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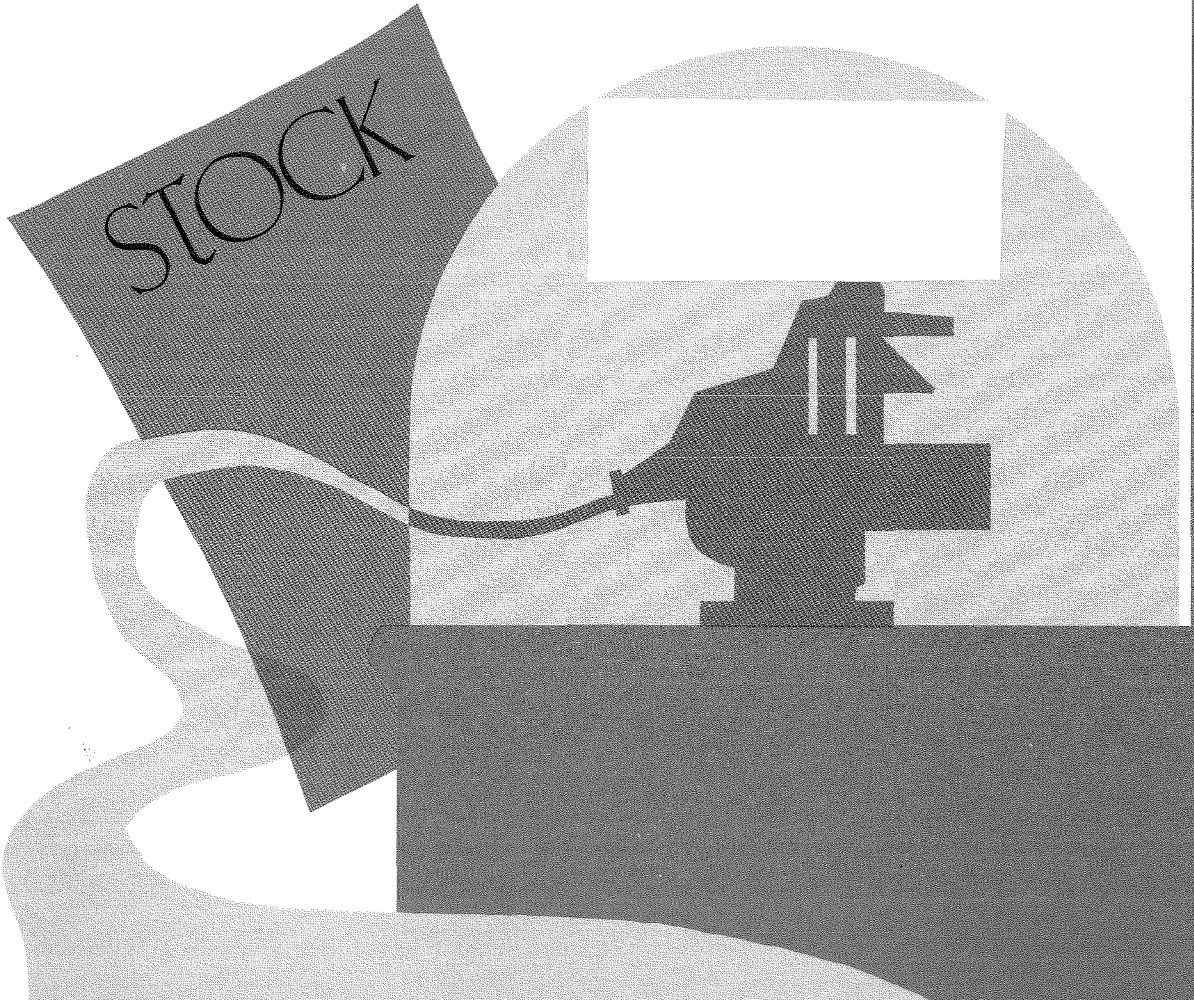

INFORMATION AND MARKET EFFICIENCY

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Public and Private Sector Information in Agricultural Commodity Markets

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When we examine the decision-making of participants in any market, we see that most participants rely upon some source or sources of information to enhance the value of their decisions. We also notice that relevant information in many markets is available from both the public and the private sector. The public/private information mix varies widely over markets. In some, such as the markets for air conditioners, shoes, calculators and pre-EPA automobiles, there is virtually no public-sector information. In others, such as the markets for labor, financial instruments and agricultural commodities, the public sector plays a very large role.

