ABSTRACT

On-farm vs. Commercial Grain Storage in Kansas

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There has been an increased interest in grain storage in Kansas the last several years. This is primarily due to low prices and wide basis levels at harvest. Further increasing this interest is the fact that total production of wheat, corn, milo, and soybeans exceeded storage capacity for the first times ever in 1997 and 1998. Historically, the majority of storage capacity in Kansas has been commercial storage as opposed to on-farm storage. An analysis of historical returns to storing grain indicate that, on average, seasonality in prices results in low returns to storing grain. When total costs are considered, returns to storing grain based solely on price increases are higher with commercial storage than on-farm storage. However, on-farm storage may be profitable when returns to storage due to marketing flexibility and premiums on identity preserved grains are considered.

BIO

Kevin Dhuyvetter is an associate professor in the Department of Agricultural Economics at Kansas State University working as an extension farm management specialist. Kevin comes from a crop and livestock farm in northwest North Dakota which led to his work interests in the areas of crop and livestock production economics, marketing, and farm financial management. Kevin holds B.S. and M.S. degrees in agricultural economics from North Dakota State University and Iowa State University, respectively, and his Ph.D. in agricultural economics from Kansas State University.

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Risk and Profitability Conference
Kansas State University
Holiday Inn Holidome, Manhattan, KS
August 19-20, 1999

Helpful comments and suggestions of Terry Kastens and Harvey Kiser are gratefully acknowledged and appreciation is expressed to Harder Ag Products of Peabody, KS for providing grain bin cost estimates.

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Introduction

Interest in grain storage in Kansas has been high these last several years. This interest can primarily be attributed to low grain prices and wide basis levels at harvest. The increased demand for storage has led to grain being stored in temporary structures, old facilities being leased, and a renewed interest in the construction of new storage facilities.

Kansas has traditionally stored much of its grain production in commercial elevators as opposed to on-farm storage. Figure 1 shows the on-farm and off-farm storage capacity in Kansas as reported by USDA. Year-to-year total storage capacity in Kansas has been steady or declining every year since 1987 until 1998 when capacity increased slightly. In 1998, on-farm and off-farm storage capacity were estimated at 400 and 784 million bushels, respectively, giving a total of just under 1.2 billion bushels of storage capacity.

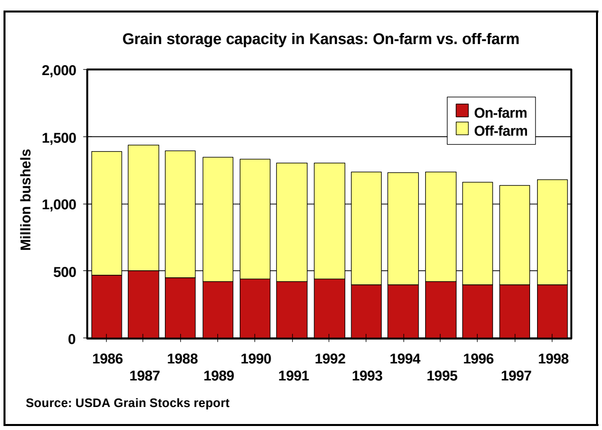

Figure 1

Total production of the four major grain crops in Kansas (wheat, corn, milo, and soybeans) has been trending up for the last decade (figure 2). This increase in production has been due to increased yields statewide and increased planted acres, especially in western Kansas. From 1980 through 1993 total production of these four crops generally was in the 700 to 900 million bushel range (data prior to 1986 not shown), however, since 1993 production has surpassed one billion bushels four times.

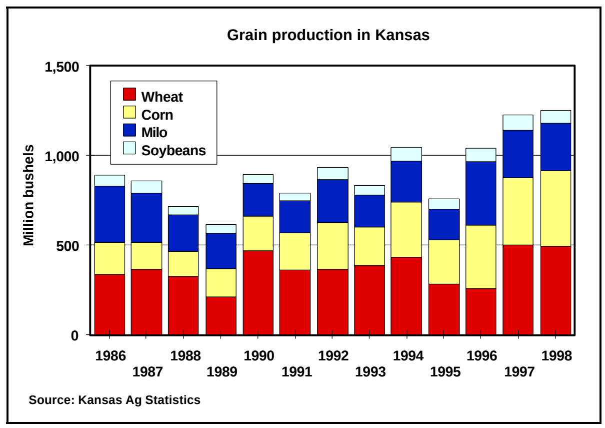

Figure 2

Figure 3 shows total grain production of wheat, corn, milo, and soybeans in Kansas versus the storage capacity. Given that total storage capacity has been considerably above a billion bushels, storage capacity in Kansas has generally exceeded total annual production of these four crops. However, due to decreasing storage capacity and increasing production, total production exceeded total storage capacity in both 1997 and 1998 for the first times since 1986 (data for on-farm storage capacity prior to 1986 are not available). This partially explains why there has been so much interest in grain storage the last several years in Kansas. This shortage of storage capacity also explains why commercial elevators were able to deduct "dumping charges" from prices in some locations in 1998 (i.e., the demand for storage exceeded the supply of storage).

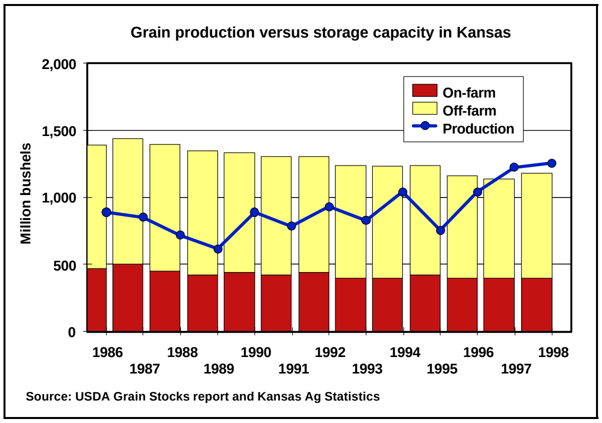

Figure 3

Figure 4 shows the on-farm storage capacity as a percent of total storage capacity for Kansas, North Dakota, and the total U.S. Only about a third of the storage in Kansas is on-farm; whereas, about 75 percent of the storage in North Dakota is on-farm. Nationally, slightly less than 60 percent of the storage capacity is on-farm. Nebraska, Iowa, and Illinois are similar to the U.S. while Oklahoma has slightly less on-farm storage than Kansas (data not shown). Why these differences exist are not real clear. They are most likely due to a number of contributing factors (e.g., transportation infrastructure, climate, livestock operations, intensity of production, type of crops stored).

While Kansas has historically relied very heavily on off-farm (commercial) storage, there are a number of factors that may lead to an increase in on-farm storage in the future. Several reasons the demand for on-farm storage may increase in the future are (1) increasing acreage of specialty crops and the need to identity preserve crops, (2) farmers changing their crop mixes due to production flexibility, (3) producers are utilizing larger trucks than in the past, thus, making it easier to haul grain to its final destination, and (4) to a lesser extent, grain quality and harvest time bottleneck concerns.

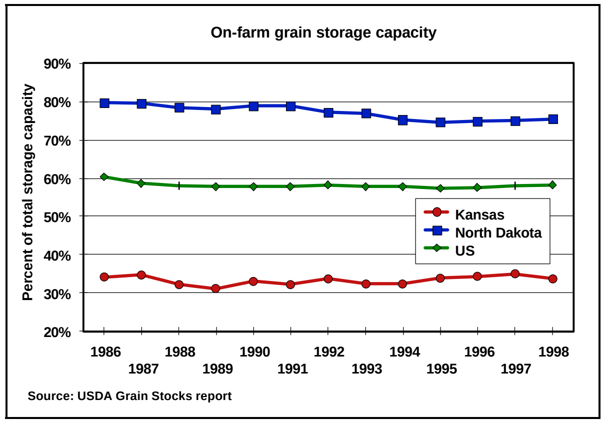

Figure 4

As producers increase their acreage to specialty crops or crops that require identity preservation, commercial storage may not be a valid alternative and thus on-farm storage is necessary. Additionally, as producers change their crop mix (i.e., plant more summer crops and less wheat), on-farm storage will be more economical because they can reduce harvest time bottlenecks associated with multiple crops. Additionally, on-farm bins will be more efficiently utilized if producing multiple crops allows them to be used for more months out of the year. Producers using larger trucks often have more flexibility with regards to where their crops are marketed and thus the benefits of on-farm storage increase relative to commercial storage. On the other hand, producers who historically have had on-farm storage because of distances to commercial elevators, will find it easier to haul to elevators as they increase the size of their trucks. Large operators may also find that on-farm storage facilities reduce bottlenecks associated with smaller and older commercial storage facilities (i.e., facilities that were not designed to accommodate semi-trucks). Finally, the advent of automatic sensory equipment has reduced some of the historical concerns with quality issues associated with on-farm storage. Furthermore, producers storing grain on-farm may possibly capture gains to managing quality with regards to the optimal moisture content of grain compared to if it were stored commercially.

