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by

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Pre-Spreading and Returns to Storage.

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Pre-Spreading and Returns to Storage.

Returns to storage at the farm level have received much attention in the literature. The main objective of this paper was to analyze returns to storage at the elevator or merchandising level. Specifically basis trading and pre-spreading marketing strategies are empirically evaluated with respect to an October- March storage period in North Central Illinois corn. Results indicate that basis trading strategy is able to enhance returns to storage and reduce the risk associated with storing grain. Although pre-spreading strategy results in higher returns to storage for some years, there is no systematic evidence that pre-spreading can enhance returns or reduce risk above and beyond a simple basis trading strategy.

Keywords : Basis trading, pre-spreading, returns to storage

Introduction

Each year crop farmers are faced with the decision of whether to sell their crops at harvest time (September through November for most US crops) to their local grain elevator, or to store their crops in the hope of selling them to their local grain elevator for a higher price at a later date. This is a complicated decision as grain prices are very volatile and unpredictable. In other words when making the decision, "to store, or not store," the farmer cannot be sure if prices at a later date will be high enough to cover his/her storage costs, or if they will even be higher than harvest-time prices. One way for a farmer to remove this price uncertainty is to sell futures contracts to hedge his/her cash grain. Futures contracts are traded on Chicago Board of Trade for all major grains. Each futures contract represents the price of a specific commodity (e.g. corn), for a specific quantity (e.g. 5,000 bushels), for a specific future delivery period (e.g. December). By selling a December corn future contract a farmer is obligated to deliver 5,000 bushels of corn in December at a fixed price, established today. By selling futures contracts farmers are able to lock in a price for their grain (a process known as hedging) months before they are harvested – removing price risk. Hedging grain in this manner leaves the farmer with a basis position. Basis is defined as a local cash, or spot, price less a futures price for the same commodity. For example, if the bid for No. 2 yellow corn at an elevator in Peoria, Illinois is $2.75 and the December No. 2 yellow corn futures contract at the Chicago Board of Trade is valued at $3.00, then the Peoria, Illinois basis is -$0.25 DEC, or 25 cents under the December futures. Basis patterns (changes in basis over time) are much more predictable than price patterns (changes in price over time). Typically, basis tends to increase after harvest-time through the next calendar year. For a farmer who has hedged his/her crop and then stores it, any increase in basis adds to his/her bottom line or selling price. So if basis increases from -$0.25 DEC to +$0.05 DEC over the storage period the basis the farmer will be able to sell his/her crop at the end of the storage period will be 30 cents higher than the price he/she could have sold the crop for at the beginning of the storage period. However, storing grain is not costless, and storage costs accumulated over

the storage period will subtract from the end selling price. Thus basis trading will benefit producers when basis movements exceed storage costs.

The potential for using this type of post-harvest marketing strategy to increase farmers' returns to storage has received much attention in literature (Zulauf and Irwin 1998; Kastens and Dhuyvetter, 1999; and Siaplay, Anderson and Brorsen, 2007). In particular, previous research suggests that strategies which incorporate futures prices and basis levels to gauge expected returns to storage – a concept first explained by Working, 1953 – may have some merit. By hedging cash grain at harvest time, and then storing grain until the delivery month, farmers could take advantage of cash and futures price convergence to capture basis increases, and so increase returns. Grain elevators routinely use this type of strategy, popularly referred to as basis trading (going long-the-basis) within the grain industry, to enhance merchandising margins. Indeed, basis trading has also been advocated by extension economists to farmers as means of increasing returns to storage. In reality, however, elevators augment their basis trades by pre-spreading futures contracts prior to harvest-time. To pre-spread futures contracts means to simultaneously buy futures contracts with a delivery date of harvest time and sell futures with a later delivery date. This action allows elevators to use the futures market to pay for storage costs that will be incurred over the storage period. Thus when pre-spreading is used in conjunction with basis trading any positive basis movements will directly add to the sale price of a crop.

The main objective of this study is to statistically analyze if basis trading and pre-spreading type strategies increase returns to storage and reduce returns risk for hedged grain positions. Strategies are compared to simply storing cash grain (un-hedged position). Daily elevator bid cash prices observed in North Central Illinois are used in the empirical analysis.

