Price Discovery Research Project – What Volume of Cash Trade is Needed for Price Discovery?

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This document summarizes findings within the Objective Measures report dated 2016-06-24. Here, pieces of that report's results are synthesized to offer answers to the question, "What volume of cash fed cattle trade is needed within each USDA-AMS reported region for there to be price discovery?" The purpose is to provide clear and brief information about what volume needed in each regional market for that market to contribute to be price discovery within the fed cattle and beef market complex. These recommendations are based on what happen in those markets from 2002-2015.

There is a clear and significant relationship between historical cash market volumes and the strength of price discovery in each USDA-AMS regional market. Observe Figure A: the market is Texas-OK-NM. The horizontal/bottom axis is cash market volume in thousand head transacted per week. The vertical/left axis is an objective measure of price discovery. The solid line are the predicted values from a regression model relating volume to price discovery. There is a positive slope between cash volume and strength of price discovery and it has modest declining curvature. The more cash volume there is then the more that Texas-OK-NM contributes to price discovery and this is increasing at a slightly decreasing rate. Of course, the cash volume is trending downward in Texas and the result communicates that Texas-OK-NM no longer plays a significant role in price discovery. With little cash volume then there is no significant price discovery. The dash lines indicate the 90% confidence interval around the regression line. The regression line itself approaches zero price discovery with zero cash market volume. The lower confidence bound indicates that price discovery is insignificantly different from zero at 6,000 head per week volume. A policy recommendation for the industry is that an average of 6,000 head per week needs to be negotiated in the cash market for Texas to contribute to price discovery. Greater volumes negotiated imply more price discovery but 6,000 gets the impact off of zero. The exact greater volume and its implementation are industry decisions.

Figure B displays results for all five USDA-AMS regional fed cattle markets and includes the same graphic for Texas from Figure A without the upper confidence band. All of the regression lines have different slopes and different intercepts. The statistics indicate that intercepts are significantly different and that the slopes are generally not. The overall conclusion is that there is clearly a positive relationship between volume and price discovery – more volume results in more price discovery. There are also strong average differences across markets. The relationship between price discovery and cash market volume has different mean effects – the intercepts are different for each regional market – while the relationship between the volume of cash trade and strength of price discovery are positive and similar. The relationship between volume and price discovery is allowed to be different for each market. But

many are similar: Texas-OK-NM, Kansas and Iowa. Colorado is different from the three and Nebraska is also slightly.

The strongest relationship between volume of cash trade and price discovery occurs with Colorado. The result is due to Colorado contributing substantially to price discovery when it had cash market volume early in the 2002-2015 sample. Iowa appears strong but actually it is rather weak. The regression coefficient is rather insignificant. This can be seen by how far the dashed line is from the solid line. The result is likely due to Iowa having little change in cash trade volumes. If the volume of cash trade does not change then it cannot explain changes in price discovery. With respect to the other regional markets, Texas is the strongest, followed by Kansas, and Nebraska is clearly the weakest market.

Changes in the strength of price discovery were examined over time. The price discovery provided by cash markets lessens over time. That is unless time and cash market volume are both used to explain the strength of price discovery. In that case, time period explains little and volume of cash trade does the work. Thus, price discovery as measured is not shrinking, or expanding, in cash markets. Price discovery is related to the market volume – allowing for inherent differences across regional markets. But the higher the cash market volume the more that cash market contributes to of price discovery. But some markets contribute strongly and others are weaker with the same volume.

There is less price discovery occurring in regional cash markets. And there is little evidence here that, with the shrinking cash trade, there is improved price discovery in the volume that is left. If there is it is very recently. Cash markets are different and contribute less with less cash trade. For example, Texas-OK-NM and to a limited extent Kansas provided a lion's share of the cash market price discovery early in the 2002-2015 sample. However, the southern plains markets late in the sample provide little price discovery. Is some other regional market doing the work? Have the northern plains markets taken over this role? There is little evidence of that. Nebraska is a weak contributor to price discovery relative to Iowa and Nebraska's role does not improve with time. The only evidence of improved contribution to price discovery is with the live cattle futures market. That market is doing relatively more price discovery work. It has always been important, its magnitude of contribution to price discovery is not increasing, but it is relatively more important as the cash volume thins.

