An Estimation of Rough Rice Basis in Southwest Louisiana

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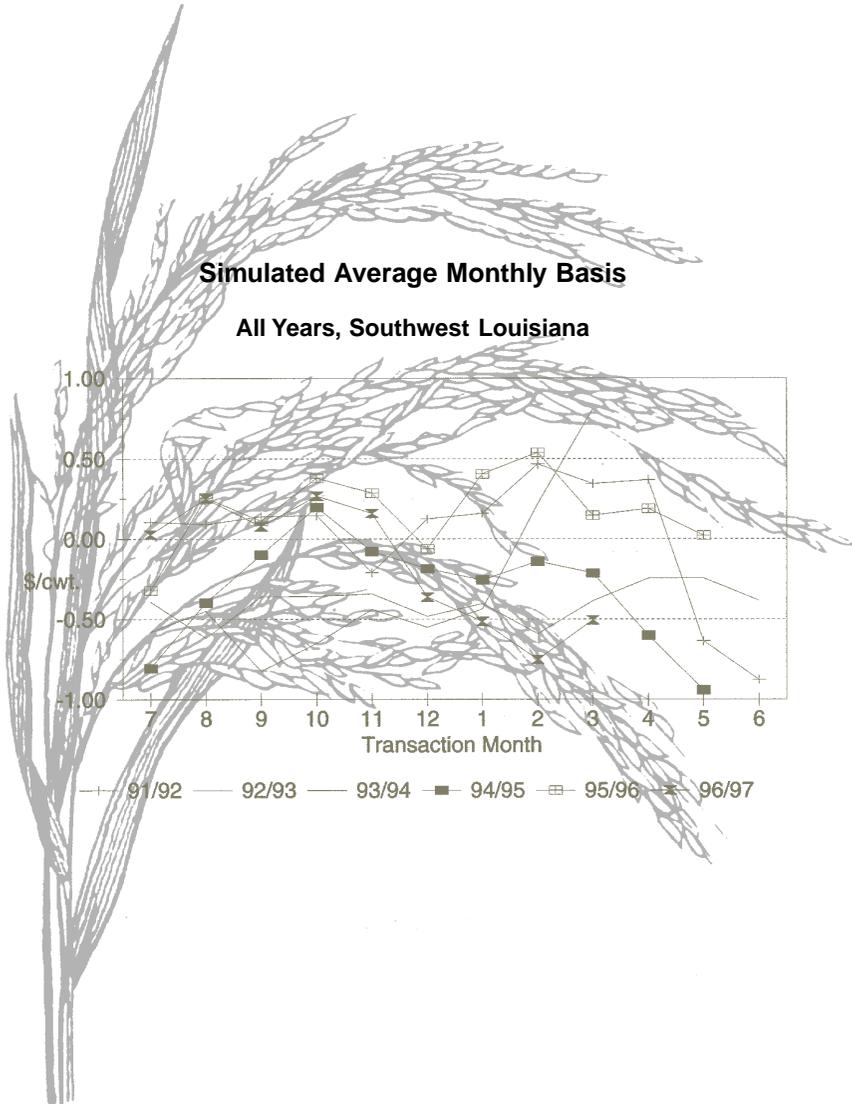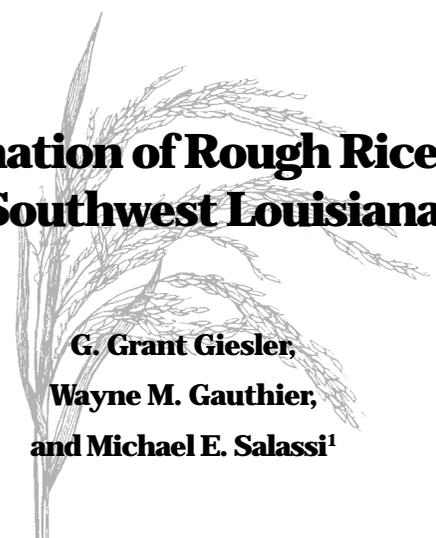
Simulated Average Monthly Basis

All Years, Southwest Louisiana

Louisiana State University
Agricultural Center
Louisiana Agricultural Experiment Station

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Introduction and Background

This report presents basis estimates for long grain rough rice in Southwest Louisiana for each of six marketing years from 1991/92 through 1996/97. Basis is the difference between a location specific cash price and nearby futures price (cash minus futures) and is an important tool used in evaluating marketing alternatives and managing price risk.[2]

The relative importance of marketing, and the use of futures markets for price discovery, as a key component of a total farm management plan, especially with respect to rice, has increased with the passage of the Federal Agricultural Improvement and Reform (FAIR) Act in 1996. This act replaced the 1990 Agricultural Act's target price/deficiency payment system with a fixed schedule of payments that will be phased out over a seven-year period. Fixed payments per hundredweight are based on program yields established by an olympic average of yields in the 1981-1985 period[3] and are decoupled from current production; a producer does not have to produce rice in order to receive transition pay-

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[2]For this report, the nearby futures price is associated with the futures contract nearest expiration, up to and including the day of expiration.

[3]The same yield upon which deficiency payments were calculated under the 1990 Bill.

ments. Under the previous farm bill, a given producer was re-
quired to plant a minimum percentage of his eligible acreage to
rice to participate in the program.

In general, the major net effects of the FAIR Act on the rice
industry can be summarized as follows:

1) Removes any floor (or ceiling) on rice production.
   Producers may plant any crop they wish and still be
   eligible for their rice FAIR payment.
2) Removes the institutional *safety net* of target prices and
   deficiency payments. Guaranteed payments do not
   change with market prices. Loan rates and loan defi-
   ciency payments remain in effect for the seven-year life
   of the Act.
3) Forces purchasers of rough rice to *buy* acreage for rice
   production from other competing crops, as opposed to
   essentially being guaranteed a minimum acreage, i.e.
   supply under the old program.

The combined result of these changes suggests a more volatile
rice market in the future, with inherently more risk associated
with it. Program mechanisms of the 1990 and previous farm bills
diminished many of the incentives for rice producers to aggres-
sively pursue alternative marketing strategies. FAIR increases the
incentives for producers to take advantage of the marketing tools
available to them.

The predominant method by which rice is marketed in South-
west Louisiana is direct, private transactions between growers
and mills. A smaller percentage of rice is sold through silent bid
public auctions conducted by the Louisiana Farm Bureau Market-
ing Association (LFBMA) and several other entities. In many
respects, rice marketing differs greatly from that of other grains.
Possible reasons for this include:

1) Rice is grown primarily for human consumption.
2) Inter-order varying, but intra-order specific, needs of
   mills in terms of quality and/or variety specifications
   required to fill current needs.
3) Relatively small geographical area where rice is grown
   in the U.S., and small market size in comparison with
   the major grains.
4) Short history of rice being traded on a futures market,

as well as real and/or perceived problems with *thinness* of that market.

5) Traditional marketing practices.

An unavoidable consequence of the current rice marketing system in Southwest Louisiana is a scarcity of publicly available information about rough rice cash prices for a specific quality of rice.[4] Without this information to establish a local basis, decisions regarding cash forward contracting, hedging, cash sales, or any other marketing strategies are more difficult than would otherwise be the case. Knowledge of the local basis is required to efficiently implement strategies made possible by these marketing tools. An inadequate understanding of local basis can lead to marketing strategies that do not augment price risk management, capitalize on predictable basis movements, or in a worst case scenario, could actually increase price risk (if basis risk is greater than cash price risk).

This study was initiated for the purpose of estimating a cash rough rice price series with quality attributes identical to, but no more specific than, those stipulated in the Chicago Board of Trade's (CBOT) rough rice futures contract. The primary goal of this study is to enhance the understanding of basis movements in Southwest Louisiana, thereby increasing the likelihood that sound marketing decisions will be made by market participants. A secondary purpose of the study was to create a historical database of cash and futures price movements that will facilitate comparison of market behavior in the pre- and post-FAIR period.

Basis Defined

"Basis is the amount that, on any given day (or any given time period), the local cash price of a commodity is above or below the current price for a particular futures delivery month.

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[4]Although the Louisiana Dept. of Agriculture publishes a list of representative sales each week from data furnished by the LFBMA, there is no calculation of a standardized 55/70 #2 long grain price. These data are published on a weekly basis. Although there may be more than one sale in some weeks, the data are combined in one report (with no specific sale date), so there is no accounting for intra-week price movements. This is required to accurately estimate basis.

When you hear someone in the grain business discuss basis, however, he is generally talking about the difference between the local cash price and the *nearest* futures delivery month."[5]

A *strong basis* is one where the local cash price is greater, relative to futures prices, than normal. <u>The cash price can still be less than the futures price in this case</u>. Conversely, a *weak basis* occurs when the local cash price is lower, relative to futures prices, than normal. <u>The cash price can still be greater than the futures price in this case</u>. As an example, if the basis at a given location in September is normally $0.40 above futures, but in a particular September is only $0.15 above futures, it would be described as positive, but weak. Basis differs from locale to locale and is generally stronger the closer one is to a delivery point or demand center for the commodity.

Determinants of basis include the following[6]:

1) Overall supply and demand of the commodity.

2) Overall supply and demand of substitute commodities and comparable prices.

3) Geographical disparities in supply and demand.

4) Transportation and transportation problems.

5) Transportation pricing structure.

6) Storage costs and availability.

7) Quality differences between deliverable grades and the cash commodity.

The local basis consists of two major components, 1) Transportation cost to par delivery markets (futures delivery points), and 2) Carrying or handling charges (storage cost, insurance, interest), which take into account all of the above determinants.

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[5] Direct quote from "Understanding Basis". The nearest futures delivery month referred to in this statement is the next contract month excluding the current month. The statement "(or any given time period)" was added by the authors.
[6] The remainder of this section draws heavily on Hollier and Hudson.

Rice Milling Grades

Rice milling grades are expressed in pounds of head rice (unbroken grains) per hundredweight, pounds of total rice per hundredweight, and a single digit number ranging from 1- 6 indicating the combined effects of red rice, chalk, heat damage, etc. on the overall quality of the rice (1 being highest quality, 6 being lowest).[7, 8] For example, 100 pounds of rough rice with a 52/68 #2 milling grade consists of 52 pounds of head rice, 68 pounds of total milled rice (or 68-52=16 pounds of broken rice), with an overall quality rating of #2. The method by which the quality rating is established is relatively sophisticated. An in-depth description of the standards and procedures utilized can be found in USDA grading publications.[9]

Because of differences in grading standards (which evolved as a function of physical differences between commodities), developing a cash price series for rice is somewhat more complex than for other grains. This is because the numerical grade for other grains establishes minimum values of quality *and* quantity per sales unit. As an example, a U.S. #2 grade for wheat specifies values for minimum test weight per bushel and maximum limits on all types of damaged kernels (including brokens) and all other foreign material. Although there may be special cases, many times a buyer simply needs to know the grade to make an informed decision on whether to attempt purchase or not. A rice numerical quality grade conveys no quantity per sales unit information at all, except a minimum of 25% head rice. To convey the same information about a unit of rice as the grade does for wheat, three variables (head rice, total rice, and grade) are required.

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[7]There is also a *sample grade* category which is of less quality than 6. It generally occurs infrequently and was excluded from the data set.

[8]Head rice is defined as all kernels longer than 75% of the length of unbroken kernels. Broken rice consists of all kernels less than 75% of the length of unbroken kernels.

[9]U.S.D.A. GIPSA Federal Grain Inspection Service Standards.

Importance of Quality in Determining Price

The role of milling grade in determining price should not be underestimated. Figure 1 shows actual LFBMA cash sales of all qualities of long grain rough rice plotted with nearby futures prices for the 1993/94 marketing year. This particular year was chosen because of its price extremes. Casual observation clearly shows that even in the low price period, deviations in prices based on quality of more than $1.50 per hundredweight were quite common. These deviations were magnified as average prices increased over the course of the year.
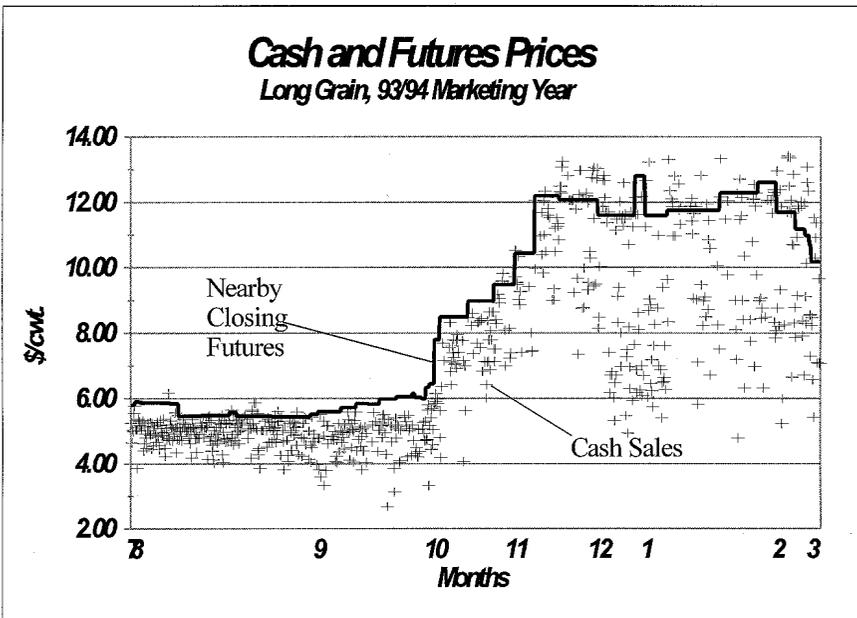

Cash and Futures Prices
Long Grain, 93/94 Marketing Year

Figure 1

Previous Work

Several previous studies in the Department of Agricultural Economics and Agribusiness have addressed different aspects of rice marketing issues in Southwest Louisiana.

Martinez, Traylor, and Fielder estimated the effects of quality and non-quality factors on medium and long grain rice prices for

the marketing years 1968/69 through 1973/74. Using regression analysis, they explored the individual impact each grading factor (red rice, chalk, foreign seeds, damage, and other) had on the single numerical grade under both Louisiana Grain Exchange and federal government grading systems, and on the competitive bid price. For medium grain, they determined that all factors affecting grade except "other" over the study period were significant. For long grain, all five factors were significant. However, in the price prediction model, the only factor that significantly affected price was red rice. Based on these findings, they questioned whether some of the other factors could be combined to facilitate streamlining the grading process.

In an earlier, similar study, O'Carroll and Traylor also used regression analysis to estimate the impact of grade factors on determining grades and on determining sales prices of medium grain rice in the 1968/69 and 1969/70 marketing years, respectively. Due to their interpretation that the coefficient of determination estimates from their model were low, they concluded that the marketing of medium grain rice in these marketing years was carried out in only a "moderately systematic" manner. The primary weaknesses they identified in the pricing system were the relationships between grade and price, grade factors and price, and between grade factors and grade.

Gandy and Traylor conducted a study examining potential benefits to the rice industry of commingling like qualities of rice, as opposed to holding each lot separately based on ownership (producer). In addition to the savings realized from more efficient use of drying and storage facilities, they found a significant increase in sales price per barrel for larger lot sizes. In 1966, the average increase was $0.20 per barrel for 2,200 barrel lots versus 1,200 barrel lots.

Hollier and Hudson examined the potential for cross-hedging rough rice with a proposed milled rice contract.[10] Because no actual data were available, it was necessary to simulate futures

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[10]Cross-hedging is the pricing of a cash commodity using the futures market of another commodity. There must be a definable and predictable relationship between the two commodities.

prices. Using risk ratio analysis, they concluded substantial price risk reduction would result from cross-hedging either medium or long grain rough rice with a long grain milled contract over the period modeled (1977-1980).

Gleason, Traylor, Zacharias, and Lange studied the potential for cross-hedging long and medium grain rough rice with the soft red winter wheat futures contract. They determined that during the 11-year study period, 1.341 and 1.357 bushels of September wheat futures were necessary to offset one hundredweight of long and medium grain rough rice, respectively, in the cash market and that there was a direct price relationship between wheat futures and rice cash prices. They concluded that the cross-hedge studied appeared to be a viable marketing option for many Louisiana rice producers over the 1975-1984 period.

