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by

Stephen R. Koontz

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ACCURACY OF USDA FED CATTLE PRICE REPORTING: IS MANDATORY PRICE REPORTING NEEDED?

Stephen R. Koontz*

Cattle industry members are concerned over the accuracy of prices reported by the USDA Agricultural Marketing Service (AMS) and there is interest in instituting mandatory price reporting. Currently, AMS relies on voluntary cooperation by feedlots and meatpackers in confirming transactions. Only confirmed transactions are released to the public. This research examines the accuracy of reported fed cattle prices in the southern and central plains states. AMS reported prices are compared to an extensive private database of cattle feeding closeout information for the time period from 6/86 to 6/93. Individual transactions are classified as below the reported range, within the reported range, or above the reported range. An ordered multinomial logit model is used to explain the probability that a transaction is in one of the three classifications. Results suggest that changing cash market conditions and expectations of changing market conditions impact whether or not a transaction is reported. There is evidence that price reporting is inefficient. Reported prices do not adjust to changing market conditions fast enough. However, there is also strong evidence of selective reporting behavior by market participants and that most of the selective reporting would benefit meatpackers. Further, AMS appears to do an effective job of not including nonstandard cattle in price reports. There is also evidence that the reporting ability of AMS is hindered by limited resources. Mandatory price reporting may be warranted in principle but will be difficult to implement in practice.

Introduction

Concern over captive supplies and meatpacker concentration has led cattle industry members, USDA personnel, and various legislative staffs into discussions of mandatory price reporting that have resulted in proposed legislation (U.S. Federal Register and U.S. Senate). USDA Agricultural Marketing Service (AMS) price reporting policy relies upon voluntary cooperation by industry participants. AMS personnel contact cattle feeding and meatpacking operations to determine trade volume and prices for different weights and grades of fed cattle. This information is released daily and summarized weekly in AMS publications.

Some industry representatives are concerned about the accuracy of reported prices, given the voluntary nature of its collection. There is concern that meatpackers do not confirm transactions when cattle prices are increasing. Further, cattle feeding operations may also contribute to the problem. A study by the Grain Inspection and Packers and Stockyards Administration (GIPSA) found cattle feeding operations failed to confirm declining prices to a greater extent than meatpackers failed to confirm price increases (USDA GIPSA).

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* Assistant Professor in the Department of Agricultural and Resource Economics at Colorado State University.

These concerns, and the evidence, suggest there may be inefficiencies in the price discovery process for cattle. Accurate information is critical for effective price discovery and market efficiency. Behavior of all decision makers in the system is influenced by the interpretation of current supply and demand conditions relative to expected future conditions (Tomek and Robinson). The appropriateness of decisions is influenced by the availability and quality of information. If reported prices are inaccurate, knowledge of market conditions will not be correct and inappropriate decisions will result (Rausser, Perloff, and Zusman).

This research compares reported USDA AMS prices for several geographic regions with transaction price data recorded by a private marketing company. Transaction prices from the private data source is sorted by region, weight and grade, and is compared to the price range reported in the USDA AMS LS-214 daily price report. The research determines the percent of transactions above and below the trading range. Patterns within these reporting categories are examined to answer the following question: Are there more trades outside of the range in markets with increasing or decreasing prices?

The specific objectives of this work are as follows. First, we determine if market participants make strategic use of price reporting through abuse of the voluntary nature of the price reporting system. This is the main thrust of the research. Second, we measure and comment on bias and efficiency in price reporting. Price reporting has a subjective element in that USDA AMS personnel consider if a trade is representative before the transaction is included in price reports. In interpreting the results, we must be careful to discriminate between strategic price reporting by market participants versus bias or inefficiency by USDA personnel in determining representative transactions. Third, we comment on the effectiveness of price discovery. Strategic price reporting, biased or inefficiency price reporting, and the voluntary nature of the institution all impact the effectiveness of price discovery. Last, we comment on the need for policy action. Is a particular group – feedlots or meatpackers – benefitting from non-reporting? In such a case, a policy prescription may be warranted. Mandatory price reporting may also be warranted if neither side benefits but there is sufficient systematic non-reporting as to question the efficiency of fed cattle price discovery. This research contributes to our knowledge of the efficiency of price discovery in fed cattle markets and will contribute to the policy making decision process.

Price Reporting Institutions

AMS is the agency within the USDA which is responsible for price reporting. AMS personnel contact cattle feeding and meatpacking operations daily regarding volume of trade and prices for different weights and grades. This information is reported daily and is submitted to various electronic data and information providers. The typical information that is reported for fed cattle includes price ranges of transactions where animals grade USDA Choice or Select, are Yield Grade 2s and 3s, and where individual animals weigh between 1100 and 1300 pounds. For example, the range for direct trade between feedlots and meatpackers in Colorado on March 15, 1992, was $76.50-$78.50 for Choice and Select animals of this Yield Grade and weight.

AMS operates in the environment of voluntary cooperation and makes use of the judgement of market price reporters. Transaction prices must be confirmed by both buyer and seller to be included in the reported range. Unlike the Grain Inspection and Packers and Stockyards Administration (GIPSA), AMS has no authority to require that industry members cooperate with requests. AMS staff uses reasonable judgement about outliers or whether a trade is representative. For example, cattle traded in Colorado on March 15, 1992, at prices below $76.50 my not be reported if the transaction included animals that would grade Standard, if there was excessive variation in individual animal weights, or if animals were otherwise judged as below the normal quality marketed. Likewise, fed cattle transactions priced above $78.50 may not be reported if the transaction includes animals of exceptionally high quality.

Reported transactions are also for cattle to be delivered to the meatpacker within 14 days. Transactions that are to be delivered in more than 14 days are considered private treaties and are not included as part of the spot market. Meatpacking facilities operate largely in a week-to-week time frame. Typically, fed cattle are purchased in the current week for delivery and slaughtered the following week. For example, cattle may be purchased on Tuesday in the current week and slaughtered on Wednesday the following week. The 14-day window used by AMS recognizes this institutional behavior.

