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# **The Smithfield / Packerland Merger and the Holstein Feeder Steer Price Differential**

Kenneth H. Burdine, Leigh J. Maynard, and A. Lee Meyer

## **Abstract**

An econometric model was used to evaluate the impact that the Smithfield / Packerland merger had on the price differential between Holstein feeder steers and non-dairy feeder steers in Kentucky. Weekly data were used from the Kentucky Livestock Database and the Livestock Marketing Information Center. An increase in the Holstein / non-dairy feeder steer spread of more than \$3.00 per hundredweight was associated with the time period following the merger. While the possibility remains that unidentified factors contributed to the wider spread, the contention that the merger was the cause could not be rejected.

## **Background, Objectives, and Motivations**

Holstein steer calves are by-products of commercial dairy operations. Heifers are much more valuable than their male counterparts so most dairies sell their steers at a very young age. The better heifers are kept for replacements and the others are sold as replacements on the open market. A large number of Holstein steers, weighting between 300 and 400 pounds, reach the market each year just after weaning and are purchased by backgrounders.

Backgrounders will typically grow Holsteins to anywhere from 700 to 1000 pounds before selling them. At this point, the Holstein feeder steers are sent to feedlots where they are finished much like traditional non-dairy calves. When properly finished, Holstein meat is considered to be of good quality and is often more uniform than meat from other breeds of cattle.

However, Holstein steers tend to finish at much heavier weights than their non-dairy counterparts. Many traditional packing plants are not properly equipped to handle the larger Holstein carcasses on their railing systems. Further, packing plants prefer uniform sized carcasses to maintain consistent product flow. For these reasons, some processing plants tend to specialize in the slaughter and processing of Hosteins (Koystra).

Consolidation is a reality in United States Agriculture and especially in the meat packing industry. This trend has greatly accelerated in the last twenty years as is evidenced by changes in the four firm concentration ratio or CR-4. In 1982, the largest four meat packing firms processed 32% of the nation's cattle. By 1987, this number increased to 54%, only to increase to 64% by 1992. Most recently, in 1997, the CR-4 in the cattle slaughter industry was 70% (Consolidation in US Meat Packing, USDA). As industries become more consolidated, market theory tells us that those firms gain market power. Especially when upstream industries are characterized by a large number of small firms, operating in a competitive environment.

Smithfield Foods Incorporated is one of the largest meat processing firms in the United States. Based in Smithfield, Virginia, it is the nation's largest pork producer and packer. In April of 2001, Smithfield purchased Moyer Packing of Souderton, Pennsylvania. Later that same year, Smithfield began discussing the acquisition of Packerland Holdings of Green Bay, Wisconsin (UM Madison).

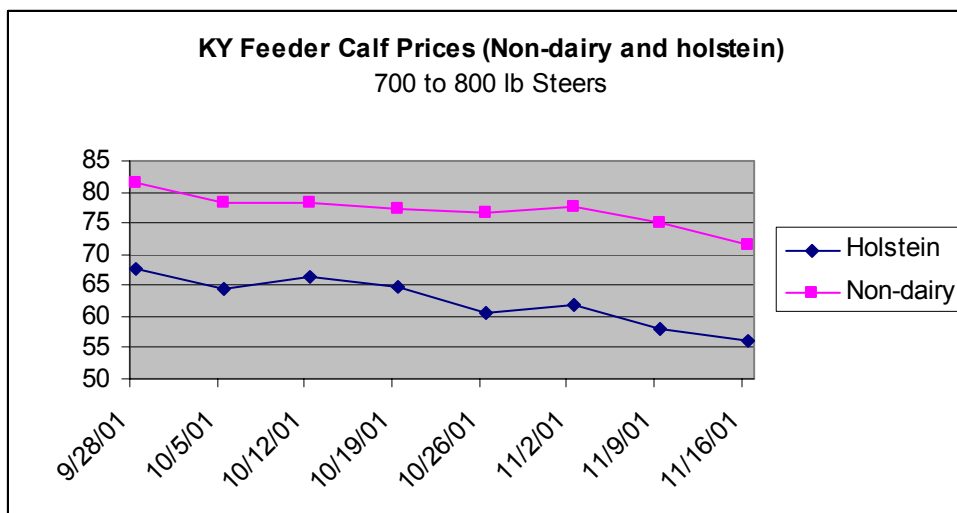
On October 25, 2001, Smithfield Foods completed its acquisition of Packerland Holdings. When Smithfield took over Packerland operations, they became the fourth largest beef company in the US and gained over nine percent of the market (Smith, Feedstuffs). Packerland was a major purchaser of Holstein slaughter animals, and due to their Green Bay, WI and Plainwell, MI locations, slaughtered many Holstein steers that originated in Kentucky.

