"Did Producer Hedging Opportunities in the Live Hog Contract Decline?"

Fabio C. Zanini and Philip Garcia*

The paper assesses the usefulness of selective hedging strategies when combined with forecast techniques in the live hog contract. The use of routine futures and options hedging is not attractive relative to a cash-only strategy. However, forecasting and hedging can contribute to price risk management improvement for risk-averse producers. Consistent with previous research, the results indicate that the live hog contract continues to offer producers attractive pricing opportunities. The findings suggests that the success of the new lean value carcass contract may depend on its ability to attract trading volume from outside the traditional production sector.

Introduction

Ginn and Purcell (1987) indicate that an improvement in price risk management may contribute to the competitive nature of the pork industry. In this context, researchers have investigated the usefulness of the live hog contract for reducing price risk, and have found encouraging results when combining hedging strategies with forecasting techniques (e.g., Brandt, 1985; Holt and Brandt, 1985; Park, Garcia and Leuthold, 1989). The studies indicate that risk-averse producers could reduce their output price variability by selling selective futures contracts based on signals provided by the forecasting procedures. Despite these findings, there is some recent concern that the hog futures and options markets no longer provide the producers with viable hedging opportunities. In particular, some anxiety has developed over the declining volume of futures trading in the live hog contract, the possible increase in basis risk and the usefulness of the contract (Unnevehr, 1988; Einhorn, 1994). In a effort to restore trading activities, contract specifications have been changed from live hog basis to lean value carcass basis.

Nevertheless, it is difficult to anticipate whether the lean hog contract will be more successful than the live hog contract in encouraging producers to hedge. A difficulty may be the changing nature of the production process which has become more vertically integrated and concentrated, and the declining volume marketed through traditional terminal markets (Rhodes, 1995). Producers may have opted to ignore the futures and options markets in favor of alternative methods of managing risk. In this context, it is important to assess whether the live hog contract continued to offer producers attractive hedging opportunities in order to understand the potential of the lean hog contract. If hedging opportunities are available and producers do not take advantage

*The authors are graduate student and professor at the Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign, Urbana IL 61801.

of them, then changes in the contract specifications may not be sufficient to restore trading volume.

The objective of the paper is to investigate the value of the live hog futures and options markets when combined with relatively straightforward forecasting approaches as marketing tools for a farrow-to-finish hog operation. Monthly forecasting models (i.e., econometric, ARIMA, seasonal indices, and composite) are identified during the period August 1981 to July 1986. Out-of-sample forecasts are generated for 84 months, from January 1987 to December 1993 by updating the models. These forecasts are used to identify the usefulness of the forecasting in conjunction with the various strategies. The effects on producer final prices are compared to cash prices using stochastic dominance and mean-variance analysis.

Simulation Framework

Careful attention is given to keep the analysis relevant to actual marketing scenarios faced by Midwestern U.S. hog producers. The futures and options trading activities follow from different strategies built for a farrow-to-finish hog operation with monthly output equivalent to the size of one live hog futures contract (30,000 pounds of weight or approximately 125 head). In order to focus the results on the differences among the pricing strategies, the production process is assumed to be continuous, with no supply response to higher or lower prices, a common approach in this type of analysis (e.g., Brandt, 1985). Hence, at any time the operation's inventory contains 125 barrows and gilts in six weight categories, totaling 750 head. The USDA indicates that almost 70% of the U.S. hog production between 1987 and 1993 came from farms with inventories over 500 head (45% from farms with more than 1,000 head).

Farrowings are assumed to take place in the first week of every month and the hedges are placed on the first working day of the second week of the month, if the decision to hedge is taken. To establish the hedge positions, one futures contract is sold (or one put option bought) with delivery six months later at slaughter. When a futures contract is not available for the slaughter month, the nearby delivery month is used. Since the production process is continuous, there are always animals being farrowed at the same time that there are six-month-old animals going to slaughter. At any one time, there may be as many as six futures positions corresponding to the growth of hogs in the production process.