Returns to grain storage

In a competitive market, price equals costs and economic profits are zero. Thus, with regards to grain storage we would not expect large average returns to storing grain, assuming the market is competitive. On the other hand, we would not expect average returns to be less than zero either. In other words, for a producer with average costs of storage the returns to storing grain should equal his costs in the long run. However, a producer with below average costs may be able to realize a profit from storing grain. Additionally, it is important to remember that the returns to storing grain can be significantly greater or less than zero in the short run.

The returns to storing grain can come about for various reasons (e.g., prices increase, basis strengthens, producers capture price differences in a local market, premiums are picked up by storing grain). Because many of these sources of returns cannot be easily measured, it is helpful to begin an economic analysis of storage by examining the returns due to price changes from routinely storing grain. In other words, ignoring all other factors, do prices increase enough to cover the cost of storing grain. Additionally, it may be important to examine the returns for various crops and various locations because market supply and demand conditions vary by crop and location.

For this analysis the returns to storing wheat, corn, milo, and soybeans were calculated for both on-farm and commercial storage for five locations in Kansas (Colby, Dodge City, Great Bend, Whitewater, and Kansas City). Figure 5 shows the geographical locations included. These locations were considered because of their geographical diversity and because a relatively long history of cash prices was available for each of these locations.

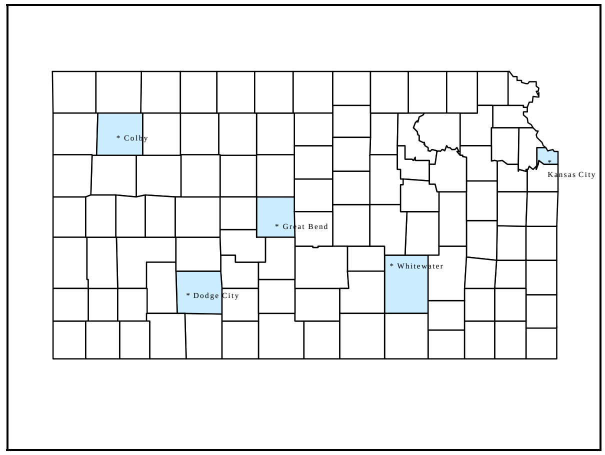

Figure 5

Before discussing the estimated returns to storage, a brief discussion of the storage cost assumptions is given.

Storage costs

Grain storage costs can have both fixed and variable components. Variable costs are those costs that are incurred only when grain is stored and fixed costs are incurred regardless of whether or not storage facilities are used. In this sense, fixed costs are the cost of owning the storage facilities (i.e., depreciation, interest, repairs, taxes, and insurance). In a decision-making framework, fixed costs are irrelevant — decisions are made solely on variable costs. In other words, if a producer can cover the variable costs of storing grain he should store grain regardless of whether or not fixed costs can be covered. However, it is important to remember that before facilities are constructed all costs are variable. Therefore, when making the investment decision to construct on-farm storage facilities all costs (variable and fixed) should be considered.

The variable costs of on-farm storage can be further broken down into one-time and ongoing components. For example, the cost of handling the grain is a one-time cost that is constant regardless of how long the grain is stored; whereas, the costs of monitoring, aerating, shrinkage, etc. will be ongoing as it depends on how long the grain is stored. In this analysis the variable costs of storing grain are assumed to be 8.5¢ per bushel for the one-time component and 0.75¢ per bushel per month of storage for the ongoing component.[1] The 8.5¢ cost represents repairs, loading, cleaning facilities, etc. that are incurred due to storing grain but are independent of how long the grain is stored. The fixed cost of owning on-farm storage facilities (e.g., depreciation and interest) are ignored in this analysis, thus, the returns over variable costs for on-farm storage should be viewed as the gross return to investing in facilities. For example, if the returns over variable costs are 10¢ per bushel, this reflects what is available to pay for fixed costs on an annual basis.

From a producer's perspective, commercial storage costs are characterized as being variable cost only. Commercial storage costs are assumed to be 0.65¢ per bushel per week which equals 2.6¢ per bushel on a monthly basis (USDA's *Summary of Offer Rates for County Elevators*).[2]

Figure 6 compares the on-farm storage cost with the commercial storage cost used in this analysis. Cumulative on-farm storage costs are higher than commercial storage costs if the grain is stored for a short time period due to the one-time component of handling the grain. However, when the grain is stored for longer time periods the commercial storage cost is greater than the on-farm cost. The breakeven point based on the assumptions used here is between 4-5 months of storage. Therefore, if grain is stored for longer than 5 months the variable costs of on-farm storage are less than the costs of commercial storage and vice versa. Keep in mind that ownership costs for on-farm storage have not been included at this point.

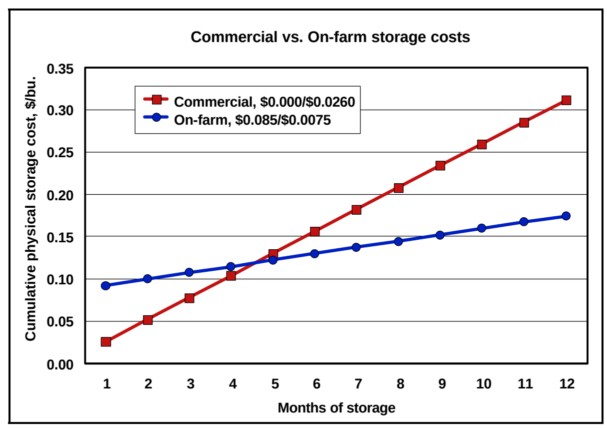

Figure 6

The other cost of storing grain is interest cost. Interest cost is incurred because holding the grain does not allow the producer to either pay off debt or invest the income from the grain (i.e., the opportunity cost of not selling). In this

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[1] The variable costs associated with on-farm storage likely depend on the size of the facility. For example, labor associated with handling grain on a per bushel basis is probably less with larger bins compared to small bins. In this analysis, no differentiation is made to variable costs with regards to bin size.

[2] Because historical data have been collected in this manner, throughout this paper months are considered to have 4 weeks and years to have 48 weeks. Months with 5 weeks have the 4th and 5th weeks averaged and reported in the 4th week.

analysis interest costs are based on the CCC rate – the interest rate at which producers could borrow money from the government (USDA's *Commodity Credit Corporation's Interest Rate Charges*). It is assumed that this same interest rate is a reasonable opportunity cost for those producers who have no debt. Figure 7 shows the historical CCC interest rate along with the prime plus one-half percent rate, which is an approximation of what producers would pay for operating funds from a bank, for comparison purposes.

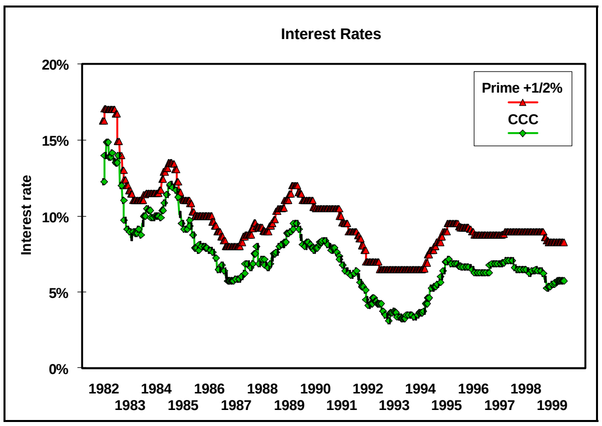


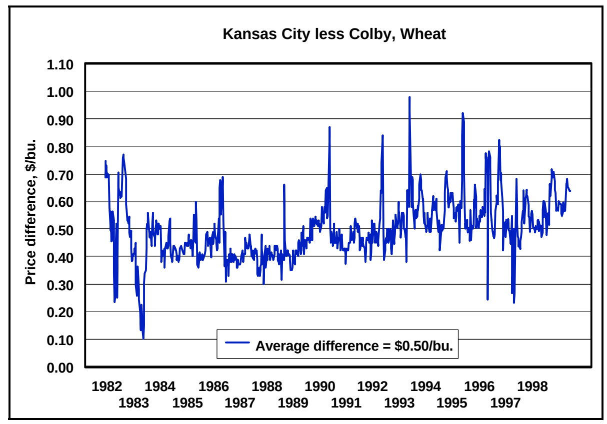
Figure 7

The interest cost of storing can approach, or even exceed, the physical cost of storage. Consider the following example:

Wheat harvest price		$3.00
Interest rate	x	7.5%
Months of storage	x	5.0
<u>Months in a year</u>	÷	<u>12</u>
Interest cost	=	9.0¢ per bushel

The physical cost of storage in this example would be 13¢ per bushel (2.6¢ x 5 months) for commercial storage and 12.25¢ (8.5¢ + 0.75¢ x 5 months) for on-farm storage. Thus, interest cost is a major part of the total storage cost and should not be overlooked.

