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by

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USE OF "BASIS" AS A GUIDELINE FOR STORAGE STRATEGIES FOR CORN, WHEAT AND SOYBEANS ON MICHIGAN FARMS

John N. Ferris*

One of the most difficult decisions crop producers face is timing of sales, whether forward pricing new crop output before harvest or pricing grain in storage. Such decisions can easily mean the difference between profit and loss, over-riding the best efforts toward production efficiency. Are there any ways in which farmers can improve their skills in becoming more effective marketers? The purpose of this paper is to determine whether "basis" information can be a helpful guideline to producers in timing sales of corn, wheat and soybeans out of on-farm storage.

Traditionally, crop producers' marketing strategy has been focused upon timing of strictly cash sales out of storage. In recognition of this, many research and extension bulletins have been written on seasonal price patterns. Typical of such bulletins is the circular, "When to Sell Corn - Soybeans - Oats - Wheat" written by T.A. Hieronymus in 1966 at Illinois (Hieronymus). These bulletins generally have presented indices of seasonal prices and some measure of dispersion such as the standard deviation of the index. Some references to storage costs were usually included. Returns to storage were explicitly introduced in an analysis of cash price patterns on corn, soybeans and wheat at Chicago (Ferris, 1985). Returns were adjusted to constant dollar values.

The use of "basis" information as a guideline for storage decisions has been given some attention by researchers, but the coverage is not extensive. Heifner examined basis as a tool for managing seasonal grain inventories (Heifner). A recent example of application of basis information in developing a marketing strategy on corn was a study in Canada (Martin and Hope). They concluded that the use and understanding of basis was one of the essential ingredients in successful marketing.

While futures markets have existed for more than a century on grains and for an extensive period on soybeans, farmers' direct use of these forward pricing instruments has been limited. Indirectly, through forward contracts offered to farmers by elevators, futures markets have provided a much more widely used means for shifting risk. Elevators protect their cash position with farmers through short sales in futures.

The question being posed in this paper is whether "basis" information can be helpful to both increase average returns to storage and reduce risks. Basis is simply defined as the difference between the price of a given futures contract and a given local cash price. The presumption is that if the basis is narrow (or strong relative to futures), the market is sending a signal that it wants the cash product. If the basis is wide (weak relative to futures), the market is indicating that it doesn't want the product and it should be held back. This sounds rather elementary but it may be a key indicator for storage decisions.

The example cited in this study relates to central Michigan. The data are mid-week prices for the crop years from 1973-74 to 1984-85. The cash market is represented by prices paid to farmers at the Saginaw terminal for corn, soybeans, and soft white

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wheat. Futures include March and July contracts on corn and soybeans and December and May on wheat, all at the Chicago Board of Trade.

The Cash Strategy

For farmers following only the cash market, previous studies in Michigan concluded that on corn, sell some soon after the first of January and the remainder in early summer, or at least regularly from January to June (Ferris, 1983). On soybeans, selling in late winter and in early summer was the preferred alternative, specifically, March to June. Wheat sales were recommended between October and January. This analysis was based on the crop years from 1958-59 to 1982-83. An alternative analysis was based on 1973-74 to 1982-83, with similar conclusions.

These conclusions were derived from an evaluation of both: (1) average returns over storage costs relative to sales at harvest; and (2) safety. These periods were established in this study as the standard by which an alternative strategy was to be judged. The only modification was that the sales period for wheat was shortened to October to December. Inspection of the data indicated that storage through January would have resulted in lower net returns.

The calculation of net returns to on-farm storage was made by subtracting the harvest price and storage costs from the average cash price to farmers at Saginaw during the designated sales period. The harvest price on corn was the average for the period from mid October to mid November; specifically, prices quoted at the end of Wednesdays (Thursdays beginning with the 1984 crop year) beginning with the third week of October and ending with the seventh week from the beginning of October.

Storage costs were considered to be the direct or variable costs of holding the grain in on-farm facilities. These costs were primarily foregone interest on the grain inventory calculated by multiplying short-term interest rates by the price of the grain. To simplify the computations, only flat (per week) rates were used. To account for in and out costs, extra drying, etc., the net returns quoted would need to be diminished accordingly. The storage costs assumed are presented in Tables 1, 2 and 3.

