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Economics of Grain Storage in Tennessee

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Introduction

For Tennessee grain producers, the decision to sell or store at harvest is a consequential marketing decision, one that is exposed to uncertainty in post-harvest futures prices and basis. On-farm storage expands the producer's marketing window. That is, storage allows grain to be marketed into later periods, potentially capturing seasonal price patterns, carry in the futures market and favorable basis movements (Edwards, 2011; Duncan, 2022). However, storage does introduce potential risks and implicit costs. These can include, but are not limited to, adverse basis movements, quality deterioration (shrink), and financing costs from the on-farm storage facility and holding inventories instead of marketing at harvest in the cash market.

A key constraint that hinders adoption of grain storage facilities is the large capital investments to construct these facilities. In Tennessee, the Tennessee Agriculture Enhancement Program (TAEP) helps offset that capital investment through a cost-share program. TAEP reimburses grain producers 50 percent of eligible costs up to a maximum of $12,000, meaning the full 50 percent rate applies to facilities costing up to $24,000. Facilities costing more than $24,000 still receive the $12,000 maximum regardless of total cost. This publication covers the economics of on-farm grain storage and how TAEP's cost-share program affects the return on that investment for Tennessee grain producers. The empirical analysis presented here is based on corn and may differ for other storable commodities such as soybeans or wheat.

Why Grain Producers Store

Producers without storage are often forced to sell at harvest when supply is at its largest, which tends to push prices down and establish a seasonal low. In contrast, producers who can store grain can delay sales until more favorable market conditions arise. Therefore, investments in grain storage infrastructure may contribute to economic gain by allowing producers to capture higher post-harvest prices and reduce storage-related costs (Edwards, 2011; Duncan, 2022).

There are four primary sources of potential gain from storing grain rather than selling at harvest:

1. **Seasonal price appreciation.** Grain prices tend to be lowest at harvest when supply is greatest. Prices typically rise through the marketing year as stocks are drawn down, allowing producers with storage to sell into this seasonal price rise. Price appreciation can come from increases in nearby futures prices and/or basis improvements.
2. **Futures market carry.** When the futures market is in a carry structure, meaning deferred contracts are priced higher than nearby contracts, producers with storage can capture this carry by storing grain and selling against a deferred futures contract.
3. **Basis improvement.** Basis is the difference between the local cash price and the futures price. Basis tends to strengthen after harvest as local demand absorbs nearby supply, providing an additional source of return for producers who store.
4. **Reduced pressure at harvest.** On-farm storage reduces the need to haul grain immediately at harvest, avoiding trucking delays and long line-up at elevators or barge points. This gives producers more flexibility when and how they move grain to market.

The Costs and Risks of Storage

Storage does not come without costs and risks. Per-bushel storage costs include three primary components:

1. **Shrink.** Grain loses weight and quality during storage through moisture loss and physical handling. This represents a direct reduction in the quantity available to sell.
2. **Interest and financing costs.** Holding grain in storage rather than selling at harvest represents an opportunity cost. Producers forgo the use of those funds or incur interest costs if the grain produced was financed for the duration of the storage period.
3. **Variable operating costs.** These include electricity for aeration, fumigation, handling, and other costs associated with maintaining grain quality in storage.

For crop producers, holding grain in storage is not just about the added costs; it can increase exposure to basis risk. For example, based on Tennessee corn market data from 1997 to 2025, cash prices can vary quite a bit, with a standard deviation of about $1.63 per bushel. Basis tends to be less volatile over the same period, with a standard deviation near $0.41 per bushel. Using a futures hedge can reduce most of the price risk, approximately 75 percent, but it does not eliminate basis risk. As a result, when one stores grain and hedges at the same time, changes in basis become the main source of uncertainty affecting your final price.

Hedging as a Companion to Storage

Given the price risks associated with storing grain, futures hedging is a common risk management tool that can reduce price risk for stored grain. When producers store grain and sell later, their realized cash price depends on both volatile futures prices and basis. Hedging creates the ability to set a futures price but does not reduce basis risk.

Table 1 illustrates a basic hedging example for a Tennessee corn producer storing grain from harvest through the following spring.