The models producing these graphics can answer the question: What level of cash trade is need for price discovery to occur in the different USDA AMS regional markets? Any cash trade in Texas-OK-NM contributes to price discovery as the solid line does not cross zero. However, 90% confidence requires 6,000 head per week. At this level of cash trade then TX-OK-NM has significantly contributed to price discovery. Kansas needs to trade 2,000-3,000 head per week to have any price discovery but significant price discovery requires 14,000-15,000 head per week. Nebraska needs to trade 17,000 head per week to have any price discovery and 90% confidence requires 26,000 head per week. Nebraska contributes to price discovery but requires higher volumes of cash trade than Texas-OK-NM or Kansas. Any cash trade in Iowa contributes to price discovery but 90% confidence requires 11,000 head per week. And any volume of cash trade in Colorado contributes to price discovery but 90% confidence requires 2,000-3,000 head per week. Price discovery is strongly provided by Texas-OK-NM in the southern plains and Iowa in the northern plains. Colorado contributes relatively little in total to price discovery but Colorado

appears to be unique and it is likely that this is due to being the market furthest from the other four markets.

These lower limit numbers are useful but can be unsatisfying. These recommendations are what is needed to go from insignificant to significant price discovery – to go from zero to "not-zero." It says nothing about the robustness of price discovery. The overall results reveal that historically each market has had a 5-10% impact in terms of contributions to price discovery – this is the number of the vertical/left axis. Thus, in Figure B, the reader needs to envision a horizontal line between 5% and 10% on the vertical axis and parallel to the horizontal axis – 5% is reasonable. Where this 5% horizontal line intersects the colored regression lines will indicate a volume needed to generate a level of price discovery consistent with history. Specifically, Texas-OK-NM needs approximately 13,000 head negotiated per week. Kansas requires 21,000 head per week. Colorado requires 5,000 head per week. Nebraska requires 31,000 head per week. Iowa requires 7,000 head per week. Similarly, lower bound – the dash line – could be used as it would establish a contribution to price discovery of 5% with 90% confidence and the volume recommendations would increase. The volume for Colorado would increase about 4,000 head per week, Nebraska and Iowa would both increase about 10,000 head per week, while Texas and Kansas recommendations would double.

Different markets are different in terms of contributions to price discovery. Texas and Kansas are strongly related but Texas historically contributes more to price discovery. Nebraska and Iowa are strongly related but Iowa does more price discovery work. Colorado is a thin cash market but it appears to be different from the southern and northern markets so uniquely contributes to price discovery. All markets contribute, some more with fewer cattle, but all contribute less with lower cash trade.

Cash volume is clearly related to this objective measure of price discovery. And less cash trade or a thinning cash market implies less price discovery. Other measures from the report are not as pessimistic or as clear. Texas-OK-NM, Iowa, Kansas, and Nebraska – in that order – are important markets. Colorado is much less so. Thus, even with substantial declines in cash market trade in important regional markets the resulting prices well-represent what is the fed cattle market. These historically important markets discover price. However, these historically important markets are doing less price discovery work. That has transferred to the live cattle futures market. Cash fed cattle markets in 2014-15, at the end of the sample studied, appear to be doing half of the price discovery work that they did when MPR was implemented. And some important markets are doing none. The southern plains markets contribute little to price discovery. Northern plains markets do proportional more cash trade. But the northern plains continue to do much of the price discovery work that they have always done. They are not doing more work. The more work has been transferred to the futures market.

