Articles

Are Harvest Forecasts News? USDA Announcements and Futures Market Reactions

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Futures market price data for corn and soybeans are used to examine reactions to U.S. Department of Agriculture harvest forecasts. These forecasts are widely known and reasonably accurate, so failure to find significant reaction would indicate that the USDA did not contribute additional news relative to information already possessed by traders. Various *t*-tests, *F*-tests, and nonparametric chi-square tests indicate rejection of the null hypothesis of no significant difference between means of absolute values or variances of changes in closing prices on days following a USDA announcement and other days. Thus, the data indicate that significant information is contained in the forecasts.

Key words: announcement effects, futures markets, harvest forecasts, information.

Economists have long claimed that information has many attributes of public goods. For example, as early as 1914, Knight observed: "Its importance for society at large is so well recognized that vast sums of public money are annually expanded in screening and disseminating information as to the output of various industries, crop conditions, and the like" (p. 260). (See also Moore; Jesse, Johnson, and Paul.) Recently, however, government spending for statistical reporting services has been reduced and services curtailed. With budget allocations reduced, economists' attention has been drawn toward identifying the value of these services to society (see Gardner, Bullock, Just).

A number of evaluation studies have assumed that government crop reports contain information, and even that the U.S. Department of Agriculture (USDA) was the sole source of harvest forecasts. Hayami and Peterson were criticized by Bullock on this score (see also Bradford and Kelejian). This article does not attempt to measure costs and benefits; it takes only the first step of investigating whether the reports do contain information.

For information services provided by the government (or any other source) to have more than consumption value, the announcement must affect economic agents' decisions and the resulting allocations of goods and services. Four factors are required for information services to be effective. First, they must cover a topic of interest to economic agents. Second, they must reach agents while relevant decisions are pending. Third, they must be considered relatively accurate—or at least useful for forecasting. Fourth, the announcements must be new in the sense that some interested economic agents do not already possess the information.

In this article we investigate the information content of the harvest forecasts of the USDA. Our approach is to examine price movements in the relevant futures markets in response to the release of corn and soybean harvest forecasts.

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Characteristics of the Markets and Crop Forecasts

Both corn and soybean are actively and continuously traded in futures markets. The United States is the dominant world producer and trader of each commodity, especially in the northern hemisphere. The demands for these commodities are not infinitely elastic, and the size of the U.S. harvest is of interest to anyone affected by the market price expected to prevail. USDA forecasts for these crops are prepared by a special board which convenes in isolation in order to prevent information leakage. Forecasts are released by the Crop Reporting Board for the months of August to November of each year; for corn, forecasts usually have also been provided in July. Crop forecasts are released around the tenth of the month. The exact release dates are announced in December for the following calendar year (Spilka). The regularity and long history of these releases make it safe to assume that interested traders may easily become aware of their existence and have access to the forecasts.

If forecasts were known to be unrelated to the actual future events that they purport to predict, they simply would be ignored by traders and other market participants. This is clearly not the case with the USDA harvest forecasts. Further, these harvest forecasts are the product of acreage estimates and yield forecasts based on nationwide surveys and in-the-field enumeration of harvest progress. Confidence in the resulting announcements does not necessarily follow, but confidence is likely increased by the perception of a professional forecasting method.

Previous studies and our own statistical evaluation were used to measure accuracy of USDA harvest forecasts for corn and soybeans. To summarize briefly, on the basis of a variety of statistical criteria, the evidence is that both corn and soybean forecasts in all months are reasonably accurate forecasts of actual crop sizes. Further, the forecasts generally become more accurate as the season progresses. Given this performance, it would be surprising if traders lacked confidence in the USDA forecasts.[1]

If traders failed to react to newly released forecasts, then this failure should be attributed to small differences between traders' prior expectations and USDA forecasts rather than to an indication of a lack of interest in, knowledge about, or confidence in these forecasts.

