Diesel Fuel Price as a means of Forecasting Livestock Yardage Costs

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Summary and Implications

Current retail values of diesel fuel can be used as an index to estimate current and near-future yardage charges in maintaining livestock

Introduction

Yardage is the charge placed on maintaining and growing livestock apart from the feed and initial animal value. The yardage charge can be broken into 3 major categories; fixed yardage costs, for example property taxes and building depreciation, which exist regardless of whether livestock are being kept or not. Production yardage costs which are associated with all animals brought on to the farm and would include daily labor, machine and power use. Then incidental yardage charges that vary depending on the group or time of year the animals are present and often is comprised of medical issues and bedding use. Yardage generally is the total of all these non feed variables costs, although it is a wise practice to itemize the incidental yardage portion, and is expressed in the unit of cost per head per day. This provides a simple way of expressing what the cost is of maintaining and growing livestock, but can lead to a degree of economical management complacency due to two issues. The first and more important issue is that the producer cannot know with complete accuracy the yardage cost until the animals are finished and sold since the costs are accrued through the time the animal is on feed until the point when pen cleaned out and repaired. Because of this issue, the next group's yardage charge is based on historical data which may be lacking in accuracy due to continuous price movement of inputs. The second issue is that the compilation of the real yardage charge is quite tedious due to the many variable costs that enter into the equation and the overlap these costs have with other enterprises in the farming operation. Because of this issue, it is a time consuming process that does not lend itself well to frequent updates. As result a static, flat yardage charge is established at some point. This value may or may not be from an actual calculation and probably does not adjust when necessary to account for changing input costs. The objective of this paper is to provide a means by which a common input, diesel fuel, can be used to forecast and frame probable current and near future yardage charges.

Material and Methods

Data regarding the raw input values used for this process were taken from 1995 through early 2010. The data sources came from the United States Department of Energy and the International Monetary Fund. These data were converted to a percent change in price from month to month over the fifteen year period collected in order to maintain a consistent unit describing values.

After securing a solid database of input values, the first step was to determine an accurate, historical yardage charge from a livestock operation. In this example a cattle feedlot was used. The actual costs within fixed yardage, the production yardage and the incidental yardage categories were determined. Second, a common input with a tangible retail value that had far reaching effects on other inputs was considered. This input was then tested against other raw inputs in order to determine if there was some solid correlation existing and then further tested through an analysis of variance in order to quantify how much of the existing price variation that occurred could be explained by price variation in this common input. The final step then was to determine the common input's influence on the particular cost items in order to create an index which could adjust the costs appropriately.

Results

Considering the concept of a common input from which others are influenced, the energy inputs were considered as ideal markers. Of these, diesel fuel seemed to stand out as one that the producer both used and priced directly as well as having a strong influence on the other inputs. Table 1 provides the correlation between price changes of a number of raw materials. Diesel fuel price change is strongly correlated to the price change of a number of these inputs. One may argue that crude oil should be used since it is more basic, traded on the futures market and may have even a greater influence on other prices. However the correlations and analysis of variance did not seem to indicate that something other than diesel is preferred. Likewise the biofuel surges, erratic futures markets and considering the fact that crude oil is not purchased directly by the producer leaves the current value of crude oil somewhat elusive and difficult to quantify at the level of production unlike diesel fuel which is purchased or contracted and easily compared to a reference point in time.

Table 2 provides the results of regressing the percent monthly price change of the diesel fuel with monthly price change of the other raw inputs. Due to the number of samples one can conclude that the relationship on all comparisons is significant so what becomes of practical

interest is how much of the variation is explained and how one can quantify this change in the other inputs.

Application of the results is the final step. The R^2 value provides a means by which we can determine the extent of influence and the equation indicates the direction of the response. Inputs such as timber prices have only about seven percent of their variation in common with diesel price variation while inputs such as iron would have 84 percent of the price variation explained. Inputs such as interest rate respond in a negative direction as one may expect since, as we consider the whole economy, an increase in prices of raw materials sequesters funds limiting purchases of other goods thus depressing the economy. The response on the grander scale which has some delay after the initial fuel price change is a depression in interest rates to promote spending. Therefore in providing an example, if we determine our current yardage charge per day is $0.40 per head and of this $0.05 per head per day is our cost of diesel, $0.04 per head per day is due to interest and $0.03 per head per day is due to hardware we can apply the equations to arrive at an estimate for the yardage charge on the next lot as described in Table 3. In reality every operation will have a different breakdown and there are many other items or a portion of these items in the yardage charge that will be affected such as machine parts, service calls, and etcetera. The example in Table 3 only provides an example of the method needed to address the issue.

Table 1. Correlations.

	Gas	Diesel Fuel	Crude Oil
Diesel	0.982	1.00	0.982
Timber	-0.272	-0.264	-0.302
Iron	0.874	0.918	0.902
Crude Oil	0.981	0.987	1.000
Interest	-0.501	-0.509	-0.529
Electricity	0.892	0.902	0.896

Table 2. Analysis of Variance using Diesel Fuel (D) as the Key Index Value.

	Std. Error	F - significance	R^2	Equation
Gas	0.08	7.43E-129	0.96	$\Delta G = 0.115 + 0.885D$
Timber	0.13	0.0004	0.07	$\Delta T = 1.078 – 0.078D$
Iron	0.26	5.37E-72	0.84	$\Delta R = -0.315 + 1.315D$
Crude Oil	0.11	1E-141	0.97	$\Delta C = -0.445 + 1.445D$
Interest	0.26	4.88E-13	0.26	$\Delta I = 1.340 – 0.340D$
Electricity	0.05	6.73E-66	0.81	$\Delta E = 0.754 + 0.246D$

*Δ = percent change in price

Table 3. Example of Estimating a Future Yardage Charge.

Item	Base $	New $	Change %	Multiplier
Diesel price	2.25	2.48	10.2	1.102
Diesel – of yardage	0.05	0.055	10.2	1.102 * 0.05
Interest – of yardage	0.04	0.039	2.5	0.04 x [1.340 – 0.340 x 1.102]
Hardware – of yardage	0.03	0.034	13.4	0.03 x [-0.315 + 1.315 x 1.102]
*Manure disposal - yardage	0.03	0.031	2.5	[(0.03 x 1.102) + (0.03 x 3)] / 4
Balance – of yardage	0.25	0.25	-	-
Total Yardage	0.40	0.41	2.0	-

*For this example manure hauling costs were considered ¼ due to fuel, ¾ due to labor & machinery.