Denison, Zapata, and Traylor evaluated the efficiency of the rough rice futures market during the first 18 months of its existence (marketing years 1986/87 and 1987/88). Using two different models (correlation of changes and second order autoregressive), they found market efficiency improved over this period, but further improvements were possible. The correlation model showed futures prices were not random in 1987/88 (a negative), but "with respect to future and cash price correlations, market efficiency improved during the second year."

In a study conducted in Texas, Covey and Bessler proposed a method of testing for Granger's full causality between cash and futures markets. Using prequential analysis, they analyzed the time-ordered relationship between the daily average slaughter cattle cash price for Texas-Oklahoma direct sales and the daily settlement price for the nearby live cattle futures contract. Results showed that "based upon at least one of the two forecast criterion in each period, a fully causal effect may be inferred from today's settle price for the nearby live cattle futures to tomorrow's average price for Texas-Oklahoma slaughter cattle."

Excluding the last study, although each of these studies addressed some important aspect of rice marketing, none of them specifically addressed basis (although a hypothetical basis had to be estimated to accomplish the goals of several of them) because, during the period they were conducted, there was no viable

futures market for rice. The CBOT rough rice futures contract did not begin trading until 1986. The last study analyzed the relationship between cash markets and futures markets for slaughter cattle but provides inferential evidence that is applicable across other commodities.

Data, Methodology, and Procedure

Silent bid auction data for each marketing year analyzed were furnished by the Louisiana Farm Bureau Marketing Association's office in Crowley. The sales sheet data comprised the following variables: 1) sale date, 2) lot number, 3) bin number, 4) approximate location, 5) variety, 6) lot size in hundredweight, 7) milling grade, 8) estimated loan deficiency payment (where applicable), 9) bid prices of all buyers who chose to bid on that particular lot, 10) loan value, 11) high bid converted to barrels (162 lbs), and 12) disposition, indicating if highest bid was accepted or rejected.

Only actual, accepted sales were used in this analysis, because a bid in and of itself does not constitute a market. A market consists of the concurrence of a buyer and seller agreeing on the value of a product. This concurrence did not transpire if the highest bid was rejected by the seller.

The bid prices were f.o.b.[11] buyer's truck at the seller's storage site. Although there was some degree of storage location information included in the data, it was not specific enough in describing the location of each lot to be used. Moreover, the purpose of this analysis was to estimate a general basis level for the Southwest Louisiana rice area, not for a specific location within this area. The assumption explicitly made was that the lots were evenly distributed throughout the area. Selected descriptive statistics for each year's data are presented in Table 1. These values are lot means, that is, they are not weighted by quantity per lot.

Several observations can be made from Table 1. First, rice quality has increased in terms of head rice but remained rela-

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[11]Delivered by the seller aboard the mode of transport at the point of shipment, without charge to the buyer.

Table 1. Selected Descriptive Statistics

Marketing Year	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97
No. of Observations	2026	1365	1141	825	791	583
	Non-Weighted Mean Values:					
Price ($/cwt.)	7.56	5.65	7.25	6.25	8.92	10.54
Head Rice (lbs./cwt.)	51.97	53.55	51.67	56.31	56.04	57.59
Total Rice (lbs/cwt.)	68.81	67.77	67.92	67.70	67.39	68.94
Grade (1-6)	2.26	2.50	2.44	2.71	2.69	2.48
Previous Days						
Closing Futures Price ($/cwt.)	8.13	6.33	8.76	6.74	8.97	10.76
Grain Length (0 or 1)	0.59	0.78	0.67	0.75	0.87	0.91

tively steady in terms of total rice and grade over the last several years. Secondly, because grain length was represented in the data set by a 0 or 1 for medium and long grain, respectively, the per-cent long grain has fairly steadily increased over time. Some caution is necessary in the interpretation of this data, however, since it is based only on actual sales of rice sold through the LFBMA auction, and is not a scientific sample of rice grown or sold in the state.

Ordinary least squares regression analysis was used to determine the impact of the selected independent variables on the dependent variable (price). Regression is a well known economet-ric technique, and therefore, no attempt will be made to explain the workings of the underlying mathematics. It is a method of quantifying the impacts of given independent (explanatory) variables on a dependent variable. The usefulness of the tech-nique is enhanced because of its ability to simultaneously esti-mate the impacts of many independent variables on a dependent variable. The SHAZAM econometrics computer package was utilized for this analysis.

As indicated previously, this analysis was intended to esti-mate basis for rice using variables no more specific than those specified in the CBOT contract. To use variables any more specific

than this would imply a higher level of knowledge about price relationships between different qualities of rough rice. Moreover, these relationships are subject to change based on prevailing market conditions during and between marketing years. The applicable specifications for the rough rice contract traded on the CBOT are as follows:

Trading Unit: 2,000 hundredweight

Deliverable Grades: U.S. No. 2 or better long grain rough rice with a total milling yield of not less than 65% including head rice of not less than 48%. Premiums and dis counts are provided for each percent of head rice over or below 55%, and for each percent of broken rice over or below 15%.

Based on these specifications, the following equation was hypothesized:

Cash Price = ƒ (head rice, broken rice, and grade)

Monthly indicator (dummy) variables were added to incorporate effects of seasonality, while the previous day's closing nearby futures price was included to provide for an indicator of the general price level of rice. The general equation estimated for each marketing year was as follows:

Cash Price = ƒ (hr, tr, gr, ivgl, fp_{t-1}, ivm)

where: hr = head rice, tr = total rice, gr = grade, ivgl = 0 or 1 indicating medium or long grain, fp_{t-1} = previous days closing futures price (nearby contract), and ivm = 0 or 1 indicating month lot was sold.

Total rice was substituted for broken rice in the general equation due to the high degree of inverse correlation between head rice and brokens. Because total rice is the sum of head rice and brokens, there was no loss of information due to this substitution. The indicator variables were used to account for price differences between long and medium grain and to more accurately reflect changes in the relationship between cash and futures during the course of a marketing year. Lot size was not used because it is not specified in the contract in a fashion that would impute an intrinsic value to it because a deliverable contract could consist of many combined small lots.

There could be some question of causality due to the inclusion of futures prices as an independent variable, i.e., do futures drive cash, or cash drive futures. In response to this, the contention is made that chronological ordering, forced by using the previous day's closing futures price, addresses this concern. Because of the pervasiveness of hedging by most grain marketing firms, in many cases it could probably be argued (in an operational sense) that the futures market is the single most important factor driving their daily cash price offers. Of course, underlying market fundamentals provide ultimate direction for both markets.[12]

The basic procedure followed for each marketing year was to run the model with all possible variables (indicator variables for every month except one) included. The initial month excluded as an indicator variable was the one with the fewest sales. After this point, additional months were excluded whenever the coefficients associated with them were insignificant or they caused multi-collinearity problems within the model. This iterative process continued until all monthly indicator variables were significant.[13] It should be noted that statistical significance was not required of the other independent variables. In fact, economic significance could be attached to the finding that any of them was statistically insignificant in a given marketing year.

The best fitting model was determined for each year in terms of predictive capability, significant indicator variables, and acceptable ranges on model diagnostic statistics. The next step was the substitution of contract-specified values for head rice, total rice, and grade into the predictive equation, to calculate an estimated, standardized 55/70 #2 cash price for each sale date. For any given year, the equation becomes:

$$\text{Predicted Cash Price} =$$

$$55hr + 70tr + 2gr + IVGLgl + FP_{t-1}fp + \{(IVM1\ldots11)*(mth1\ldots mth11)\}$$

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[12]The causality relationship referred to in this paragraph appears to be very similar to that investigated by Covey and Bessler.

[13]Significance was ascribed to an independent variable if its T-ratio was greater than a critical T-value at the 0.025 confidence level of 1.980 with 120 degrees of freedom (critical value of 1.960 at ∞). A correlation coefficient equal to or greater than 0.8 was interpreted to indicate multi-collinearity existed between two independent variables.

where: hr = estimated head rice coefficient

        tr = estimated total rice coefficient

        gr = estimated grade coefficient

        gl = estimated grain length coefficient[14]

        fp = estimated futures price coefficient

        mth = estimated coefficients for each respective month indicator variable (actual number used varies from year to year)

Results

Graphic results for all years by sale date and by monthly average are presented in figures 2 through 13. Table 2 shows contract volume and open interest data, while tables 3A, 3B, and 4 show results in tabular format. Table 5 shows coefficient estimates and, selected variable and model statistics for each year. Complete output tables from each regression run are provided in Appendix tables 1-6. Each point in figures 2-13 and tables 3A and 3B corresponds to one sale date, while Figure 14 and Table 4 show monthly averages. Confidence intervals expressed as percentages of the coefficient estimates are presented in Figures 15-21. The number of sales LFBMA conducts varies between months, which explains the unequal distribution of points among months. The impact of this on the robustness of predictions will be discussed in the limitations.

1991/92 Marketing Year

Futures, estimated cash prices, and simulated basis for the 1991/92 marketing year are presented in figures 2 and 3. Figure 2 shows estimated cash price levels during this year were above $8.00 per hundredweight until April, decreased to the $7.75 range in April, and were lower thereafter. Estimated basis levels were positive until the last part of April, except for a brief period in November. One possible explanation for the sharply weakening

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[14]The value of ivgl is effectively one because a long grain price was being estimated.
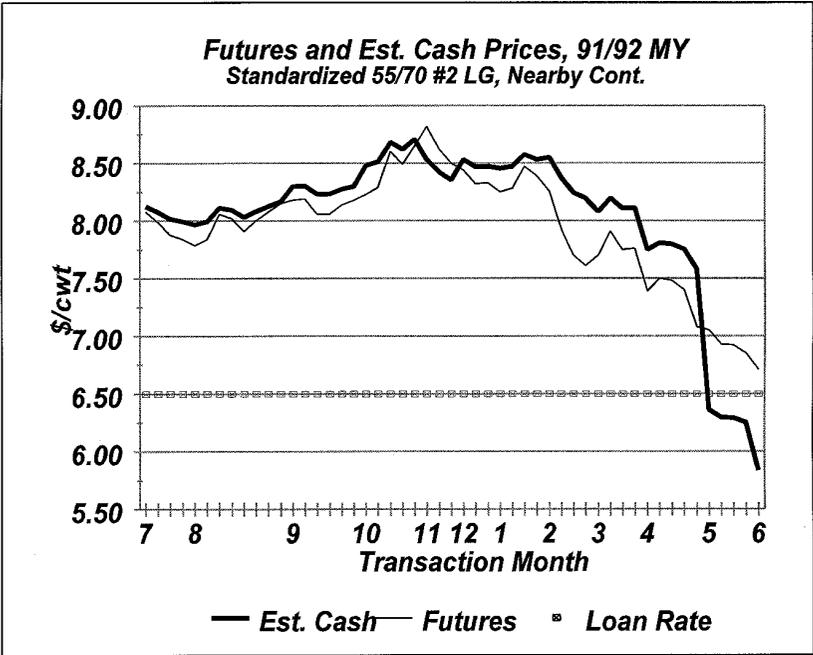
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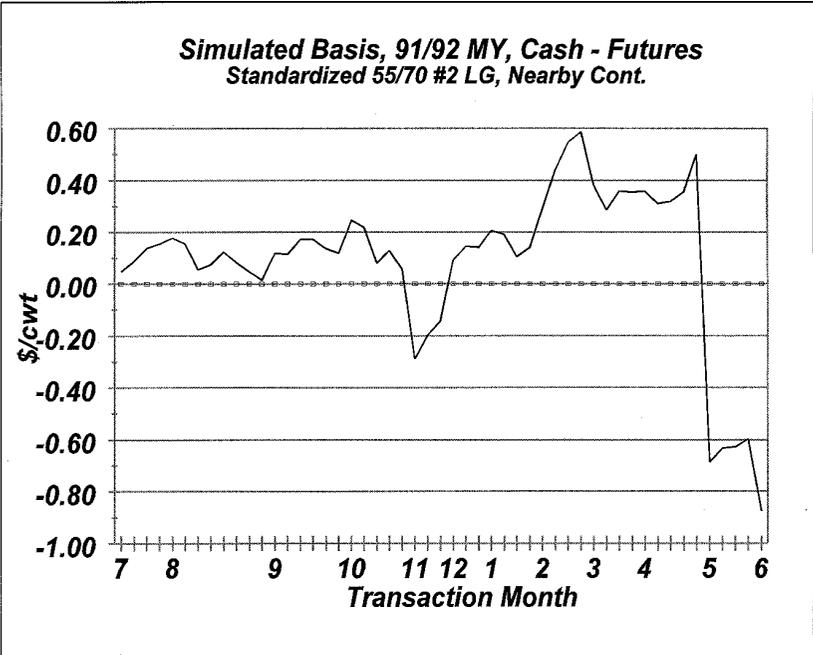
Figure 3

basis during the November period is that it coincides with futures market highs for this year and the sharp rise in futures the preceding week. Given these factors, a relatively weak basis is not uncommon and would not be unexpected. The drastic drop in basis at the end of April should be discounted because of 1) the limited amount of rice sold, 2) end of year bin clearing, and 3) the transition between old and new crop years, coupled with fact that the average market price during 1992 was approximately $2.00 per hundredweight lower than that of 1991.[15] Total absolute variation in the estimated cash price and basis series is $2.87 and $1.46, respectively.

1992/93 Marketing Year

Futures, estimated cash prices, and simulated basis for the 1992/93 marketing year are presented in figures 4 and 5. Figure 4 shows estimated cash price levels during this year were slightly
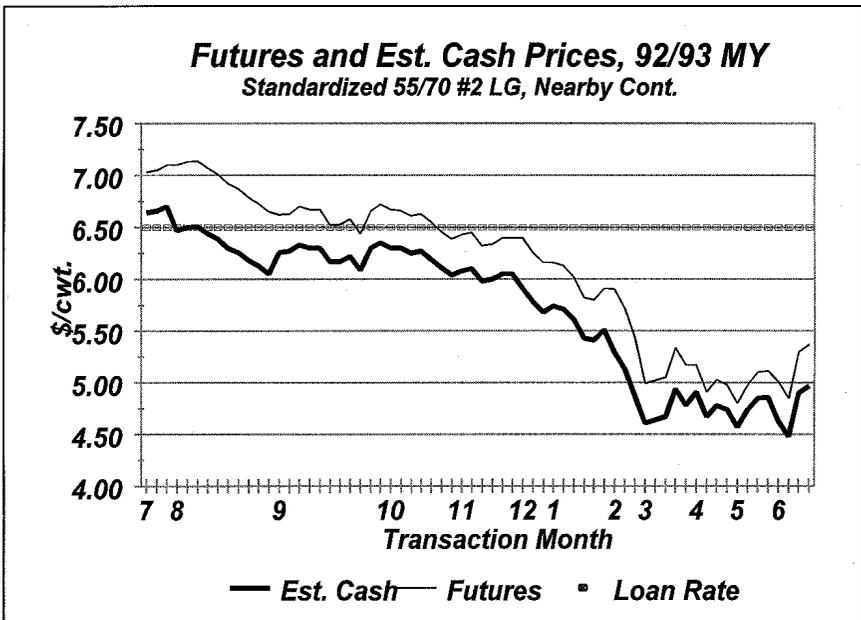
Figure 4

