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Farmer's Income Shifting Option in Post-harvest Forward Contracting

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Abstract

We estimate the cost of post-harvest forward contracting corn and soybeans for January and March delivery from 1980 through 2009. For both corn and soybeans we saw a downward trend in the cost of forward contract for January delivery and we conclude that the cost of forward contracting for January delivery is partly compensation for the counterparty risk borne by the grain merchant. Our results for the March delivery forward contracts indicate that this cost is flat, and the cost of forward contracting soybeans for March delivery is slightly downward sloped, but less than the cost of forward contracting soybeans for January delivery. This indicates that cash flow risk may be more important than risk of default by the farmer counterparty in the forward contracts for March delivery. We did not find a significant increase in the cost of forward contracting for January delivery, when there is an income shifting benefit compared to the cost of forward contracting for March delivery when there is not an income shifting benefit. We conclude that the choice of forward contracts for January verses March delivery offer a relatively inexpensive means of smoothing income tax burden across years.

Farmer's Income Shifting Option in Forward Contracting

Introduction

Local commodity markets in the United States are reasonably well integrated in that the only barrier keeping farmers from selling to one elevator versus another is the cost of transporting the commodity. However, as transportation costs are not trivial, local markets may be environments in which non-competitive behavior can take place. That is, given that it is costly for farmers to transport their commodity to distant outlets that may offer a better price, they may effectively be price takers at the local elevator. This isolation is not symmetric, however, because elevators are in the business of aggregating and transporting bulk quantities of commodity, which usually means they have multiple options such as truck, barge, or train with which they can sell the grain up the marketing channel. Therefore, it may be that elevators are able to exhibit market power over farmers even if they are price takers downstream in the marketing chain. However, this market power can only be exerted to a limited degree and is captured primarily by influencing the rate of flow of commodity into the market through the marketing year.

This is particularly evident at the end of the tax year in December. Farmers harvest corn and soybeans in the fall, and there are often strong incentives from a tax planning perspective to sell unpriced bushels[1] before or after the first of the year depending on the farmer's income level in the current year. This is because the U.S. income tax system is a progressive scheme that is a step function. This means an incremental increase in income (before the start of the new tax year) can put an entity into a higher tax bracket. In this case, there are advantages to pushing back the incremental income until after the first of the year. For a farmer with grain to sell, this can be accomplished in three ways: 1) the farmer can forward contract for January delivery; 2)

[1] Unpriced bushels refer to the amount of a farmer's contract that is not already under contract for delivery at a specific price.

the farmer can sell the grain in the spot market with deferred payment until after January; or 3) the farmer can store the grain until after January and sell into the spot market or forward contract at that time. Each of these has different benefits associated with them. The first eliminates the price risk while retaining the income tax benefits. The second has a similar benefit, but leaves the farmer exposed to the risk of the elevator's default[2]. The third option leaves the farmer exposed to full price risk while he stores unpriced bushels of grain.

In this article we examine the cost of forward contracting after harvest, for delivery in January and March, respectively. We find that the cost of forward contracting for delivery after the first of the year is not significantly more costly than the cost of forward contracting for March delivery when the income tax benefits are not present. This indicates that the use of forward contracts is typically a relatively low cost way for farmers to shift income across tax years, and thereby smooth their income tax burden.

Surveys show that farmers prefer forward contracting over futures contracts to manage price risk; e.g., see Musser, Patrick, and Eckman (1996) and Patrick, Musser, and Eckman (1998). Further, studies estimate that there exists an implicit cost of forward contracting; the cost of forward contracting which can be loosely defined as the change in the basis bid from the time the contract is signed to the delivery date. See Brorsen, Combs, and Anderson (1995), Townsend and Brorsen (2000), and Shi et al. (2005), and Mallory et al. (2012) for examples.

Previous research has given attention to how tax policy effects farmer's marketing decisions. McNew and Gardner (1999) use a simulation model calibrated to the U.S. corn market to examine how farmers' storage behavior changes under progressive and flat income tax systems. They find that carryover stocks are reduced and price variability is increased under a

[2] This is not the case with the forward contract because if the elevator declares bankruptcy before the date of delivery the farmer retains ownership of the grain, even if it is stored with the elevator. If they agree to defer payment, however, they must stand in line with the elevator's other claimants.

progressive tax system relative to a flat tax system. Their insight is that under a progressive tax system, an increase in the inter tax-year price spread can induce less storage if the marginal tax-rate is high enough.

Tronstad (1991) explores after tax optimal hedging and storage behavior through the cotton marketing year using a stochastic dynamic programming model. He finds that cash sales are preferred to storage early in the marketing year, but as the end of the tax year approaches, storing cotton becomes more attractive. This is because the benefits of deferring income to the next tax year outweigh the probability of an adverse price movement.

