Design, Pricing, and Returns of Short-Term Hog Marketing Window Contracts

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INTRODUCTION

The North American hog industry has seen a period of rapid structural change in both production and marketing practices. Among the changes has been the advent of a variety of new risk-management alternatives including various over-the-counter (OTC) instruments. Window contracts are a new and increasingly used OTC price risk tool in the hog industry. These instruments provide a mechanism that partially protects producers from decreasing market prices but provides greater flexibility in gaining from upward market moves than do forward contracts (Lawrence, 1995). Window contracts are offered in both Canada and the United States. Window contracts offered in Canada are short-term contracts, generally the length of the production process, and are priced off

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of current futures and options markets. United States window contracts are often longer term, being three-to-ten years in length. The pricing mechanism and the choice of price window are arbitrary in existing window contracts.

A window contract establishes a price floor and ceiling for the duration of the contract. The producer accepts all price risk for market prices within the window. Conceptually, the producer removes price risk below the window floor in exchange for giving up price gains above the window ceiling. Conversely, the provider of the contract, often a processor or marketing organization, foregoes the possibility of purchasing hogs below the floor price in exchange for removing purchase prices above the window ceiling. A sharing agreement, that splits gains or losses proportionately between the producer and provider of the contract when prices are outside of the window, is common.

Research on the design, pricing, and performance of window contracts in managing agricultural price risk is almost nonexistent. Window contracts on the market at this time appear to be incorrectly priced and use ad hoc methods for determining the price window. To address this research void, four issues are addressed in this article. First, window contracts are defined and explained. From the viewpoint of the producer, a window contract represents a European option portfolio that is long puts and short calls. Second, a method for valuing short-term window contracts is presented. This research focuses specifically on short-term marketing contracts written for the length of the production process, but the principles are applicable across a range of contract types. Because the empirical section evaluates the risk from a Canadian perspective, Canada–United States currency adjustments are included in the valuation model. Domestic U.S. users of short-term window contracts would need similar, albeit simpler, valuation models. Third, two methods for picking the size and location of the window are evaluated. Break-even price projections and futures price confidence interval forecasts are used to establish the window floor. The choice of reasonable floor and ceiling prices is difficult, and this research illustrates some fundamental problems with short-term window contracts. Fourth, a profit series for a western Canadian hog operation is simulated using historical data and different price risk management strategies. Risk management effectiveness of short-term window contracts is compared to cash, hedging, and forward contracting strategies. In conclusion, this article presents an overall assessment of short-term window contracts.

BACKGROUND ON EMPIRICAL HOG RISK RESEARCH

Previous research has assessed the effectiveness of different marketing instruments and techniques in reducing hog-marketing risk. Using hedging-simulation techniques for the period of January 1976 through April 1984, Brandt (1985) found that a selective hedging strategy reduced price risk and increased prices received by producers compared to cash marketing, though improvements over the mean and standard error of cash marketing were small. Routine hedging increased risk and lowered mean returns compared with cash marketing. Holt, Brandt, and Hurt (1985) simulated a farrow-to-finish hog operation from February 1977 through January 1983 to explore selective hedges. A dynamic selective hedging program significantly reduced price risk and enhanced the price received by the producer compared with routine hedging. More recent research by Gore and Leuthold (1993), using data from 1981 to 1991, reinforced the result that some selective-hedging strategies increased mean returns and decreased variance of returns compared to cash marketing. Again, the improvements in mean and variance were relatively small. Put options were also examined, and this strategy lowered mean returns and variances compared to futures hedging and cash marketing. Kenyon and Clay (1987), for the period 1975 to 1980, researched the usefulness of cross hedging the major hogfeed inputs, corn and soybeans, and hedging with live hog futures contracts. The authors found that hedging hogs only when specific expected profit margins occurred significantly increased average returns and reduced the variance of returns compared to cash marketing. Similarly, selected hedging strategies on hogs and corn increased average returns and reduced the returns variance. These studies often ignored other risk measures such as frequency and magnitude of losses. No published research exists that discusses window contract issues or examines the effectiveness of window contracting on reducing price risk to pork producers.

CONCEPTUAL DESCRIPTION OF WINDOW CONTRACTS

An understanding of window contract concepts is crucial for the subsequent discussion on valuation and risk management effectiveness. Window contracts provide a minimum floor price and a maximum ceiling price to the producer. Price risk between the floor price and the ceiling price is accepted by the producer. Similar to forward contracts, the cost to enter into window contracts is assumed, and designed, to be zero (Hull,