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[15]Zapata and Frank.
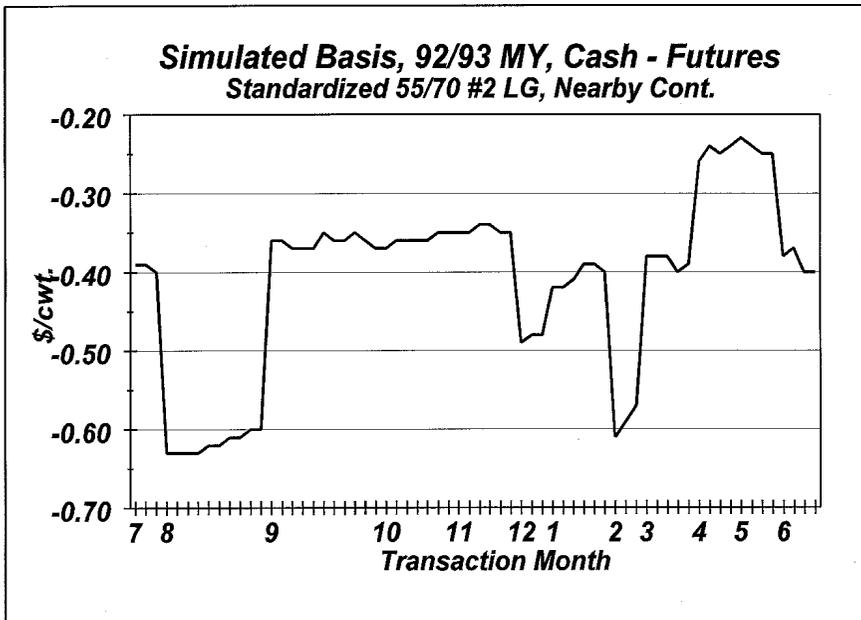
Figure 5

above the loan rate at the very beginning of the year and trended downward throughout the year, falling below $5.00 per hundredweight in the last five months of the marketing year. Estimated basis levels were relatively steady, but negative, throughout the entire year. Total absolute variation in the estimated cash price and basis series is $2.22 and $0.40, respectively.
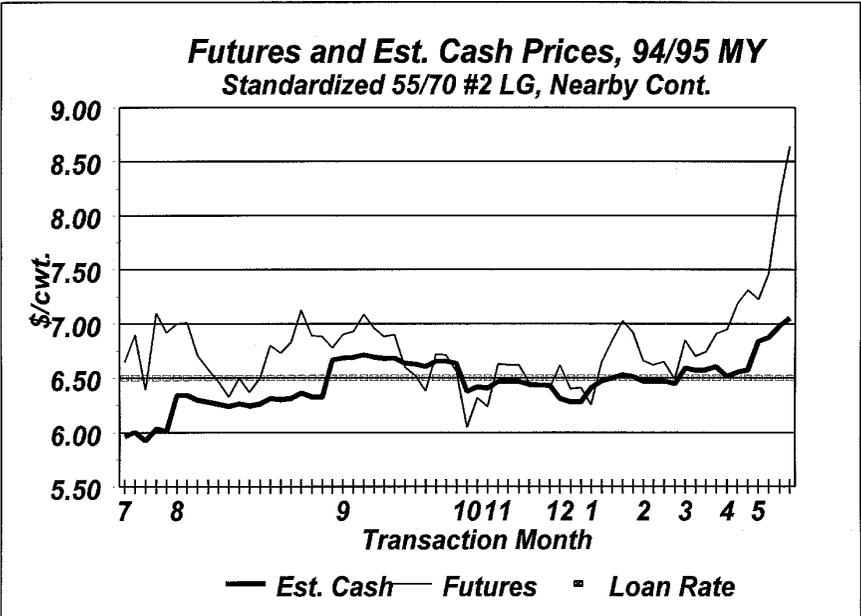
1993/94 Marketing Year

Futures, estimated cash prices, and simulated basis for the 1993/94 marketing year are presented in figures 6 and 7. Figure 6 shows estimated cash price levels during this year were below $6.00 per hundredweight through the end of September but more than doubled thereafter. This drastic price rise was associated with a Japanese crop failure and their subsequent purchase of large amounts of rice. This fundamental change in the market necessitated the estimation of two separate regression equations for this year, one for the pre-October period and one for the remainder of the year.

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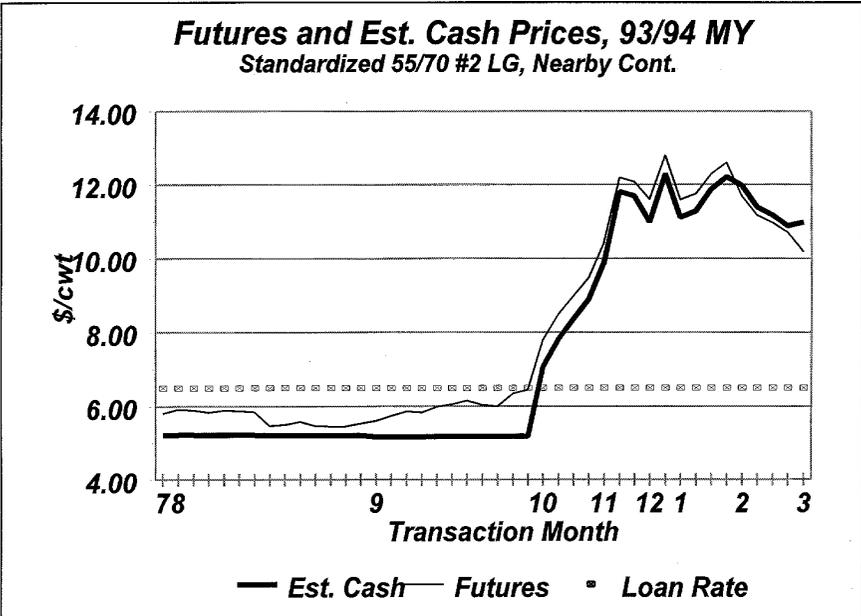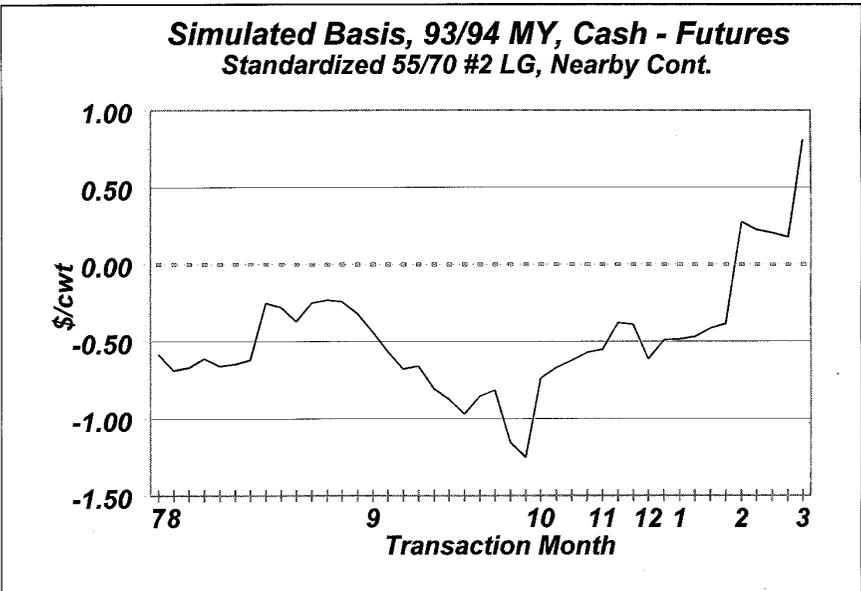
Figure 6

Figure 7

Because 1993/94 was such an atypical year, it may seem that it would be somewhat difficult to infer very much useful information about basis from it. This is partially true, but two critical inferences can be made. The first being, based on the pre-October equation for this year, ***when cash market prices are below the loan rate, futures prices can sometimes be statistically insignificant in predicting cash prices***, thereby totally disqualifying the use of futures markets for reducing price risk during these periods because there is no discernable relationship between the two series.[16] It is obvious from the figures that variation in basis is greater than that of cash price from July to October in this marketing year. The second inference that can be made from the October through March period in this year is that ***during periods of sharp price rises and instability, basis will tend to be weaker than normal*** (this is seen in some of the other years on a short term basis). Total absolute variation in the estimated cash price and basis series is $7.16 and $2.06, respectively.

1994/95 Marketing Year

Futures, estimated cash prices, and simulated basis for the 1994/95 marketing year are presented in figures 8 and 9. As shown in Figure 8, estimated cash price levels during this year initially were around the $6.00 level, but they gradually trended slightly upward throughout the year. As in the first part of 1993/94, loan rate interactions make it difficult to infer very much useful information about basis during this year, except to reemphasize that when cash prices are near or below the loan rate, the importance of basis in reducing price risk can be greatly diminished. For this year, futures prices are only slightly statistically significant in predicting cash prices relative to years in which cash prices are above the loan rate. Total absolute variation in the estimated cash price and basis series is $1.13 and $1.91, respectively.

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[16]The T-ratio for futures price in this equation is 0.6473.
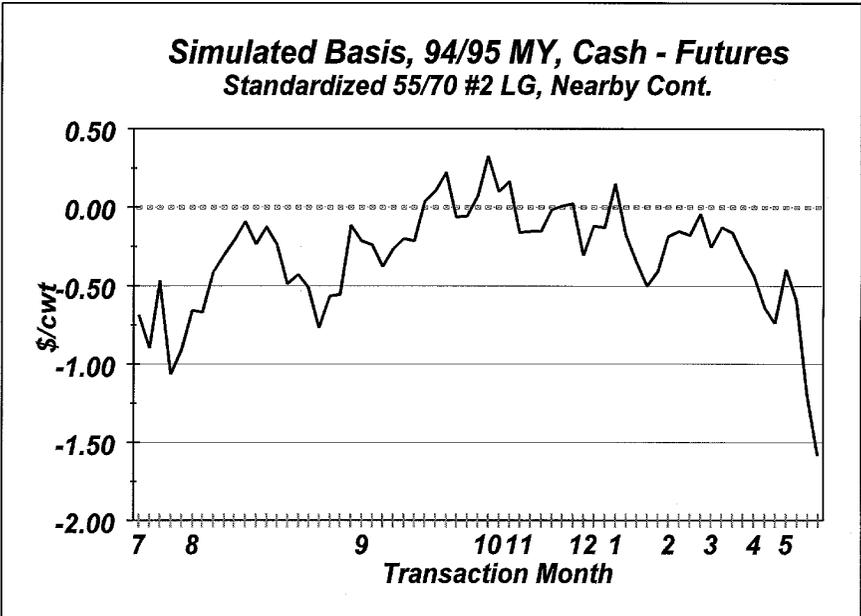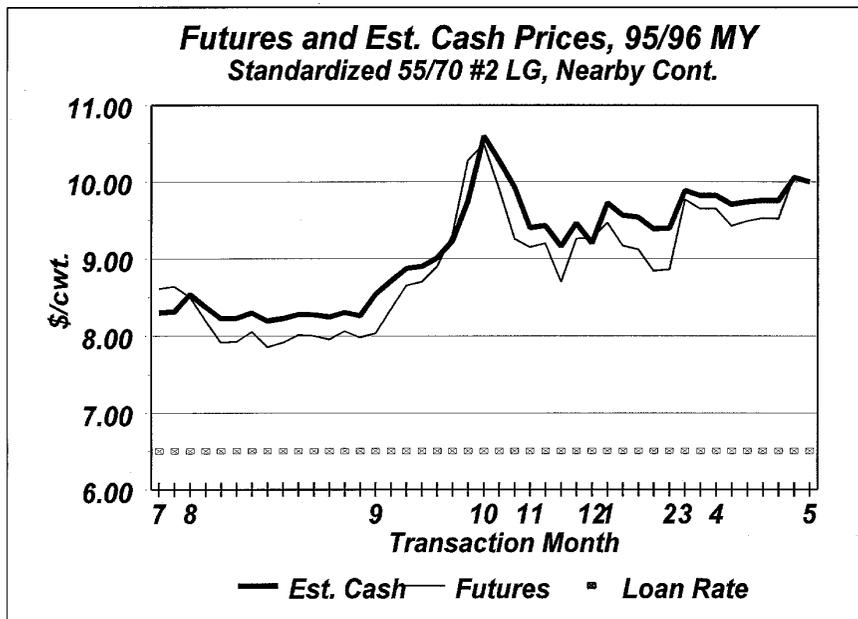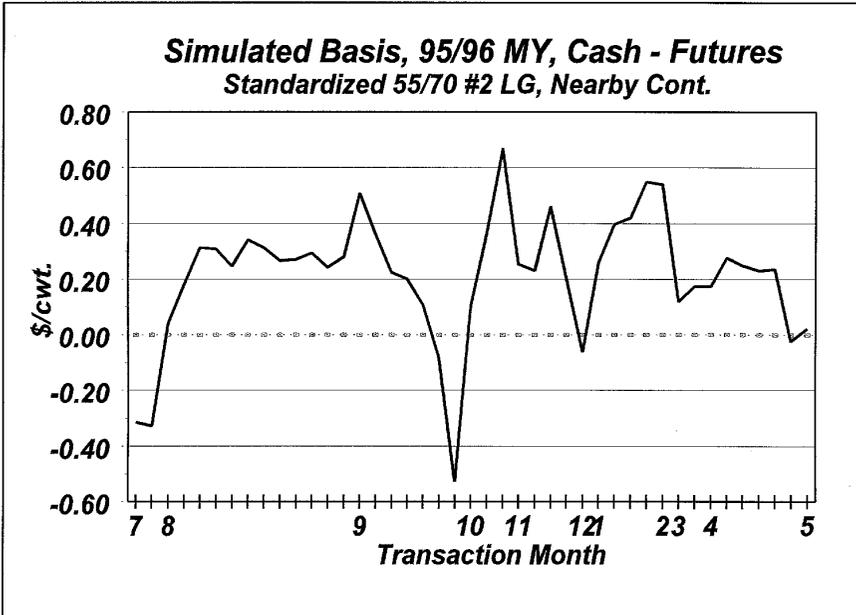
Figure 8

Figure 9

1995/96 Marketing Year

Futures, estimated cash prices, and simulated basis for the 1995/96 marketing year are presented in figures 10 and 11. As shown in Figure 10, estimated cash price levels during this year were well above the loan rate and ranged from a low of $8.19 per hundredweight to a high of $10.59 per hundredweight. After briefly being negative at the beginning of the marketing year, estimated basis levels were generally positive throughout, except for short negative periods at the end of September and also in December. The sharply weakening basis estimates for both of these periods correspond with sharp increases in futures prices, and as discussed for other years, it is not unexpected that basis would tend to weaken during these short term periods. Total absolute variation in the estimated cash price and basis series is $2.40 and $1.20, respectively.

