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**Did the Voluntary Price Reporting System
Fail to Provide Price Transparency in the
Cash Market for Dressed Steers:
Evidence from South Dakota**

by

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Did the Voluntary Price Reporting System Fail to Provide Price Transparency in the Cash Market for Dressed Steers: Evidence from South Dakota

ABSTRACT

The information value of the former USDA voluntary price reporting system is investigated for dressed weight slaughter steers. The ability of the former system to promote market transparency and price discovery in the cash market is evaluated with state level mandatory price reporting data collected from September 1999 to April 2001.

The empirical framework evaluates the informational value of public price reports according to the criteria established in the market integration literature. The empirical results indicate that in the cash market for dressed weight steers, in South Dakota and Nebraska the former voluntary price reporting system did foster market transparency and aided in the price discovery process.

Did the Voluntary Price Reporting System Fail to Provide Price Transparency in the Cash Market for Dressed Steers: Evidence from South Dakota

Introduction

Political momentum behind passage of mandatory price reporting legislation at both the state and federal levels originated from lobbying efforts by producer groups concerned over the effects of increased packer concentration and thinning public livestock markets on the accuracy of voluntary price reports, price discovery, and market transparency. The reliability of the former voluntary price reporting system was called into question by proponents of mandatory price reporting, who claimed that 1) market transparency was degraded as a result of industry participants failing to report an estimated 30 to 40 percent of all transactions;¹ and 2) there is a propensity for buyers and sellers in the cash market to behave strategically when voluntarily reporting market transactions,² with one possible outcome being a lack of integration between the voluntary price reporting system and actual market transactions.³

The linkage between the former voluntary price reporting system and actual market transactions is investigated using South Dakota Mandatory Price Report (SDMPR) data collected before the implementation of the federal mandatory price reporting system. This issue has national implications because the legislation authorizing the federal mandatory reporting system has a sunset clause, and

¹ Wachenhiem and DeVuyst (2001) discuss the issue of market and price transparency in livestock markets. They report an Agricultural Marketing Service (AMS) estimate that 35% to 40% of all negotiated spot market cattle transactions are not reported under the voluntary price reporting system. They argue that increased transparency under mandatory price reporting may reduce competition in the fed cattle market. Azzam (2003) arrives at the opposite conclusion in a recent paper on mandatory price reporting. Note: Under the former voluntary price reporting system the AMS reported only confirmed transactions to the public.

² Koontz (1999) discusses the issue of strategic price reporting by buyers and sellers under the voluntary price reporting system. Koontz finds empirical evidence to support his hypothesis that packers and feedlots do engage in strategic price reporting and concludes that public price reporting is inefficient under certain market conditions. Several computer simulation studies on the public price reporting system arrived at a similar conclusion: Bastian et al. (2001) and Anderson et al. (1998).

³ Lack of “integration” implies that the information contained in public price reports does not accurately reflect market conditions and therefore market transparency is degraded.

renewal of the legislation will be debated in the near future on the floor of the U.S. Congress.⁴ The debate will likely focus on the cost imposed upon the packing industry by mandatory price reporting requirements versus the gain in market transparency. We believe our contribution to the literature will clarify the issues surrounding the mandatory versus voluntary price reporting debate.

Our objective is to empirically investigate the relationship between the weekly Agricultural Marketing News Service regional voluntary price reports (AMS 1999-2001) and actual market transactions in the cash market for dressed weight steers in South Dakota.

Mandatory vs Voluntary Price Reporting in the Cash Market for Fed Cattle: A Discussion of the Issues

Five states (Iowa, Minnesota, Missouri, Nebraska, and South Dakota) passed variants of mandatory price reporting legislation prior to passage of federal legislation. National mandatory livestock price reporting legislation was passed in October 1999 and the first publicly issued mandatory price report was released on April 2, 2001. The US Congress delegated the responsibility for collecting and reporting transaction data to the AMS. The selection of the AMS was obvious since the AMS has been responsible for operating the national voluntary livestock price reporting system since 1946 (LMPR Review Team 2001).

The passage of federal legislation created a new mandatory price reporting system for livestock markets, replacing the system of voluntary price reporting. The information structure of livestock markets and in particular the cash market for slaughter cattle changed structurally under the new price reporting regime. A number of regional price reports published under the former voluntary system were discontinued. They were the Montana Direct, South Dakota Direct, California Direct/Arizona Direct/Nevada Direct, Indiana/Michigan/Ohio Direct, Illinois Direct, Wyoming/South Dakota/Nebraska

⁴ The legislative authorization for federal mandatory livestock price reporting expires October of 2004.