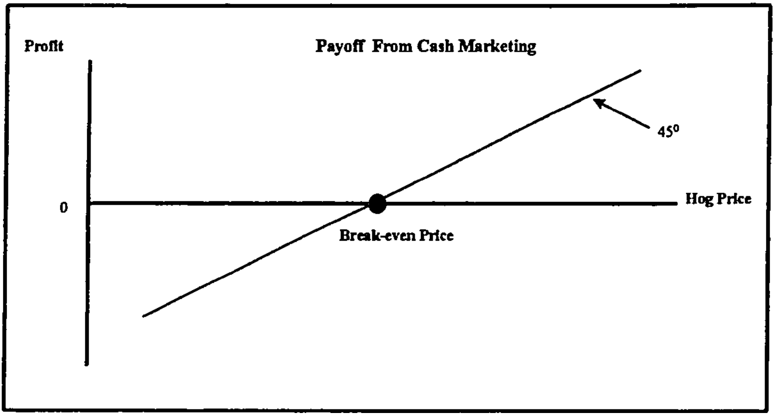

FIGURE 1
Payoff from cash marketing

1993). This is an important assumption to make at this stage in the research on window contracts. The usefulness of the assumption will be discussed later in this article. Payoff diagrams explain key features of window contracts from the viewpoint of the producer. Hogs are used as an example here, but the discussion applies to other commodities.

A pork producer starts with a cash position in the hog market (Figure 1). If the market price is above the break-even price, the producer has a profit. If the market price is below the break-even price, there is a loss.

A window contract, from the producer perspective, is a combination of a long put and a short call. The long put strike price provides the floor price. The short call strike price provides a ceiling price. Figure 2 shows the terminal payoffs on a long put and a short call when option premiums are included. The window contract is designed to have zero value at the beginning of the contract by selecting a call strike price, and therefore the premium received, that equals the put premium paid. Further, to have a valid price window, the put strike price must be less than the call strike. Because exercise of the window contract is not available prior to delivery, the options are European.

Figure 3 vertically adds the payoffs for the two option positions to show the payoffs to the window contract only. The window contract has zero terminal value if the market price at contract expiration is between the two strike prices. The producer makes money on the contract if prices are below the put strike price and loses money if the price is above the call strike price. The dashed lines show payoffs when the producer and

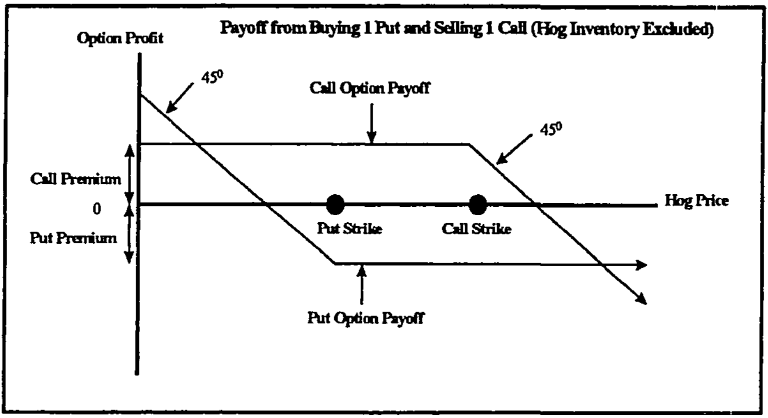

FIGURE 2
Payoff from buying one put and selling one call.

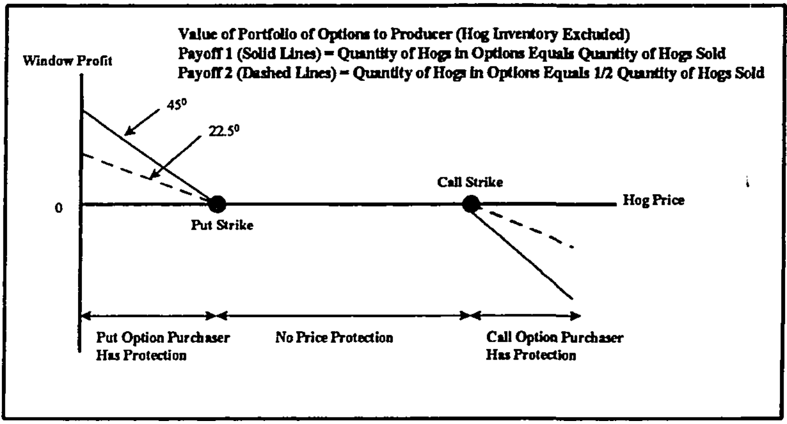

FIGURE 3
Combined payoff from put and call options

the contract provider agree to a 50/50 split of profits or losses outside the window boundaries. Potential profits or losses are less sensitive to final hog prices with this risk sharing. The 50/50 risk sharing is one alternative risk-sharing agreement between the producer and the contract provider that can be explained with these diagrams. Risk sharing does not change the valuation models presented in the next section.

