Design and Pricing of Short Term Hog Marketing Contracts

by

James Unterschultz, Frank Novak,
Donald Bresee, and Stephen Koontz

Design and Pricing of Short Term Hog Marketing Contracts

James Unterschultz, Frank Novak, Donald Bresee and Stephen Koontz[1]

Risk research has not addressed the theoretical and empirical implications of window contracts in the hog industry. Short term window contracts are modeled here as portfolios of puts and calls. A confidence interval approach and a break even approach are used to determine the price window. An empirical simulation found that the price window varied with market conditions. No one window strategy evaluated here stood out as superior in all risk measurement criteria; increased mean revenues, lowered standard deviation of revenues, reduced the frequency of large losses and reduced maximum loss.

1. 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 which partially protects producers from decreasing market prices but provides greater flexibility in gaining from upward market moves than forward contracts (Lawrence 1995). Window contracts are offered in both Canada and the United States. Window contracts offered in Canada are short term contracts priced off of current futures and options market prices. U.S. window contracts are often longer term, being three to ten years in length.

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 which splits gains or losses proportionately between the producer and provider of the contract when prices are outside of the window is often included.

Research on window contracts for managing agricultural price risk is almost non-existent. To address this research void, four issues are addressed here. These are:

[1] Authors are Assistant and Associate Professors, Dept. of Rural Economy, University of Alberta, Former Graduate Research Assistant, Dept of Rural Economy, and Assistant Professor, Michigan State University, respectively. Financial assistance from the Swine Research Endowment Trust and the Alberta Agricultural Research Institute is gratefully acknowledged.

A. Conceptually explaining window contracts.

B. Valuing window contracts.

C. Rationally picking floor prices and ceiling prices, or more specifically examining how wide should the window be and determining where to position the price window relative to current prices.

D. Empirically evaluating the risk management effectiveness of short term window contracts.

The research objectives are achieved by briefly examining previous pork industry risk research and then presenting conceptual issues in window contracts. From the producer's viewpoint, a window contract represents a specialized European option portfolio that is long puts and short calls. Armed with the conceptual tools, a method for valuing window contracts is then presented. Since, the empirical section evaluates the risk from a Canadian perspective, Canada-United States currency adjustments are included in the valuation model. Domestic United States users of short term window contracts would use similar, albeit simpler valuation models. Two methods for picking the size and location of the window, futures prices confidence interval forecasts and hog industry break-even projections are then presented. An historical simulation of a Western Canadian hog operation incorporates the valuation model discussion to measure the risk management effectiveness of short term window contracts. An overall assessment of window contracts concludes the paper.

2. Background on Empirical Hog Risk Research

Previous research has assessed the effectiveness of many 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 to cash marketing. Holt et al. (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 to routine hedging. More recent research by Gore and Leuthold (1993) from 1981 to 1991 reinforced 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 hog feed inputs, corn and soybeans and hedging with live hog futures contracts. The authors found that hedging hogs only when a particular expected profit margin 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. Little research was found discussing window contract issues or examining the effectiveness of window contracting on reducing price risk to pork producers. Attention now switches to a simple description of window contracts using typical option pricing diagrams.

3. Conceptual Description of Window Contracts

A clear understanding of window contracts is crucial in understanding 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 fully accepted by the producer. Similar to forward contracts, the cost to enter into window contracts is assumed to be zero (Hull 1993). Payoff diagrams are used here to explain key features of window contracts from the viewpoint of the producer. The commodity example presented here refers to hogs but the discussion applies equally to other commodities.

A pork producer starts with a cash position in the hog market. 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. Figure 1 demonstrates the producer payoffs in the cash market. Profits rise as market prices increase. This cash position figure will be combined with window payoff diagrams explained next.

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 window price. Figure 2 shows the terminal payoffs on a long put and a short call when option premiums are included. If the window contract is to have zero value at the beginning of the contract, the call premium received by selling the call must equal the put premium paid by the producer. Furthermore to have a relevant price window, the put strike price must be less than the call strike. Since early exercise of the window contract is not available prior to delivery, the window contract options are European.

Figure 3 vertically adds the terminal 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 window contract if prices are below the put strike price and loses money if the price is above the call strike price. The dashed lines in Figure 3 show the contract payoffs when the producer and the contract provider agree to risk share on a 50/50 basis outside the window boundaries. Potential profits or losses from the window contract are less sensitive to final hog prices with risk sharing. The 50/50 risk sharing is one example of alternative risk sharing agreements 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 3 demonstrates that the window contract is simply a combination of long puts and short calls on a market price. The number of options purchased and sold depends on the payoff scheme of the window. Assuming that the quantity of hogs in one option contract equals the quantity of hogs to be sold, a producer purchasing one put and selling one call to the contract provider agrees not to share gains or losses outside of the window. A 50/50 sharing agreement means the quantity of hogs to be sold doubles the quantity of hogs in the put option purchased and the call option sold.