Strategies

In the six strategies described below, the six-month old hogs are sold in Omaha, in the first week of the month, at the average price for that week. Delivery in the futures market is never considered and the hedges opened at slaughter are lifted on the first working day of the second week of the month. The short futures positions are liquidated by buying one futures contract. The put options may be allowed to expire if the strike price is below the futures market price or otherwise are exercised and the resulting short futures contract position is offset by the purchase of a futures contract. The final prices received for the hogs slaughtered are the cash prices plus the net gains and losses from the trading activity in futures and options. Commission costs and put premiums are built into the trading signals, but margin calls are not taken into account in the simulation since margin calls can be fulfilled by T-Bills.[1]

Strategy 1 - cash-only strategy. The cash-only strategy is included as a benchmark, so that the usefulness of forecasting and hedging can be assessed under current market conditions. The final price is the average cash price in Omaha during the first week of the slaughter month. Results from previous works indicate that the cash-only strategy has not always been the best pricing strategy available in terms of risk reduction (Brandt, 1985; Holt and Brandt, 1985; Adam, Garcia and Hauser, 1993).

Strategy 2 - routine futures contract hedge. In the routine hedge strategy, hedges are placed for every group of pigs farrowed by selling a live hog futures contract with delivery six months later in the slaughter month. The final price received by the producer is the Omaha cash price adjusted by the gains or losses from the futures trade and by $0.15/cwt. commission costs. The evidence in the literature of the value of this routine strategy has been mixed. While Adam, Garcia and Hauser (1993) indicate that selling a futures contract is a robust hedging strategy for risk-averse producers that are uncertain about forthcoming price variation, Holt and Brandt (1985) argue that the routine hedge can be outperformed by the cash-only strategy and by selective hedging strategies.

Strategy 3 - routine put option hedge. Put options are attractive since they allow the producers to set a floor price without eliminating price increase opportunities. One at-the-money put option is bought at farrowing, where the delivery month of the underlying futures contract is the same as that of the futures contracts sold under the routine futures contract hedge (Strategy 2). If there is no open interest on the at-the-money put option on the first working day of the second week of the month, the next lower strike price is used. The producer exercises the put option if the futures price on the put expiration day is below the strike price. The put option is allowed to expire otherwise. If the put is exercised but the expiration day is earlier than the slaughter month, a short position in the futures market is kept open until the first working day of the second week of the slaughter month. Following this procedure may be more costly than simply selling back the put option, but allows the producer to remain hedged until slaughter. The final price received by the producer equals the average cash price of the first week of the month in Omaha, discounted by the put option premium and by any net gain from the futures market trade. The initial commission costs are $0.08/cwt. for each put option bought. If the option is allowed to expire, there are no additional costs or gains for the producer. On the other hand, when put options are exercised, an additional $0.15/cwt. in commission costs are charged and the producer gains the difference between the futures price on the first working day of the second week of the month and the put option strike price.

Strategy 4 - selective futures contract hedge. The selective futures contract hedge differs from the routine futures contract hedge (Strategy 2) since the hedges can be placed at any time from farrowing to the end of the growing period. Hedges are placed when the basis-adjusted forecast price is below the

[1]The T-Bills do not bear interest rate if they are used to fulfill margin calls.

futures price by more than the commission costs. The producer does not enter the futures market otherwise. Whenever a hedge is placed, the short positions in the futures contract is held until slaughter, when the futures contract is bought back. The final price received by producer equals the first week of the month average cash price in Omaha plus any net gain and losses from futures trades. The commission costs are $0.15/cwt. charged only when the hedges are placed. It is possible that the signal to sell a futures contract occurs when the same futures contract is being bought to lift a hedge at slaughter. In this case, there is no net change of position in the futures contract and the producer pays no extra commission costs.

