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# Testing the Effectiveness of Using a Corn Call or a Feeder Cattle Put for Feeder Cattle Price Protection

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# Testing the Effectiveness of Using a Corn Call or a Feeder Cattle Put for Feeder Cattle Price Protection

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**Testing the Effectiveness of Using a Corn Call Instead of a Feeder Cattle Put for Feeder Cattle Price Protection**

*This paper studies the effect, from an options market perspective, that the substantial increase in corn prices and volatility has had on the feeder cattle market. An empirical study is conducted to compare the effectiveness of a feeder cattle operator using either a corn 'call' or a feeder cattle 'put' to mitigate the margin risk from price volatility. Specifically, the operator sets feeder cattle price conditions at different periods of the year and applies either option strategy. The period studied is from 2003 to 2012. Results are of higher margin variability for the latter years as anticipated – where corn faced much increased demand. In general, operations using a corn call resulted in a bit higher margin variability than operations using a feeder cattle put for most of the years considered. This is not as anticipated, given the broader and more diversified market for corn options – reflected in the much larger number of 'at the money' or nearest 'in the money' transactions at expiration - in comparison to the thinner feeder cattle options market. However, this may be due to the much fewer number of 'at the money' or nearest 'in the money' transactions for feeder cattle puts (i.e. many cases having no puts traded or be all 'out of the money'), which results in less margin variability. Another finding is that operators who set price conditions in May (instead of July or October) generally through a corn call, did not experience substantial increase of margin variability - especially during a very volatile 2009 year. This may respond to mostly circumventing changing conditions in the corn market during summer and fall season, with the arrival of new crop information.*

**Keywords** corn calls, feeder cattle puts, options market premiums, feeder cattle risk protection.

## Introduction

Grain feed markets have experienced substantial increases in price and volatility in recent years. In the case of corn, intense growth in demand - generated mainly by fuel mandates for ethanol production– has had a bullish effect on prices. Agricultural production has always been risky which has led to price volatility. As the corn market has become more closely linked with the energy markets through the growth in the ethanol industry, this has added another source of risk to the market and likely contributed to increased price volatility. (Tejeda and Goodwin, 2009; Trujillo-Barrera et al., 2011).

Increased volatility in corn prices has impacted cattle feeding operations and may have contributed to increased volatility in feeder cattle prices. CME Feeder Cattle option premiums have increased substantially in the last several years, reflective of this increased uncertainty in the market place. In particular, premiums for feeder cattle 'put' options have grown by more than

50% from early 2000s to late 2000s. Yet in comparison to corn options, feeder cattle options are much more thinly traded. Is it possible that given this lower trading activity of feeder cattle options with respect to corn options, that the risk premiums associated with feeder cattle option pricing is higher than that associated with corn option pricing? Thus, would it be more effective for feeder cattle producers to use a corn call option instead of feeder cattle put option to obtain the same level of price protection?

The objective of this study is to compare the variability results of a cattle back-grounding operation, by setting a price for feeder cattle and either applying the purchase of feeder cattle puts or the purchase of corn calls to the operation. The two strategies will be compared in a mean-variance framework and additionally, the strategies will be compared in the 2003-2012 time period - designed to capture the pre and post period of significant increase in corn demand.

## (Brief) Literature Review

There is a vast literature addressing studies of options in financial futures markets. Coval and Shumway (2000) find substantial overpricing of options in financial futures option markets. Santa Clara and Yan, (2010) find the average premium compensating investors for ex-ante risk is 70% higher than the premium for realized volatility.

Studies addressing options in agricultural commodity markets include Simon (2002), which finds that corn implied volatility is higher than realized volatility, but not enough to produce returns from short straddle positions. Egelkraut and Garcia (2006), construct implied forward volatilities for grains and hogs, finding a proper forecasting performance for the volatilities of these markets. Manfredo and Sanders (2004) find that for live cattle futures, implied volatility was a biased, inefficient forecast of one week realized volatility. Brittain et al. (2009) find implied volatility being an upward biased and inefficient predictor of realized volatility, for both feeder cattle and live cattle options

## Methods

For this study, the implied volatility is taken as given from the priced options and two different margin scenarios are set for a feeder cattle operator in order to compare the two option alternatives. The scenarios consider as given the initial calf, and the other feeding and operating costs are deemed equivalent among the two alternatives. The mean-variance framework may be noted as:

$$\text{Max } E\left(\pi_{t,i}\middle|X_{t-1}\right) - \frac{\lambda}{2} Var\left(\pi_{t,i}\middle|X_{t-1}\right) \quad (1)$$

Where $\pi_{t.i}$ is the margin of the feeder cattle operator, for year *t* and strategy (case) *i*, subject to information at period $X_{t-1}$. The variable $\lambda$ is a measure of the operator's risk aversion. Assuming an unbiased futures market, no transaction costs and a specific risk aversion level from the operator, the objective becomes to minimize the variance (variability) of the margin.

The operation considers a farmer/operator taking the weaned calf in the fall and applying a 'back-grounding' strategy for up to 90 days, subsequently delivering the feeder cattle in January. (see Feuz and Umberger, 2003). Five different cases (scenarios) of operation, for either the application of a corn call (1.1 through 1.5) or a feeder put (2.1 through 2.5) are presented. For cases 1.1 through 1.5, corn calls are purchased at different weekly dates during specific months (e.g. May, July, October). The condition for each of these calls is that once lifted during expiration (at different weekly dates in 1st half of September or December), it is either 'at the money' or nearest 'in the money' to the corresponding (delivery) futures price (i.e. smallest positive difference between corresponding futures price and strike price). In addition, feeder cattle is delivered in January (likewise considering different weekly dates) either through the settlement of a prior sold futures contract (1.1a through 1.5a) or directly by a cash sale (1.1b through 1.5b).