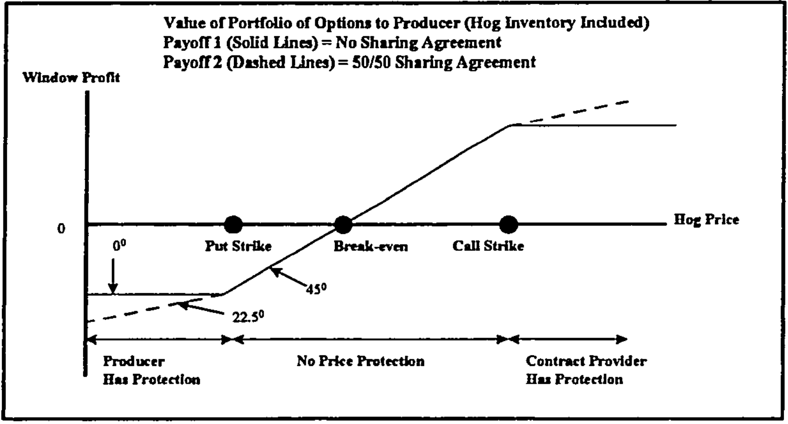

FIGURE 4
Payoff to producer taking a window contract (zero basis risk).

Figure 4, the combined cash and window contract payoff for the producer is constructed by vertically combining Figures 1 and 3. There is no price protection between the put strike and the call strike, in the price window, as demonstrated by the 45° payoff line between the two strike prices. Outside the price window there is limited downside price risk and limited upside price potential. The producer gains downside price protection by giving up upside price moves. The dashed lines represent 50/50 risk sharing between the producer and the contract provider.

Figure 4 demonstrates the conceptual risk management properties of window contracts when combined with a cash position in hogs. Clearly, a window contract with a very narrow price range between the floor and the ceiling takes on risk properties very similar to a hedge position established using futures. A window contract with a very wide price range between the floor and the ceiling takes on risk properties very similar to a straight cash position. However, the payoff illustrated in Figure 4 is only relevant when the break-even price is between the put and call strike prices. The choice of pricing window becomes problematic when the break-even production price is above the relevant futures price. This issue is explored below. Further, basis risk is not included in these payoff figures. The contract provider is assumed to accept basis risk in the window contract to ensure the supply of hogs. It may be that producers are willing to pay the contract provider to assume the basis risk or that the contract provider is willing to pay producers to secure a supply of hogs. This is a relevant but separate issue in need of future research. A valuation model for window contracts is presented next.

WINDOW CONTRACT PRICING MODEL

Window contracts are composed of European puts and calls. This implies that window contracts can be valued using standard options-pricing models. Currency considerations are included in the model used here, because the empirical example evaluates windows for Canadian hog producers. The relevant hog futures market for Canadian hog producers and processors is the Chicago Mercantile Exchange (CME) live hog contract which is located in the United States. The relevant public currency market for Canada–United States exchange rates is the International Monetary Market (IMM), also located in the U.S. Physical location of the relevant futures markets is a key consideration for any contract provider offering window contracts, if the contract provider is planning to hedge their window contract price risk. Hence the need to price the window contract using cross-currency option models when the markets are located in a foreign country.

A window contract is identical to the producer purchasing a put option from the contract provider and the contract provider purchasing a call option of equal value from the producer. These are European options, so a closed-form analytic solution is available. A modified version of the European cross-currency option pricing model by Wei (1997) is used. Wei's model adjusts the Black (1976) model to account for the cross-currency options implicit in a Canadian window based on United States futures prices. The model, modified to account for the IMM valuation of Canadian dollars in U.S. currency, takes the form:

$$Call_i = e^{-r_i(T_i - t_i)}\left[\frac{HF_t}{X_t}N(d1) - \frac{K_i}{X_{i,0}}N(d2)\right] \qquad (1)$$

and

$$Put_i = e^{-r_i(T_i - t_i)}\left[\frac{K_i}{X_{i,0}}N(-d2) - \frac{HF_t}{X_t}N(-d1)\right] \qquad (2)$$

where:

$$d1 = \frac{\ln\left[\dfrac{\left(\dfrac{HF_t}{X_t}\right)}{\left(\dfrac{K_i}{X_{i,0}}\right)}\right] + \sigma_{i,HF,X}{}^2(T_i - t_i)/2}{\sigma_{i,HF,X}\sqrt{T_i - t_i}} \qquad (3)$$

and

$$d2 = d1 - \sigma_{i,HF,X}\sqrt{T_i - t_i}$$

and where:

