## Forward Contracting Costs for Illinois Corn and Soybeans: Implications for Producer Pricing Strategies

By Chris Stringer and Dwight R. Sanders

**Abstract**

The implied costs of forward contracting Illinois corn and soybean prices at planting-time are estimated. Thirty years of basis data are collected for seven regions in Illinois. Forward basis quotes are collected at planting-time (May) and actual basis levels are recorded at harvest time (October). Costs embedded in the forward basis quote are estimated and the implications for producer marketing strategies are examined. The results suggest that elevators' embedded premium-producers' cost of forward contracting-are rather small, especially for corn. Forward contracting costs vary significantly across the state. Implications for producer risk management strategies are explored.

### Introduction

Farm managers rely heavily on forward contracting with local elevators to make pre-harvest sales and establish pricing (Patrick, Musser, and Eckman). Upon entering a forward contract, producers are essentially setting a futures price and establishing the basis: the difference between the producer's local cash price and the exchange-traded futures price. On the other side of the transaction, the elevator is providing the services of establishing and managing the futures position and assuming the basis risk. Producers do not pay an explicit cost for these services. Therefore, it is reasonable to expect that elevators embed a premium in their forward basis to indirectly compensate themselves for the costs of providing forward contracts. Given the importance of basis and forward contracting in agricultural risk management (Tomek and Peterson), it is crucial that farm managers understand the magnitude of these embedded costs to make informed decisions among alternative forward pricing methods.

Chris Stringer is an undergraduate student in Agribusiness Economics at Southern Illinois University at Carbondale. He anticipates completing his B.S. degree in December of 2005. Chris can be reached at ctsring@siu.edu.

Dwight R. Sanders is an Assistant Professor of Agribusiness Economics at Southern Illinois University at Carbondale. Current research interests include agribusiness risk management, price analysis, and forecasting. He received his Ph.D. in Agricultural Economics from the University of Illinois in 1995. Dr. Sanders can be reached at (618) 453-1711 or DwightS@siu.edu.

Lenders, cooperative extension agents, and private marketing advisors often urge producers to reduce price risk by hedging with futures or forward contracting cash grain (Townsend and Brorsen). Forward contracting eliminates all price risk while a futures hedge reduces the producer's risk to fluctuations in the basis. Nelson suggests that forward contracting has advantages over futures hedging, namely the ability to sell non-standardized quantities, no interest cost, and the absence of basis risk. However, Harris and Miller as well as Shi, Irwin, Good, and Hagedorn reason that there is a premium embedded in forward basis quotes which reflect the elevator's hedging costs: basis risk, lumpiness, interest, default risk, and transaction costs. Producers who forward contract are implicitly paying these costs by receiving a lower price via a weaker basis subsumed within the forward contract price.

It is important that marketers of grain fully understand the embedded cost of forward contracting versus other forward pricing strategies such as futures hedging or hedge-to-arrive contracts. In this vein, Elam and Woodworth calculate that forward contracting soybeans in East Central Arkansas costs $.18 at 10 months prior to harvest and only $.02 one month before harvest. Harris and Miller find that forward contracting corn and soybeans in South Carolina costs between $.02 and $.07 per bushel versus traditional futures hedging. Using more advanced modeling techniques, Townsend and Brorsen find that forward contracting Oklahoma hard red winter wheat one hundred days before harvest costs $.06 to $.08 per bushel, while Shi, Irwin, Good, and Hagedorn estimate that the cost of forward contracting corn in Illinois is $.01 per bushel at one hundred days prior to harvest.

This research expands on prior efforts in three regards. First, the implied cost of forward contracting is examined for both corn and soybeans. This is important for most farm managers in Illinois using a standard corn-soybean rotation. Second, the costs across regions are compared. Specifically, we examine premiums in seven diverse geographical regions in Illinois, allowing farm managers to more fully understand the costs in their area. Finally, the estimated forward contracting costs are used to make practical recommendations concerning the use of alternative forward pricing tools in each region. The results have important ramifications for farm managers who must carefully manage output prices in an increasingly competitive environment.

## Forward Prices

In the pre-harvest period, the expected harvest-time price for a crop is made of two components: the new crop futures price and the expected local basis:

(1) E(Harvest Price) = Futures Price + E(Basis).