Tronstad and Taylor (1991) use a stochastic dynamic programming model to determine the optimal dynamic marketing strategy of a Montana winter wheat producer, where the producer can store, sell in the cash market, hedge in the futures market, or use a combination of these strategies. They find that when cash prices are low and before tax income levels are low, cash grain sales are higher at the end of the tax year than at the beginning. Conversely, when before tax income levels are high, cash sales are deferred until the next tax year and the price hedged in the futures market.

This body of literature is small, but it is consistent in its prediction that (progressive) income taxes influence a farmer's optimal storage behavior. The question of whether or not this is reflected in actual farmer behavior or in equilibrium market outcomes has not been examined with actual data, however. In this article we explore the degree to which forward contract basis bids reflect this by examining the cost of forward contracting before and after the first of the year.

Conceptual Model of the Cost of Forward Contracting

Farmers often have unpriced bushels of grain remaining after harvest. This may be because the farmer only chose to hedge a portion of his crop with forward, futures, or options contracts prior to harvest and must market the remaining after harvest. Alternatively the farmer may rely on crop insurance to guarantee a minimum level of income and then chooses to market his grain after harvest is complete. Or the farmer may engage in some combination of these two activities. In any case farmers often have grain to market after harvest is complete. In marketing these unpriced bushels the farmer could sell his grain immediately or forward contract for January delivery. Alternatively, he could store the grain until January and sell the grain in the spot market or forward contract for delivery in March, and so forth. Typically, grain merchants who offer forward contracts publish daily forward 'bids', the price at which they are willing to contract with farmers on that particular day for delivery at a specified time in the future. These forward bids are most commonly expressed as a forward basis; that is, the amount under or over the futures contract nearest to the delivery window, rather than as a forward price level.

Townsend and Brorsen (2000) and Mallory et al. (2012) have shown that farmers incur a cost at the time of entering a forward contract with local grain merchants, which is defined as the expected difference between the spot price at location *j* at delivery and the current forward price at location *j*:

(1) $$C_j\left(t,t^*\right)=E_t\left(S_j\left(t^*\right)-f_j\left(t,t^*\right)\right).$$

where $C_j\left(t,t^*\right)$ is the cost of forward contracting at time *t* for delivery at t^*; $S_j\left(t^*\right)$ is the spot price at t^*; $f_j\left(t,t^*\right)$ is the forward bid at time *t* for delivery at t^*, and $E_t\left(.\right)$ is the expectation operator at time *t*.

Let *F* be a futures contract that matures after the delivery date of the forward contract. Then the price of *F* at time *t* is represented by $F(t)$. Now define the forward basis $B_j(t,t^*)$ as the difference between the forward bid and the futures price at time *t*:

(2) $$B_j(t,t^*) = f_j(t,t^*) - F(t).$$

Correspondingly, the cash basis at maturity of the forward contract is:

(3) $$b_j(t^*) = S_j(t^*) - F(t^*).$$

After solving for $f_j(t,t^*)$ in equation (2) and $S_j(t^*)$ in (3), we substitute into (1) and obtain,

(4) $$\begin{aligned} C_j(t,t^*) &= E_t\left[b_j(t^*) + F(t^*) - B_j(t,t^*) - F(t)\right] \\ &= E_t\left[b_j(t^*) - B_j(t,t^*)\right] + E_t\left[F(t^*) - F(t)\right]. \end{aligned}$$

We assume the futures price follows a martingale measure[i], so that the second term in equation (4) is zero. Then we have an expression for the cost of forward contracting at time *t* for delivery at time t^*:

(5) $$\begin{aligned} C_j(t,t^*) &= E_t\left[b_j(t^*) - B_j(t,t^*)\right] \\ &= E_t\left[b_j(t^*)\right] - B_j(t,t^*), \end{aligned}$$

where the second line follows because the forward basis bid, $B_j(t,t^*)$, is known at time *t*. So, the quantity represented in equation (5) is the expected improvement in the cash basis from time *t* to time t^*, or the difference between the expected spot basis and the forward basis bid at time *t*. In essence, when the farmer enters into the forward contract at time, *t*, he or she is agreeing to forgo an expected basis improvement of $C_j(t,t^*)$ in order to eliminate price uncertainty.

Data and Background

Our dataset contains forward basis bids that are generated as a part of a daily survey of 50 to 60 grain merchants throughout Illinois who forward contract with farmers. The survey is conducted by the Illinois Ag Market News Service and contains data from 1980 through 2009. The forward bases come from seven regions of Illinois: (1) Northern, (2) Western, (3) North Central, (4) South Central, (5) Wabash, (6) West Southwest, and (7) Little Egypt. We use the mid-point of the week's price range to obtain a single price for each region and each week. The weekly forward basis for corn (soybeans) refers to No. 2 yellow corn (No. 1 yellow soybeans) bought for shipment by rail or truck for fall delivery to country grain merchants every Thursday before harvest. We use the Chicago Board of Trade (CBOT) March futures contracts for both corn and soybeans to construct the forward bases. Although some of our forward bids occur before expiration of the December corn futures contract, we constructed all bases relative to the March futures contracts so that our results would not be confounded by carry present in the December to March price spread.