Methods and Approach

Basis Trading

Basis can be used as a signal to store grain after harvest (Woking, 1953).

(1) $$F_t^{t+1} - S_t > SC_t \ ,$$

Equation (1) shows that if the difference between current futures price F_t^{t+1} and spot price S_t, observed at harvest-time for a delivery location (basis in absolute value terms), exceeds storage costs, SC_t, then this can be taken as a signal to store grain. Under such circumstances, storing and hedging grain (basis trading) over period *t+1* will result in higher net returns than selling grain today (period *t*). Storage costs are calculated as

(2) $$SC_t = (S_t).(r).(154/360) \ ,$$

where *r* is current annual prime interest rate observed in time period *t* plus 2%. The 2% accounts for additional expenses associated with storing gain such as shrink and insurance. The term

$(154/360)$ represents the number of storage days from October to March as a fraction of days in a year.

Net returns to basis trading are then

(3) $$Net\ returns = (S_{t+1} - F_{t+1}^{t+1}) - (S_t - F_t^{t+1}) - SC_t.$$

In this case, because grain is stored at a delivery location, and so basis at *t+1* is zero (or $F_{t+1}^{t+1} = S_{t+1}$), equation (3) reduces to

(4) $$Net\ returns = F_t^{t+1} - S_t - SC_t.$$

Thus following the basis signal in equation (1), and trading the basis at the delivery location when $F_t^{t+1} - S_t > SC_t$, will ensure that the net returns are captured.

The success of such a strategy is less certain when storing grain at non-delivery locations – the situation faced by farmers and country grain elevators. In this case basis storage signal is expressed as

(5) $$F_t^{t+1} + E_t(S_{t+1} - F_{t+1}^{t+1}) - S_t > SC_t,$$

where the term $E_t(S_{t+1} - F_{t+1}^{t+1})$ reflects the expected basis at the end of the storage period (futures contract maturity time). In this case if the signal indicates to store, net returns to basis trading are as in equation (3). In grain industry this form of basis trading is referred to as going Long-the-Basis. At harvest time the elevator forms a buy basis (buy cash grain and sell futures: $S_t - F_t^{t+1}$). The lower the initial buy basis the greater potential for higher net returns to storage. At the end of the storage period the elevator forms a sell basis (sell cash and buy futures: $S_{t+1} - F_{t+1}^{t+1}$). The higher the sell basis the greater the potential for higher net returns to storage. In effect the two-step transactions offset the elevator's futures position allowing him/her to sell grain and profit from a positive change in the basis over the storage period. Although, there is now basis risk when storing grain, seasonal patterns in basis allow elevators and farmers to make fairly accurate predictions about $E_t(S_{t+1} - F_{t+1}^{t+1})$, and hence determine the potential returns that may be earned by basis trading in any particular year. In our empirical analysis we follow Zulauf and Irwin (1998) by using the previous year's basis at contract maturity to proxy current year's expected basis.

Spreading

The act of spreading futures positions refers to "rolling" futures hedges from one contract to another. This typically occurs when grain is stored for a long period of time, and so hedged positions (buy basis positions) initially established against the nearby harvest-time contract will have to be rolled or spread into deferred maturity contracts as the nearby contract approaches maturity. When futures contracts for different delivery periods (termed market structure) are trading at successively higher prices, spreads between contracts will be positive and the market

structure will be at a “carry”. In other words higher futures prices for later delivery periods provide firms with an incentive to store commodities and sell at higher prices later in the year. Basis levels tend to follow spreads, so when there is a carry market structure basis will tend to increase over time. Thus under a Long-the-Basis strategy firms storing hedged grain (against nearby contracts) will earn the spread (increases returns) as hedged positions are rolled into later maturing contracts.