Figure 4, the producer's combined terminal cash and window payoff, is constructed by vertically combining Figures 1 and 3 when the break-even price is between the put and call strike prices. There is no price protection between the put strike and the call strike, the price window, as demonstrated by the 45 degree 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 favourable upside price moves. Again the dashed lines represent 50/50 risk sharing between the producer and the contract provider outside the window range. Figure 4 demonstrates the theoretical risk management properties of window contracts when combined with a cash position in hogs.

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. A brief discussion on basis risk is included in the sections below. A valuation model for window contracts is presented next.

4. Window Contract Pricing Model

Window contracts, as demonstrated above, are composed of European puts and calls. This strongly suggests that window contracts can be valued using standard futures options pricing models. Option models on futures are the standard approach to valuing commodity options. Currency considerations are included in the model used here since the empirical example presented below evaluates windows for Canadian hog producers. The relevant hog futures market for Canadian hog producers or processors is the Chicago Mercantile Exchange live hog contract which is located in the United States. The relevant public currency market for Canada-United States exchange rates is the IMM also located in the United States. 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 since early exercise is not available. Therefore a closed form analytic solution is feasible. A modified version of Wei's (1994) European cross-currency option pricing model is used to price window contracts. Wei's model adjusts the Black (1976) model to account for the cross-currency options implicit in a Canadian window based on U.S futures prices. The Wei model, slightly modified to account for the IMM valuation of Canadian dolla[rs] in U.S. currency, takes the form:

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

and

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

where:

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

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

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 (the IMM definition)

$X_{i,0}$ = delivery exchange rate in U.S. dollars to buy 1 Canadian dollar (pre-specified and fixed over term of option)

$T_i - t_i$ = time to expiration of option (T=date of expiration, t=date of calculation)

$\sigma_{i,HF,X} = \sqrt{\sigma_{i,HF}^2 + \sigma_{i,X}^2 - 2\rho_i\sigma_{i,HF}\sigma_{i,X}}$ = standard deviation of returns on Canadianized futures price

$\sigma_{i,HF}^2$ = CME hog futures variance of returns

$\sigma_{i,X}^2$ = Currency exchange rate variance of returns

ρ_i = correlation coefficient between returns on futures market and spot exchange rate for period i.

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. Also notice that the strike prices are 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 in Wei's (1994) formula) when the domestic currency is priced in the foreign currency (i.e. IMM viewpoint).

The window valuation model uses the option formulas presented above in the following manner. Assume the floor price, which is a put option strike price, is known. 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 Canadianized to account for the cross currency nature of the futures markets available to Canadian hog producers or processors. A critical issue remaining to be addressed is the determination of the price window.

5. Establishing the Price Window

A major issue with window contracts is where to establish the window floor and ceiling prices. Either the floor price or the ceiling price must be prespecified if the window contract is to be valued. Location of the price window determines in part how much risk is shared between the producer and the contract provider. Selection of the price window is not a trivial issue and is explored in depth here.

Two methods for determining the price window are proposed in this study. The first method estimates 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. Alternatively, the second method uses a projected break-even forecast to aid in the selection of the window. Discussion begins with the confidence interval approach.

All the information needed to calculate confidence intervals is available from the option pricing model presented above. Under the assumption that prices are lognormal, assumptions required in the Wei (1994) and Black (1976) models, various 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 (put strike price). Determination of the ceiling pricing 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 with zero drift and by Hull (1993, 207-240), the lower bound of a $(100-\alpha)$ confidence interval to establish a window floor price for time t+j where j= T-t is calculated as follows:

$$Floorp_i = \frac{HF_{t,t+j}}{X_{t,t+j}} e^{\left(\frac{\sigma_{i,X}^2}{2} \frac{\sigma_{i,HF}^2}{2}\right)\tau - Z\sigma_{i,HF,X}(T_i - t_i)} \qquad \text{(Equation 4)}$$

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

$Z = \frac{\alpha}{2}$ 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. The choice of the confidence interval bound is an empirical issue addressed below. The ceiling and floor prices must be adjusted with a basis forecast to localize the window contract. This is because prior to adjusting for basis, the window represents a window contract offered in Chicago in Canadian dollars, which does not account for delivery costs. Adjusting for the basis yields a contract established around the local forecast cash price. Therefore the basis forecasting ability of the party offering the contract and the methodology used to establish the price window are integral in fairly establishing a window contract. If the forecast basis is too narrow, the localized window ceiling and floor prices will be too high. Conversely, if the forecast basis is too wide, the localized window ceiling and floor prices will be too low.