Table 1. Basic Hedging Example for Stored Corn

	Harvest (September)	Post-Harvest (March)
Cash Price	$4.50/bu	$4.80/bu
March Futures Price (Short)	$4.70/bu	$4.95/bu
Basis	-$0.20/bu	-$0.15/bu

How it works, step by step

1. Producer shorts (sells) March futures at harvest: **$4.70/bu locked in**
2. Grain sold in March at cash price: **$4.80/bu**
3. Futures position closed at $4.95/bu, futures market loss: **-$0.25/bu**
4. Net realized price: $4.80 − $0.25 = **$4.55/bu**
5. Basis improved from -$0.20 to -$0.15, additional return captured: **+$0.05/bu**

Hedging does not protect against movements in basis. Depending on market conditions, producers who are more risk-averse will tend to hedge a greater share of stored bushels, accepting a potential lower return in exchange for reduced exposure to worst-case price outcomes. Producers who are more confident in the futures price outlook but uncertain about local basis may prefer a basis contract, locking in their local basis while retaining upside from futures price movement. Producers who are more concerned about futures price volatility tend to prefer a futures hedge to lock in the futures price while retaining exposure to basis improvement.

Basis Contracts work in the opposite direction. The basis is locked in at a known level, but the futures price remains open (Duncan, Bowling, and Smith, 2024). The producer knows exactly what their local premium or discount to the futures will be, but their final price still moves with the futures market. Table 2 illustrates a basis contract example for the same producer.

Table 2. Basis Contract Example for Stored Corn

	Harvest (September)	Post-Harvest (March)
Cash Price	$4.50/bu	$4.80/bu
March Futures Price (Short)	$4.70/bu	$4.95/bu
Basis (Locked)	-$0.20/bu	-$0.20/bu

How it works, step by step

1. Producer signs a basis contract at harvest: -$0.20 basis locked in
2. Final cash price = wherever March futures settle + locked basis
3. If futures rise to $4.95/bu: $4.95 + (-$0.20) = $4.75/bu received
4. If futures fall to $4.40/bu: $4.40 + (-$0.20) = $4.20/bu received
5. The basis is certain, the futures price is not

TAEP and Grain Storage Investment

As mentioned above, while grain storage offers marketing flexibility, bins require capital to build. To help offset some of the capital, the TAEP program offers reimbursements to producers. TAEP reimburses grain producers 50% of eligible costs up to a maximum of $12,000. Because the reimbursement is capped at a flat dollar amount, the share of total facility cost reimbursed varies depending on the size of the investment. Based on data from 740 Tennessee producers enrolled in TAEP's grain storage category, the average total bin cost was $77,285, with a median bin capacity of 30,000 bushels. The average TAEP reimbursement was $13,295 (cap was formerly $20,000 but currently $12,000), covering approximately 22.5 percent of total bin cost on average. Smaller bins receive a proportionally larger share, approximately 29.3 percent, while larger bins receive approximately 14.5 percent, reflecting the flat dollar cap structure. Table 3 illustrates how the reimbursement share changes across facility sizes.

Table 3. Basis Contract Example for Stored Corn

Facility Size	TAEP Reimbursement	Reimbursement Share
Small Bin *~ 12,000 bushels*	$12,000	~29.3%
Average Bin *~ 22,500 bushels*	$12,000	~22.5%
Large Bin *~ 50,000 bushels*	$12,000	~14.5%

Source: TAEP participant dataset, 740 Tennessee grain storage enrollees. Average total bin cost was $77,285.

Despite receiving a smaller proportional reimbursement, larger facilities still benefit from TAEP because the $12,000 reduces the producer's annualized facility payment that must be recovered through storage returns. Using 28 historical corn price scenarios from 1997 to 2025, the analysis estimates the average net return from storing corn relative to selling at harvest. Net returns account for an assumed variable storage and handling cost of $0.10 per bushel and the annualized bin payment after TAEP reimbursement. As shown in Table 4, average annual net returns were $0.226 per bushel for the March marketing window, $0.274 per bushel for May, and $0.384 per bushel for July. These per-bushel returns are multiplied by bin capacity to calculate the annual additional revenue shown for small, median, and large bins. Results reflect corn specifically and may differ for other commodities.

Net return per bushel from storage is calculated as:

Net Return ($/bu) = Post-Harvest Cash Price − Harvest Cash Price − Per-Bushel Storage Cost − Annualized Bin Payment Per Bushel

The analysis assumes a variable storage and handling cost of $0.10 per bushel. This assumption is intended to represent short-run costs such as shrink, interest on stored grain, aeration, handling and other operating expenses. Actual storage costs vary by facility, storage duration, grain condition, financing and management practices; therefore, producers should use their own expected costs when evaluating a storage investment. The annualized bin payment is calculated separately using the producer's out-of-pocket facility cost after TAEP reimbursement. The annualized bin payment reflects the producer's out-of-pocket cost after TAEP reimbursement divided over a 30-year bin life. These estimates are based on 28 historical price scenarios drawn from CBOT corn futures and USDA NASS Tennessee cash corn prices from 1997 to 2025, across three marketing windows.

