problem. Domestic purchase prices that depend on international benchmarking will have downside currency risk for a buyer. USA wheat prices might be falling, however a falling AUD/USD could cause local wheat- flour prices to rise. As well, all imported ingredients will also have downside currency risk. Alternatively, a higher priced domestic finished product can be undercut by cheaper imports because of higher exchange rates. Whilst some import-export companies internalize currency risk effectively, the timing of import and export operations may not always align, thus increasing the importance of currency risk management either through currency risk transfer or price risk management.

**7. Given the risks of product securement, price, basis, currency risk, customer good-will, and supply chain relationships, what strategy would you have selected during August-September 2012 without the benefit of hindsight?**

**ANSWER:** The client matches the strategy to the firm's own unique risk profile. This is very much dependent on the various factors discussed above, as well as the market environment at that point in time. Based on the given set of circumstances, it might have been advantageous to have adopted Strategy 2 as opposed to the other strategies.

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