At the start of the harvest season, elevators cease to offer forward bids for harvest delivery and they begin offering forward bids for January delivery. In a typical year this begins in mid-September to early October and runs until the first part of December. The length of this period varies from year-to-year because it depends on the beginning and duration of harvest. Likewise, after the first of the year, elevators cease January forward bids and they begin to make forward bids for March delivery. We focus on explaining the structure of the forward bids.

Measuring the Cost of Forward Contracting

We define the cost of forward contracting in equation (5) as the bias in the forward basis bid at location *j* compared to time *t* expectation about the spot basis at maturity of the contract, which is time t^*. We estimate this quantity by the expression in equation (6):

$$(6) \qquad c_j\left(t,t^*\right)=\sum_{i=1}^{T}\left(b_{i,j}\left(t^*\right)-B_{i,j}\left(t,t^*\right)\right)\Big/T\ ,$$

where *i* indexes the year of our sample and *T* represents the number of years in our sample. So, we estimate the cost of forward contracting at calendar week *t* for delivery at time t^* as the average bias of the forward basis bid during week *t* against the realized spot basis.

We also need to define exactly what we mean by the realized spot basis at delivery in year *i*, $b_{i,j}\left(t^*\right)$. The forward contracts offered by grain merchants usually specify the delivery date to be any time within the delivery month. For the purposes of our analysis, we define the spot basis bid at maturity *t*, in the year *i* as the average spot basis during the maturity month in that year.[ii]

A Look at the Data

In figures 1 and 2 we plot the cost of forward contracting corn and soybeans, respectively, as calculated in equation (6). Focusing first on figure 1 we display the costs of forward contracting corn in both level and percentage terms, with levels represented by the solid lines and percentage represented by the dotted lines. Also, motivated by the work in Mallory et al. 2012, which demonstrated a significant increase in the pre-harvest cost of forward contracting, we show the 2007-2009 average separately in order to see if this effect in present in the post-harvest forward bids as well.

The average cost of forward contracting for January delivery in calendar week 40, which is usually the last week of September or the first week of October, is roughly 5 cents per bushel, or 2.75%, from 1980 through 2006. The average cost of forward contracting in both levels and percentage terms falls throughout the harvest season so that by week 50 (first or second week of December) the average cost of forward contracting for January delivery is roughly 1 cent per bushel or 0.25%. This is in contrast to the pattern of the cost of forward contracting for March delivery, which appears to be roughly flat at about 2 cents per bushel or 0.75%.

Given the perceived tax advantages of having the ability to shift income from one calendar year to the next, it is interesting to consider the cost of forward contracting for January delivery, which involves shifting income, to the cost of forward contracting for March delivery, which does not involve income shifting, since the contract is initiated and completed within the same calendar year. Forward bids for March delivery are only made for approximately five weeks, weeks 54 through 58 in figure 1. Consider then, the cost of forward contracting for January delivery approximately four weeks before maturity, or week 50 in figure 1. This is roughly 1 cent per bushel or 0.25%. The cost of forward contracting for March delivery four weeks from maturity (week 58) is roughly 2 cents per bushel or 0.8%, which appears to be roughly the same as the cost of forward contracting for January delivery. Therefore, on average, the ability to shift income from one tax year to another does not appear to be an important determinant of the cost of forward contracting corn.

Focusing now on the cost of forward contracting corn from 2007 to 2009 in figure 1, we are faced with a greater degree of variability because we are only averaging over three years in this case. However, the cost of forward contracting for January delivery in 2007 to 2009 does not appear to be significantly higher than the cost in 1980 through 2006, which is in contrast to Mallory et al. 2012 who found that the cost of pre-harvest forward contracting in 2007 through 2010 was significantly higher than the cost of forward contracting in 1980 through 2006. There does appear to be significantly higher cost of forward contracting for March delivery in 2007 through 2009 relative to the average from 1980 through 2006.

Now we turn to figure 2 and the cost of forward contracting soybeans for January and March delivery. As in figure 1, the solid lines represent the cost in levels and the dotted line represents the cost in percentage terms. We see a similar pattern here as we observed for corn. Prior to 2007, we see a distinct downward trend in the cost of forward contracting soybeans for January delivery. At week 40, which is roughly the last week of September or the first of October, the cost of forward contracting soybeans is 8 cents per bushel or 1.5%. By week 50 (mid December) this falls to roughly 4 cents per bushel or 0.70%.

Looking now at the cost of forward contracting soybeans for March delivery, it appears that there may be more pronounced downward trend than we saw in the cost of forward contracting corn for March delivery. At week 54, which is roughly the beginning of January, the cost of forward contracting soybeans is about 3.5 cents per bushel or 0.5%. By week 58 the cost falls to roughly 1 cent per bushel or 0.2%.