Direct, and Washington/Oregon/Idaho Direct.⁵ These smaller-area regional voluntary price reports have been replaced with more aggregated mandatory price reports. The advantage of these new reports is the breakdown of direct sales into negotiated, formulated, and forward contract reports. Ironically, however, the disadvantage is the potential loss of transparency of local market conditions. Aggregation may mask any divergence of local market conditions from conditions reported in aggregate price reports.

Price Transparency and Market Integration: A Discussion

Market transparency refers to a market environment where all relevant information on market conditions is publically available to all market participants. One important component of market transparency is the concept of price transparency. Price transparency is defined as a market condition where all relevant information on transaction prices is publically available to all market participants. The goal of public price reporting is to provide accurate and timely market price reporting (Lawrence et al, 1996). Accurate and timely market price reports are necessary for adequate price discovery and for market efficiency (Ward 1987).

Recent literature on the relationship between competitive spatial equilibrium and market integration demonstrate that they are related but distinctly different concepts (Barrett and Li 2002, McNew 1996, McNew and Fackler 1997). When interregional trade is nonnegative, Barrett and Li note that a long-run competitive spatial equilibrium condition holds when marginal profit from arbitrage activity is equal to zero. Under this condition, when trade is positive, regional price differentials move “one-for-one with the costs of spatial arbitrage.” On the other hand, market integration, as discussed in the contestable market literature “implies the transfer of Walrasian excess demand from one market to another, manifest in the physical flow of commodity, the transmission of price shocks from one market to another, or both,” (Barrett and Li p. 293, and McNew and Fackler p. 192). Furthermore, this literature

⁵ Diersen (2002) discusses the change in the information structure of livestock markets under the new mandatory price reporting regulations.

concluded that linear cointegration techniques are inadequate when transaction costs are not stationary, or trade is bidirectional, or trade is discontinuous.⁶

We assert Barrett and Li's definition of market integration implies spatial price transparency, i.e. a price shock occurring in one region is quickly transmitted to a spatially relevant adjoining region. We propose that there are two conditions necessary for the former AMS voluntary price reporting system to be considered as an efficient price discovery mechanism. The first condition is for a spatially relevant regional voluntary price report series to have a spatial equilibrium relationship with South Dakota's mandatory price reporting series. The second condition is the existence of spatial price transparency between a spatially relevant voluntary price report series and the South Dakota mandatory price reporting series.

The establishment of whether or not the former voluntary price reporting system was an efficient price discovery mechanism for South Dakota producers is dependent upon whether spatial price transparency can be empirically verified. Empirical testing of the proposition that the former voluntary price reporting system did generate spatial price transparency is based on two assumptions: a) given unidirectional trade, regional competitive spatial arbitrage did determine price in South Dakota's market for slaughter steers, and b) South Dakota's mandatory price reporting mechanism collected all transaction data in South Dakota. Therefore, South Dakota's mandatory price reporting series is a complete information set, and an accurate reflection of the South Dakota market for slaughter steers.⁷ Given these assumptions, the following testable propositions are proposed:

⁶ The caveats raised by Barrett and Li concerning the use of linear cointegration do not apply to the problem addressed in this paper because South Dakota slaughter cattle are shipped out of state for processing. Thus, exporting South Dakota slaughter cattle to other states for processing is continuous and unidirectional. In the empirical results section, empirical evidence of stationary transaction costs is provided.

⁷ This assumption assumes full compliance with price reporting regulations by all market participants. Therefore, the expected value of collected transaction prices is an unbiased estimate of equilibrium price and is consistent with Tomek (1980).

- a) As a result of competitive spatial arbitrage, South Dakota's mandatory price reporting series has a long-run spatial equilibrium relationship with adjoining regional markets which import South Dakota slaughter cattle for processing.
- b) If South Dakota's mandatory price reporting series is cointegrated with a regional voluntary price series, then that voluntary report is an accurate reflection, in the long run, of actual market transactions in that region.
- c) If price shocks occurring in an AMS voluntary price series are empirically shown to be transmitted rapidly and completely to the South Dakota mandatory price series, then spatial price transparency exists between these spatially linked markets.