Details and alternative measures are offered in the report. And it is important to recognize that these results and recommendations are based on history. The results summarize what has happened over the 2002-2015 market and price history.
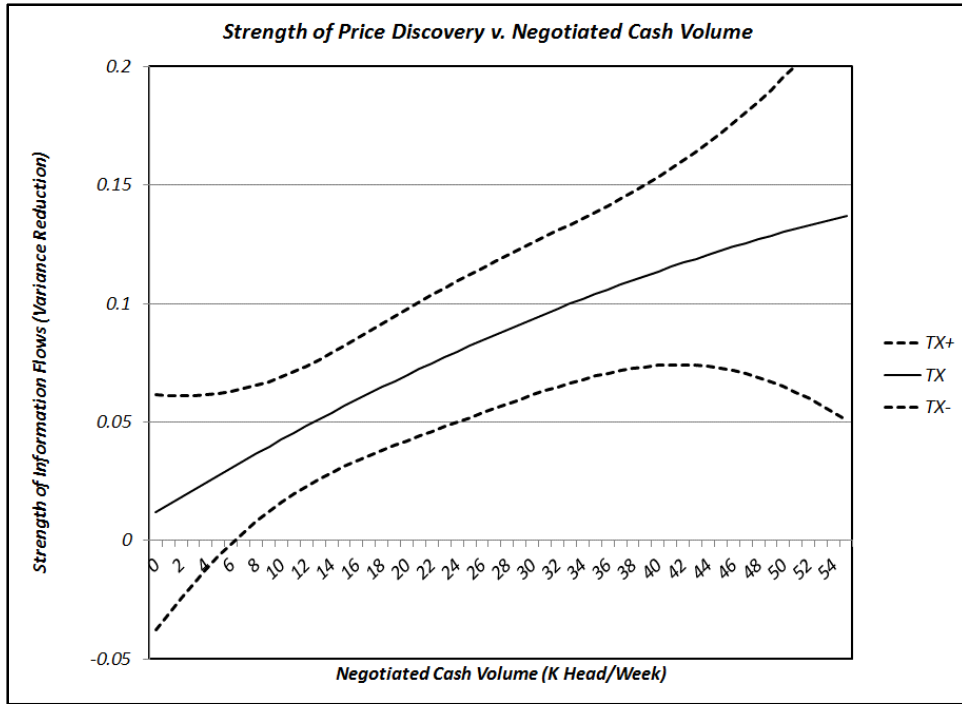
Figure A: Relationship Between Negotiated Cash Volume and the Contribution of Texas-OK-NM to Price Discovery.
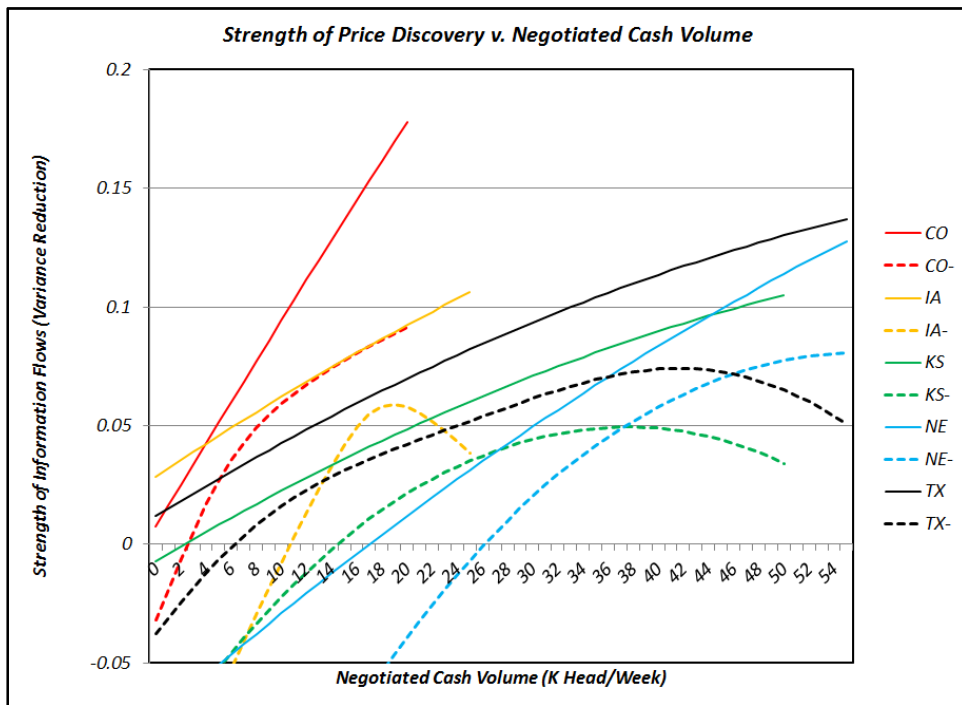

Figure B: Relationship Between Negotiated Cash Volume and the Contribution of the Listed USDA-AMS Regional Market to Price Discovery.