If we focus in figure 2 on the cost of forward contracting soybeans since 2006, we also see a similarity to what we found in the cost of forward contracting corn. From 2007 through 2009, the downward trend in the cost of forward contracting soybeans for January delivery is not as pronounced as it was from 1980 through 2006. We do not see an increase in the cost of forward contracting soybeans for January delivery compared to the cost in 1980 through 2006, but we do see a higher cost of forward contracting for March delivery than we did on average from 1980 through 2006.

In tables 1 through 4, we provide a more detailed breakdown of the cost of forward contracting data in three year sub-periods, since the discussion above and the econometric results to follow could be influenced by outliers. Table 1 contains the cost of forward contracting corn for January delivery in levels. The only sub-periods that stand out are perhaps week 39 in sub-periods 1980 through 1982 and 1995 through 1998. The sub-period 1980 through 1982 was an exceptionally low cost of forward contracting relative to the average, but the cost of forward contracting in this sub-period the next week (week 40) is not remarkably low. In the sub-period 1995 through 1998, the cost of forward contracting is notably high in weeks 39 and 40, but by week 41 the cost comes down to more typical levels. All in all, the costs of forward contracting for January delivery appear to be quite stable across the sub-periods considered here.

The cost of forward contracting soybeans for January delivery is shown in three year sub-periods in levels in tables 2. As for corn, 1995 through 1998 proved to be a high cost year to forward contract for January delivery in week 39.

Tables 3 and 4 contain three year sub-period averages of the cost of forward contracting corn and soybeans for March delivery in levels; they are organized the same way as in tables 1 and 2. Here though, we do not observe any sub-periods whose cost of forward contracting is an extreme outlier. In the next section, we specify an econometric model that will allow us to test if the observations we have made in this section are statistically significant.

Econometric model

Our data set is an unbalanced panel with missing values so we use the Fisher-type test reviewed in Choi (2001) to determine if the data are stationary. We reject the null hypothesis that there is a unit root in the cost of forward contracting panels defined by equation 6.[iii] Following Brorsen et al. (1995) and Townsend and Brorsen (2000) and motivated by the plots from the preceding section we specify the cost of forward contracting as a linear function of time:

(7) $c_{j,t}\left(t,t^*\right)=\alpha+\beta t+z_{j,t}$,

where $z_{j,t}$ is the error term. We estimate the model by regressing $c_{j,t}\left(t,t^*\right)$ against an intercept and a time trend, *t*. Ordinary Least Square (OLS) estimates of equation (7) may be problematic if the residuals are autocorrelated, which we expect to be the case based on plots of the dependent variable. If the residual follows a first order autoregressive process (AR (1)), such that $z_t=\rho z_{t-1}+\varepsilon_t$ where ε_t is iid white noise, equation (7) can be written as:

(8.1) $c_{j,t}\left(t,t^*\right)=\alpha+\beta t+\rho z_{j,t-1}+\varepsilon_{j,t}$

(8.2) $=a+bt+\rho c_{j,t-1}\left(t,t^*\right)+\varepsilon_t$, where $a=\alpha\left(1-\rho\right)+\rho\beta$ and $b=\beta\left(1-\rho\right)$.

By estimating equation (8.2), we can obtain estimates of the actual cost coefficients in equation (8.1): $\alpha=\dfrac{a-\rho\beta}{\left(1-\rho\right)}$ and $\beta=\dfrac{b}{\left(1-\rho\right)}$. Since the left-hand side of equation (8.2) represents the degree to which forward basis bids are biased downward compared to the expected spot basis at maturity of the forward contract, we expect the constant term α in equation (8.2) to be greater than zero. We saw in figures 1 and 2 that the cost of forward contracting may decrease as delivery approaches, so we will test whether the coefficient on *t* is negative (note that a larger *t* represents a date that is closer to delivery).

Price levels, basis, and implicitly, the cost of forward contracting are affected by yearly random weather realizations. In our econometric model, we interpret these as year specific random shocks which can be incorporated into our specification by including year specific fixed effects, r_t. This modification is reflected in equations (9.1) and (9.2) :

(9.1) $c_{j,t}\left(t,t^*\right)=\alpha+\beta t+\rho z_{j,t-1}+r_t+\varepsilon_{j,t}$

(9.2) $c_{j,t}\left(t,t^*\right)=a+bt+\rho c_{j,t-1}\left(t,t^*\right)+r_t+\varepsilon_{j,t}$

where $a = \alpha(1-\rho) + \rho\beta$, $b = \beta(1-\rho)$, $r = \gamma(1-\rho) + \rho\delta$, and $d = \delta(1-\rho)$.

Since we have data for seven regions in Illinois we tested for the significance of regional effects; however, when we estimated equation (9.2) with regional dummies we were unable to reject the null hypothesis of no regional effects, so we will only discuss the pooled model represented by equation (9.2) in the remainder of the article. We also tested for higher order terms on our time trend, *t*, but we were unable to reject the null hypothesis no quadratic time trend.