Methodology

We intend to empirically investigate the relationship between a spatially relevant publicly reported price series and the SDMPR series for dressed weight slaughter steers during the time period just before federal mandatory price reporting rules went into effect. Specifically, we will test if the information contained in a spatially relevant public price report accurately reflects actual cash market transactions in South Dakota. The application of cointegration will provide empirical evidence on the possible existence of a long-run spatial relationship between the information contained in a selected spatially relevant publicly reported price series and the information contained in South Dakota's mandatory price series. If a long-run relationship is found, then an error correction mechanism (ECM) approach will be used to investigate the short-run disequilibrium adjustment process. If empirical evidence from the error correction model indicates a robust transmission of price shocks from an AMS voluntary price series to the South Dakota mandatory price series, then we can conclude that there is spatial price transparency between South Dakota and the adjoining regional market. This would imply that the former voluntary price reporting system was an accurate and efficient source of price information for South Dakota and the regional market spatially linked to South Dakota.

The use of cointegration to examine commodity price relationships and regional market spatial relationships began to find its way into the agricultural economics literature in the late 1980s and the early 1990s (e.g. Ardeni 1989, Goodwin and Schroeder 1991). Cointegration is especially useful for investigating long-run relationships between economic variables with non-stationary I(1) time-series processes. Engle and Granger (1987) demonstrate that a linear combination of two I(1) series can produce a stationary series of I(0).

Two variables are cointegrated over time if individually they follow a unit root process but jointly move together over time. The requirement that each variable follows a unit root process implies that individually each variable's movement over time appears random and unpredictable, but the location of one variable provides information on the other variable's location if they are cointegrated. The application of cointegration is well suited for investigating whether the former voluntary price reporting system accurately reflected actual market transactions in South Dakota.

Assume Y_t denotes the South Dakota mandatory price series for the weekly dressed weight direct price for slaughter steers. Let X_t denote a public price report series for the weekly direct dressed weight price for slaughter steers. To test for a cointegrating relationship between Y_t and X_t , the first step is to determine if these price series have a unit root. The process formally begins by modeling the price series as an autoregressive process AR(p):

$$1) Y_t = \alpha + \beta_1 Y_{t-1} + \dots + \beta_p Y_{t-p} + \epsilon_t$$

$$2) X_t = a + b_1 X_{t-1} + \dots + b_p X_{t-p} + e_t$$

The existence of a unit root is tested for by either using the Augmented Dicky-Fuller (ADF) test or the Dicky-Fuller (DF) test as proposed by Dicky and Fuller (1979 and 1981). The decision criterion for test selection is based on if there is a serial correlation problem when the first difference of Y_t (i.e., ΔY_t) is regressed on Y_{t-1} . If serial correlation is detected, then the order of the autoregressive process (AR=n) on

which the ADF test is based is determined empirically.⁸ After evaluating the data, as suggested by Gujarati (2003, pp.816-17), a random-walk-with-drift model was selected for the unit root test.⁹ The unit root test result for each of the individual price series used in this study is provided in Table III.

If it is established that both of the price series under consideration have a unit root, then the estimated residuals from regressing Y_t on X_t are generated using the ordinary least squares procedure. To determine if Y_t and X_t are cointegrated, the estimated residual series from the cointegrating regression is evaluated by using either the ADF or DF test for detecting the existence of a unit root in the estimated residual series.¹⁰ The cointegration test results are summarized in Table IV.

Data

In July of 1999 South Dakota Codified Law: Chapter 40-15B (SDCL 2000) required mandatory livestock price reporting in South Dakota to begin on Sept 1, 1999. All private livestock transactions were to be reported to the South Dakota Department of Agriculture. Civil and criminal penalties for non-compliance were incorporated into the legislation. The Department of Agriculture collected data until federal mandatory price reporting began. The Secretary of Agriculture's office supplied all of the collected data to South Dakota State University. The South Dakota mandatory price reporting data was

⁸ Conducting the ADF unit root test was done in a multi-step procedure as suggested by Gujarati (2003, p.817). First, the simple Dickey-Fuller test is conducted by regressing the first difference of Y_t on Y_{t-1} using an OLS procedure (SAS ETS 1993). A Durbin-Watson d test statistic was estimated to detect the presence of serial correlation. If serial correlation was detected, based on 5% critical value, a first order autoregressive model was estimated using OLS. If serial correlation was detected in this step, then a second order autoregressive model was estimated, and so on until the error term of the ADF equation was determined to be serially uncorrelated. Higher order models used Durbin's t-test, based on a 5% critical value, as suggested in the SAS ETS manual.

⁹ For a discussion of unit root testing procedures and testing for cointegration between non-stationary time series variables see Gujarati (2003). The general form of the ADF test is based on:
 $\Delta Y_t = Y_t - Y_{t-1} = \delta_1 + \Theta Y_{t-1} + \sum_{i=1}^n \alpha_i \Delta Y_{t-i} + v_t$. Where $\Theta = 1 - \beta_1$. The unit root hypothesis test is: $H_0: \Theta = 0$, $H_1: \Theta < 0$. If the null hypothesis is rejected, then the series is stationary.