Figure 10

Figure 11

1996/97 Marketing Year

Futures, estimated cash prices, and simulated basis for the 1996/97 marketing year are presented in figures 12 and 13. As shown in Figure 12, estimated cash price levels during this year were well above the loan rate and relatively stable through December. During the entire year, they ranged from a low of $10.09 per hundredweight to a high of $11.43 per hundredweight. Basis was positive in the beginning of the year and remained so except for a few isolated negative occurrences until December. It was negative in January through March of 1997. As in other years with extended periods of negative basis (when prices are above the loan rate), this occurred while futures were rising rapidly. Total absolute variation in the estimated cash price and basis series is $1.35 and $1.26, respectively.
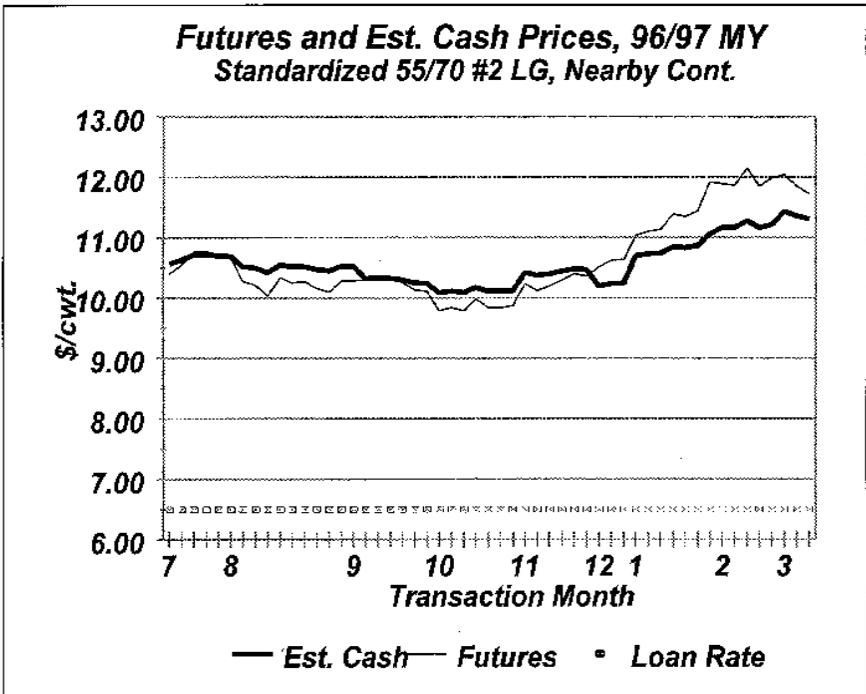
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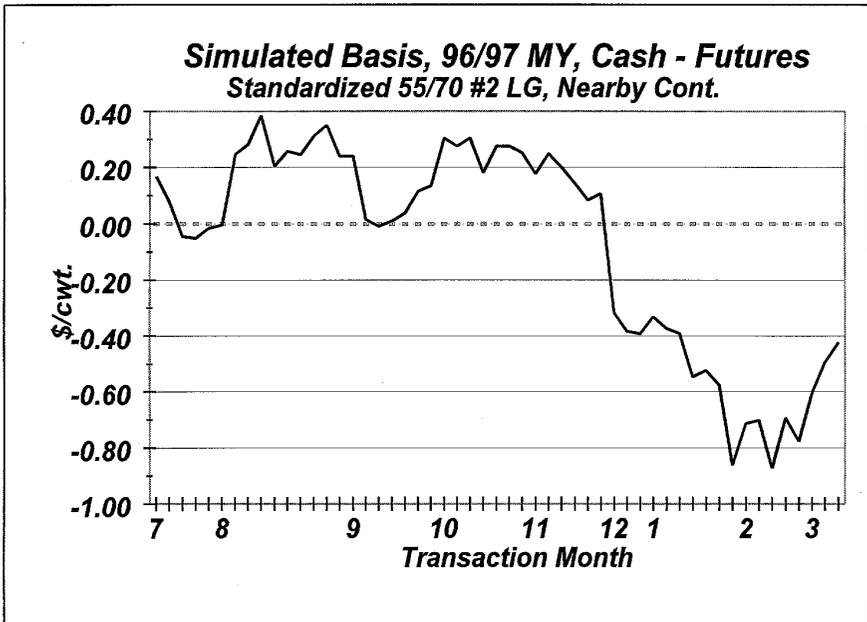
Figure 13

Changes in Contract Volume and Open Interest

There are important differences in simulated basis between years or periods of years when cash prices are near or below the loan rate. The 1992/93 marketing year experienced a consistently negative, but relatively steady basis, while the first three months of 1993/94 and the entire 1994/95 marketing year possessed a generally strongly negative basis combined with an extremely high degree of variation relative to variation in cash prices. Insight into possible reasons for this can be found in differences in contract volume and open interest between marketing years. Contract volume and open interest data for each marketing year are shown in Table 2.

As shown in Table 2, contract volume/open interest ratios as expressed in the weighted average column range between 14% and 15% in the last four years in this study but are only 10.11% and 11.77% in the first two years, respectively. These ratios are a basic measure used in the trade to gauge the level of commercial participation in the market (lower ratios indicate more commercial hedging activity, while higher ratios indicate relatively more speculative activity[17]). While no proof is being offered, the proposition being put forth is that higher levels of speculative activity relative to strictly commercial activity can contribute to increased basis volatility if the increased number of transactions is not offset by a directly corresponding increase in liquidity. The suggestion is made that differences between basis estimates in the aforementioned years when prices were near the loan rate are a function of the combination of distortionary effects of the loan rate combined with relatively more speculative activity in the latter two years.

All information contained in figures 2-13 is presented in tables 3A and 3B.

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[17]"...if a contract experiences relatively low volume levels but high open interest, it is generally assumed that commercial participation is high. This is because commercial hedgers tend to use the markets for longer term hedging purposes, putting their trades on and keeping them until they're no longer needed to manage a given risk. Conversely, high volume with low open interest tends to indicate more speculative activity. This is because the majority of traders prefer to get in and out of the market on a daily basis." (Direct quote from "Trading in Futures, An Introduction for Speculators").

Table 2. Contract Volume/Open Interest Ratios by Marketing Year.

Futures and Est. Cash Prices, 95/96 MY
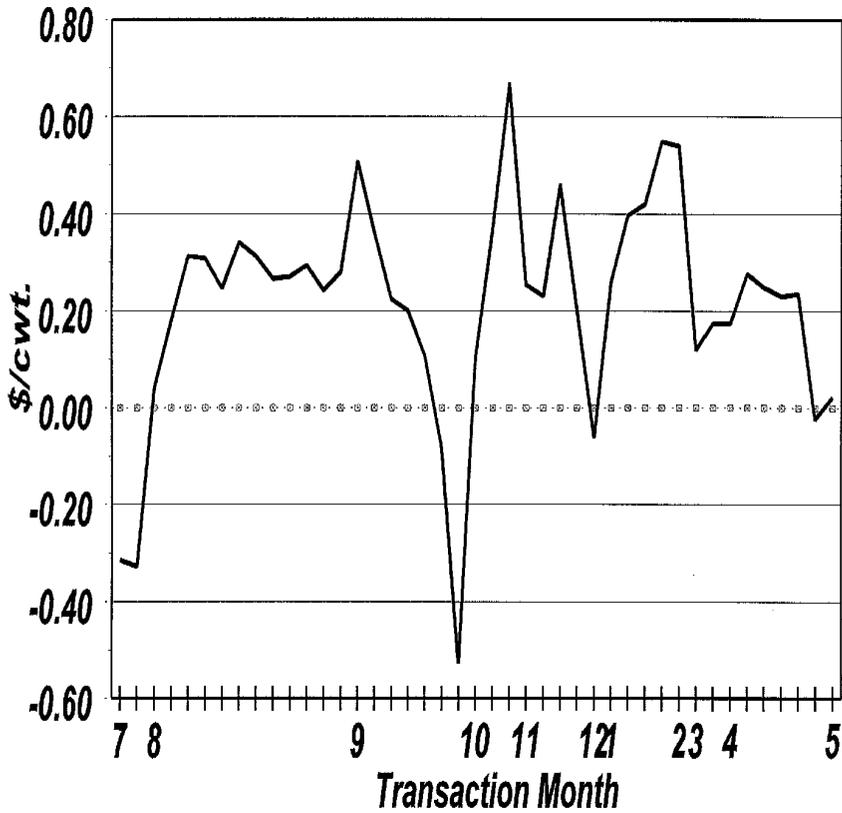### Standardized 55/70 #2 LG, Nearby Cont.
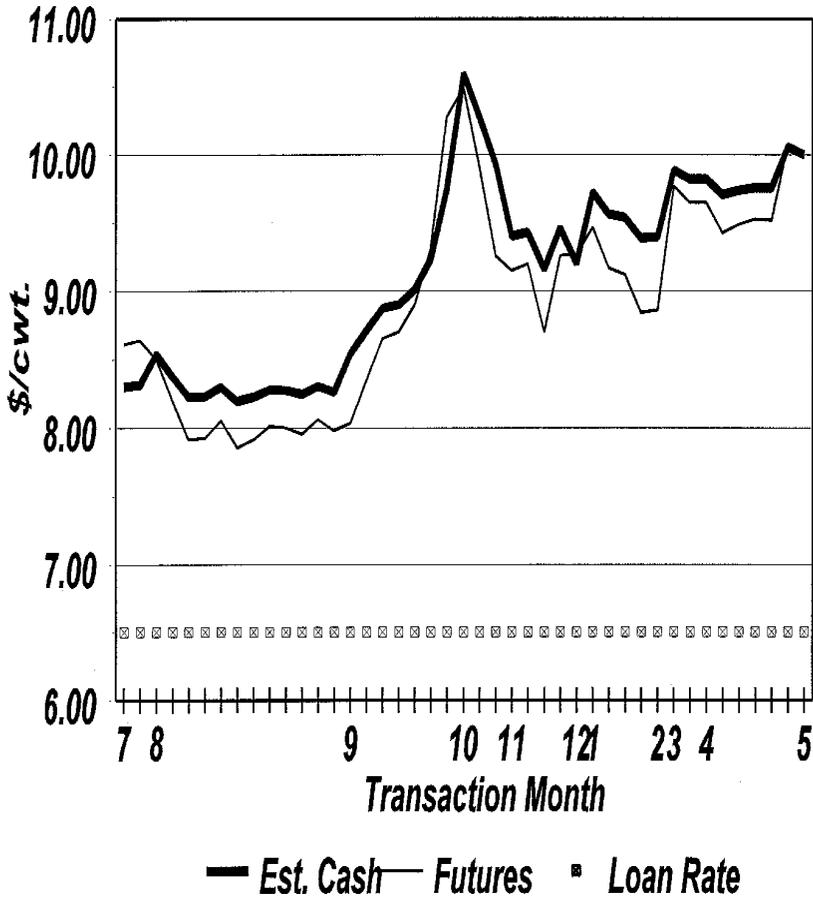
Figure 11

Table 3A. Estimated Cash, Futures, and Simulated Basis for each Marketing Year

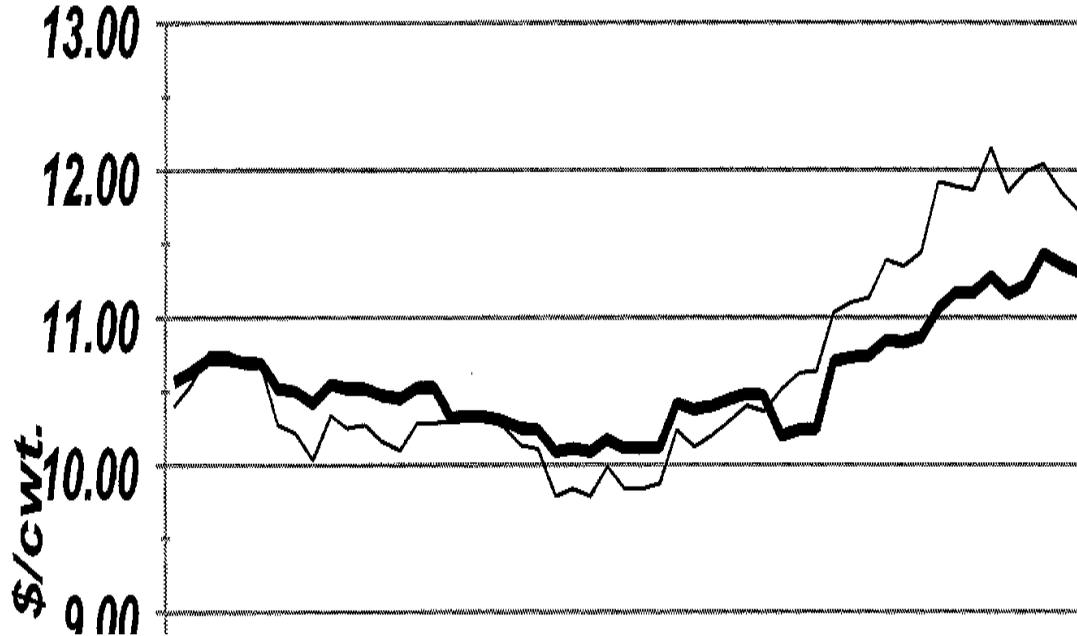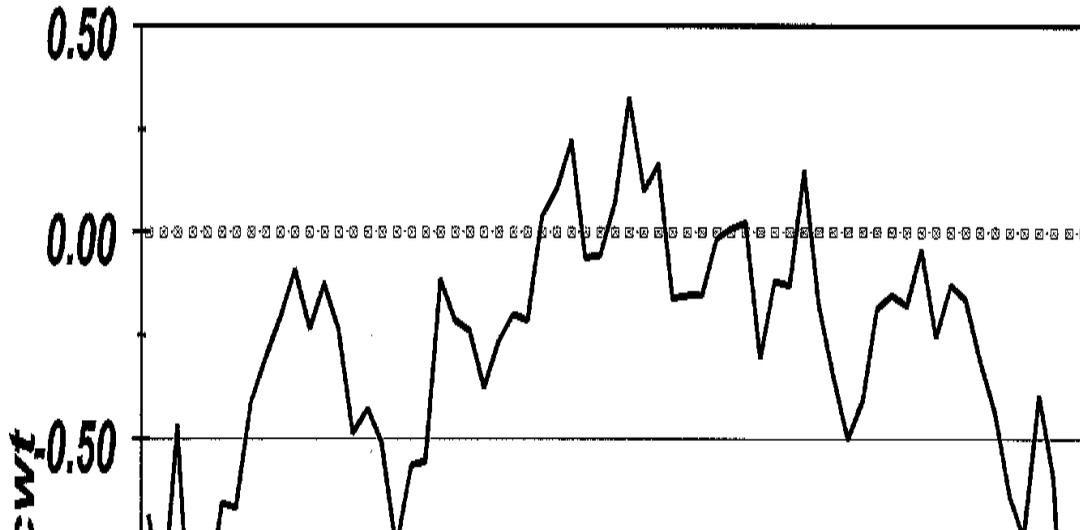Futures and Est. Cash Prices, 96/97 MY
Standardized 55/70 #2 LG, Nearby Cont.

Figure 2

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Table 3B. Estimated Cash, Futures, and Simulated Basis for each Marketing Year

Simulated Basis, 94/95 MY, Cash - Futures
Standardized 55/70 #2 LG, Nearby Cont.

Figure 8

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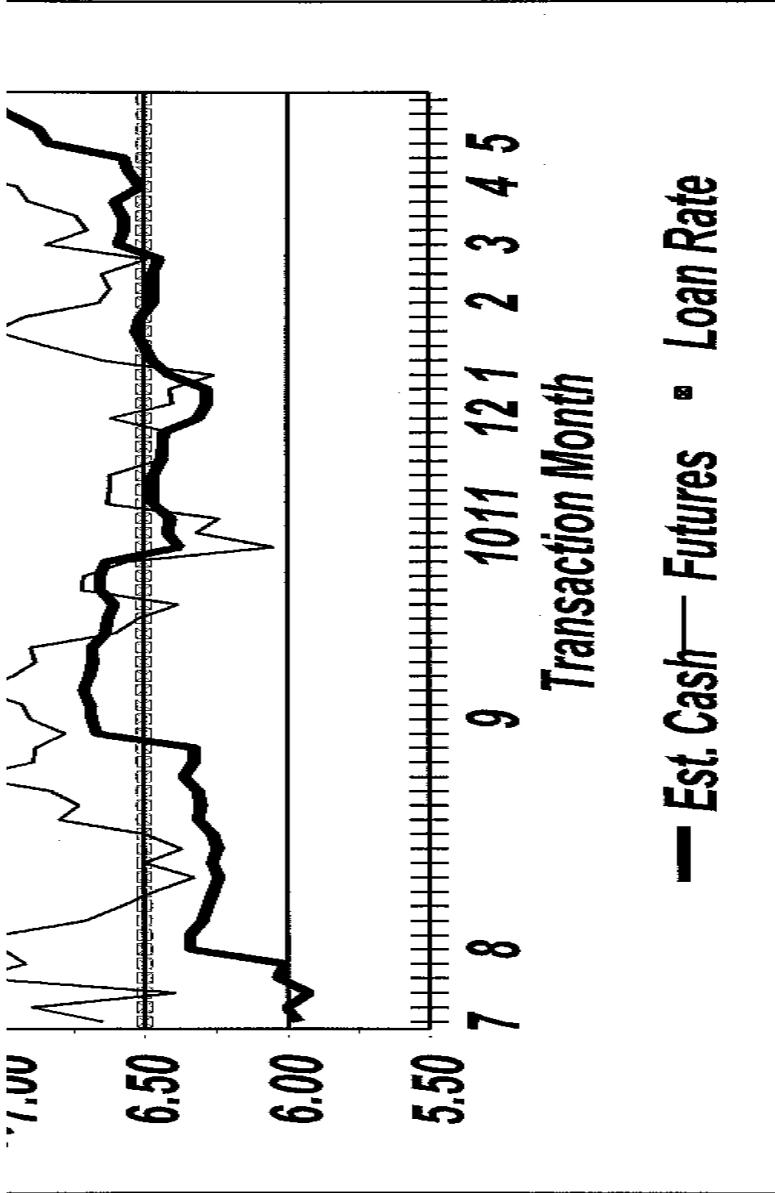
Monthly Average Basis Estimates

The preceding discussion has focused on simulated basis estimates associated with each sale date, which could be referred to as *point* estimates of basis because they are associated with a specific day. While they are necessary to arrive at an estimate of basis, the usefulness of any one of these point estimates in terms of the confidence one can place in them for forecasting what basis will be in the future, and making appropriate marketing decisions, is limited. The fundamental reason for this is the basis estimate for any specific day (sale) can be significantly impacted by market or non-market factors that have only a short term impact (less than 24 hours in some cases). The randomness of these factors makes them impossible to predict. A secondary reason associated with the methodology used in this analysis is that, even over the longer term, there are imprecise relationships in the marketplace between the explanatory variables and the dependent variable. The technique simply calculates the best overall fit of each independent variable in explaining movements in the dependent variable.