Pre-Spreading

Next we turn to the concept of pre-spreading, a strategy commonly employed by elevators to lock in good carry spreads prior to buying grain at harvest-time. Pre-spreading is used prior to harvest in anticipation of buying and carrying grain post-harvest. To motivate the idea of pre-spreading we present a simple example in table 1 of the mechanics needed to transact the pre-spread and generate additional returns to storage. In April the elevator anticipates buying corn at harvest-time (October) and storing it until March, so he sets a pre-spread by buying December futures at $4.00 and simultaneously selling March futures at $4.60. It is assumed that this +$0.60 carry pre-spread will more than cover expected storage costs. At harvest time as cash grain is bought at $3.80, December futures contracts are sold at $4.20. This creates a normal harvest time buy basis of -0.40 December. However, because the elevator already had a December Mach pre-spread established, December futures positions would be automatically offset and the elevator would in effect have a buy basis adjusted for the spread of -1.00 March. By capturing a good (high) carry pre-spread prior to harvest the elevator ensures a good (low) buy basis to carry grain. To conclude our example, grain is finally sold in March and March futures position offset, resulting in a margin of $0.95 per bushel before accounting for storage costs. For a pre-spread to enhance returns to storage the pre-spread must be higher than the harvest-time spread. This is ultimately an empirical question, which we address in the Results section of the paper. Another empirical issue that we will address is whether pre-spreading can reduce return risk.

In this paper we consider pre-spreads between December (harvest-time) corn futures and March (post-harvest) futures. The time frame we consider for the pre-spread is from April 1 to October 1 (26 pre-harvest weeks). Of course this begs the question as to what constitutes a good pre-spread? We consider a trading rule based upon the percentage coverage of expected storage costs by the pre-spread. We empirically test cases for each year in the sample period whereby pre-spread levels at 100%, 125%, and 150% of expected storage costs are transacted at the first available opportunity (beginning April 1). Obviously, there is a trade off – although the higher coverage levels the better, also the higher the coverage level chosen, the less likely it will actually be available during the pre-harvest window. We calculate expected storage costs (opportunity costs of storing grain) as

(6) $$E_{t-1}(SC_t) = E_{t-1}(S_t).(r).(154/360),$$

where the forecast of $E_{t-1}(S_t)$ comprise harvest time futures price plus expected current year basis.

(7) $E_{t-1}(S_t) = F_{t-1}^{t} + E_{t-1}(S_t - F_t^{t})$.

In our empirical application, we use last year's harvest basis as a forecast of current year's expected basis.

Analogous to the basis trading strategy, the basis signal with pre-spreads is

(8) $F_t^{t+1} + (F_{t-1}^{t+1} - F_{t-1}^{t}) + E_t(S_{t+1} - F_{t+1}^{t+1}) - S_t > SC_t$,

where the additional term $(F_{t-1}^{t+1} - F_{t-1}^{t})$ represents the pre-spread. Also, with pre-spreads net returns are defined as

(9) $Net\ returns = (S_{t+1} - F_{t+1}^{t+1}) - (S_t - F_t^{t+1}) + (F_{t-1}^{t+1} - F_{t-1}^{t}) - SC_t$,

again with the additional pre-spread term $(F_{t-1}^{t+1} - F_{t-1}^{t})$ included.

If no opportunity arises in the pre-harvest period to transact at these pre-spread levels then for that particular year and spread level case it is assumed the elevator will have to store and basis trade grain without a pre-spread. In other words in such situations net returns for that particular year and pre-spread level will be identical to trading basis using March futures (as measured by equation 3). In addition, it is assumed that in both basis trading and basis trading with pre-spread cases, if the basis signal indicates it is not advantageous to store, then storage does not take place. In years during the sample period when this occurs, returns to storage for all three strategies (un-hedged, basis trading, and basis trading with pre-spreads) are not calculated and are in effect excluded from the empirical analysis. This only occurs for two crop years (1996-1997 and 1997-1998), and net returns for all three strategies are omitted for these years.

In summary, it is our objective to empirically test whether basis trading and basis trading with pre-spreads are able to enhance returns to storage and/or reduce return risk compared to a simple strategy of storing grain un-hedged. To implement the analysis we use daily North Central Illinois elevator corn cash bid prices (collected from Agricultural Marketing Service), daily settlement Chicago Board of Trade corn future prices, and daily St. Louis Federal Reserve Bank prime interest rates, from April 1992 through July 2009 (17 years).

Results

Figure 1 illustrates historical weekly average December/March pre-spreads as a percentage of expected storage costs over the pre-harvest period (26 weeks from April 1 to October 1). Interestingly, better pre-spreads (covering a higher percentage of expected storage costs) are on average offered by the market place closer to harvest-time. There is a noticeable upward trend in average pre-spread percentage coverage from April to October. Between 14 weeks or less before harvest pre-spreads on average cover greater than 100% of expected storage costs. In the 10 week period just prior to harvest, on average, pre-spreads covering 110-155% of expected storage costs can be attained 95% of the time. This would suggest that pre-spreading too early in

the year may not be the best strategy, but good pre-spreads opportunities are available over the 14 week period just prior to harvest.