¹⁰ The issue of serial correlation was addressed for each residual series in the same manner discussed in footnote 8. The cointegrating regression is: $Y_t = \gamma + \theta_1 X_t + \epsilon_t$. The residual regression is: $\epsilon_t - \epsilon_{t-1} = \delta_1 + \Phi \epsilon_{t-1} + \sum_{i=1}^n \alpha_i \Delta \epsilon_{t-i} + v_t$. The unit root hypothesis test is: $H_0: \Phi = 0$, or $H_1: \Phi < 0$. If the null hypothesis is rejected, then the series is stationary.

used to construct a weekly price series for all dressed weight steer transactions occurring in the state during the 19-month period prior to implementation of federal mandatory price reporting.

The AMS voluntary price series selected for this study is the Nebraska Weekly Direct Weighted Average report. The Nebraska series was selected because it represents a major market and processing area for South Dakota’s slaughter cattle. Price reports represent the cash market for dressed weight steers. Daily reports were converted into weekly weighted average price series based on volume.

The South Dakota Mandatory Price Reporting data set contains 80 weeks of weekly weighted average price data for the direct sale of dressed weight steers in South Dakota. The data set contains 88,995 head and 858 recorded transactions. Table I contains the summary statistics on the price series used in the empirical analysis.

TABLE I
CASH MARKET FOR DRESSED WEIGHT STEERS SUMMARY STATISTICS (\$/cwt.)¹

Price Series	# of Wkly Obs.	Mean	Standard Deviation
Neb Direct	83	\$112.47	\$7.87
SD Mandatory Price Report	82	\$112.72	\$7.83

1. The mandatory price reporting data set supplied to Dept. of Economics at SDSU by the State of South Dakota contains transaction data on over 600,000 head of cattle. Live weight sales, grid sales, forward contract sales, marketing agreement transactions, and heifer and Holstein transactions were excluded from the sample. Voluntary price report data were collected from various issue of the AMS Livestock, Meat and Wool Weekly Summary and Statistics report (1999-2001).

Table II offers empirical evidence that the mean price differential is statistically non-zero between SDMPR price series and the Nebraska Direct series. This set of empirical results is consistent with spatially integrated markets and previous work on spatial arbitrage in the slaughter cattle industry (Koontz 1996, Goodwin and Schroeder 1991). The statistically significant price differentials seem to be reasonable estimates for the transaction costs associated with the transportation cost associated with delivering South Dakota steers to market.

TABLE II
MATCHED PAIRS MEANS TEST BETWEEN PRICE SERIES(\$/cwt.)¹

Price Series	# of Wkly Obs.	Matched Pair: Mean Difference Test	P-Value Null Hyp. Ho: $U_y - U_x = 0$
SDMPR			
Neb Direct	82	\$0.36	.001

1. A set of paired difference between populations means: a matched pairs test (Newbold 1995, p. 391) was conducted to determine if an average price differential existed between SDMPR series and the voluntary price reporting series. The Anderson-Darling normality test (Gujarati 2003, p.147) was applied and the test results indicate that the distributions for all of the paired differences were not normally distributed. The Wilcoxon Signed Rank test was selected to test the null hypothesis that the mean of the pair differences was zero.

Empirical Results: Testing for Unit Roots and Cointegration

Table III presents the ADF test statistics, the associated p-values for the unit root tests, for each of the price series. The associated test statistic for detecting the presence of serial correlation is the Durbin's t.¹¹ Lagged terms were added to the ADF equation until the error structure was empirically verified as whitened.

TABLE III
UNIT ROOT TEST RESULTS

Price Series	Obs.	Tau Statistic	P-Value
Nebraska Weekly Direct Weighted-Average report. ¹	81	-0.84	0.80
South Dakota Mandatory Price Reporting Data. ²	78	-0.96	0.76

1. The order of the autoregressive model selected for the ADF test is AR(1). Durbin's t= 0.95

2. The order of the autoregressive model selected for the ADF test is AR(1). Durbin's t= 0.89

The unit root hypothesis test results indicate that all of the price series are non-stationary (Table III). Engle and Granger (1987) state that if two series are I(1) then it is possible that a linear combination of the two series is I(0). Engle and Granger propose a *cointegrating regression*: regressing one I(1) series on another I(1) series. The residual series generated by the cointegration regression is tested for the existence of a unit root. If the unit root test indicates that a unit root exists, then it is concluded that the

¹¹ Serial correlation tests were conducted at the 5% level.

two series are not cointegrated and there is no long-term relationship between the two time series variables. The cointegration results are presented in Table IV.