Given this, much more confidence could be placed on an average of several point estimates to arrive at an average basis over some period of time. The length of the period chosen can be arbitrary, with the caveat that in general, as the period is shortened, the accuracy of the estimate will be decreased. Conversely, too lengthy a period will reduce the usefulness of the estimate. Figure 14 shows average monthly basis estimates for all marketing years included in the analysis. Numerical values are shown in Table 4.

As shown in Figure 14 and Table 4, average monthly basis for 1991/92, 1995/96, and 1996/97 is generally positive and follows a similar pattern for the first part of each marketing year. Discounting year-end aberrations, 1991/92 and 1995/96 continue to follow a similar pattern through the remainder of the year. Average basis for 1996/97 is negative beginning in December and continues so the rest of the year, which is a function of the rapidly rising futures market during this period. Average monthly basis for 1992/93, 1993/94, and 1994/95 follows a dissimilar pattern relative to the other years. The basis for these years was influ-
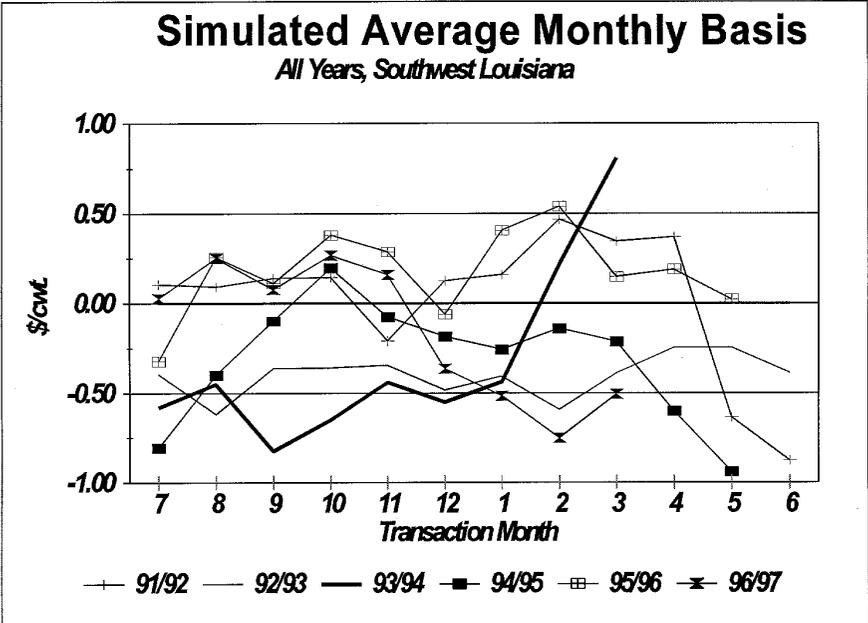
Simulated Average Monthly Basis
All Years, Southwest Louisiana

Figure 14

Table 4. Monthly Average Basis Estimates by Marketing Year:

Marketing Year	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97
Month	Basis ($/cwt.)					
July	0.11	-0.39	-0.58	-0.80	-0.32	0.03
August	0.09	-0.62	-0.45	-0.40	0.26	0.25
September	0.14	-0.36	-0.83	-0.10	0.11	0.08
October	0.15	-0.36	-0.65	0.20	0.38	0.27
November	-0.21	-0.35	-0.44	-0.08	0.29	0.16
December	0.13	-0.48	-0.55	-0.19	-0.06	-0.36
January	0.16	-0.40	-0.44	-0.26	0.41	-0.51
February	0.47	-0.59	0.22	-0.14	0.54	-0.75
March	0.35	-0.39	0.81	-0.21	0.15	-0.51
April	0.37	-0.25		-0.60	0.19	
May	-0.64	-0.25		-0.94	0.02	
June	-0.88	-0.39				

enced by loan rate interactions and a rapid rise in prices due to the Japanese crop failure.

Based on the marketing years included in this study and given no change in other factors, the following conclusions can be drawn.

1) When cash prices are above the loan rate, rough rice basis in Southwest Louisiana is generally positive during the first half of the marketing year. After December, basis is somewhat less predictable. It remained positive during two years in this category but was negative in one year.

2) When cash prices are at or below the loan rate, basis is generally less predictable, nearly always negative, and basis risk is frequently greater than cash price risk. In addition, under these conditions, futures prices are some times statistically insignificant in predicting cash prices. Basis for these years was influenced by loan rate interactions and/or a rapid rise in prices due to the Japanese crop failure.

Table 5. Selected Model and Variable Statistics.

	1991/92		1992/93		1993/94		
Model Statistics:					Equation #1		
Adj. R Square	0.86		0.91		0.85		#
Durbin Watson	1.57		1.28		1.62		#
							#
Variable	Coeff.	T-Ratio	Coeff.	T-Ratio	Coeff.	T-Ratio	#
Head Rice	0.0839	57.93	0.057906	39.2	0.0525	36.15	#
Total Rice	0.0617	16.95	0.050476	13.75	0.0406	8.63	#
Grade	-0.1118	-14.16	-0.11181	-17.08	-0.1018	-9.77	#
Futures Price	0.5461	20.07	0.92869	55.68	0.0295	0.65	#
Grain Length	0.7636	43.96	-0.01191	-0.6372	0.1259	5.19	#
July							#
August			-0.23347	-11.22			#
September	0.1170	4.73			-0.0501	-2.05	#
October	0.2685	9.11					#
November							#
December	0.2078	6.79	-0.14669	-4.933			#
January	0.2356	9.55	-0.08966	-3.449			#
February	0.3266	11.76	-0.29623	-8.752			#
March	0.1624	4.14	-0.13369	-2.989			#
April							#
May	-1.2014	-22.81					#
June			-0.1314	-2.766			#

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Model Evaluation

To this point, the focus has been on the results of each model, with little information with respect to a statistical evaluation of the model itself, except the results shown are from the *best* model. Table 5 presents coefficient estimates and selected variable and model statistics for each year.

The adjusted R square in Table 5 shows that the included variables in each model explain between 79 and 91 percent of total variation in cash price movements. The lowest R Square is associated with the 1994/95 marketing year, which is in part due to loan rate distortions of the basis relationship. Even including this year, the explanatory variables show fairly high degree of inter-year consistency in explaining cash price movements, though the impact of each individual variable changes yearly.

The most significant variable in each year is Head Rice, except for 1992/93, where Futures Price is more significant. There is a very noticeable influence on the value of the Head Rice coefficient in equation #2 of 1993/94 due to Japanese purchases of high quality rice. The second most significant variable is Head Rice,

	1993/94		1994/95		1995/96		1996/97	
	Equation #2							
#	0.82		0.79		0.82		0.83	
#	1.44		1.38		1.24		1.52	
#								
#	Coeff.	T-Ratio	Coeff.	T-Ratio	Coeff.	T-Ratio	Coeff.	T-Ratio
#	0.1217	20.81	0.0641	22.98	0.0706	19.28	0.0522	18.32
#	0.1501	8.71	0.5486	8.86	0.0874	10.10	0.0962	10.90
#	-0.3959	-13.28	-0.1189	-10.92	-0.2365	-15.59	-0.1350	-10.75
#	1.0994	14.37	0.1540	3.35	0.5387	14.58	0.4059	13.98
#	1.4572	15.88	0.3794	12.57	-0.1397	-2.75	0.3654	7.57
#			-0.5048	-8.65	-0.9687	-8.49		
#			-0.1815	-4.71	-0.6653	-9.97		
#			0.1754	4.14	-0.4121	-8.07	-0.2133	-3.98
#	-0.6251	-2.53			0.3140	5.74	-0.2315	-3.78
#	-0.7018	-4.56			-0.1513	-2.83	-0.0857	-2.08
#	-0.8770	-5.14	-0.1530	-2.34	-0.4114	-2.97	-0.4208	-8.50
#	-0.7495	-4.97					-0.1264	-3.32
#								
#	0.6856	2.33	0.0923	2.32			0.2006	2.84
#								
#			0.2768	3.28				
#								

Grade, Futures Price, or Grain Length, depending on the year. Each year in the analysis possessed some degree of seasonality, as indicated by the statistical significance of the month indicator variables. However, no individual month had a consistent impact (positive or negative) on cash prices across years in which it was significant. The inclusion of the monthly indicators did have the effect of reducing the calculated significance of futures prices in the model. Stated differently, excluding the time element would have incorporated it in the futures price variable, but not as precisely as it is expressed in the form of the indicator variables. This is borne out in the significance of many of the monthly indicator variables.

The signs on grain length show that in all years except 1992/93 and 1995/96, long grain commanded a price premium over medium grain. Because grain length was an indicator variable, the amount of this premium is equal to the coefficient. The estimated discount for long grain in the two years it did not command a premium is $0.01 and $0.14 per hundredweight, respectively. All non-indicator variables are significant in every year, except as previously stated, futures price was insignificant in Equation #1 for 1993/94, and Grain Length was insignificant in 1992/93.

Lagrange Multiplier (LM) tests were conducted on each year's model to test the ordinary least squares (OLS) assumption of normally distributed residuals. Based on these tests, every model except 1993/94 Equation #2 exhibited some degree of non-normality in the residuals, indicating the presence of autocorrelation. Alternative model specifications including autoregressive conditional heteroscedasticity (ARCH) and various robust estimation techniques were investigated to determine if one of them resulted in better estimates. In each case, they resulted in either basically equivalent or slightly to grossly less accurate results than OLS.

Confidence Levels Associated with Selected Parameter Estimates

The level of confidence that each parameter estimate is, in fact, the *true* parameter varies between variables and years. Confidence intervals at the 95% level are presented in the appendix tables. Because multiple differently scaled independent variables are associated with each year, confidence interval interpretation with respect to impacts on the dependent variable and the relative differences between variables in the same year and across years can be somewhat difficult without actually calculating each years equation. In an effort to transcend some of these difficulties, figures 15 through 21 present 95% confidence intervals with each variable's lower and upper bound expressed as a percent of its coefficient estimate. Because of this transformation, it is important to remember that a particular variable exhibiting a high degree of variability in these figures does not necessarily translate to a corresponding high degree of variability in the dependent variable as the value of the given independent variable changes. The following figures can be interpreted as a relative measure of the accuracy with which each independent variable is estimated by year. Valid comparisons of these figures include same-year comparisons among all variables and comparison across years of an individual variable.

Figure 15

Cash and Futures Prices
Long Grain, 93/94 Marketing Year

Figure 16

Confidence Intervals, 1993/94 MY
95% Confidence Level, Regression #1
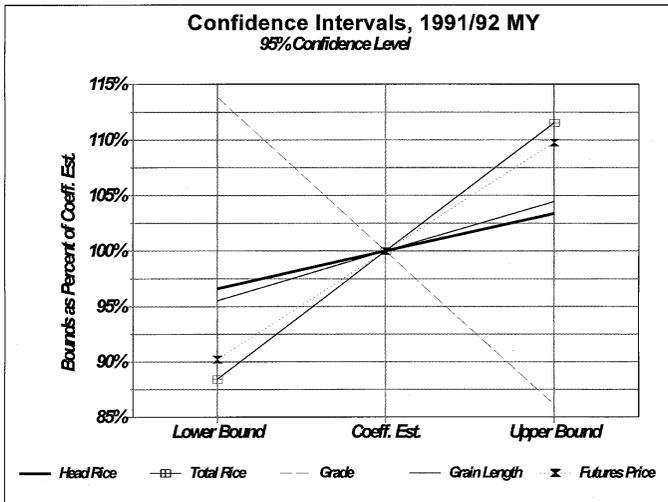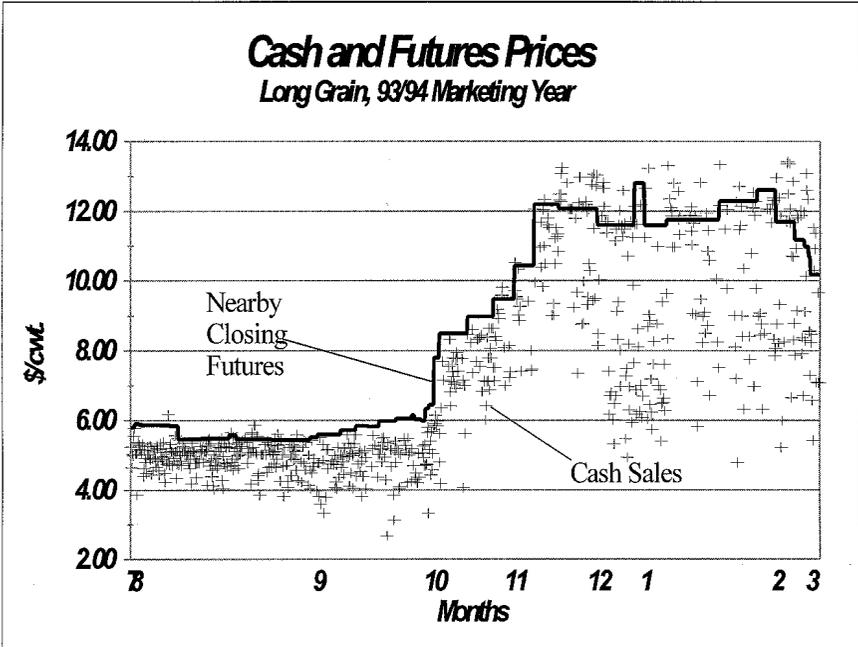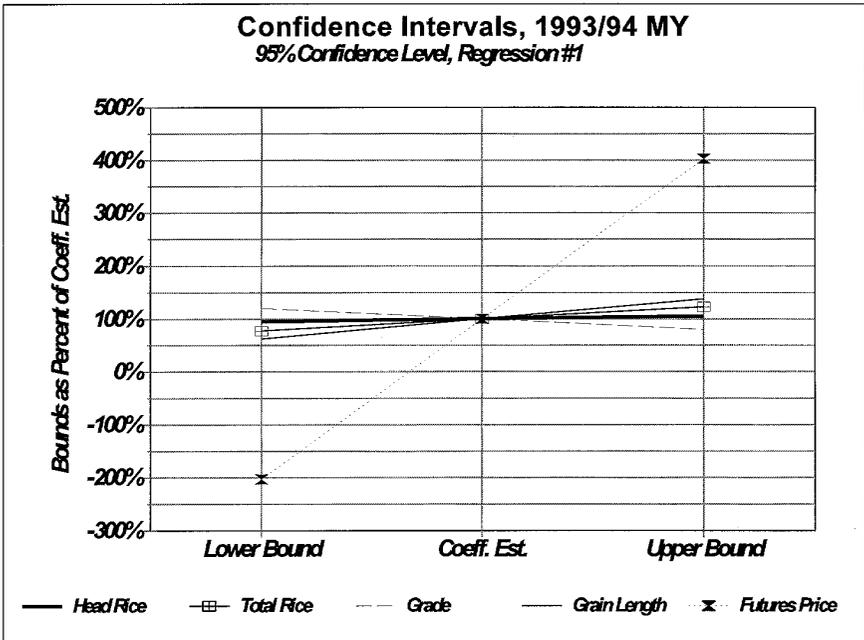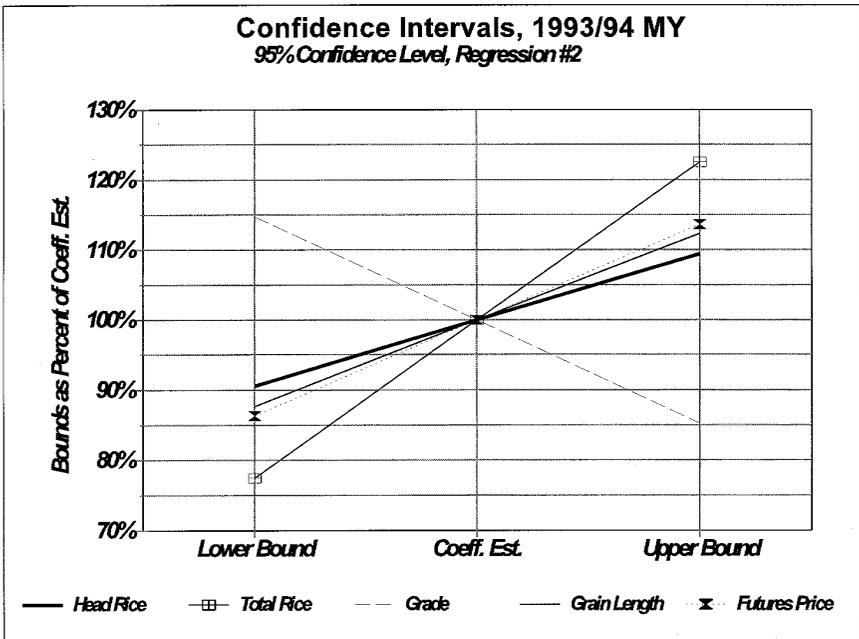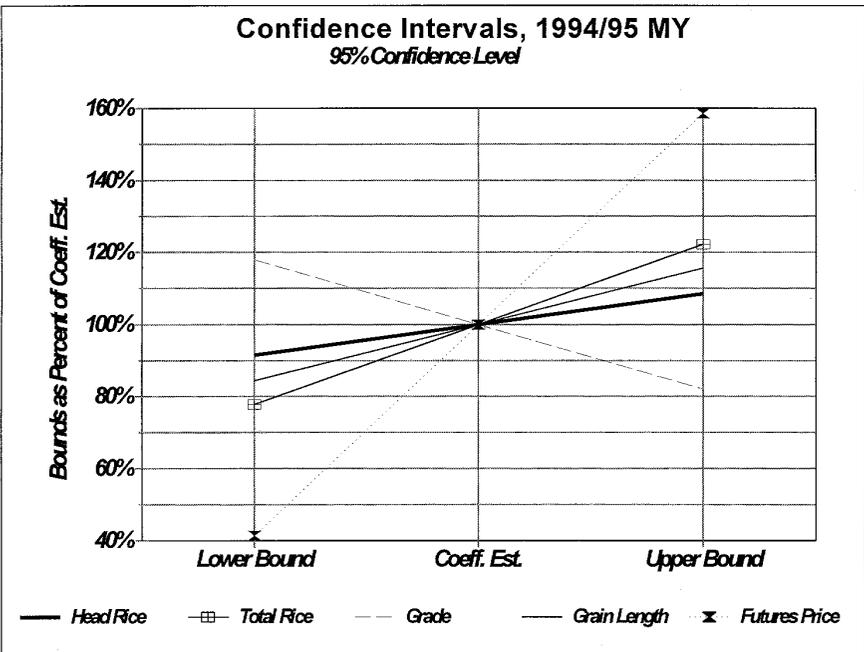
Figure 17