The purpose of this paper is to explore the relationship between public- and private-market information, with particular emphasis on a specific market with a large component of public-sector information—the market for agricultural commodities. First, we show how public information both destroys and creates opportunities for providers of private-sector information. We then measure the private sector's response to these new opportunites in the case of three major agricultural commodities with highly-developed spot and futures markets. Our analysis indicates that private-information sources correctly forecast public-sector announcements for soybeans, but do not do so for corn and wheat.

I. Relationship Between Public and Private Sector Information

In order to discuss the interaction of public and private information, it is useful to construct a model of an information sector. In doing so, however, it is not necessary that all the real-world circumstances be exactly duplicated. Basically, the model involves the development of a commodity market, the emergence of private firms supplying information to market participants, and the entry of public-sector information providers—due to the public sector's belief that an inadequate supply of information is available from the private sector. Finally, the model includes a readjustment by private firms to the new presence of the public sector.

Private-sector entry

A market for a particular commodity or commodity group emerges at some point in time. In developing countries, this may happen when a commodity emerges from the traditional world of subsistence agriculture and is bought and sold in the market. In developed economies, this may happen when a new commodity or service is created, such as microwave ovens, calculators, stock options or kiwi fruit.

As a market emerges, so too do information providers. In some cases, market participants may conduct their own information search through discussions with other market participants; thus the information providers and the information users become one and the same. This would tend to be true of very small markets. In other cases, a distinct set of private-sector information providers may arise. Some may simply be existing firms which expand to cover a new market, while others may be new firms. In either case, resources are organized to provide information to a new market when it is profitable to do so. Private-sector information expands until the cost of providing the last unit of information is just equal to its price—or value, when market participants generate their own information.

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Public-sector entry

This equilibrium amount of private information is provided until the public sector makes its entry. If the public sector is assumed to aim at maximizing social welfare, specifically with regard to the use of information as a public good, then it would be likely to consider available information inadequate whenever the private sector is left to do the job on its own. The public sector thus would "decide" to undertake the task of creating the appropriate information.[1]

However, public servants may be just as interested in their own survival as in social welfare. In a democracy, high-level public servants are either elected by the populace or serve at the pleasure of those who are so elected. If a large voting bloc wants the public sector to provide information to some particular market, public officials would be likely to pay attention because of their own interest in re-election. Their willingness to grant such requests would depend upon the voting strength (or campaign support) of the interests affected, but also upon their own ability to justify to others the social subsidy involved in the public provision of the information in question. In the case of agriculture, the farm sector's political power could be expected to generate demands for publicly-provided information on commodity markets, with this situation being justified to the rest of society on the grounds of its contribution to a stable supply of food at stable prices.

One caveat is in order. Not all participants in all markets would benefit from the public provision of market information. Some participants who benefit from a less-than-competitive market might suffer if broadly available information made that market more competitive. Where freely-supplied market information provides a positive value to market participants, those participants would have an incentive to ask for it. But where the government obtains market information through surveys, the value of the information would have to exceed any inconvenience costs before market participants would have any incentive to request it.

Private-sector response

When government provides market information, it disrupts the equilibrium in the production of private information. To the extent that the free (or low-cost) government information substitutes for existing private-sector information, private providers may be forced to change their product or to leave the business entirely. But at the same time, new opportunities can arise from these private firms. They can provide analysis and prescription—in other words, translate government statistics into specific market advice in the form of market letters. They can also sell information predicting what the next package of government information will say. Good predictions are valuable to people who want to profit by taking positions in advance of any price change induced by the next release of government information.