Where, E represents the expectations operator, and the futures price is assumed to be the best unbiased expectation for the overall price level. For example, in May, if the December corn futures are trading at $2.50 per bushel and the expected or typical harvest-time basis in Central Illinois is -$.25, then the expected harvest price is $2.25 per bushel ($2.50 - $0.25).

Clearly, the harvest price is composed of two variable components: futures prices and basis. A producer has a number of ways of securing one or both pieces of this price in the pre-harvest period. For instance, the producer can directly use the futures market (in their own account) to lock-in a futures price, and then simply receive the basis that occurs at harvest-time. Alternatively, a producer can forward contract a harvest price with their local elevator, implicitly entering a contract for the prevailing futures price and a basis offered by the elevator (forward basis). In this instance, the elevator will manage their market exposure by hedging the futures price. The cost of providing this service to the producer should be reflected in a lower forward basis. That is, if the elevator expects a basis of -$.25, then they may offer a basis of -$.30 to compensate themselves $.05 per bushel for the costs of hedging. The crux of this paper is to estimate this cost for corn and soybeans across the state of Illinois and then draw practical implications for producer marketing strategies.

## Data

Basis data is obtained from the new crop corn and soybean prices reported by the Illinois Agricultural Marketing Service and compiled by the University of Illinois' FarmDoc project (see http://www.farmdoc.uiuc.edu/marketing/basis/index.asp). The basis data are collected for seven Illinois regions: Northern, Western, North Central, South Central, Wabash, West Southwest, and Little Egypt (see Figure 1) from crop year 1975 through 2004 (30 observations).

Prices reflect the midpoint of country elevator quotes for each region. Usually beginning in February, elevators provide "new crop" forward quotes for the coming harvest-time delivery period. From these quotes, a forward basis is calculated using the December futures for corn and the November futures for soybeans. During harvest, the basis is simply the spot cash quote minus the December futures (corn) or November futures (soybeans).

Representative Illinois planting and harvesting dates are determined with the USDA's *Weekly Weather and Crop Bulletin* from 1990 through 2004. Specifically, the average date when 50 percent of the Illinois crop is planted is deemed the planting-date. Likewise, the midpoint of the Illinois harvest (50% harvested) is used as the harvest-date. Over the sample, the average corn planting and harvest dates are the weeks of May 11 and October 16, respectively. While, the average soybean planting date is the week of May 17 and harvesting is the week of October 24. For consistency, the same planting and harvesting weeks are used for each marking year throughout the sample. During the specified planting week, the forward basis quotes are collected. During the specified harvest weeks, the spot or actual corn and soybean basis are collected.

This data set provides a unique picture of the forward basis offered to producers during the middle of planting and the basis actually realized during the middle of harvest. In the following section, we examine the forward basis offered by the elevators and that which is actually available to producers at harvest-time, the difference representing the embedded cost of forward contracting.

## Methods and Results

### Summary Statistics

The planting- and harvest-time basis summary statistics are presented in Table 1 for corn and Table 2 for soybeans. A casual examination of the corn statistics shows that the planting-time (forward) basis quotes are not markedly different from the harvest-time (actual) basis. For instance, in the Northern region the average forward corn basis was -$.31 per bushel and realized spot basis averaged -$0.301 for a difference of just $.009 per bushel. So, producers forward contracting at planting-time were getting just $.009 per bushel less than those using futures themselves. Or, the implied cost of forward contracting is just $.009 per bushel. Importantly, the standard deviation of the forward basis is notably smaller than that of the harvest basis. The Northern Illinois forward basis has an annual standard deviation of $.082; whereas, the harvest-time basis has a standard deviation of $.13 per bushel. This suggests that using forward basis positions may be less risky than relying on the harvest-time basis.

The summary statistics for soybeans (Table 2) show a greater disparity between the planting-time and harvest-time basis levels. Looking again at the Northern region, the average planting-time forward basis is -$.39 and the harvest-time basis is -$.366 for a difference of $.024 per bushel, suggesting that elevators are extracting $.024 per bushel to compensate for the costs of offering forward soybean contracts. Again, the planting-time basis is much less volatile year-over-year than the harvest-time basis. The Northern basis has a standard deviation of $.098 while the harvest-time basis standard deviation is $.154 per bushel. Again, this hints of a potentially lower-risk strategy involving the forward basis.