For example, the price of corn at Saginaw at the close of Wednesday, May 31, 1978 was $2.26. The harvest price calculated by averaging the Wednesdays from October 19, 1977 to November 16, 1977 was $1.57. From the mid point of harvest to May 31, 1978 was 30 weeks. With storage costs at $.0046 per week, the total storage cost was about $.14. Deducting $1.57 and $.14 from $2.26 provided a net return to storage of $.55 per bushel. These returns were averaged over the January to June 1978 period to estimate what a prudent farmer might have realized in the 1977-78 crop year from on-farm storage over direct costs. This turned out to be $.30 (Table 1).

Because the general price level increased markedly over the period analyzed, earnings from storage in the early part of the period were more valuable in terms of purchasing power than in the latter part of the period. Net returns were calculated in terms of 1985 dollars by deflating by the Consumer Price Index. This provided a more comparable level of net returns over the period for computing both a mean and a standard deviation (Tables 1, 2 and 3).

The Cash/Hedge Strategy

As can be noted in Tables 1-3, the mean net returns to storage in crop years 1973-84 were minimal on corn, negative on soybeans and, except for the inclusion of the very

Table 1. Net Returns from Storing Corn on Farms Under Cash and Cash/Hedge Strategies; Central Michigan, 1973-84 Crop Years

	Years													
	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	Mean	S.D.
	$/bu													
	Net Returns Over Storage Costs Relative to Selling At Harvest													
Cash Strategy: Sell regularly from January to June														
Nominal	.43	- .83	.06	-.01	.30	.30	-.07	-.09	-.08	.61	-.22	-.20	.016	.358
1985 $	.99	-1.73	.12	-.01	.52	.46	-.10	-.12	-.09	.67	-.23	-.21	.023	.648
Cash/Hedge Strategy:														
Sell at harvest[a/]	0	0												
Cash strategy[b/]														
Hedge[c/]					.30	.30					0	0		
Month(s)										.61				
Net return			July	July			July	March-July	July				.214	.180
Net return in 1985 $	0	0	.25	.18			.25	.36	.30					
			.49	.33	.52	.46	.35	.45	.34	.67	0	0	.302	.230
Storage Costs per Week[d/]	.0046	.0046	.0046	.0046	.0046	.0046	.0058	.0092	.0092	.0069	.0092	.0092		

[a/] Sell at harvest if the basis does not exceed the "breakeven basis" by more than 6 percent of the cash price, unless conditions for the cash strategy prevail.

[b/] Store unhedged grain as under the cash strategy if the harvest price is more than 5 percent under the government loan.

[c/] If [a/] and [b/] are not the case, sell either March or July futures depending on which has the widest basis relative to "breakeven basis." Lift hedge if and whenever basis drops below the "breakeven basis" by at least 2 percent of the cash price. Roll March hedges into July if net profit of 1 percent of cash price can be realized.

[d/] Variable on-farm costs which are mostly interest on the stored grain.

Table 2. Net Returns from Storing Soybeans on Farms Under Cash and Cash/Hedge Strategies; Central Michigan, 1973-84 Crop Years

	Years													
	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	Mean	S.D.
	$/bu													
Net Returns Over Storage Costs Relative to Selling at Harvest														
Cash Strategy: Sell regularly from March to June														
Nominal	-.39	-2.85	-.24	2.65	1.68	.98	-1.28	-1.12	-.57	.45	- .99	-.62	-.191	1.399
1985 $	-.89	-5.94	-.47	4.86	2.86	1.53	-1.78	-1.39	-.66	.50	-1.05	-.63	-.255	2.533
Cash/Hedge Strategy:														
Sell at harvest[a/]	0	0		0		0				0	0	0		
Cash strategy[b/]														
Hedge[c/]														
Month(s)			March		March		July	March-July	July					
Net return			.17		-.01		-.04	.43	.36				.076	.152
Net return in 1985 $	0	0	.33	0	-.02	0	-.06	.53	.41	0	0	0	.099	.192
Storage Costs per Week[d/]	.0115	.0115	.0115	.0115	.0115	.0115	.0150	.0196	.0184	.0138	.0207	.0161		

[a/] Sell at harvest if the basis does not exceed the "breakeven basis" by more than 2 percent of the cash price, unless conditions for the cash strategy prevail.

[b/] Store unhedged beans as under the cash strategy if the harvest price is more than 5 percent under the government loan.

[c/] If a/ and b/ are not the case, sell either March or July futures depending on which has the widest basis relative to the "breakeven basis." Lift hedge if and whenever basis drops below the "breakeven basis" by at least 2 percent of the cash price. Role March hedges into July if net profit of 1 percent of cash price can be realized.