In addition to interest rate, interest cost will be a function of the price of grain. Figures 8-11 show the price difference between Kansas City and Colby for wheat, corn, milo, and soybeans, respectively. It can be seen that for all four commodities Kansas City prices typically are greater than Colby prices, however, the magnitude of the difference depends on the crop. For example, prices in Kansas City have averaged 67¢, 50¢, 29¢, and 21¢ per bushel more than in Colby for soybeans, wheat, milo, and corn, respectively.



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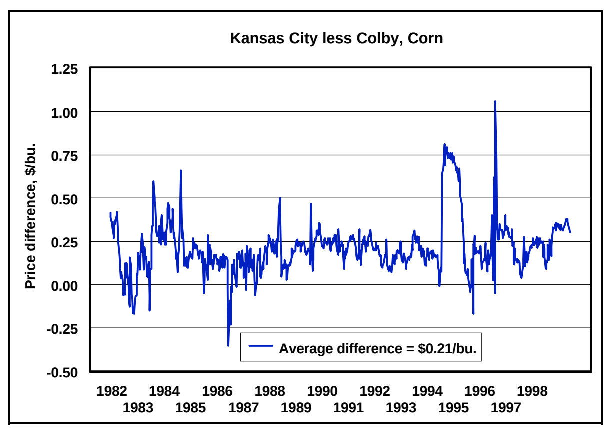

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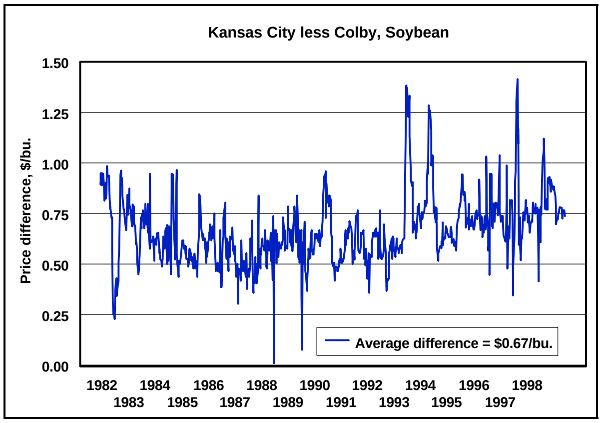

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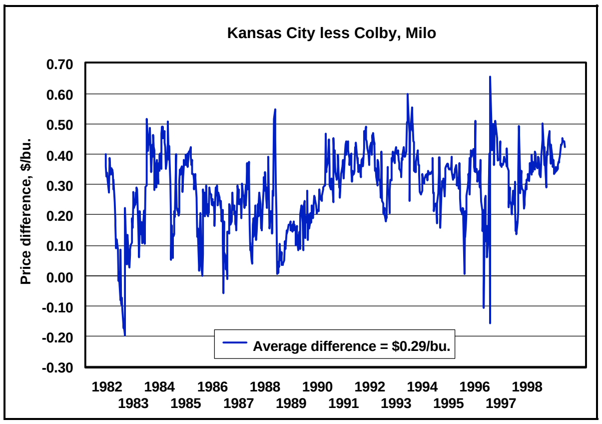


Figure 11

The relative differences in prices between Kansas City and Colby for the different crops suggest that the absolute interest cost varies by crop. For example, the interest cost of storing wheat and soybeans will be higher for Kansas City compared to the interest cost associated with corn and milo. These differences have to do with geographical supply and demand for the different crops (i.e., there is a strong demand for feed crops in western Kansas). What this suggests, ignoring all other factors, is that western Kansas has a comparative advantage to store wheat and soybeans and eastern Kansas has a comparative advantage to store feed grains.

Calculated returns to storage

Weekly returns to commercial storage were calculated according to the following:

$$(1)\ Return_t = Price_t - Storage\ cost \times weeks$$
$$- Price_{harv} \times (1 + Int_t \times weeks \div 48)$$

where, $Return_t$ is the return to storage ($/bu) in week t, $Price_t$ is the price in week t, *Storage cost* is the weekly storage cost (0.65¢ per bushel), *weeks* is the number of weeks the grain has been stored, $Price_{harv}$ is the harvest price, and Int_t is the CCC interest rate in week t. Harvest price is assumed to be the monthly average price in July for wheat and the monthly average price in October for corn, milo, and soybeans. Storage returns are calculated for 44 weeks (4 weeks/month) beginning in the first week of August for wheat and the first week of November for corn, milo, and soybeans.

An equation similar to (1) was used for on-farm storage returns except *Storage cost* was comprised of a fixed component (8.5¢ per bushel) and a variable component (0.1875¢ per bushel per week). By definition, the returns to on-farm storage will be greater than the returns to commercial storage for grain stored more than four and a half months. Similarly, commercial storage will be more profitable for grain stored less than four and a half months.

Figure 12 shows the weekly returns to storing wheat post-harvest unhedged in a commercial elevator in Great Bend for the most recent 17 crop years. Returns have been extremely variable ranging from a loss of over $2/bushel to a gain of about $2/bushel. The variability in returns has been greater in the nineties that it was during the eighties. Figures 13-17 show the weekly average returns over 17 years for both commercial and on-farm storage for each of the locations considered. At all five locations, returns were highest for wheat stored about five months. Thus, if the only source of storage returns is due to prices increasing (i.e., price seasonality), there is no incentive to store wheat beyond January or early February.

The average returns for storing until around the first of the year were in the range of 7¢ to 10¢ per bushel, however, statistically we have little confidence that these returns are different from zero because of the large variability. There is little difference in returns geographically indicating that certain locations do not have a comparative advantage for storing wheat as would be expected based on varying interest costs.

Figure 18 shows the weekly returns to storing corn post-harvest unhedged in a commercial elevator in Great Bend for the most recent 16 crop years. As with wheat, returns have been extremely variable ranging from a loss of over $1/bushel to a gain of over $1/bushel. However, unlike wheat it does not appear that the variability in returns has been greater in the nineties that it was during the eighties. Figures 19-23 show the weekly average returns (16 year) for both commercial and on-farm corn storage for each of the locations considered. Returns were typically highest for corn stored until mid to late May.

The average returns for storing until mid to late May were in the range of 7¢ to 10¢ per bushel, however, as with wheat, we do not have much confidence that returns are different from zero because of the large variability. There are subtle differences in returns geographically. For example, there is little incentive to store corn commercially in Whitewater beyond December as price increases beyond then essentially offset storage costs, however, in Dodge City prices increase more than storage costs up until about June providing an incentive to store corn longer. This difference is likely due to the strong demand for corn by the cattle feeding industry in western Kansas.

Figure 24 shows the weekly returns to storing post-harvest milo unhedged in a commercial elevator in Great Bend for the most recent 16 crop years. As would be expected, the variability in milo storage returns follow the pattern of corn very closely. Figures 25-29 show the weekly average milo storage returns (16 year) for both commercial and on-farm storage for the different locations. Similar to corn, returns were typically highest for milo stored until mid to late May. An exception to this is in Kansas City where returns to storing until around the first of March were as good, or better, than storing until May.

The average returns for storing until mid to late May in western and central Kansas were basically at breakeven levels. The locations further east had average returns of about 5¢ per bushel. This suggests that storing milo in the anticipation of earning a return due to prices increasing seasonally may depend somewhat on a producer's location. However, as noted previously, differences between locations are small. Furthermore, because of the large variability we do not have much confidence that returns are different from zero at any of the locations.