TABLE IV
SDMPR COINTEGRATION TEST RESULTS

Price Series Cointegrating Regressions	Number Of Obs. ¹²	<u>Cointegrating Regression</u>		Tau Statistic	P-Value
		Intercept Estimate	Parameter Estimate		
SDMPR & Nebraska Wkly Dir. Wt. Avg. ¹	82	0.799	0.996	-8.36	0.001

1. The order of the autoregressive model selected for the ADF test is AR(0). DW d test stat = 1.998.

The results of the cointegration analysis indicate that the Nebraska voluntary price series selected for this study is cointegrated with actual transaction data collected by the State of South Dakota during the 19-month period covered in this study. This empirical evidence suggests a long-run spatial relationship between the former AMS voluntary price reporting series for dressed weight steers and actual cash transactions in South Dakota did exist. This result supports the propositions of: a) competitive spatial arbitrage linking prices paid in South Dakota to Nebraska markets, and b) the Nebraska voluntary price series being an accurate reflection of actual market transactions in South Dakota and Nebraska in the long run.

The empirical evidence in Tables IV clearly indicates that in the long run, producers in South Dakota and Nebraska received prices consistent with what was being reported by the AMS for the region. However, the empirical evidence of highly cointegrated price series over the 19-month period does not tell us anything about short-run deviations away from the empirically established long-run relationship between the former voluntary Nebraska series for dressed weight steers and the South Dakota series. Short-run divergence from the long-run equilibrium relationship may result from the alleged flaws in the former voluntary price reporting system, as it has been suggested in the literature. If this conjecture is

¹² The number of observations reported are for the cointegrating regression.

correct, then spatial price transparency is not possible. To investigate this issue an error correction mechanism will be employed to investigate the effect of short-run anomalies on the empirically established long-run relationship discussed above.

Error Correction Model

We have established empirically that there is a long-run spatial relationship between the Nebraska voluntary price series and the South Dakota Mandatory price series. While the estimated long-run spatial relationship is statistically significant, there is still room to speculate that sustained short-run deviations from the long-run equilibrium relationship could pose a barrier to spatially linked markets achieving spatial price transparency and could hinder price discovery. Sustained short-run deviations would be evidence of the failure of the voluntary price reporting system to act as an efficient mechanism or conduit for the transmission of changing market conditions to the public.

An error correction modeling procedure is therefore utilized with the following set of premises concerning price determination in the cash market for dressed weight slaughter steers. It is assumed here that the equilibrium cash price of slaughter steers is determined by market conditions outside of South Dakota. Packers engaged in the direct cash purchase of dressed weight slaughter steers in South Dakota are aware of the current national market conditions for beef and the transactions costs associated with placing South Dakota steers into the national supply channel. As discussed by Goodwin and Schroeder (1991), arbitrage activities create spatial price linkages across regional markets and eliminate price differentials over and above transaction and transportation costs across regions. This assumption is consistent with our empirical findings of a statistically significant long-run spatial relationship between price series. Furthermore, it is assumed here that the trend in transaction and transport cost was relatively flat during the time period covered by this study.¹³ Given these assumptions, a price shock to the dressed weight slaughter steer cash market will eventually be reflected in the direct price paid to South Dakota

¹³ During the time period covered by this study the average Midwest retail weekly #2 diesel price per gallon was \$1.41 and the standard deviation was 12 cents (U.S. Dept. Of Energy, Energy Information Administration).

producers. Simply stated, a price shock of x dollars per cwt. at time t will disrupt the long-run equilibrium price relationship between the Nebraska region and South Dakota. The disequilibrium condition will persist until the South Dakota market fully adjusts to the price shock in some future period $t+n$, where n is the number of periods (weeks) needed for full adjustment to take place. It is during this period of disequilibrium that price transparency can be affected.¹⁴ The length of time (n) it takes for the transmission of a price shock opens a window of opportunity for profitable arbitrage activities to occur in smaller regional markets like South Dakota.¹⁵

The answer to the question of how effective, in the short run, the former voluntary price reporting system was in promoting price transparency and facilitating price discovery in South Dakota markets will be based on how robust the price shock transmission mechanism was between the former voluntary price reporting system and the South Dakota mandatory price reporting series. To empirically test if a price shock to the long-run equilibrium relationship between the mandatory and voluntary price series has a sustained negative effect on price transparency, analysis of short-run deviations from long-run equilibrium will be carried out with an error correction modeling procedure.