For cases 2.1 through 2.5, the feeder cattle put(s) is(are) likewise purchased at different weekly dates during the same specific months (e.g. May, July, October); and under similar conditions of once being lifted at expiration, it is either 'at the money' or nearest 'in the money' to the corresponding (delivery) futures price. Likewise, corn is obtained in 1st half of September or December by either settling a previously purchased futures contract (2.1a through 2.5a), or directly by cash purchase (2.1b through 2.5b). The purpose of including a futures contract for the remaining commodity in the operation (i.e. one without a call or put), is to gauge its level of effect in the variability of the margin. Each case is detailed below:

| **1.1 (a or b)** | **Cash Market** | **Futures & Options Market** |
|---|---|---|
| **May** (Weekly) | | Short Feeder Cattle **(Only a)**: Delivery January.<br>***Long corn 'call' at Strike Price X:***<br>***Delivery in September*** |
| ***September***<br>(1st 2 Weeks) | Buy Corn | Exercise 'in the $' corn option<br>gain: (Fc - X) – premium. |
| **January**<br>(Weekly) | Sell Feeder Cattle | Buy Feeder Cattle **(Only a)** |

| **1.2 (a or b)** | **Cash Market** | **Futures & Options Market** |
|---|---|---|
| **May** (Weekly) | | Short Feeder Cattle **(Only a)**: Delivery January<br>***Long corn 'call' at Strike Price X:***<br>***Delivery in December*** |
| ***December***<br>(1st 2 Weeks) | Buy Corn | Exercise 'in the $' corn option<br>gain: (Fc - X) – premium. |
| **January**<br>(Weekly) | Sell Feeder Cattle | Buy Feeder Cattle **(Only a)** |

| **1.3 (a or b)** | **Cash Market** | **Futures & Options Market** |
|---|---|---|
| **July** (Weekly) | | Short Feeder Cattle **(Only a)**: Delivery January<br>***Long corn 'call' at Strike Price X:***<br>***Delivery in September*** |
| ***September*** (1st 2 Weeks) | Buy Corn | Exercise 'in the $' corn option<br>gain: (Fc - X) – premium. |
| **January** (Weekly) | Sell Feeder Cattle | Buy Feeder Cattle **(Only a)** |

| **1.4 (a or b)** | **Cash Market** | **Futures & Options Market** |
|---|---|---|
| **July** (Weekly) | | Short Feeder Cattle **(Only a)**: Delivery January<br>***Long corn 'call' at Strike Price X:***<br>***Delivery in December*** |
| ***December*** (1st 2 Weeks) | Buy Corn | Exercise 'in the $' corn option<br>gain: (Fc - X) – premium. |
| **January** (Weekly) | Sell Feeder Cattle | Buy Feeder Cattle **(Only a)**: |

| **1.5 (a or b)** | **Cash Market** | **Futures & Options Market** |
|---|---|---|
| **October** (Weekly) | | Short Feeder Cattle **(Only a)**: Delivery January<br>***Long corn 'call' at Strike Price X:***<br>***Delivery in December*** |
| ***December*** (1st 2 Weeks) | Buy Corn | Exercise 'in the $' corn option<br>gain: (Fc - X) – premium. |
| **January** (Weekly) | Sell Feeder Cattle | Buy Feeder Cattle **(Only a)** |

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| **2.1 (a or b)** | **Cash Market** | **Futures & Options Market** |
|---|---|---|
| **May** (Weekly) | | ***Long feeder cattle 'put' at Strike Price Y:***<br>***Delivery in January***<br>Long Corn Delivery September **(Only a)** |
| ***September*** (1st 2 Weeks) | Buy Corn | Sell Corn **(Only a)** |
| **January** (Weekly) | Sell Feeder Cattle | Exercise 'in the $' feeder cattle option<br>gain: (Y – Ffc) – premium. |

| **2.2 (a or b)** | **Cash Market** | **Futures & Options Market** |
|---|---|---|
| **May** (Weekly) | | ***Long feeder cattle 'put' at Strike Price Y: Delivery in January*** |
| | | Long Corn Delivery December **(Only a)** |
| **December** ($1^{st}$ 2 Weeks) | Buy Corn | Sell Corn **(Only a)** |
| **January** (Weekly) | Sell Feeder Cattle | Exercise 'in the $' feeder cattle option gain: (Y – Ffc) – premium. |

| **2.3 (a or b)** | **Cash Market** | **Futures & Options Market** |
|---|---|---|
| **July** (Weekly) | | ***Long feeder cattle 'put' at Strike Price Y: Delivery in January*** |
| | | Long Corn Delivery September **(Only a)** |
| ***September*** ($1^{st}$ 2 Weeks) | Buy Corn | Sell Corn **(Only a)** |
| **January** (Weekly) | Sell Feeder Cattle | Exercise 'in the $' feeder cattle option gain: (Y – Ffc) – premium. |

| **Case 2.4** | **Cash Market** | **Futures & Options Market** |
|---|---|---|
| **July** (Weekly) | | ***Long feeder cattle 'put' at Strike Price Y: Delivery in January*** |
| | | Long Corn Delivery December **(Only a)** |
| ***December*** ($1^{st}$ 2 Weeks) | Buy Corn | Sell Corn **(Only a)** |
| **January** (Weekly) | Sell Feeder Cattle | Exercise 'in the $' feeder cattle option gain: (Y – Ffc) – premium. |

| **2.5 (a or b)** | **Cash Market** | **Futures & Options Market** |
|---|---|---|
| **October** | | ***Long feeder cattle 'put' at Strike Price Y: Delivery in January*** |
| | | Long Corn Delivery December **(Only a)** |
| ***December*** ($1^{st}$ 2 Weeks) | Buy Corn | Sell Corn **(Only a)** |
| **January** (Weekly) | Sell Feeder Cattle | Exercise 'in the $' feeder cattle option gain: (Y – Ffc) – premium. |

The return (margin) for the operator when using a corn call with strike price *X*, that is either 'at the money' or nearest 'in the money' to the futures price upon lifting the option at expiration,[1] is given by:

$$R_{t,i} = S_{fc_{t,i}} - \left(F_{fc_{t,i}} - F_{fc_{t-2,i}}\right) - [S_{c_{t-1,i}} - \{ (F_{c_{t-1,i}} - X) - prem_{c_{t-2,i}} \}] \quad (2)$$

The return (margin) for the operator when using a feeder cattle put with strike price *Y*, that is either 'at the money' or nearest 'in the money' to the futures price upon lifting option at expiration,[2] is given by:

$$R_{t,i} = S_{fc_{t,i}} - \left\{ \left(Y - F_{fc_{t,i}}\right) - prem_{fc_{t-2,i}} \right\} - S_{c_{t-1,i}} + (F_{c_{t-1,i}} - F_{c_{t-2,i}})$$

where $fc$ = feeder cattle; $c$ = corn;
*t* = January, *t-1* = December or September, and *t-2* = October, July or May of a respective year;
*i* = case 1.1a or 1.1b, case 1.2a or 1.2b,….., case 2.4a or 2.4b, case 2.5a or 2.5b.

In addition, the case of not applying any risk strategy (i.e. baseline) is calculated. This case considers only (cash) purchasing corn in September or December, and (cash) selling feeder cattle in January. Prices of a futures contract of feeder cattle (for 50,000 lbs.) and a futures contract for corn (5,000 bu.) where applied in each case, along with their respective option prices, in order to have income compatibility between the two different options.