Figure 18

Figure 19
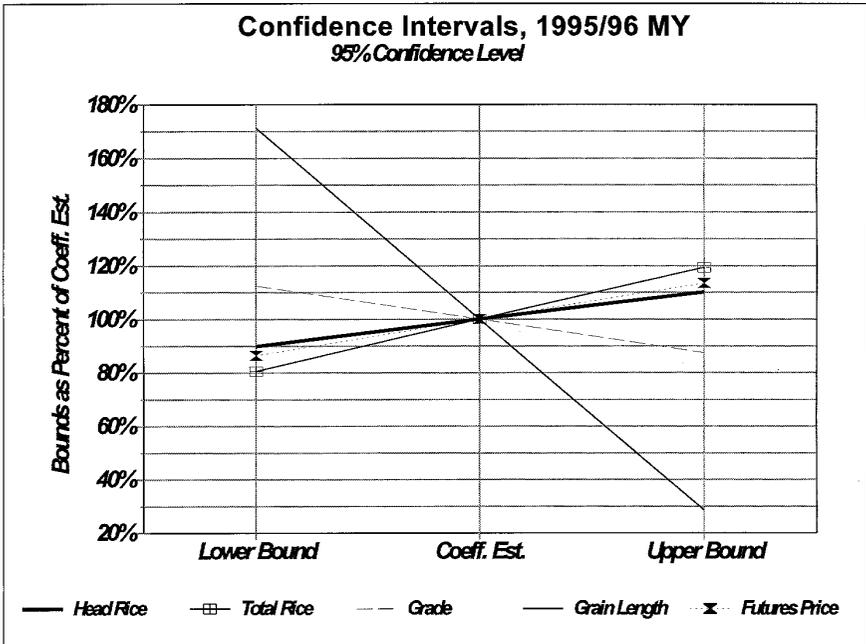
Figure 20
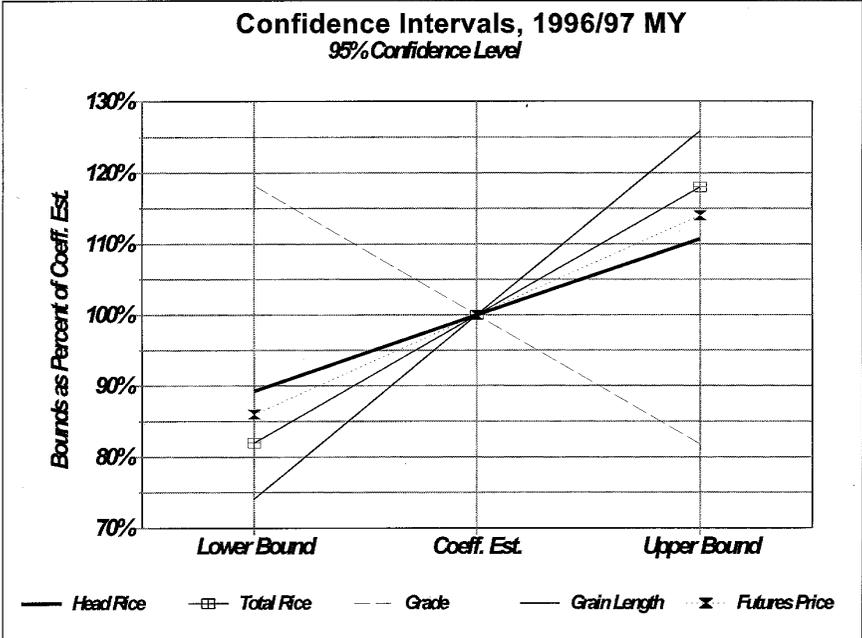
Figure 21

The 95% confidence level for Head Rice has the least percentage variation of all included variables over all years, except one. Although not readily evident from Figure 16, futures price did have slightly less percent variation in the 1992/93 marketing year. Grain length was the least predictable variable at the 95% confidence level in 1992/93, 1995/96, and 1996/97, while Grade and Total Rice were the least predictable in 1991/92 and 1993/94 #2, respectively. Futures Price was the least predictable in 1993/94 #1 and 1994/95 (which corresponds to the years when it exerted little impact on cash prices).

These findings appear to reflect prevailing market conditions in each respective marketing year in terms of what the most important components of value were during that year, and to a large extent, the T-ratio rankings (in order of statistical significance) in Table 5. They differ slightly from the T-ratio rankings in 1993/94 #1 between Total Rice and Grade, and in 1995/96 between Grade and Grain Length. This is because more significant variables can sometimes also have relatively higher standard errors associated with them compared with less significant variables.

Basis Variability vs. Cash Price Variability

As noted previously, there are several years where variation in simulated basis is greater than variation in estimated cash prices. This can severely hamper the effectiveness of basis (whether positive or negative) in evaluating marketing alternatives. Because of the high degree of basis variation during many of the marketing years, a key item that should be addressed is the timing of basis variability within a marketing year. For instance, it would be important to know if most of the variability occurs at the beginning and ending of a marketing year, or during the middle. Figure 22 shows variation in cash prices minus variation in basis, accumulated monthly for each marketing year. Each point represents (maximum cash-minimum cash) - (maximum basis-minimum basis) up to that month for each of the marketing years. For example, the points in month nine are the maximum and minimum values for the period 7/1 - 9/30. The tenth month is 7/1 - 10/31, and so forth.

Accumulated Variation by Month
Cash - Basis

Legend: 1991/92, 1992/93, 1993/94, 1994/95, 1995/96, 1996/97
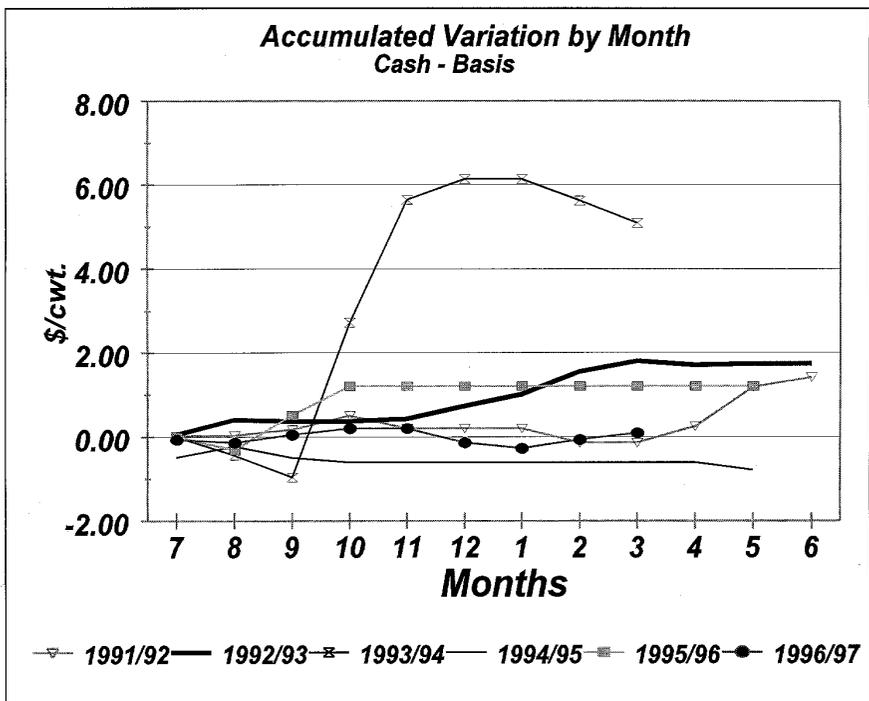
Figure 22

Every negative point denotes where basis has varied more than cash based on the estimates of this report. As could be expected, Figure 22 clearly shows that two of the three years (or periods within years) where cash prices were around the loan rate exhibited more basis variability relative to cash fairly consistently (first three months 93/94 and all of 94/95). Years where cash prices were well above the loan rate show short periods of greater basis variability. These years appear to have generally less, but sometimes minimally more, basis variability relative to cash prices through November. Basis variability tends to increase during the December through March period, but it decreases thereafter.

Figure 22 paints a less than perfect picture in terms of the usefulness of futures markets in reducing rough rice price risk directly. The same type of figure for soybeans in Southwest Louisiana would show that basis variability exceeded cash price

variability only in one of the last 10 marketing years[18] (1985/86 - April, 1995/96). However, ignoring 1994/95 because of loan rate distortions, Figure 22 does show that basis variability is less than cash price variability in forty-three of fifty-three months, or 81% of the time. As exemplified by the 1993/94 marketing year, strong price movements result in much more variation in cash than basis (the shape of curve for 1993/94 would not be substantially changed if prices had fallen instead of risen because it is measuring variation only). Based on the information presented in Figure 22, a hedge will usually, but not always, reduce price risk. Although this may reduce the importance of basis in making prudent marketing decisions in some cases, it does not reduce the importance of market participants knowing the basis.

Limitations

Data for every year in the analysis, except 1991/92, are composed of validated confirmed sales only. When data for 1991/92 were (previously) entered, the variable that determined whether a confirmed sale took place was discarded. Therefore, for this year, it was assumed that the last time a given lot was offered during the marketing year, it was sold. Because of this, a bit more confidence can be placed on the reliability of the data associated with the other years.

The R-square values for these regressions range from 0.79 to 0.91.[19] The remaining variation is a largely due to variables other than those used in contract specification, such as a specific variety, distance of storage site to mill, and any other variable that could impact the bid price and the producer's decision to accept on any given day. In addition, there are numerous occurrences in the data of a higher quality rice selling for less than a lower quality rice of the same variety on the same day. This may be attributable to a

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[18]Unpublished data. Department of Agricultural Economics, LSU Agricultural Center.
[19]79% to 91% of the total variation in cash prices is explained by the model.

combination of the silent auction process, and the lack of area and quality specific market information in the rice industry. In any case, it introduces built-in errors to the data, which in turn, reduce the accuracy of the estimates.

With respect to the point estimates, some degree of bias may be present within each month. Because each point estimated corresponds to one sale date, the points are not evenly distributed within months, and even more importantly, there were different numbers of confirmed sales on each sale date. This resulted in a weighting of the sale dates that had the largest number of confirmed sales within a given month and could lead to some degree of bias in the point estimates within that month in the direction of those sale dates. This should not bias monthly average estimates as shown in the last figure because of the use of monthly indicator variables.

Another factor that could have an impact on the basis for all these years, except 1996/97, is the government program. As previously noted, there is little doubt that the loan rate had an impact in 1992/93, the first part of 1993/94, and 1994/95. What is uncertain is the impact of the target price on cash, futures, or by extension, basis. Because the target price did not set a price ceiling (as opposed to the loan rate contributing to setting a price floor), it seems reasonable to assume target prices had no impact on futures or cash prices. However, the precise impact of the total government program package on various market participants remains unquantified.

An item related to the impacts of the government program is its effect on industry participation, especially that of producers, in futures markets. Given the changes affecting rice in the farm program, the overall level of participation may increase well beyond levels realized in the years in this analysis. Given this, liquidity should increase within the market and serve to make it a more viable marketing tool. However, it also may cause the market to behave differently in the future relative to the past. This factor could reduce the direct applicability of findings presented in this report to future marketing years.

Conclusions and Implications

This report has presented an estimate of rough rice basis in Southwest Louisiana for six recent marketing years. Ordinary least squares regression analysis was used to estimate the impact of various explanatory variables on cash market prices in each year. From coefficients estimated for each explanatory variable, an estimated 55/70 #2 cash price for each sale date was calculated. The previous days closing futures price was then subtracted from this value to arrive at a point estimate of basis for that day. These values were presented, as were monthly averages of them.

Three years included in the analysis show generally similar basis patterns in the first half of the marketing year. One of these three diverges from the others in the second half of the marketing year because of rapidly rising futures prices. The three other years were impacted by extremely low prices that resulted in loan rate interactions and/or extremely rapidly rising prices. In 1993/94 and 1994/95, these extremes resulted in cash and futures price movements that reduced the usefulness of basis in reducing price risk. In 1992/93, the additional impact of a lack of speculative activity in combination with low prices appears to have contributed to the result of a steady, but consistently negative, basis.