$Call_i$ = call option for period i
Put_i = put option price for period i
$N(d(x))$ = normal cumulative distribution function
HF_t = current hog futures market price on day t in U.S. dollars
K_i = strike price of option in U.S. dollars (fixed over term of option)
X_t = current exchange rate in U.S. dollars to buy 1 Canadian dollar (IMM definition)
$X_{t,0}$ = delivery exchange rate in U.S. dollars to buy 1 Canadian dollar (prespecified and fixed over term of option)
$T_i - t_i$ = time to expiration of option (T = date of expiration, t = date of calculation)
$\sigma_{i,HF,X} = \sqrt{\sigma^2_{i,HF} + \sigma^2_{i,X} - 2\rho_i\sigma_{i,HF}\sigma_{i,X}}$ = standard deviation of returns on Canadianized futures price
$\sigma^2_{i,HF}$ = CME hog futures variance of returns calculated in this study using 58-day historical estimate from market close to close
$\sigma^2_{i,X}$ = currency exchange rate variance of returns calculated in this study using 58-day historical estimate from market close to close data
ρ_i = correlation coefficient between futures and spot exchange rate for period I using 58-day historical returns
r_i = risk-free interest rate (relevant Canadian T-Bill rate for this study)

The difference between these formulas and the standard Black (1976) model is the inclusion of currency conversions and the volatility measure that incorporates the variance of returns on the foreign future commodity price, the variance on the currency and the correlation between the commodity futures and the currency. The strike prices are also converted to Canadian dollars at the time the option is opened, and the strike price remains fixed for the remainder of the option period. The correlation coefficient is subtracted (versus added) when the domestic currency is priced in the foreign currency.

The window valuation model uses the option formulas in the following manner. A floor price, which is a put option strike price, is chosen. Put option premiums can be calculated using the put model. This requires the standard inputs on volatility, domestic interest rates, current commodity futures prices, exchange rates, and time to maturity of the option (Hull, 1993). Equating the put option premium to the call option premium, the condition for the window to have zero value when initiated, allows one to numerically calculate the ceiling price, which is the call strike price. Thus, the window has zero value and a price window between the put strike and the call strike. In this particular model, the strike prices are in Canadian dollars to account for the cross-currency nature of the futures markets available to Canadian hog producers or processors. This type of valuation model avoids the ad hoc valuation approach practiced at the present time and represents a reasonable model for ensuring that both parties enter into a contract that has zero initial value. A critical issue remaining to be addressed is the determination of the price window.

ESTABLISHING THE PRICE WINDOW

The major issue with short-term and long-term window contracts is where to establish the floor and ceiling prices. Selection of the price window for existing industry contracts has often been arbitrary, with floor and ceiling prices chosen symmetrically around some predetermined cash price or around the futures price. This industry practice does not guarantee that the contract has zero value when opened. The modified Black pricing model proposed above requires that either the floor price or the ceiling price must be specified before the window contract can be valued. The location of the price window determines the risk characteristics of the contract. Selection of the price window is not a trivial issue.

Two methods for determining the price window are proposed in this study. The first method uses a projected break-even price to determine the price floor of the window contract. The second method uses estimates of a confidence interval on the expected futures price at window contract expiry. The lower bound on the confidence interval is used to determine the price floor.

A break-even price is a natural selection for a price floor in the window contract. The producer or the contract provider calculate the expected break-even price for the hogs to be protected, using a window contract. An arbitrary adjustment to the break-even, for example subtracting C$0.05/kg. from the break-even price, could also be incorporated. In this case, the producer or contract provider is choosing a maximum acceptable loss. This choice determines the put strike price. Determination of the call strike value follows. Numerically, it is easily demonstrated that the futures price is not halfway in between the put strike and the call strike with this price window. This provides justification for avoiding zero initial value window contracts, where the difference between the floor price and the futures price is arbitrarily set equal to the difference between the futures price and the ceiling price.

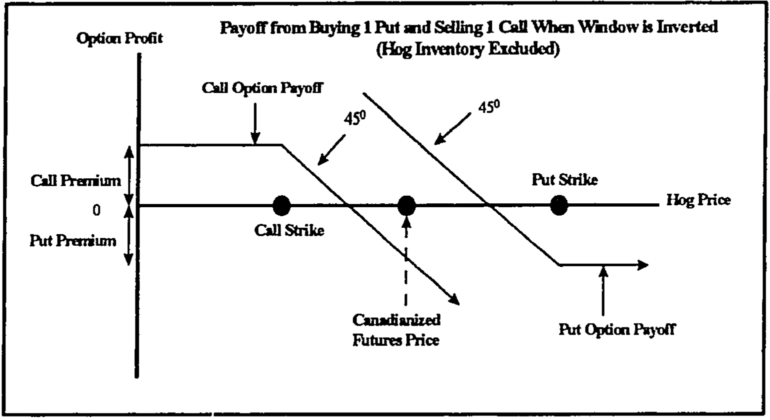

FIGURE 5
Payoff when put and call options are in-the-money (inverted window)

One serious problem arises when determining price windows using break-even analysis. Periodically, the window is inverted. That is, the call strike price is lower than the put strike price. This situation arises when the current futures price is below the adjusted break-even price. When this occurs, the necessary put option is in the money. Window valuation method selects a call option that is also in the money. Thus an inverted window is created. Subsequent empirical work indicates this occurs often. This result is not surprising considering the conclusions of Koontz, Hudson, and Hughes (1992) that distant futures contracts traded at approximately average cost of feeding levels—in other words, around break-even levels.