Based on the work by Granger (1981, 1983), the Granger Representation Theorem states that if two time series variables are cointegrated, then the relationship between them can be expressed as an error correction mechanism (ECM). If two time series variables are cointegrated, there is a long-run equilibrium relationship. The error term of the cointegrating regression is treated as the equilibrium error, reflecting a short-run divergence from long-run equilibrium if the equilibrium error is non-zero. This error term can be used to link the long-run behavior of South Dakota's mandatory price series to its short-run behavior during periods of short-run deviations from its long-run equilibrium relationship with the former voluntary price reporting system.

¹⁴Koontz (1996) reported that packers and feedlots are more likely to withhold transaction information during periods of sharp price movements.

¹⁵ The possibility of excess profit potential arising in this type of situation has been alluded to by Goodwin and Schroeder (1991) and Tomek (1980).

Formally, the error correction mechanism for a pair of cointegrated series is defined as,

$$3) \Delta Y_t = \gamma_0 + \gamma_1 \Delta X_t + \gamma_2 \varepsilon_{t-1} + z_t,$$

where Δ is the first difference operator, z_t is the random error term, and ε_{t-1} is the equilibrium error term estimated from the cointegrating regression defined in footnote 10, lagged one period. The variables Y_t and X_t are the price series defined in equations 1 and 2. The regression parameters are γ_0 , γ_1 , and γ_2 . The parameter γ_0 is the intercept coefficient. The parameter γ_1 is the slope coefficient and is interpreted as the short-run relationship between ΔY_t and ΔX_t . The parameter γ_2 is interpreted as the “speed of adjustment” coefficient to short-run deviations from long-run equilibrium (Gujarati 2003, p.825). The error correction model was estimated using OLS. The empirical estimates are provided in Table V.

TABLE V
ERROR CORRECTION MODEL OLS ESTIMATES

Price Series ECM Regressions	Number Of Obs.	ECM Regression Estimates ¹		
		Intercept Est.	Slope Est.	Speed of Adjustment Est.
Δ SDMPR & Δ Nebraska Wkly Dir. Wt. Avg.	80	0.013 (0.19)	0.96 (22.2)	-0.839 (-7.57)

1. Student t test statistics are given in parentheses below the respective parameter estimate. The ECM model tested negative for the presence of serial correlation.

The intercept estimate is statistically zero in Table V. This result implies that the long-run equilibrium relationship is stationary if there are no price shocks affecting the system. This result provides empirical evidence that transaction costs were stationary during the period covered in this study. Therefore, the stationary caveat raised by Barrett and Li does not apply to the econometric modeling procedure selected for this study.

The slope parameter estimate (Table V) is highly significant and has a p-value of less than .001. The slope parameter estimate indicates that if a price shock affecting the Nebraska price series in period t , then 96% of that shock will be reflected in the SDMPR series in period t .

The “speed of adjustment” parameter estimate (Table V) is highly significant and has a p-value of less than .001. The “speed of adjustment” parameter estimate indicates the proportion of the price-shock-residual remaining after period t that will be transmitted to the SDMPR series in period t+1. For instance, the ECM slope parameter estimate indicates that 96% of the price shock affecting the Nebraska price series in period t will be transmitted to the SDMPR series in period t. The residual of that shock that was not transmitted in period t is 4%. Thus the long-run equilibrium relationship is disrupted in period t. In period t+1, the “speed of adjustment” coefficient indicates that 83.9% of the residual resulting from the price shock will be transmitted in period t+1. Therefore, in period t+1, 99.3% of the price shock has been transmitted to the SDMPR series one week after the shock.¹⁶ The faster a price shock is transmitted from one series to another the greater is the degree of spatial price transparency between the two series.

The “speed of adjustment” estimate leads to the conclusion that spatial price transparency did exist between SDMPR and the Nebraska voluntary series. This empirical evidence also implies that the information contained in the voluntary price reports did contribute to market transparency and promoted price discovery in South Dakota. The economic implications of this empirical evidence, within the context of propositions b and c, is that not only was the Nebraska voluntary price series an efficient source of price information for South Dakota, it was also an accurate reflection of actual cash transactions in Nebraska.¹⁷ Extending the economic implications one step further, the former voluntary price reporting system did contribute to market transparency and price discovery in the cash market for dressed steers in South Dakota and Nebraska.

¹⁶ The price adjustment estimate is calculated as follows: $96\% + (.839)(4\%) = 99.3\%$.

