More Reasons Why Farmers Have So Little Interest in Futures Markets

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Abstract

The use by farmers of futures contracts and other hedging instruments has been observed to be low in many situations, and this has sometimes seemed to be considered surprising or even mysterious. We propose that it is, in fact, readily understandable and consistent with rational decision making. Standard models of the decision about optimal hedging show that it is negatively related to basis risk, to quantity risk, and to transaction costs. Farmers who have less uncertainty about prices have a lower optimal level of hedging. If a farmer has optimistic price expectations relative to the futures market, the incentive to hedge can be greatly reduced. And finally, farmers who have low levels of risk aversion have little to gain from hedging in terms of risk reduction, in that the certainty equivalent payoff at their optimal hedge may be little different to the certainty equivalent under zero hedging. These reasons are additional to the argument of Simmons (2002) who showed that, if capital markets are efficient, farmers can manage their risk exposure through adjusting their leverage, obviating the need for hedging instruments.

Key words: hedging, risk, risk aversion, flat payoff functions

1. Introduction

Simmons (2002) asked the question "Why do farmers have so little interest in futures markets?" He was responding to the common observation that the use by farmers of futures contracts (and other hedging instruments) is less than might be expected based on a reading of the economics literature that deals with optimal hedging. The literature indicates that hedging with futures or forward contracts will benefit agricultural producers by offsetting their price risk (e.g., Johnson, 1960; McKinnon, 1967; Peck, 1975; Danthine, 1978; Holthausen, 1979; Feder et al., 1980; Anderson and Danthine, 1983; Robison and Barry, 1987; Lapan and Moschini, 1994; Lubulwa et al., 1996). While the actual use of price hedging instruments varies between agricultural industries and between counties, there are many cases where relatively few producers use them. (e.g., Berck, 1981; Patrick et al., 1993; Brorsen, 1995; Collins, 1997; Hardaker et al., 1997; Simmons and Rambaldi, 1997; Carter, 1999).

Simmons (2002) showed that if capital markets are efficient, in the sense that there are negligible differences between interest rates for lending and borrowing, then farmers can achieve their optimal risk exposure entirely by adjusting leverage, so that the optimal hedging ratio is zero. Perhaps this helps to explain the low use of hedging to some extent, although the usual existence of differences between borrowing and lending interest rates reduces the power of the explanation.

In this paper we argue that, even without Simmon's explanation, there are several other factors that contribute to low use of hedging instruments by many farmers. One potential factor is bias in subjective price expectations, to which little attention has been paid in the literature. A common assumption is that each farmer's expectations about spot prices correspond exactly to the relevant futures price ("unbiased" price expectations), allowing analyses to focus on hedging, rather than speculation. Nevertheless, Hardaker et al. (1997) noted that low usage of futures by farmers may be due in part to an expectation that the cash (or spot) price will be above the futures price when the product is sold. Conversely, if expectations about cash prices are below the futures price, then farmers have an increased incentive to use futures. Shi and Irwin (2005), building on the models of Lence and Hayes (1994a, 1994b) and Foster and Whiteman (2002), explored the consequences of relatively optimistic and pessimistic expectations about spot price. They showed that there are both speculative and hedging components to the optimal use of price risk instruments. In a sensitivity analysis they showed that, if farmers have high confidence in their beliefs about prices (a low variance of the subjective price distribution), the speculative component can be larger in magnitude than the hedging component.

Other factors that have been recognized as potential contributors to low hedging ratios include production uncertainty (Lapan and Moschini, 1994), basis risk (Pennings and Meulenberg, 1997) and transaction costs associated with purchasing and selling futures contracts (Bond and Thompson, 1985).

Finally, there is the question of how much benefit the farmer is able to obtain through price risk management. Based on the literature on the adoption of innovations, both in agriculture (e.g. Pannell et al., 2006; Feder and Umali, 1993) and more generally (Rogers, 2003), we understand that, in order to adopt a new practice, farmers need to expect that it will deliver a "relative advantage" to them that is sufficient to outweigh the costs of learning about and implementing the practice. It is thus important to consider the magnitude of the expected gain from hedging under various circumstances.

The purpose of this paper is to evaluate the relative importance of the above factors as potential contributors to low adoption of price hedging instruments among some groups of farmers. This requires a numerical analysis, which is done for a case study of wool production from sheep in Australia. The results obtained do not yield general conclusions, but provide hypotheses that can be tested in other case studies.

