Using USDA Production Forecasts: Adjusting for Smoothing

By Dwight R. Sanders, Ira J. Altman, Mark R. Manfredo and Rachel Anderson

Abstract

Agribusinesses, producers and farm managers rely heavily on forecasts made by the U.S. Department of Agriculture and other government agencies in forming expectations that drive management decisions. While agency forecasts are a valuable and low cost source of forecast information, it is commonly thought that these agencies may unintentionally make gradual adjustments to their forecasts. In other words, agency forecasts may be "smoothed" such that they slowly evolve toward a rational forecast. In this paper, we investigate forecast smoothing in the USDA's cotton production forecasts and demonstrate how forecasting practitioners and farm managers should correct the forecasts.

Introduction

An important function of the U.S. Department of Agriculture (USDA) is to produce forecasts on key production and price variables (NASS). These forecasts are often heavily relied upon by forecasters, producers and farm managers as an inexpensive and informative source of public forecast information. The USDA's forecasts are widely used throughout the U.S. and world food, fiber and forestry industries. While the USDA routinely provides adjustments to their forecasts in future report releases, it is commonly thought that they refrain from making any bold adjustments to their initial forecasts. That is, USDA forecasts may exhibit "smoothing," such that they slowly evolve toward a rational forecast (Isengildina, Irwin and Good).

The smoothing of forecasts is likely unintentional; still, smoothed forecasts may not provide forecast users with the best possible information. Indeed, using smoothed forecasts may result in less than ideal decision making. Given this, it is important that agribusiness forecasters, farm managers and other users of agency forecasts test for smoothing, and then make the appropriate corrections to those forecasts. Often times, USDA forecasts contain very useful information, but it is important that they be tested and corrected for smoothing prior to incorporating them into the decision making process. Correcting the forecasts for smoothing will allow managers to extract the best possible information from the USDA forecasts.

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A number of researchers have attempted to quantify the "value" of USDA forecasts (see Fortenbery and Sumner; Gunnelson, Dobson and Pamperin; Egelkraut, Garcia, Irwin and Good; Sumner and Mueller). In this paper, we focus on illustrating a practical and easy-to-implement procedure to test and correct for forecast smoothing using USDA cotton production forecasts as an example. Farm managers, agribusiness forecasters and other decision-makers who use this correction may benefit from an improvement in forecast accuracy, information and decision-making.

Agency Forecasts and Data

USDA forecasts for cotton production and acreage have received some attention by previous researchers (Frank; Houston et al.). Here, the USDA's annual cotton production forecasts are used to illustrate a simple technique for identifying and correcting forecast smoothing. Cotton is one of the most important textile fabrics in the world, and the U.S. is the leading supplier in the international market with 20 percent of global cotton production and 35 percent of the world export market (Brooks; McDonald and Meyer). USDA production forecasts are widely followed within the industry as they have a large impact on pricing this important product for producers, processors, exporters and textile manufacturers in both the U.S. and abroad.

Cotton is grown primarily in the southern and western United States, and the harvest season typically extends from July through December. Accordingly, the USDA publishes forecasts for total U.S. cotton production six times per year, starting in August and running through January, before the final production is published in May. The initial USDA forecasts in August and September mainly reflect subjective factors such as weather conditions during the growing season. In the following months, as more of the crop matures and is harvested, the forecasts reflect objective yield estimates from sampled fields. The final January forecast reflects surveys of producer yields and processor throughput as indicators of crop size. Then, the actual or final crop size reported in May reflects any adjustments from additional stock surveys. So, the data consists of six forecasts - August, September, October, November, December, January - each updated with new information, with the final production value reported in May.

For illustrative purposes, Table 1 reports the Mean Absolute Percentage Error (MAPE) for August through January USDA cotton production forecasts from 1971 to 2005 (35 years). As one would expect, the forecast accuracy as measured by MAPE improves as the harvest season progresses and more information is known about the ultimate size of the harvest. The August forecast has a relatively large MAPE of 6.6 percent, but it declines to under 1 percent (0.60%) with the January forecast - the last forecast produced before the final production reported in May.