Break even analysis is an alternative method for determining the price window. 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 $5/cwt from the break even, determines the put strike price. Determination of the call strike value then follows.

One serious problem arises when determining price windows using break even analysis. Periodically the calculated 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 put option is in the money. Window valuation ensures that the call option is also in the money. Thus, an inverted window occurs and subsequent empirical work indicates this occurs often. This result is not surprising considering the conclusions of Koontz et al. (1992) that distant futures contracts traded at approximately average cost of feeding levels, in other words at approximately 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. One alternative producer strategy when the break even method gives inverted windows is to substitute a minimum price contract (put) for the window. A drawback to this alternative may be the very high premiums required to purchase the minimum price contract.

Information explaining conceptual issues surrounding window contracts have been presented. Valuation models have been discussed and along with determination of the price window. Empirical investigation of the risk management properties of short term window contracts are presented in the next section.

6. Empirical Risk Evaluation of Window Contracting in the Canadian Pork Industry

The Canadian empirical investigation simulated several different types of window contracts developed using one of two criteria. The first group of window contracts involved establishing a window based on a confidence interval around the forecast price at sale time, using the lower bounds of the interval to establish the window floor. The second group of window contracts were established using the projected break-even price at sale time minus a target profit amount to establish the window floor price at farrowing. The window contracts were combined with an historical simulation of a farrow to finish hog barn in Western Canada. The time from farrowing to market was 175 days and the simulation covered the time period from 1981 to the end of 1995. Cash marketing, routine hedging of hog prices and routine forward contracting on hog prices on each pen were compared to window contracts. Complete details of the historical simulation, performed weekly, and window parameter estimation for each pen of hogs are available from the authors.

The first step in establishing a price window involved choosing a window floor price. Window floor prices were established using a confidence interval and a break even approach. Basis, a fifty-two week historical rolling average, adjusted prices to Western Canada.

Windows established using a 25%, 50% and 75% confidence interval were evaluated. Figure 7 provides an illustration of the price window established using a 50% confidence interval for the time period 1990-1995. Short period price windows vary widely over time as the floor and ceiling price change. Thus price protection changes which is in contrast to long term U.S. window contracts that fix the window. Table 1, maximum and minimum window widths established using the three different confidence intervals, further illustrates the varying size of the window over the entire time period of the simulation. For example, the minimum and maximum price window observed during the simulation was $0.09/kg (Can $) and $0.62/kg respectively when the 50% confidence interval was used to establish the floor price. Volatilities and current price have a very large impact on the size of the price window established using the confidence interval approach.

Several measures were used to evaluate the risk management effectiveness of window strategies. These risk measures, mean-variance analysis and downside risk analysis included:

1) Mean returns and standard deviation of returns,

2) Maximum loss and Maximum profit,

3) Number of pens losing more than $20/head,

4) Number of pens losing more than $40/head,

5) Percentage of losing pens in the simulation.

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. The smaller the maximum loss, the fewer pens with large loses and the lower the total percentage of losing pens, the more useful the strategy.

Table 2 presents the risk measures for window contracts established using confidence intervals and a break even strategy combined with minimum price contracts when the price window is inverted. The minimum price contract was set at the break-even price. Cash marketing, routine hedging and routine forward contracting are also presented in Table 2 as benchmark measures. Cash marketing had the highest return ($19.72/head) and highest standard deviation ($32.94/head). Routine hedging, hedging hog prices on each pen, decreased mean returns and the standard deviation of returns but it also increased the number of pens losing over $20/head.

Window contracts developed using confidence intervals provided mixed results depending on the type of window simulated. All window contracting strategies resulted in a lower mean and standard deviation of returns compared to cash marketing. Contracts using a 75% confidence interval to set the floor price were often too wide, and as a result did not provide adequate downside protection. Contracts using a 25% confidence interval were often too narrow and limited upside price potential. Contracts using a 50% confidence interval to establish the floor price provided the most acceptable balance between downside protection and ability to gain from upward market moves when using the confidence interval approach to set the floor price.

The 50% confidence interval routine window strategy reduced the frequency of losses over 20 dollars per head, eliminated losses over 40 dollars per head, and effectively decreased the standard deviation of returns. A mean return of over 15 dollars per 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% no share 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.

Sharing gains and losses 50/50 outside of the window (results not shown), compared to not sharing gains and losses, had the effect of slightly increasing mean returns while sacrificing some downside protection. This was because a sharing agreement allows for producers to partially take advantage of prices higher than the window ceiling price in return for only partial protection from prices lower than the window floor.