This last stage could be characterized as a market with a mature information sector—one which has reached a second stage of equilibrium incorporating both private- and public-sector information flows. With the completion of the external shock from the public sector, any new adjustments will probably be relatively minor. There will always be commodity-market changes which induce further changes in its associated information sector. There will also be technological changes in the information industry itself. These may arise from developments in theoretical or applied statistics, such as those which led agricultural officials to adopt new sampling techniques during the early 1960's or from innovations in engineering, such as the remote sensing devices which allow satellites to "photograph" the midwestern corn crop or the Brazilian coffee crop.

II. Information in the Market for Agricultural Commodities

The public sector probably accounts for a greater share of total market information in agriculture than in any other market except finance. And despite continuing minor changes, the information sector in agriculture can appropriately be characterized as mature. The public sector began providing information to these markets over a century ago, and the private sector has generally completed its adjustment to this government role. At this point, it would be useful to consider the institutional background to the information sector associated with these commodity markets.

Public-sector information

The U.S. Department of Agriculture (USDA) provides virtually all the public-sector information relevant to the nation's agricultural markets. (However, the Department of Commerce and the Federal Reserve provide information on related economic conditions, and farm officials in individual states generate data on local agricultural markets). The USDA publishes production, price and other data for all major (and many minor) crop and livestock products. Most of this information is available free of charge, and it is widely used by farmers, merchants, and other market participants.

One of the most useful USDA series is the monthly Crop Production Report, which contains harvest forecasts for a number of major crops. Early in the year, farmers are asked how much acreage they intend to plant to each crop, and those planting intentions are compiled for each major crop by state. After the planting season, Department representatives count the plants growing in a systematic sample of all U.S. farms. Because of the comprehensiveness and predictive accuracy of these surveys, USDA announcements of expected crop production are generally taken as scripture by market participants.

Private-sector information

The private sector tends to complement rather than substitute for the public sector, reflecting the fact that the latter already provides a vast amount of free and high-quality information. In the private sector, it is useful to distinguish between the information that market participants generate for sale to others in the market. Some firms generate information in the form of market letters and market-information services, but others— such as large grain companies, food-processing firms, and food-brokerage firms— generate substantial amounts of internal information as a means of identifying emerging market opportunities as quickly as possible. Because of the difficulty of measuring this type of market information, the tests performed in the next section of this article must be indirect rather than direct.

Private-sector firms, again, may complement the USDA both in the collection and the analysis of raw data. There might appear to be little opportunity for private firms in the area of data collection since the USDA collects data on practically every variable of interest to market participants, but these firms still play an important role by filling a time gap. USDA information is published at regular intervals—weekly, monthly, quarterly, or annually—but important developments often occur between reporting dates and thereby affect the profit prospects of market participants. Some firms develop interim estimates by conducting limited field surveys, but most develop these estimates by evaluating the effects of weather, disease or pest developments on the most recent USDA estimates of crop production.

Private firms similarly play an important role by filling an analysis gap. While the USDA provides some useful analysis in its Situation Reports, it does not usually predict price movements, nor does it provide market participants with advice on the positions they should take in the market. This type of analysis gap is filled by a number of market letters and services, each of which is generally aimed at a different audience of farmers, merchants, or speculators.

III. Measuring the Performance of the Private Information Sector

The agricultural-information sector is mature in the sense that it has already incorporated both a public-sector entry and a private-sector response. But how successful has the private sector been in filling the analysis gap and the time gap that remain after the public sector has done its job? We cannot answer in the case of the analysis gap, which is not amenable to quantitative testing, but we can make an estimate in the case of the time gap. Fortunately, we can do so without inspecting private-firms' actual predictions. This is doubly fortunate because private-sector subscriber information is often difficult or costly to acquire—and frequently difficult to evaluate because of being presented in qualitative rather than quantitative terms—while much other private forecast information is simply impossible to acquire because of being prepared only for confidential internal documents.