Results

Table 5 contains the results after estimating equation (9.2) with our data. There are two panels containing the results for corn on the left and soybeans on the right. Within the corn panel, are two columns, one that estimates the cost of forward contracting for January delivery and one that estimates the cost of forward contracting for March delivery. For each delivery date there are also two columns, the one on the left contains the regression results when we specify the cost of forward contracting in levels, and the one on the right contains the regression results when we specify the cost of forward contracting in percentage terms.

In each specification we find the drift term, *a*, positive and significant, the time trend term, *b*, negative and significant, and the auto-regressive term, ρ, positive and significant in a range of 0.59 to 0.72. These terms work together to determine how the cost of forward contracting evolves through time. A negative time trend and auto-regressive term less than 1 both contribute to a cost of forward contracting function that is a decreasing function of time, while the positive drift (intercept) term counteracts this effect. We saw that the cost of forward contracting for January delivery decreased with time, on average for both corn and soybeans.

The cost of forward contracting for March delivery, however, was relatively flat, especially in corn. We can see this effect in the regression results as the size of the coefficients contributing to a negative relationship of cost with time (the time trend and auto-regressive terms) are relatively larger than the drift terms in the January specifications than in the March specifications. For example, if we focus on the cost of forward contracting corn the drift, trend, and auto-regressive terms in the January equation are $a = 4.541$, $b = -.079$, and $\rho = 0.722$. In the March equation the drift, trend and auto-regressive terms are $a = 35.463$, $b = -.581$, and $\rho = 0.616$. In the January equation the b and ρ overpower the relatively small drift term, a, while in the March equation the drift term is much larger at $a = 35.463$ and balances out the negative drift and auto-regressive term.

Conclusions

In this paper we estimated the post-harvest cost of forward contracting corn and soybeans for January and March delivery from 1980 through 2009. This period is an important in famers' marketing programs. Even if a farmer actively markets his crop before harvest with forward or futures contracts, the total size of the crop is uncertain, and farmers are typically left with a significant number of unpriced bushels after harvest. The farmer can sell in the spot market, forward contract for future delivery, or store unpriced for sale or forward contracting at a later date. This decision is complicated by the fact that the income tax year in the United States ends on December 31st. In many years the farmer has an incentive to sell the unpriced bushels remaining after harvest before or after the first of the year according to whether or not the marginal income puts them into a higher tax bracket.

Given the importance of forward contracting in farmers' marketing programs, and given the active use of the January and March delivery maturities, the relative cost of these instruments compared to one another and compared to the cost of pre-harvest forward contracts is important to quantify. Mallory et al 2012 argued that a downward trend in the cost of forward contracting indicates that the cost of forward contracting is based on a risk premium for the grain merchant to bear the counterparty risk of entering into the contract with the farmer, while a flat cost of forward contracting indicates that the cost of forward contracting may be derived as compensation for bearing cash flow risk in maintaining a future margin account. For both corn and soybeans we saw a downward trend in the cost of forward contract for January delivery, so we conclude that the cost of forward contracting for January delivery is partly compensation for the counterparty risk borne by the grain merchant. This is in contrast to the finding in Mallory et al. 2012 which concluded that the cost of pre-harvest forward contracting was primarily compensation for cash flow risk, since the cost of pre-harvest forward contracting is relatively flat.

Our results for the March delivery forward contracts are more in line with the results of Mallory et al. 2012. The cost of forward contracting corn for March delivery is flat, and the cost of forward contracting soybeans for March delivery is slightly downward sloped, but less than the cost of forward contracting soybeans for January delivery. This indicates that cash flow risk may be more important than risk of default by the farmer counterparty in the forward contracts for March delivery.

We did not find a significant increase in the cost of forward contracting for January delivery when there is an income shifting benefit compared to the cost of forward contracting for March delivery when an income shifting benefit is not present. We conclude that the choice of forward contracts for January verses March delivery offer a relatively inexpensive means of smoothing income tax burden across years.

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Table 1: Cost of forward contracting corn for January delivery, by week in three year sub-periods 1980-2009, in levels