The objective of this study was to examine the price differential between Holstein feeder steers and non-dairy feeder steers since 1999. The motivation for the study was concern by industry leaders that consolidation in the Holstein slaughter and processing industry, specifically Smithfield Foods' acquisition of Packerland, may have had a damaging effect on the price of Holstein feeder steers.

### Empirical Observations

This merger was surrounded by much media coverage, which drew a great deal of attention to Holstein prices during this time period. Many industry players were expecting a fundamental change and many observed what they thought was one. There was an immediate drop in Holstein feeder prices following October 25, 2001, which added to speculation of monopsonistic price depression.

For the week of October 19, 2001, 700 to 800 pound Holstein steers in Lexington, KY were selling for \$64.75 per cwt. The following week of October 26, 2001, prices dropped to \$60.60 per cwt, a decrease of more than \$4.00. Furthermore, in the four weeks prior to the merger, 700 to 800 pound Holstein steers averaged \$65.85 / cwt. In the four weeks following the merger, these steers averaged \$59.12 / cwt, a decline of nearly seven dollars (KY Livestock Database, see graph below).

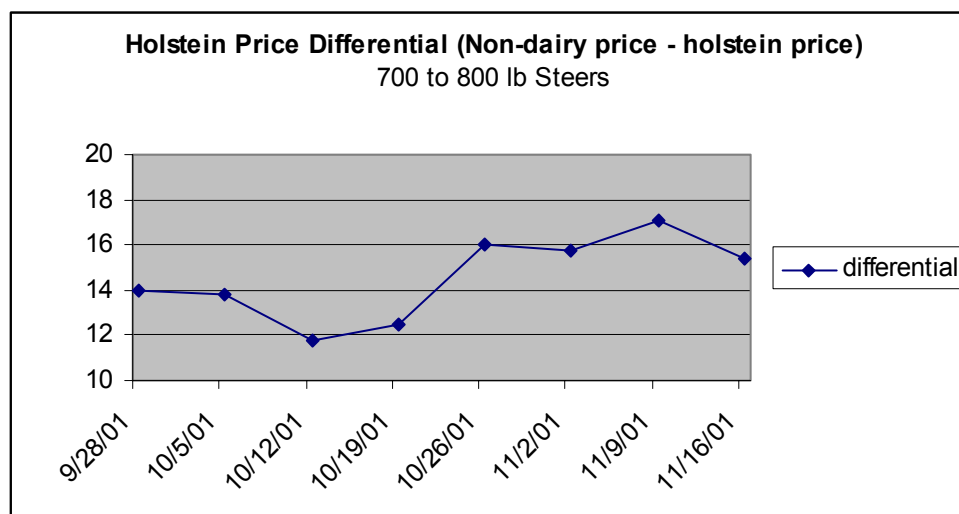


Despite empirical evidence to suggest a cause and effect, it could not be determined that the merger of Smithfield and Packerland caused this price depression. There are many factors that go into a price and market environment is only one of those factors. It was clear that a more detailed study would be needed to determine if this merger did in fact cause a depression of Holstein feeder prices.

## Methodology

This question was difficult to address due to the tragedy of September 11, which occurred so close to the merger. Prices of all cattle dropped considerably following this date. Therefore, it was decided not to examine the effects of the merger on the price of Holstein feeders itself. Rather, the impact is evaluated on the difference between holstein feeder steers typical non-dairy feeder steers. This is done in an attempt to minimize the effect of variables that may not be included within the model; macroeconomic variables should effect all prices similarly.

