Public Reporting of Fed Cattle Grid Prices:
Policy Reform Consequences

by

Scott Fausti*
Bashir Qasmi
Matthew Diersen

Economics Staff Paper 2007-1
April 2007

***Scott Fausti (scott.fausti@sdstate.edu) is a Professor and Bashir Qasmi (bashir.qasmi@sdstate.edu) and Matthew Diersen (matthew.diersen@sdstate.edu) are Associate Professors in the Department of Economics, South Dakota State University, Brookings, SD 57007-0895.**

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ABSTRACT

Mandatory livestock price reporting was implemented in April 2001. Empirical evidence indicates a significant change in volatility occurred in publicly reported fed cattle grid premiums and discounts after its implementation. Empirical analysis of grid premiums and discounts across the pre-and post-reform periods indicates that increased transparency is compatible with either an increase or a decrease in price volatility in the post-MPR period. Furthermore, it appears that the public price reporting system for weekly grid premiums and discounts failed to provide an adequate level of transparency prior to the implementation of price reporting reforms.

Our methodology extends the literature on the use of volatility measures for investigating issues associated with market transparency. This extension can be applied to the development of volatility measures for monitoring the price reporting behavior of firms.

Public Reporting of Fed Cattle Grid Prices: Policy Reform Consequences

The Agricultural News Marketing Service (AMS) has been providing weekly grid price reports for slaughter cattle since 1996. These reports provide the market with information on weekly premiums and discounts for quality grade, yield grade, and weight (Fausti et al 1998). Until April 2001, these price reports were based on information collected from meat packing companies under a voluntary price reporting (VPR) system. When the VPR system ended, only six packing firms were providing weekly reports. After mandatory livestock price reporting (MPR) was implemented, all firms were required to report. As a result, market transparency is expected to increase due to: a) an increased number of firms reporting, and b) an increase in the quantity and quality of information reported by packing firms.

The general perspective on the relationship between transparency and price dispersion in the MPR literature is: As transparency increases, price dispersion decreases, which decreases price uncertainty for market participants (e.g. Azzam 2003). The simple weekly average time-series data for reported grid premiums and discounts (figures 1-4) show that this supposition may not apply to a number of AMS grid price categories. For a number of grid categories, there seems to be an increase in dispersion in the post-MPR period, but for other categories this does not seem to be the case. These findings are a conundrum. Is increased transparency compatible with increased dispersion?

Previous studies examining the time-series behavior of grid price series, pre- and post-MPR, also suggest that there is evidence of a change in premium and discount volatility after MPR was implemented (Priebe 2004; Hogan and Ward 2005). This empirical puzzle suggests the relationship between the increase in transparency and the change in grid price dispersion needs additional investigation. We intend to investigate this relationship by exploiting the link between price dispersion and price volatility.

The linkage between price discovery, price transparency, market information flows, price dispersion, and price volatility has received considerable attention in the market microstructure literature (O'Hara 1995, Calamia 1999). The theory of market microstructure behavior focuses on the functional structure of a market and its effect on market participants' trading behavior. It has been established in this literature that regime change which increases the level of market transparency can either increase or decrease the level of price volatility while improving price efficiency (e.g. Madhavan 1996, Bloomfield and O'Hara 1999).

Our empirical approach is to investigate how regime reform (from VPR to MPR) affected the volatility of grid premiums and discounts. The stylized facts derived from the market microstructure literature are used to investigate this issue. The link between transparency, market information flow, and volatility suggests that volatility is an appropriate yardstick for examining the effect of regime change on the level of sensitivity of public grid price reports to changes in current market conditions. Increased price volatility increases price dispersion. Common measures of price dispersion, such as the standard deviation, squared deviations from the mean, and the high-low range, are commonly used proxies in price volatility studies. Our objective is to provide insight, based on changes in grid premium and discount volatility, on the level of transparency associated with the current MPR system relative to the VPR system.

Literature Review of Cattle Marketing Issues

Grid Pricing

The development of a value based marketing system for fed cattle has been a priority issue for the beef industry since the publication of War on Fat by the Value Based Marketing Taskforce in 1990 (VBMTF, 1990).[1] Today the most successful form of value based marketing (VBM) for cattle is referred to as "grid pricing" (Fausti et al. 1998).[2] The AMS began voluntary public price reporting of national grid premium and discount prices (the weekly simple average and the high-low range) in October 1996.

The focus in the grid pricing literature has been on the incentive structure of grid pricing relative to average pricing of slaughter cattle and its potential success of supplanting the average pricing marketing channel (e.g. Johnson and Ward 2005; Fausti and Qasmi 2002; Feuz 1999; Fausti and Feuz 1995). Feuz (1999) estimated that there were at least 25 different price grids being used by the packing industry shortly after the AMS began issuing public grid price reports. This suggests that packer premium and discount schedules vary across firms. Feuz (1999) also discussed the practice of large packing firms adjusting their grid premium and discount schedules based on plant averages. The implication was that grid premiums and discounts not only varied across firms but also within a firm. If the VPR system for grid pricing was providing transparency, then publicly reported data should reflect this attribute.

The success of value based marketing is dependent on transparency and is important for the long-run sustainability of the beef industry. Comparing pre- and post-MPR grid premium and discount values will provide insight on the level of transparency provided by both reporting systems.

Mandatory Livestock Price Reporting

The impetus for imposing MPR in U.S. livestock markets was the belief by producer groups, economists, and government officials that VPR had become ineffective. Discussion in the literature suggests that increased industrial concentration in the packing and feedlot industries and increased use of captive supply procurement methods were the causes for the VPR system's failure to provide accurate and timely market information to market participants (e.g. Anderson et al. 1998; Wachenheim and DeVuyst 2001).

Recent empirical studies suggest that MPR has only marginally improved transparency in the fed cattle cash market (Grunewald et al. 2004; Fausti and Diersen 2004; Pendell and Schroeder 2006). Accordingly, this evidence suggests that the VPR system was not as inefficient as alluded to in the earlier literature. However, MPR has resulted in a dramatic improvement in the level of transparency in the captive supply market (Ward 2006). The grid cash market for cattle is the only AMS public report where the transparency issue associated with regime change has not been investigated.

Market Microstructures: Stylized Facts

Market Transparency and Volatility

Market transparency is defined as a market environment where all relevant information on market conditions is publicly available to all market participants in such a manner as to allow efficient completion of all transactions. Tomek and Robinson (1981) state that the requirement for transparency in a commodity market is that all market participants have access to complete and unbiased information on market supply and demand conditions.

An extensive discussion of the relationship between the arrival of information on market conditions and market price volatility can be found in the market microstructure literature (e.g. Clark 1973, Andersen 1996, Fleisher 2003, Calvo et al. 2005). This branch of the market microstructure literature has developed a strong theoretical and empirical linkage between increased information flow and increased price volatility. According to another branch of this literature, a policy-induced increase in market transparency can lead to either increased or decreased price volatility (e.g. Madhavan 1996, Bloomfield and O'Hara 1999).

