

REVISED RESEARCH NOTE: Structural Seasonal Alpha in Physical Commodities

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Date: January 13, 2026

Subject: Systematic Seasonal Outperformance Net of Institutional Friction

Status: Revised & Stress-Tested (65bps Friction)

1. Executive Summary

This research identifies a structural bifurcation in market efficiency between physical commodities and financialized assets. By implementing a **Recursive Expanding-Window** model that accounts for a revised **0.65% (65bps) transaction friction penalty**, we demonstrate that seasonal alpha persists in markets with rigid supply constraints. While theoretical "paper" alpha decayed in financial benchmarks, the Lumber strategy maintained a **6.73% net annualized alpha** with a 0.61 Sharpe Ratio.

2. Stress-Tested Performance (65bps Tax)

The table below reflects the "Institutional Stress Test," simulating slippage, commissions, and contract roll costs under a high-friction environment.

Asset	Net Ann. Alpha	Sharpe (WF)	P-Value	Result
LUMBER	+6.73%	0.61	0.000***	Robust Alpha
WHEAT	+2.52%	0.36	0.000***	Robust Alpha
CORN	+1.10%	0.33	0.004***	Robust Alpha
DOW JONES	-6.42%	0.00	0.722	Efficient (Control)
BITCOIN	-61.2%	0.46	0.130	Negative Alpha

### 3. Portfolio Engineering: The "Master Fund" Aggregator

To mitigate idiosyncratic volatility, a multi-asset aggregator was developed to synthesize non-correlated signals.

- **Drawdown Compression:** The Master Fund reduced the Maximum Drawdown (MDD) from **-23.6%** (Lumber) to **-16.3%**.
- **Cross-Asset Synergy:** By blending Agricultural (Wheat/Corn) and Industrial (Lumber) seasonality, the strategy achieved a smoothed equity curve suitable for professional mandate.

### 4. Methodology & Robustness

- **Friction Modeling:** A **0.65% penalty** is applied to all active seasonal positions to account for real-world execution.
- **Recursive Walk-Forward:** Strategies are re-optimized annually using an expanding window, simulating real-world systematic environments without look-ahead bias.
- **Statistical Validation:** 1,000-rep Permutation Tests confirmed that Lumber and Wheat achieved **p = 0.000**, indicating the signals are structural rather than stochastic noise.

### 5. Strategic Thesis

The persistence of net alpha is driven by **Physical Rigidity**.

1. **Biological/Harvest Cycles:** Fixed production timelines in Grains and Timber cannot respond instantly to price signals.
2. **Storage & Logistics:** High carry costs and physical decay prevent financial arbitrageurs from smoothing seasonal curves.
3. **The Efficiency Gap:** Seasonality fails in financialized/liquid assets (Bitcoin/Dow) but remains a viable structural premium in supply-constrained "bulk" physicals.

### 6. Conclusion

The results of this research demonstrate that while the Efficient Market Hypothesis (EMH) is "nearly" correct for financialized assets, it fails to account for the **structural rigidities** inherent in physical commodity supply chains. By implementing a rigorous **Recursive Expanding-Window** model, we have identified a persistent and exploitable seasonal premium in Lumber and Grains that remains robust even after applying an institutional-grade **0.65% friction penalty**.

Ultimately, this research provides a realistic, friction-adjusted framework for capturing premiums that are largely uncorrelated with broader equity markets. By prioritizing statistical significance through **Permutation Testing** and eliminating look-ahead bias, this model serves as a validated blueprint for institutional alpha extraction in the physical commodity complex.