**Results & Discussion**

The following Tables 1 and 2 contain the margin variability results for applying a corn call, or feeder cattle put, respectively; with corn being delivered *in September*. In addition, Figures 1 and 2 are presented with cases of corn call or feeder cattle put were each case includes either a futures contracts for the remaining commodity (case a.), or just cash for the remaining commodity (case b).

Comparing the variability of the operations when using either a corn call or feeder cattle put (Tables 1 & 2 and Figure 1.) with corn being delivered in September, in general during the early years (2003-2005) as well as the latter periods (2008 onwards) the feeder cattle put results in a bit higher variability, as initially anticipated or hypothesized (i.e. 2.1a and 2.3a are larger than 1.1a and 1.3a, respectively). This result seems to persist despite taking the futures contracts out of the operations for the remaining commodity (i.e. cases b.), where in some periods a lower variability is attained (e.g. 2006-2009). These results will be further studied and investigated by applying regression methods ahead. The baseline operation generally has lower variability for both corn call and feeder cattle put operations that include futures contracts (cases a.). However, once the future contracts are omitted, the baseline case is no longer better than cases where price

[1] In rigor, none of the operations from the cases described were 'at the money'. However, the operation is included as a certain possibility for other (alternative) cases.
[2] Operations from cases previously described were likewise without 'at the money' choices; yet included for other (alternative) cases.

conditions where set in May, especially for corn calls (i.e. 1.1b more than 2.1b). This seems to indicate that once corn price terms are set before the summer growing season, the margin is unaffected by any changing conditions which may arise. This is most clear for the 2009 'spike' period, which was very volatile.

Tables 3 and 4 contain the margin variability results for applying a corn call, or a feeder cattle put; with corn being delivered in *December*. In addition, Figures 3 and 4 are presented with cases of corn call or feeder cattle put were once again, each case includes either a futures contracts for the remaining commodity (case a.), or just cash for the remaining commodity (case b). Similar to prior results, upon comparing the variability of corn call or feeder cattle put operations with corn being delivered in December (Tables 3 and 4 and Figure 3), feeder cattle puts result in a bit higher variability than when using corn calls, specifically during the first years (2003 to 2005) and latter period (post 2008). This is anticipated and in line with September delivery corn. However, after taking out the futures contract of the 'remaining' commodity from each operation (case b and Figure 4), the jump (spike) in variability during 2009 is led mainly by corn call cases over the feeder cattle put operations (i.e. 1.4b and 1.5b over 2.4b and 2.5b). Following 2009, the variability from each feeder cattle put operation is relatively similar up to 2012, where these operations are slightly more variable than with a corn call. In addition, once the futures contracts are not considered in the operations, the variability of the baseline case is slightly above a few of the operations. Moreover, once again the operations that set price conditions in May, especially corn call (i.e. 1.2b and most 2.2b - except before 2005 and for 2012) do not experience substantial increase in variability especially during the volatile year 2009 - in line with prior results for corn delivery in September.

In order to corroborate or add robustness to these findings, yearly linear regressions were applied considering all margins from each operation as outcomes, and explanatory dummy variables assigned to each specific case. Results from the regressions are in Tables 5 and 6 for corn settlement in September and December, respectively.

From Table 5 for most of the years considered, the feeder cattle put operations (that include corn futures) – with a bit higher variability than those with corn call (from prior discussion) – have significant parameters *that change to* zero or become non-significant parameters when attributed to 'just' feeder cattle puts (i.e. case b - when corn is not set with a futures contract but simply cash purchased at September).[3] Only 2004 with operations set in July, or the latter years – 2009, 2010 and 2012 - have variability attributable to 'just' the feeder cattle put operation. On the contrary, from 2005 onwards the variability in the corn call operation (that includes feeder cattle futures) are all significant parameters that subsequently can be generally attributed, in part, to the 'sole' corn call operation from significant parameters in case b (i.e. case b – when feeder cattle is

[3] This is corroborated by additionally including in the regression(s) the outcomes of simply applying the corn futures attributed to the feeder cattle put operations. The estimated parameters obtained are generally large and significant.

simply sold in January and not through a futures contract set in May or July). This can be inferred from the significant parameters from this case (b.) through most of the years, excepting 2011. Thus it seems that the initial higher variability from feeder cattle put operations (Figure 1) is fittingly attributable mainly to the corn futures in its operation (excepting 2004), and not from the thinner option market it has in comparison to that of corn options as initially hypothesized.

Results from Table 6 show that feeder cattle put operations (with corn futures) that were implemented in May and July (i.e 2.2 and 2.4, respectively) generally do not have any variability attributable to 'lone' feeder cattle put operations but would likewise mainly respond to the variability from corn futures.[4] Only from most of the operations implemented in October (i.e. 2.5b) do the 'lone' feeder cattle put operations produce margin variability. For the case of considering the corn call operations, estimated parameters when accounting 'just' for corn call operations (i.e. case b when feeder cattle is arranged via cash, and not with a futures contract) are somewhat significant (about half of them). This occurs when operations are implemented either in May or July (i.e. 1.2 and 1.4, respectively). However in October, and contrary to the feeder cattle put case, the simple corn call operation produces no significant variability and it is mostly attributed to the feeder cattle futures.

From these estimations, it is not possible to argue in favor of a higher variability for feeder cattle options given the thinner trading conditions they are exposed to with respect to trade of corn options. As can be inferred from the previous results, the corn options tend to have higher variability in operations at the money, or nearest at the money under the different cases (scenarios) considered. Thinner feeder cattle option markets may likewise either be out of the money at many instances, or not trade puts at all. Hence the variability from operations that make use of them along with corn futures under the cases considered, mainly respond to the risk in the corn futures contracts.

**Conclusions**

This study compared the variability effect of risk premiums from two different option strategies, applied to the margin of 'back-grounding' feeder cattle operations. The study was conducted under a mean-variance framework. Price conditions for a feeder cattle margin were set, and either a corn call or feeder cattle put were applied to five different yearly scenarios. In addition, futures contracts were likewise considered in the operation for the commodity without the option, in order to gauge the effect on the margin's variability. The study was conducted from 2003 to 2012, thus including the effect from periods of substantial increase in corn demand.