While the summary statistics in Tables 1 and 2 are suggestive of embedded costs and relative basis variability, it is important that specific tests are conducted for the statistical significance of the premiums and for differences in volatility.

### Test for Embedded Cost

It is important to directly estimate the size of the embedded cost and test it for statistical significance. In essence, we want to know if the planting-time basis quote is systematically biased or different from the actual harvest-time basis. Following a methodology suggested by Pons, we define the cost of contracting as follows,

$$(2) \qquad Cost_t = Basis^H_t - Basis^P_t$$

Where, $Basis^H_t$ is the harvest-time actual basis in year t, $Basis^P_t$ is the planting-time forward basis for year t, and $Cost_t$ is the embedded cost of forward contracting. So, if in year t, an elevator offers a forward basis of -$.25 ($Basis^P_t$) and the harvest basis ($Basis^H_t$) is -$.20, then the elevator received a premium of $.05 per bushel. To calculate the magnitude and test the statistical significance of this cost through the sample period, the following regression is estimated,

(3) $Cost_t = \quad + \quad {}_t$.

Where, $Cost_t$ as defined in equation (2), γ is the sample estimate for the average cost, and $\mu_t$ is a random error term. The null hypothesis of no embedded cost, $\gamma = 0$, is tested with a t-test. If the null hypothesis cannot be rejected, then on average the planting-time basis equals the average harvest-time basis, and the producer does not pay an implicit cost for the forward contracting. The two-tailed alternative hypothesis is that producers pay an embedded cost ($\gamma > 0$) or elevators actually subsidize forward contracting as a customer service ($\gamma < 0$).

Equation (3) is estimated with an OLS regression. Error terms are tested for serial correlation using a Lagrange multiplier test, and the standard errors are corrected using the Newey-West estimator where appropriate (Sanders and Manfredo). The estimated premium and the corresponding t-statistic are presented in Table 3.

The corn results (Table 3, Panel A) show that the embedded costs paid by producers to elevators for forward contracting corn are quite small. The largest cost is $.023 per bushel in South Central Illinois, and the smallest is actually a negative $.011 in Little Egypt. Indeed, none of the estimated costs are statistically different from zero at the 10 percent level. Based on this data, there is little evidence that corn producers are paying elevators for the forward contracting services at planting time.

In contrast to corn, the soybean results (Table 3, Panel B) indicate relatively large and statistically significant costs for forward contracting soybeans at planting time. The largest cost is a statistically significant $.074 per bushel in South Central Illinois, while the smallest is a statistically unimportant $0.001 in the Wabash region. Of the seven regions, four have embedded costs that are greater than $.045 and statistically significant at the 10 percent level. The evidence suggests that soybean producers are in fact compensating elevators for forward contracting services.

It is noteworthy that elevator premiums are largest, for both corn and soybeans, in the North Central and South Central regions. Competition among elevators should lower embedded costs, so it is odd that the largest costs are in the regions with the largest number of elevators and the greatest crop production. It is not clear from the data why this pattern is observed.

**Basis Risk**

In considering harvest-time prices, producers face risk inherent in both the futures price and the local basis. Basis variability is a factor in the year-over-year prices received by producers. To the extent that producers can reduce basis volatility, then overall price volatility may also be reduced. So, as a component of the decision-making process, it is important to compare the variability of the planting-time forward basis and the harvest-time actual basis. Here, we calculate a simple variance ratio and conduct the corresponding F-test for differences in variance.

The results in Table 5 indicate that the forward basis is much less volatile than the harvest-time basis. Indeed, for both corn and soybeans, the harvest-time basis has over twice the variance of the forward planting-time basis. The variances are statistically different at the 10 percent level for all regions in both corn and soybeans. Clearly, forward contracting the basis at planting time reduces growing season basis risk; but, this evidence suggests that it will also reduce year-over-year risk generated by changes in local basis levels. In the following section, we examine how knowledge of basis risk, along with the estimated cost of forward contracting, suggests the use of alternative pricing strategies across Illinois.

## Strategy Implications

As shown in equation (1), the pricing decision involves two parts: a futures price and the basis component. While the futures price is the driver in the overall price, the basis component is not negligible and a few cents can be important in an industry with notoriously small margins. So, it is important to consider strategies that help to minimize costs and potentially reduce risk.