Figure 5 illustrates the options involved in the inverted window, when the put strike is greater than the call strike price. Figure 6 provides one example of the potential payoff when the inverted window payoffs are combined with the cash position. Losses are guaranteed. Inverted windows do not provide any protection that could not be achieved directly by using futures and hedging a loss. Alternative methods for choosing a price window are required.

Addressing the problem of what to do when the window is inverted leads the decision maker through a number of alternatives similar to choices made in selective-hedging programs. Should the producer consider locking in a loss through hedging or purchase of a put option, and what is the acceptable loss? Previous research suggests the producer may want to begin production but will wait to establish price protection. Fa-

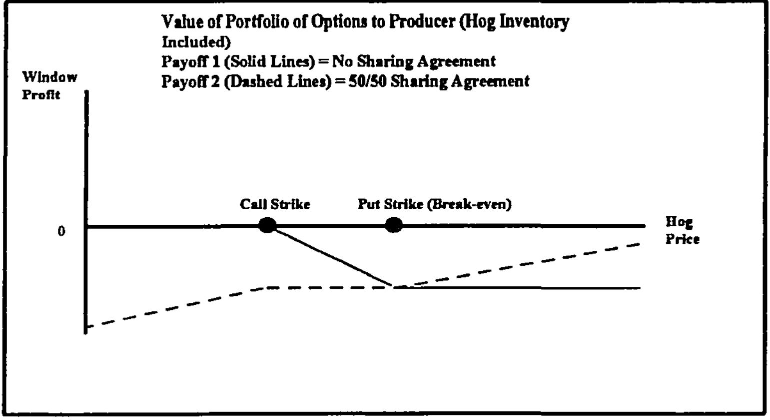

FIGURE 6
Payoff to producer taking inverted window contract.

vorable hedges, and thus window contracts, are often available over the production period. But not always. The number of possible alternatives is rather large. Instead of pursuing this path, and as an alternative, window contracts are specified based on the stochastic properties of the underlying futures price. A confidence interval around the futures price is used to establish the floor price. We perceive this approach as being more useful. First, the approach is as simple and natural as tying the window to a break-even price. The floor is tied to various low price realizations of the underlying price distribution. Second, this approach may be more useful for a marketing organization and processors, because a noninverted price window will always exist using this method. Marketing organizations write and merchandise contracts to producers, and are likely trying to achieve a continuous flow of contract business.

The information needed to calculate confidence intervals for the underlying futures price is available from the option-pricing model. Under the assumption that prices are lognormal, assumptions required in the Wei (1997) and Black (1976) models, confidence bounds on the expected futures price at market time can be calculated. The lower bound on the confidence interval is used to set the window floor price. Determination of the ceiling price is then numerically derived. The confidence interval establishes the lower price bound but the final price window is not a confidence interval.

Assuming that futures prices are lognormally distributed and follow the stochastic process discussed in Hull (1993, pp. 207–240) (i.e., zero drift), the lower bound of a (100 − α) confidence interval to establish a window floor price for time t + j where j = T − t is calculated as follows:

$$Floorp_i = \frac{HF_{t,t+j}}{X_{t,t+j}} e^{\left(\frac{\sigma^2_{i,X}}{2} - \frac{\sigma^2_{i,HF}}{2}\right)\tau - Z\sigma_{t,HF,X}(T_t - t_t)} \tag{4}$$

where:

$Floorp_i$ = non-localized window floor price in Canadian dollars
$\sigma_{i,X}$, $\sigma_{i,HF}$ and $\sigma_{i,HF,X}$ as defined previously
$T_i - t_i$ = time to expiration of contract in years
$Z = \alpha/2$ critical value from standard normal distribution

Using the confidence interval based on the current futures price to determine the floor price ensures that the put strike price is always less than the call strike price. Both the put option and the call option are guaranteed to be out of the money options. A further appeal of the approach is that it provides additional information on one of the difficulties of writing short-term window contracts, that being the position of window floor and ceiling. Using a probabilistic approach to select the price floor is appealing, but the price floor depends on the current futures price level, volatility measures, and time to expiration. Changes in the floor imply changes in the underlying put option premium, changes in the ceiling price, and a variable window width. Varying the window width will affect the risk characteristics of the contract, whether or not the contract is an appealing alternative to currently available risk management tools, and whether or not firms writing such contracts will continue the practice. These risk characteristics associated with window contracts developed using a confidence interval approach are next discussed with the empirical simulation presented.