Volatility and the Statistical Range

Considerable resources have been invested in the study of volatility and the development of stochastic volatility models for financial markets. One of the key issues investigated in this literature is the identification of an efficient proxy for price volatility. A range-based measure of volatility over a finite sampling interval have been shown to be more efficient than other popular volatility proxies, such as squared returns for the period (Parkinson 1980, Alizadeh et al. 2002, Brandt et al. 2003, Martens and van Dijk 2005).[3] Furthermore, Parkinson (1980) demonstrates that the statistical (high-low) range is a more efficient proxy for volatility than squared returns regardless of interval length.

Methodology

Market Microstructure Behavior and Public Price Reporting

Market microstructure theory addresses the issue of how the short-run behavior of market participants is affected by the functional structure of an organized market. Empirical analysis of market microstructures, as reported in the literature, relies primarily on high frequency data from stock and foreign exchange markets. Functional differences across stock exchanges, central banks, government regulatory organizations, etc. provide the backdrop for studies examining market issues of price transparency, price discovery, and price volatility.

The implementation of mandatory price reporting in the livestock industry has changed the functional structure of both the government's data collection and reporting procedures and the behavior of firms when they report premiums and discounts to the government. We assert that the behavior of market price established in the market microstructure literature provides a reasonable template for investigating the effect of regime change on government-reported prices for grid premiums and discounts.

Regime Change and Volatility Measures

The passage of MPR regulations altered the institutional structure of public price reporting of grid premiums and discounts for slaughter cattle in two ways. First, all firms are obligated to report grid premiums and discounts for all grids on which they purchase cattle.[4] Second, the AMS has the right to audit the weekly reports submitted by firms. This is expected to impact the behavior of reporting firms. Packer compliance implies increased diligence in the reporting of grid premiums and discounts to the AMS and should increase the quantity and quality of information being reported. Policy reform is expected to enhance the ability of the public price reporting system to provide greater transparency in the post-MPR period.

Regime change from VPR to MPR is expected to affect the public price reporting data series in two ways: a) a sample size effect, and b) an information flow effect. The sample size effect refers to an increase in the number of firms reporting. The information flow effect is defined as an increase in the *quantity and quality of information each firm* provides to the AMS. Both of these policy reform effects will alter the level of volatility of reported grid premiums and discounts. We propose to use two volatility proxies: a) the standard deviation of a grid category's weekly average, and b) the weekly high-low range of a grid category.

Increasing the number of firms providing information to the AMS under MPR is analogous to increasing the sample size. As the number of firms reporting information increases, ceteris paribus, the sample standard deviation of a price series is expected to decline in the post-MPR period. Therefore the sample size effect is expected to reduce the level of volatility (measurement error) reflected in the standard deviation. As the proportion of firms reporting increases, ceteris paribus, the high-low range increases. If the quality and quantity of information provided by each firm has not changed, then the increase in the high-low range reflects greater statistical precision in identifying extreme points in a distribution, not increasing volatility.

An increase in the flow of information into the public price reporting system, ceteris paribus, is expected to increase the level of volatility of the price series publicly reported in a manner consistent with the market microstructure literature (Clark 1973, Anderson 1996, Fleischer 2003). Holding the number of firms reporting constant, our proxies for volatility, the high-low range and the standard deviation, are expected to increase as the quality and quantity of information increases.

Implementation of MPR is expected to increase sample size as well as increase the quality and quantity of market information reported to the government. The increase in sample size is expected to decrease volatility, and the increase in information flow is expected to increase volatility.

We can *not* ascertain if a change in the post-MPR level of the intra-weekly high-low range is the result of the increased sample size or the increased information flow. The standard deviation (σ) can be useful in answering this question. The answer to this question will help reveal which publicly reported grid premium and discount categories may have lacked transparency prior to regime change.

Empirical Test I: Sampling Effect versus Information Flow Effect

The goal of the first empirical procedure is to determine if the sampling effect or information flow effect dominates in the post-MPR period. The statistical procedure has two components, a) a difference in means hypothesis test to compare pre- and post-MPR intra-weekly range grid categories, and b) a difference in variance hypothesis test to compare pre- and post-MPR grid category standard deviations.

Due to policy reform, increased transparency will result from, ceteris paribus, an: a) increase in the proportion of firms reporting; and b) increase in the quantity and quality of information reported. We hypothesize that both of these effects will cause the mean intra-weekly range (μ) for the post-MPR period to increase relative to the pre-MPR period for all grid premium and discount series. Hypothesis I tests the null of a decline or no change in the mean value of the intra-weekly range against the alternative that it increased in the post-MPR period.

Hypothesis 1:

$$HO: post\ \mu \leq pre\ \mu$$
$$H1: post\ \mu > pre\ \mu$$

We expect that the sample standard deviation (σ) of grid premium or discount category weekly average to decline in the post-MPR period relative to the pre-MPR period as the proportion of firms reporting increases, ceteris paribus. But we also expect that an increased flow of information will increase the standard deviation in the post period. Thus we do not have an *a prior* assumption on the effect of regime change on the standard deviation. Hypothesis II tests the null of a decrease in the sample standard deviation (σ) of a grid premium or discount weekly average against the alternative of no change or an increase in the post-MPR period.

<u>Hypothesis 2</u>:

$$HO: post\ \sigma < pre\ \sigma.$$
$$H1: post\ \sigma \geq pre\ \sigma.$$

If the null for hypothesis 1 is rejected and the null for hypothesis 2 is accepted, then we can only conclude that the regime change has *not* increased information flow and the increase in the high-low range is the result of an increase in the number of firms reporting. This implies the sampling effect dominates the information flow effect. This would be consistent with previous theoretical work on MPR by Azzam (2003). Azzam suggests that MPR should improve transparency by reducing uncertainty (as measured by the standard deviation) surrounding public price reports for spot market transactions. Under this scenario (*scenario one)*, regime change increases market transparency by increasing the number of firms reporting information but reduces volatility reflected in public price reporting grid categories. In this case the increase in the high-low range reflects the increase in the number of firms reporting, not an increase in information flow. Scenario one suggests that the VPR system was providing a less precise level of reporting accuracy to the market because there is no evidence of increased information flow in the post MPR period. In this case, policy reform has a positive but marginal impact on transparency due to increased reporting accuracy.

If the nulls for both hypotheses 1 and 2 are rejected, then we can conclude that regime change has not only increased the number of firms reporting market information but has also increased market information flow. In this case (*scenario two),* regime change increases transparency by increasing the number of firms reporting and increasing the level of market information flow. Scenario two implies that policy reform has had a significant and positive impact on market transparency. Empirical evidence supporting scenario two indicates that the VPR system failed to provide timely and accurate information to the market.

Scenario two is not predicted in the MPR literature and raises an interesting question. If statistical evidence suggests that that there has been an increase in price report volatility as a result of MPR, then is it possible to identify the source for this increase in volatility? Identifying a linkage between premium and discount volatility and variables reflecting market conditions can support the proposition that increased volatility is the result of increased market information flow. Establishing a linkage between increased market information flow and increased volatility can provide an answer to the conundrum revealed in the work of Priebe (2004); and Hogan and Ward (2005).