The routine break even/minimum price contract (BE/MPC) strategies (Table 2) that established a floor price equal to the projected break-even price worked well in reducing risk. It eliminated the number of the large pen losses from 54 with cash marketing to 14 with BE/MPC. The maximum loss was also decreased with this strategy. Reducing the floor price below the projected break-even price by $0.03/kg, $0.05/kg or $0.10/kg (results not shown) reduced the effectiveness of these windows. The number of large losses experienced by the producer increased because price protection occurred at a level that was too low. The BE/MPC strategies minimally reduced mean returns compared to cash marketing.

The BE/MPC strategies performed reasonably well from 1981 to 1995. Standard deviation of returns were reduced and the lower end of the revenue distribution was truncated with this strategy. The effectiveness of the BE/MPC strategies was due to their ability to provide the producer with a minimum price guarantee that covered the projected total cost at sale time. During periods when the projected break-even price was high and the Canadianized futures price was low, the window contracts were inverted and the simulated producer purchased a minimu price contract instead. It should be noted that minimum price contract premiums were as high a 40 dollars per head in the simulation. This is expensive price insurance. Purchasing thi expensive insurance paid off during the 1981-1989 time period but was less successful during th period of 1990 to 1995.

Comparison of the routine hedging to the routine forward contracting provides ar indication of the basis risk assumed by the providers of window contracts. Any reduction in variability to the producer in the forward contract over the routine hedge could be attributed to fixing the basis . Forward contracting has a slightly lower standard deviation than routine hedging. However routine forward contracting had fewer pens with large loses. This is suggestive of the potential basis risk the contract provider assumes since the simulation fixed the basis risk in the windows and forward contracts but did not fix the basis risk in the routine hedge. The contract provider was assumed to accept the basis risk. Further work on the basis risk is required.

Historical analysis of window contract effectiveness in the Western Canadian hog industry provided mixed results. Establishing window floors based on a 50% confidence interval provided some risk relief. Windows established using break even analysis also reduced several risk measures, however window contracts would be used only 41% of the time (Table 2) and the remainder of the time a minimum price contract was purchased.

7. Key Conclusions on Window Contracts

Window contracts are a new and increasingly used OTC price risk tool in the hog industry. These instruments provide a mechanism which partially protects Western Canadian producers from decreasing market prices but provides greater flexibility in gaining from upward market moves than forward contracts. 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. However their effectiveness varies with different historical time periods. Short term window contracts produce much more volatile price protection than their long term counter parts. Window widths vary widely and the price floor moves with the changing price conditions.

No one window strategy evaluated here stood out as superior in all risk measurement criteria; increased mean revenues, lowered standard deviation of revenues, reduced the frequency of large losses and reduced maximum loss. Two main reasons drive this result. In several time periods such as late 1988, early 1989, late 1994 and early 1995 feed prices increased sharply while hog prices sharply declined, resulting in loses not protected by price window contracts. In these situations, hedging the feed inputs could improve window's risk reduction performance. Other strategies that used window contracting or minimum price contracting did allow for the eventual price received to cover the projected break-even price, but were expensive price insurance. Cash marketing still showed the highest mean returns and the largest standard deviation of returns.

Short term window contracts are another risk management tool that allow more pricing flexibility but they are not a universally superior alternative. Windows offer enough promise to justify further investigation into their design and implementation.

8. Bibliography

Black, F. 1976. The Pricing of Commodity Contracts. *Journal of Financial Economics*. 3:167-179.

Brandt, J. 1985. Forecasting and Hedging: An Illustration of Risk Reduction in the Hog Industry. *American Journal of Agricultural Economics*. 67(2):24-32.

Gore, P., and R. Leuthold. 1993. *Selective Hedging Opportunities and Strategies in Livestock Futures and Options Markets*. OFOR Paper Number 93-01. July.

Holt, M., J. Brandt, and C. Hurt. 1985. Managing Risk With Forecasts and the Futures Market: An Application to Hog Production. *Journal of the American Society of Farm Managers and Rural Appraisers*. 49(1):6-11.

Hull, J. 1993. *Options, Futures and Other Derivative Securities*. Second Edition. New Jersey, Prentice Hall Inc..

Kenyon, D. and J. Clay. 1987. Analysis of Profit Margin Hedging Strategies for Hog Producers. *The Journal of Futures Markets*. 7(2):183-202.

Koontz, S., M. Hudson, and M. Hughes. 1992. Livestock Futures Markets and Rational Price Formation: Evidence for Live Cattle and Live Hogs. *Southern Journal of Agricultural Economics*. Southern Agricultural Economics Association. 24(1):233-249. July.