Our base case strategy, of storing un-hedged cash corn when basis signal indicates store, is presented in figure 2. Average net returns to un-hedged storage are positive and increase over the storage period, ranging from 5 cents per bushel by week 4 to 35 cents per bushel by week 21. However, average net returns to un-hedged storage are not significantly different from zero at the 5% test level. This indicates that using a basis signal to decide when to store does not yield systematic positive net returns. The wide 95% confidence interval incorporates losses as well as positive returns for all but week 14 of the post-harvest storage period. This is consistent with Zulauf and Irwin who found basis signal was not useful in making the decision of whether to store un-hedged corn.

Turning to results of basis trading with a basis signal, average net returns are presented in figure 3. In contrast to results with respect to storing un-hedged corn, net returns to basis trading are significantly positive from week 5 onwards. Average net returns to basis trading although lower than average net returns to un-hedged grain are much less variable and peak at 17 cents per bushel by week 20. This provides strong evidence that basis trading is able to reduce risk of storing grain and ensure that on average systematic positive returns can be earned by elevators or farmers who basis trade.

Next we address the issue of whether pre-spreading at various percentage coverage levels of expected storage costs levels in combination with basis trading is able to enhance average net returns to storage (increase net returns and/or reduce net return risk) over and above average net returns generated from basis trading alone. Figures 4 and 5 summarize our empirical conclusions with respect to this issue. Figure 4 shows that pre-spreading at the 100% and 125% coverage levels yields lower average net returns compared with basis trading with no pre-spreads set. This suggests that on average buy basis levels established at harvest are lower than harvest buy basis levels adjusted for spreads. Pre-spreads at the 100% level are attainable for every year in the sample period, but actually yield on average lower net returns. Similarly pre-spread levels at the 125% level are attainable for all but 3 years in the sample period, but again yield on average lower net returns. Finally, pre-spreading at the 150% level results in almost identical average net returns to simply basis trading (with no pre-spreads set). These spread levels are attained approximately half of the time (9 years out of 17 in sample period). Of these 9 years, 5 of them yield net returns higher than simply basis trading. Statistically, there is in fact no difference in net returns between any of the pre-spread levels and basis trading (with no pre-spreads set). In other words the corn futures market does not appear to be offering systematically higher carrying premiums in the pre-harvest period. In sum, extending the marketing window to include pre-harvest period does not appear to enhance net returns to storage.

Finally, in figure 5 we present standard deviations of average net returns for each week in the post-harvest storage period with respect to each of our pre-spread level and basis trading strategies. In general, standard deviations increase for all strategies as the storage period increases. In other words the longer an elevator or farmer stores, the greater his net return-risk. However, we find no statistical evidence that risk differs across strategies. So pre-spreading irrespective of level does not reduce the return risk of basis trading (without pre-spreads).

Conclusions

In summary, we find that average net returns for un-hedged corn over an October to March storage period are not significantly different from zero. In some years, farmers or elevators storing grain in this manner will earn large net returns, while in other years they will sustain large losses. Figure 2 shows that 95% of the time average net returns will range between 70 cents per bushel and -5 cents per bushel by week 21 of our storage period. In contrast, average net storage returns to basis trading are significantly positive and much less variable. Figure 3 shows that that 95% of the time average net returns will range between 23 cents per bushel and 13 cents per bushel by week 21 of our storage period. In sum, our results suggest there are significant risk-return advantages to basis trading as opposed to storing un-hedged corn.

However, we find no evidence that pre-spreading offers similar risk-return advantages over simply basis trading without pre-spreads. Average net storage returns across pre-spread levels and basis trading without pre-spreads are not statistically different from each other. Similarly, standard deviation of net storage returns across pre-spread levels and basis trading without pre-spreads are not statistically different from each other.

References:

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Working, H. "Futures Trading and Hedging." 1953. *American Economic Review*, 43:314-343.