Location and Dispersion Testing Methodology

Data diagnostics were performed to evaluate the statistical characteristics of the pre- and post-MPR grid data collected on the intra-weekly range and the weekly simple average for grid premiums and discounts. The Anderson-Darling normality test (Gujarati 2003, p.147) was used to evaluate the normal distribution assumption. All of the pre- and post-MPR variables failed the normality test. To conduct hypothesis test one, we selected the nonparametric Wilcoxon Two-Sample Rank Sum test for location (SAS

1990, pp. 127 and 1196). The non-parametric Brown-Forsythe equality of variance test was selected for hypothesis test two because it is not dependent on the assumption of equal location parameters (Brown and Forsythe 1974).

Empirical Test II: Identifying Sources of Increased Information Flow

The goal of the second empirical procedure is to determine if an empirical relationship can be identified between the pre- and post-intra-weekly range, and variables reflecting market conditions in the slaughter cattle market. The variables selected are: a) the national beef carcass price, b) the weekly proportion of steers grading at least quality grade choice and yield grade 3, and c) the national weekly average slaughter weight of steers sold live. Comparing the strength of the empirical linkage between a premium and discount volatility proxy and variables reflecting market conditions in the pre- and post-MPR periods will provide insight on the ability of the VPR system to provide transparency.

AMS reported grid premiums and discounts represent the market value of particular carcass characteristics. The market value of these carcass characteristics should be influenced by supply and demand conditions in the national market for beef. In order for grid pricing to be a more efficient conduit for the transmission of consumer preferences for a particular type of beef product back to the beef producer, grid premium and discounts must reflect current supply and demand conditions in the market for beef.

Theoretically, the interaction between grid premiums and discounts and general market conditions should revolve around an equilibrium relationship between weekly grid prices and the market variables that reflect demand and supply conditions. Therefore, changes in market conditions imply new information has been introduced into the market and this in turn should affect the level of volatility of grid prices.

We propose that the technique of cointegration is an appropriate method to test if equilibrium relationships exist between the intra-weekly grid premium and discount statistical range and the market variables selected to reflect supply and demand conditions in the beef market. A comparison of cointegration results across grid premium and discount categories (pre- and post-MPR) will provide additional insight on whether the VPR system failed to provide an adequate level of transparency to the market.

Cointegration theory postulates that if a linear combination of two nonstationary time series variables is found to be stationary, then the relationship between those two variables is considered to be in an equilibrium relationship (Gujarati 2003). We propose to test hypothesis three for each of the pre- and post-MPR grid premium and discount intra-weekly range series. Each series will be individually regressed upon: a) the national beef carcass price, b) the weekly proportion of steers grading at least quality grade choice and yield grade 3, and c) the national weekly average slaughter weight of steers sold live.

Hypothesis 3

HO: The residual of the cointegration regression is nonstationary.
H1: The residual of the cointegration regression is stationary.

If the null hypothesis is rejected, this suggests that there is evidence of an equilibrium relationship between a grid discount or premium series (pre- or post-MPR) and the selected market variable. In this case, we would conclude that premium or discount volatility is affected by the flow of market information on supply and demand conditions. If the null hypothesis is accepted, then we would conclude there is no evidence of a relationship between premium or discount volatility and the flow of market information on supply and demand conditions embodied in the selected market variable.

Evidence of a cointegrating relationship in the post-MPR period and no relationship in the pre-MPR period for a specific premium or discount series would suggest that VPR failed to provide an adequate level of transparency to the market.

Cointegration Methodology

Data diagnostics were preformed on the pre- and post-MPR grid premium and discount date collected on the intra-weekly range. The Phillips-Perron Unit Root Test (SAS/ETS, 1999, pp.361-63) was conducted on pre- and post-MPR data: a) intra-weekly Range, b) *5 Area Weekly Weighted Average* dressed weight price of slaughter cattle (35% to 65% choice), c) the weekly regional grading percentage from regions 7&8, and d) the *5 Area Weekly Weighted Average* for live slaughter steer weight. In the pre-MPR data set, all of the series are nonstationary except the select and Yg 3.5-4.0 series. In the post-MPR data set, all of the series are nonstationary except Yg 3.0-3.5 and Yg 3.5-4.0.

Each of the nonstationary pre- and post-yield and quality grade series were regressed on hot carcass weight price and then on the regional grading percentage. Each of the nonstationary pre-and post-discount weight series were regressed on hot carcass weight price and then on the weekly live slaughter weight. Cointegration tests were preformed using the Phillips-Ouliaris Cointegration Test (SAS/ETS, 1999, p.363). The critical values for the Z tau statistics are from Phillips and Ouliaris (1990, p.190, Table II a-b-c). Unit root and cointegration tests were adjusted for serial correlation.

Data

Public Price Reporting of Grid Premiums and Discounts: Pre and Post MPR

The AMS began issuing weekly grid premium and discount reports out of its Des Moines, Iowa, office in 1996. The VPR data collection process in the Des Moines office consisted of weekly phone calls from the AMS reporter to packers on Monday morning. Packers provided their premium and discount schedules for the week. No auditing or verification procedures were conducted to confirm the reliability of the data.[5]

After MPR, the St. Joe, MO, office of the AMS was given the responsibility of collecting packer grid premium and discount data. The St. Joe office considers its premium and discount reports to be distinctly different from the reports issued under the old reporting regime. Packers under MPR are required to submit a Cattle Premiums and Discount Weekly Report (form # LS-177) by 2 pm Monday of each week. This report must be filed by each packing plant that purchases cattle on a grid. The St. Joe office tabulates the reported data and issues a public report each Monday. The report contains essentially the same premium and discount categories and provides the weekly simple average mean and range for each category. The St. Joe office is also responsible for the auditing of reports to ensure packer compliance.[6] The structure of the new reporting regime suggests that the packing industry will be more diligent in providing accurate weekly premium and discount reports to the St. Joe office.

Data Sources

Data on national slaughter cattle grid premium and discount values were collected from an AMS publication (USDA-AMS: the National Carcass Premiums and Discounts for Slaughter Steers and Heifers weekly report). The data set also includes: a) the 5 *Area*

Weekly Weighted Average dressed weight price of slaughter cattle (35% to 65% choice) and the *5 Area Weekly Weighted Average* for live slaughter steer weight (USDA-AMS: the Livestock, Meat and Wool Weekly Summary and Statistics weekly reports); and b) the weekly regional grading percentage from region 7&8 (USDA-AMS: National Steer & Heifer Estimated Grading Percent weekly report). The data series cover the period from January 6, 1997 to March 14, 2005.

The time series data was not adjusted for inflation. It was decided that the conversion process would also affect variability in the data. Given that the objective of this research is to investigate volatility in pre- and post-MPR for AMS reported grid premium and discounts series, this seems to be a reasonable course of action.

Empirical Results

Location and Dispersion Test Results

Table 1 contains the summary statistics for the pre- and post-intra-weekly range and the p-values for the one-sided Wilcoxon test for location. The test results indicate strong empirical evidence supporting the *alternative* hypothesis that the intra-weekly range is greater in the post-MPR period relative to the pre-MPR period.[7] The only exception is the Yg 3.5-4.0 category.