Lawrence, J. 1995. *Long-Term Hog Marketing Agreements*. Iowa State University. University Extension. Ames , Iowa. M1282lMarch

Wei, J. 1994. *Pricing Forward Contracts and Options of Foreign Assets*. Contributed article to the 2nd edition of Handbook of Derivative Instruments.

acts. *Journal of Financial*

ı Illustration of Risk Red
Economics. 67(2):24-32.
ng Opportunities and Stra
Number 93-01. July.
Risk With Forecasts and th
! of the American Society o

ive Securities. Second Edi

argin Hedging Strategies f
:183-202.
/estock Futures Markets a
'e Hogs. *Southern Journa*
: Association. 24(1):233-2
'ements. Iowa State Unive

ıs of Foreign Assets. Con
uments.

num and Minimum Window Widths (1981-1995)

	25% Window	50% Window	75% Window
low Width ($/kg)	0.34	0.62	0.99
low Width ($/kg) dressed)	0.04	0.09	0.15

ressed weight.

Table 2. Results of Alternative Marketing Strategies

Strategy	Mean	Standard Deviation	Maximum Loss	Maximum Profit	< -20 $/head	< -40 $/head	% Losing Pens	% Window Contracts Taken
Routine 25% Window (NS)	14.82	23.26	33.98	87.20	30	0	29.4	100
Routine 50% Window (NS)	15.40	23.69	39.78	88.94	24	0	27.8	100
Routine 75% Window (NS)	16.49	25.75	46.59	103.21	32	3	26.6	100
Routine BE/MPC (NS)	16.64	26.44	27.80	100.38	14	0	29.8	41
Routine Forward Contracting	14.53	24.80	31.56	83.81	38	0	32.5	-
Cash Marketing	19.72	32.94	46.98	116.86	54	7	25.7	-
Routine Hedging	15.18	26.32	54.80	91.05	66	6	28.9	-

*Note: NS = gains or losses not shared between producer and contract provider.
BE/MPC = window floor established at projected break-even cost
Minimum price contract taken if projected break-even > futures price at farrowing
There are 758 pens (time periods) simulated from 1981 to 1996.