Data

The approach used is to compare AMS prices reported for several geographic regions with transaction price data recorded by a private marketing company. AMS daily price range data from five regions are used. The regions are: Texas-Oklahoma-New Mexico, Western Kansas, Colorado, Eastern 2/3s of Nebraska, and Western Nebraska and Wyoming. The price ranges are for fed steers and heifers grading Choice and Select, Yield Grade 2s and 3s, weighing between 900-1100 pounds and 1100-1300 pounds. Both weight ranges are used if they are reported on a given day. The 900-1100 pound range is the most commonly reported early in the sample period and the 1100-1300 pound range is most common late in the sample.

Professional Cattle Consultants (PCC) is a private company that collects closeout information from customers. Closeout information on 108,783 pens of steers and heifers fed in Texas, Oklahoma, New Mexico, Kansas, Colorado and Nebraska between June 1986 and June 1993 was used.[1] The data used in the analysis contains between 1000-1500 transactions per month. PCC clientele over this period include over 150 feedlots with a total capacity over 30% of marketings from monthly USDA Cattle on Feed reports. Clientele are more commonly medium to large commercial feedyards and individual feedyards within multiple-yard operations are identified in the database.

Closeout information on each pen transaction includes the date of sale, sale weight, number of head sold, and dollars of revenue. With this information, transaction price and

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[1] PCC made changes in the database in 1993 that limit the use of more recent data.

average animal weight can be calculated. Transactions with animals outside of the 900-to-1300 pound weight range are discarded. Holstein cattle transactions are also discarded. There is no information in the database that directly measures pen quality. For example, there is no information on the percent of the pen that grades Choice or Select. This is a limitation addressed through the modelling.

Approach and Model Specification

The transaction price data and AMS reported price data are used to construct a dependent variable that is used in an Ordered Logit Regression Model (see Greene). Each transaction price inferred from the private closeout data is compared to the AMS price range on the date of sale. A transaction is classified as being below the reported range, within the reported range, or above the reported range:

$$y_{it} = \begin{cases} 0 & \text{if Transaction } P_{it} < \text{AMS Reported Low } P_t \\ 1 & \text{if AMS Reported Low } P_t \leq \text{Transaction } P_{it} \leq \text{AMS Reported High } P_t \\ 2 & \text{if AMS Reported High } P_t < \text{Transaction } P_{it} \end{cases}$$

for all $i = 1, ..., N_t$ transactions on day t. This classification system is ordered and an ordered multinomial qualitative regression procedure is appropriate. The main question asked of this model is: Do market direction variables explain whether or not a transaction is in the reported range? A more complete discussion of the model specification follows.

Independent variables are included in the model to explain the impact of four things on classification of a transaction price. First, because the closeout database does not contain information on pen quality, variables are included to proxy for quality. These include the number of days a pen is on feed and the conversion rate of the pen.[2] Quadratic, cubic, and interactions between these variables are also included. Second, there are large variations in supplies over the sample period. These variations are primarily seasonal. AMS has had declining resources during this period. It is likely that the agency less effective in price reporting during periods of large supplies compared to periods of smaller supplies because of limited resources. Seasonal dummy variables are included and a dummy variable for steer versus heifer pens. Steer marketings are more numerous.

Third, we are interested in answering questions about potential problems in price reporting. Therefore, the number of head in a pen is included to determine if the reporting of small or large transactions is more problematic. Frequently, prices that AMS reports on Thursday and Friday are identical to Wednesday. We are interested in determining if this is a

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[2] Conversion rate is the pounds of feed fed to a pen of cattle relative to the weight gained by those animals.

price reporting inefficiency or if this is found in the data. We are also interested in determining if there are problem locations. Are transactions within different regions more or less likely to be reported? Dummy variables are included for the different states to measure this potential effect. Captive supplies have also been found to have different levels in different regions (Ward and Bliss). These state-identifying dummy variables may also measure this phenomena.

Last, market direction variables are included to capture the strategic use of price reporting. Two types of variables are used. A variable is constructed to capture the movement in the cash market over the previous business week, i.e., 5 days. The midpoint of the reported AMS range is used to calculate daily differences and a moving-sum of the differences is constructed. We are interested in the asymmetric reporting of prices in response to the cash market increasing or decreasing. Thus, two variables are constructed to capture this behavior. A third variable is also constructed to capture a neutral market. If the sum of the previous week's price changes are less than -$0.50/cwt., the market is decreasing. If the sum of the previous week's price changes are more than +$0.50/cwt., the market is increasing. And if the sum of the previous week's price changes are greater than -$0.50/cwt. and less than +$0.50/cwt., the market is neutral.

A second market direction variable is constructed from the difference between the cash price and the nearby live cattle futures contract price, i.e., basis. The cash price is again the midpoint of the AMS reported range and the nearby futures price is the price of the contract closest to delivery but not in the delivery month. This variable should capture expected short-term price changes. Like the cash market variable, the response in price reporting may be asymmetric with a neutral range. However, basis is in general positive. It is approximately +$1.25/cwt. for the sample period with a standard deviation of $0.75/cwt. If basis is less than $0.00/cwt., the expected market direction is lower. If basis is more than +$2.50/cwt., the expected market direction is higher. And if basis is between $0.00/cwt. and +$2.50/cwt., the expected market direction is neutral.

The model is estimated using maximum likelihood where least squares regression coefficients are used as starting values. The optimization converges to the maximum rapidly. A coarse grid search ($0.25/cwt. increments) was used to determine the cutoff levels of the market direction variables, i.e., identify an increasing, decreasing, or neutral market. As long as the number of true breaks in the independent variables are less than the number used, i.e., three, the model will only suffer efficiency problems. And given the number of is observations, the efficiency problems will not be large.