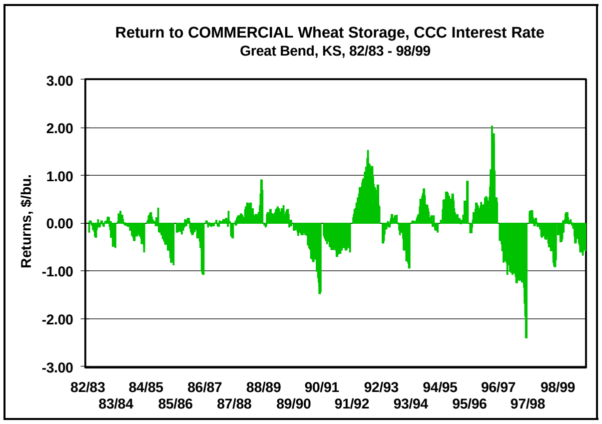
Figure 30 shows the weekly returns to storing soybeans post-harvest unhedged in a commercial elevator in Great Bend for the most recent 16 crop years. Returns have been extremely variable ranging from a loss of over $3/bushel to a gain of over $3/bushel. Just the opposite as was the case with wheat, it appears the variability in returns was greater in the eighties than it was during the nineties. Figures 31-35 show the weekly average returns (16 year) for both commercial and on-farm storage of soybeans for each of the locations considered. Storage returns were highest for soybeans stored into April at all five locations. Storage returns were positive in May and early June and then became quite negative. Unlike wheat, storing soybeans until the first of the year has not been profitable. Producers storing soybeans should either sell them prior to mid December or else hold onto them until at least mid February. This weakness in prices around the first of the year is most likely due to tax management and cash flow selling that occurs at that time.

The average returns for storing until early April were in the range of 20¢ per bushel. Similar to the other crops, statistically we do not have much confidence that these returns are different from zero because of the large variability. While the average return for soybeans is higher than the returns on the other crops in absolute terms (i.e., 20¢ versus 5-10¢), on a percentage basis it is similar. Thus, the risks and returns to storing soybeans are similar to those of storing wheat, corn, or milo. There is little difference in returns geographically indicating that certain locations do not have a competitive advantage for storing soybeans as might be expected based on varying interest costs.

Summary of calculated returns

The returns to storing wheat, corn, milo, and soybeans in Kansas are extremely variable over time indicating there is considerable risk involved with routinely storing any of these crops. The storage returns calculated for the different crops and different locations support efficient markets. That is, there are not large returns that can be realized, on average, by routinely storing crops and capturing seasonal price increases. The small average return, which is only marginally statistically different from zero, can be viewed as a return to the risk associated with storage. Furthermore, returns for the different crops are similar suggesting there is not a strong incentive to store some crops but not others. However, the optimal length of storage varies by crop. For example, returns are highest when wheat is sold around the first of the year; whereas, corn, milo, and soybean returns are greatest when stored until the April to May time period. With a few minor exceptions, there are little differences in storage returns geographically. This suggests that differences that exist in interest costs (due to absolute price level differences) have very little impact on the returns to storage.

This analysis was based on storing grain unhedged which implies that all gains (losses) were due to both prices and basis changing. An alternative storage strategy would be that when harvest-time basis is wider than normal, producers would implement a storage hedge. With a storage hedge returns to storage are based solely on basis changing because price is locked in. However, Kastens and Dhuyvetter found that average returns to storage when this strategy was considered were not significantly different from zero either. Thus, their study further confirmed that markets are generally efficient (i.e., it is very difficult for producers with average costs to pick a storage strategy that will routinely “beat the market”).



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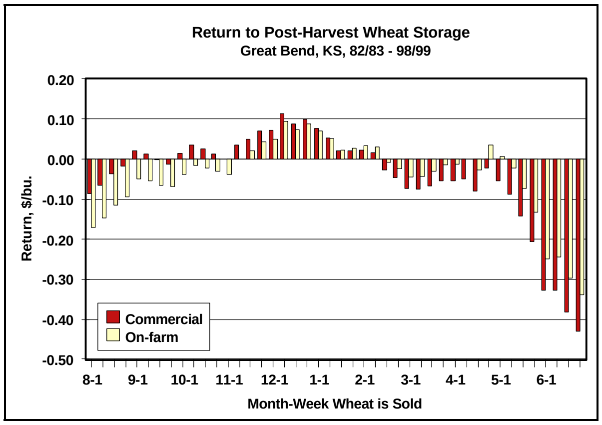

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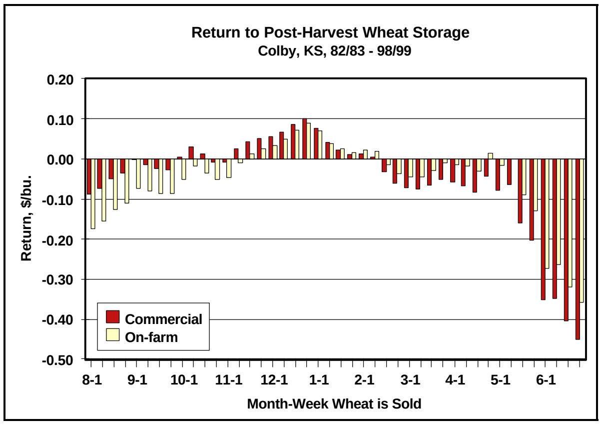

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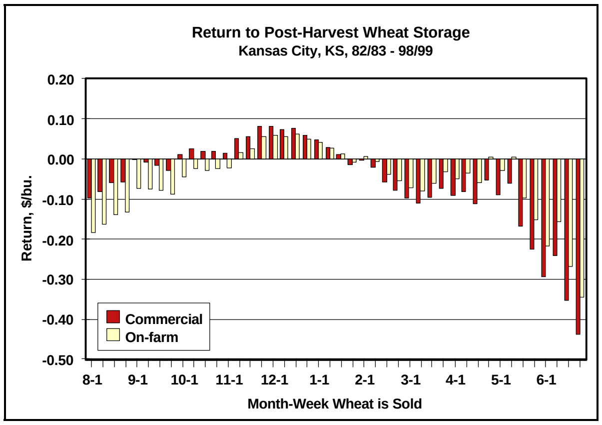

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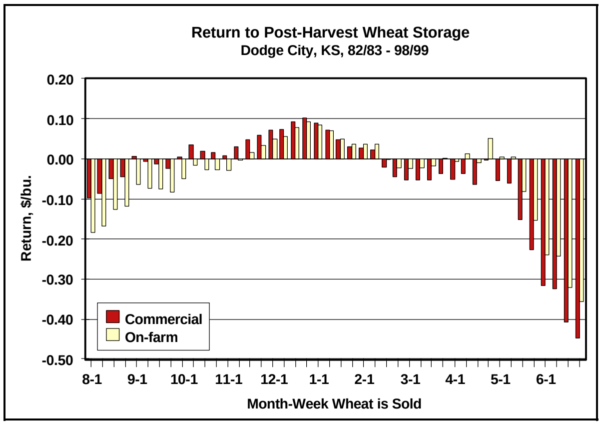

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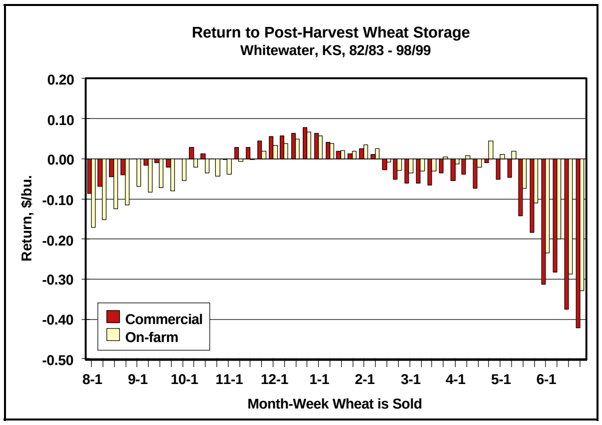