10. Figures

Figure 1. Payoff from Cash Marketing

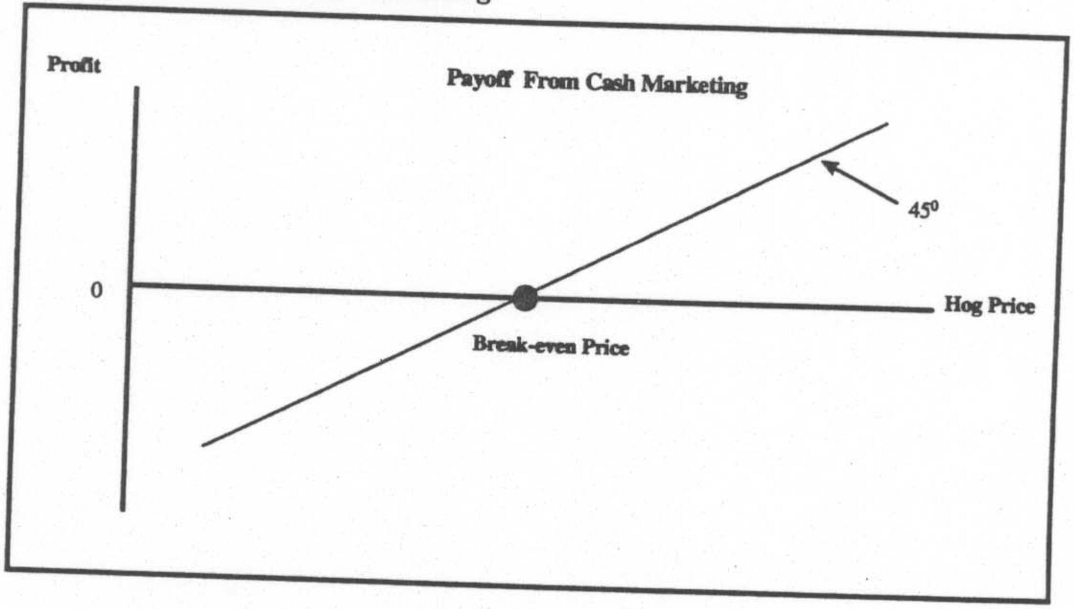

Figure 2. Payoff from Buying One Put and Selling One Call

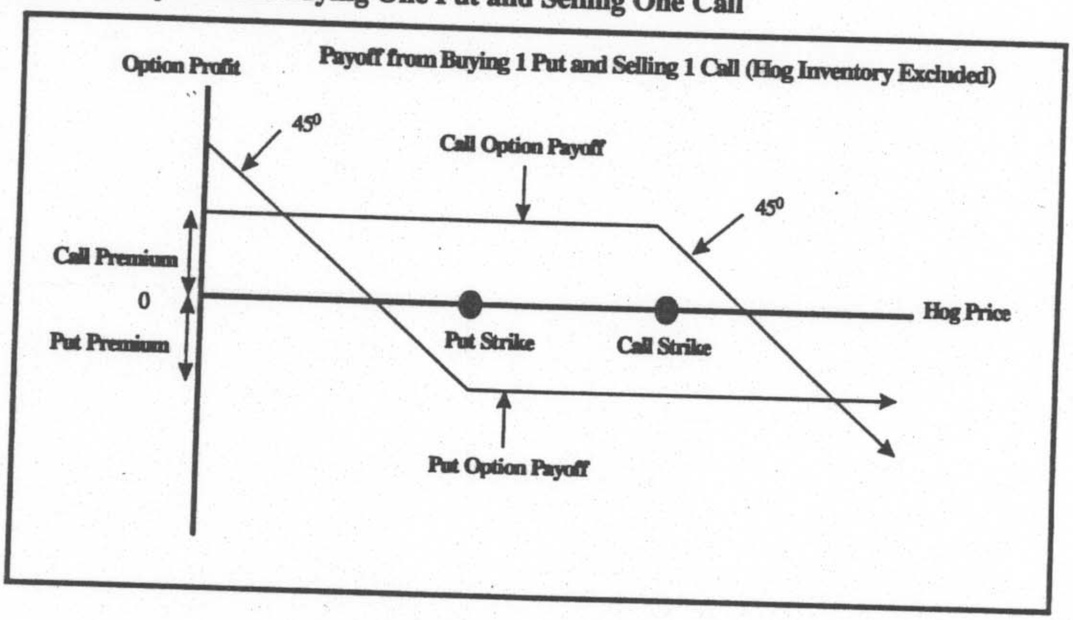

Figure 3. Combined Payoff from Put and Call Options

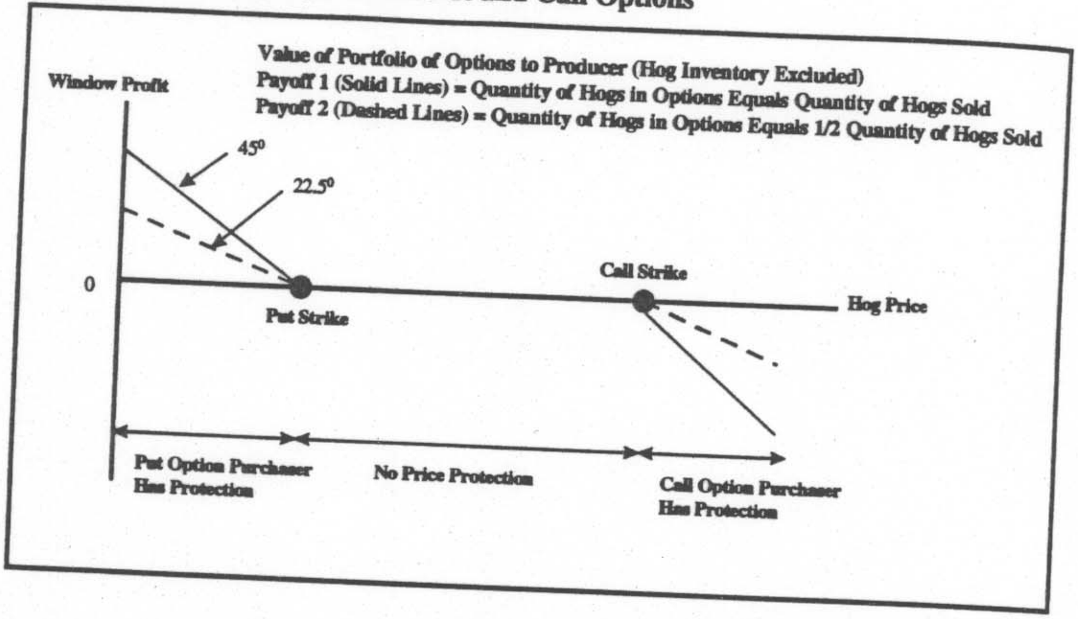

Figure 4. Payoff to Producer Taking a Window Contract (Zero Basis Risk)