Effects of Announcements on Futures Market Prices

The USDA goes to great lengths to restrict access to the forecasts until their public announcement, and they are generally considered successful in these efforts. They do not, however, have a monopoly on information regarding harvest prospects. Many groups assess weather conditions and crop progress in the major growing areas.[2] Hence, the USDA forecasts must be judged against this background information.

If the prior information traders possessed and how they evaluated it were known, one might measure directly the increment provided by the government. One could also judge whether a particular quantity forecast was higher or lower than prior expectations. However, the prior beliefs of traders cannot be observed. Nor can we even observe whether an announcement represents an increase or decrease relative to expectations. But market prices before and after announcements can be observed, and these are the data used in this study.[3] Futures markets are used in the empirical analysis because (*a*) futures markets have been in place for many years; (*b*) they are large, liquid, well organized, and

[1] Among other measures, we found high R^2's in regressions of the actual on forecasted harvest, small intercepts, and slope coefficients near 1.0. Previous evaluations of the supply forecasting performance of the USDA by Gunnelson, Dobson, and Pamperin; Smith; and Choi yield general results similar to those found in our own analysis (available as an appendix from the authors); see also Just and Rausser.

[2] Weather reports and crop prices were discussed recently by Roll. See Moore for an early study.

[3] Several authors have examined the impacts of USDA crop and livestock reports on agricultural prices (Pearson and Houck, Gorham, Miller, Hoffman, Choi). While particular approaches differ, these studies all tend to assume that they are able to specify the information set of traders prior to an announcement. The standard approach was to relate the size and direction of market price movements to the size and direction of revisions in the USDA forecast from one month to the next. The authors attribute mixed results (in the signs and magnitudes of coefficients and statistical tests) to market imperfections, imperfections in crop forecasts, or other complications rather than to the impact of crop news available from other sources between USDA announcements.

After this paper was written, the authors saw drafts of two papers, one theoretical (Falk and Orazem) and one empirical (Fackler) that discuss some of these issues using approaches more consistent with those of this study.

well understood; and (*c*) daily price data for futures markets are readily available.[4]

The basic idea underlying the empirical analysis is summarized as follows. Reservation prices of market participants depend on their supply and demand information as well as on personal and business characteristics. On average, a change in the relevant perceptions of a significant number of traders will be reflected in a movement in the market price. Because the direction in which perceptions are changed is unknown, a priori, the market price may move up or down, and a simple average of market price movements is likely to be zero. Measures of price movements such as the average of the absolute values or of the squared price changes, on the other hand, likely will be significantly positive. Finally, the degree of change in perceptions of traders will be reflected in the degree of market price movement so that above-average changes in perceptions are associated with higher-than-average market price movements (see Tauchen and Pitts and related models of Anderson and Danthine, Turnovsky).

This reasoning implies that the price movement on the day following a USDA announcement will be larger than on other comparable, nonannouncement days only if these announcements contain some information that causes a significant number of traders to change their reservation prices.[5]

Futures Market Data and Empirical Approach

The empirical analysis focuses on the movements of daily closing prices for corn and soybean contracts on the Chicago Board of Trade Futures Market. Data are used for periods of 12 trading days surrounding announcement dates for the years 1961 to 1982. For soybeans the announcements occur in the months from August through November, yielding a sample of 1,056 trading days. The January contract for soybeans is the first contract after the close of the fall harvest. For corn, data are also used for the seventeen years in which a July harvest forecast was released. The corn sample includes closing prices for the December contract for a total of 1,260 trading days.

The measure of price change is the difference between closing prices. The USDA announcements are made public after the futures market is closed on the day of release. For an announcement on 12 August, say, the relevant measured price change is the difference between the prices at which the market closed on the 13th and on the 12th. In addition to the "announcement" price change, the sample includes price changes for five days prior to and five days after the price change on the announcement day. In order to account for differences in the level of prices over the twenty-two-year period, a relative price change variable was defined as

$$\Delta P/P_t = (P_{t+1} - P_t)/P_t.$$

In both the corn and the soybean markets, Chicago Board of Trade rules limit movements of futures prices on a single day. Hitting the limits was more common in the early to mid-1970s than before or after. In general, only a small portion of the trading days have limit moves. Such constraints on price movements would likely dampen the measured impact of crop report releases in a single trading day, but the data were not adjusted for limited moves. Thus, our tests may underestimate the significance of announcement effects.