EMPIRICAL EVALUATION OF WINDOW CONTRACTS FOR CANADIAN PORK PRODUCERS

Properties of window contracts are evaluated using a simulated farrow to finish hog operation in western Canada. The simulation uses historical data from 1981 through 1995. Key inputs into the simulation are weekly western Canadian barley prices, canola meal prices, soybean meal prices, and other input costs required to simulate a farrow to finish enterprise. Break-even prices are calculated using variable input prices on the day of farrowing and the breakeven also includes fixed and overhead costs. The operation is assumed to sell market hogs each week for a total of 758 pens simulated from 1981 to 1995. The time from farrowing to market is 175 days. Simulation profits are reported as Canadian dollars per head. The key properties evaluated are the variation in the price window, frequency that window contracts are opened, and selected risk-management measures. Windows using three variations on break-even floor prices and three variations on confidence-interval floor prices are examined. Inputs used to value these window contracts include CME live hogs futures contracts maturing after the window contract expiry, International Money Market Canada–U.S. exchange rate futures contracts maturing after the window contract maturity, and historical estimates of volatilities and correlations as discussed above in equation (1). Cash marketing, routine hedging of hog prices, and routine forward contracting on hog prices are used as benchmark comparisons to the window contracts. (Complete details of the simulation are available from the authors.)

The break-even (BE) strategies established a floor price equal to the projected break-even price, break-even less C$0.05/lb live weight, and break-even less C$0.10/lb live weight. A first attempt to establish this window occurred at farrowing, the start of the production period. This would potentially establish a window contract with 175 days to maturity. If the window was inverted the simulated producer waited to establish a window. The market was checked each week until eight weeks prior to final cash sale to determine if a noninverted window could be established. Similarly, 25%, 50%, and 75% confidence intervals (CI) around the futures price were used to establish window floor prices. These CI contracts, due to their construction, were always opened at farrowing, with 175 days to maturity.

Variations in the size of the price window, and the frequency with which the simulated producer takes a price window are presented in Table I. Maximum BE window widths varied from C$.30/lb to C$0.55/lb for BE less $0.0 and BE less C$0.10/lb respectively. Maximum CI window widths varied from C$0.12/lb to C$0.35/lb for 25% and 75% CI windows respectively. Minimum window widths were C$0.05/lb, with the 75% CI and C$0.00 for all BE window strategies. Clearly, the window price interval can be very large at times and very narrow at other times. Figure 7 presents the price window established using a 50% confidence interval for the time period 1990 to 1995. Window widths vary widely over time, as the floor and ceiling price change (illustrated in Figure 8). Thus price protection changes through time with these windows contracts. Even the BE windows have very large changes in the window width. This is in

TABLE I

Maximum and Minimum Window Widths and Number of Window Contracts Opened

Strategy	*Maximum Window Width (C$/lb live weight)*	*Minimum Window Width (C$/lb live weight)*	*% of Total Pens Window Contracts Opened*[a]
BE-0.0 window	0.30	0.00	59(41)
BE-.05 window	0.43	0.00	82(68)
BE-.10 window	0.55	0.00	95(90)
25% CI window	0.12	0.01	100
50% CI window	0.22	0.03	100
75% CI window	0.35	0.05	100

[a]Number in brackets represents the total percent of window contracts opened at farrowing.
[b]BE = non-inverted window floor established at projected break-even cost less C$0.0/lb, C$0.05/lb, or C$0.10/lb live weight. If BE non-inverted window contract cannot be opened at farrowing, it is checked again each week until eight weeks prior to sale.
[c]CI = windows opened where the floor price is determined using a 25%, 50% or 75% confidence interval. These contracts are always opened at time of farrowing. There are 758 pens (time periods) simulated from 1981 through 1995.

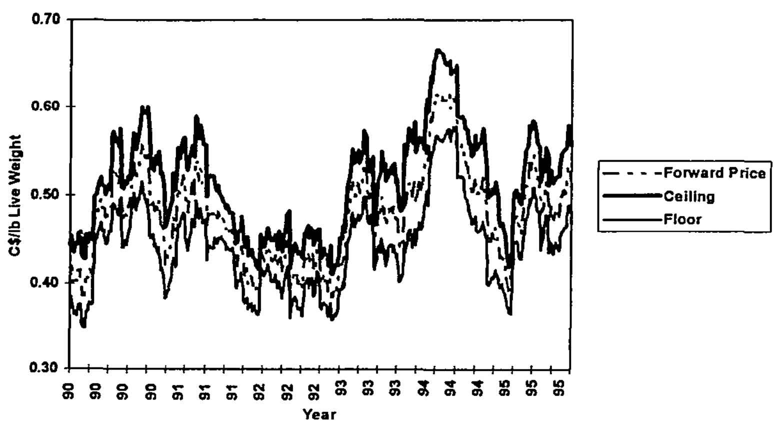

FIGURE 7
Price window established using 50% confidence interval (1990–1995)

strong contrast to long-term United States window contracts that fix the window.

However, BE window widths vary for different reasons than CI window widths. Wide BE price windows occur when pork production is very profitable. The break-even price is far below the prevailing futures price.