The magnitude of basis vs. cash price variation within several of the years as measured by the total absolute variation of each series suggests knowledge of basis is important, but market participants should proceed with caution when evaluating marketing alternatives solely on basis without taking into account other market fundamental and technical indicators. This is especially true for hedging because, in several of these years, variation in basis is greater than variation in cash prices, which negates the entire purpose of hedging.[20] The basis estimates presented in this report are *NOT* a substitute for an individual seller's tracking bids from buyers in his area and establishing his own basis series. Sometimes, due to changes in local market forces, variation in bid prices in the same area will be greater than those between areas.

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[20]Hedging exchanges price risk for basis risk. If basis risk (variation) is greater than price risk, there is no reason to hedge.

Finally, based on the findings of this analysis, information generated by futures markets (and by extension, basis) can and should be utilized to make more informed rice marketing decisions. However, possibly due to 1) previous government programs, 2) quality attributes specific to rice, 3) short history of rice being traded on a futures market, and 4) the position of the U.S. and Southwest Louisiana relative to the rest of the world in terms of percent of total rice produced and exported, among others, the relationship between cash markets in Southwest Louisiana and futures markets for rice appears to be not as well established as it is with other grains.

Acknowledgments

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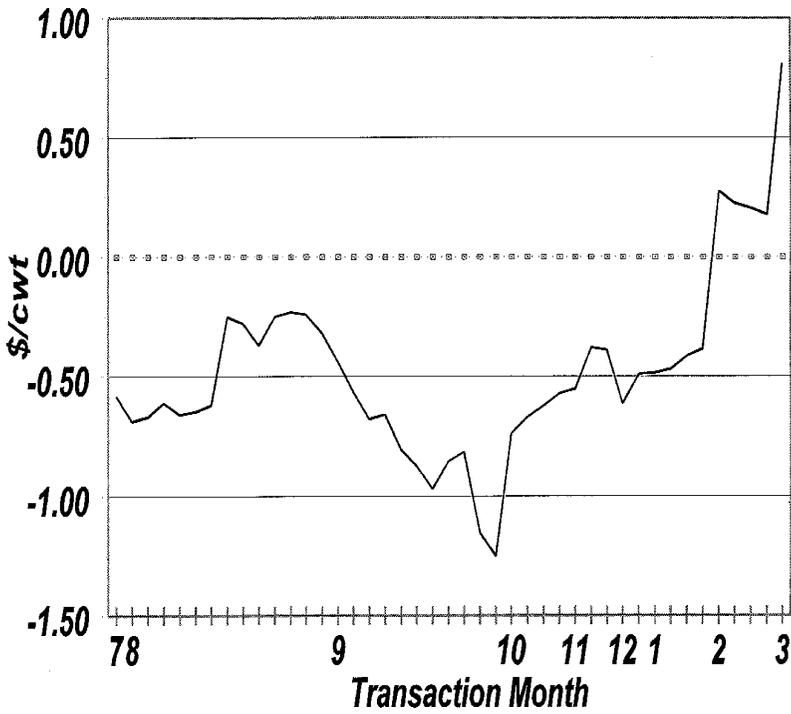
Figure 7

Futures and Est. Cash Prices, 93/94 MY
Standardized 55/70 #2 LG, Nearby Cont.

Est. Cash — Futures ⊗ Loan Rate
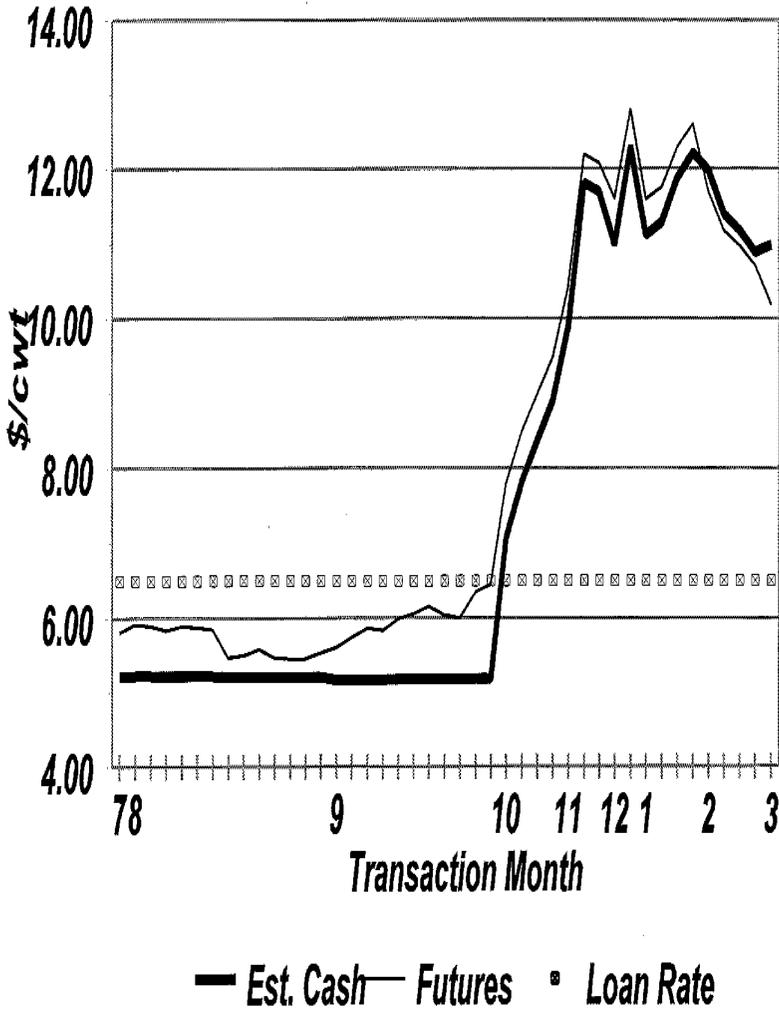
Figure 6

Simulated Basis, 92/93 MY, Cash - Futures
Standardized 55/70 #2 LG, Nearby Cont.
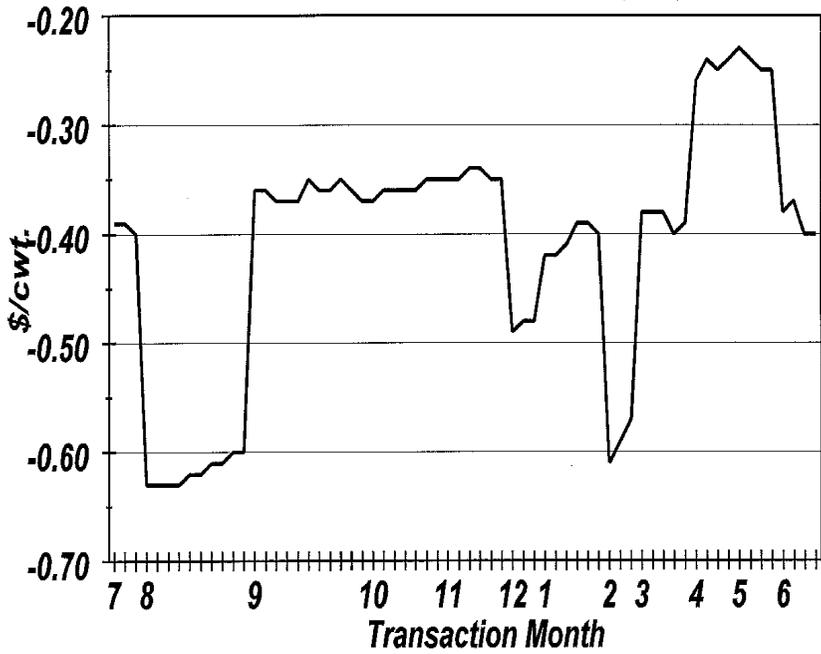
Figure 5

Futures and Est. Cash Prices, 92/93 MY
Standardized 55/70 #2 LG, Nearby Cont.
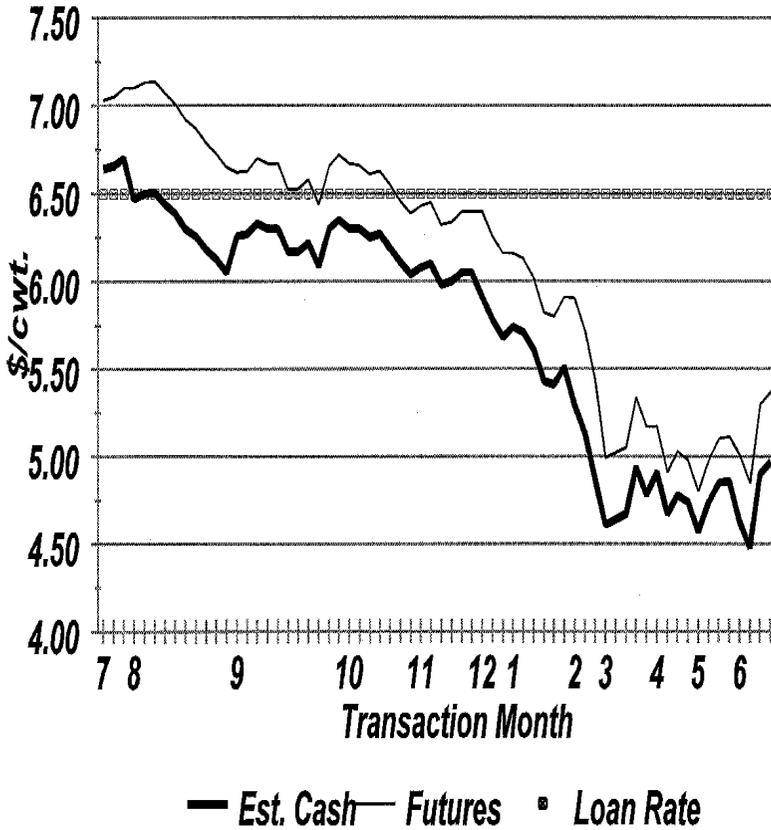
Figure 4

54

Simulated Basis, 91/92 MY, Cash - Futures
Standardized 55/70 #2 LG, Nearby Cont.
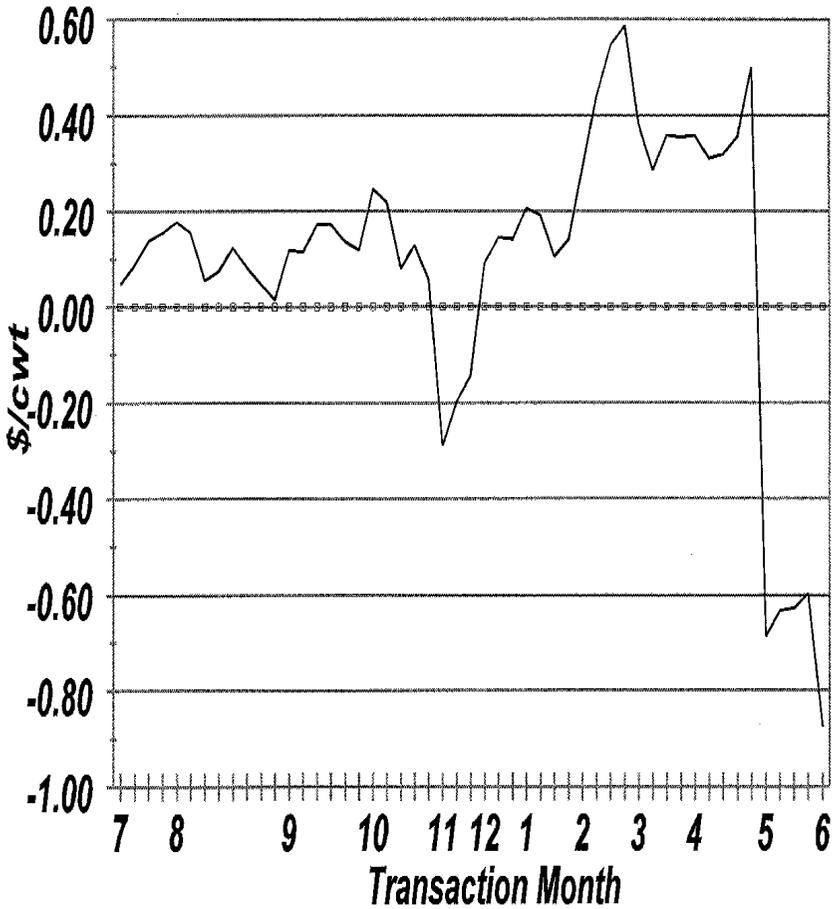
Figure 3

Accumulated Variation by Month
Cash - Basis
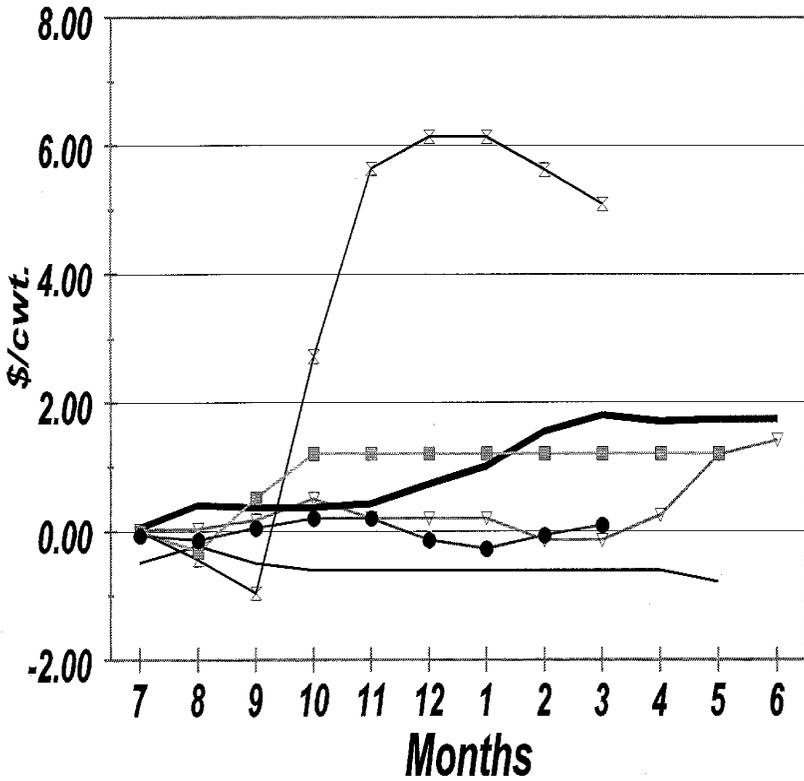
Legend: 1991/92 — 1992/93 — 1993/94 — 1994/95 — 1995/96 — 1996/97
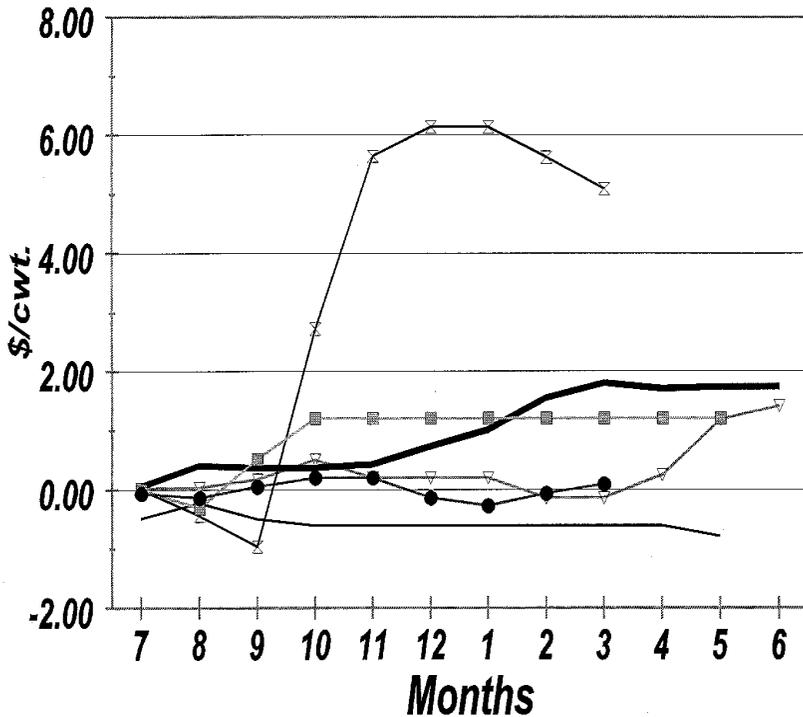
Figure 1

56

Accumulated Variation by Month
Cash - Basis

Figure

22

Confidence Intervals, 1996/97 MY
95% Confidence Level

Figure 31.