In section 2 we present a standard model of hedging that incorporates all of the above factors. Section 3 describes the numerical case study. Section 4 presents and discusses results, and section 5 is a summary of conclusions.

2. The model

We theoretically derive the optimal hedge ratio using a mean-variance framework. Symbols are listed in Table 1.

Table 1: Summary of model parameters. All prices apart from f_0 relate to time 1.

Parameters	Description
$\bar{p}$	Expected cash price
σ_p	Standard deviation of cash price
$\bar{f}_1$	Expected futures price at time 1
σ_f	Standard deviation of subjective distribution of futures price
f_0	Current futures price (at time 0)
$\bar{q}$	Expected output
σ_q	Standard deviation of subjective distribution of output
h	Quantity hedged
ρ_{fp}	Correlation coefficient between cash price and futures price at time 1
ρ_{pq}	Correlation coefficient between cash price and output
ρ_{fq}	Correlation coefficient between futures price at time 1 and output
τ	Transaction costs
C_v	Variable input costs
C_f	Fixed costs
λ	Parameter of absolute risk aversion

There are two trading dates in the model. At time 0, the farmer purchases inputs (x) to produce output q that will be harvested at time 1 according to the production function $q = f(x, \upsilon)$, where υ is a variable outside the control of the farmer. The farmer can sell the output in the cash market upon harvest at time 1 for a price p. In addition, the farmer can trade on the futures markets. If a farmer took a long position in the cash market by producing a commodity for future sale, and a short position in the futures market, any losses (or gains) resulting from changes in the spot price would be approximately offset by gains (or losses) in the future market . By this means, hedging can reduce the level of price risk faced.

Let h be the quantity of output hedged at time 0, which will be settled by an offsetting position at time 1. Let f_0 be the price of futures at time 0 (when the futures contract is purchased) and f_1 be the price at which the futures contract can be settled at time 1. The farmer knows f_0 with certainty, but f_1 is correlated (imperfectly) with the uncertain cash price of the product, and so is uncertain.

When the farmer decides on h at time 0, the farmer has a joint subjective probability distribution for three stochastic variables at period 1, the uncertain prices ($\tilde{p}$, $\tilde{f}_1$) and yield ($\tilde{q}$). Let $\bar{p}$, $\bar{f}_1$ and $\bar{q}$ represent the expected prices and yield and let Ω_{ij} be the variance-covariance of ($\tilde{p}$, $\tilde{f}_1$, $\tilde{q}$). ρ's are correlation coefficients and σ's are standard deviations. Then,

$$\Omega = \begin{bmatrix} \Omega_{pp} & \Omega_{pf} & \Omega_{pq} \\ \Omega_{fp} & \Omega_{ff} & \Omega_{fq} \\ \Omega_{qp} & \Omega_{qf} & \Omega_{qq} \end{bmatrix} = \begin{bmatrix} \sigma_p^2 & \rho_{pf}\sigma_p\sigma_f & \rho_{pq}\sigma_p\sigma_q \\ \rho_{fp}\sigma_f\sigma_p & \sigma_f^2 & \rho_{fq}\sigma_f\sigma_q \\ \rho_{qp}\sigma_q\sigma_p & \rho_{qf}\sigma_q\sigma_f & \sigma_q^2 \end{bmatrix} \quad (1)$$

The farmer's profit at period 1 is thus a random variable defined as:

$$\pi = \tilde{q} * \tilde{p} + h * (f_0 - \tilde{f}_1) - C_v(\tilde{q}) - C_f - h\tau \quad (2)$$

where $C_v(\tilde{q})$ is the total variable cost function, C_f are fixed costs, and τ are the transaction costs of using the futures market. Simmons (2002) has estimated that transaction costs for Australian farmers are approximately 2 per cent of the value of contracts. Bond and Thompson (1985) showed that risk attitude will affect the extent of hedging if transaction costs are nonlinearly related to the level of hedging, but for simplicity we assume a linear relationship.

Our optimal hedging model takes into account uncertainty surrounding cash price, production output, variable cost of production, and the basis (i.e. the difference between the spot price and the nearby futures price, $p - f_1$). That is, the risk facing producers is assumed to arise from price risk on the spot market with $p \sim N(\bar{p}, \Omega_{pp})$, basis risk because f and p are not perfectly correlated, so $f_1 \sim N(\bar{f}_1, \Omega_{ff})$, and production risk with $q \sim N(\bar{q}, \Omega_{qq})$, which also results in uncertainty about variable costs, with $C_v(q) \sim N(C_v(\bar{q}), C_v^{'}(\bar{q})\Omega_{qq})$, where $C_v(\bar{q})$ is total variable cost at the expected yield, and $C_v^{'}(\bar{q})$ is marginal cost.