Table 2 contains the summary statistics for the pre- and post-weekly simple average grid premium and discount standard deviations, and the p-values for the equality of variance tests. The test results provide strong empirical evidence for rejecting the *null* hypothesis that the post-MPR period standard deviations are lower than in the pre-MPR period for the quality grade categories, the yield grade premium categories, and the lightweight discount categories. Examining the standard deviation data, it appears that for the yield grade discount categories Yg 3.0-3.5, Yg 3.5-4.0, and the heavyweight discount category W 950-1000 there was not a statistically significant change in variance as a result of regime change. However, for the yield grade discount categories Yg 4.0-5.0, Yg >5.0, and the heavyweight discount category W >1000, there was a statistically significant decline in variance as a result of regime change.

The location and dispersion test results collectively show statistical evidence to support the conclusion that regime change resulted in an increase in the flow of information into the public grid price reports beyond the level expected from an increase in the number of firms reporting for the following categories: a) the yield grade premiums categories, b) the quality grade premium and discount categories, and c) the lightweight discounts categories. The empirical results for these categories are consistent with scenario two. Policy reform increased transparency by increasing information flow, which increased price report volatility. This implies that for these grid categories, the VPR system failed to provide an adequate level of transparency.

It is interesting that the only categories for which we did not find evidence of increased information flow are the yield grade discount and the heavyweight discount categories. The empirical results for these categories are consistent with scenario one. Increased transparency and diminished price report volatility suggest that these discount categories may have experienced a greater level of market information flow relative to other premium and discount categories during the pre-MPR period. This implies that discount categories were responsive to changing market conditions in the pre-MPR period. This pre-MPR attribute may have contributed to the producer view that grid pricing seemed to be a system of discounts only (Fausti et al. 1998; Fausti and Qasmi 2002).

Cointegration Results: Scenario One

Only grid yield and weight discount categories were identified as having greater transparency and less volatility in the post-MPR period. Yield grade discounts were regressed on HCWP and then on regional grading percentage for the pre- and post-periods. Heavyweight discounts were regressed on HCWP and then on weekly average slaughter weight for the pre- and post-periods. Analysis of the residuals of the cointegration equations (Tables 3&4) indicates that: a) deep yield discount categories had a long-run equilibrium relationship with the selected market variables in both the pre- and post-MPR periods and this relationship strengthened in the post-MPR period; b) the slight yield grade discount residuals were stationary in the post period and so no conclusion can be drawn; and c) heavyweight discounts had a long-run equilibrium relationship with the selected market variables in both the pre- and post-MPR periods and this relationship strengthened in the post-MPR period.

We conclude that the voluntary system for reporting these grid discounts was providing a measure of transparency to the market, but policy reform did improve the level of transparency. This conclusion is based on improved tau statistics in the post-MPR period.

Cointegration Results: Scenario Two

Grid quality grade premium and discount categories, grid yield premium categories, and lightweight discount categories were identified as having greater volatility in the post-MPR period. Quality grade premiums and discounts and yield premiums were regressed on HCWP and then on regional grading percentage for the pre- and post-periods. Lightweight discounts were regressed on HCWP and then on weekly average slaughter weight for the pre- and post-periods. Analysis of the residuals of the cointegration equations (Tables 3-5) indicates that: a) yield grade 1.0-2.0 premium had a long-run equilibrium relationship with the selected market variables in post-MPR period but not the pre-MPR period; b) yield grade 2.0-2.5 premium did not have a long-run equilibrium relationship with the selected market variables in either the pre-MPR period or post-MPR period; c) yield grade 2.5-3.0 premium did have a long-run equilibrium relationship with HCWP but not regional grading percentage in both the pre-and post-MPR periods; d) prime quality grade premium did not have a long-run equilibrium relationship with the selected market variables in either the pre-MPR period or post-MPR period; e) select discount has a long-run equilibrium relationship in the post-MPR period, but this series was stationary in the pre-MPR period so no comparison can be made; f) standard discount had a long-run equilibrium relationship with the selected market variables in post-MPR period but not the pre-MPR period; and g) lightweight discounts had a long-run equilibrium relationship with the selected market variables in the post-MPR period but not the pre-MPR period.

The empirical results suggest that the VPR system for these grid premium and discount categories was not providing transparency and did not reflect changing market conditions in the pre-MPR period. We surmise that the increase in grid premium volatility in the post-MPR period is a result of market information now being reflected in weekly grid reports.

Overall, the cointegration results indicate that grid premium and discounts have a stronger relationship to market conditions in the post-MPR period relative to the pre-MPR period. Evidence also suggests that discounts have a stronger link to market conditions in the pre and post-MPR periods relative to grid premiums. We conclude that: a) regime change was necessary, and b) grid marketing still appears to rely more on discounts for evaluating cattle.

Summary:

Statistical evidence suggests that a policy-induced increase in transparency is compatible with an increase or decrease in volatility. However, increased transparency has come at the cost of increased volatility for grid premiums, and this suggests a lack of transparency in the pre-MPR period.

It appears that only discounts were influenced by market conditions in the pre-MPR period. This suggests that the producer complaints about the grid pricing system being a system of "discounts only" may have been valid. Even though the new public price reporting mechanism is providing greater transparency, discounts levied by packers continue to be more responsive to changes in market conditions than premiums in the post-MPR period. This conclusion raises concern over the effectiveness of the grid pricing system as a value based system for fed cattle. It appears that the grid incentive mechanism still has a negative bias.

The methodology presented in this paper extends the empirical literature on the use of volatility measures to investigate the issue of market transparency. One potential extension of this methodology is to use volatility measures to monitor price reporting behavior of firms to see if firm reporting behavior is consistent with current market conditions.

Endnotes:

1. In the late 1980s, The National Cattlemans Beef Association (NCBA) sanctioned the formation of the Valued Based Marketing Taskforce to study the competitive position of beef. The taskforce issued a white paper in 1990 titled War on Fat. The taskforce identified average pricing of slaughter cattle in the cash market as a major barrier to the transmission of consumer preferences for leaner beef product with greater quality consistency back to the producer via the price mechanism. For an expanded discussion on the issue of value based marketing for slaughter cattle see Cross and Savell (1994) and Fausti et al. (1998).
2. Grid pricing typically accesses carcass premiums and discounts based on carcass quality grade, carcass yield grade, and hot carcass weight. The concept of grid pricing evolved from the traditional grade and yield pricing system. The AMS weekly public report provides prices for quality grade (prime, select, standard), yield grade(Yg 1.0-2.0, Yg 2.0-2.5, Yg 2.5-3.0, Yg 3.0-3.5, Yg 3.5-4.0, Yg 4.0-5.0, Yg >5), and weight discounts based on hot carcass weight (400-500, 500-550, 950-1000, over 1000 lbs). See Fausti et al. (1998) for an expanded discussion.
3. Alizadeh et al. (2002) demonstrate that the log range is also an efficient proxy for volatility and also has the property of being Gaussian as opposed to other volatility proxies such as squared returns or absolute log of returns. Unfortunately, the AMS grid data has a number of premium and discount categories with zero being either the high or low range value. We would be unable to analyze the yield grade 2.5 to yield grade 4 categories and lose a significant number of select discount observations using the range of log prices.