Following the 2007-2008 years, margin variability was in general substantially higher for both type of option strategies. Unexpectedly, the margin operations with corn call had larger variability than with feeder cattle puts - throughout both periods considered (once the effect of

[4] Corroborated similarly to prior settings of corn delivery in September. i.e. including outcomes of merely applying corn futures from the feeder cattle put operations to the regression(s), and obtaining large and significant estimators.

futures contract from the remaining commodity was taken out). The low number of ‘at the money’ or of nearest ‘in the money’ puts for feeder cattle operations (taken at different dates), (e.g. they were mostly ‘out of the money’ or not traded at all), produced overall lower variability in its operations in comparison to the much larger number of operations with corn calls being ‘in the money’ (or closest to ‘at the money’). Thus the expanded number of demanded operations (from a substantially broader market) for corn options, especially during times of increased corn price volatility, produce an overall larger variability of the risk premium in comparison to the thinner traded feeder cattle option market.

One particular operation – mostly using a corn call but also instances of using a feeder cattle put – did not experience substantial increased variability during the latter period of amplified corn demand. The operation(s) began (by setting feeder cattle price conditions) in May and had corn delivered in September or December. A (plausible) reason may be that by setting corn price conditions before summer, for delivery after harvest (and being ‘at the money’ or the nearest ‘in the money’), the operation is unaffected by any changing conditions from new information arriving (increasing risk) during corn’s growth period. Further study may incorporate additional cases (i.e. set conditions during other months of the year) and data to corroborate findings.

Table 1. Corn Calls (*Sept. expiration*) and Feeder Cattle with Futures Contracts (a) or Cash (b)

| | 1.1a | | 1.1b | | 1.3a | | 1.3b | | Baseline | |
|---|---|---|---|---|---|---|---|---|---|---|
| year | n | σ | n | σ | n | σ | n | σ | n | σ |
| 2003 | 128 | 723.26 | 32 | 775.44 | 200 | 352.04 | 40 | 778.77 | 8 | 845.92 |
| 2004 | 128 | 950.57 | 32 | 1,675.79 | 200 | 1,071.38 | 40 | 1,668.07 | 8 | 1,754.51 |
| 2005 | 192 | 1,465.61 | 48 | 1,173.24 | 192 | 1,463.43 | 48 | 1,149.29 | 12 | 1,244.37 |
| 2006 | 75 | 849.02 | 20 | 614.00 | 96 | 1,006.43 | 32 | 773.34 | 8 | 640.39 |
| 2007 | 100 | 948.82 | 30 | 807.16 | 80 | 818.78 | 24 | 816.90 | 6 | 778.64 |
| 2008 | 200 | 1,204.98 | 40 | 783.33 | 200 | 1,421.96 | 40 | 835.86 | 8 | 786.61 |
| 2009 | 128 | 1,578.85 | 32 | 917.50 | 200 | 3,190.85 | 40 | 3,174.35 | 8 | 874.22 |
| 2010 | 128 | 861.74 | 32 | 605.12 | 128 | 536.88 | 32 | 567.87 | 8 | 537.57 |
| 2011 | 192 | 1,489.68 | 48 | 1,633.03 | 192 | 1,009.28 | 48 | 1,647.06 | 12 | 1,778.18 |
| 2012 | 300 | 2,190.50 | 60 | 1,397.70 | 192 | 1,685.84 | 48 | 1,396.45 | 12 | 1,419.53 |

1.1a May price conditions with corn call expiring in *September*; feeder cattle futures for January.
1.1b ; feeder cattle cash in January.
1.3a July price conditions with corn call expiring in *September*; feeder cattle futures for January.
1.3b ; feeder cattle cash in January.
Baseline. Corn cash purchased in September and feeder cattle cash sold In January.

Table 2. Feeder Cattle Puts and Corn with Futures Contracts (a) or Cash (b) (*Sept. delivery*)

| | 2.1a | | 2.1b | | 2.3a | | 2.3b | | Baseline | |
|---|---|---|---|---|---|---|---|---|---|---|
| year | n | σ | n | σ | n | σ | n | σ | n | σ |
| 2003 | 32+ | 862.34 | 8+ | 845.92 | 40+ | 821.56 | 8+ | 845.92 | 8 | 845.92 |
| 2004 | 40 | 2,218.23 | 10 | 2,326.08 | 80 | 1,974.30 | 16 | 2,011.12 | 8 | 1,754.51 |
| 2005 | 48+ | 1,174.24 | 12+ | 1,244.37 | 48+ | 1,149.52 | 12+ | 1,244.37 | 12 | 1,244.37 |
| 2006 | 30* | 557.72 | 8* | 640.39 | 24+ | 692.17 | 8+ | 640.39 | 8 | 640.39 |
| 2007 | 30 | 579.59 | 6 | 455.52 | 80 | 606.99 | 16 | 475.38 | 6 | 778.64 |
| 2008 | 40* | 778.14 | 8* | 786.61 | 170 | 976.54 | 34 | 820.58 | 8 | 786.61 |
| 2009 | 96 | 2,313.34 | 24 | 946.59 | 200 | 4,650.18 | 40 | 1,455.51 | 8 | 874.22 |
| 2010 | 32* | 603.32 | 8* | 537.57 | 112 | 642.04 | 28 | 650.84 | 8 | 537.57 |
| 2011 | 48+ | 1,553.68 | 12+ | 1,778.18 | 48+ | 1,562.55 | 12+ | 1,778.18 | 12 | 1,778.18 |
| 2012 | 195 | 3,918.82 | 39 | 3,677.22 | 156 | 3,018.44 | 39 | 2,617.01 | 12 | 1,419.53 |

* **NO Puts traded**

\+ **ALL Puts OUT of the MONEY**

2.1a *May* price conditions with corn futures for *September*; feeder cattle put for January.
2.1b with corn cash in *September;* feeder cattle put for January.
2.3a *July* price conditions with corn futures for *September*; feeder cattle put for January.
2.3b with corn cash in *September*; feeder cattle put in January.
Baseline. Corn cash purchased in *September* and feeder cattle cash sold In January