Assuming that the producer maximizes expected utility, the objective function is:

$$\begin{aligned} CE = {} & \bar{q} * \bar{p} - h * \bar{f}_1 + h * f_0 - C_v(\bar{q}) - C_f - h\tau - (\lambda/2)\{\bar{q}^2\sigma_p^2 + (\bar{p}^2 \\ & + C_v^{'}(\bar{q})^2 - 2\bar{p}C_v^{'}(\bar{q}))\sigma_q^2 + 2\bar{q}(\bar{p} - C_v^{'}(\bar{q}))\rho_{pq}\sigma_p\sigma_q \\ & + h^2\sigma_f^2 - 2h\bar{q}\rho_{pf}\sigma_p\sigma_f + 2h(C_v^{'}(\bar{q}) - \bar{p})\rho_{fq}\sigma_f\sigma_q\} \end{aligned} \quad (3)$$

where λ is the Arrow-Pratt coefficient of absolute risk aversion (ARA). For a given level of expected output, the optimal hedge is

$$h^* = \frac{\left(f_0 - \bar{f}_1 - \tau\right)}{\lambda\sigma_f^2} + \frac{(\bar{p} - C_v'(\bar{q}))\rho_{qf}\sigma_q}{\sigma_f} + \frac{\bar{q}\rho_{pf}\sigma_p}{\sigma_f} \quad (4)$$

or, expressed as a proportion of expected output (the "hedging ratio"), it is

$$\frac{h^*}{\bar{q}} = \frac{\left(f_0 - \bar{f}_1 - \tau\right)}{\bar{q}\lambda\sigma_f^2} + \frac{(\bar{p} - C_v'(\bar{q}))\rho_{qf}\sigma_q}{\bar{q}\sigma_f} + \frac{\rho_{pf}\sigma_p}{\sigma_f} \quad (5)$$

Equation (5) is similar to the function provided by Carter (1999), apart from the addition of transaction costs and risky variable costs in the current study.

The third term in Equations (4) and (5) is the main hedging component. The lower the correlation between cash price and settlement price (i.e. the greater the basis risk), the lower is the optimal hedge.

The second term represents the effect of production risk on the optimal hedge. If production is negatively correlated with price, the two risks counteract each other to some extent, and this reduces the optimal hedging ratio. This effect only operates if the marginal cost of inputs is not equal to the expected output price. In other words, the effect of output risk will be small unless the producer is operating at some distance from the optimal input level.

The first term is the speculative component. For a non-producer (q = 0), who can only participate in the market as a speculator, Equation (4) collapses to the first term, $h^* = \frac{\left(f_0 - \bar{f}_1 - \tau\right)}{\lambda\sigma_f^2}$. Positive speculation is encouraged if the settlement price is expected to be less than the current futures price (in other words, if the farmer believes that the current futures price is optimistic), and is discouraged by transaction costs. Note that risk aversion moderates the speculative component, but does not affect the hedging components, given the assumptions of this model. If the current futures price is an unbiased estimate of the settlement price and transaction costs are absent, there is no speculative component.

The effects of changing key parameters are summarized through the following comparative static results:

Expected cash price (assuming $p = f_1$):

$$\frac{\partial h}{\partial \bar{p}} = -\frac{1}{\lambda\sigma_f^2} + \frac{\rho_{qf}\sigma_q}{\sigma_f} \quad (6)$$

which, assuming that quantity and price are negatively correlated, is negative.

Transaction cost: $$\frac{\partial h}{\partial \tau} = -\frac{1}{\lambda\sigma_f^2} < 0 \quad (7)$$

Expected output: $$\frac{\partial h}{\partial \bar{q}} = \frac{\rho_{pf}\sigma_p}{\sigma_f} \geq 0 \quad (8)$$

Basis risk: $$\frac{\partial h}{\partial \rho_{pf}} = \frac{\bar{q}\sigma_p}{\sigma_f} \geq 0 \quad (9)$$

That is, as basis risk falls (i.e., as ρ_{pf} rises), the optimal hedge rises.