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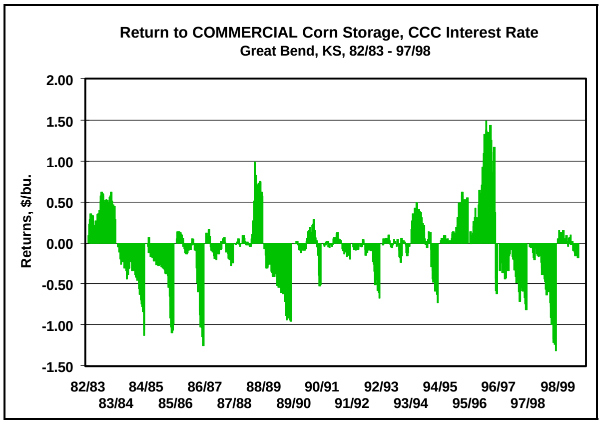

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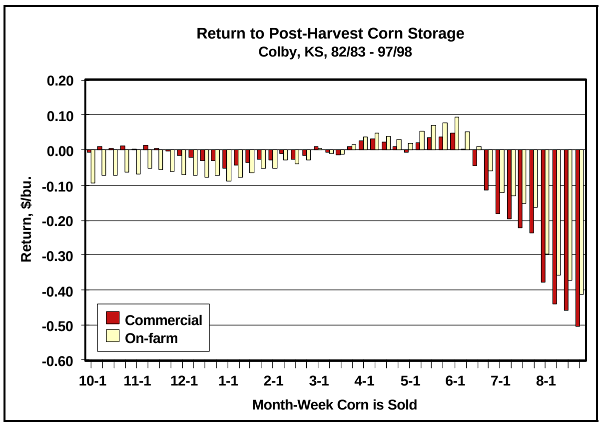

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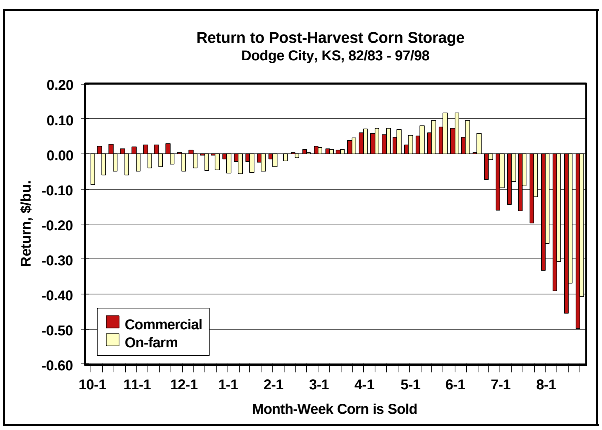

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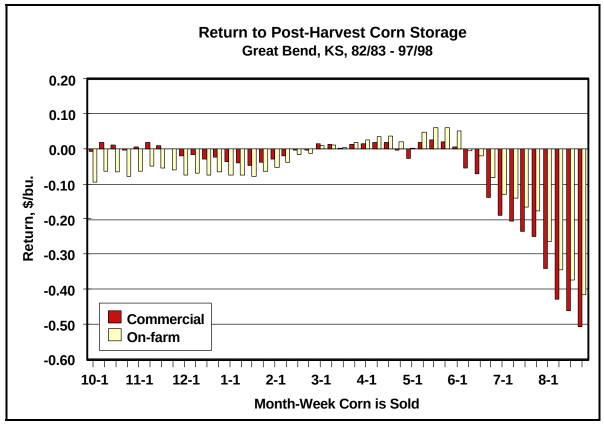

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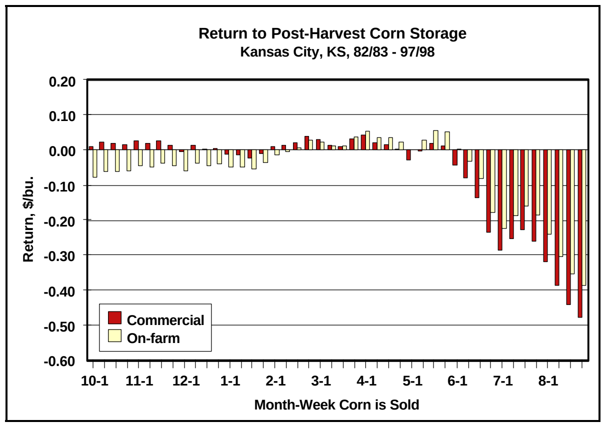

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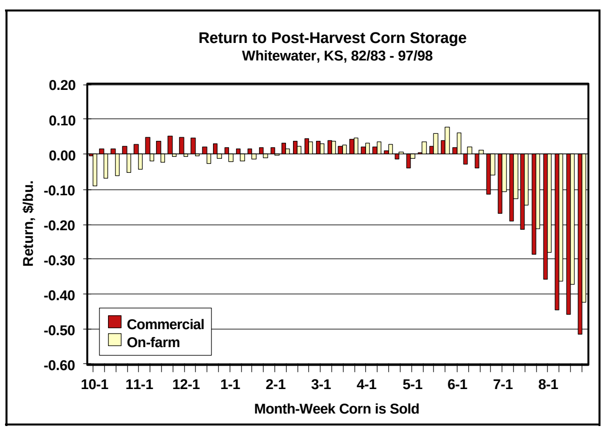

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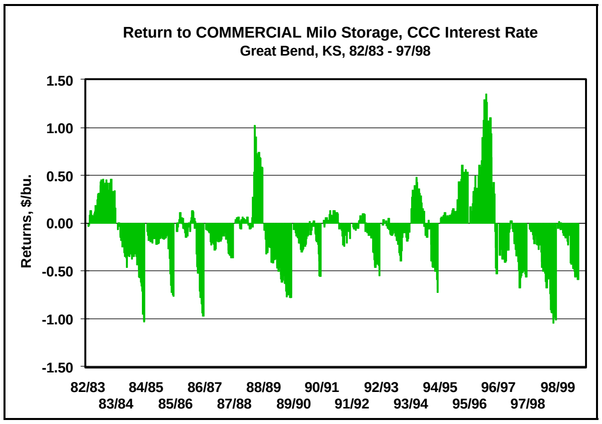

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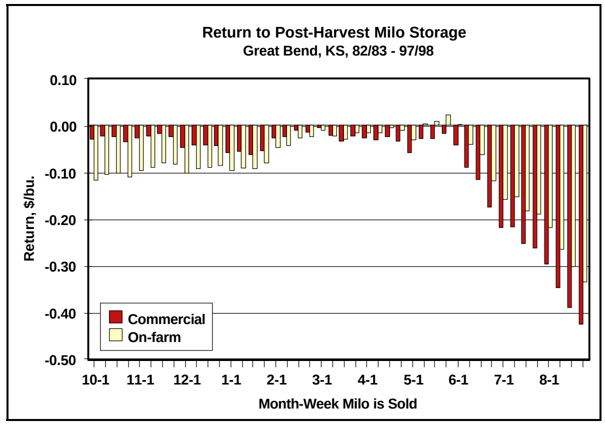

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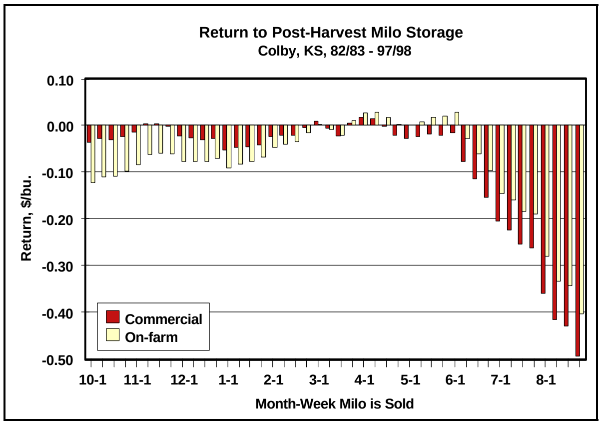

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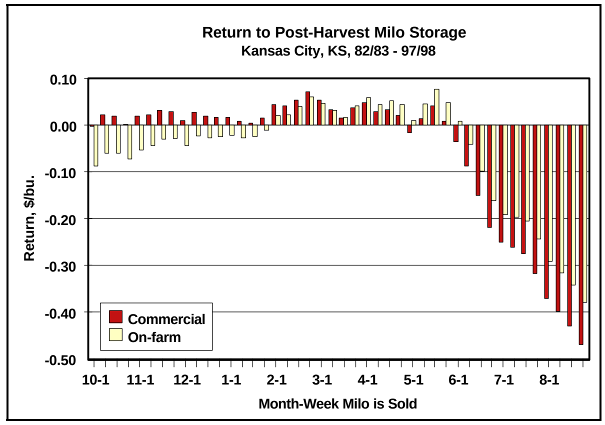