Table 4 converts the average per-bushel net returns into annual additional revenue for three representative bin sizes, assuming each bin is filled to capacity.

Table 4. Average Annual Additional Revenue from Storage by Bin Size and Marketing Window

Marketing Window	Small Bin (12,000 bu)	Median Bin (30,000 bu)	Large Bin (60,000 bu)
March	$2,714	$6,785	$13,570
May	$3,293	$8,233	$16,465
July	$4,614	$11,534	$23,068

Source: Based on 1997–2025 CBOT futures and USDA NASS Tennessee cash corn prices. Results reflect corn and assume bins are filled to capacity.

Average returns do not occur every year. Table 5 shows the range of historical outcomes for a median 30,000-bushel bin stored from harvest to March, including the average year, the best year, and the worst year.

Table 4. Average Annual Additional Revenue from Storage by Bin Size and Marketing Window

Scenario	Return per Bushel	Dollar Impact
Average year (unhedged)	+$0.226/bu	+$6,785
Best year (2021)	+$1.247/bu	+$37,417
Worst year (2008)	-$0.603/bu	-$18,083

Storage was the optimal marketing decision in approximately 58 percent of historical price scenarios across all three marketing windows. Payback periods on the producer's out-of-pocket cost after TAEP range from 4.7 years (July window) to 8.1 years (March window), all well within the 30-year expected bin life. In comparison to 9.8 years (March), and 5.7 (July) years respectively, without TAEP.

Recommendation

On-farm grain storage is a worthwhile investment for most Tennessee grain producers. As shown in Tables 4 and 5, storage generated positive returns in the majority of historical price scenarios across all three marketing windows, with the investment recovering the producer's out-of-pocket cost well within the expected bin life.

Producers considering a grain storage investment should evaluate the following:

1. **Utilization.** A facility that sits partially empty significantly reduces the return on investment. Producers should size their bin to match production volumes and consider the potential for growth.
2. **Marketing plan.** Storage only pays if grain is eventually sold at a favorable price (greater than the harvest low less fixed and variable storage costs). Producers should have a target price and marketing strategy for all bushels before storing.
3. **Price risk management.** Producers who are uncomfortable with futures price risk should consider a basis contract to lock in their local basis while retaining upside from futures price movement. Producers who are more concerned about basis deterioration should consider a futures hedge to lock in the futures price while retaining exposure to basis improvement.
4. **TAEP cost-share.** On-farm storage reduces the need to haul grain immediately at harvest, avoiding trucking delays and long line-up at elevators or barge points. This gives producers more flexibility when and how they move grain to market.

The ability to store crops provides producers with additional marketing alternatives and extends the marketing interval. On-farm storage expands the producer's feasible marketing decisions, allowing grain to be sold into seasonal price appreciation, futures market carry, and favorable basis movements rather than at harvest-time lows. TAEP's cost-share program reduces the capital barrier to storage investment, improving the return on investment for Tennessee grain producers across all facility sizes. Basis risk remains the primary residual risk for producers who store and hedge, and producers should account for this in their marketing decisions.

Online Resources

TAEP eligibility and application requirements. tn.gov/agriculture/farms/taep.html

Barnaby, G.A. Grain Storage Decision. Kansas State University Extension. bookstore.ksre.ksu.edu/pubs/economics-of-on-farm-storage_MF2474.pdf

Edwards, W. Grain Storage Alternatives. Iowa State University Extension. extension.iastate.edu/agdm/crops/html/a2-35.html

Plastina, A. Grain Storage Management. Iowa State University Extension. shop.iastate.edu/extension/farm-environment/crops-and-soils/crop3083e.html

Duncan, W.H., Smith, S.A., Narayanan, C.R., and Martinez, C.C. Estimating Costs for Grain Storage: Bags and Bins. University of Tennessee Extension. W1060. solutions.tennessee.edu/publication/W1060/

Duncan, W.H., Bowling, B., and Smith, S.A. Regional Tennessee Corn and Soybean Basis. University of Tennessee Extension. W1091. solutions.tennessee.edu/publication/W1091/



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