Table 1 provides descriptive statistics by month for the relative price change for each commodity. This information about the basic data is useful in evaluating the procedures and results. Table 1 shows that means are not significantly different from zero in any month and that variances are not constant over months. [An examination of the variance of $(\Delta P/P_t)$ by year also indicates that variances were not constant over years and that prices were particularly volatile in the mid-1970s.] Examination of histograms reveals that $(\Delta P/P_t)$ has a roughly bell-shaped distribution overall and in each month. The skewness and kurtosis statistics in table 1 indicate that distributions of relative price changes are generally symmetric but have fatter tails than a normal distribution. Normality is rejected for the whole sample and for most months. These findings are generally

[4] A large literature examines the impacts of releases of information on stock prices. Another related research area examines the effect of money supply announcements on financial markets. That literature presumes a release of information in order to test models of the effects of news in complex markets. In this study we are testing for the information content of the release using a straightforward and accepted model of the effects of a release of information. Thus, the maintained and tested hypotheses involved in the two issues are reversed. A survey of papers devoted to the money supply announcement issue appears in Cornell.

[5] Other relevant events tending to fall on the same days as USDA announcements would confound the tests. While it cannot be ruled out, we have found no evidence of such convolution in the timing of events.

Table 1. Statistics for Relative Daily Price Change, by Month, 1961–82

Statistic for $(\Delta P/P_t)$	Month/Crop (C = Corn; S = Soybeans)								
	July[a]	August		September		October		November	
	C	C	S	C	S	C	S	C	S
Mean	−.11[b]	.13	.02	−.02	.02	−.03	−.08	.02	.06
(s.e.)	(.10)[b]	(.10)	(.10)	(.08)	(.08)	(.08)	(.08)	(.06)	(.08)
Variance	1.93[b]	2.29	2.63	1.70	1.63	1.37	1.52	.99	1.63
Skewness[c]	.228	.504	.152	.088	.146	−.140	−.213	.263	−.358
Kurtosis[c]	.811	1.14	1.67	2.10	.948	1.84	1.07	2.46	1.47
Normality[d]	.068	.104	.135	.097	.074	.073	.091	.055	.106

[a] Sample sizes are 187 for July and 242 for other months.
[b] All values for the means and standard errors have been multiplied by 10^2. All values for variances have been multiplied by 10^4.
[c] The critical values for skewness at .05 are about .29 for a sample size of 187 and about .256 for a sample size of 242. The critical values for rejection of a normal kurtosis level at .05 is about .6 for 187 observations and about .53 for 242 observations. Rejection at .05 holds for all our monthly samples. (See Snedecor and Cochran, table A6, p. 552.) These are calculated using the SAS UNIVARIATE procedure.
[d] Normality refers to the Kolmogorov D-statistic. For 187 observations normality is rejected at .05 if the D-statistic is over .065 and for 242 observations the .05 critical value is .057. Therefore, normality is rejected at .05 (and usually below .01) for all samples except November corn, and in that case we are only slightly below the critical value.

consistent with the analysis of futures price data by others. Correlation coefficients and correlograms indicate no autocorrelation of the day-to-day relative price movements. This finding facilitates application of the tests below, most of which depend upon independently distributed observations. It also indicates that price movements on one day are not generally reversed on the following day.

Two measures of price variability are used. The expected value of the absolute relative price change:

$$E[ABS(\Delta P/P_t)] = \frac{1}{T}\Sigma_t|P_{t+1} - P_t|/P_t,$$

and the variance of the relative price change,

$$\text{var}(\Delta P/P_t) = \frac{1}{T}\Sigma_t\{[(P_{t+1} - P_t)/P_t] - \frac{1}{T}\Sigma_t[(P_{t+1} - P_t)/P_t]\}^2,$$

where T is the sample size. In both cases the values of the variables will be positive. The null hypothesis is that no difference occurs between announcement days and the other days.