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Table 1 Pre-Spreading example

Time	Cash		December Futures		March Futures		Basis
	Buy	Sell	Buy	Sell	Buy	Sell	
April			4.00			4.60	+0.60 spread
October	3.80			4.20			-0.40 December Buy Basis
							-1.00 Adjusted Buy Basis
March		4.40			4.45		-0.05 March Sell Basis
Return	+0.60		+0.20		+0.15		+0.95

Figure 1.

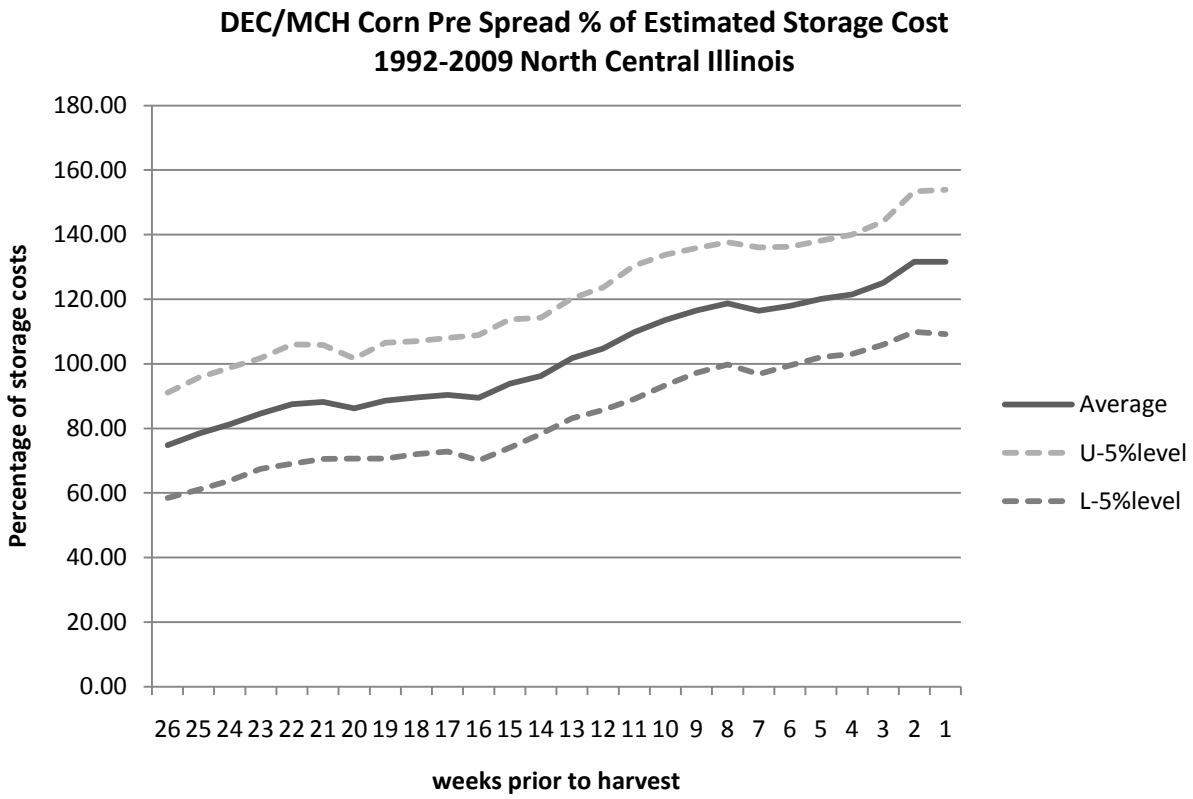

DEC/MCH Corn Pre Spread % of Estimated Storage Cost
1992-2009 North Central Illinois
Percentage of storage costs
180.00
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
weeks prior to harvest
Average
U-5%level
L-5%level

Figure 2.