Nature of test

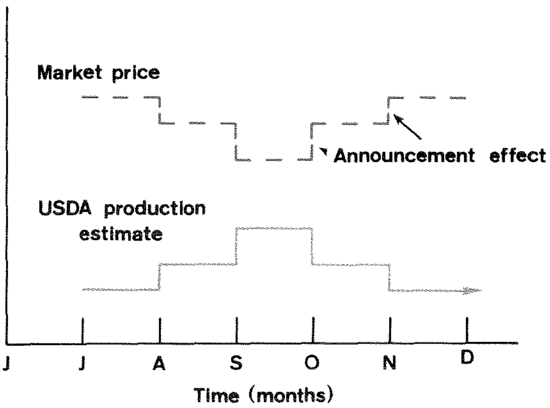
The test consists of examining the effects of USDA output forecasts on specific commodity prices. If USDA announcements are fully anticipated by market participants, they should not affect market prices, but if they are surprises, they should cause prices to jump one way or the other. Thus, from observing the movement of market prices in response to USDA announcements, we can infer how well the private-information sector forecasts those announcements. (Chart 1).

The USDA typically makes monthly forecasts of the coming harvest of wheat, corn and soybeans from midsummer through November each year. County surveys of crop conditions are conducted around the first of the month, and are then sent to Washington and kept in a double-locked box until the compilation of the official estimates around the tenth of the month. On that day, compilers work behind locked and guarded doors until the state and national totals are tabulated and inspected by a representative of the Secretary of Agriculture. That individual takes the approved report directly to the USDA press room, where it is released immediately. In other words, utmost secrecy surrounds the preparation of production estimates for crops which are traded heavily in commodity markets.

If the USDA were the only source of information, a unique price could be associated with any given crop-production forecast, and prices would change only after a monthly announcement changed the previous forecast. In other words, the world might look something like Chart 1. But when other reliable information is available the market-price path will appear more jagged during the month and the announcement effect on prices will be more moderate. In the extreme case, private-sector information may become so well developed that the USDA will never offer any surprises and the announcement effect on prices will be zero.

Chart 1

USDA AS SOLE SOURCE OF CROP INFORMATION



In order to estimate this announcement effect, we examine the monthly production forecasts and associated market prices for three commodities (corn, wheat and soybeans) for the 1970-77 period. The announcement effect is represented by the coefficient "b" in the following basic equation:

$$\%\Delta P = a + b\%\Delta Q \qquad (1)$$

where $\%\Delta Q$ is the percentage change between the current month and the previous month in the USDA harvest forecast, and $\%\Delta P$ is the percentage change in the market place between the day of and the day following the announcement. (Price is measured by the closing futures' price of the post-harvest contract, which is December for wheat and corn and January for soybeans.) Since the USDA announcement is always made at 3 p.m. EST, after the close of all spot and futures markets, this information should be fully captured by the change in the price between the close of the market on the announcement day and the same time on the following day. Also, to take account of the ceilings imposed on daily futures' price movements, the terminal price used in the $\%\Delta P$ figure is the closing price on the first post-announcement day on which the limit was not reached.

Some asymmetry is involved in using daily price changes on one side of the equation and monthly quantity changes on the other. However, an example will demonstrate the appropriateness of our test. Assume that a wheat-crop forecast is made on the 10th of July, and that the market accepts this as the best available at that time. As the month progresses and rainfall becomes lighter than expected, private-information providers will adjust the July USDA forecast downward. To the extent that this downward adjustment is off the mark and the market is surprised by the new USDA forecast of August 10, the surprise will show up only in the August 11 price change. Thus, since we are simply trying to estimate the degree to which the market is surprised by the USDA forecast adjustment, this test is appropriate. If, on the other hand, we were trying to estimate an elasticity of demand, we would need to use the same time period for both price and quantity, and the test used here would not be appropriate.