However, another advantage of range based volatility proxies relative to others is that they are “ …much less contaminated by measurement error” (p.1086).

4. Only packers slaughtering over 125,000 annually are required to report to the AMS.
5. The AMS data collection procedure was verified by the authors via a personal phone call made on July 15, 2005, to the Des Moines, Iowa, office.
6. It is the view of the AMS that packers are providing the actual premium and discount schedule they will be using for the week when the packers file their reports Monday morning.
7. When examining the means of the pre- and post-weekly premiums and discounts across periods we find; the change in the price level is relatively small when compared to the change in intra-weekly range across periods. This suggest that the change in the intra-weekly range across periods can not be simply explained as being caused by the mean change in the price level of a premium or discount across periods.

REFERENCES

Alizadeh, Sassan, Michael W. Brandt, and Francis X. Diabold, 2002, "Range-Based Estimation of Stochastic Volatility Models." *The Journal of Finance,* LVII(3): pp. 1047-1091.

Anderson, Torben G., 1996, "Return Volatility and Trading Volume: An Information Flow Interpretation of Stochastic Volatility." *The Journal of Finance*, LI(1): pp. 169-204.

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.

Azzam, A., 2003, "Market Transparency and Market Structure: The Livestock Mandatory Reporting Act of 1999." *Amer. J. Agr. Econ.* 85(2): pp. 387-395.

Brandt, Michael W., and Francis X. Diebold, 2003, "A No-Arbitrage Approach to Range-based Estimation of Return Covariances and Correlations." The Rodney L. White Center for Financial Research. 07-03. The Wharton School. University of Pennsylvania.

Brown, Morton B., and Alan B. Forsythe, 1974, "Robust Test for Equality of Variances." *Journal of the American Statistical Association.* 69(346): pp. 364-367.

Bloomfield, R., and M. O'Hare, 1999, "Market Transparency: Who Wins and Who Loses?" *The Review of Financial Studies*, 12(1): pp. 5-35.

Calamia, Anna, 1999, "Market Microstructure: Theory and Empirics." Laboratory of Economics and Management, Sant'Anna School of Advanced Studies, University of Rome, La Sapienza, LEM Working Paper Series 1999/19 (Sep. 1999).

Calvo, Guillermo, Alejandro Izquierdo, and Rudy Loo-Kung, 2005, "Relative Price Volatility Under Sudden Stops: The Relevance of Balance Sheet Effects." NBER Working Paper Series, National Bureau of Economic Research. Cambridge, MA. (June 2005).

Clark, Peter K., 1973, "A Stochastic Process Model with Finite Variance for Speculative Prices." *Econometrica,* 41(1): pp. 135-155.

Cross, H.R., and J.W. Savell. "What do we Need for a Value-Based Beef Marketing System?" *Meat Science*: Vol. 36, 1994, pp. 19-27.

Fausti, S.W, and Feuz, D.M., 1995, "Production Uncertainty and Factor Price Disparity in the Slaughter Cattle Market: Theory and Evidence." *American Journal of Agricultural Economics*, Vol. 77, No. 3, pp. 533-540.

Fausti, S.W, Feuz, D.M., and Wagner, J.J., 1998, "Value Based Marketing for Fed Cattle: A Discussion of the Issues.", *International Food and Agribusiness Management Review*, Vol. 1, No.1., 1998, pp. 73-90.

Fausti, S.W, and Qasmi, B.A., 2002,"Does the Producer have an Incentive to Sell Fed Cattle on a Grid?" *International Food and Agribusiness Management Review*, Vol. 5, No.1.,2002, pp.23-39.

Fausti, S.W., and M.A. Diersen, 2004, "The Voluntary Reporting System's Ability to Provide Price Transparency in the Cash Market for Dressed Steers: Evidence from South Dakota." *Journal of Agricultural and Resource Economics,* 29(3): pp. 553-566.

Feuz, D.M., 1999,"Market Signals in Value-Based Pricing Premiums and Discounts." *Journal of Agricultural and Resource Economics*: Vol. 24. No.2, pp. 327-341.

Fleischer, Petra, 2003, "Volatility and Information Linkages Across Markets and Countries." *Australian Journal of Management,* 28(3): pp. 251-272.

Grunewald, S, T.C. Schroeder, and C.E. Ward, 2004, "Cattle Feeder Perceptions of Livestock Mandatory Price Reporting." *Review of Agricultural Economics,* 26(4): pp. 521-38.

Gujarati, D.N., 2003, Basic Econometrics, 4th ed., McGraw-Hill, NY, NY.

Hogan, R., and C.E. Ward, 2005, "Examining the Fed Cattle Choice-Select Discount", Paper presented at the Southern Agricultural Economics Association Annual Meeting, Little Rock AK, February 2005.

Johnson, H.C., and C.E. Ward, 2005, "Market Signals Transmitted by Grid Pricing." *Journal of Agricultural and Resource Economics*: Vol. 30. No.3, pp. 561-579.

Madhavan, A, 1996, "Security Prices and Market Transparency" *Journal of Financial Intermediation,* Vol. 5, pp. 255-83.

Martens, Martin, and Dic van Dijk, 2005, "Measuring Volatility with the Realized Range." Econometric Institute, Erasmus University, Rotterdam. (Jul 2005).

O'Hara, A, 1995, Market Microstructure Theory, Blackwell Publishers, Cambridge, MA.

Pakinson, Michael, 1980, "The Extreme Value Method for Estimating the Variance of the Rate of Return." *The Journal of Business,* 53(1): pp. 61-65.

Pendell, D.L., and T.C. Schroeder, 2006, "Mandatory Price Reporting and Fed Cattle Market Integration." *Journal of Agricultural and Resource Economics*, 31(3): pp. 568-579.

Phillips, P.C.B., and S. Ouliaris, 1990, "Asymptotic Properties of Residual Based Test for Cointegration." *Ecometrica,* 58(1): pp. 165-193.

Priebe, J., 2004, The Effect of Mandatory Price Reporting on the Structure of Weekly Reported Grid Premium and Discount Prices for Fed Cattle. Masters Thesis, Dept. of Economics, South Dakota State University, April.

SAS Institute, Inc. SAS/ETS User's Guide, Version 6., Cary, NC: SAS Institute Inc., 1990.

SAS Institute, Inc., 1999, SAS/ETS User's Guide, Version 6,2nd ed., Cary, NC: SAS Institute Inc.

Tomek, W.G., and K.L. Robinson, 1981, Agricultural Product Prices 2nd ed., Cornell University Press.

USDA-AMS. Livestock, Meat and Wool Weekly Summary and Statistics weekly reports 1-1-97 to 3-14-05.

USDA-AMS. National Carcass Premiums and Discounts for Slaughter Steers and Heifers, weekly reports 1-1-97 to 3-14-05.