Results

Some basic sample statistics are reported first. Sixty percent of the transactions are less than the low price reported, 20% are in the range, and 20% are greater than the high price reported. The average difference between the transaction price and the low reported price is $1.59/cwt. or 2.25%. The average difference between the transaction price and the high reported price is $1.07/cwt. or 1.5%. At first, this appears to suggest there is substantial under-reporting. However, the result is most likely due to the negative skewness of prices. Figure 1 presents a histogram of transaction prices for Colorado during March 1992. Prices were stable for this month. The AMS range for this month is approximately $76.50 to $78.50/cwt. The reported range consistently captures the median and mode of the transaction price distribution.

The conclusion that under-reporting may not be a problem is also supported by the results of the Ordered Logit model. Parameters of the model are used to predict the probability that the typical transaction is in each of the three classifications. The mean levels of the independent variables are used. The transaction with the characteristics of the mean pen is in the less-than reported range with probability 37%. The same pen is in the greater-than reported range with probability 14% and is in the reported range with probability 49%. Thus, a typical pen has a 50% probability of being reported. Also, almost a majority of the non-reported low-priced and non-reported high-priced cattle are in those classifications due to pen-level characteristics. This suggests that USDA AMS price reporters use considerable judgement in determining which pens to include in the price range and that judgement is good at sorting out nonstandard cattle.

The model fits the data relatively well. The model predicts the correct classification for 76.5% of the sample. The pen performance and the supply variables are the most important in terms of explanatory power. The results are also as expected. Pens with nonstandard levels of the performance variables are less likely to be in the reported range. The results also clearly suggest that a pen is less likely to be reported during high-volume periods. This is found in the seasonal variable results, and in that steer pens are less likely to be reported. Also, pens with the average number of head are also less likely to be reported. These results are consistent with a reporting agency having to do more monitoring with limited resources. Thus, when supplies are large, monitoring is less effective.

There are day-of-the-week effects but they are a moderate surprise. Transactions that take place on Tuesday through Thursday are no less likely to be reported than transactions that take place on Monday. Thus, price reporting on Tuesday through Thursday is not different from Monday. However, Friday is different from Monday. Transactions on Friday are more, and not less, likely to be reported. This suggests that the price discovery that occurs in the cash market does so early in the week, and that it is not a problem to use the daily AMS price data even though prices do not change by very much late in the week.

There are regional differences in price reporting. Texas is the base region and there are no differences between price reporting between Kansas, Oklahoma, New Mexico, and Texas.

However, transaction prices are less likely to be reported in Colorado and Nebraska. The result for Colorado may be related to captive supplies. Colorado tends to have more captive supplies than some of the other markets and the national average (Ward and Bliss). However, this is not the case for Nebraska. This region tends to have below average captive supply numbers. The result may be due to the large number of smaller farmer-feeders in this state relative to Texas. This suggests transactions by more numerous and smaller firms are more difficult to monitor.

The market direction variables are all significant and significantly different from each other. Likewise, the expected market direction variables are all significant and significantly different from each other. The results from these variables are discussed using predicted probabilities from the model and are plotted in figures. Independent variables are all set to their mean levels and the variable of interest is changed to examine the probability that a transaction is reported. This technique generates the probability that a transaction with the typical pen characteristics has a transaction price that is below the reported range, in the reported range, or above the reported range. The measures are referred to as classification probabilities. Allowing one variable to change over its range reveals variation in the classification probabilities. This shows how price reporting changes under changing market conditions.

Figure 2 presents the classification probabilities during increasing cash prices. As the sum of the previous week's price changes increases, a transaction price is more likely above the reported range, initially more and then less likely in the range, and much less likely below the range. This suggests two things. First, there is inefficiency in price reporting. The reported range does not increase fast enough during a price rise. Second, there is strategic price reporting Meatpackers would benefit from non-reporting of increasing prices. However, the same general result is seen when the market moves down. Figure 3 presents the classification probabilities during decreasing cash prices. As the sum of the previous week's price changes decreases, a transaction price is more likely below the reported range, less likely to be in the range, and much less likely to be above the range. This suggests there is inefficient reporting when prices are changing, and/or that both sides of the market – meatpackers and feedlots – selectively report during changing market conditions.

Figure 4 presents the classification probabilities during neutral cash prices. As the sum of the previous week's price changes increase during a neutral market, more pens are reported and fewer pens are below the range. However, more pens are above the range. Who would benefit from this behavior? Feedlots appear to be selectively reporting during neutral markets.

Figure 5, using information from Figures 2 and 3, shows probabilities that a transaction price is in the reported range during a price move. The horizontal axis is the absolute value of the price change, in both increasing and decreasing markets. We see that transactions are initially more likely reported, in an increasing market than a decreasing market. Feedlots benefit from this behavior and are likely selectively reporting.

Figure 6 also uses information from Figures 2 and 3. In this case, the probabilities that a transaction price is not reported in the direction of the price move, i.e., the transaction is above the range during an increasing market or is below the range during a decreasing market. The probability that a transaction is below the range is greater than the probability that a transaction is above the range, but this is because of the skewness in the transaction price distribution. It is more important that the probability of not-reporting in the direction of the move increases faster in an increasing market than in a decreasing market. There is not restriction in the model that requires this to happen – in fact it does not occur in the basis variable results. This result is inefficient price discovery at best – market price reporters are reluctant to adjust the range. Or there is selective reporting by meatpackers at worst – there is more non-reporting of high prices than low prices.

Figures 7, 8, and 9 present the probabilities of non-reporting and reporting for the expected price move variables – positive basis, negative basis, and even basis. Results from these variables are the most powerful in addressing strategic price reporting. Interpretation of the expected price move variables does not involve efficiency in price reporting. Market participant behavior, and not market observer behavior, causes the reporting probabilities to change as basis changes. Figure 10, condensing information from Figures 7 and 8, presents the probability that a transaction is reported during an expected price move – during a large positive and negative basis. During premiums, more transactions are reported initially but the reporting declines as the premium increases. During discounts, more transactions are reported. This behavior would appear to benefit meatpackers. It is significant, but rather small.