<u>Strategy 5 - dynamic futures contract hedge.</u> This strategy is similar to the selective futures contract hedge, but the producer is allowed to lift the hedges before maturity. Similarly, the hedging positions offset prior to slaughter may be reestablished within the six months growing period. A hedge is placed when the basis-adjusted forecast price is below the futures prices by more than the commission costs and lifted when it is above the futures prices by more than the commission costs. Therefore, trading signals within the commission costs range do not change the producer's futures market positions, avoiding an excessive number of trades that could be caused by the random fluctuations present in the futures prices and forecasted prices. The final price received by the producer equals the average cash price during the first week of the month in Omaha plus the sum of net gain and losses in futures trading.

<u>Strategy 6 - selective put option hedge.</u> The put-option selective-hedging strategy is constructed in the same manner as the selective futures contract hedge (Strategy 4), but put options are bought instead of futures contracts when hedges opportunities are signaled.[2] The put option signals differ from the futures contract signals since premiums are built into the put option signals in addition to the commission costs built into futures contract signals. The final price received by the producer is calculated similar to Strategy 3.

Data

The data are provided by the Office for Futures and Options Research at the University of Illinois. The **cash prices** are a simple average of daily prices for the Omaha market during the first week of the month, which is the week that contains the first working day of the month. If the first working day is on Friday, however, the next week is used.[3] The **current futures prices** are defined as the average of the closing prices during the first week of the month defined above. Current futures market prices are estimated for each month, for every live hog futures contract, and are used to produce the trading signals and to define the at-the-money put option strike prices. The **futures contract price** used in the trades is

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[2] A dynamic put option strategy which would offset the option when the price signal is above the commission and premium adjusted futures prices was not included in the work. The incentives to follow such a strategy are not as strong as the incentive to follow a dynamic futures strategy because Strategy 6 permits the producer to capture the large gains associated with increasing prices.

[3] This definition of the first week of the month is consistent with Garcia and Sanders (1996).

defined as the closing price on the first day of the second week of the month. The **put option premiums** are the closing price on the first working day of the second week of the month for the at-the-money strike price, which has the first strike price available below the current price of the underlying futures contract. For example, the at-the-money strike price is $40.00 if the current futures price is equal to or higher than $40.00, but lower than $42.00. When there was no open interest for the at-the-monthly strike price, the next lowest was used.

All the data used to generate the forecasts are available at the time the forecasts are generated. Since the hog prices are obtained in the first week of each month, they are available on the Monday of the second week of the month when the models are estimated. The in-sample period used to identify all the forecasting models is from August 1981 to July 1986. The sample has 60 observations, which is above the minimum of 40 to 50 observations required to estimate ARIMA models (Granger and Newbold, 1986). During the out-of-sample period, the number of observations is kept constant at 60, permitting the estimates to more quickly capture fundamental structural changes (Leuthold, Garcia, Adam and Park, 1989). The data used in the econometric estimation are: monthly U.S. population (millions) and personal income (billions of dollars); U.S. sow farrowings (million heads); U.S. hog slaughter (million pounds), cattle slaughter (million pounds) and broiler slaughter (million heads); average Central Illinois price of corn (No. 2, yellow) and U.S. Treasury Bill rate. Except for sow farrowings, all observations are published monthly. Sow farrowings are published quarterly. The **basis** is defined as the average cash prices during the first week of the month in Omaha minus the current futures prices.

Basis Forecasting

Holt and Brandt (1985) suggest that three-year simple moving averages may lead to reasonable forecasts since basis patterns are seasonally repetitive. Garcia and Sanders (1996) have indicated that the predictability of the basis has not changed considerably and should not affect the attractiveness of hedging. Thus, in order to keep the forecast process parsimonious, a three-year average basis forecasting model is used here. The forecasted basis is generated by taking the simple average of the actual basis observed over the last three years in the month for which the predicted values are generated.