USDA-AMS. National Steer & Heifer Estimated Grading Percent Report weekly reports 1-1-97 to 3-14-05.

Value Based Marketing Task Force. The War on Fat, National Cattleman's Association, Denver CO: (1990).

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. 2006, “An Assessment of the Livestock Mandatory Reporting Act.” Fact Sheet # F-606, Oklahoma Cooperative Extension Service, Oklahoma State University, Stillwater, OK.

Table 1: Pre- and Post-MPR Grid Intra-Weekly Statistical Range for Premiums and Discounts (Summary Statistics).[a]

	Pre MPR (N=219)		Post MPR (N=206)		Two Sample Wilcoxon Rank Sum test for Location: P Values = $\alpha/2$
Grid Category	Mean	Std.	Mean	Std.	HO: $\mu_{post} \le \mu_{pre}$ H1: $\mu_{post} > \mu_{pre}$
Prime	7.598	2.178	18.351	6.633	PV < 0.001
Select	2.358	1.126	8.008	3.885	PV < 0.001
Standard	16.464	4.665	20.554	3.560	PV < 0.001
Yg 1.0-2.0	3.945	1.520	7.887	0.382	PV < 0.001
Yg 2.0-2.5	2.012	0.360	4.307	1.129	PV < 0.001
Yg 2.5-3.0	2.042	0.356	4.246	1.162	PV < 0.001
Yg 3.0-3.5	0.961	0.125	0.907	0.510	PV=0.136
Yg 3.5-4.0	1.000	0.000	0.931	0.622	PV> 0.999
Yg 4.0-5.0	10.671	2.169	14.648	3.721	PV < 0.001
Yg >5.0	10.675	2.173	15.043	2.740	PV < 0.001
W 400-500	16.863	2.036	34.612	2.059	PV < 0.001
W 500-550	13.429	1.507	29.458	3.166	PV < 0.001
W 950-1000	13.849	2.294	17.692	3.531	PV < 0.001
W >1000	17.091	2.527	23.617	3.653	PV < 0.001

[a]See SAS (1990, pp.127 and 1196) for a discussion of the Wilcoxon Rank Sum Test.

Table 2: Pre- and Post-MPR Grid Weekly Simple Average for Premiums and Discounts (Summary Statistics).[a]

	Pre MPR (N=219)		Post MPR (N=206)		Brown-Forsythe test for Dispersion: P Values = α
Grid Category	Mean	Std.	Mean	Std.	HO: $\sigma_{post} < \sigma_{pre}$ H1: $\sigma_{post} \geq \sigma_{pre}$
Prime	5.62	0.49	6.43	1.61	PV< .0001
Select	-7.54	3.16	-9.29	4.56	PV=0.0165
Standard	-17.42	2.61	-17.58	3.96	PV=0.002
Yg 1.0-2.0	1.89	0.32	2.85	0.37	PV=0.057
Yg 2.0-2.5	0.88	0.093	1.65	0.23	PV< .0001
Yg 2.5-3.0	0.88	0.093	1.27	0.18	PV< .0001
Yg 3.0-3.5	-0.15	0.024	-0.0785	0.033	PV=0.359
Yg 3.5-4.0	-0.30	0.026	-0.080	0.041	PV=0.373
Yg 4.0-4.5	-15.38	1.87	-12.77	1.071	PV> 0.99
Yg >5	-20.55	1.75	-18.24	0.812	PV> 0.99
W 400-500	-21.46	0.97	-22.83	1.714	PV< .0001
W 500-550	-17.36	0.98	-15.25	1.487	PV< .0001
W 950-1000	-16.13	1.63	-7.35	1.602	PV=0.274
W >1000	-21.47	2.038	-17.51	1.517	PV> 0.99

[a]See Brown and Forsythe (1974) for the robustness of the equality of variance test under nonnormality.

Table 3. Yield Grade: Pre- and Post-MPR Grid Weekly Intra-Weekly Range Cointegration Results.

(Phillips-Ouliaris Z-Tau Critical Values: Tables II a-b-c)

Cointegrating Regression[a]	Post MPR (N=206)			Pre MPR (N=219)		
	P-O Residual Unit Root Test[b]	Z-Tau Stat	P-O Coint Test P-Value	P-O Residual Unit RootTest	Z-Tau Stat	P-O Coint Test P-Value
Yg 1.0-2.0/HCWP:						
ZMean	Stationary	-4.47	P< 0.01	Smean and Trend Non-Stationary	NA	NA
SMean	Stationary	-4.45	P< 0.01			
Trend	Stationary	-4.43	P< 0.01			
Yg 1.0-2.0/Grade%:						
ZMean	Stationary	-4.36	P< 0.01	Z/Smean and Trend Non-Stationary	NA	NA
SMean	Stationary	-4.35	P< 0.01			
Trend	Stationary	-4.39	P< 0.01			
Yg 2.0-2.5/HCWP:						
ZMean	Trend non-stationary	NA	NA	Trend non-stationary	NA	NA
SMean						
Trend						
Yg 2.0-2.5/Grade%:						
ZMean	Smean non-stationary	NA	NA	Smean and Trend Non-Stationary	NA	NA
SMean						
Trend						
Yg 2.5-3.0/HCWP:						
ZMean	Stationary	-3.32	P< 0.025	Stationary	-3.15	P< 0.025
SMean	Stationary	-3.31	P< 0.075	Stationary	-3.14	P< 0.10
Trend	Stationary	-3.54	P< 0.10	Stationary	-3.20	P> 0.15
Yg 2.5-3.0/Grade%:						
ZMean	Smean non-stationary	NA	NA	Trend non-stationary	NA	NA
SMean						
Trend						
Yg 3.0-3.5/HCWP:						
ZMean	NA	NA	NA	Stationary	-3.75	P< 0.01
SMean				Stationary	-3.74	P< 0.025
Trend				Stationary	-3.76	P< 0.05
Yg 3.0-3.5/Grade%:						
ZMean	NA	NA	NA	Stationary	-3.42	P< 0.01
SMean				Stationary	-3.41	P< 0.05
Trend				Stationary	-3.41	P< 0.125
Yg 3.5-4.0/HCWP:						
ZMean	NA	NA	NA	NA	NA	NA
SMean						
Trend						
Yg 3.5-4.0/Grade%:						
ZMean	NA	NA	NA	NA	NA	NA
SMean						
Trend						
Yg 4.0-5.0/HCWP:						
ZMean	Stationary	-5.68	P< 0.01	Stationary	-3.86	P< 0.01
SMean	Stationary	-5.66	P< 0.01	Stationary	-3.85	P< 0.025
Trend	Stationary	-5.68	P< 0.01	Stationary	-3.92	P< 0.05
Yg 4.0-5.0/Grade%:						
ZMean	Stationary	-4.83	P< 0.01	Stationary	-4.25	P< 0.01
SMean	Stationary	-4.82	P< 0.01	Stationary	-4.24	P< 0.01
Trend	Stationary	-5.66	P< 0.01	Stationary	-4.24	P< 0.025
Yg >5.0/HCWP:						
ZMean	Stationary	-6.48	P< 0.01	Stationary	-3.85	P< 0.01
SMean	Stationary	-6.46	P< 0.01	Stationary	-3.84	P< 0.025
Trend	Stationary	-6.42	P< 0.01	Stationary	-3.91	P< 0.05
Yg >5.0/Grade%:						
ZMean	Stationary	-6.46	P< 0.01	Stationary	-4.28	P< 0.01
SMean	Stationary	-6.44	P< 0.01	Stationary	-4.27	P< 0.01
Trend	Stationary	-6.42	P< 0.01	Stationary	-4.26	P< 0.025

[a]Zmean refers to no drift, Smean is with drift, and Trend refers to a trend component. NA refers to not applicable. If the residuals of a regression are found to be nonstationary, then NA is assigned to Z-tau and Pvalue columns. The pre- and post-3.5-4 series is stationary and so is the pre 3-3.5 series and thus a cointegration test is NA.
[b]Residual unit roots test were conducted using a critical value of 10%.