A recent unpublished paper by Pearson and Houck[2] uses a non-parametric chi-square test to examine the hypothesis of an inverse relationship between USDA forecast adjustments and associated market-price changes. For the 1963-75 period, they found that forecast changes and market prices moved in opposite directions for corn, soybeans, and spring wheat, but not for winter wheat. The current paper extends the Pearson and Houck tests by 1) using regression analysis for estimating the magnitude of the announcement effect, 2) expanding the sample period from 12 to 28 years, and 3) testing for changes in the announcement effect through the crop season and over time.

Announcement effect?

We obtain the following results from estimating Equation 1 (t values in parenthesis):

$$\%\Delta P_S = -.632 - .004\%\ \text{Soybeans} \qquad R^2 = .000$$
$$(2.43)\quad (0.05) \qquad DW = 1.97$$
$$SER = 2.36$$
$$n = 84$$

$$\%\Delta P_W = .028 - .202\%\ \text{Wheat} \qquad R^2 = .029$$
$$(0.10)\quad (1.56) \qquad DW = 2.07$$
$$SER = 2.48$$
$$n = 84$$

$$\%\Delta P_C = .078 - .236\%\ \text{Corn} \qquad R^2 = .079$$
$$(0.31)\quad (3.01) \qquad DW = 1.68$$
$$SER = 2.60$$
$$n = 107$$

While the explanatory value of the equations is quite low, all of the coefficients carry the expected sign, which implies that price moves in the opposite direction from quantity. However, the relationship is highly significant only for corn, while it is weakly significant for wheat and essentially zero for soybeans. This suggests that the private market does a very good job anticipating changes in the soybean forecast, a somewhat poorer job anticipating changes in the wheat harvest and a considerably poorer job in anticipating changes in the corn harvest. Note that while the magnitude of the announcement effect is roughly the same for wheat and corn, the effect for corn is much more statistically significant.[3]

Much of this difference can be explained by technical differences among crops. Soybeans are a very hardy crop, so that month-to-month changes in temperature and rainfall affect yields to a relatively minor extent. Corn and, to a lesser extent, wheat yields are much more affected by environmental changes. In fact, the variability of soybean yields is roughly only half that of corn or wheat (Table 1). The ranking of the crops by variability of yield parallels their ranking by the private sector's output-forecasting performance, which suggests that the technical difficulty of the task is the primary factor determining the private sector's ability to forecast changes in USDA estimates.

Table 1
Per-Acre Crop Yields, 1966-76[a)]
(Bushels per Acre)

	Mean	Standard Deviation	Coefficient of Variation
Soybeans	25.52	1.83	.072
Wheat	27.94	3.36	.120
Corn	75.12	12.71	.169

a) Yield data taken from USDA, *Agricultural Statistics 1977*

Variation over crop season

As the crop season progresses, the uncertainty associated with crop estimates decreases. Crop-production estimates are based upon: 1) an estimate of planted acreage, and 2) an estimate of yield per acre. While good acreage estimates can be obtained early in the season, initial yield estimates are subject to change during the course of the season. As the season progresses, yield estimates involve fewer assumptions and therefore become less uncertain. Consequently, both the public and private sectors should do a better forecasting job as the season progresses. Indeed, throughout the past 28 years, the accuracy of the USDA forecast improved and the variation in the forecast error fell as the season advanced. (Table 2).

Table 2
Accuracy of and Variation in USDA Monthly Forecast, 1950–77

	Forecast/post-harvest estimate				
	July	August	Sept.	Oct.	Nov.
Soybeans	—	.990	.996	.997	.997
Wheat	.993	.996	.999	.999	.999
Corn	—	1.031	1.032	1.035	1.040
	Variation in Forecast Error[a]				
Soybeans	—	.080	.043	.034	.027
Wheat	.044	.023	.010	.016	.016
Corn	—	.084	.077	.076	.077

a) Measure of variation $= \sqrt{\frac{1}{m}\sum_{i=1}^{m}\left(\frac{\text{forecast}_i - \text{final}}{\text{final}}\right)^2}$

While summary statistics similar to those in Table 2 cannot be constructed for private-sector forecasts (for reasons explained above), the private sector's improvement through the crop season can be measured in an indirect fashion. If this sector improves its forecast at roughly the same rate as the public sector we would expect to find no systemetic change in the announcement effect over the crop season. If, on the other hand, it lags behind the public sector's performance, we would expect to find an increasingly significant announcement effect over the crop season.