Figure 11 presents the probabilities that a transaction price is not reported in the direction of the expected price move and Figure 12 shows the probabilities in the opposite direction of the price move. As the basis premium increases, the probability that a transaction occurs above the reported range increases. In other words, high-priced cattle do not get reported. Likewise, as the basis discount increases, the probability that a transaction occurs below the reported range decreases. In other words, low-priced cattle get reported. The same thing occurs for the non-reported transactions in the opposite direction of the price move. As the basis premium increases, the probability that a transaction occurs below the reported range decreases – low-priced cattle get reported. And as the basis discount increases, the probability that a transaction occurs above the reported range increases – high-priced cattle do not get reported. These results clearly show the strategic use of price reporting by meatpacking firms.

In summary, both feedlots and meatpackers appear to use price reporting strategically. Feedlots do so through reporting transactions selectively and depending on changes in cash prices. Meatpackers do so through not reporting transactions and depending more on expected price changes. In totality, the strategic use of price reporting appears to benefit meatpackers in a more significant way. Further, the strategy followed by the two groups of firms appears to have substantial differences. The difference is that of naive strategy which focuses on current market conditions versus a subtle strategy which uses foresight of expected future market conditions.

Conclusions

There is some evidence in this research to support mandatory price reporting. Price reporting is used strategically and does appear to benefit one side of the market more than the other. Meatpackers appear to abuse the voluntary nature of price reporting more than feedlots. Likewise, the work also raises questions about the efficiency of price reporting and price discovery which are most likely due to the voluntary nature of price reporting. Reported prices and the interpretation of changing market conditions by AMS personnel appear to be slow to adjust to changing transaction prices.

However, the work also clearly shows the importance of and need for the use of judgement by price reporters. The price ranges reported are not biased and center over the median and mode of the distribution of transaction prices. The reported range (mean of which is between $2 and $3/cwt.) likely provides more meaningful information than the actual range of prices. Further, the model shows that price reporters do a very effective job in not reporting transactions where the cattle are likely nonstandard. If mandatory price reporting is adopted, AMS will likely need to change the format of reported prices. Reporting a range will not be informative under mandatory reporting. A measure of central tendency will also be needed. This statistic should be a median, and not an average, given skewed distribution of transaction prices. Further, the increasing occurrence of non-reported transactions during high-volume time periods suggests the AMS is hindered by limited resources. Mandatory price reporting, and the difficulties that accompany it, may not be needed if resources to AMS were simply increased.

Results from this work suggests the answer to the policy question is difficult. In concept, mandatory price reporting may be needed. But implementing the policy so that price information and price discovery are improved will be difficult.

Figure Histogram of Transaction Prices for Colorado during March 1992

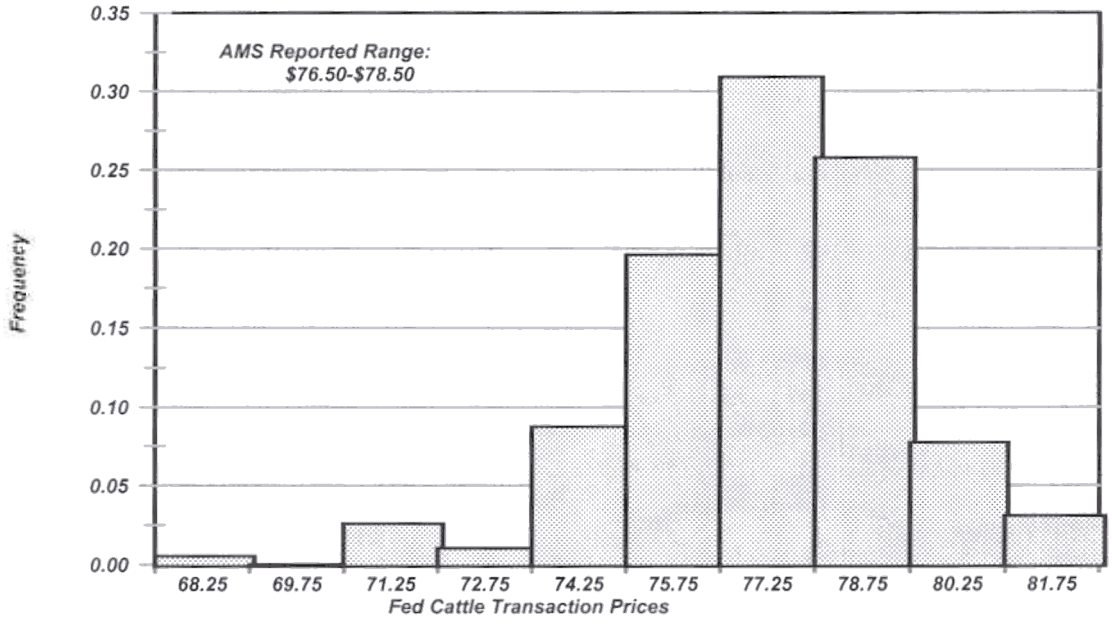


Figure 2. Probabilities of the Three Price Reporting Classifications during Increasing Cash Prices.