The Evidence for an Announcement Effect

This section reports a variety of evidence rejecting the null hypothesis of no measurable effects of USDA harvest forecast announcements on the futures market prices for corn and soybeans. The broadest and simplest evidence comes from a t-test of a significant difference between the mean of the absolute value of the change in closing price for announcement days and the mean for other (nonannouncement) days. The test is summarized as follows:

Corn:

1050 nonannouncement days	105 announcement days
$E[ABS(P/P_t)]$ = .0085(.0003)	.0154(.0012)

t-statistic = 5.57, degrees of freedom = 113

Soybeans:

880 nonannouncement days	88 announcement days
$E[ABS(P/P_t)]$ = .0088(.0003)	.0177(.0014)

t-statistic = 6.45, degrees of freedom = 95,

where standard errors of the estimates are shown in parentheses.[6] Price movements on announcement days average more than 1.5% compared to less than 0.9% on other days.

These means and t-tests are presented for simplicity. All other evidence from the pooled sample confirms strong rejection of the null hypothesis of no difference in price movements. This is true using F-tests of variances and regression specifications. The null hypothesis is also strongly rejected using a variety of nonparametric tests.

Table 2 presents month-by-month tests of announcement effects using both parametric

[6] For calculation of the t-statistics and the degrees of freedom, see the footnotes to table 2.

Table 2. Means, Variances and Statistical Tests for Announcement Effects by Month

Statistic[a] for $(\Delta P/P_t)$	Month/Crop (C = Corn; S = Soybeans)								
	July	August		September		October		November	
	C	C	S	C	S	C	S	C	S
Nonannouncement days									
$E[ABS(\Delta P/P_t)] \times 10^2$	.97 (.07)	1.00 (.07)	1.02 (.08)	.844 (.06)	.83 (.05)	.76 (.05)	.80 (.05)	.70 (.04)	.86 (.06)
$\mathrm{Var}(\Delta P/P_t) \times 10^4$	1.79	2.03	2.23	1.46	1.25	1.09	1.20	.84	1.51
Announcement days									
$E[ABS(\Delta P/P_t)] \times 10^2$	1.54 (.26)	1.80 (.29)	1.98 (.32)	1.55 (.29)	1.92 (.27)	1.72 (.24)	1.89 (.25)	1.06 (.26)	1.28 (.23)
$\mathrm{Var}(\Delta P/P_t) \times 10^4$	3.64	4.85	6.12	4.36	5.06	4.13	4.65	2.57	2.81
Parametric test statistics for announcement effects									
t-statistic[b]	2.12	2.74	2.93	2.42	4.02	3.99	4.33	1.37	1.79
F-statistic[c]	2.04	2.39	2.68	2.99	3.98	3.80	3.90	3.06	1.86
Nonparametric test statistics for announcement effects									
Chi-square statistic for Savage scores[d]	5.68	9.69	13.35	10.71	34.16	26.69	38.59	5.32	3.60

[a] All statistics and tests are applied to the one-day relative change in the relevant closing prices where means of absolute values and variances are as defined in the text. Values for estimated means (and their estimated standard errors shown in parentheses) have been multiplied by 100. Values of estimated variances have been multiplied by 10,000.

[b] The t-statistics and associated degrees of freedom are approximate under the hypothesis of unequal variances. The values reported have been computed as follows:

$$t = (x_a - x_o)/(s^2_a/n_a + s^2_o/n_o)^{1/2}$$

$$\mathrm{df} = \frac{(s^2_a/n_a + s^2_o/n_o)}{[(s^2_a/n_a)^2/(n_a - 1)] + [(s^2_o/n_o)^2/(n_o - 1)]},$$

where the subscripts represent the announcement day and other day samples, x represents the sample mean and s^2 represents the sample variance. The number of announcement observations (n_a) is 17 in July and 22 in all other months for a total of 105 for corn and 88 for soybeans. Approximate degrees of freedom are therefore 19 in July, 24 in August, 23 in September and October, and 22 for corn and 24 for soybeans in November.