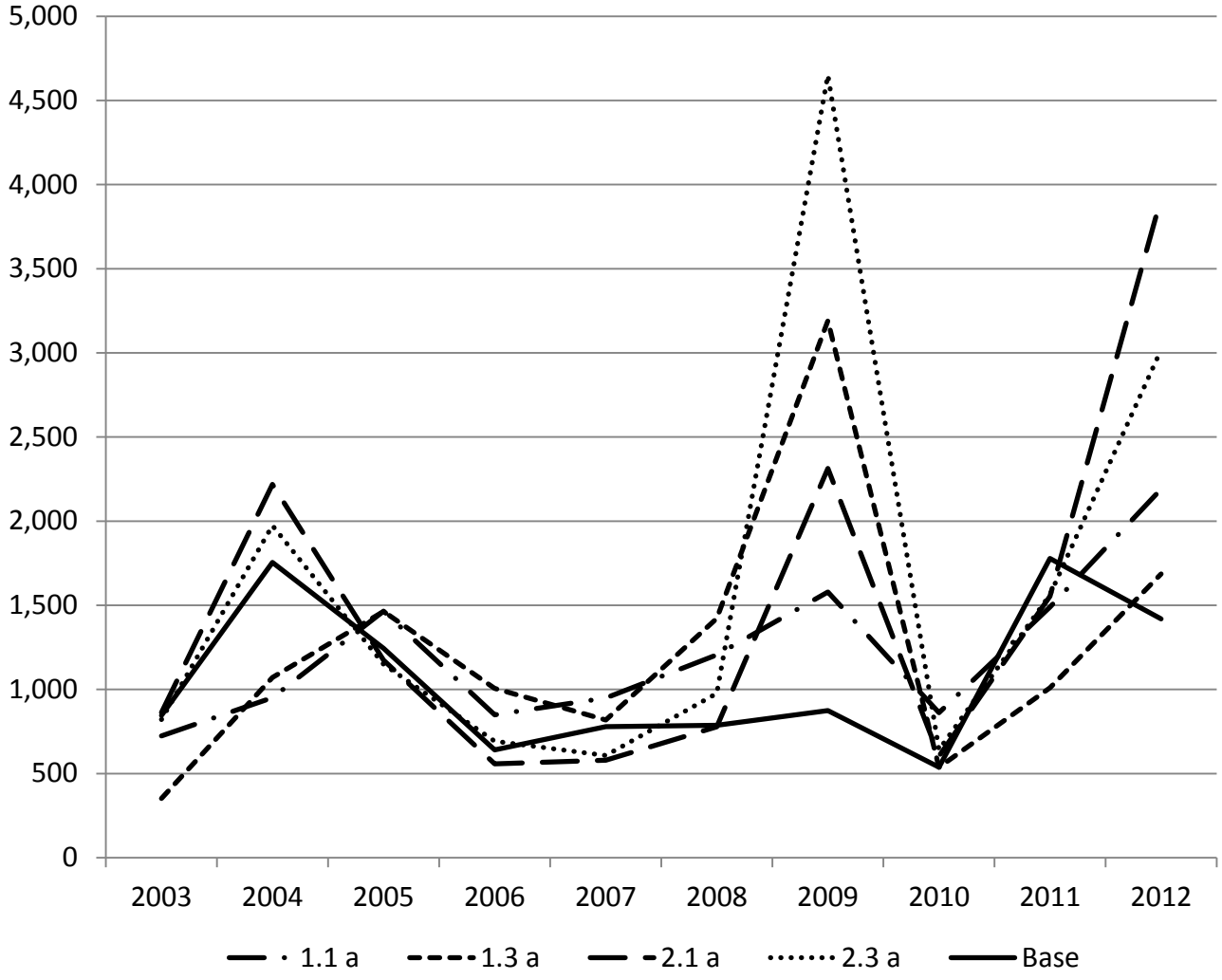


Figure 1. Margin Variability Corn Call or Feeder Cattle Puts - September Corn Delivery

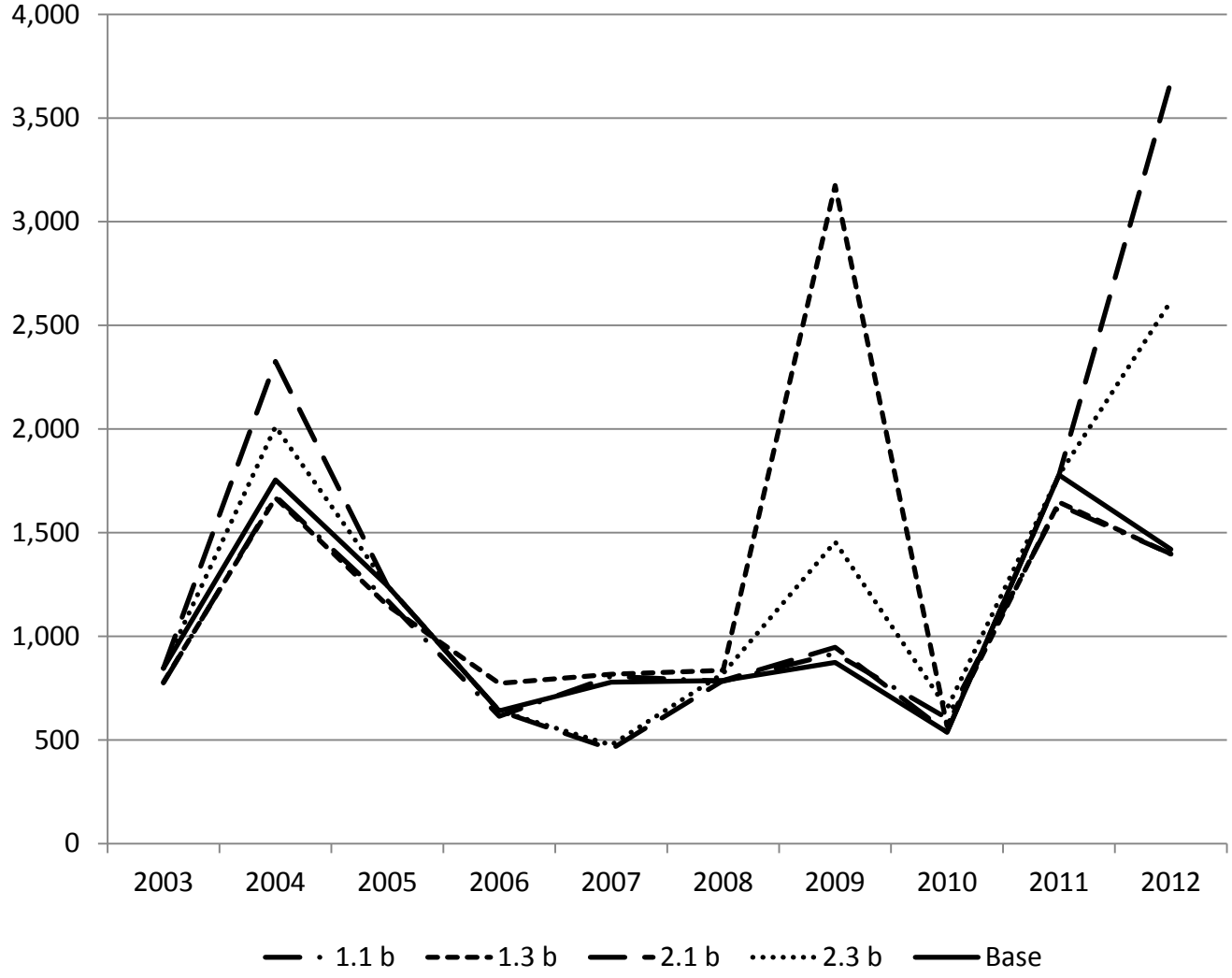


Figure 2. Margin Variability: Corn Call or Feeder Cattle Puts (Without Futures) - September Corn Delivery