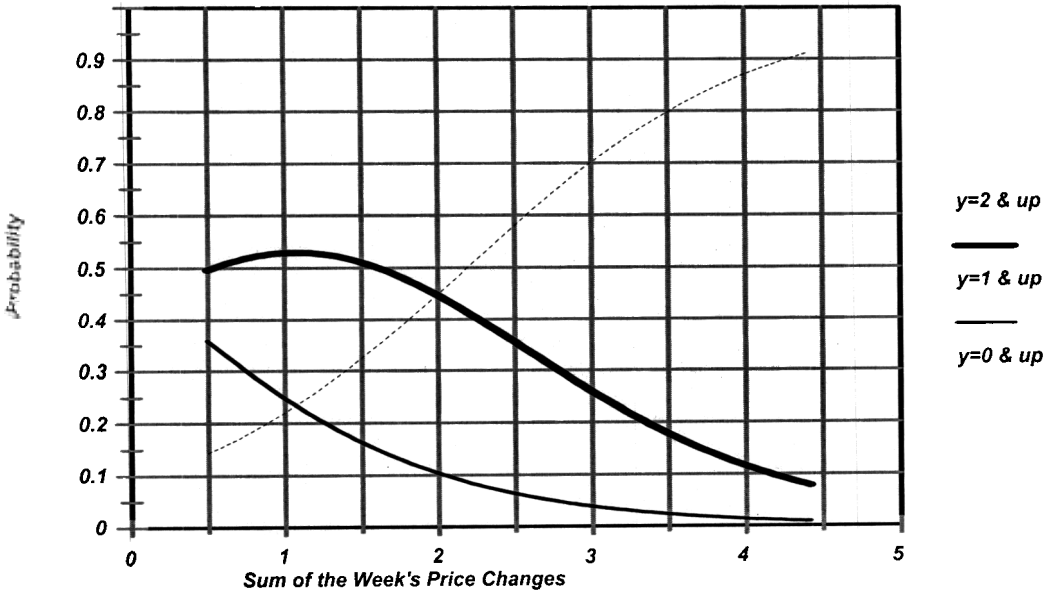


Figure 3. Probabilities of the Three Price Reporting Classifications during Decreasing Cash Prices.

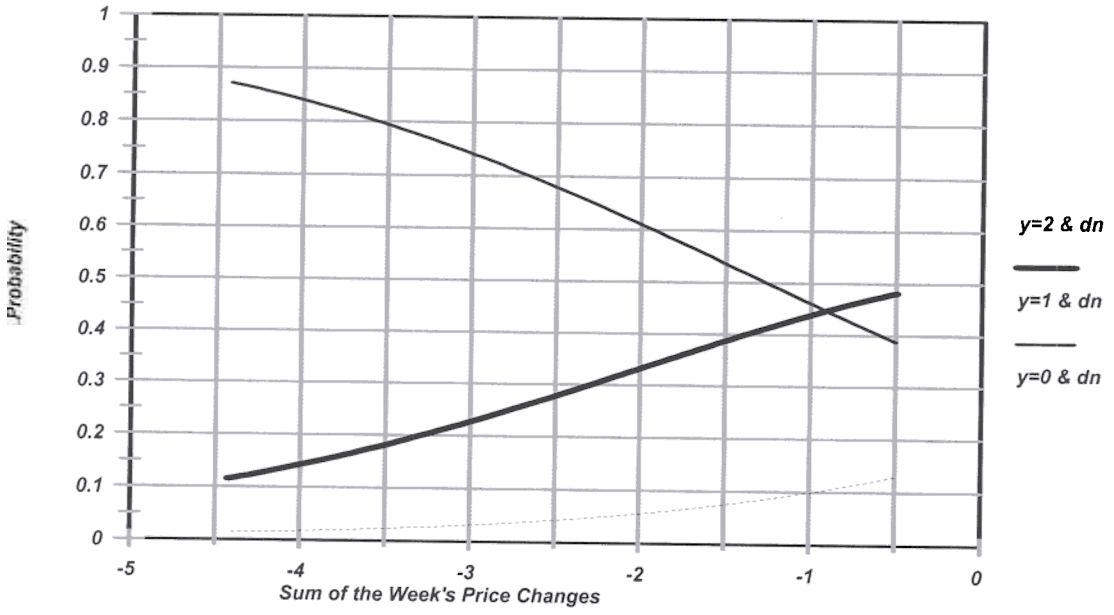


Figure 4. Probabilities of the Three Price Reporting Classifications during Neutral (or Even) Cash Prices.

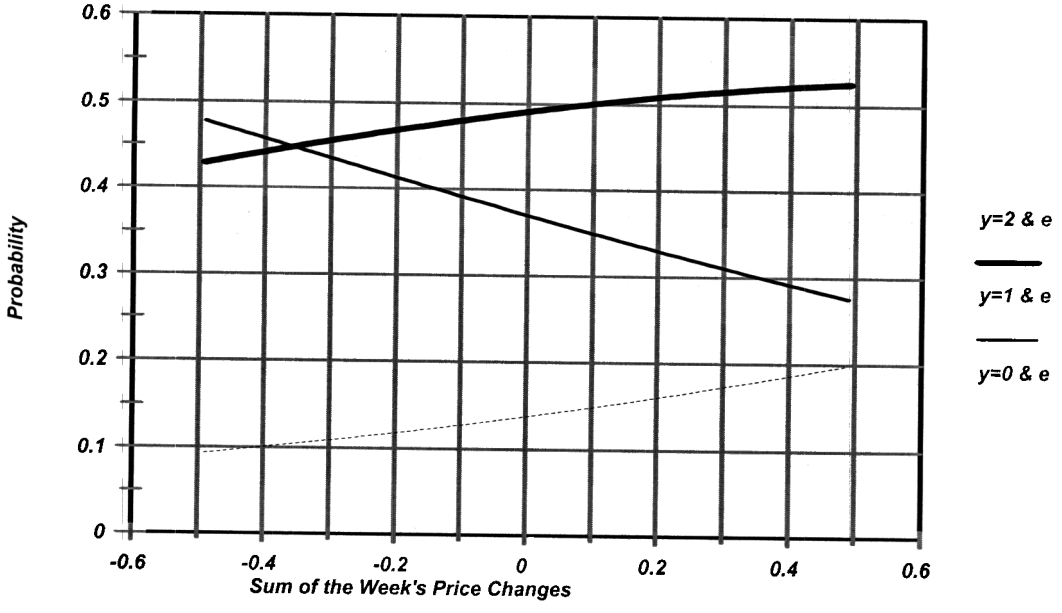


Figure 5. Probabilities of Prices Being Reported Increasing and Decreasing Cash Prices.