Before considering potential pricing methods, it is important to look at the costs of different pricing alternatives. The cost of futures hedging is assumed to be $50 per 5,000 bushel contract for commissions, (Martines-Filho, et al.) as well as a $25 liquidity cost (Brorsen). The total cost of futures hedging is then $.015 per bushel. If a producer doesn't want to manage their own futures position, they may choose to use hedge-to-arrive (HTA) contracts. HTA contracts put the management of the futures hedge with the elevator. In a phone survey of ten country elevators, the average cost to the producer for entering a HTA contract was found to be $.025 per bushel. The difference between this cost (2.5¢) and traditional futures hedging (1.5¢) is a convenience payment to the elevator for managing the futures position. With both futures hedging and HTA contracts, the farm manager is faced with an uncertain basis at harvest-time. However, anytime during the growing season, they can eliminate that risk by entering a forward-basis contract with the elevator-which will likely have an embedded cost equal to or smaller than those presented in Table 3. The costs of futures hedging (1.5¢) and HTA contracts (2.5¢) are now compared to the embedded cost of forward contracting to draw implications for producer pricing strategies.

Based on the results in Table 3 (Panel A), Illinois corn producers are paying at most $.023 per bushel (North Central) during planting time to forward contract harvest-time corn prices. The costs are not statistically different from zero in any region and actually negative in the Wabash and Little Egypt regions. During planting, Illinois corn producers wishing to price their crop should be relying heavily on forward pricing contracts and forward basis contracts. In the extreme case, the corn producer in the Wabash region is on average being subsidized $.010 for using forward contracts. Moreover, as shown in Table 1, the Wabash region has the highest harvest-time corn basis risk in the state. Wabash corn producers who want to forward price should be using forward contracts. For those producers who prefer to do their own futures hedging, they should consider forward basis contracts to eliminate basis risk. Generally speaking, planting-time forward prices and forward basis contracts for corn allow Illinois producers to set prices or eliminate basis risk at essentially no embedded cost.

The results for soybeans are more variable across the state. The contracting costs range from $.001 in the Wabash region to $.074 in South Central Illinois. Certainly in the Wabash, Little Egypt, and Northern regions – where the embedded contracting costs are not statistically different from zero - producers should be using forward contracts. However, in the Western, West Southwest, and Central regions of the state, the cost of forward contracting is more pronounced. For instance, a South Central Illinois producer may not want to pay the implicit $.074 cost to forward contract. As an alternative, they can hedge themselves in the futures market for a cost of $.015 or they can let the elevator hedge for them with a HTA contract for $.025. In either case, they are setting the futures price, and then they are able to capture the actual harvest-time basis which is on average $.074 stronger than the forward basis quoted by elevators. So, the use of futures hedging or HTA contracts may be particularly appealing to farm managers in these areas.

South Central Illinois producers who use a HTA contract will on average get an additional $.049 ($.074 - $.025) for harvest-time soybeans versus using a forward contract. However, this "savings" must be carefully weighed against the uncertainty surrounding the realized harvest-time basis. That is, some producers may view the $.049 as a fair premium to pay for elimination of the basis risk. It is important to note that the cost of forward contracting in the Wabash region is a negligible $.001 per bushel (Table 3); yet, the Wabash harvest-time basis variance is the highest in the in the state (Table1). This strongly suggests that forward pricing contracts and forward basis contracts may be the best alternative in this region for reducing risk at the lowest cost.

Clearly, a blanket rule for contracting choices cannot be applied for all crops or all regions. Rather, farm managers need to examine the specifics to their crop and region. For those areas with negligible costs, forward contracting represents a cost effective pricing tool. This is the case for nearly all corn producing areas and soybean areas outside of the major production areas: Western, North Central, South Central, and West Southwest Illinois. In these major production areas, the embedded forward contracting costs for soybeans need to be carefully weighed against the cost and risk inherent in alternative pricing methods such as futures hedging and HTA contracts.