[c] F-statistic degrees of freedom are 16 and 169 for July and 21 and 219 for the other months.

[d] The chi-square statistics have one degree of freedom. Values over 3.84 are significant at below .05; values of 6.63 are significant at below .01.

and nonparametric tests. The top six rows of the table indicate that for every month and for both crops, the means of the absolute values and the variances of the one-day price movements are larger for the sample of announcement days. The next two rows provide the t-test and F-test results for comparing the means and variances. The t-statistics are all above 2.0 and are highly significant except for the November announcements. Even for November, the one-tailed test rejects equal means at .10 for corn and at .05 for soybeans. The F-tests tell a similar story.

The last row of table 2 provides chi-square statistics for a nonparametric test on $ABS(\Delta P/P_t)$. A number of alternative nonparametric analysis of variance tests all showed significant chi-square statistics. The tests differ slightly in design and in the underlying distribution for which they are most powerful (SAS). To conserve space only the Savage test is reported. The Savage test is based on order statistics from an exponential distribution which is close to the shape of the distribution of $ABS(\Delta P/P_t)$. The Savage test chi-square statistics reported in table 2 are generally significant and follow a similar pattern to the t-statistics and F-statistics.

So far announcement day price movements have been compared to all other days in the two-week period as a group. Now evidence comparing announcement days to other days

separately is considered. Some have hypothesized that the fact that an announcement is forthcoming could affect the market before its release. It might also take more than one day for the announcement effect to play out. If this is true, comparisons of an announcement day with other days a week before or a week after the announcements may be more appropriate than comparisons with days nearer to the announcement. To control for the position of the announcement in the two-week sample periods, paired comparison tests were computed by day.

When the paired comparisons were performed on the samples with months pooled, the mean differences were between four and seven times the estimated standard errors for each other day compared to the announcement day. A variety of nonparametric tests also provided strong evidence for rejection of the hypothesis of no difference. Especially large differences were found between the announcement day and those days immediately preceding it.[7]

Even though sample sizes become small, it is useful to examine by day differences separately for each month. Table 3 shows t-statistics and F-statistics for paired comparisons of the announcement with each nonannouncement day, by month. The announcement was released on day six of the two-week sample period, so in table 3, days one through five represent the trading days in the week prior to the announcement, and days seven through eleven represent the days after the announcement.

Given the relatively small sample sizes, evidence for announcement effects remains strong. For pairs in the months of August, September, and October, the t-statistics and F-statistics are almost always highly significant for both crops. For July, however, days one and two and days ten and eleven show only marginally less price movements than the announcement days. In November a number of paired comparisons do not have significant t-statistics or F-statistics. These results support the hypothesis that the July and November announcements provide less information than those for the intermediate months.

[7] Dates of reports from private information sources (including the well-known Leslie Report) were available in some years. These reports tend to be released a few days before the USDA report. Our analysis of a small sample of Leslie Report release dates failed to uncover any evidence of an announcement effect.

Table 3 also indicates that crop reports may affect the market on days surrounding the announcement. Price changes in days four and five are somewhat smaller than those in days one and two or ten and eleven. Day seven exhibits a tendency to have a larger price movement than the days more distant from the announcement. This suggests that some residual effect may remain after the first day's adjustment.

Finally, a slightly different approach to measuring announcement effects was taken by regressing $ABS(\Delta P/P_t)$ on an intercept and a dummy variable that is equal to one for announcement days. These regressions for each crop, by month, included sets of control variables for year, year squared, and day of the week. In every case the announcement day coefficient is positive and at least twice the size of its estimated standard error, confirming the analysis of variance evidence.

The regression analysis was also used to examine the pattern of announcement effects on twenty-two yearly subsamples. The yearly model includes month dummies but no interaction terms. For corn, ten of the twenty-two announcement dummy coefficients are more than twice their standard errors and an additional six t-ratios are more than 1.6. In the last eleven years of the sample, all but three of the t-statistics were more than 2.0. For soybeans, thirteen of the twenty-two t-statistics were above 2.0 and an additional five were above 1.6. Again, the larger and more significant coefficients were in the later years. These regressions indicate considerable announcement effect given samples of only four or five announcements per year. The pattern also suggests that traders have reacted more to the USDA harvest forecast reports in the last decade than in previous years.