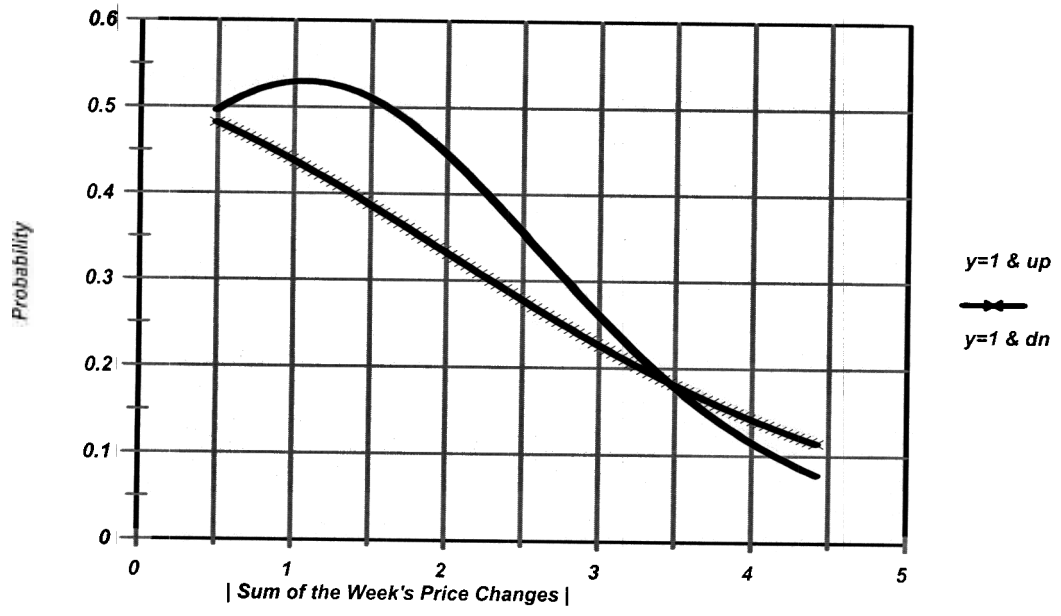


Figure 6. Probabilities of Prices Not Being Reported in the Direction of the Cash Price Change.

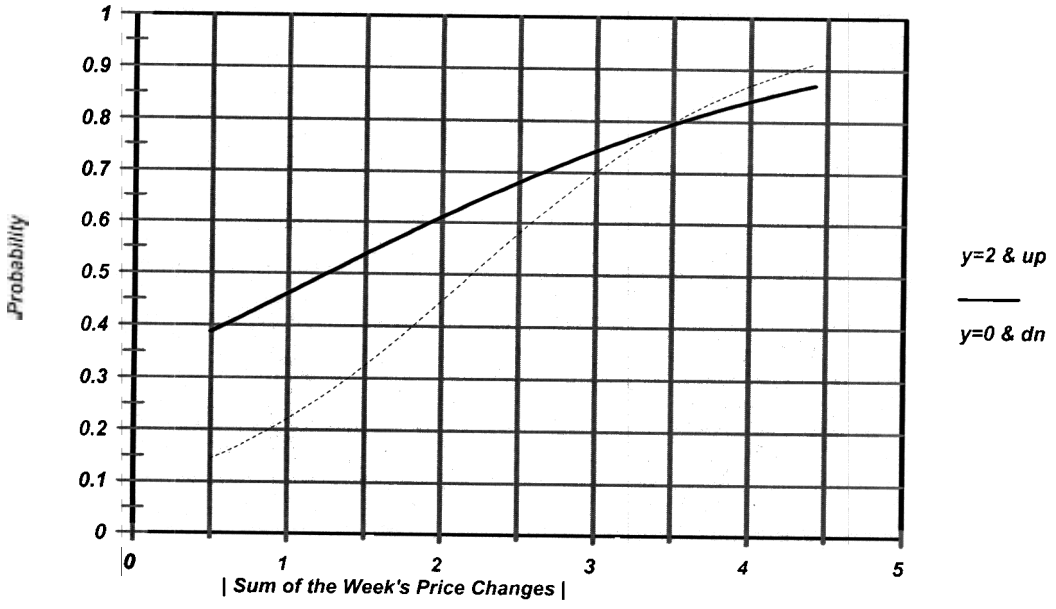


Figure 7. Probabilities of the Three Price Reporting Classifications during Positive Expected Price Changes.

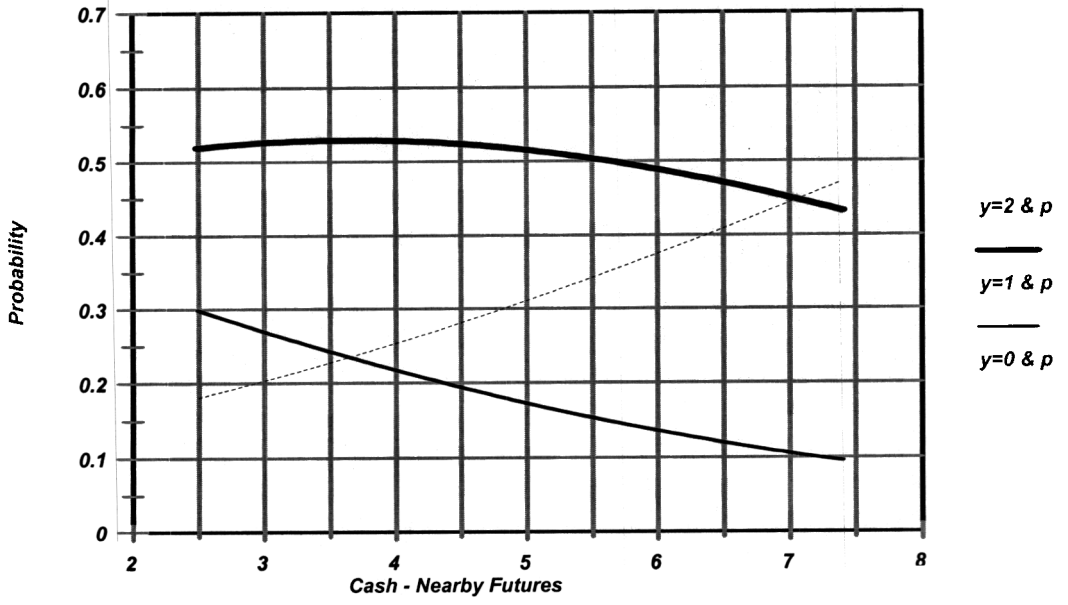


Figure 8. Probabilities of the Three Price Reporting Classifications during Negative Expected Price Changes.