## Conclusions and Discussion

This study specifically examines the cost of forward contracting for corn and soybeans at planting-time in Illinois. The results suggest that the cost of forward contracting corn in Illinois at planting-time is not statistically different from zero for any region. The highest estimate is $.023 per bushel for the South Central region and $.017 in the North Central region. These estimates are slightly different from the $.010 recorded by Shi, Irwin, Good, and Hagedorn. The difference likely stems from the different statistical methodologies and alternative levels of data aggregation in the studies. Also, the $.010 estimate is for 100 days or 14 weeks prior to harvest; whereas our planting-time date is 23 weeks before harvest. Regardless, both studies are consistent in showing that the cost of forward contracting corn in Illinois appears to be relatively small which makes forward contracting a potentially attractive alternative to futures hedging or HTA contracts.

Consistent with prior research (Elam and Woodworth), the costs of forward contracting soybeans are larger than for corn. Four Illinois regions, Western, North Central, South Central, and West Southwest, display statistically and economically large forward contracting costs in excess of $.045 per bushel. In these regions, producers may want to consider using futures hedging and HTA contracts as less-costly alternatives for forward pricing. However, in the other areas (Northern, Wabash, and Little Egypt), the cost of forward contracting is less than $.025 per bushel-making forward contracts a cost-effective alternative to other pricing methods.

The other notable result from this research revolves around risk. The forward planting-time basis for both corn and soybeans is less volatile than the actual harvest-time basis. In itself, this is not surprising. However, it does suggest that producers who forward contract the basis may be able to reduce the year-over-year basis risk at essentially no cost in corn. In soybeans, the cost is negligible except for the four regions shown to have statistically significant forward contracting costs (Table 3). So, even for those producers who prefer to employ their own futures hedging, they may benefit from forward contracting the basis to eliminate the basis risk.

Oddly, the results indicate that the cost of forward contracting-where the elevator is presumably being compensated for assuming the producer's basis risk-is not related to basis volatility. For instance, harvest-time soybean basis variance is the lowest in the Central regions, which have the highest cost of contracting. Likewise, the Wabash region has the greatest variability in harvest-time soybean basis and the lowest cost of contracting. Although this relationship is counter-intuitive, it certainly enhances the attractiveness of forward pricing and basis contracts in areas with highly volatile harvest-time basis such as the Little Egypt and Wabash regions.

Farm managers are faced with an array of choices for pricing crops prior to harvest. This research explicitly examines the cost of forward contracting Illinois corn and soybeans at planting-time. The results provide farm managers and producers with an estimate of those costs for seven regions across the state. Armed with this information, managers should be able to make better decisions in regards to forward pricing mechanisms for corn and soybeans. Although the costs are relatively small when viewed within the context of growing season price fluctuations, astute managers will undoubtedly take every penny they can get.

## References

Brorsen, B.W. "Liquidity Costs and Scalping Returns in the Corn Futures Market." *Journal of Futures Markets*. 9(1989):225-235.

Elam, E. and J. Woodworth. "Forward Selling Soybean with Cash Forward Contracts, Futures Contracts, and Options." *Arkansas Business and Economic Review*. 22(1989):10-20.

Harris, H.M. and S.E. Miller. "An Analysis of Cash Contracting Corn and Soybeans in South Carolina." *National Conference on Grain Marketing Patterns*, Southern Cooperative Series Bulletin No. 307 (March 1981):290-300.

Martines-Filho, J., B.G. Stark, S.M. Cabrini, S.H. Irwin, D.L. Good, W. Shi, R.L. Webber, L.A. Hagedorn, and S.L. Williams. "Advisory Service Marketing Profiles for Corn Over 1995-2000." AgMAS Report 2003-3, Department of Agricultural and Consumer Economics, University of Illinois, 2003.

Nelson, R.D. "Forward and Futures Contracts as Preharvest Commodity Marketing Instruments." *American Journal of Agricultural Economics*. 67(1985):15-23.

Patrick, G.F., W.N. Musser, and D.T. Eckman. "Forward Marketing Practices and Attitudes of Large-Scale Midwestern Grain Producers." *Review of Agricultural Economics*. 20(1998):38-53.

Pons, J. "The Accuracy of IMF and OECD Forecasts for G7 Countries." *Journal of Forecasting*. 19(2000):53-63.

Sanders, D.R. and M.R. Manfredo. "USDA Production Forecasts for Pork, Beef, and Broilers: An Evaluation." *Journal of Agricultural and Resource Economics*. 27(2002):114-127.