Conclusions and Interpretations

The preceding section provided a variety of evidence that USDA harvest forecast announcements affect market price movements. Moreover, the intermediate releases—in August, September, and October—appear to have the strongest impact on daily changes of futures market closing prices for both corn and soybeans. The July forecast for corn had less impact than forecasts for later months; this may reflect a lower accuracy of the July forecasts. The November forecasts were very ac-

Table 3. Statistical Tests for Announcement Effects: *t*-tests for Paired Comparisons and *F*-tests for Announcement Days and Each Other Day, by Month

		Month/Crop (C = Corn; S = Soybeans)								
		July[a]	August		September		October		November	
Day	Test	C	C	S	C	S	C	S	C	S
1	*t*	1.36	2.32	3.06	2.17	4.48	4.09	3.59	1.38	3.05
	F	1.92	2.14	3.64	2.13	4.37	5.59	3.40	4.35	4.81
2	*t*	1.55	2.58	4.12	2.12	3.56	3.38	3.68	.562	1.16
	F	1.88	2.19	2.39	2.42	2.83	2.03	2.85	1.70	2.31
3	*t*	1.70	3.15	4.07	2.14	4.82	4.53	4.44	1.12	1.26
	F	1.35	2.82	3.40	1.82	4.81	3.28	3.58	3.37	2.05
4	*t*	2.31	3.25	4.34	4.17	5.61	3.23	4.58	2.47	1.97
	F	1.98	3.42	6.94	9.66	6.83	4.02	5.25	5.93	1.87
5	*t*	2.79	4.29	4.35	3.41	5.77	4.50	4.50	2.13	2.98
	F	3.57	7.50	2.25	6.31	7.01	3.45	5.53	8.18	2.61
7	*t*	1.44	1.59	3.55	2.76	3.95	3.52	4.70	.788	1.56
	F	1.77	1.87	2.71	4.65	2.80	2.72	3.08	2.04	1.95
8	*t*	2.73	3.30	3.06	2.02	4.48	4.76	5.24	1.76	1.74
	F	3.35	1.77	2.48	1.99	3.88	4.67	3.30	4.31	1.83
9	*t*	3.32	2.17	2.07	2.78	4.25	4.13	4.45	.431	.667
	F	3.41	1.48	1.87	2.62	3.40	6.74	3.76	1.82	1.07
10	*t*	1.60	4.29	2.96	2.45	3.30	4.85	5.62	1.82	2.60
	F	1.91	3.11	1.63	3.00	3.04	4.82	4.69	4.01	2.56
11	*t*	1.54	3.62	3.90	2.92	4.75	4.33	11.6	1.28	1.11
	F	2.46	2.53	3.01	3.52	4.44	6.85	8.66	3.32	1.63

[a] For *t*-tests there are 16 degrees of freedom for July and 21 degrees for other months. For *F*-tests the degrees of freedom are 16 and 16 and 21 and 21.

[b] Critical values for one-tailed tests are as follows:

July	Other Months
$t_{.05} = 1.75$ $t_{.01} = 2.58$	$t_{.05} = 1.72$ $t_{.01} = 2.51$
$F_{.05} = 2.34$ $F_{.01} = 3.37$	$F_{.05} = 2.11$ $F_{.01} = 2.86$

curate but seem to have had less impact, probably because many decisions were already made and market participants already possessed good information about the crop.

Significant information content does not mean that crop reports are worth the price to taxpayers or that private suppliers would not—in the absence of government forecasts—provide a similar service. However, the empirical results presented here indicate that USDA reports have passed the first necessary test to justify their continued support.

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References

Anderson, Ronald W., and Jean-Pierre Danthine. "Cross Hedging." *J. Polit. Econ.* 89(1981):1182–96.