Price Forecasting Models and Forecast Results

Cash prices are forecasted using three individual procedures (seasonal index, ARIMA, econometric) and one composite model (simple average of ARIMA and econometric forecasts). Since the out-of-sample forecast period starts in January 1987 and lasts until December 1993, the models are first identified and estimated in July 1986, six months before the first slaughter. During the out-of-sample period, the parameters of both the econometric and the ARIMA models are estimated monthly before the forecasts are generated. The seasonal index is re-calculated every January. The ARIMA model is re-identified every month during the out-of-sample period, allowing for the possibility that it might be sensitive to the sample used. The econometric model is re-identified every January during the out-of-sample period since changes in fundamental supply and demand conditions are difficult to capture when changing only one observation.

The first forecasting procedure is the seasonal-index which was found by Holt and Brandt (1985) to be useful in guiding a selective hedging strategy. The construction of the seasonal index is described in Newbold and Boss (1994, pp. 160-177). Cash prices are forecasted one to six months ahead by multiplying the current seasonal-adjusted cash price by the seasonal indexes for the forecast months. The current seasonal-adjusted price is defined as the average of the current and the past two two-month cash prices divided by their corresponding seasonal indexes. The average of the past two month cash prices is used to attenuate the influence of extreme values, as suggested by Newbold and Boss (1994).

The second individual forecasting procedure is an ARIMA model, identified and estimated by the Hannan and Rissanen's method. The Hannan-Rissanen method yields consistent estimates as long as the order of the moving average is close to the invertibility region (Granger and Newbold, 1986). The ARMA(2,0)xSAR$(1)_{12}$ model is selected to generate the forecast hog prices for the initial period of the simulation, since it provides the lowest BIC value within the models that generated white noise residuals. The identification of a seasonal component in the ARMA model is consistent with models identified in related works (Park, Garcia and Leuthold, 1989; Holt and Brandt, 1985).

The majority of the models selected out-of-sample generate the lowest BIC value for several months, indicating that the criteria used to select the models are not sensitive to small changes in the sample period. In the first out-of-sample month, the ARMA(1,1)XSAR$(1)_{12}$ is the model with the lowest BIC value and white noise residuals. The ARMA(1,1)xSMA$(1)_{12}$ is the predominant model from July 1986 to August 1988. After September 1988 and to the end of the simulation, the best models are the ARMA(1,0)xSAR$(1)_{12}$ and the ARMA(1,0)xSMA$(1)_{12}$, with June 1990 as the only exception.

The third forecasting procedure is an econometric model, adapted from the farm-level recursive demand-supply model of the hog market in Leuthold, Garcia, Adam and Park (1989). The supply equation specifies hog production as a function of the expected output and input prices, interest rate, lagged sows farrowings, and monthly dummy variables. The expected input and output prices are represented by corn prices and hog prices lagged seven months in order to simplify the estimation. Interest rate is used as a proxy for the opportunity cost of the capital allocated for hog production. Sow farrowings are an average lag of two and three quarters (Leuthold, Garcia, Adam and Park, 1989). The demand equation specifies the hog prices in Omaha as the dependent variable. The independent variables are hog slaughter, cattle slaughter, broiler slaughter, income per capita and monthly dummy variables.

<u>Supply</u>

$$\text{Hog Slaughter}_{(t)} = \alpha_1 + \beta_1 \text{Hog Price}_{(t-7)} + \beta_2 \text{Corn Price}_{(t-7)} + \beta_3 \text{Interest Rate}_{(t-7)} + \beta_4 \text{Sow Farrowings}_{(t-7)} + \beta_{5\text{-}15} \text{Monthly Dummy Variables} + \epsilon_1.$$

<u>Demand</u>

$$\text{Hog Price}_{(t)} = \alpha_2 + \delta_1 \text{Hog Slaughter}_{(t)} + \delta_2 \text{Cattle Slaughter}_{(t)} + \delta_3 \text{Broiler Slaughter}_{(t)} + \delta_4 \text{Income}_{(t)} + \delta_{5\text{-}15} \text{Monthly Dummy Variables} + \epsilon_2$$

The equations are estimated individually since typically prices in the hog sector are formed recursively. Each equation is initially estimated by least squares, but since the OLS residuals are autocorrelated (based on the Ljung-Box Q-statistic), a generalized least squares procedure (GLS) is used to obtain efficient estimates both in the supply and the demand estimations. The supply residuals are third-order autocorrelated and the demand residuals are first-order autocorrelated.