		week 39	week 40	week 41	week 42	week 43	week 44	week 45	week 46	week 47	week 48	week 49	week 50
1980-	mean	-8.26	1.79	2.91	7.81	3.98	2.49	1.38	2.81	1.53	1.86	1.53	7.99
1982	stdev	3.09	8.73	7.74	2.87	7.30	7.99	7.78	6.89	7.92	6.74	8.05	4.67
1983-	mean	8.35	4.78	5.25	4.58	5.71	3.89	4.79	4.33	2.70	2.10	2.24	1.93
1986	stdev	3.16	5.11	4.75	6.46	5.69	6.42	5.93	5.36	5.49	5.82	6.57	5.50
1987-	mean	4.87	4.42	3.99	3.70	3.76	3.04	2.06	1.85	1.98	1.33	0.37	-0.27
1990	stdev	6.17	4.13	4.01	3.89	4.39	3.11	3.45	3.07	3.50	3.00	2.76	2.59
1991-	mean	3.11	3.03	2.31	2.55	2.28	2.16	1.70	1.98	1.16	0.51	-0.26	0.05
1994	stdev	3.73	3.18	2.56	2.68	2.67	2.68	3.28	3.13	3.80	3.59	2.95	1.82
1995-	mean	39.21	11.84	5.51	3.36	2.58	2.69	2.84	2.54	1.55	1.23	0.95	0.90
1998	stdev	3.58	1.67	4.71	4.33	4.70	5.42	5.05	4.85	3.98	3.98	4.04	3.55
1999-	mean	3.89	3.69	2.95	2.71	1.62	1.23	0.81	0.57	-0.19	-0.73	-1.31	-4.96
2002	stdev	4.32	4.08	3.90	4.33	4.01	3.41	3.58	3.71	3.97	3.61	3.43	1.59
2003-	mean	2.15	2.34	2.96	2.09	1.71	1.35	1.81	0.92	3.34	-0.17	1.71	-6.56
2006	stdev	4.46	5.67	6.90	6.97	7.23	6.68	7.13	6.90	5.72	6.62	6.44	1.76
2007-	mean	-0.15	5.44	5.38	2.96	1.23	1.34	0.85	0.92	5.51	0.91		
2009	stdev	8.59	11.97	12.31	11.02	9.34	9.76	9.63	9.03	7.22	9.17		
1980-	mean	5.42	3.82	3.66	3.56	3.04	2.40	2.23	2.12	1.67	0.84	0.64	0.76
2006	stdev	10.17	5.41	5.15	5.09	5.39	5.31	5.39	5.05	4.98	4.92	5.06	5.01
2007-	mean	-0.15	5.44	5.38	2.96	1.23	1.34	0.85	0.92	5.51	0.91		
2009	stdev	8.59	11.97	12.31	11.02	9.34	9.76	9.63	9.03	7.22	9.17		

Table 2: Cost of forward contracting soybeans for January delivery, by week in three year sub-periods 1980-2009, in levels

		week 39	week 40	week 41	week 42	week 43	week 44	week 45	week 46	week 47	week 48	week 49	week 50
1980-	mean	11.97	11.60	14.44	16.61	14.77	13.25	12.29	13.68	8.51	8.11	9.77	17.54
1982	stdev	5.33	5.85	8.79	10.50	8.69	11.16	12.05	10.92	9.39	9.42	13.73	10.07
1983-	mean	8.78	5.24	10.29	9.31	10.70	9.29	10.45	8.45	6.70	4.86	4.67	4.50
1986	stdev	8.16	5.31	8.18	6.73	7.37	8.45	9.49	10.52	9.89	10.28	9.49	8.89
1987-	mean	3.39	8.39	7.18	8.29	9.99	8.18	7.38	7.54	8.15	5.92	6.17	5.57
1990	stdev	5.68	8.90	7.61	7.12	5.94	6.14	7.89	9.09	4.24	2.83	2.34	3.35
1991-	mean	11.82	11.07	7.33	5.27	7.59	6.47	5.38	4.11	3.36	3.18	3.09	-0.45
1994	stdev	3.23	2.95	4.75	4.94	4.25	4.89	4.26	4.79	3.51	3.41	2.90	1.75
1995-	mean	41.11	14.17	8.55	6.96	7.46	5.64	5.01	2.76	1.56	0.79	0.37	2.17
1998	stdev	4.64	1.64	6.33	4.72	3.89	5.98	6.27	5.15	5.24	5.57	6.97	5.98
1999-	mean	8.38	8.23	8.51	7.48	6.14	6.34	4.29	3.58	2.25	1.54	0.94	0.11
2002	stdev	4.06	4.09	3.04	3.69	3.18	3.13	5.26	5.19	4.80	4.05	3.10	1.61
2003-	mean	6.23	4.04	4.23	4.20	0.80	3.26	3.04	4.66	4.87	2.02	3.77	-2.74
2006	stdev	16.15	15.70	14.58	15.13	19.95	17.26	16.70	13.33	16.13	12.42	13.70	3.69
2007-	mean	-7.32	12.22	9.08	6.56	-3.19	1.00	0.84	2.27	3.94	0.10		
2009	stdev	12.00	31.54	28.74	23.05	15.38	18.58	14.95	11.42	8.45	10.46		
1980-	mean												
2006	stdev	9.59	7.82	8.39	7.75	7.94	7.28	6.63	6.13	4.91	3.61	3.90	4.40
2007-	mean	12.27	9.42	8.70	8.77	9.99	9.45	9.94	9.38	8.47	7.87	8.35	8.29
2009	stdev	-7.32	12.22	9.08	6.56	-3.19	1.00	0.84	2.27	3.94	0.10		