Table 3. Corn Calls (*Dec. expiration*) and Feeder Cattle with Futures Contracts (a) or Cash (b)

| | 1.2a | | 1.2b | | 1.4a | | 1.4b | | 1.5a | | 1.5b | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| year | n | σ | n | σ | n | σ | n | σ | n | σ | n | σ |
| 2003 | 128 | 705.78 | 32 | 758.76 | 200 | 396.56 | 40 | 800.32 | 200 | 883.69 | 40 | 792.65 |
| 2004 | 128 | 939.45 | 32 | 1,669.36 | 200 | 1,064.67 | 40 | 1,663.68 | 200 | 1,663.74 | 40 | 1,661.92 |
| 2005 | 192 | 1,458.82 | 48 | 1,164.61 | 196 | 1,415.79 | 48 | 1,086.97 | 192 | 1,112.60 | 48 | 956.06 |
| 2006 | 45 - | 819.13 | 9 - | 471.86 | 144 | 998.37 | 48 | 760.85 | 225 | 465.88 | 48 | 557.40 |
| 2007 | 150 | 890.65 | 30 | 610.05 | 150 | 743.86 | 36 | 735.67 | 150 | 1,476.27 | 36 | 736.44 |
| 2008 | 200 | 1,238.56 | 40 | 835.08 | 200 | 1,440.57 | 40 | 867.76 | 200 | 1,500.23 | 40 | 851.19 |
| 2009 | 128 | 1,567.24 | 32 | 896.89 | 200 | 3,312.47 | 40 | 3,310.23 | 200 | 2,289.80 | 40 | 1,748.36 |
| 2010 | 128 | 1,331.15 | 32 | 569.54 | 128 | 1,232.01 | 32 | 696.97 | 128 | 1,269.43 | 32 | 697.55 |
| 2011 | 192 | 1,603.97 | 48 | 1,594.48 | 192 | 926.69 | 48 | 1,596.99 | 240 | 1,279.84 | 48 | 1,674.91 |
| 2012 | 300 | 2,198.76 | 60 | 1,410.78 | 192 | 1,922.38 | 48 | 1,678.44 | 300 | 1,376.01 | 60 | 1,478.56 |

- **ALL Calls OUT of the MONEY**

  **Baseline Values similar as for Table 1.**

1.2a May price conditions with corn call expiring in *December*; feeder cattle futures for January.
1.2b ; feeder cattle cash in January.
1.4a July price conditions with corn call expiring in *December*; feeder cattle futures for January.
1.4b ; feeder cattle cash in January.
1.5a October price conditions & corn call expiring in *December*; feeder cattle futures for Jan.
1.5b ; feeder cattle cash in January

Table 4. Feeder Cattle Puts and Corn with Futures Contracts (a) or Cash (b) (*Dec. delivery*)

| | 2.2a | | 2.2b | | 2.4a | | 2.4b | | 2.5a | | 2.5b | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| year | n | σ | n | σ | n | σ | n | σ | n | σ | n | σ |
| 2003 | 32+ | 793.85 | 8+ | 793.64 | 40+ | 819.75 | 8+ | 793.64 | 80 | 1,060.34 | 18 | 1,052.37 |
| 2004 | 40 | 2,212.86 | 10 | 2,324.59 | 80 | 1,958.12 | 16 | 2,009.46 | 200 | 1,544.96 | 40 | 1,520.14 |
| 2005 | 48+ | 1,161.51 | 12+ | 992.83 | 48+ | 1,086.97 | 12+ | 992.83 | 192 | 1,128.92 | 48 | 1,141.24 |
| 2006 | 45* | 543.12 | 12* | 574.92 | 32+ | 689.17 | 12+ | 574.92 | 120 | 426.39 | 24 | 445.71 |
| 2007 | *45* | 576.05 | 9 | 1,009.11 | 120 | 582.68 | 24 | 565.33 | 105 | 1,236.60 | 21 | 606.80 |
| 2008 | 40* | 778.52 | 8* | 868.19 | 170 | 924.48 | 34 | 891.65 | 200 | 892.35 | 40 | 761.52 |
| 2009 | *96* | 988.47 | *24* | 946.59 | 200 | 3,532.30 | 40 | 1,455.51 | 200 | 1,870.91 | 40 | 1,034.55 |
| 2010 | 32* | 619.96 | 8* | 912.05 | 112 | 623.92 | 28 | 957.18 | 160 | 1,107.81 | 32 | 880.95 |
| 2011 | 48+ | 1,551.24 | 12+ | 1,677.25 | 48+ | 1,559.80 | 12+ | 1,677.25 | 60+ | 2,740.65 | 12+ | 1,677.25 |
| 2012 | 195 | 3,847.09 | 39 | 3,667.26 | 156 | 2,913.88 | 39 | 2,612.79 | 300 | 1,376.73 | 60 | 890.93 |

* **NO Puts traded**

\+ **ALL Puts OUT of the MONEY**

**Baseline Values similar as for Table 2.**

2.2a *May* price conditions with corn futures for *December*; feeder cattle put for January.

2.2b with corn cash in *December;* feeder cattle put for January.

2.4a *July* price conditions with corn futures for *December*; feeder cattle put for January.

2.4b with corn cash in *December*; feeder cattle put in January.

2.5a *October* price conditions with corn futures for *December*; feeder cattle put for January.