Surprisingly, the estimated coefficients of the expected input and output prices (hog price and corn price lagged seven months) and interest rates are not significant in explaining hog supply. An F-test at a 1% level of significance indicates that the coefficients of the economic variables are not jointly statistically different than zero. However, the coefficient of the sow farrowings variable in the restricted model is significant with a positive sign as expected. The Q-statistic indicates that the residuals of the restricted model are white noise and the adjusted R^2 (.88) shows reasonable explanatory power. In Leuthold, Garcia, Adam and Park (1989) the expected output hog price was significant, but corn prices and interest rates were not significant variables in explaining hog supply. They explained the insignificance of the variables due to collinearity in the data, which may also explain why no economic variable was significant in explaining hog supply in the sample period used here. At the same time, Skold, Grundmeier and Johnson (1989) indicate that hog supply is essentially a function of investment decisions taken at breeding almost four months before farrowing. After farrowing, producers may change output either by slaughtering sows or by changing the weights of barrows and gilts sold, but the overall response to economic variables may be small. This is more consistent with our findings.

Problems were encountered with the demand specification. The in-sample estimates of coefficients are inconsistent with economic relationships normally anticipated. While the hog slaughter variable had the expected negative sign, the coefficients of the cattle and broiler slaughter were incorrect (indicating complementary) and insignificant, respectively. Likewise, the income variable has a significant but negative coefficient. Thus, a restricted model with only hog supply and dummy variables is tested against the unrestricted model based on F-statistic.

The F-statistic fails to reject the hypothesis that the restricted coefficients on broiler slaughter, cattle slaughter and income per capita are equal to zero at a 5% level of significance, supporting the restricted equation. However, in the case, the t-statistic on hog slaughter is not significant. Since hog slaughter is highly seasonal (see the supply estimations), there is strong reason to believe that a high degree of collinearity between the hog slaughter and the dummy variables is influencing the restricted model estimation. Consequently, the model is further restricted by dropping the seasonal dummy variables from the demand estimation. The F-statistic on the restricted model with only hog slaughter explaining hog prices against the original model is not significant, suggesting that all coefficients are equal to zero, except for hog slaughter. Both the Q-statistic and the R^2 (.683) indicate that the model is reasonably well specified.

During the out-of-sample period, the coefficients of the demand equation are not stable. Respecification of the demand model each year again identified problems with signs and significance of the broiler and cattle slaughter and income variables. Hence, in general, the model with only hog slaughter in the explanatory set is used in the forecasting model. Clearly, structural changes are occurring in the demand equation which warrant further investigation.

Last, a composite forecast based on a simple average of the ARIMA model and the econometric model is considered. In general, Granger and Newbold (1986) argue that most economic forecasts are not optimal and might be improved by expanding the information set used to generate the forecasts by combining competing models.

An analysis of the models' out-of-sample forecast performance is provided using the forecast root mean squared error for the 84 months from January 1987 through December 1993 (Table 1). The more reliable forecasts are at the shorter horizons (one and two months). Similar to previous findings, the econometric model performed better than the ARIMA specifications at distant forecast horizons, while the ARIMA model performed better at shorter forecast horizons. The simple average composite model has the lowest root mean squared error, except for the one-month forecast horizon, when the errors from the econometric model inflate the composite. The poor performance of the seasonal index model clearly indicates that supply and demand relationship and/or price patterns should be considered when building a model to forecast hog prices as suggested by Brandt (1985).

Table 1. Root Mean Squared Forecast Errors, January 1987 - December 1993.