Variable costs: $$\frac{\partial h}{\partial C_v'(\bar{q})} = -\frac{\rho_{qf}\sigma_q}{\sigma_f} \quad (10)$$

3. Numerical example

A numerical case study is presented for Australian wool producers, who as a group make little use of hedging instruments. The purpose is to illustrate the quantitative importance of different influences on the optimal hedge. Parameter values (Table 2) are based on a study conducted in the late 1990s (Coad, 2000), which drew on many data sources, including a bio-economic farming model of the region, MIDAS (Kingwell and Pannell, 1987) and studies of risk attitudes (Bardsley and Harris, 1987; Abadi Ghadim and Pannell, 2003). Consistent with the model presented above, Hinchy and Fischer (1988) concluded that wool prices approximate a normal distribution.

Coad (2000) elicited the subjective price expectations of a sample of wool producers. Figure 1 illustrates distributions for two farmers, showing that different farmers hold different subjective expectations about future market prices. This is further highlighted in Figure 2, which shows the frequency distribution of mean price expectations for a sample of 50 wool producers. There are remarkably large differences between producers in their price expectations. Clearly, many of these producers do not believe that the futures price provides a reliable predictor of cash prices in the future. These results were used to establish relevant parameter values in Table 2.

Table 2. Assumed parameter values in numerical case study.

Parameters	Units	Base case	Alternative value(s) for sensitivity analysis
$\bar{p}$	c kg^{-1}	500	
σ_p	c kg^{-1}	30	50
$\bar{f}_1$	c kg^{-1}	500	
σ_f	c kg^{-1}	30	50
f_0	c kg^{-1}	500	475
$\bar{q}$	kg	32000	
σ_q	kg	1000	0
h	kg	Endogenous	
ρ_{fp}	-	0.9	1.0
ρ_{pq}	-	-0.1	0
ρ_{fq}	-	-0.1	0
τ	c kg^{-1}	10	0
C_v	$	$0.1881q + 7.51859\text{E-}05q^2$	$0.1881q + 5.95609\text{E-}05q^2$
$C_v'(\bar{q})$	c kg^{-1}	500	400
C_f	$	10000	
λ	-	1.0E-06	4.0E-06

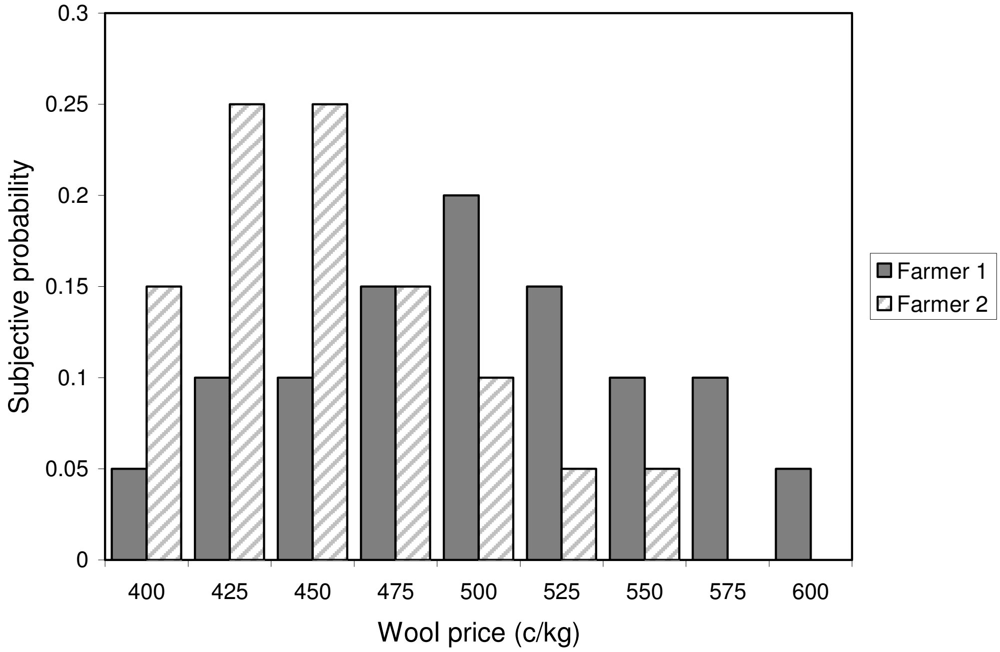

Figure 1. Subjective probability distributions of wool price for two surveyed farmers. Expected prices are A$5.00 for Farmer 1 and A$4.54 for Farmer 2.