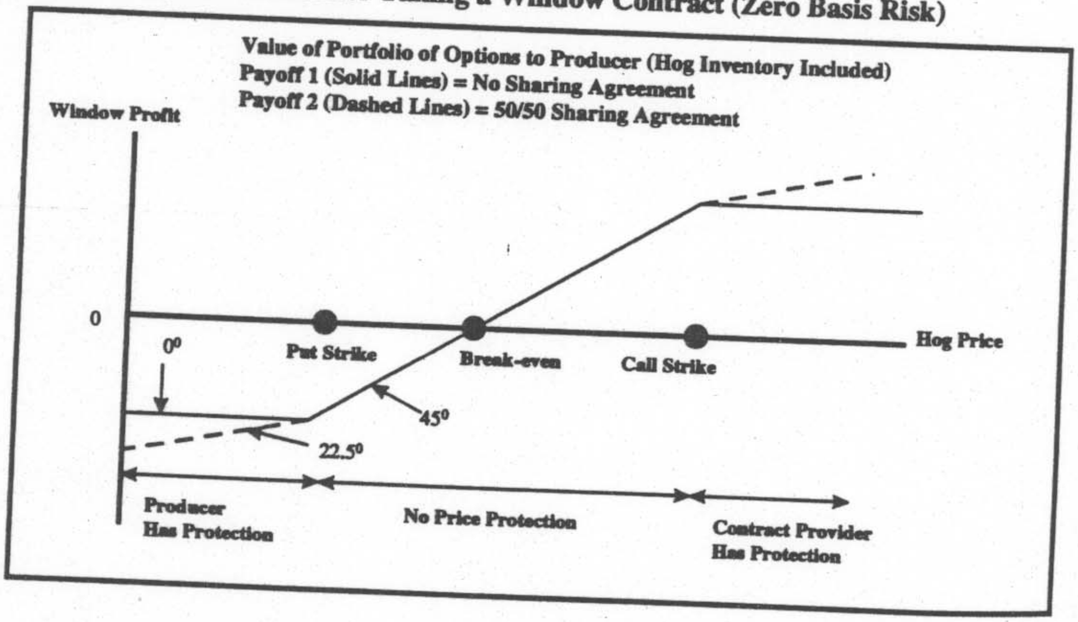

Figure 5. Payoff When Put and Call Options are In-the-Money (Inverted Window)