To test this hypothesis, we estimated Equation 1 separately for each monthly change. For example, the announcement effect for the July/August change in the corn forecast, estimated with

Table 3
Announcement Effect As Crop Season Progresses[a]

Month of Change	Soybeans	Wheat	Corn
July/Aug.	c	−.218 (1.18)[b]	−.061 (0.99)
Aug./Sept.	−.011 (0.12)	−.186 (0.78)	−.443 (2.16)
Sept./Oct.	−.051 (0.25)	−.935 (0.77)	+.028 (0.18)
Oct./Nov.	−.008 (0.03)	d	−.550 (2.85)

a) Announcement effects are estimates of "b" in Equation 1, calculated for each crop and for each monthly change. Each estimate is based upon 28 observations for the 28 years of the sample.
b) t-values in parentheses
c) No soybean-crop estimate prepared for July.
d) October/November changes were too small to use for estimation.

the 28 annual observations, can be seen in the upper right hand corner of Table 3. Altogether, no consistent increase or decrease in the announcement effect is apparent over the crop season. This suggests that the private sector does indeed improve its forecasts at roughly the same rate as the private sector. However, since forecast improvements over the crop season are due almost exclusively to an easier forecasting environment, it might be expected that all forecasters would find themselves improving at about the same rate.

Variation over time

The USDA has taken a number of steps to improve the accuracy of its forecasts, and these measures have led to a gradually improved forecast ever since 1929.[4] Even within the shorter 1950 to 1977 period under consideration in this paper, the accuracy of USDA forecasts has improved considerably, as is evident from the shrinking variation in the forecast error displayed in Table 4. The only exception is a decline in the forecasting accuracy for soybeans as we move from the late 1960's into the commodity-turbulent early 1970's.

Table 4
Variation in the USDA Forecast Error Through Time, 1950-77[a]

	1950-56	1957-63	1964-70	1971-77
Soybeans	.076	.037	.033	.042
Wheat	.037	.025	.024	.022
Corn	.137	.075	.054	.043

a) Measure of variation used here is the same as that in Table 2.

But has the private sector kept pace with these public-sector improvements? In a test similar to the one above, Equation 1 was estimated for each of four 7-year periods, with the results reported in Table 5. With only a single exception, the announcement effect grew increasingly larger and more significant over time—that is, market participants became increasingly surprised over time. This suggests that the private sector lagged behind the public sector in improving its forecast.

This might have been expected. Unlike the forecast improvement over the crop season, which is attributable to environmental changes, improvements over time are generally attributable to actions taken by the forecasting agent itself. Because some improvements may be too costly to be adopted by private firms (since they may not stimulate a commensurate rise in revenues), the public sector adoption of such improvements would tend to enhance its forecast accuracy relative to the private sector. Examples might be a move to larger sampling frames or more intensive physical counts within each frame. Thus, due to the profitability constraint in the private sector, a well-endowed public sector agency like the USDA might be expected to improve its forcasts at a more rapid rate than the private sector, thus generating larger announcement effects over time. (A more formal and technical presentation of this interpretation can be found in the Appendix.)

Table 5
Announcement Effect Over Time[a]

Period	Soybeans	Wheat	Corn
1950-56	.021 (0.45)	.003 (0.08)[b]	−.017 (0.31)
1957-63	−.134 (1.34)	−.016 (0.31)	−.147 (1.45)
1964-70	−.315 (2.31)	−.198 (1.27)	−.229 (2.14)
1971-77	.214 (0.63)	−.972 (1.63)	−.918 (2.60)

a) Announcement effects are estimates of "b" in Equation 1 for each crop, for each of four time periods. Corn equations are based upon 35 observations (5 months x 7 years); wheat and soybean equations are based upon 28 observations (4 months x 7 years).

b) t-values in parenthesis

IV. Conclusion

This paper was designed to explore the relationship between the provision of public and private information to participants in commodity markets. We emphasized particularly the market for agricultural commodities, since this is a market with a large component of public-sector information.