¹⁷ Empirical evidence indicates that South Dakota’s mandatory price reporting series is spatially integrated with the Nebraska voluntary price series. We assume that SDMPR series is perfectly integrated with the SD cash market. Therefore, the Nebraska voluntary price series is also spatially integrated with SD’s cash market. If competitive spatial arbitrage exists between SD and Neb’s cash markets then the nature of this spatial relationship would generate spatial integration. If Neb’s cash market is spatially integrated with SD’s cash market then Neb’s cash market must also be spatially integrated with Neb’s voluntary price reporting series. The alternative is that the Nebraska voluntary price series is integrated with SD’s cash market but not with Nebraska’s cash market.

Conclusions and Summary

The debate over whether the former voluntary price reporting system engendered market transparency and promoted price discovery engaged our interest once we learned of the existence of a mandatory price data set comparable with price data generated by the former voluntary price reporting system. The uniqueness of the transaction data collected by South Dakota's Department of Agriculture provided us with an opportunity to empirically gauge the robustness of the former AMS voluntary price reporting system before federal mandatory price reporting rules came into existence. All previous studies looking at the reliability of the voluntary price reporting system used simulated data or secondary data supplied by private firms in their analysis. Empirical findings discussed in this paper have implications for future rule making and contribute to the debate over mandatory versus voluntary price reporting in the cattle industry.

Empirical analysis using cointegration techniques were conducted to determine if there was any evidence of spatial linkages and the strength of those linkages between AMS voluntary price reports on market transactions in regional spot markets with actual transactions occurring in South Dakota's cash markets for dressed weight steers. The results of the empirical analysis suggest that there was a robust spatial relationship between the information contained in the former regional voluntary price reports on market transactions and actual market transactions in South Dakota. We conclude that the presence of spatial price transparency between regional voluntary price reports and actual cash transactions in South Dakota indicates that the former voluntary price reporting system contributed to overall market transparency and the price discovery process in the South Dakota cash market for slaughter steers.

The overall conclusion from the empirical evidence presented is that the former voluntary price reporting system was fostering market transparency and promoting price discovery in the cash market for dressed weight slaughter steers in South Dakota. Evidence indicates that, in the case of South Dakota and Nebraska, the former voluntary price reporting system was an efficient mechanism for promoting market transparency and price discovery. This study is the first to provide empirical evidence that the former

voluntary price system was not as flawed as previous studies have concluded. While our study only covers one small corner of the livestock sector, it raises the question that if the former voluntary price reporting system was an efficient mechanism for promoting market transparency and price discovery in the cash market for dressed weight steers in South Dakota, what about other regions and other types of livestock? We are not advocating that the former voluntary price reporting system was more robust than the new federal mandatory system, but we are saying there is ample evidence that the former system was not as flawed as previous research has suggested. Therefore, it is not necessarily valid to justify the need for mandatory price reporting based on the assertion that the former voluntary price reporting system degraded market transparency in the cash market for slaughter cattle.

We conclude that additional research is needed to answer these questions: 1) What are costs and benefits associated with the new federal mandatory price reporting system and should they be identified before the renewal issue is debated on the floor of Congress? 2) Is the loss of market information from smaller discontinued regional voluntary price reports hindering market transparency and price discovery in those local markets where voluntary price reports were discontinued? and 3) Are there other regional cattle markets or other types of livestock markets where the former voluntary price reporting system was an efficient mechanism for promoting market transparency and price discovery? Answers to these questions are needed before an informed debate on the current structure of the federal mandatory livestock price reporting system can begin.

