# Determining the Effectiveness of Optimal Time-Varying Hedge Ratios for Cattle Feeders under Multiproduct and Single Commodity Settings.

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ABSTRACT for:

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**Abstract**

The objective of this paper is to compare the effectiveness of multiproduct optimal time-varying hedge ratios - for cattle feeders - over single commodity optimal time-varying hedge ratios. Multiproduct optimal hedge ratios take into account a multivariate portfolio approach which may generate benefits from production-related commodities decreasing the price risk faced (from production) over the case of single commodity hedging. Cattle feeders have faced increased volatility in recent years from their feed markets, given the surge in grain prices (especially corn) and from soybean meal. In addition, feeder cattle markets and fed (live) cattle markets have likewise experienced a rise in their price volatility in recent years.

Optimal multiproduct time-varying hedge ratios are determined by estimating a multivariate model of regime switching dynamic correlations. The model estimated is the regime switching dynamic correlations (RSDC) model, from Pelletier (2006). These estimated dynamic correlations between cash and future prices switch endogenously between two different regimes, obtaining an improved fit over prior studies that considered applying a constant conditional correlations matrix among the prices. The difficulty in estimating time-varying conditional correlation matrices for a large number of variables (e.g. feedlot operator - considering feeder cattle, live cattle, corn, and soybean meal markets) is that for each period, the correlation matrix must be positive semi-definite (PSD). This problem has generally been circumvented by applying a constant conditional correlation matrix. As such, this model provides a better characterization of the multiproduct dynamic process for cattle feeders, since it captures the evolution of the cash/futures correlation matrix when the series switch from a regime of low correlation to one of higher correlation or vice-versa.

As mentioned, cash and futures prices of corn, soybean meal and feeder cattle are the inputs and live cattle (slaughter) prices are the output. Prior literature addressing multiproduct optimal hedge ratios in agricultural markets applied different methods using constant conditional correlations, to a soybean complex. Example of these studies are Tzang and Leuthold (1990), Fackler and McNew (1993), and Garcia, Roh and Leuthold (1995). Similarly, Noussinov and Leuthold (1999) apply a constant conditional correlation matrix to estimate optimal multiproduct hedging for a feed lot operation. Subsequently, Haigh and Holt (2000) applied time-varying

correlation methods to multiproduct optimal hedging of grains and freight rates. They estimated wheat and their freight rate, and separately soybean and their freight rate by using a BEKK MGARCH model. This model however, suffers from a dimensionality problem and only few series can be estimated at a time (Pelletier, 2006). More recently, Power and Vedenov (2010) study multiproduct optimal hedges in a feedlot operation from a downside risk perspective (though only consider corn and live cattle markets), and find that optimal hedges are lower than mean-variance hedges. The prior two studies only account for the estimated correlation between two commodity markets at a time. Noussinov and Leuthold (1999) study multiproduct optimal hedging for a (full) feedlot operation by considering corn, soybean meal, feeder cattle and live cattle markets. They find a significantly lower multiproduct hedge ratio over single commodity for feeder cattle and fed cattle; however, as mentioned, their study applies a constant correlation matrix among the price series. The present paper models the data more effectively by estimating time-varying correlation matrices, and hence more accurate results are obtained. More importantly, the model estimates the dynamic interaction between four commodity markets - including both their cash and futures prices - thus identifying time-varying correlations between a larger number of production related commodities, elucidating the potential advantage in the application of this method.

**Relevance to Profession/World:**

Recent steady growth in the volatility of agricultural commodity markets along with an increasing need for proper risk management tools in related production settings may be addressed through multiproduct hedging. Previous studies for multiproduct hedging have arrived at mixed results. Some papers show improvement of multiproduct hedging over more naive hedging strategies, e.g. Noussinov and Leuthold (1999) for feedlot operations, and Haigh and Holt (2000) for grains and freight rates. However, a paper by Collins (2000) found no significant improvements of optimal multiproduct hedging studies performed on a soybean complex, for a large set of out-of-sample data. A caveat is that each of these soybean complex studies had used a constant condition correlation matrix and not time-varying correlations. This paper applies a new, parsimonious model for multiproduct hedging of a feedlot operation, which has estimation and characterization advantages over previous models applied. Findings contribute to identify advances in multiproduct hedging tools, yielding managerial implications for risk management.

**Research Methodology:**

The multivariate Regime-Switching Dynamic Correlations model (RSDC, Pelletier, 2006) is non-structural, of reduced form, where all variables are assumed to be endogenous and characterized by weakly stationary processes. The models permit the depiction of time-varying correlations for multiple series of cash and/or future prices in two or more different regimes. This study applies the parsimonious model to two correlation regimes.

Weekly cash prices for corn, soybean meal (CP-44%), feeder cattle and live cattle (slaughter) prices are obtained from the USDA. In addition, weekly futures prices for corn, soybean meal, feeder cattle and live cattle are obtained from the Commodities Research Bureau (CRB). Price series are from January 2000 through December 2008, and out-of-sample data is from January 2009 to May 2012.

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