Simple graphical analysis did suggest that the spread increased following October 25<sup>th</sup> (see graph below). From October 19<sup>th</sup> to October 26, the Holstein price differential increased from \$12.49 to \$15.98 per cwt. In the four weeks prior to the merger, the differential averaged \$12.99. During the four-week period following the merger, the spread had risen to \$16.03 per cwt. on average, an increase of more than \$3.00 per hundredweight.



In order to estimate the impact of the Smithfield / Packerland merger on this spread, an econometric model was used. For the purposes of this paper, the Holstein price differential refers to the average price of 7 to 8 weight non-dairy feeder steers in Kentucky, minus the price of 7 to 8 weight Holstein feeder steers at Bluegrass Stockyards in Lexington, KY for that same week. This differential is always a positive number as Holstein feeder steers always bring a lower price than traditional feeder steers. The Holstein margin was regressed against numerous explanatory variables in an attempt to predict as much variation in this margin as possible.

### **The Theoretical Model**

The theoretical model developed was: Holstein differential =  $f(P_{fi}, P_{gb}, P_{corn}, P_{fut6}, S_{c/s}, \text{season})$ , where,  $P_{fi}$  is the feeder calf index for seven weight steers reported by the Chicago Mercantile Exchange,  $P_{gb}$  is the most recently reported weekly wholesale ground beef price,  $P_{corn}$  is the most recently reported weekly corn price,  $P_{fut6}$  is the most recent weekly close of the fat cattle futures contract six months in advance,  $S_{c/s}$  is the most recent weekly value for the choice / select price spread, and season is intended to capture the seasonal effects of the cattle market.

The feeder cattle index ( $P_{fi}$ ) is included to serve as a base for the spread. One would expect the spread between Holsteins and non-dairy steers to widen as the overall market for feeder calves improved. It was assumed that in the Holstein market, prices are driven by the price of ground beef, so the wholesale price of ground beef is included. Corn price always comes into play when evaluating feeder calf prices; the price of corn has a major impact on the profitability of finishing cattle and the associated feeder cattle bids. Since Holsteins tend to finish at higher slaughter weights, more corn is needed to finish them relative to non-dairy feeders. For this reason, higher corn prices are expected to increase the price differential.

The fat cattle futures contract price is included because it is the best estimate available for finished cattle prices in the future. The contract six months ahead is used to estimate the futures price when the steers would be finished and reach the fat market, assuming a feeding period of roughly 180 days. This also allows us to account for the hedging opportunity that existed at the

time the cattle were ready to be placed on feed should the feedlot have chose to use price risk management.

Lastly, the choice / select price spread is included as a measure of premium paid for quality. Although it does not directly relate to the Holstein spread, it may give us a feel for how the market is discounting cattle that do not grade choice. Since Holsteins are generally thought to be of inferior quality relative to typical beef steers, it was assumed that there might be some link between this spread and the Holstein feeder steer price spread.

**Table 1. Expect Sign of Parameter Estimates**

Variable	Variable Definition	Expected Sign
$P_{fi}$	CME feeder cattle index	positive
$P_{gb}$	Wholesale price of ground beef	negative
$P_{corn}$	Chicago corn price	negative
$P_{fut6}$	Fat futures prices, 6 month contract	positive
$S_{c/s}$	Choice Select Price Spread	positive
terr	Sept. 11, 2001 to Oct. 25, 2001	none
smpac	Period following Oct. 25, 2001	positive
fall	September, October, November	negative
winter	December, January, February	negative
summer	June, July, August	negative

### The Empirical Model

Given the theoretical model, variables were included to evaluate the impact of the Smithfield - Packerland merger. A binomial variable was used to denote each weekly observation following the merger date of October 25, 2001. In order to test the hypothesis that the September 11<sup>th</sup> terrorist attack did not affect the Holstein spread, a second dummy variable



was used to account for the time period following September 11, 2001, but prior to October 25, 2001.