[d/] Variable on-farm costs which are mostly interest on the stored beans.

Table 3. Net Returns from Storing White Wheat Under Cash and Cash/Hedge Strategies; Central Michigan, 1973-84 Crop Years

	Years													
	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	Mean	S.D.
	$/bu													
Net Returns Over Storage Costs Relative to Selling at Harvest														
Cash Strategy: Sell regularly from October to December														
Nominal	1.60	.12	.10	-.57	.17	.43	-.25	.22	.07	-.46	-.39	-.15	.074	.545
1985 $	3.67	.25	.19	-1.04	.29	.68	-.35	.27	.08	-.51	-.42	-.15	.247	1.123
Cash/Hedge Strategy:														
Sell at harvest[a]	0													
Cash strategy[b]						0				0	0			
Hedge[c]					.17									
Month(s)		Dec.	May	Dec.			Dec.	Dec.	Dec.			Dec.	.080	.191
Net return		-.14	.27	.40			-.21	-.02	.43			.06		
Net return in 1985 $	0	-.29	.52	.73	.29	0	-.29	-.02	.49	0	0	.06	.124	.305
Storage Costs per Week[d]	.0069	.0069	.0069	.0069	.0069	.0069	.0081	.0115	.0115	.0092	.0092	.0092		

[a] Sell at harvest if the basis does not exceed the "breakeven basis" by more than 3 percent of the cash price, unless conditions for the cash strategy prevail.

[b] Store unhedged grain as under the cash strategy if harvest price is more than 5 percent under the government loan.

[c] If a/ and b/ are not the case, sell either December or May futures depending on which has the widest basis relative to the "breakeven basis." Lift hedge if and whenever basis drops below the "breakeven basis" by at least 2 percent of the cash price. Roll December hedges into May if net profit of 1 percent of the cash price can be realized.

[d] Variable on-farm costs which are mostly interest on the stored grain.

profitable crop year of 1973-74, would have been negative on wheat. Because the standard deviations are relatively large with some years very profitable and some very unprofitable, a crucial question is, "In which years should producers store and in which years should they sell at harvest?"

To explore this question, a cash/hedge strategy was established for each crop employing both information about basis and the government non-recourse loan program. To evaluate storage prospects using basis, a "breakeven basis" function was calculated. For any given point in time this function is equal to the storage cost to the period just prior to delivery on a given futures contract plus the "normal" basis in that period. Whenever the actual basis is greater than the breakeven basis, hedging will be profitable if the normal basis materializes. Otherwise, hedging would not be profitable.

The comparison between the actual basis and the breakeven basis also provides an important guideline for lifting hedges. Whenever the actual basis is less than the breakeven basis, additional profits can be realized above and beyond those anticipated when the hedge is placed. For example, if the actual basis is $.10 per bushel over the breakeven basis and a hedge is placed, the hedger would expect a net return of $.10 (less brokerage costs) if the basis near delivery turns out to be "normal." In the meantime, however, if the actual basis happens to drop below the breakeven basis by say $.05 per bushel, the hedge could be lifted with a net return of $.15 per bushel (less brokerage costs).

The implementation of the breakeven basis concept is illustrated in Figure 1 on the 1981-82 crop year for corn. At harvest, the farm price averaged $2.37 and July futures $3.22 for a basis of $.85. Storage costs to the period just prior to delivery were estimated to be about $.32 (35 weeks times $.0092/week). The normal basis was assumed to be equal to the actual basis for the 5 week period prior to delivery for the 3 years before 1981, that is, 1978-80. This figure was $.28. Subtracting $.32 and $.28 from $.85 gives $.25 as the expected net return from storing under a hedge (less brokerage, extra drying, etc.). This is indicated in Figure 1 by the extent to which the actual basis exceeds the breakeven basis at harvest.