References

- Anderson, J.D., C.E. Ward, S.R. Koontz, D.S. Peel, and J.N. Trapp, 1998, "Experimental Simulation of Public Information Impacts on Price Discovery and Marketing Efficiency in the Fed Cattle Market." *Journal of Agricultural and Resource Economics*, 23(1): pp.262-78.
- Ardeni, P.G., 1989, "Does the Law of One Price Really Hold for Commodity Prices?", *American Journal of Agricultural Economics*, 71(3): pp. 661-69.
- Azzam, A., 2003, "Market Transparency and Market Structure: The Livestock Mandatory Reporting Act of 1999", *American Journal of Agricultural Economics*, 85(2): pp. 387-395.
- Barret, C.B., and J.R. Li, 2002, "Distinguishing Between Equilibrium and Integration in Spatial Price Analysis", *American Journal of Agricultural Economics*, 84(2): pp. 292-307.
- Bastian, C.T., S.R. Koontz, and D.J. Menkhous, 2001, "Will Mandatory Price Reporting Improve Pricing and Production Efficiency in an Experimental Market for Fed Cattle?", Proceedings of the NCR-134 Conference held in Saint Louis, Mo in April, 2001.
- Dicky, D.A., and W.A.Fuller, 1979,"Distribution of Estimates for Autoregressive Time Series with a Unit Root.", *Journal of the American Statistical Association*, 74: pp.427-31.
- Dicky, D.A., and W.A.Fuller, 1981, "Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root." *Econometrica* 49: pp. 1057-72.
- Diersen, M.A., 2002, "Gleaning Information from Mandatory Livestock Price Reporting", Economics Staff Paper Series, #2002-1, Dept. of Economics, South Dakota State University, Brookings, SD.
- Engle, R.F. and C.W.J. Granger, 1987, "Co-Integration and Error Correction: Representation, Estimation, and Testing." *Econometrica* 55(2), pp. 251-76.
- Goodwin, B.K. and T.C. Schroeder, 1991, "Cointegration Tests and Spatial Price Linkages in Regional Cattle Markets." *American Journal of Agricultural Economics*, 73(2): pp. 452-64.
- Grain Inspection and Packers and Stockyards Administration, 2002, Packers and Stockyards Statistical Report: 1999 reporting year, USDA, Washington, D.C.
- Granger, C.W.J., 1981, "Some Properties of Times Series Data and Their Uses in Econometric Model Specification," *Journal of Econometrics*, pp. 121-30.
- Granger, C.W.J., 1983, "Co-Integration and Error Correcting Models." unpublished UCSD Discussion Paper:83-13.
- Gujarati, D.N., 2003, Basic Econometrics, 4ed., McGraw-Hill, Ny,Ny.
- Koontz, S.R., 1996, "Arbitrage Costs Between Regional Fed Cattle Markets: Estimates Using Public Price Data" in Definition of Regional Cattle Procurement Markets, GIPSA-RR 96-1, GIPSA, Washington, D.C.

- Koontz, S.R., 1999, "Accuracy of USDA Fed Cattle Price Reporting: Is Mandatory Price Reporting Needed?" Proceedings of the NCR-134 Conference held in Chicago IL: pp. 53-68.
- Lawrence, J.D., J.A. Shaffer, and M.L. Hayenga, 1996, "Valuing Public Price Reporting: The Iowa Experience" *Journal of Agribusiness*, 14(1), pp. 15-32.
- LMPR Review Team, 2001, Livestock Mandatory Price Reporting System, Report to the U.S. Secretary of Agriculture, July 2nd.
- McNew, K. 1996, "Spatial Market Integration: Definition, Theory, and Evidence." *Agricultural and Resource Economics Review*, 25(1): pp.1-11.
- McNew, K., and P.L. Fackler, 1997 "Testing Market Equilibrium: Is Cointegration Informative?" *Journal of Agricultural and Resource Economics*, 22(2): pp. 197-207..
- Newbold, P., 1995, Statistics for Business and Economics, 4th ed., Prentice Hall Pub., Englewood Cliffs, NJ.
- SAS Institute, Inc. SAS/ETS User's Guide, Version 6,2nd ed., Cary, NC: SAS Institute Inc., 1993.
- Savin, N.E., and K.J.White, 1978, "Testing for Autocorrelation with Missing Observations," *Econometrica* 46(1), pp. 59-67.
- SDLC., 2000, Livestock Packer Transactions, South Dakota Codified Law, Chapter 40-15B, State of South Dakota, Pierre, South Dakota.
- Tomek, W.G., 1980, "Price Behavior on a Declining Terminal Market." *American Journal of Agricultural Economics*, 62(3): pp. 434-44.
- USDA-AMS, Livestock, Meat and Wool Weekly Summary and Statistics weekly reports 9-1-99 to 3-31-2001, Des Moines, IA.
- U.S. Dept. Of Energy, Energy Information Administration web site: [Http://tonto.eia.doe.gov/oog/ftp/area/wogirs/xls/psw18vwall.xls](http://tonto.eia.doe.gov/oog/ftp/area/wogirs/xls/psw18vwall.xls).
- Wachenheim, C.J. and E.A. DeVuyst, 2001, "Strategic Response to Mandatory Reporting Legislation in the U.S. Livestock and Meat Industries: Are Collusive Opportunities Enhanced?" *Agribusiness* 17(2): pp. 177-95.
- Ward, C.E.1987, "Market Structure Dynamics in the Livestock-Meat Subsector: Implications for Pricing and Price Reporting." in Key Issues in Livestock Pricing: A Perspective for the 1990's, W. Purcell and J. Rowsell Eds., Blacksburg, Va: Research Institute in Livestock Pricing: pp. 8-53.