The empirical model is now,  $\text{Hostein margin} = b_0 + b_1 P_{fi} + b_2 P_{gb} + b_3 P_{corn} + b_4 P_{fut6} + b_5 S_{c/s} + b_6 \text{terr} + b_7 \text{smpac} + b_8 \text{fall} + b_9 \text{winter} + b_{10} \text{summer} + \epsilon$ , where terr includes observations following the September 11<sup>th</sup> attack but prior to the merger, smpac includes observations following the Smithfield / Packerland merger, fall is a binomial variable accounting for the months of September, October, and November, winter is a binomial variable accounting for the months of December, January, and February, and summer is another binomial variable accounting for the months of June, July, and August. All results are interpreted relative to the spring market, prior to September 11, 2001.

### **Data Collection and Sources**

One of Kentucky's largest and most thoroughly tested holstein feeder steer markets is in Lexington, KY at Bluegrass Stockyards. Data from 700 to 800 pound holstein feeder steers sold in Lexington were used in this study along with the state average of beef steers during the same timer period. These data are collected and averaged on a weekly basis by the Kentucky Department of Agriculture, and compiled into the Kentucky Livestock Database. For this work, weekly price data were used beginning in January of 1998 and continuing through the end of April 2002.

For purposes of the model, the corn price, ground beef price, and the choice select spread, reported the week prior to the Holstein price report was incorporated. Depending on the variable and the associated reporting period, this was anywhere from one to four days prior. The price of seven weight non-dairy feeders was reported the same day and this value was used in the model. Finally, the live futures price was included. The value used was the current prices of the contract selling for delivery six months in the future. If there was not a contract selling six months from the price reporting date, the next month's contract was used.

Weekly data for these explanatory variables were available through the Livestock Marketing Information Center, which keeps weekly data on economic indicators such as these. Data from the Kentucky Livestock Database and the Livestock Marketing Information were formatted for use in SAS so that it could be further analyzed. Full sets of data were not available for each week during the three-year period. In some weeks there was insufficient numbers to truly test the market and no price data was reported. In total, 117 weekly observations were used in the analysis.

Before data analysis could begin, numerous tests were performed on the model if any assumption of the Ordinary Least Squares method were violated. The empirical model was tested for normality, linearity, auto-correlation, and multi-collinearity, using the SAS system. A Chi-Squared test failed to reject the normality assumption, Ramsey's Reset test failed to reject the linearity assumption, a Durbin-Watson test failed to reject the null hypothesis that  $\rho$  was equal to zero, and although less technical, a variance of inflation test suggested that multi-collinearity was not a problem within this data set. Given that the basic assumptions hold, results could be interpreted using the Ordinary Least Squares method.

## **Results**

Despite the inclusion of five continuous explanatory variables and dummy variables to account for the merger in question, the September 11<sup>th</sup> terrorist attack, and seasonal price differences, the adjusted  $R^2$  for the model remains quite low. The empirical model is explaining less than 30% of the variation in the Holstein feeder steer spread. However, an F-test suggested that the model was useful in understanding the differential, and many of the explanatory variables were found to be significant.

Not surprisingly, the CME feeder cattle index was significant in explaining the margin at the 90% confidence level. An increase in the index of \$1 per hundredweight was associated with an increase in the spread of around twenty-five cents per hundredweight. The price of corn also had a positive impact on the spread and was significant at the 90 and 95% confidence levels. An

increase in corn price of ten cents per bushel, would be associated with a widening of the Hostein spread by fifty-seven cents per hundredweight.

The price of ground beef had the opposite effect on the Holstein spread and was significant at the 90% confidence levels. As expected, an increase in the price of ground beef by one dollar per pound was associated with a narrowing of the spread by almost nine cents per hundredweight. The six-month futures price and the choice select price spread were both insignificant at reasonable confidence levels.

The seasonal dummy variables that were included were helpful in understanding the Holstein spread. Although fall and summer were not found to be statistically different from spring, the winter variable was found to be significant at the 99% confidence level. The Holstein feeder steer spread, for 7 to 8 weight calves, was found to be over \$2.00 per cwt. wider in the winter.