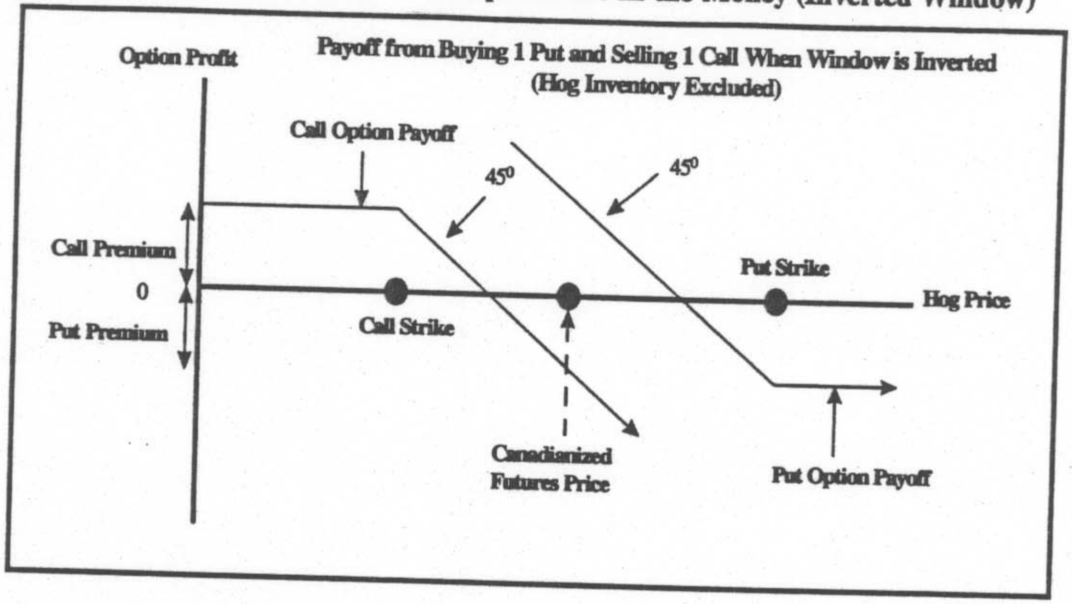

Figure 6. Payoff to Producer Taking Inverted Window Contract

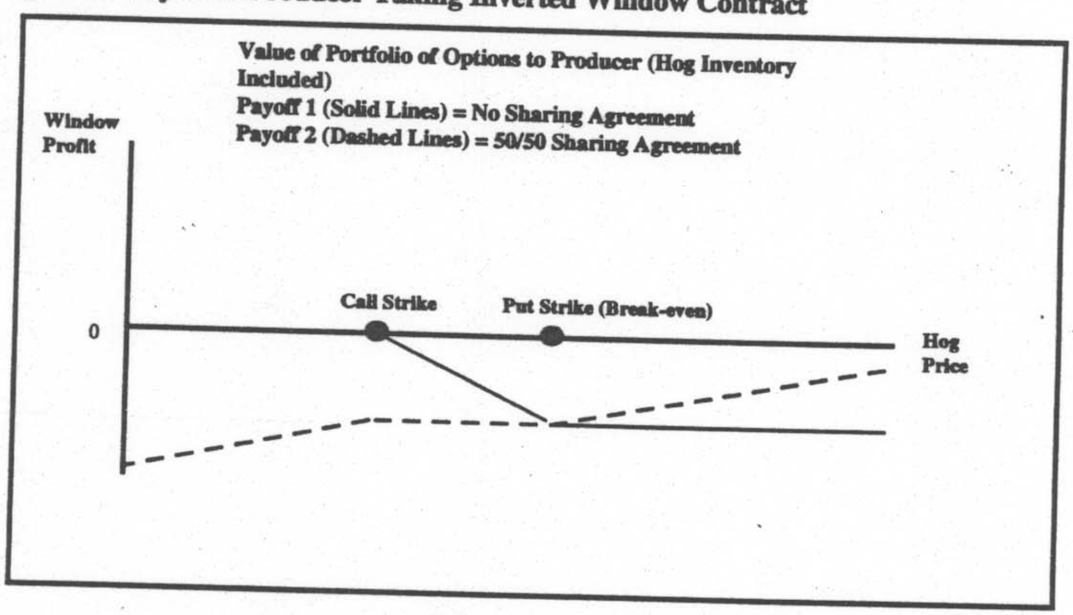

Figure 7. Price Window Established Using 50% Confidence Interval (1990-1995)

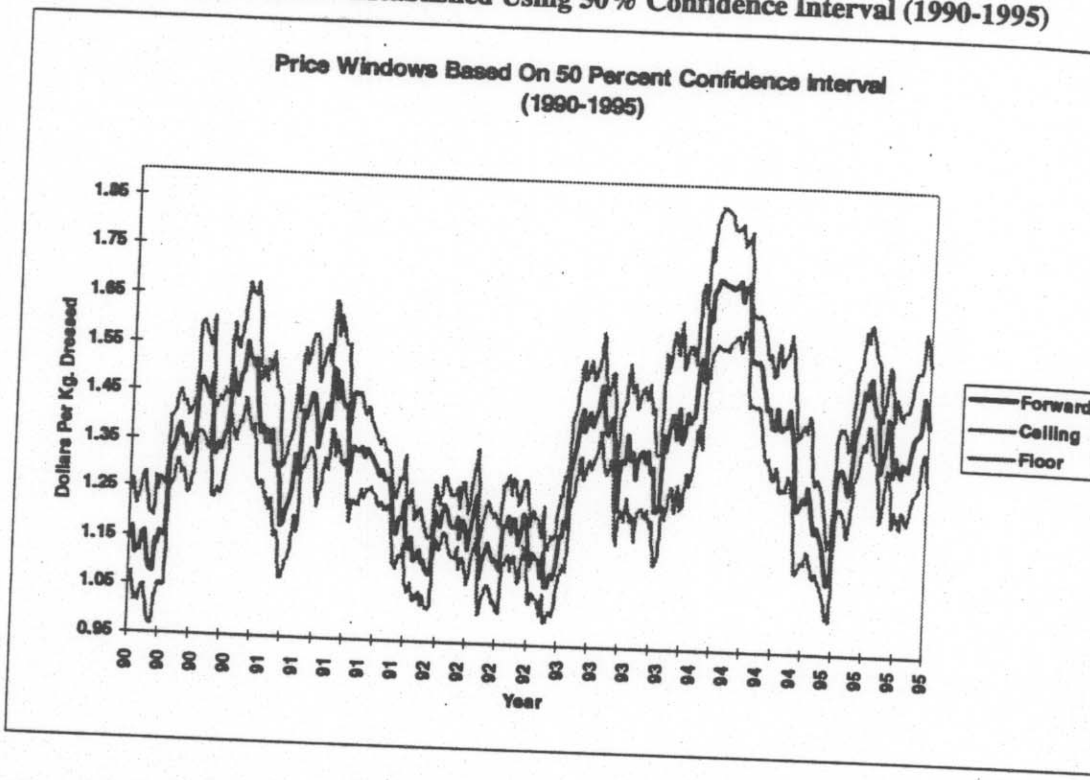

Figure 8. Price Window Widths (1990-1995)