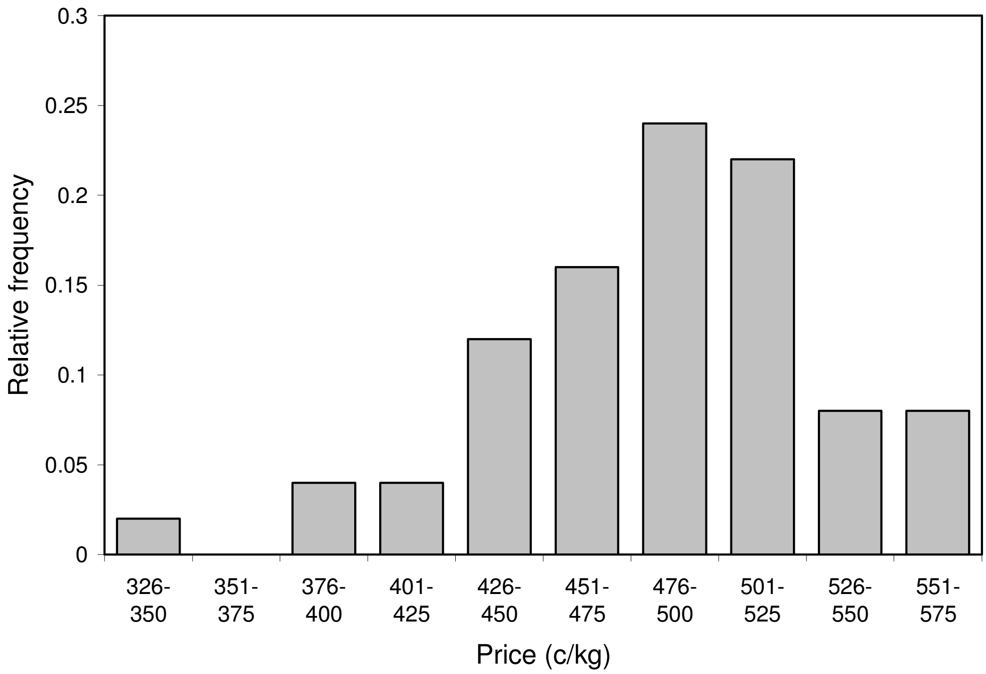

Figure 2. Distribution of expected wool prices for a sample of wool producers in Western Australia (n = 50).

Calculations for the results that follow are available at http://cyllene.uwa.edu.au/~dpannell/archive/hedging.xls

4. Results and discussion

Tables 3 and 4 show results for optimal hedging ratio for a selection of parameter combinations. Table 3 illustrates the sensitivity of the optimal hedge to changes in risk aversion, price risk, transaction costs and the current futures price[1]. Other parameters are at the base-case levels shown in Table 2.

Each of these parameters makes a substantial difference to the optimal hedging ratio. Lower price risk reduces hedging through reducing its risk-related benefits. Notably, there is a strong interaction between price expectations and risk aversion. This is highlighted further in Figure 3. At the risk aversion level judged to be typical for this group of producers (1.0E-06), the optimal hedging ratio is very sensitive indeed to differences in price expectations. A change in price expectations of 5 per cent is sufficient to change the optimal hedging ratio by almost 90 percentage points (e.g. from 90 per cent to 3 per cent in one of the cases illustrated). On the other hand, for producers who are highly risk averse (ARA = 4.0E-06), the sensitivity of hedging to price expectations is much reduced (though still important) – a 5 percent change in price expectations changes the optimal hedging ratio by around 20 percentage points. For farmers who are optimistic about spot prices, lower risk aversion reduces the optimal use of futures through enhancing the speculative component of the decision.

Table 3. Optimal hedging ratio for various parameter combinations (other parameters at base-case values)

λ	$\sigma_f = \sigma_p$	τ	f_0	h^* ratio
0.000001	30	10	500	0.55
0.000001	30	10	475	-0.32
0.000001	30	0	500	0.90
0.000001	30	0	475	0.032
0.000001	50	10	500	0.78
0.000001	50	10	475	0.46
0.000001	50	0	500	0.90
0.000001	50	0	475	0.59
0.000004	30	10	500	0.81
0.000004	30	10	475	0.60
0.000004	30	0	500	0.90
0.000004	30	0	475	0.68
0.000004	50	10	500	0.87
0.000004	50	10	475	0.79
0.000004	50	0	500	0.90
0.000004	50	0	475	0.82

[1] Changing the current futures price while leaving expected market price and expected settlement price constant is equivalent to a test of the impact of changing expected prices.