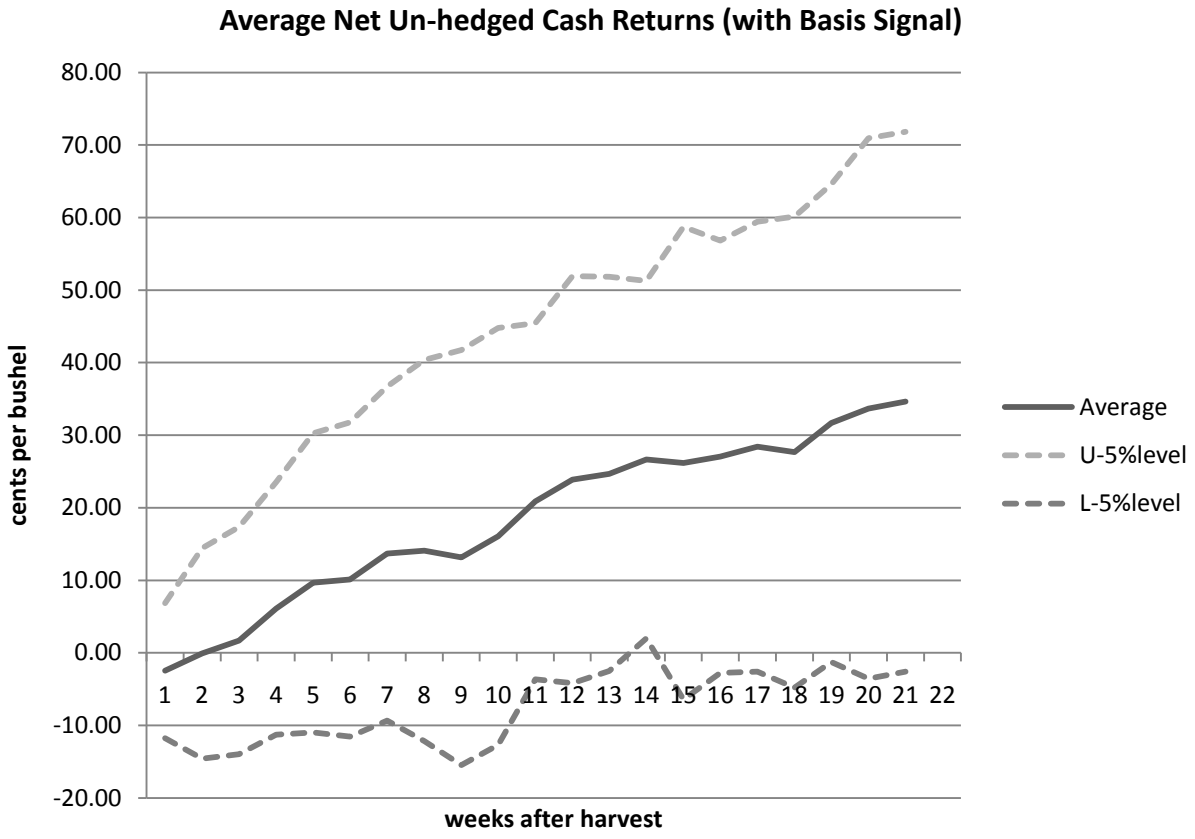

Average Net Un-hedged Cash Returns (with Basis Signal)
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
-10.00
-20.00
cents per bushel
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
weeks after harvest
Average
U-5%level
L-5%level

Figure 3.