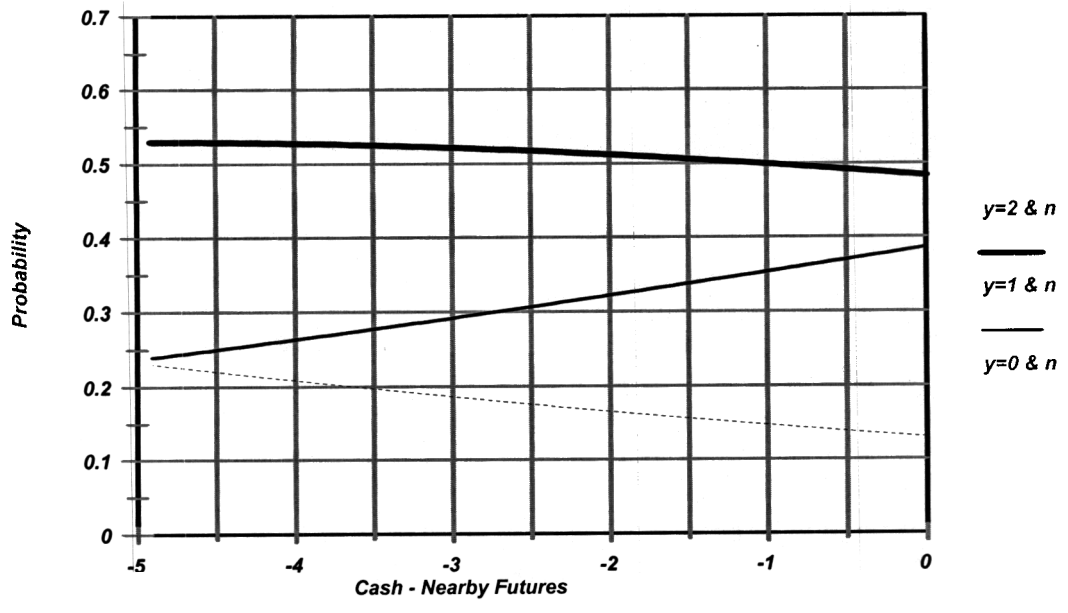


Figure 9. Probabilities of the Three Price Reporting Classifications during Neutral (or Even) Expected Price Changes.

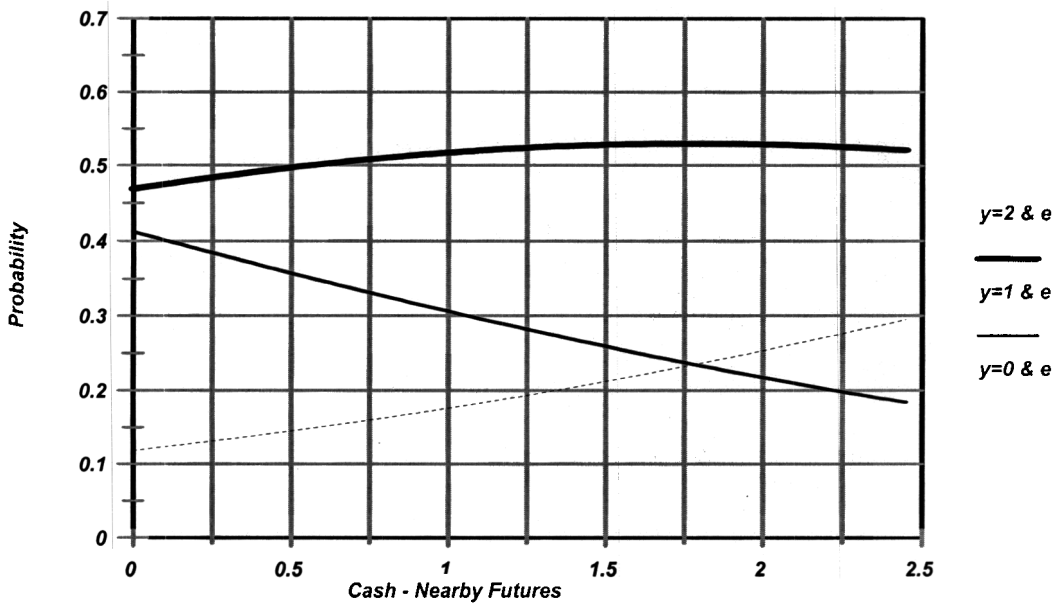


Figure 10. Probabilities of Prices Being Reported Increasing and Decreasing Expected Price Changes.