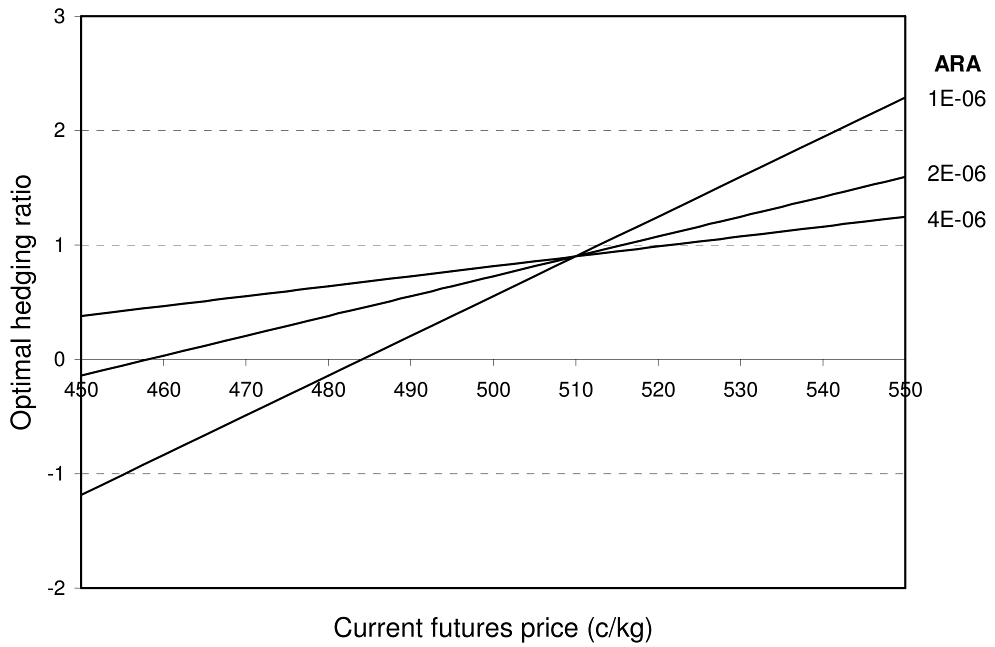

Figure 3. Optimal hedging ratio when current futures price differs from the expected settlement price (500 c/kg), for different levels of absolute risk aversion (ARA).

From Equation (5), if transaction costs are zero, basis risk is zero, price expectations are unbiased and other parameters take the base case values from Table 2, the optimal hedging ratio is 100 per cent, irrespective of the degree of risk aversion. Introducing basis risk (ρ_{fp} = 0.9) and transation costs (τ= 10 c kg^{-1}) moves the point where the optimal hedging ratios are insensitive to risk aversion to 90 per cent hedging, at a price expectation of 510 c kg^{-1}, as shown in Figure 3.

Table 4 illustrates the sensitivity of the optimal hedge to changes in marginal input cost, the correlation between quantity and prices, the variance of quantity produced, and the correlation between the cash price and the settlement futures price (negatively related to basis risk). Again, other parameters are at the base-case levels shown in Table 2. Of these parameters, only basis risk makes a noticeable difference to the optimal hedge. The others only affect hedging at all when production is risky *and* correlated with prices, *and* the marginal cost is not equal to the expected sale price (i.e. when the producer is not operating close to the optimal level of production output), and even then, the effect is small.

To assess the overall sensitivity of optimal hedging to each of the varied parameters, a complete factorial experiment was conducted using all combinations of parameter levels shown in Table 2. Then for each parameter, we calculated a sensitivity index, equal to the absolute value of the change in h^* averaged across all combinations of the other parameter levels. In Table 5 the parameters are ranked according to their sensitivity index value. Reinforcing the results in Tables 3 and 4, the parameters with the greatest impact on optimal hedging are price expectations, risk aversion, price risk and transaction costs.