2.5b with corn cash in *December*; feeder cattle put in January

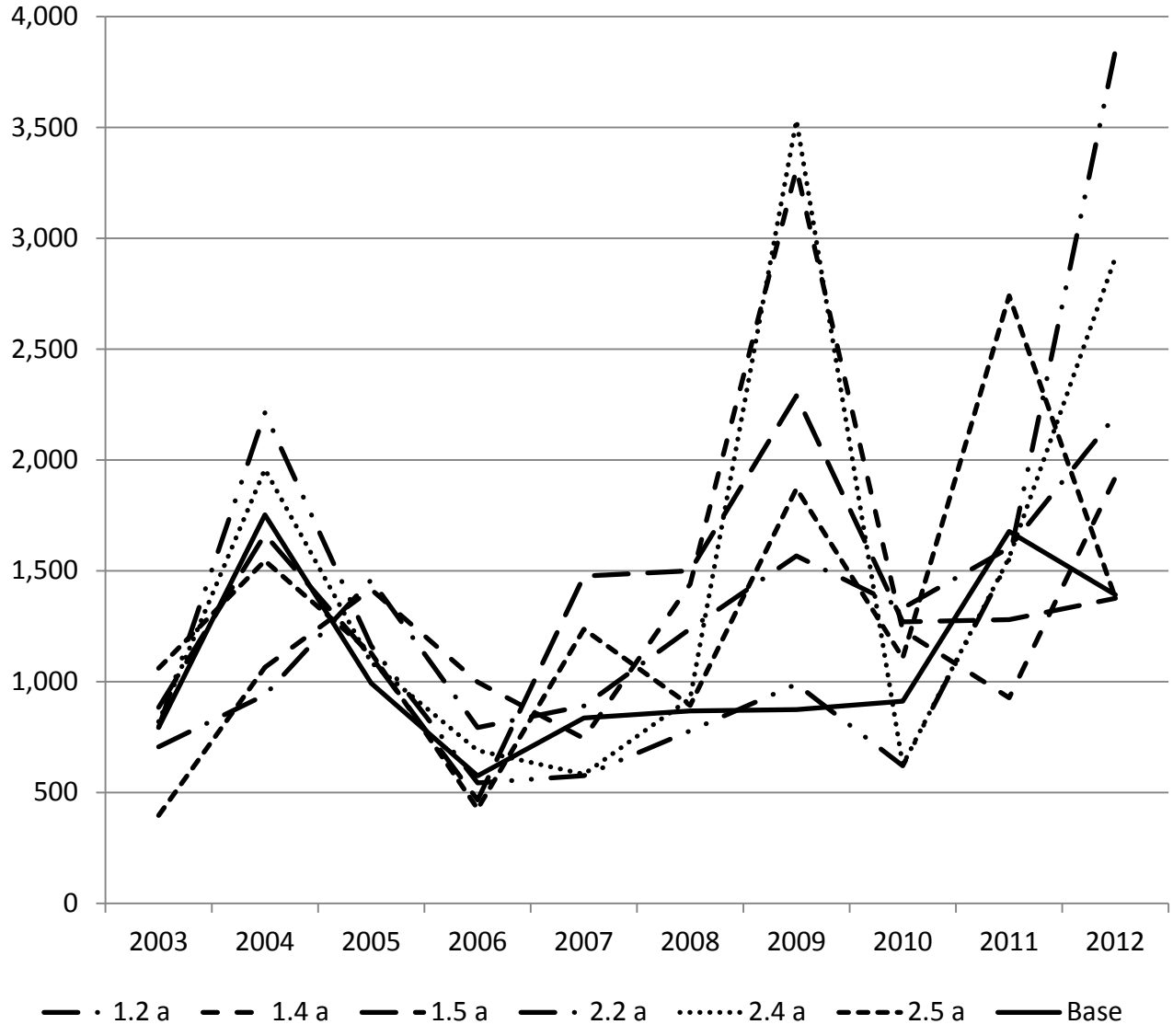


Figure 3. Margin Variability Corn Call or Feeder Cattle Puts - December Corn Delivery

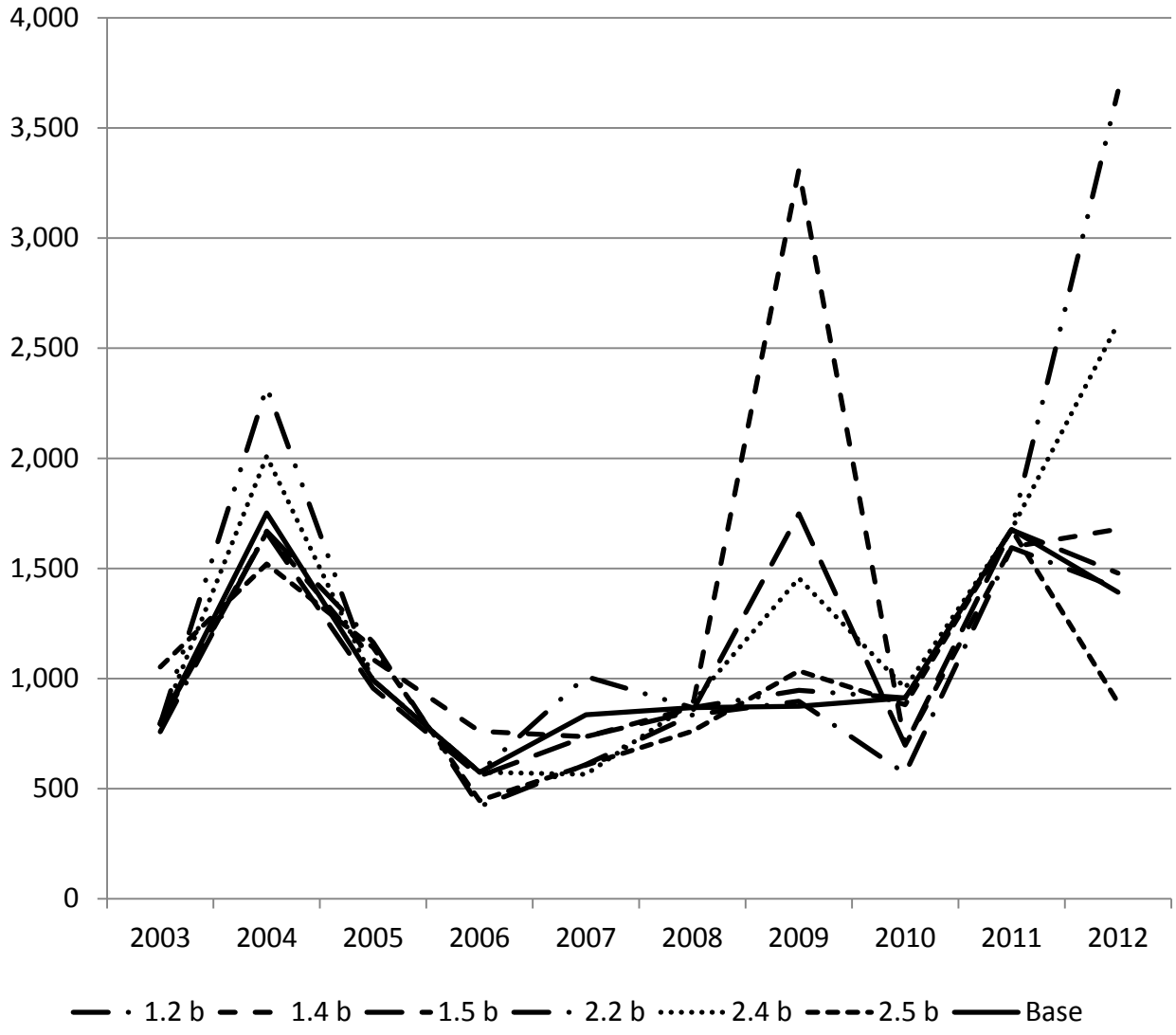


Figure 4. Margin Variability: Corn Call or Feeder Cattle Puts (Without Futures) - December Corn Delivery