	6-Month	5-Month	4-Month	3-Month	2-Month	1-Month
Seasonal Index	7.055	6.793	6.510	5.934	5.964	4.219
ARIMA	6.833	6.500	6.031	5.370	4.573	3.658
Econometric	6.036	5.941	5.856	5.723	5.546	5.400
Composite (ARIMA and Econometric)	5.851	5.604	5.355	4.886	4.388	3.823

Simulation Results

The first-degree stochastic dominance approach is a useful technique to evaluate choices under uncertainty since it requires only that more would be preferred to less (Levy, 1990). Under the first-degree stochastic dominance approach, a strategy dominates another if its cumulative distribution function is to the right of the dominated strategy's cumulative distribution function. First-degree stochastic dominance is not conclusive if the two cumulative distribution functions cross at least once. In this case, second-degree stochastic dominance approach can be used by assuming that the decision maker is risk averse, and that more is preferred to less. First-degree stochastic dominance implies second-degree stochastic dominance, but not the reverse (Levy, 1990). A strategy dominates another in the second-degree dominance approach if the accumulated area under its cumulative probability function is less than the accumulated area under the dominated strategy's cumulative probability function. At the same time, the second-degree stochastic dominance approach is consistent with the mean-variance analysis when the returns are normally distributed and the producer is risk averse.

The stochastic dominance results discourage the use of the routine futures contract, the routine put option and the selective put option strategies.[4] The routine futures contract strategy and the routine put option strategy are first-degree dominated by the cash-only strategy. Likewise, the routine futures contract and the routine put option hedging strategies are first-degree dominated by the selective hedging strategies. Hog producers who prefer higher output prices to lower output prices would not benefit from routine hedging. Out of the eight-four trades examined, only twenty-five trades in the routine futures contract hedge and nine trades in the routine put option hedge resulted in profits after adjusting for the premium and commission costs. Holt and Brandt (1985) found similar results for the routine futures contract strategy, but they did not consider the routine put option strategy. Interestingly, the selective put option hedging strategy avoids many of the trades that generate losses, but it provides only a few profitable trades. Consequently, when the seasonal index model or the ARIMA model are used, the selective put option strategy is first-degree dominated by the cash-only strategy. When the econometric model and the composite model are used, the dynamic futures contract strategy second-degree dominates the selective put option.

The remaining choice between the cash-only strategy and the static and dynamic futures contract hedging cannot be determined by the first- or the second-degree stochastic dominance analyses since the visual inspection of the cumulative distribution functions is inconclusive. Mean-variance analysis is used below to clarify the results of the stochastic dominance analysis. The mean and standard deviation of the final prices generated by the different strategies and forecast procedures are presented in Table 2. The Jarque-Bera test for normality indicates that only the final prices from put option and static seasonal strategies are non-normal, but these strategies are always dominated in a first-degree stochastic dominance context. Hence, assuming risk aversion, the mean-variance findings potentially provide a more precise procedure for differentiating among the strategies which is consistent with second-degree stochastic dominance.

[4] The graphs are not presented for purposes of brevity, but are available from the authors.

Table 2. Summary Statistics of Final Prices from Strategies, January 1987 - December 1993.

Forecasting Procedure Strategies	Mean	Standard Deviation	Skewness	Normality Test[a]
Cash Only (1)	48.069	6.373	0.581	4.796
Routine hedge				
Futures contract (2)	45.055	4.488	0.437	3.606
Put option (3)	46.708	6.077	0.659	6.134
Seasonal index				
Selective Futures (4)	47.472	6.220	0.688	6.626
Dynamic Futures (5)	47.698	6.333	0.504	4.553
Put option (6)	47.573	6.474	0.555	4.442
ARIMA				
Selective Futures	47.581	5.526	0.409	2.944
Dynamic Futures	48.253	5.698	0.277	1.758
Put option	47.597	6.249	0.523	4.158
Econometric				
Selective Futures	47.754	5.161	0.058	1.379
Dynamic Futures	48.093	5.472	0.133	1.781
Put option	48.748	6.036	0.538	4.228
Composite				
Selective Futures	47.912	5.618	0.178	1.759
Dynamic Futures	48.268	5.861	0.301	2.311
Put option	47.720	6.160	0.554	4.572

[a] The Jarque-Bera normality statistic is asymptotically Chi-squared distributed with two degrees of freedom. The Chi-squared values are 5.991 at a 5% level of significance, and 9.210 at a 1% level of significance.