It is noteworthy that price expectations are highly ranked in Table 5, particularly in view of their relative neglect in many studies. Often it is assumed that producers' price expectations coincide with the futures price. Figure 2 illustrates that this assumption is likely to be incorrect for many, if not most, farmers, and the results above show that the assumption can alter hedging results greatly, especially for farmers who have low to moderate levels of risk aversion.

Table 4. Optimal hedging ratio for various parameter combinations (other parameters at base case values)

$C_v'(q)$	$\rho_{fq} = \rho_{pq}$	σ_q	ρ_{fp}	h^* ratio
500	-0.1	1000	0.9	0.55
500	-0.1	1000	1	0.65
500	-0.1	0	0.9	0.55
500	-0.1	0	1	0.65
500	0	1000	0.9	0.55
500	0	1000	1	0.65
500	0	0	0.9	0.55
500	0	0	1	0.65
400	-0.1	1000	0.9	0.54
400	-0.1	1000	1	0.64
400	-0.1	0	0.9	0.55
400	-0.1	0	1	0.65
400	0	1000	0.9	0.55
400	0	1000	1	0.65
400	0	0	0.9	0.55
400	0	0	1	0.65

The sensitivity of results to price expectations reveals that the speculative component of decisions about futures contracts is comparable in importance to the hedging component, and potentially more important for farmers of low to moderate risk aversion. Combined with the influence of transaction costs, this provides a strong potential explanation for low use of futures by some farmers. If they perceive that current futures prices are pessimistic (i.e. likely to be lower than the settlement price will be), they have a motivation to reduce the level of hedging selected. Indeed, for the model with all base-case parameter values apart from a pessimistic futures price (second line of Table 3), the optimal hedging ratio is negative, indicating that it would be optimal for the producer to take a long position in the futures market – buying rather than selling contracts.

Table 5. Ranking of model parameters according to sensitivity index

Parameter	Sensitivity index
f_0	0.37
λ	0.31
$\sigma_f = \sigma_p$	0.24
τ	0.15
ρ_{fp}	0.10
$C_v'(q)$	0.002
$\rho_{fq} = \rho_{pq}$	0.002
σ_q	0.002

Another potential explanation proposed earlier is that the benefits of hedging are not large enough to motivate farmers to participate. This may be especially relevant to farmers who are not already experienced in the operations of the futures market, given the learning costs that they would need to bear in order to participate. Table 6 shows the percentage gain in welfare (measured as certainty equivalent) as a result of switching from zero hedging to the optimal level of hedging. Results are shown for combinations of the four parameters to which hedging is most sensitive (Table 5).

Table 6. Percentage gain in welfare (certainty equivalent) from hedging optimally relative to zero hedging

λ	$\sigma_f = \sigma_p$	τ	f_0	CE increase from hedging (%)
0.000001	30	10	500	2.3
0.000001	30	10	475	0.7
0.000001	30	0	500	6.0
0.000001	30	0	475	0.0
0.000001	50	10	500	14.2
0.000001	50	10	475	5.1
0.000001	50	0	500	19.1
0.000001	50	0	475	8.2
0.000004	30	10	500	25.1
0.000004	30	10	475	13.5
0.000004	30	0	500	30.7
0.000004	30	0	475	17.7
0.000004	50	10	500	245
0.000004	50	10	475	203
0.000004	50	0	500	263
0.000004	50	0	475	219

For the highly risk-averse farmer, if price uncertainty is high, the percentage gains from hedging can be very high (over 200 per cent increase in CE in this example). On the other hand, if the farmer has only a moderate degree of risk aversion, and moderate price uncertainty, the gains from hedging can be very small indeed. Results suggest that less risk-averse farmers may have little to gain by hedging, and so little motivation to bear the associated learning costs.

The explanation is that the payoff function (certainty equivalent) is flat (cf Pannell 2006). Figure 4 shows certainty equivalent as a function of hedging ratio for the base-case assumptions for standard and high levels of risk aversion (corresponding to the first and ninth lines of results in Table 6). Clearly, there is little to be gained from hedging by farmers who correspond to the base case. The certainty equivalent at the optimal hedge (56 per cent) is only very slightly higher than for zero hedging. For the case of high risk aversion, the gain from hedging is more pronounced: a 25 per cent increase at 81 per cent hedging compared to zero hedging. Given that the majority of farmers are not highly risk averse, perhaps the observed low usage of hedging instruments simply reflects a realistic assessment that there is too little to be gained. Anxiety over the pressures resulting from participation in the futures market (Buschena and Zilberman, 1994) or subjective uncertainty about the operation of the market may outweigh the potential gains illustrated in Figure 4 and Table 6, particularly if the farmers lack experience with the market.