Table 3: Cost of forward contracting corn for March delivery, by week in three year sub-periods 1980-2009, in levels

		week 54	week 55	week 56	week 57	week 58
1980-	mean	6.83	5.03	5.67	8.09	6.24
1982	stdev	1.77	8.12	5.79	4.44	5.55
1983-	mean	-0.32	1.96	1.13	1.59	1.46
1986	stdev	3.42	2.17	2.82	2.97	2.45
1987-	mean	2.89	2.34	2.84	1.99	-1.33
1990	stdev	2.16	1.69	1.79	1.39	4.35
1991-	mean	4.93	5.74	6.97	5.32	5.19
1994	stdev	3.33	1.88	1.39	1.13	0.90
1995-	mean		2.16	3.47	3.44	4.59
1998	stdev		1.44	0.94	1.34	2.59
1999-	mean	0.19	2.02	1.79	2.09	-3.94
2002	stdev	4.21	2.49	2.79	2.83	9.54
2003-	mean	-0.03	-1.39	-0.77	-0.89	-0.25
2006	stdev	5.06	3.33	3.65	3.50	2.99
2007-	mean	11.46	9.96	8.56	6.67	5.31
2009	stdev	8.78	7.33	5.89	5.87	3.16
1980-	mean	2.05	2.55	2.48	2.91	1.59
2006	stdev	4.17	4.26	3.94	3.85	6.24
2007-	mean	11.46	9.96	8.56	6.67	5.31
2009	stdev	8.78	7.33	5.89	5.87	3.16

Table 4: Cost of forward contracting soybeans for March delivery, by week in three year sub-periods 1980-2009, in levels

		week 54	week 55	week 56	week 57	week 58
1980-	mean	3.34	8.01	13.68	10.38	10.87
1982	stdev	1.71	5.06	8.34	4.79	4.34
1983-	mean	3.23	3.80	2.34	1.39	2.56
1986	stdev	5.18	6.16	4.96	5.89	5.44
1987-	mean	7.33	5.49	4.33	3.09	-5.46
1990	stdev	6.14	6.09	6.72	6.04	6.29
1991-	mean	0.96	2.64	6.47	0.77	-1.74
1994	stdev	4.72	7.28	2.91	3.41	10.73
1995-	mean		-0.24	-0.60	-0.89	2.04
1998	stdev		2.55	2.14	2.47	2.44
1999-	mean	1.38	2.29	2.52	2.30	-1.44
2002	stdev	3.79	3.46	3.72	3.55	6.41
2003-	mean	4.37	2.99	3.85	2.75	-0.66
2006	stdev	8.37	8.82	9.85	9.40	9.02
2007-	mean	12.12	12.59	12.84	9.41	4.69
2009	stdev	10.62	11.34	13.73	12.36	20.66
1980-	mean	3.38	3.96	4.89	3.17	1.21
2006	stdev	5.80	6.37	7.62	6.37	8.59
2007-	mean	12.12	12.59	12.84	9.41	4.69
2009	stdev	10.62	11.34	13.73	12.37	20.66

Table 5. Regression model estimates of the cost of forward contracting corn and soybeans in Illinois, 1980-2009

Equation (9.2) $c_{j,t}(t,t^*) = a + bt + \rho c_{j,t-1}(t,t^*) + r_t + \varepsilon_{j,t}$

	Corn				Soybeans			
	January		March		January		March	
	(level)	(percent)	(level)	(percent)	(level)	(percent)	(level)	(percent)
a	4.541***	0.026***	35.463***	0.142***	11.550***	0.023***	54.548***	0.090***
	(1.004)	(0.004)	(5.901)	(0.027)	(1.933)	(0.003)	(9.515)	(0.015)
b	-0.079***	-0.001***	-0.581***	-0.002***	-0.146***	-0.000***	-0.852***	-0.001***
	(0.020)	(0.000)	(0.104)	(0.000)	(0.032)	(0.000)	(0.154)	(0.000)
ρ	0.722***	0.701***	0.616***	0.592***	0.624***	0.596***	0.722***	0.651***
	(0.045)	(0.052)	(0.048)	(0.055)	(0.034)	(0.037)	(0.066)	(0.066)
N	2060		680		2068		686	

[a] Robust standard errors in parentheses
[b] * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure 1: The average cost of forward contracting Corn in Illinois Pre-and-Post 2006