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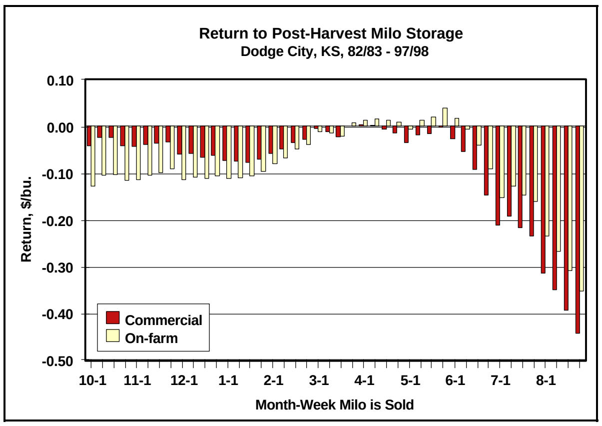

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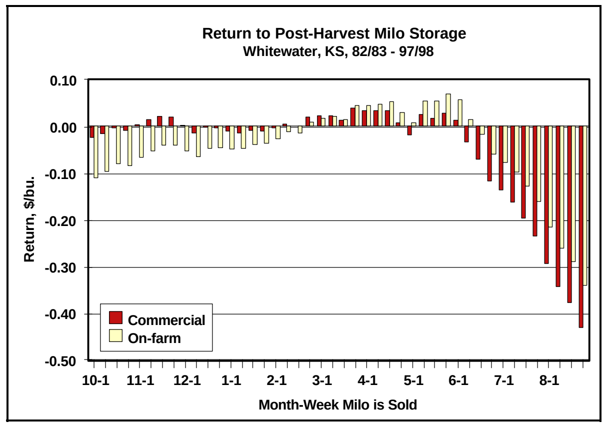

Figure 29

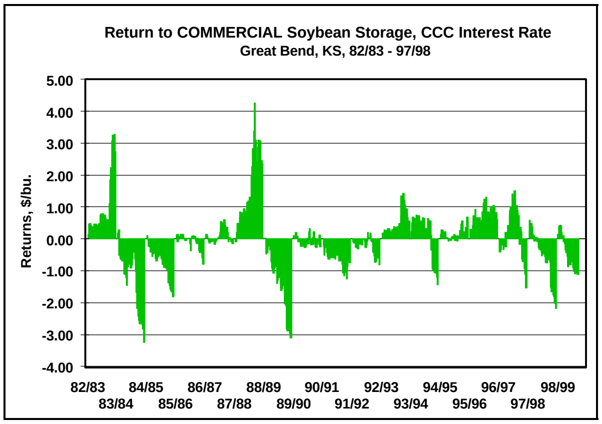

Figure 30

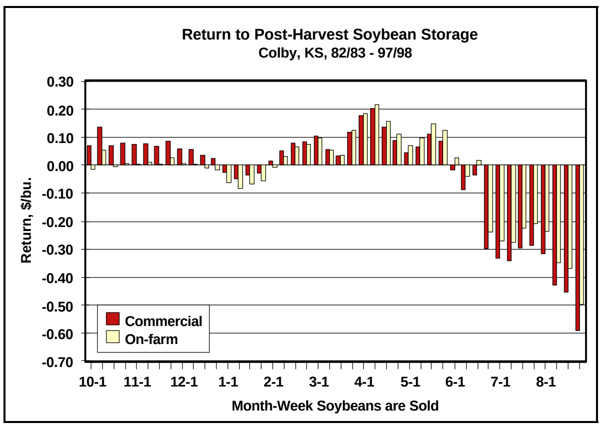

Figure 31

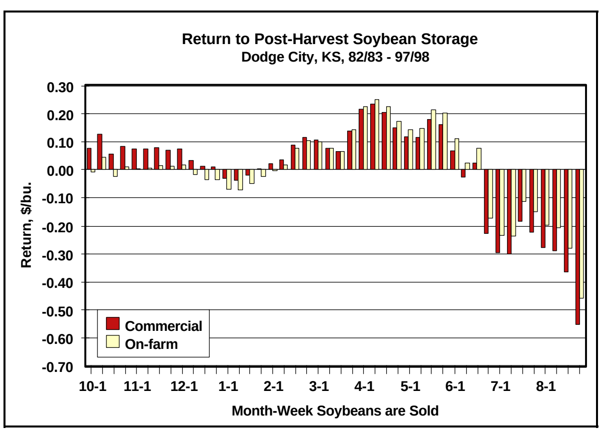

Figure 32

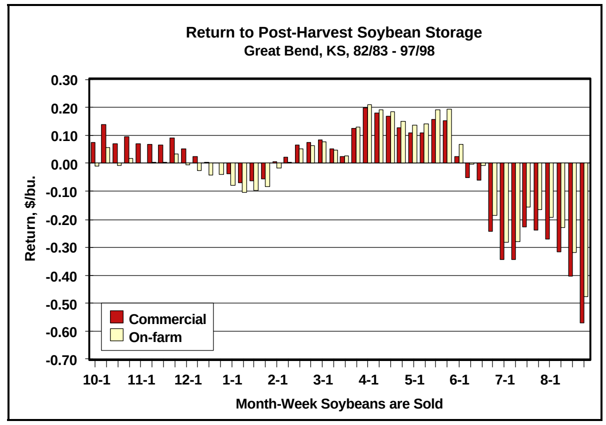

Figure 33

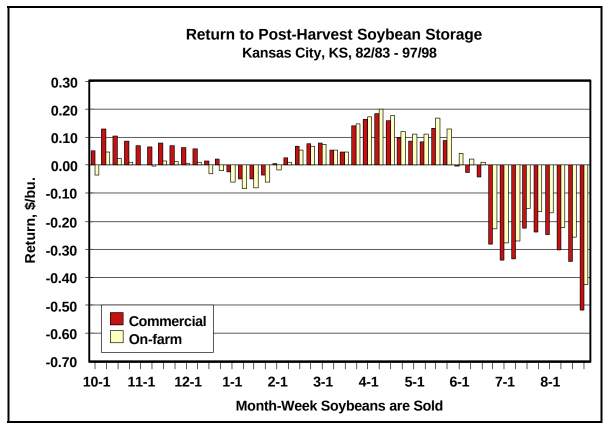

Figure 34

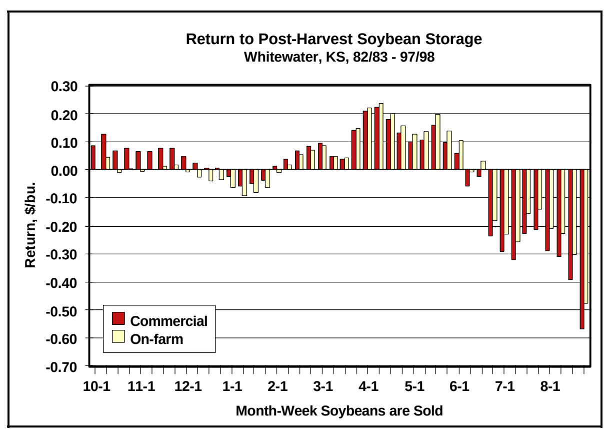

Figure 35

Ownership costs of on-farm storage

The previous analysis for on-farm storage did not include any facility ownership costs (i.e., fixed costs). The fixed costs of owning storage facilities are those costs that are incurred annually regardless of whether or not the facilities are used. The fixed costs of owning facilities are depreciation, interest, repairs, taxes, and insurance. It is assumed that some repairs will be incurred whether facilities are used or not while others will be incurred only with use. While fixed costs are not considered when making management decisions (i.e., to store or not to store), if a producer is considering building new facilities these costs need to be considered because they are still variable costs at this point.

The annual fixed cost of storage facilities will depend on the size of the investment. The relevant investment to consider is the investment per bushel of capacity. Figure 36 shows the investment for materials of seven different bins both with and without aeration equipment included (Harder Ag Products). The capacity of these seven bins ranges from about 1,800 to almost 50,000 bushels. These prices represent actual sales made in 1999 excluding monitoring equipment, concrete, site preparation, and construction. Figure 37 shows these same bins with K-State estimated costs for concrete, site preparation, and construction included.

Based on this small sample of observations several considerations become apparent. First, the lowest cost is for the bins with about 11,000 bushels of capacity indicating that larger bins do not necessarily cost less on a per bushel basis. Secondly, there is a large amount of variability in what bins might cost. This variability is due to different options and types of equipment (e.g., fans, floor type, supports) a producer might choose.