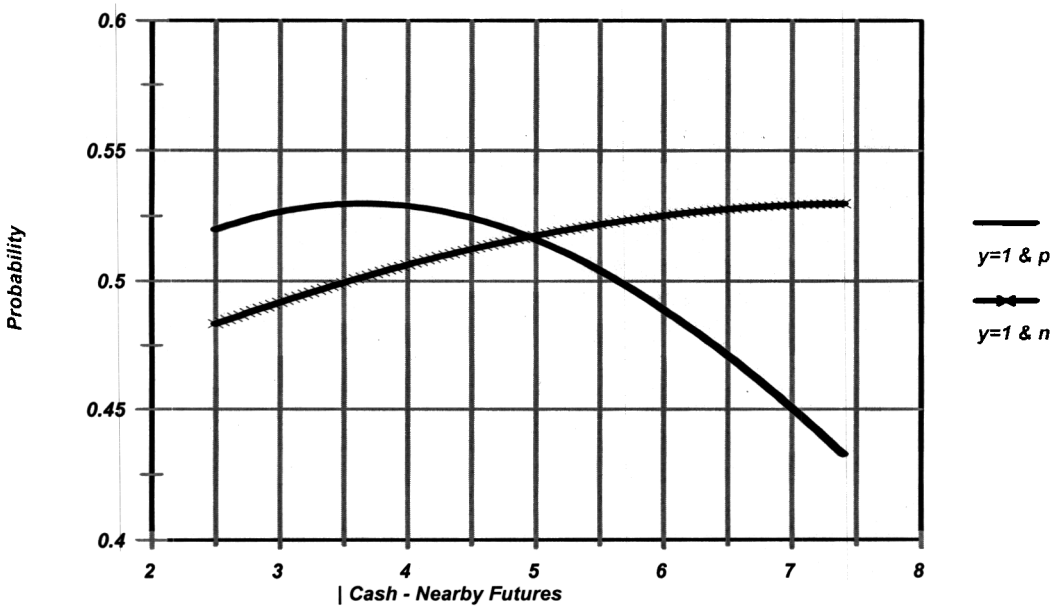


Figure 11. Probabilities of Prices Not Being Reported in the Direction of the Expected Price Change.

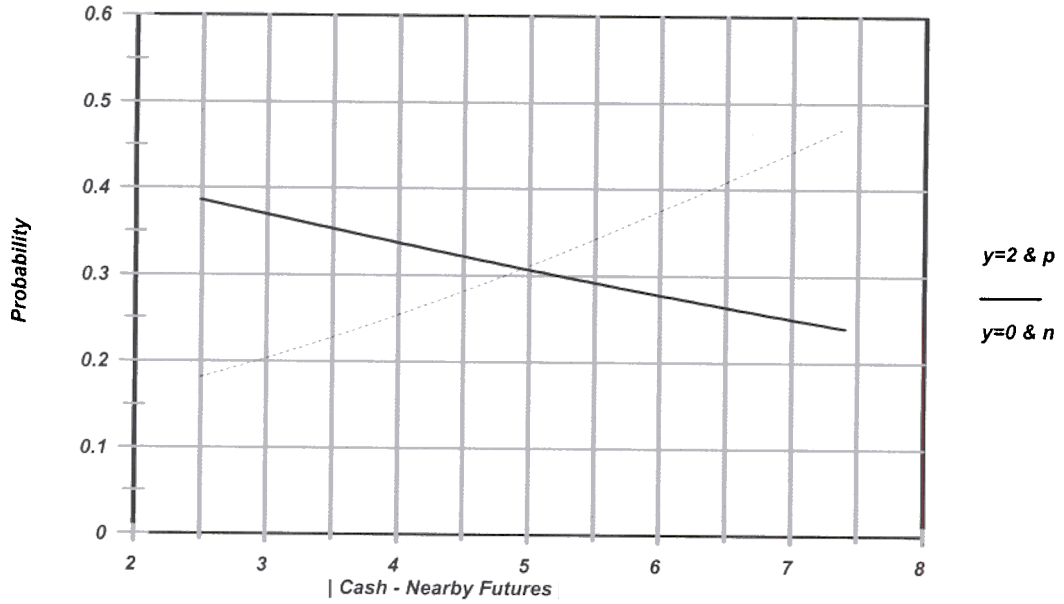
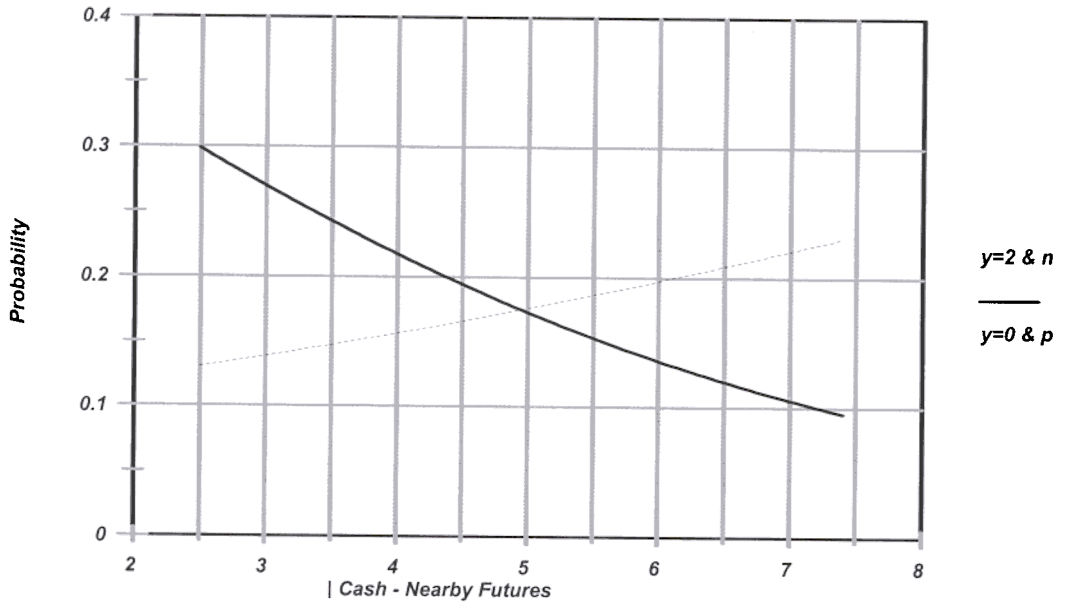


Figure 12. Probabilities of Prices Not Being Reported in the Opposite Direction of the Expected Price Change



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