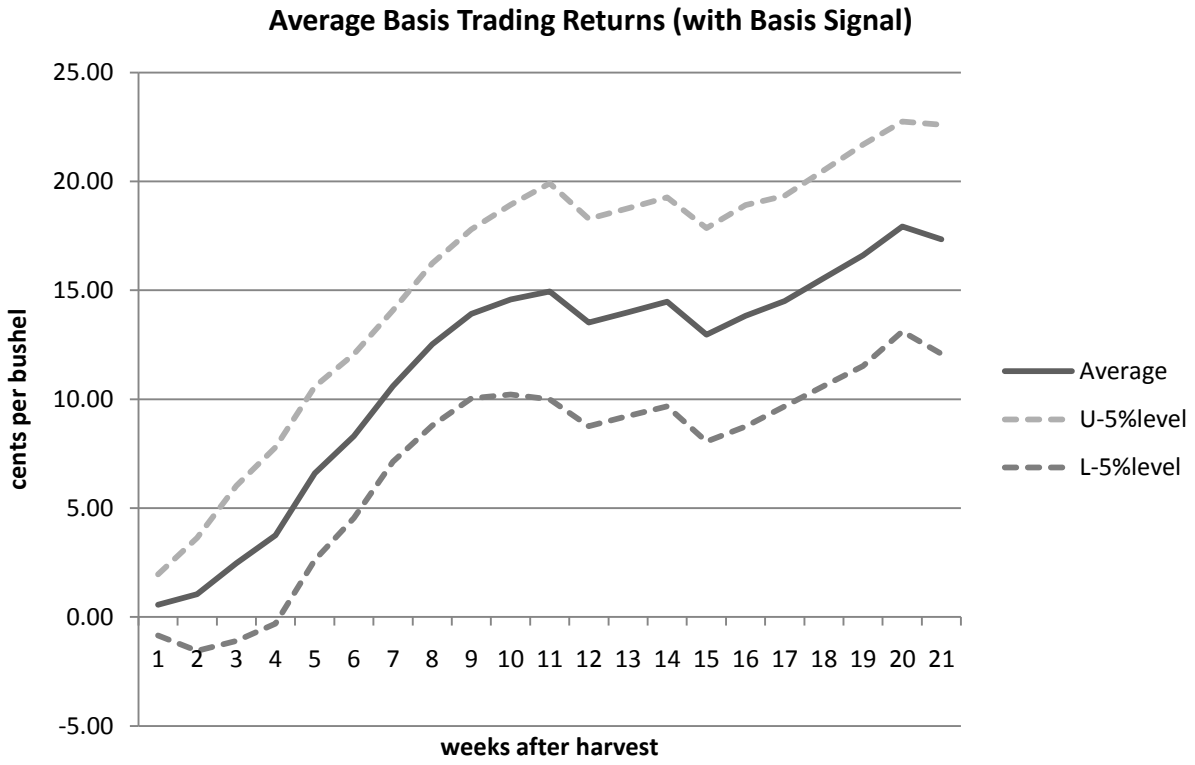

Average Basis Trading Returns (with Basis Signal)
25.00
20.00
15.00
10.00
5.00
0.00
-5.00
cents per bushel
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
weeks after harvest
Average
U-5%level
L-5%level

Figure 4.