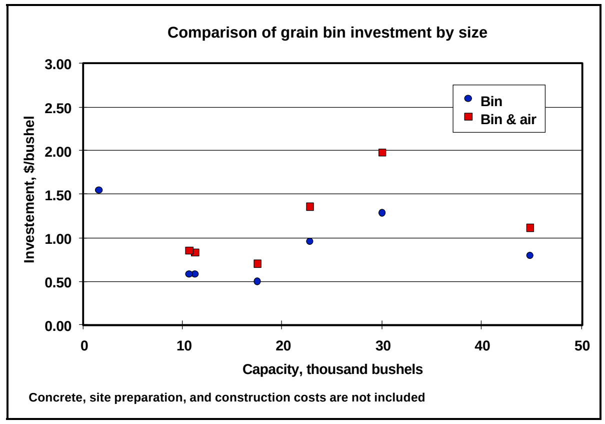

Figure 36

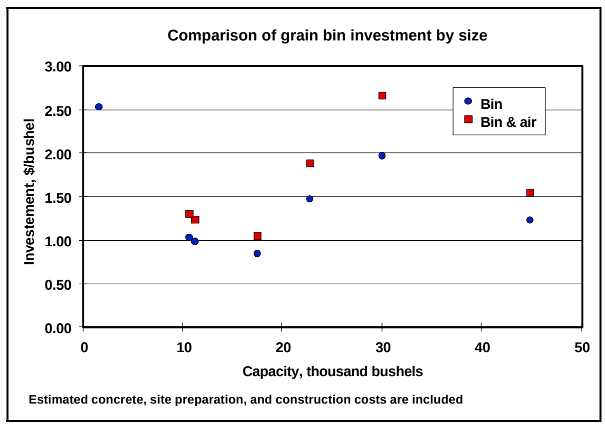

Figure 37

Once the investment per bushel is known, an annualized cost needs to be calculated. The annual cost can be viewed as an amortized loan payment (i.e., principle and interest). Thus, the annual cost will simply be a function of years and some interest rate. However, in this case the "interest rate" will include interest (rate of return on investment), repairs, taxes, and insurance.

Consider the following assumptions:

Interest rate	9.0%
Repairs	1.5%
Taxes	1.5%
Insurance	0.25%
TOTAL	12.25%

Based on this "interest rate" of 12.25% and an assumed useful life of 20 years, the annualized cost of an investment can be determined.[3] Figure 38 shows what the annual ownership cost per bushel would be for the each of the seven bins shown in figure 37. Based on these assumptions, the annual ownership costs for a bin with air generally falls in the range of 15¢ to 25¢ per bushel.

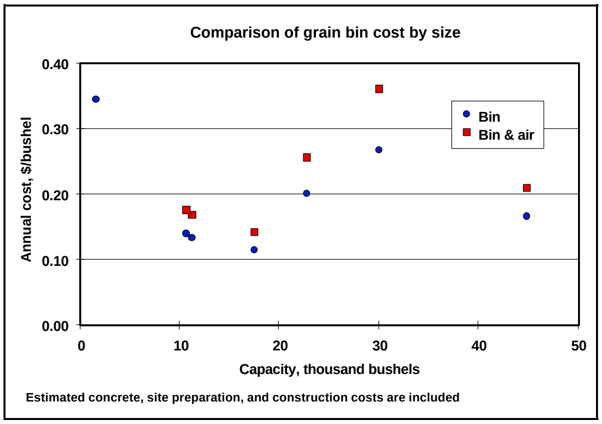

Figure 38

Should I invest in storage facilities?

Does it seem reasonable for a producer to invest in on-farm storage facilities? Given the information presented so far, if the returns to storage are simply capturing seasonal price moves, the answer is clearly no. Because the returns to on-farm storage were comparable with commercial storage when only variable costs were included, adding another 15¢ to 25¢ per bushel of fixed cost would result in on-farm storage returns being negative on average. Thus, the fact that there is considerable interest in on-farm storage suggests there are advantages of on-farm storage not factored into the analysis. The following are some possible advantages of on-farm storage compared to commercial storage:

- Storage space is likely available when needed.
- Increased marketing flexibility.
- Potential for identity preservation of grain.
- Reduced bottlenecks and quality considerations.
- Grain readily available for livestock feed on farm.
- Variable costs may be less than commercial storage cost.

As previously mentioned, in years where commercial storage space is tight, producers may have to pay a "dumping charge" to store grain commercially. Additionally, in years when storage space is tight, an alternative is to store grain on the ground or in temporary facilities. The risk of grain quality loss increases significantly in these situations. Furthermore, in some years storing may not even be an option as was the case in some locations in 1998. Thus, in these situations there may be a substantial benefit to owning on-farm storage facilities that has not been factored into the previous analysis. The value of this advantage when averaged over many years is likely fairly small because commercial storage tends to be available for most producers in most years. However, this is a potential benefit of on-farm storage that should be considered as it can occur. Additionally, given production and storage capacity trends, storage shortages may occur more often in the near future.

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[3] The annual cost is easily calculated using the amortized loan payment function in a computer spreadsheet or from an amortized loan payment table.

A benefit of on-farm storage that is often cited by producers is the increased marketing flexibility they have. For example, when grain is stored commercially it typically is sold to that same elevator. While elevators may allow you to take your grain out of storage and sell it elsewhere, there usually is an 8¢ to 10¢ out-charge that offsets the benefit of marketing the grain elsewhere. As an example to show how market flexibility may have value, weekly historical prices from Garden City and Scott City are compared. These two locations are roughly 35 miles apart so a producer farming between them could presumably haul grain to either location. For simplicity, assume that these are the only relevant locations for this producer and that delivery costs are equal. Figures 39-42 show the difference in price between Garden City and Scott City on a weekly basis since 1982 for wheat, corn, milo, and soybeans, respectively.

The price of wheat in Garden City has been greater than the Scott City price almost half of the time (43%). The average difference when Garden City was higher was 3¢ per bushel. However, 42% of the time the price of wheat in Scott City was higher than the price of wheat in Garden City by an average of 2.8¢ per bushel. This indicates that a producer who routinely stored his wheat in Garden City (Scott City) would be better off almost half of the time if his grain were stored in Scott City (Garden City).

The difference between the two locations appears to be quite random from year to year indicating it is difficult on a real-time basis to predict which market to be in. Furthermore, the difference is fairly persistent for relatively long time periods, i.e., when price is higher in Scott City it tends to be that way for quite a few weeks and vice versa. This means that it may be difficult for a producer who delivered in the "lower price market" to delay selling his crop until it becomes the "higher price market."

Even if this is possible, this timing may not be consistent with when the producer plans to sell his wheat. A producer with on-farm storage would not have this problem as he could wait and determine which location to deliver to at the time he was selling his wheat.

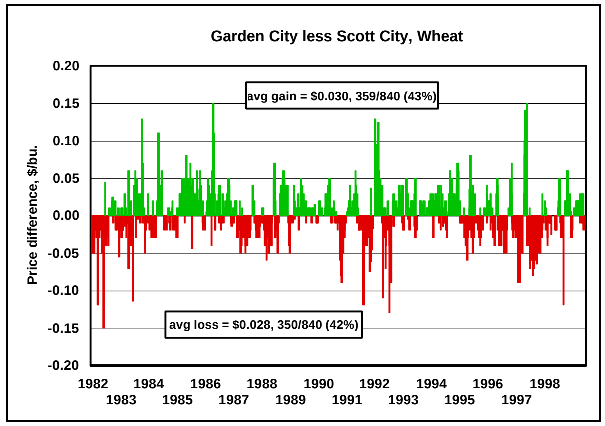

Figure 39

The price differences for corn and milo show similar patterns, however, the differences appear to be less random. For example, the price of corn in Garden City tended to be less than in Scott City up until about 1990. Since 1990, the price in Garden City has been higher. Similarly, the price of milo in Garden City has typically been higher than the price in Scott City so the market to be "selling in" is easier to predict compared to wheat. Price differences of soybeans between these two locations appear to be fairly random as they were with wheat.

The main point of figures 39-42 is not to show that a producer with on-farm storage will capture huge gains. Rather, they show that by having marketing flexibility (i.e., being able to deliver to multiple locations) a producer might consistently pick up a couple of cents per bushel compared to "locking himself in" to a specific market.