Whenever public information is considered reliable, its release would be expected to have a significant impact on the market. However, market participants have an obvious incentive to predict such public announcements, since this is equivalent to predicting a movement in prices. In a mature information sector, private information providers would become fairly adept at making such predictions, so that we would expect to find a fairly weak public-announcement effect. In our test, however, we found that the private information sector did a good job of prediction only for soybeans. Corn and, to a lesser extent, wheat still have significant announcement effects.

For technical reasons, public-sector information generally improves in quality over the crop season—and the same appears to be true for private-sector performance. However, over time, public-sector information has improved in quality, whereas the private sector's forecasting ability has lagged behind.

This should not be too surprising. The public sector, unlike the private sector, is not constrained by considerations of profitability when adopting improved methods of forecasting or expanding its survey activities—although of course it is subject to certain budget constraints. Thus, in response to constituents and other pressures, the USDA has been able to improve its forecasting ability more rapidly than has the private sector.

APPENDIX

The notion that an increasing announcement effect suggests that the private sector lags the public sector in increasing its forecast accuracy has some intuitive appeal. However, a more formal demonstration of the conditions under which diverging forecast accuracy leads to increased announcement effects would make such a notion more plausible.

Let G and P represent the forecast error of the government and private sector respectively. Furthermore, let the government error be written as a function of both the private sector error (to the extent that both sectors make the same types of mistakes) and its own unique source of error, E, such that:

$$1)\quad G = aP + E$$

where $a > 0$ to reflect the fact that both private and public tend to make errors in the same direction, and both E and P have zero mean and some positive variance, σ_E^2 and σ_P^2 respectively. Assume further that the covariance between P and E is zero and that a is independent of both σ_E^2 and σ_P^2. Now, the variance of the government error can be written as a function of the variance of the private error and the independent government error

$$2)\quad \sigma_G^2 = a^2\sigma_P^2 + \sigma_E^2$$

Let us take the case where the errors initially have the same variance and then the variance of the government error falls, while the variance of the private error remains unchanged. There are two ways in which the variance of the government error can decline according to equation 2. Either "a" could fall which would mean that the government began to rely less on the methods or data it shared with the private sector, or σ_E^2 could fall because of increased public sector reliance on better techniques or data not available to the private sector.

The announcement effect could either increase or decrease depending upon which of these two factors, a or σ_E^2, was responsible for the accuracy of the government forecast. Since the size of the announcement effect depends upon the expected difference between the two errors, let us write the square of that expected difference as

$$3)\quad E(P-G)^2 = (a-1)^2\sigma_P^2 + \sigma_E^2$$

Clearly, if the government increases its accuracy by reducing the variance of the error unique to the government, i.e., σ_E^2, then the expected difference expressed in equation 3 will also fall and the announcement effect will decrease. If, on the other hand, government accuracy increases because it improves on a technique used by both sectors (while the private sector does not make the improvement), then "a" falls. Note that $0 < a < 1$ since we assumed (1) that government and private errors were positively correlated which implies $a > 0$ and (2) that initially $\sigma_P^2 = \sigma_G^2$, which from equation 2 implies that $a < 1$. Now, as a positive "a" approaches zero, the expected difference in equation 3 grows and, thus, the announcement effect grows larger.