In general, the results suggest that forecasting procedures using price patterns or supply and demand information can play an important role in producer marketing effectiveness. When forecasts from the ARIMA model, the econometric model and the composite model are used, the dynamic futures contract strategy generates final prices with a lower standard deviation and a higher mean than the cash-only final prices. Hence, the dynamic futures contract strategy should be preferred to the cash-only strategy by any risk-averse producer. In contrast, if only the seasonal index model were available to forecast cash prices, most risk-averse producers would prefer the cash-only strategy to the static or to the dynamic futures contract strategy.

Using the forecasts to lift hedges is a key element to the success of the dynamic futures contract hedging strategy. In the selective futures contract strategies, more than half of the hogs slaughtered are hedged. A large number of the hedges are placed late in the growing period. In the dynamic strategies, more than 20% of the number of hedges are lifted before the slaughter month. Frequently, hedges are lifted and replaced within the six-month period (three-round trades happened only twice).

The put option mean-variance results are consistent with the stochastic dominance findings since the dynamic futures contract strategy dominates the selective put option strategy for all forecasting approaches considered. Hence, risk-averse producers would choose the dynamic futures contract strategies rather than the selective put option strategy. Further, the routine put option's standard deviation is very close to the cash-only standard deviation while the routine put option's mean-price is $1.36 lower than the cash-only price (Table 2). Hence, producers would not gain from buying put options selectively instead of facing flat cash price risks.

Interestingly, the routine hedge has the lowest standard deviation within the strategies considered and is not dominated by any strategy in a mean-variance context. However, the first-degree stochastic dominance results above suggest that any producer who prefers more to less would not gain by routine hedging. This can be understood by examining the probability distribution function generated by the routine hedge. The upper tail indicates that producers cannot take advantage of upward movements in the prices. At the same time, the lower tail of the probability distribution functions indicates that there is no reduction in the probability of low prices. As a result, the routine contract hedge has a mean price that is $3.01 lower than the average cash price (Table 2) and no producer who prefers more to less would benefit from this strategy.

Conclusions and implications

The results of the analysis are fairly consistent with previous studies performed over earlier data periods. The findings indicate that routine hedging strategies, either using futures or put options, are not attractive relative to a cash-only position. However, there is some indication that combining forecasting and hedging can contribute to an improvement in price risk management for risk-averse producers, increasing the mean and reducing the variation of producer prices over a cash-only position. Nevertheless, some caution is likely warranted given the relative instability of the several of the forecasting models, and that the increase in price and reductions in variance are relatively modest.

The consistency of the findings with previous research suggests that changes in the hog sector have not appeared to have reduced the attractiveness of selective hedging in the live hog futures contract. Forecasts from straightforward forecasting models can be successfully used to guide hedging opportunities. Our findings, which indicate that the live hog contract has continued to offer producers attractive pricing opportunities, suggest that the success of the new lean value carcass contract may depend on its ability to attract trading volume from outside the traditional production sector. Failure to attract alternative sources of trading volume may limit dramatically the success of the new contract, and result in further contract specification changes to encourage added trading.

Finally, some caution is warranted in interpreting the findings in light of the relative instability of several of the forecasting models, and the fact that the differences among the return distributions are relatively modest. Further, preliminary analysis of recent extreme hog price movements from 1994 through 1996 suggests that the relative attractiveness of the strategies examined here may have changed. It is clear that some research needs to be directed to examining the performance of the live hog contract in its last years. More importantly, research efforts need to be directed to compare the distribution of returns from vertically integrated producers to the distribution of returns from producers incorporating forecasts and hedging. Since contracting is an alternative for farmers to reduce market risks, it would be interesting to compare farms following alternative production and pricing strategies, including hedging strategies and vertical integration (Rhodes, 1995). Such work would be complicated by the limited accessability of firm level data.

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