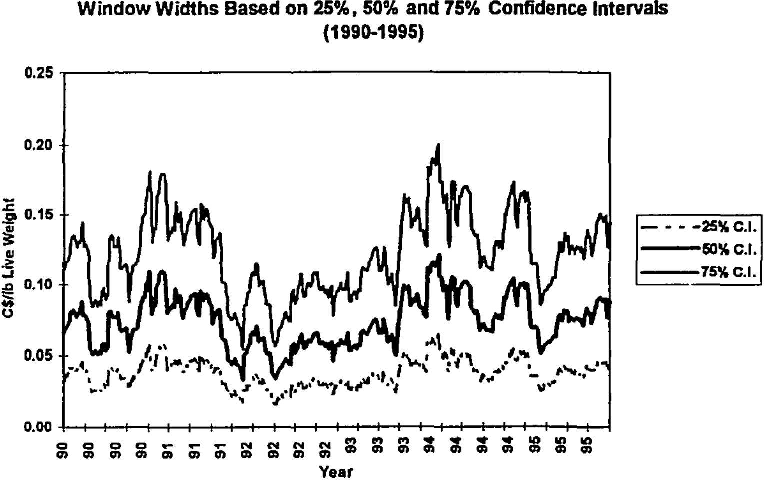

FIGURE 8
Price window widths (1990–1995).

By construction (Equation 4) CI price windows will be larger when hog prices are more volatile. This highlights another shortcoming with ad hoc window construction that fixes the floor and ceiling equally around the futures price on each contract. Numerically, it is also easy to demonstrate that changing volatilities change the value of these ad hoc contracts upon opening, and this change is to the detriment of one of the contract holders.

Break-even window contracts have one further problem. Table I shows how often the producer is without any price protection due to the occurrence of inverted windows. BE less C$0.00/lb contracts are opened only 41% of the time at farrowing. This increases to 59% when the simulated producer checks the market weekly. Even with BE less C$0.10/lb, the producer is without price protection on 5% of the production. BE windows do not prevent losses.

Selected risk measures for these window contracts were also evaluated and compared to cash marketing, hedging, and forward contracting. Before presenting these comparisons, further discussion on parts of the simulation, in particular basis, is presented. Prices for the forward contracting strategy and floor and ceiling prices for the different window contract strategies must be adjusted with a basis forecast to localize the window contract to western Canada. Prior to adjusting for basis, contracts are based on United States futures prices offered in Canadian dollars, which do not account for differences between the local Canadian price and the U.S. futures price. A 52-week historical rolling average of basis was used to adjust U.S. prices to western Canada. The basis forecasting ability of the party offering the contract and the methodology used to establish the basis level are integral in establishing forward and window contracts. If the forecast basis is too narrow, the localized prices will be too high. If the forecast basis is too wide, the localized prices will be too low.

Basis forecasting is linked to the cost of the contract. Do producers pay processors or do processors pay producers to enter into the contract? Payment takes the form of the basis adjustment relative to actual, and presumably historical, basis levels. This is an important but separate issue from the selection of window widths and a general description of contract risk characteristics. We assume a zero cost in the simulation or that the contracts make use of historical basis relationships. Mean returns from the strategies could be increased or decreased by the average cost of the contract to adjust results to address this question.

Measures used to evaluate the risk-management effectiveness of window strategies included: mean returns and standard deviation of returns, maximum loss and maximum profit, percentages of money losing pens in the simulation, percentage of pens losing more than C$20/head, and percentage of pens losing more than C$40/head. Outcomes with higher means and lower variance are the preferred outcome when using mean-variance analysis. The other measures are proxies for the downside or bankruptcy risk.

Table II presents the risk and return measures for the different strategies. Cash marketing had the highest return (C$19.72/head) and highest standard deviation (C$32.94/head) on returns. Routine hedging decreased mean returns and the standard deviation of returns but it also increased the percentage of pens losing over C$20/head. Routine forward contracting provided the lowest returns of all strategies (C$14.53/head), the lowest standard deviation, and the lowest percentage of large-loss pens of the nonwindow strategies.

The break-even window (BE) strategy reduced variance risk but did not appreciably reduce the maximum loss. The strategy reduced the percentage of the large pen losses from 7.1 with cash marketing to 5.5. Reducing the floor price below the projected break-even price by C$0.05/lb or C$0.10/lb, increased the percentage of losing pens over break-even windows, but reduced the number of pens with large losses. The percentage of large losses experienced by the producer also decreased as the

TABLE II

Risk Measures for Windows Contracts (1981–1995)