Table 4. Weight Discount: Pre- and Post-MPR Grid Weekly Intra-Weekly Range Cointegration Results.

(Phillips-Ouliaris Z-Tau Critical Values: Table II a-b-c)

Cointegrating Regression[a]	Post MPR (N=206)		Pre MPR (N= 219)	
	Tau Stat	P-value	Tau Stat	P-value
W 400-500/HCWP: ZMean SMean Trend	-8.28	P< 0.01	-2.42	P> 0.15
W 400-500/Livewt: ZMean SMean Trend	-8.49	P< 0.01	-2.08	P> 0.15
W 500-550 /HCWP: ZMean SMean Trend	-6.51	P< 0.01	-5.10	P< 0.01
W 500-550/Livewt: ZMean SMean Trend	-6.40	P< 0.01	-4.11	P< 0.01
W 950-1000/HCWP: ZMean SMean Trend	-3.97	P< 0.01	-3.37	P< 0.05
W 950-1000/lLivewt: ZMean SMean Trend	-4.07	P< 0.01	-3.62	P< 0.05
W >1000/HCWP: ZMean SMean Trend	-6.08	P< 0.01	-3.57	P< 0.05
W >1000/Livewt: ZMean SMean Trend	-5.49	P< 0.01	-3.81	P< 0.01

[a]Zmean refers to no drift, Smean is with drift, and Trend refers to a trend component.

Table 5. Quality Grade: Pre- and Post-MPR Grid Weekly Intra-Weekly Range Cointegration Results.

(Phillips-Ouliaris Z-Tau Critical Values: Tables II a-b-c)

Cointegrating Regression[a]	Post MPR (N=206) P-O Residual Unit Root Test[b]	Post MPR (N=206) Zau Stat	Post MPR (N=206) P-O Coint test P-value	Pre MPR (N= 219) P-O Residual Unit Root Test	Pre MPR (N= 219) Zau Stat	Pre MPR (N= 219) P-O Coint Test P-value
Prime/HCWP: ZMean SMean Trend	Trend non-stationary	NA	NA	Smean and Trend Non-Stationary	NA	NA
Prime/Grade%: ZMean SMean Trend	Trend non-stationary	NA	NA	Smean and Trend Non-Stationary	NA	NA
Select /HCWP:						
ZMean	Stationary	-4.48	P< 0.01	NA	NA	NA
SMean	Stationary	-4.47	P< 0.01			
Trend	Stationary	-5.12	P< 0.01			
Select/Grade%:						
ZMean	Stationary	-4.21	P< 0.01	NA	NA	NA
SMean	Stationary	-4.39	P< 0.01			
Trend	Stationary	-5.57	P< 0.01			
Standard/HCWP:						
ZMean	Stationary	-5.87	P< 0.01	Smean and Trend Non-Stationary	NA	NA
SMean	Stationary	-5.85	P< 0.01			
Trend	Stationary	-6.11	P< 0.01			
Standard/Grade%:						
ZMean	Stationary	-5.62	P< 0.01	Smean and Trend Non-Stationary	NA	NA
SMean	Stationary	-5.50	P< 0.01			
Trend	Stationary	-6.28	P< 0.01			

[a]Zmean refers to no drift, Smean is with drift, and Trend refers to a trend component. NA refers to not applicable. If the residuals of a regression are found to be non stationary , then NA is assigned to Z-tau and Pvalue columns. The pre-MPR Select series is stationary and thus a cointegration test is NA.
[b]Residual unit roots test were conducted using a critical value of 10%.

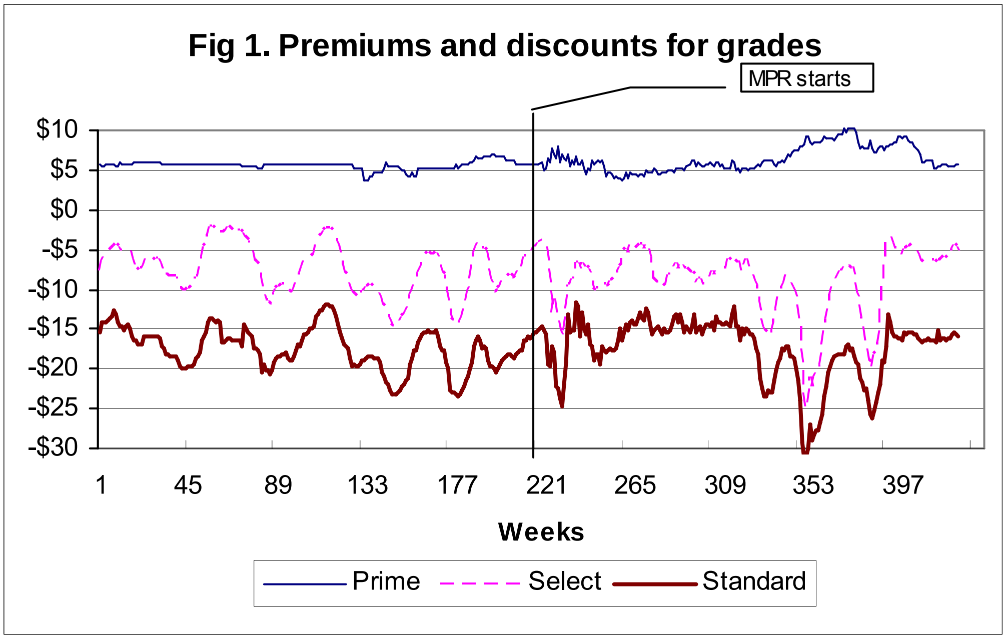

Fig 1. Premiums and discounts for grades
MPR starts
$10
$5
$0
-$5
-$10
-$15
-$20
-$25
-$30
1
45
89
133
177
221
265
309
353
397
Weeks
Prime
Select
Standard