58
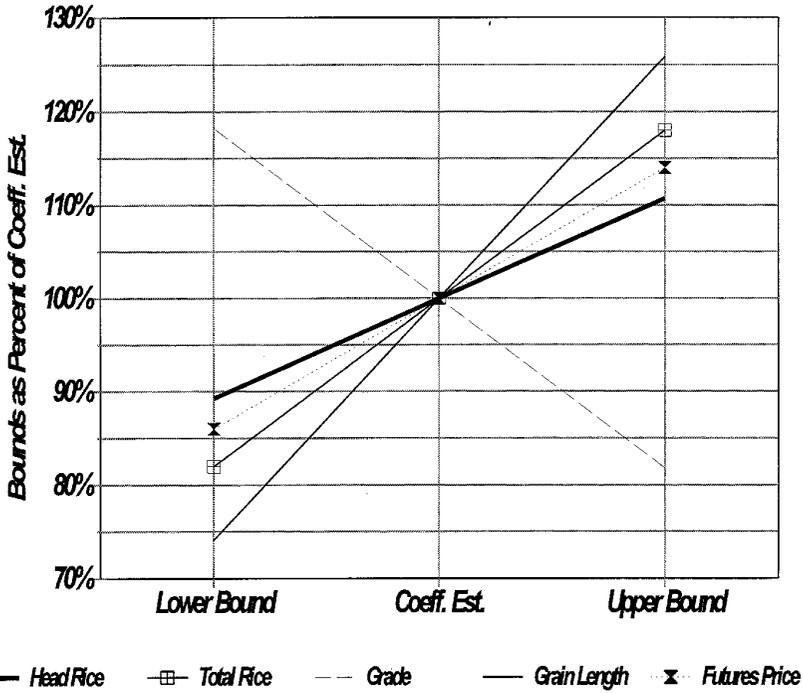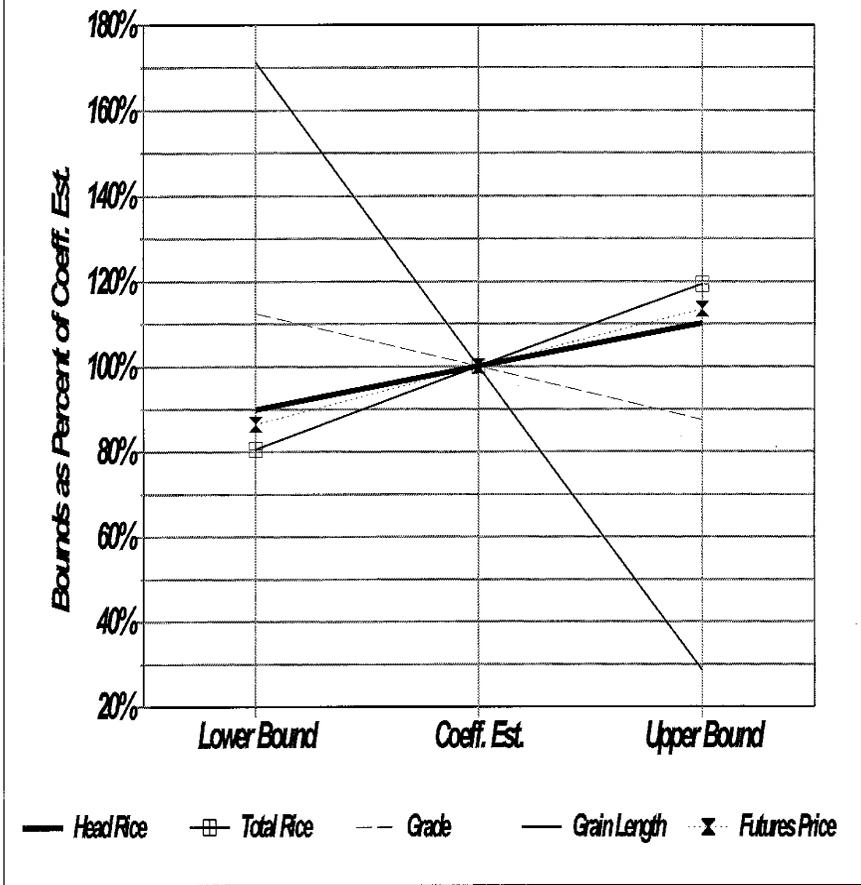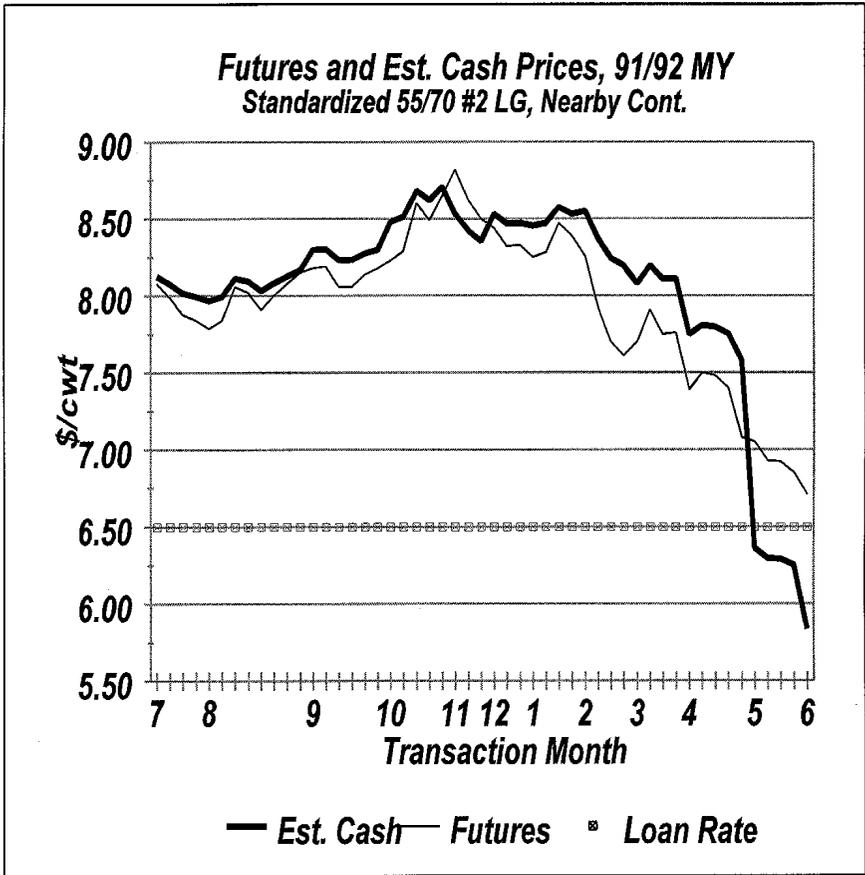
Figure 20

Figure 2

Confidence Intervals, 1994/95 MY
95% Confidence Level
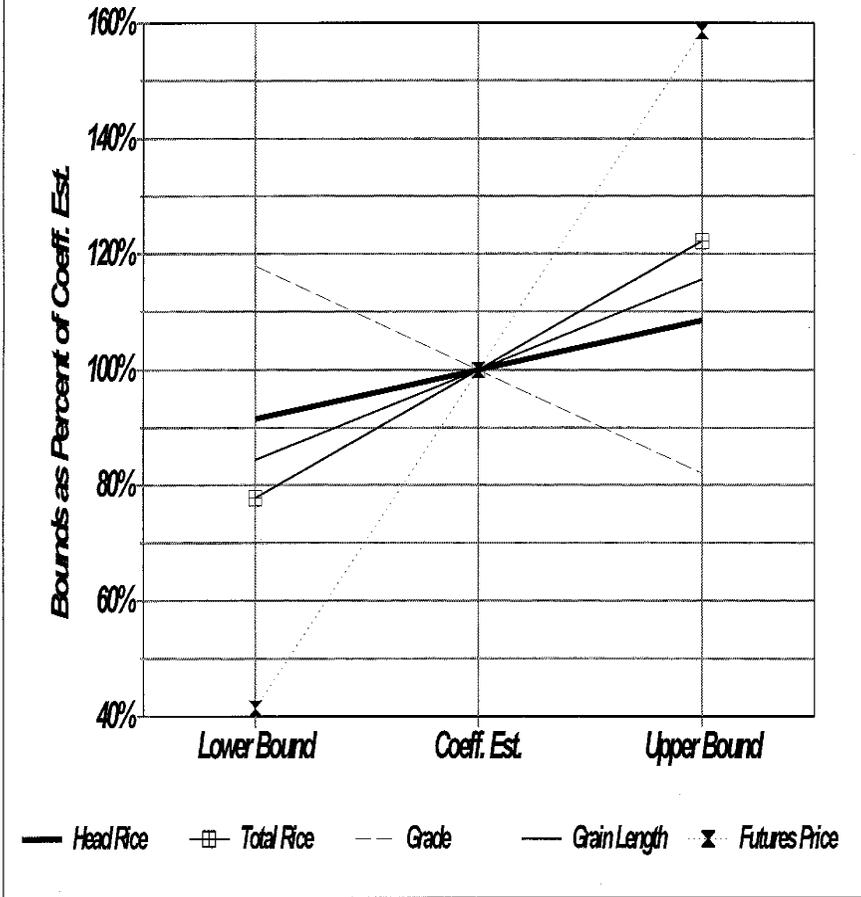
Figure 19
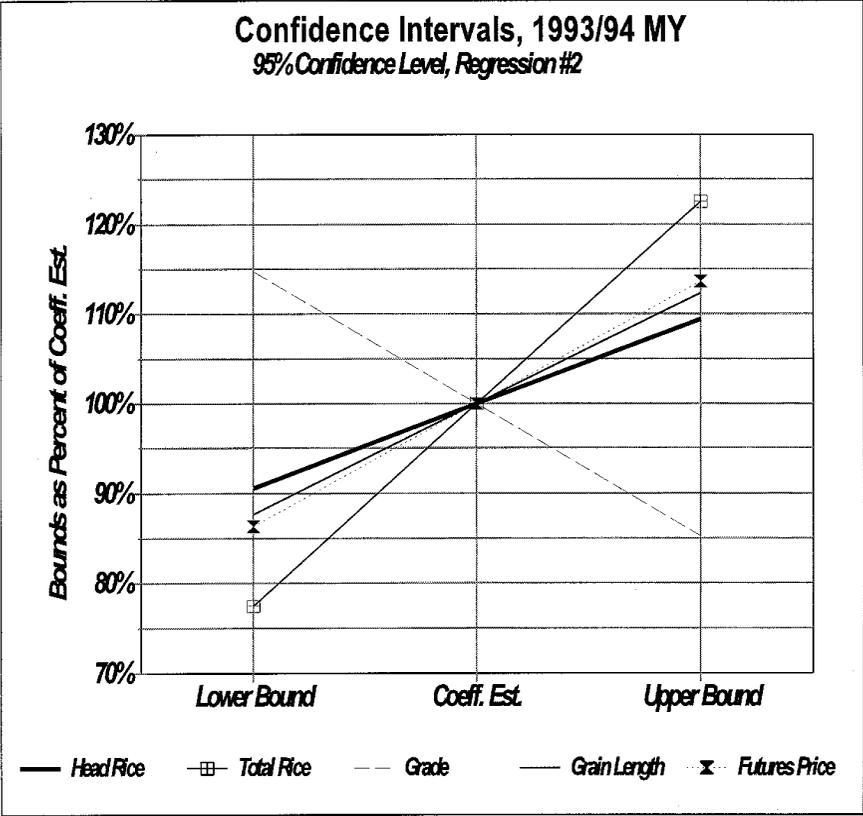
Confidence Intervals, 1993/94 MY
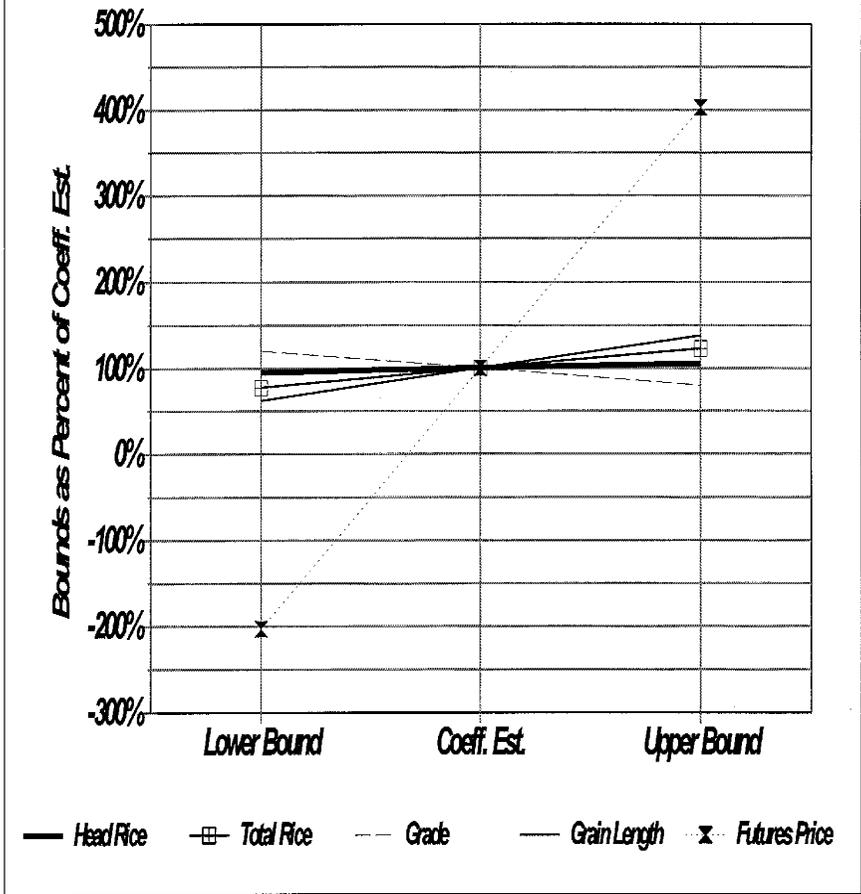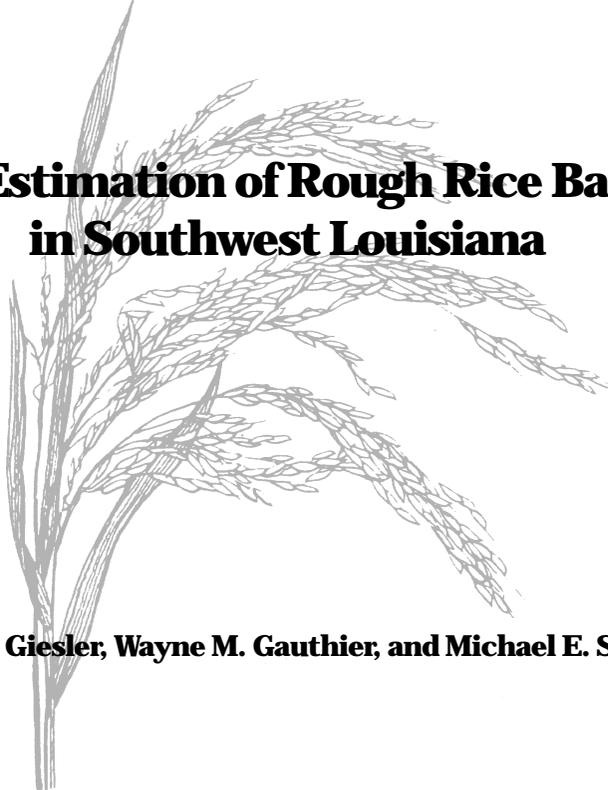*95% Confidence Level, Regression #2*

Figure 18

Figure 17

An Estimation of Rough Rice Basis in Southwest Louisiana

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