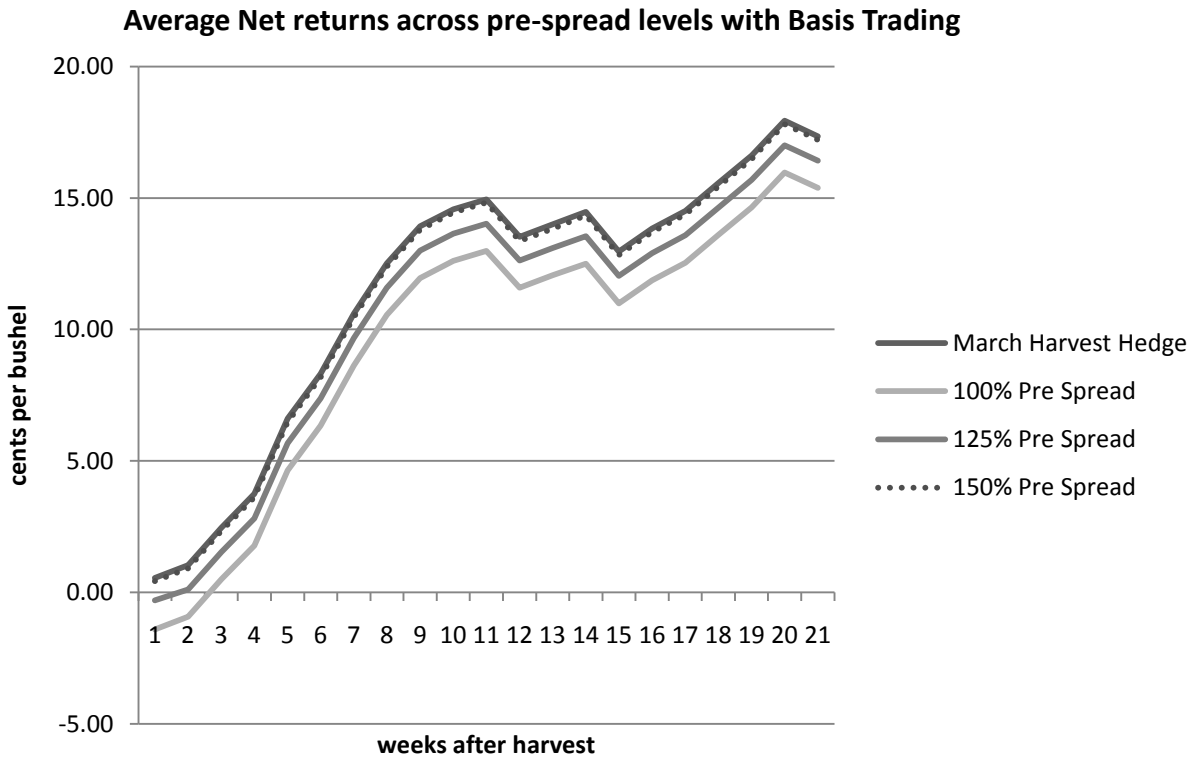
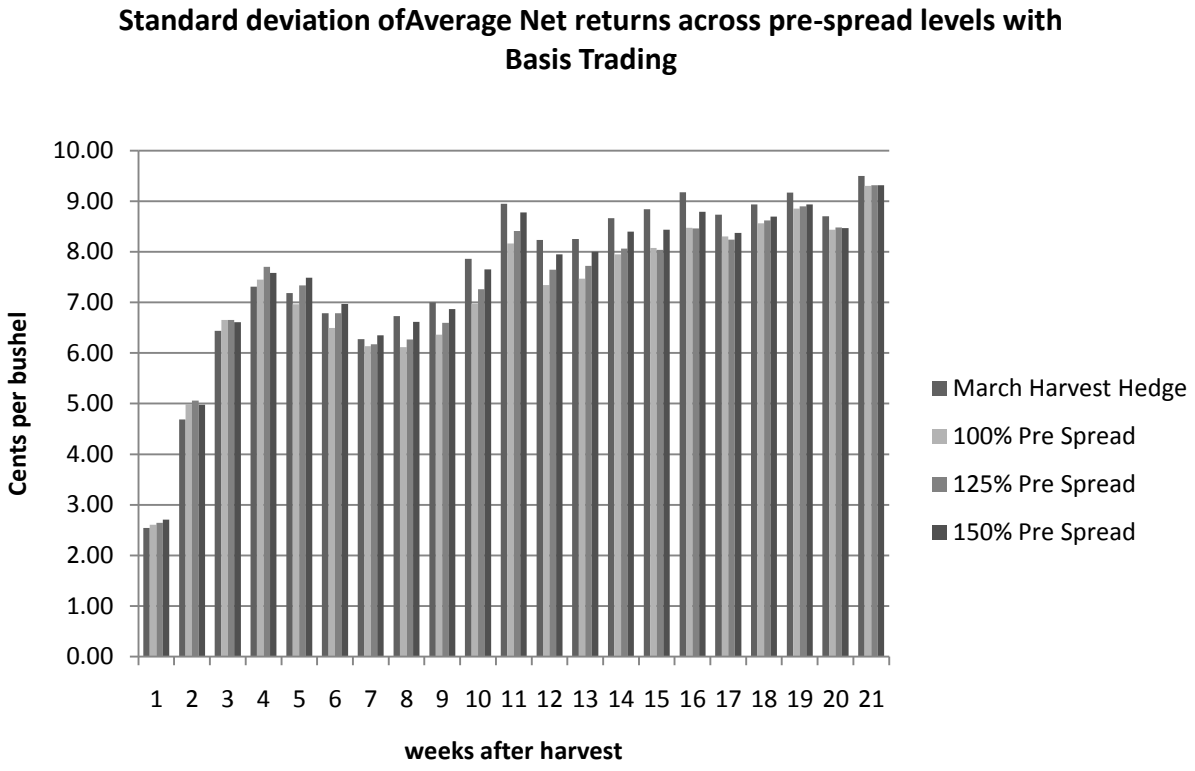

Average Net returns across pre-spread levels with Basis Trading
20.00
15.00
10.00
5.00
0.00
-5.00
cents per bushel
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
weeks after harvest
March Harvest Hedge
100% Pre Spread
125% Pre Spread
150% Pre Spread

Figure 5.


Standard deviation ofAverage Net returns across pre-spread levels with Basis Trading
Cents per bushel
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
weeks after harvest
March Harvest Hedge
100% Pre Spread
125% Pre Spread
150% Pre Spread