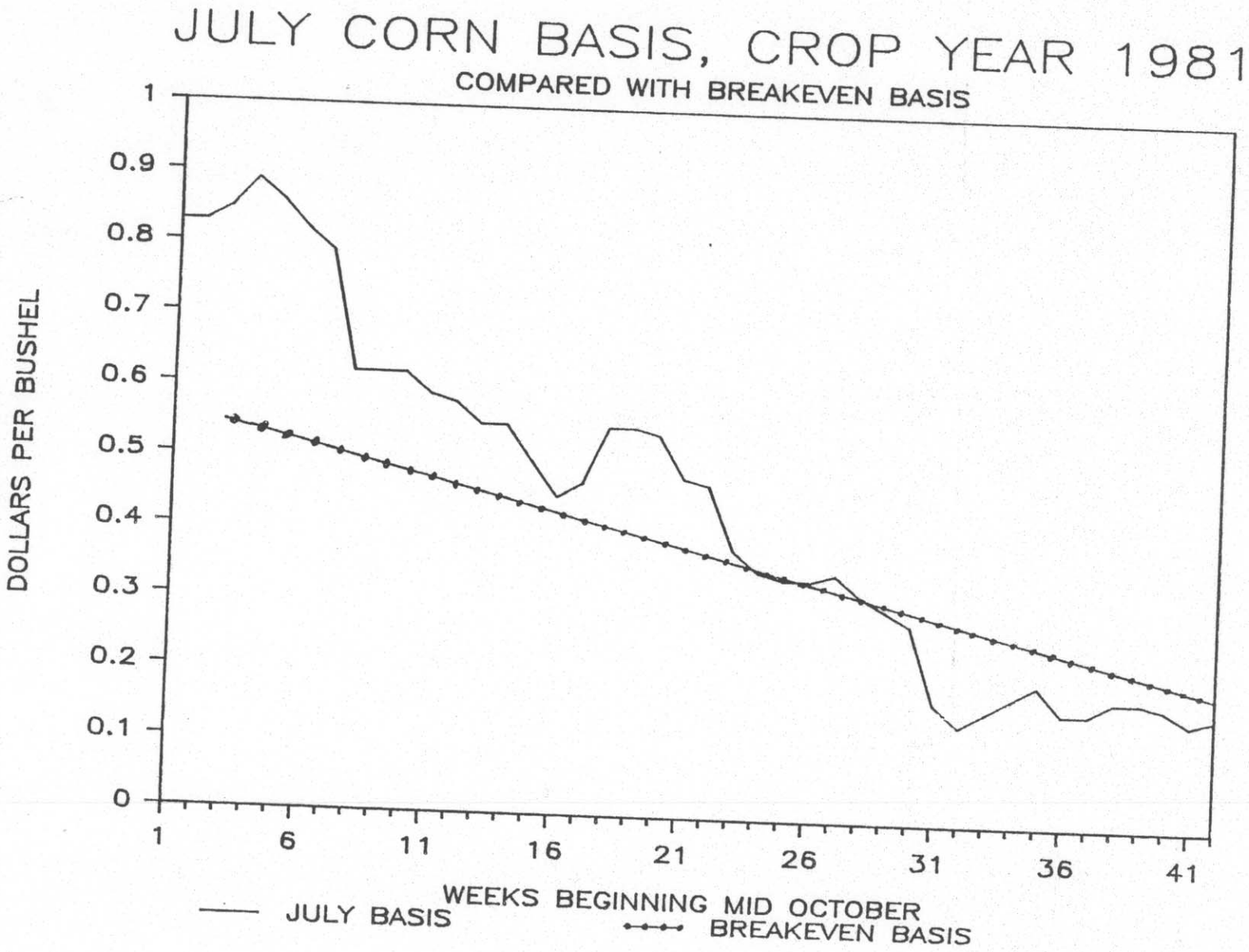
During the week of March 31, 1982, the basis dropped below the breakeven basis by enough to warrant lifting the hedge. In this case the basis was $.07 below the breakeven basis, adding this amount to the net return from the hedge, for a total of $.32. Brokerage costs were assumed at $.02 leaving a net of $.30 for the Cash/Hedge Strategy in crop year 1981-82 (Table 1).

For a number of years, the basis on corn and soybeans in mid Michigan within a month of delivery was fairly consistent and dependable. With changes in the competitive structure of the industry plus certain disruptions to the normal flow of grain (such as the short 1983 crop and the PIK program), the basis has narrowed. For this reason, a moving average of the previous 3 years was used as an indicator of "normal."

In the example cited above, if the basis had not narrowed down to the breakeven level by the period just prior to delivery, the hedge would have been lifted with net returns less than the $.25 expected. It so happened that the basis did drop even further below the breakeven level after March and higher profits could have been realized. However, major departures of basis from the norm are not easily predicted.