Bradford, David F., and Harry H. Kelejian. "The Value of Information for Crop Forecasting with Bayesian Speculators: Theory and Empirical Results." *Bell J. Econ.* 9(1978):123–44.

Bullock, J. D. "Social Costs Caused by Errors in Agricultural Production Forecast." *Amer. J. Agr. Econ.* 58(1976):76–80.

Choi, Jin Wook. "An Analysis of Price Responses to Public Information: A Case Study of the USDA Corn Crop Forecasts." Ph.D. thesis, Iowa State University, 1982.

Cornell, Bradford. "The Money Supply Announcements Puzzle: Review and Interpretation." *Amer. Econ. Rev.* 73(1983):644–57.

Fackler, Paul L. "On the Relation Between Futures Price Movements and USDA Reports." *Applied Commodity Price Analysis, Forecasting, and Market Risk*, pp. 247–66. Proceedings of the NCR-134 Conference, 1985.

Falk, Barry, and Peter F. Orazem. "A Theory of Futures Market Responses to Government Crop Forecasts." Iowa State University, 1985.

Gardner, Bruce. "Fact and Fiction in the Public Data Budget Crunch." *Amer. J. Agr. Econ.* 65(1983): 882–88.

Gorham, Michael. "Public and Private Sector Information in Agricultural Commodity Markets." Federal Reserve Bank of San Francisco *Econ. Rev.* (spring 1978), pp. 30–38.

Gunnelson, G., W. D. Dobson, and S. Pamperin. "Analysis of the Accuracy of USDA Forecasts." *Amer. J. Agr. Econ.* 54(1972):639–45.

Hayami, Y., and W. Peterson. "Social Returns to Public Information Services: Statistical Reporting of U.S. Farm Commodities." *Amer. Econ. Rev.* 62(1972): 119–30.

Hoffman, George. "The Effect of Quarterly Livestock Reports on Cattle and Hog Prices." *N. Cent. J. Agr. Econ.* 2(1980):145–50.

Jesse, E. N., A. C. Johnson, Jr., and A. B. Paul. "User Fees, Deregulation, and Marketing Efficiency." *Amer. J. Agr. Econ.* 64(1982):909–15.

Just, Richard E. "The Impact of Less Data on the Agricultural Economy and Society." *Amer. J. Agr. Econ.* 65(1983):872–81.

Just, Richard E., and Gordon C. Rausser. "Commodity Price Forecasting with Large-Scale Econometric Models and the Futures Market." *Amer. J. Agr. Econ.* 63(1981):197–208.

Knight, Frank H. "Risk, Uncertainty, and Profit." New York: Hart, Schaffner and Marx, 1921.

Miller, Steve. "The Response of Future Prices to New Market Information: The Case of Live Hogs." *S. J. Agr. Econ.* 11(1979):67–70.

Moore, Henry L. *Forecasting the Yield and Price of Cotton.* New York: Macmillan Co., 1917.

Pearson, Daniel, and James P. Houck. "Price Impacts of SRS Crop Production Reports: Corn, Soybeans, and Wheat." Mimeographed. Dep. Agr. and Appl. Econ., University of Minnesota, April 1977.

Roll, Richard. "Orange Juice and Weather." *Amer. Econ. Rev.* 74(1984):861–80.

SAS User's Guide: Statistics, Version 5 Edition. Cary NC: SAS Institute, 1985.

Smith, Garry L. "An Evaluation of the Impact of Improved Crop Information in the Market for Soybeans." M.S. thesis, Purdue University, 1978.

Snedecor, George W., and William G. Cochran. *Statistical Methods,* 6th ed. Ames: Iowa State University Press, 1967.

Spilka, Walter, Jr. "An Overview of the USDA Crop and Livestock Information System." *J. Futures Mkts.* 3(1983):167–76.

Tauchen, George E., and Mark Pitts. "The Price Variability–Volume Relationship on Speculative Markets." *Econometrica* 51(1983):485–505.

Turnovsky, Stephen J. "The Determination of Spot and Futures Prices with Storable Commodities." *Econometrica* 51(1983):1363–87.