Strategy	*Mean returns C$/head*	*Standard deviation of returns C$/head*	*Maximum loss C$/head*	*Maximum profit C$/head*	*% Losing pens*	*% of pens< −$20 head*	*% of pens< −$40 head*
Cash marketing	19.72	32.94	46.98	116.86	25.7	7.1	0.9
Routine hedging	15.18	26.32	54.80	91.05	28.9	8.7	0.8
Routine forward contracting	14.53	24.80	31.56	83.81	32.5	5.0	0
BE-0.0 window	17.38	24.40	46.98	113.34	20.1	5.5	0.7
BE-.05 window	15.17	23.76	46.59	113.34	21.0	3.4	0.4
BE-.10 window	14.76	27.19	46.39	113.34	34.0	3.7	0.3
Routine 25% CI window	14.82	23.26	33.98	87.20	29.4	4.0	0
Routine 50% CI window	15.40	23.69	39.78	88.94	27.8	3.2	0
Routine 75% CI window	16.49	25.75	46.59	103.21	26.6	4.2	0.4

*Notes: BE = non-inverted window floor established at projected break-even cost less C$0.0/lb, C$0.05/lb, or C$0.10/lb live weight. If BE non-inverted window contract cannot be opened at farrowing, it is checked again each week until eight weeks prior to sale. CI = windows opened where the floor price is determined using a 25%, 50% or 75% confidence interval. These contracts are always opened at time of farrowing. There are 758 pens (time periods) simulated from 1981 through 1995.

floor is adjusted down. The BE strategies reduced mean returns compared to cash marketing.

Window contracts developed using confidence intervals provided mixed results. All window contracting strategies resulted in a lower mean and standard deviation of returns compared to cash marketing (Table I). Contracts using a 75% confidence interval to set the floor price were often rather wide, and as a result provided weaker downside profit protection. Contracts using a 25% confidence interval were often rather narrow and limited upside price potential. Contracts using a 50% confidence interval provided a balance.

The 50% confidence interval routine window strategy, when compared to cash marketing, reduced the frequency of losses over C$20/head, eliminated losses over C$40/head, and decreased the standard deviation of returns. A mean return of over C$15/head was realized with this strategy, which, while lower than the average return from cash marketing, was still profitable. Although the 50% window strategy did limit upside potential, the windows were wide enough to provide the producer with some degree of price flexibility while yielding effective downside market protection. As a result, the routine 50% CI window-contracting strategy is a viable alternative to cash marketing. One weakness of this strategy, however, is that the window floor price will not necessarily cover the projected break-even price.

No single window strategy evaluated here stood out as superior in all risk-measurement criteria: increased mean revenues, lowered standard deviation of revenues, reduced frequency of large losses, and smaller maximum losses. In several time periods, such as late 1988, early 1989, late 1994, and early 1995, feed prices increased while hog prices declined, resulting in losses not protected by price window contracts. Cash marketing shows the highest mean returns and the largest standard deviation of returns.

Window contract effectiveness in the Western Canadian hog industry provided some attractive results. Windows established using break-even prices reduced several risk measures relative to cash and hedging strategies. However, certain window contracts were used only 41% of the time at farrowing. Establishing window floors based on a 50% confidence interval also provided attractive risk relief.

CONCLUSIONS

Window contracts are a new and growing OTC price risk tool in the hog industry. These instruments provide a mechanism that protects users partly from decreasing market prices but provides greater flexibility in gaining from upward market moves than hedging or forward contracts. Their risk characteristics and issues in valuation have not been examined. Window contracts can be priced as a portfolio of long European puts and short European calls using standard option models.

Overall, window contracts reduce some market risks associated with hog production in Western Canada and are attractive risk-management instruments compared to traditional tools. Mean returns for window contracts are lower than cash market returns, but there is also about a 25% reduction in the standard deviation of the return series. Means returns for the selected window contracts are similar to returns to routine hedging (while having similar to smaller standard deviations) and are better than returns to routine forward contracting (while having similar standard deviations).

However, short-term window contracts are not without their problems. Selection of the price floor and ceiling is not a trivial issue. The relationship between futures prices and production costs are such that a short-term window contract that will guarantee no losses cannot be offered better than 59% of the time. The window becomes inverted in this case and, realistically, the producers must remain without a contract or possibly resort to other instruments such as put contracts. Basing the choice of price floor on the possible low realizations from the distribution of futures prices—the confidence interval method—is an alternative method of the designing the short-term window contract to alleviate the inverted window problem. Although the contracts have attractive risk management features, study of this specification reveals another fundamental problem with short-term window contracts. The window widths vary extensively over time, the price floor moves with changing price conditions, and the risk properties of the contract change with this variation. Thus short-term window contracts produce more volatile price protection than their long-term—several years in length—counterparts.

Short-term window contracts are another risk-management tool that allows for more pricing flexibility, but they are not a universally superior risk management alternative. Windows offer sufficient promise to justify further investigation into their design, pricing, and implementation. This would include improved pricing models, further distribution analysis, and improved estimation of parameters for valuing window contracts. Further work evaluating the use of window contracts with alternative instruments such as puts is also justified.

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