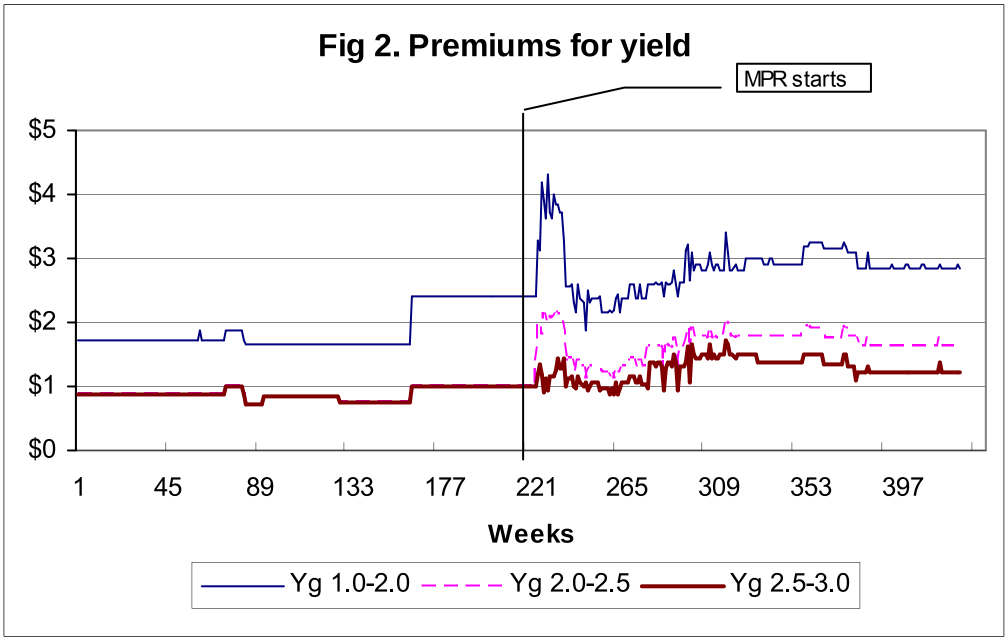

Fig 2. Premiums for yield
MPR starts
$5
$4
$3
$2
$1
$0
1
45
89
133
177
221
265
309
353
397
Weeks
Yg 1.0-2.0
Yg 2.0-2.5
Yg 2.5-3.0

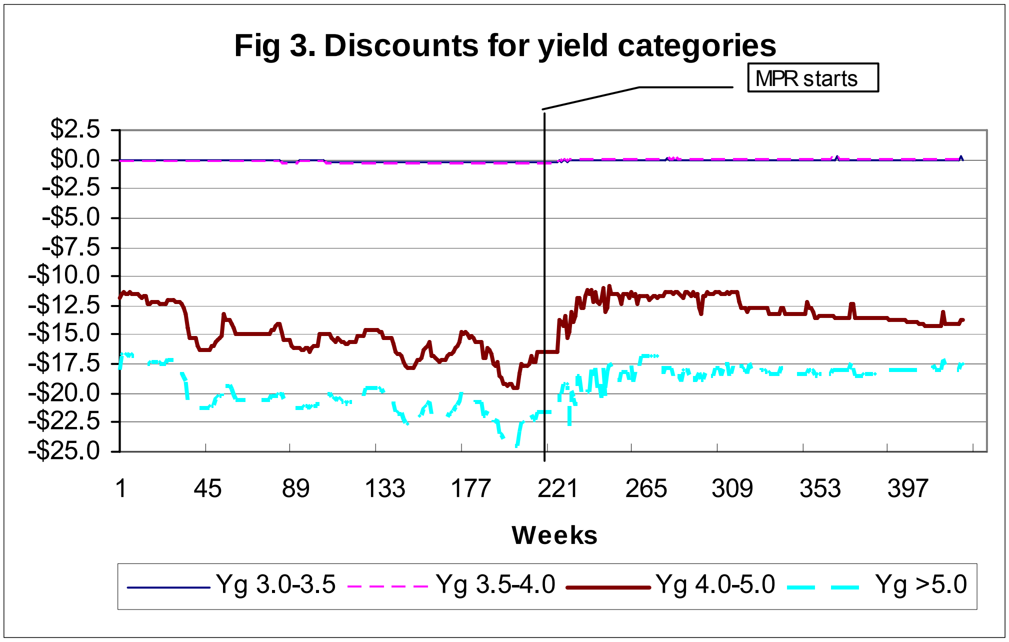
Fig 3. Discounts for yield categories
MPR starts
$2.5
$0.0
-$2.5
-$5.0
-$7.5
-$10.0
-$12.5
-$15.0
-$17.5
-$20.0
-$22.5
-$25.0
1
45
89
133
177
221
265
309
353
397
Weeks
Yg 3.0-3.5
Yg 3.5-4.0
Yg 4.0-5.0
Yg >5.0

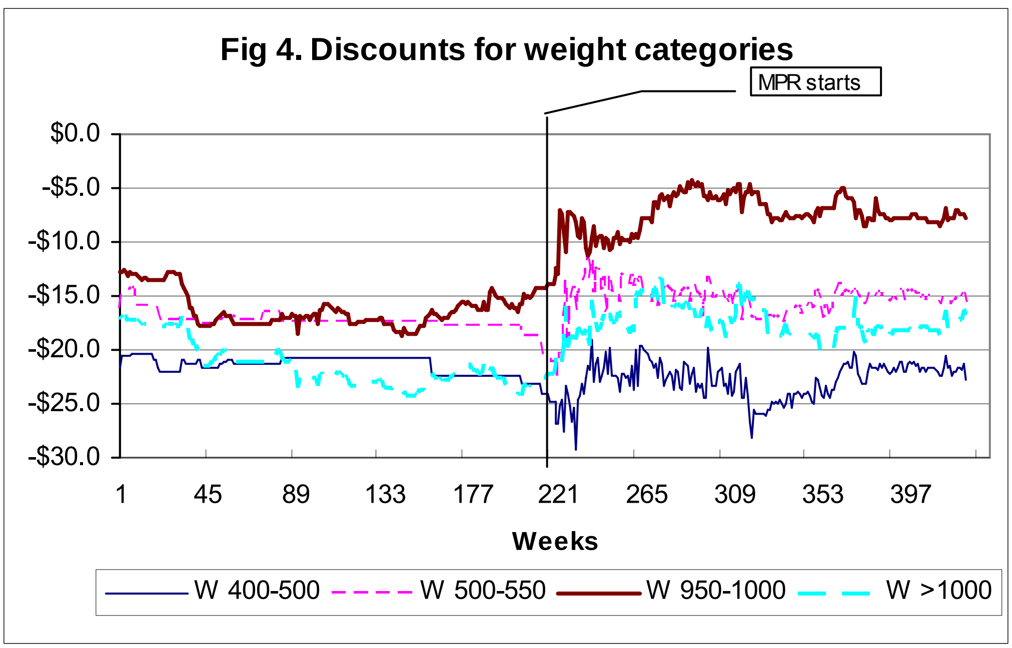
Fig 4. Discounts for weight categories
MPR starts
$0.0
-$5.0
-$10.0
-$15.0
-$20.0
-$25.0
-$30.0
1
45
89
133
177
221
265
309
353
397
Weeks
W 400-500
W 500-550
W 950-1000
W >1000