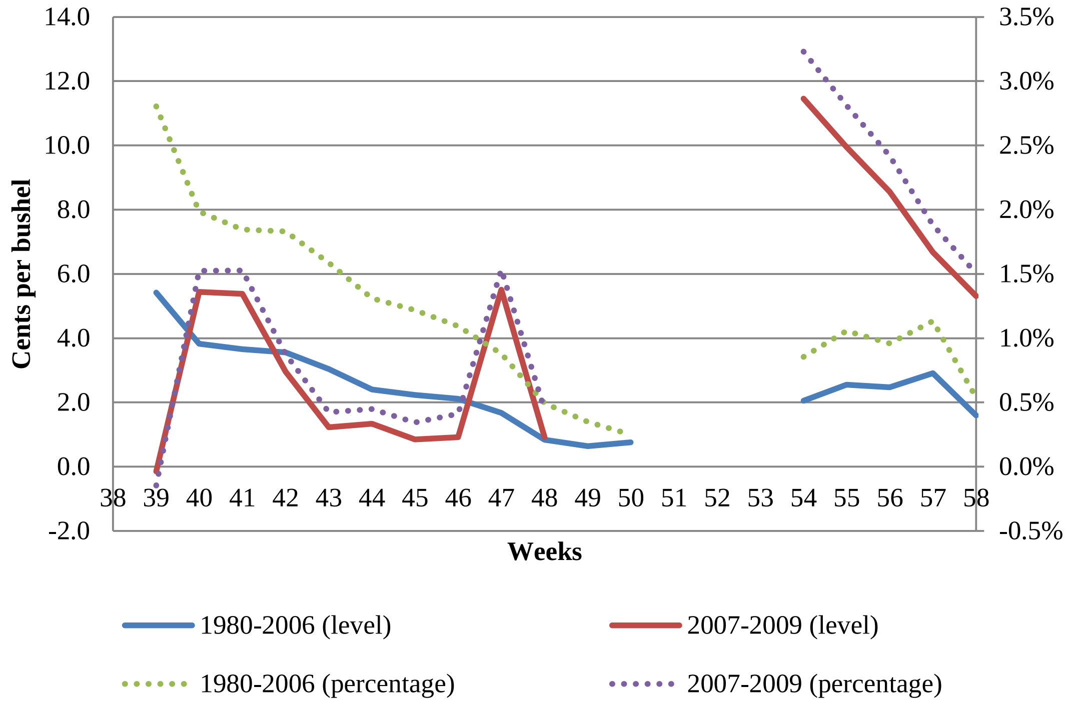
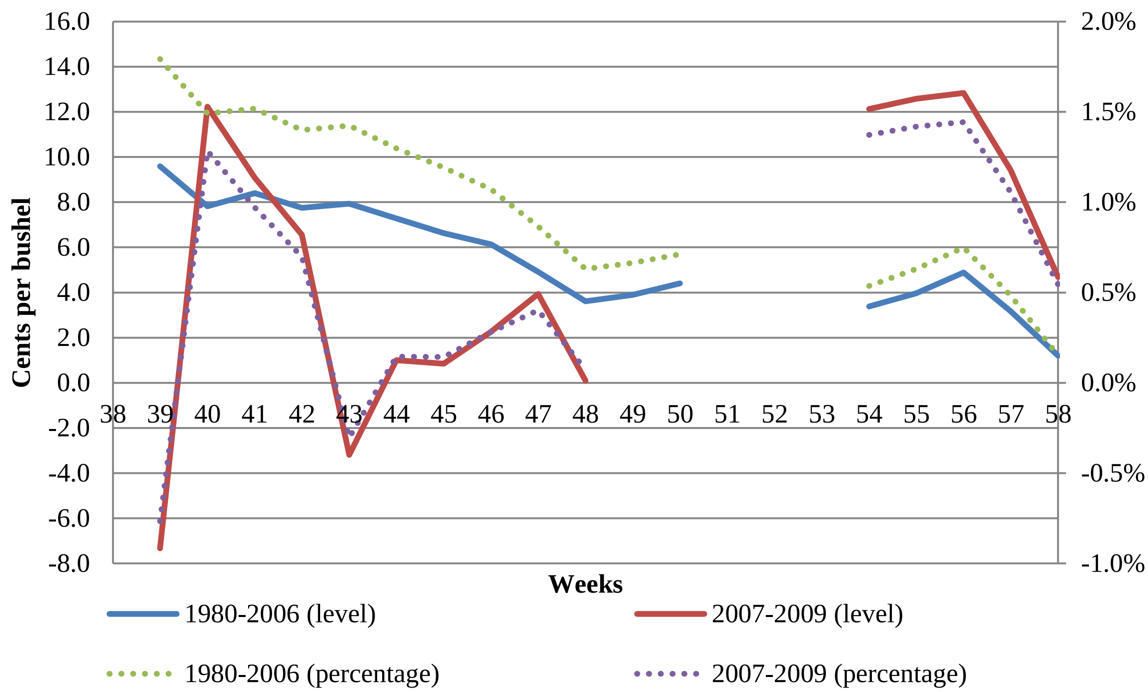


Figure 2: The average cost of forward contracting Soybeans in Illinois Pre-and-Post 2006



Endnotes

[i] This is equivalent to assuming that futures prices are unbiased predictors of future spot prices.

[ii] Except for the calculating the spot basis in March where we only use the first two weeks, which corresponds to our time of analysis.

[iii] These results are available from the authors upon request.