The focus of this paper was to examine the effect that the October 25<sup>th</sup>, 2001 merger may have had on this differential. The variable *smpac*, representing the time period following the merger, was found to be significant at the 90%, 95%, and 99% confidence levels. The holstein spread, following this date, tended to be over \$3 per hundredweight wider than before the merger.

The dummy variable used to represent the time period between the September 11<sup>th</sup> attack and the merger was not found to be significant in explaining the spread. This suggests that the widening of the Holstein spread in late 2001 was most likely associated with an event occurring in late October rather than mid September.

The Smithfield / Packerland merger was certainly the most obvious event, occurring during this time that could have caused a change such as this. The spread widened when holding all other variables in the model constant; this eliminates the effects of non-dairy feeder price, futures price, corn price, and seasonality. There is considerable statistical evidence to suggest that the merger between Smithfield and Packerland, may have sparked a change in the price difference between holstein feeder steers and non-dairy type feeder steers.

## **Conclusions**

The purpose of this study was to examine the apparent decrease in prices of Holstein feeder steers in the 700 to 800 pound weight range. Since the overall market trend during the time in question was downward, it was decided to examine change in the price spread between Holstein feeder steers and non-dairy feeder steers in this weight range. Specifically, the authors wanted to evaluate the impact, if any, the Smithfield / Packerland merger may have had on this differential.

Due to the rigor of academic careers and the multiple roles that extension specialists play, it is quite easy for those in academic institutions to overlook the affects of such changes. Those persons who work in the beef sector on a daily basis are better able to detect slight, gradual, market changes that can have huge impacts when multiplied on a regional scale. Thus generating the hypotheses for those within the academic world to test; this was the case with this particular study. Through the benefit of a good relationship between area cattle buyers and extension personnel in the University, this question was identified and appropriately addressed.

Based on findings of the econometric model, authors rejected the hypothesis that the Smithfield / Packerland merger had no effect on the price difference between Holstein feeder steers and non-dairy feeder steers in the 700 to 800 pound range. In fact, the model pointed towards the merger as the most likely cause of more than a \$4.00 per hundredweight increase in the price difference. However, given the low  $R^2$  and the complicated nature of spreads, it is impossible to say that this merger was definitely the cause. One can say, with considerable confidence that something happened in late October of 2001 that caused a considerable and significant widening in this price differential.

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**Table 2. Variable Means, Ranges, and Standard Deviations**

Variable	Mean	Standard Deviation	Low	High
P <sub>fi</sub>	\$83.66	5.7245	\$68.34	\$91.25
P <sub>gb</sub>	\$99.65	9.8173	\$79.82	\$122.31
P <sub>corn</sub>	\$2.01	0.1493	\$1.59	\$2.33
P <sub>fut6</sub>	\$71.07	3.4268	\$63.87	\$77.67
S <sub>c/s</sub>	\$7.83	3.1180	\$2.21	\$15.21
terr	0.0513	0.2215	0	1
smpac	0.2393	0.4285	0	1
fall	0.2308	0.4231	0	1
winter	0.2479	0.4336	0	1
summer	0.1624	0.3704	0	1

\*, \*\*, and \*\*\* denote statistical significance at the .10, .05, and .01 levels, respectively

**Table 3. Parameter Estimates, Standard Errors, and Significance**

Variable	Parameter Estimate	Standard Error
Intercept	4.58990	9.03880
P <sub>fi</sub>	0.25505*	0.14119
P <sub>gb</sub>	-0.08718*	0.04806
P <sub>corn</sub>	5.73540**	2.31804
P <sub>fut6</sub>	-0.23606	0.24332
S <sub>c/s</sub>	0.02008	0.10499
terr	0.66291	1.54812
smpac	3.04459***	1.11657
fall	0.78897	1.19253
winter	2.34809**	0.87548
summer	0.08633	0.99294

\*, \*\*, and \*\*\* denote statistical significance at the .10, .05, and .01 levels, respectively