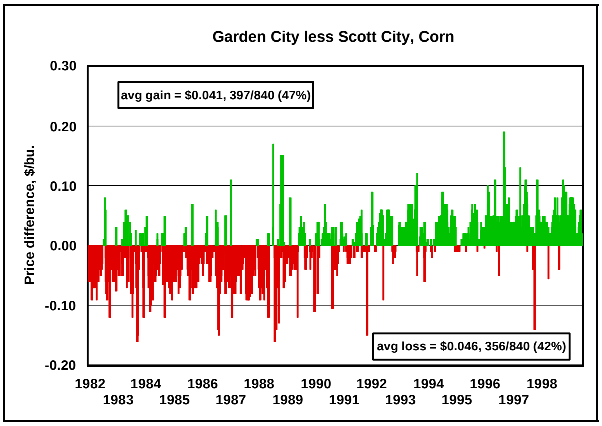

Figure 40

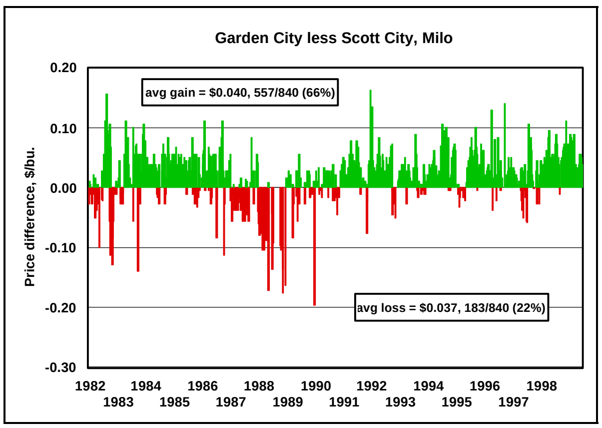

Figure 41

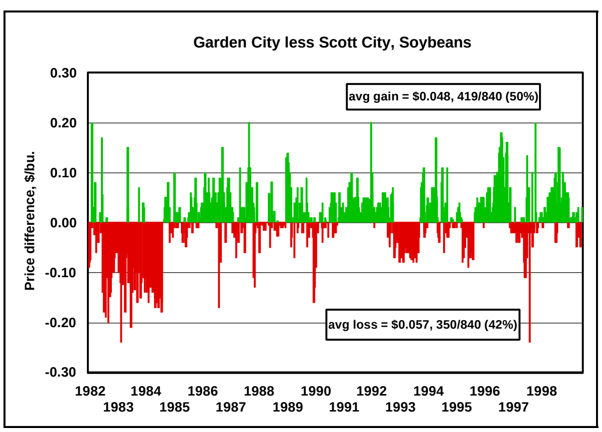

Figure 42

Another benefit of marketing flexibility that is not captured in these figures has to do with truck bids. Producers often indicate that they receive premiums of 10¢ per bushel on truck bids relative to elevator bids (this is especially true for feed grains in western Kansas). This premium is primarily due to not having to pay the out charge that would be incurred at the elevator, but it may also be related to quality issues in some cases. For example, feedyards might consider farm stored grain to be higher quality, from a feed processing standpoint, because likely less farm stored grain is dried with heat.

There has been considerable interest in specialty or "non-commodity" type crops in Kansas in recent years (e.g., white wheat, white corn, high oil corn). The advantage of these crops is that they potentially have higher value than their "commodity" crop counterparts (i.e., red wheat, no. 2 yellow corn). However, preserving the identity of these crops is a requirement in order to realize any higher value they may have. Until production of these type of crops becomes fairly significant, preserving the identity of these crops will most likely have to happen at the farm level. Therefore, producers considering these higher value crops may be required to have on-farm storage facilities. In this case, part of the higher return of these crops is due to the crop itself, but part of it should also be viewed as a return to on-farm storage facilities.

Another advantage of on-farm storage facilities has to do with reduced bottlenecks associated with dumping at harvest. If producers have long distances to haul and/or have to wait in line at commercial elevators, on-farm storage may have a benefit of allowing a more timely harvest. While quantifying this benefit is difficult, it is something producers need to consider and how it affects their particular operations.

Historically, maintaining grain quality has been considered a disadvantage of on-farm storage. However, as automatic sensory equipment becomes more common this is less of an issue. It is illegal to add water directly to grain to add weight. However, the benefit of increasing moisture content of on-farm stored grain through aeration, as a means of improving grain quality, has been discussed in several popular press articles (Farm Journal, 1997, 1998). To the extent that this is possible, this aspect of on-farm storage could have considerable value for producers who sell grain that is "too dry" (because premiums are not typically paid on dry grain).

Producers that feed livestock need to consider the advantage of having grain available when and where it is needed. In these cases, the return to on-farm storage facilities is often factored into the livestock enterprise, however, it should be recognized that there is a benefit to having the storage facilities on-farm. Even if a producer buys all of his feed, as opposed to feeding his own grain production, on-farm storage facilities offer the benefit of market flexibility (i.e., the producer can buy feed from various sources at various times). Similar to truck bids, buying feed at harvest and storing may eliminate out charges, and reduce feed costs by up to 10¢ per bushel.

Another advantage of on-farm storage is that the variable cost of storing on-farm will often be less than the cost of commercial storage, especially for grain stored for longer time periods. However, this is not an issue for producers who are considering constructing new on-farm storage facilities. In this case, all costs (fixed and variable) need to be considered.

While there are a number of advantages of on-farm storage producers need to consider, there are also some disadvantages they need to be aware of. The following are some possible disadvantages of on-farm storage:

- Responsible for condition of grain.
- Total cost may be greater than commercial storage costs.
- Higher risk with regards to grain quality and costs being uncertain.
- Additional labor may be required to handle the grain.

An advantage of commercial storage is that once the grain is delivered, as a producer, you do not need to worry about the condition of the grain. With commercial storage you are paid for the quality of the grain that is delivered into storage, however, with on-farm storage you are paid for the quality of grain that is taken out of storage. Therefore, it is important to recognize the management requirements associated with maintaining the condition of grain stored on-farm.

The total costs of on-farm storage will often be greater than the cost of commercial storage. This should not be surprising because large commercial elevators that specialize in grain storage would be expected to have a cost advantage. What this means is that producers considering on-farm storage will need to recognize benefits that they would not realize with commercially stored grain.

In addition to costs being higher than commercially stored grain, on-farm storage costs will be more variable. Commercial storage costs are basically known with certainty when you put the grain into storage, however, on-farm storage costs will vary depending on grain condition, repairs, etc. Thus, from a cost standpoint, there is more risk associated with on-farm storage. However, for good managers the variability in cost is likely small so this may be a relatively minor point.

With commercial storage once the grain is dumped there are no further labor requirements on the producer's part. With on-farm storage additional labor may be required when the grain is eventually hauled out. However, for operations that tend to under- utilize labor during some months, this may be an efficient way to use labor. For example, a crop producer without livestock may find that hauling grain in the winter is a good way to capture returns to storage if they place a low opportunity cost on their time.

While many of the advantages and disadvantages listed for on-farm storage are difficult to quantify, it is important for producers to attempt to place a value on each of these. Given the cost assumptions listed previously, the cumulative net value of the advantages and disadvantages needs to be a minimum of 15¢ to 25¢ per bushel on an annual basis in order for on-farm storage to be more profitable than commercial storage.

Summary and Conclusions

Low crop prices and wide basis levels the last several years, along with a shortage of storage space, has increased the interest in on-farm storage. An analysis of historical prices indicates that, as would be expected with an efficient market, there are very small returns to routinely storing crops. This result is quite robust for the different crops (i.e., wheat, corn, milo, and soybeans) as well as geographical location.

Returns to storing grain on-farm are comparable to storing grain commercially when only variable costs are included. When including fixed costs of approximately 20¢ per bushel, total costs for storing on farm are greater than commercial charges. This suggests that producers storing on-farm need to capture benefits that are not available to producers storing commercially. The most likely potential benefits are premiums due to increased market flexibility and premiums due to identity preservation of crops. An additional benefit of on-farm storage might be simply due to it being available when needed. If prices are low and basis is wide at harvest, producers wanting to store grain may not be able to store it commercially without taking a discount if storage space is short. Unless more storage capacity is added in Kansas, this may become a more frequently occurring problem than in the past. Thus, the time may be appropriate for producers to consider on-farm storage.

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