So, it is only an increase in government accuracy via a fall in "a" that is consistent with our interpretation in this paper. The question then becomes whether the actual source of increased USDA accuracy has been a fall in σ_E^2 or a. For one thing, private forecasters can sell their forecasts partly on the basis that they are good forecasts of yet-to-be-announced USDA forecasts, thus allowing subscribers to take advantageous market positions. This creates an incentive for private forecasters to behave in a manner that keeps "a" as close to 1 and E as close to zero as possible (in equation 1). To the extent that they are successful in this and that there is little E and a lot of "a" for the public sector to reduce, most of the reduction in the variance of the public sector forecast would likely come from reductions in a. Futhermore, the government forecasts are based upon surveys of farms, while the private sector forecasts are based both upon farm surveys and the integration of secondary information on weather conditions, random media coverage of the farm sector and so on. To the extent that USDA expands the size or quality of its farm surveys beyond that allowed by profitability considerations in the private sector, this represents a fall in "a" and an increased announcement effect. This is probably more typical of what has taken place over the past several decades. (Note: This treatment was suggested by Patrick Weber.)

FOOTNOTES

1. A **public good** is one whose cost of production is unaffected by the number of people who consume it. This is to be distinguished from a **collective good**, which (once produced) is automatically consumed by all. (Public safety is a collective good.) Information, per se, is a pure public good, since the cost of creating it is the same whether it is used by one or by a million people. (Note that while the message is a public good, the medium—book, pamphlet or magazine—is a private good.) The problem with a public good is that the private sector will not price it at the marginal cost of production—which is zero since adding a new consumer costs nothing—but will rather charge some price which will cover fixed costs and allow a profit. It is generally recognized that this is not optimal, because (once produced) the information can be provided to additional people—i.e. social welfare can be increased—at no additional cost. While this suggests that government intervention **may** make society better off, it is by no means clear that it would.

The private sector can come fairly close to providing the optimal amount of information if it can charge each consumer a price equal to the value of the information to him or, more realistically, if the cost of creating the information becomes very small relative to the cost of disseminating it. In the latter case, the portion of the price attributable to the public good (the message) approaches the optimal level of zero, while the bulk of the price charged to the consumer is the price of the private good (the medium). In the case of paperback books, information costs are low relative to dissemination costs, and thus the private sector may be providing close to the optimal amount of information; in the case of the National Income Accounts, production costs are so great that the private sector would probably provide considerably less than an optimal amount. Information on agricultural markets probably lies somewhere between these two extremes, but closer to the latter.

The classic article on the optimal level of a public good is Paul Samuelson, "The Pure Theory of Public Expenditure", **Review of Economic Studies** (November 1954). A recent merging of the public-goods and economics-of-information literature can be found in Bruce Owen, Jack Beebe and Willard Manning, **Television Economics** (Lexington, Mass: Lexington Books, 1974).

2. Daniel Pearson and James P. Houck, "Price Impacts of SRS Crop Production Reports: Corn, Soybeans, and Wheat," unpublished manuscript, Department of Agriculture and Applied Economics, University of Minnesota, April 1977.

3. The price effect of a change in the harvest forecast should be rather sensitive to the amount of the commodity currently in storage. The new harvest does not usually make up the total supply, but simply adds to that supply—and price is determined by the intersection of demand and total supply. Since stock levels changed considerably over the sample period, it seemed appropriate to control for these changes. Thus Equation 1 was modified such that $\%\Delta Q$ refers to the change in total supply, where total supply equals July 1 stocks plus the harvest forecast. As might be expected, the size and significance of the coefficients and the fit of the equations improve modestly, though the announced effect for soybeans remains essentially zero. The new estimated equations are:

$$\%\Delta P_S = .629 - .013\ \%\Delta \text{Total Soy} \qquad R^2 = .003$$
$$(2.42)\ (0.15)$$

$$\%\Delta P_W = .020 - .356\ \%\Delta \text{Total Wheat} \qquad R^2 = .040$$
$$(0.07\ (1.84)$$

$$\%\Delta P_C = .059 - .357\ \%\Delta \text{Total Corn} \qquad R^2 = .086$$
$$(0.24)\ (3.16)$$

4. A moderate improvement in USDA forecast accuracy over the 1929-1970 period was discovered using different techniques than those in Table 4 by G. Gunnelson, W.D. Dobson, and S. Pamperin, "Analysis of the Accuracy of USDA Forecasts," **American Journal of Agricultural Economics** (November 1972).