Another major consideration in deciding on a storage strategy is the level of market prices relative to the regular government loan rate, and in some years relative to the reserve loan rates, release prices and CCC sales prices. In this study, only the

FIGURE 1


JULY CORN BASIS, CROP YEAR 1981
COMPARED WITH BREAKEVEN BASIS
DOLLARS PER BUSHEL
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
6
11
16
21
26
31
36
41
WEEKS BEGINNING MID OCTOBER
JULY BASIS
BREAKEVEN BASIS

regular loan rate was included in the strategy. Since generally, the regular loan rate establishes a floor on market prices, the need for price protection and downside price risks are much less when harvest prices are below the loan rate. The use of basis was over-riden by the rule that if market prices are more than 5 percent below the loan rate at harvest, producers should store the crop unhedged. The alternative of actually placing grain under the loan could have been examined but was not done because of the focus on comparing the two strategies. In years when the market price at harvest is more than 5 percent under the loan, the two strategies are the same.

The specific rules are enumerated in the footnotes to Tables 1-3. Somewhat arbitrary are the penetration levels related to how much above the breakeven level the basis must be at harvest to prompt a hedge. A greater percentage of the cash price was included on corn because of the extra drying below 15.5 percent moisture required for safe storage, for which the market generally does not pay a premium.

Two futures contracts were included for each commodity with an allowance for rolling ahead the hedge if the nearer term contract was sold at harvest. Again the profit of 1 percent of the cash price from rolling ahead is an arbitrary figure.

If the basis does not narrow down to points enough below the breakeven basis to provide an extra return amounting to 2 percent of the cash price, the hedge is carried to the month ahead of delivery. The average cash and futures prices for the last 5 weeks of the futures contract were used in calculating the net return to the hedge.

A topic for further research would be to examine the penetration points to establish certain optimum hedging rules. Neither the parameters for the Cash nor Cash/Hedge Strategies are optimal in terms of net returns or risk, but represent some reasonable choices.

Results

The Cash/Hedge Strategy on corn resulted in both higher average net returns and less risk than did the Cash Strategy (Table 1). The average real net return was $.30 per bushel for Cash/Hedge with a standard deviation of $.23 compared to the average real net return of $.02 and a standard deviation of $.65 for Cash.

Net returns from Cash/Hedge were higher in 8 out of the 12 years and the same in 3. Only in 1973 did Cash generate higher returns. In no year did the Cash/Hedge result in a loss relative to sales at harvest. For the Cash, losses were observed in 7 years.

Basis information can be valuable to producers even though they may not hedge. If they had followed the situation signalling sales at harvest, they would have avoided losses in 1974, 1983 and 1984, more than offsetting the profit in 1973.

Comparisons between the two strategies were similar on soybeans (Table 2). Average net returns were higher and variability of returns were less from the Cash/Hedge Strategy. The Cash/Hedge average real net return was $.10 per bushel and the standard deviation was $.19. In contrast, the average real net return for the Cash was -$.19 with a standard deviation of $2.53.

Net returns from the Cash/Hedge Strategy exceeded that from the Cash in 8 years out of 12. Small losses were incurred in two years with the Cash/Hedge with substantial losses observed with the Cash Strategy in 8 years. A narrow basis at harvest correctly called for harvest sales in 4 years and incorrectly in 3 years.

The performance of the Cash/Hedge Strategy was less convincing on white wheat (Table 3). Basis risk is relatively high on Michigan's white wheat because it is not deliverable against the Chicago Board of Trade contract. While soft white prices tend to move in tandem with soft red, the different uses for the soft white does cause departures from time to time.

The average real net returns from the Cash/Hedge Strategy was $.12 per bushel compared to $.25 on the Cash Strategy. However, if 1973 were excluded, the net from Cash would have been -$.06. The Cash/Hedge Strategy did reduce variability which was $1.12 under Cash and $.30 under Cash/Hedge. The narrow basis rule of thumb correctly called for harvest sales in only two out of the four years it was observed.

Producers incurred losses in 5 out of the 12 years under the Cash Strategy. Losses were realized in 3 years under Cash/Hedge, two of which were rather significant.

Conclusions

Basis information, modified by considerations of the level of market prices relative to the regular government loan rate, has been valuable in storage decisions on corn and soybeans. While less useful for storage decisions on Michigan's white wheat, those storing this class will still want to monitor the basis. Likely, basis information would be more reliable for those storing soft red wheat.

Average real net returns to storage under the Cash Strategy since 1973 have been minimal on corn even when only the direct on-farm storage costs are included in the computation. On soybeans, the average return was negative. The average real net returns on wheat, while nearly $.25 per bushel for the entire 1973-84 period would have been negative if the very profitable year of 1973 were omitted. However, with the guidelines provided by the appropriate analysis of basis, producers could have both increased their net returns from storage and reduced their risks.

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