Shi,W.,Irwin, S.H., Good, D.L., and Hagedorn, L.A. "The Cost of Forward Contracting." Presented at the American Agricultural Economics Association (AAEA) 2004 Annual Meeting. Denver, Colorado. August 1-4, 2004.

Tomek, W.G., and Peterson H.H. "Risk Management in Agricultural Markets: A Review." *The Journal of Futures Markets*. 21(2001):953-985.

Townsend, J.P., and B. W. Brorsen. "Cost of Forward Contracting Hard Red Winter Wheat." *Journal of Agricultural and Applied Economics*. 32(2000):89-94.

*Table 1. Summary Statistics, Illinois Corn Basis by Region, cents per bushel, 1975-2004*

| | Northern | Western | North Central | South Central | Wabash | West Southwest | Little Egypt |
|---|---|---|---|---|---|---|---|
| | | | **Panel A: Planting-forward** | | | | |
| **Average** | -31.0 | -29.6 | -24.8 | -24.7 | -20.1 | -26.2 | -20.4 |
| **Std. Dev.** | 8.2 | 7.2 | 7.3 | 8.4 | 8.0 | 7.6 | 7.9 |
| | | | **Panel B: Harvest-actual** | | | | |
| **Average** | -30.1 | -29.1 | -23.1 | -22.4 | -21.1 | -25.1 | -21.5 |
| **Std. Dev.** | 13.0 | 12.2 | 11.5 | 12.5 | 14.9 | 12.9 | 14.3 |

*Table 2. Summary Statistics, Illinois Soybean Basis by Region, cents per bushel, 1975-2004*

| | Northern | Western | North Central | South Central | Wabash | West Southwest | Little Egypt |
|---|---|---|---|---|---|---|---|
| | | | **Panel A: Planting-forward** | | | | |
| **Average** | -39.0 | -35.8 | -30.6 | -28.5 | -25.2 | -31.2 | -29.1 |
| **Std. Dev.** | 9.8 | 9.5 | 8.2 | 9.0 | 11.5 | 10.1 | 9.9 |
| | | | **Panel B: Harvest-actual** | | | | |
| **Average** | -36.6 | -31.2 | -24.4 | -21.1 | -25.1 | -26.0 | -27.3 |
| **Std. Dev.** | 15.4 | 13.5 | 12.3 | 12.8 | 17.1 | 14.7 | 16.3 |

*Table 3. Estimated Forward Basis Premiums, by Region, cents per bushel, 1975 - 2004*

| | Northern | Western | Central | Central | Wabash | Southwest | Egypt |
|---|---|---|---|---|---|---|---|
| | | | | **Panel A: Corn** | | | |
| **Premium, γ (t-statistic)** | 0.9 (0.53) | 0.5 (0.30) | 1.7 (1.04) | 2.3 (1.35) | -1.0 (-0.48) | 1.1 (0.64) | -1.1 (-0.52) |
| | | | | **Panel B: Soybeans** | | | |
| **Premium, γ (t-statistic)** | 2.4 (1.02) | 4.6 (1.82)* | 6.2 (2.87)** | 7.4 (2.98)** | 0.1 (0.04) | 5.1 (2.16)** | 1.8 (0.87) |

**Statistically significant at the 10% level; **Statistically significant at the 5% level.*

*Table 4. Harvest: Planting-Time Basis Variance Ratios, by Region, 1975 - 2004*

| | Northern | Western | North Central | South Central | Wabash | West Southwest | Little Egypt |
|---|---|---|---|---|---|---|---|
| | | | | **Panel A: Corn** | | | |
| **Ratio (p-value)[a]** | 2.52 (0.02) | 2.84 (0.01) | 2.52 (0.02) | 2.24 (0.03) | 3.46 (0.00) | 2.90 (0.01) | 3.32 (0.00) |
| | | | | **Panel B: Soybeans** | | | |
| **Ratio (p-value)[a]** | 2.47 (0.02) | 2.02 (0.06) | 2.26 (0.03) | 2.01 (0.06) | 2.20 (0.04) | 2.10 (0.05) | 2.70 (0.01) |

[a] *P-value for test of equality in the harvest- and planting-time basis variances.*

*Figure 1. Illinois Price Reporting Regions*