5. Conclusions

We believe that the limited use of futures and other price hedging instruments by farmers in many situations is no mystery. Standard models from the literature reveal a range of factors that are likely to contribute to this outcome.

The first group of factors consists of variables within the model. For example, it is well known that basis risk, transaction costs, and uncertainty about production cause the optimal hedging ratio to fall. In our case study we found that the impacts of basis risk and transaction costs on hedging are moderate, while uncertainty about production has only a minor influence. Lower price uncertainty also reduces the optimal hedge and may contribute to low use of futures by some farmers.

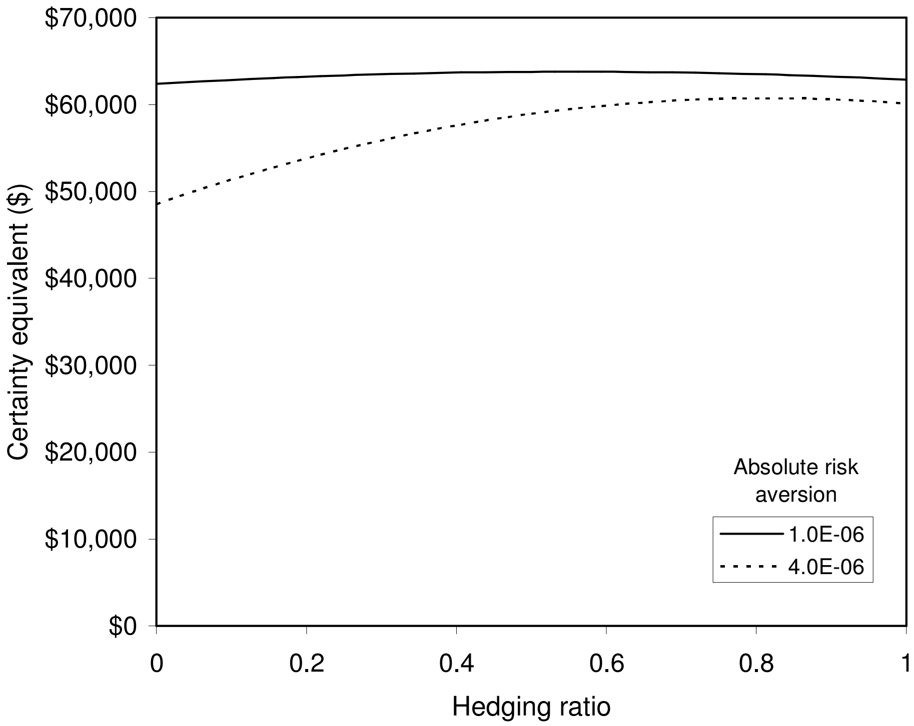

Figure 4. For farmers who have low to moderate risk aversion (ARA = 1.0E-06) and unbiased price expectations, certainty equivalent is unresponsive to the level of hedging selected. (Other parameters at base case levels – Table 2).

A different contributing cause of low hedging was proposed by Simmons (2002): the ability of farmers to manage their risk exposure by adjusting leverage. He concluded that with a fully efficient capital market, adjustment of leverage can fully supplant the use of hedging instruments. There may also be other risk management strategies that farmers prefer to use in place of hedging, such as diversification.

Thirdly, the use of hedging instruments has impacts beyond the reduction of price risk, which is the main focus of economic research in the area. If a farmer's expectations about cash price deviate from the futures price on offer, purchase of a futures contract will alter the farmer's expected profit, and this may have an influence on the optimal hedging ratio. While this has been recognized by a small number of authors, its influence on optimal hedging decisions has perhaps been under-recognised. Particularly for farmers who are not highly risk-averse, "biased" price expectations can have a major impact on the optimal hedge. If a farmer has optimistic price expectations relative to the futures market, the incentive to hedge can be greatly reduced. We cited empirical evidence illustrating the wide diversity of price expectation among one relatively homogeneous population of farmers.

Fourthly, and perhaps most importantly, unless a farmer is highly risk-averse, the gain in utility from the use of futures contracts is likely to be small, perhaps very small. If the farmer has to bear learning costs due to inexperience with the futures market, or is uncomfortable or anxious about hedging, the benefits of hedging may well be insufficient to justify the effort.

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