Table 5. OLS estimated parameters for yearly operation outcomes from Corn calls and Feeder Cattle put with September Corn Settlement

| | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|---|---|---|
| Interc. | 25,937.50* | 30,461.25* | 40,176.67* | 45,450.00* | 34,697.50* | 30,727.50* | 18,052.50* | 30,385.00* | 36,825.83* | 33,901.67* |
| 1.1a | -2,166.44* | -1,951.56* | -8,582.29* | -5,296.15* | 720.00* | 1,929.37* | 3,618.53* | -4,173.44* | -6,940.10* | -12,804.25* |
| 1.1b | 183.56 | -914.06 | -4,149.17* | -1,268.75* | -1,908.75* | -2,864.38* | -4,803.34* | -6,045.31* | -233.85 | -1,992.50* |
| 1.3a | -2,380.62* | -608.75 | -1,690.63* | -7,720.94* | 4,401.87* | 6,745.62* | 4,157.50* | 1,434.38* | 6,189.06* | -6,733.85* |
| 1.3b | 133.12 | -36.25 | -1068.75* | -1,939.06* | -1,259.38* | -448.13 | -5,998.75* | -1,293.75* | 98.44 | -415.10 |
| 2.1a | 11,009.4* | -1,340.13* | -3,195.62* | -738.33* | -2,337.08* | -2,092.50* | 2,238.96* | -6,031.25* | 3,775.00* | -8,109.42* |
| 2.1b | (1) | -855.75 | (1) | (2) | -558.33 | (2) | 4,885.83* | (2) | (1) | -10,629.17* |
| 2.3a | 1,872.50* | -672.50 | -978.12* | -1,702.71* | -864.38* | 148.82 | -3,853.12* | -1,888.39* | 3,884.38* | -2,672.28* |
| 2.3b | (1) | -1,562.50* | (1) | (1) | 243.37 | -41.18+ | 432.50 | -863.39* | (1) | -6,457.69* |
| n | 551 | 698 | 696 | 345 | 452 | 852 | 912 | 596 | 684 | 1254 |
| Adj. $R^2$ | 0.9636 | 0.1797 | 0.8321 | 0.8407 | 0.9028 | 0.8811 | 0.6761 | 0.9425 | 0.8897 | 0.7919 |

(1) All Puts 'out of the Money'

(2) No Puts traded

*Significant at $p < 0.05$

+Significant at $p < 0.10$

Table 6. OLS estimated parameters for yearly operation outcomes from Corn calls and Feeder Cattle put with December Corn Settlement

| | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|---|---|---|
| Interc. | -27,662.50* | 30,311.25* | 41,718.33* | 45,070.83* | 27,495.83* | 26,752.50* | 28,752.50* | 27,335.00* | 30,492.50* | 41,643.33* |
| 1.2a | -2,898.44* | -1,732.81* | -9,737.50* | -4,027.50* | 2,680.00* | 3,195.62* | -6,515.62* | -1,031.56* | -7,117.81* | -16,115.42* |
| 1.2b | -548.44+ | 695.31 | -5,090.62* | (3) | 425.00 | -1,418.13* | -14,937.50* | -3,920.31* | -86.92 | -5,301.67* |
| 1.4a | -3,0516.25* | -480.00 | -3,215.62* | -8,777.71* | 5,929.17* | 6,843.75* | -7,797.50* | 3,439.53* | -6,238.54* | -10,723.96* |
| 1.4b | -1,002.50* | 92.50 | -2,705.00* | -2,995.83* | 246.98 | -350.00 | -17,935.50* | -305.47 | 48.96 | -4,405.21* |
| 1.5a | -1,623.13* | 4280.00* | 1,420.31* | -463.33* | 4,782.08* | 6,528.75* | -3,453.75* | -177.66 | -7,941.88* | -6,057.92* |
| 1.5b | -911.88* | 5.00 | -517.19 | -585.42 | 300.62 | -122.50 | -5,142.50* | -488.28 | -693.23 | -3,004.17* |
| 2.2a | 687.50* | 683.87 | -5,807.50* | -1,736.67* | 4,093.33* | 857.50 | -10,060.26* | -2,762.50* | 8,778.12* | -13,850.26* |
| 2.2b | (1) | -855.75 | (1) | (2) | -41.39 | (2) | 4,885.83* | (2) | (1) | -9,680.77* |
| 2.4a | 326.25 | -123.75 | -2,593.75* | -2,776.67* | 5,427.29* | 2,478.82* | -17,300.00* | 1,458.48* | 8,725.00* | -9,575.40* |
| 2.4b | (1) | -1,562.50* | (1) | (1) | 300.62 | -41.48 | 432.50 | -863.39+ | (1) | -6,570.00* |
| 2.5a | 1,879.03* | 1,139.00* | -1,879.03* | -1,653.65* | 3,176.31* | 1,895.50* | -6,255.00* | -592.19 | 1,822.50* | -6,490.21* |
| 2.5b | -1,055.28* | -112.25 | -1,055.28* | -1,130.00* | 64.64 | 343.00 | -5,057.50* | -1,529.69* | (1) | -4,071.88* |
| n | 980 | 1216 | 1272 | 873 | 1056 | 1412 | 1368 | 1020 | 1080 | 1929 |
| Adj. $R^2$ | 0.9636 | 0.6253 | 0.8917 | 0.9556 | 0.7738 | 0.8256 | 0.8788 | 0.7433 | 0.9205 | 0.8019 |

(1) All Puts 'out of the Money'

(2) No Puts traded

(3) All Calls 'out of the Money'

*Significant at $p < 0.05$

+Significant at $p < 0.10$

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