Ideally, each month's forecast would be a rational forecast in that it is the best possible estimate at that particular point in time. A necessary condition for that ideal is that the successive changes in the forecasts must be independent. For example, if the agency increases their forecast from August to September, then that should have no bearing on the magnitude or direction of any forecast revision from September to October. If it does, the agency is smoothing the forecasts. That is, the forecasts are considered smoothed if successive revisions are positively correlated.

It is not clear that the USDA has any motivation for slowly adjusting forecasts to higher or lower levels. There may be a subconscious bias against making dramatic changes or shifts in forecast levels (see Isengildina, Irwin and Good); but more likely, forecast smoothing is inadvertent, arising from the process of forming a consensus forecast with a committee. Regardless, if smoothing does occur in agency forecasts, then they need to be measured and corrected by forecast users.

Testing for Forecast Smoothing

One simple and practical approach to testing for smoothing is to graph the successive forecast revisions in an Excel scatter plot. When doing this, it is important that the revisions be measured as a percent of the prior month's estimate such that the changes in the absolute size of the variable through time do not impact the results. As an example, in Figure 1 we use the cotton production data described earlier and plot the first revision of the year, September from August, on the x-axis. The second revision for the year, October from September, is plotted on the y-axis. The resulting x-y plot for cotton is shown in Figure 1, along with the accompanying linear regression line and statistics.

As shown in Figure 1, there is a positive correlation between the revisions made in October and those made in September. That is, if the USDA increases (decreases) their production estimates in September, they are likely to increase (decrease) them again in October. More specifically, the slope of the regression line indicates that a one percent increase in the September estimate is followed on average by a 0.28 percent increase with the October estimate. Clearly, the cotton production forecasts show smoothing from September to October.

Figures 2 through 5 show the comparable analysis for subsequent monthly forecast revisions. For example, Figure 2 shows that a one percent revision in October is followed by a 0.68 percent revision in the same direction in the November forecast. Indeed, the evidence suggests that all of the monthly revisions from September through January show smoothing. Only the final revision appears free from smoothing.

In these diagrams, the R-squared represents the percent of the revision that is explained by the prior month's revision. The R-squared varies from a low of 0.03 when regressing the final estimate of production versus the January revision (Figure 5), and a high of 0.42 when considering the November versus October revisions (Figure 2). So, in some months, a large portion of subsequent forecast revisions can be anticipated from the prior month's revision. This is indicative of a forecast sequence where revisions are smoothed—that is, the sluggish incorporation of old information, as opposed to new information being provided to decision makers immediately when it becomes available. To make the best possible decisions using the USDA forecasts, it is important that producers and managers correct the forecasts for this smoothing process.

Forecast Corrections

In the event that forecasts do appear to be smoothed, such as the USDA cotton production forecasts illustrated, corrective measures can be taken to provide a more accurate forecast. By definition, a smoothed forecast is not quickly incorporating all available information into the most recent forecast; instead, it is impounding information over a number of correlated revisions. While this process can be modeled in a rigorous statistical manner, simple corrections based on the presented figures will provide worthwhile improvements in overall forecast accuracy.

As an example, consider 2005 cotton production forecasts. The August forecast was for 21,291 (thousand bales) and the September revision was up 4.65 percent to 22,282. Based on the regression information provided in Figure 1, a forecast user should adjust the September forecast using the estimated regression relationship. That is, the +4.65 percent revision suggests that the next revision will likely be a magnitude of +0.79 percent (4.65% x 0.2871 - 0.0055). Therefore, the forecast should be adjusted upward to 22,458 (22,282 x 1.0079) to reflect the smoothing expected with the October revision. In this example, the actual October 2005 was in fact an upward adjustment of 1.95 percent to 22,717.

Forecast smoothing creates a chain effect where an upward revision portends additional upward revisions in each successive forecast. Therefore, to fully correct for smoothing, the forecast user must account for how an initial revision works through subsequent forecast revisions. Continuing with the above example, the September revision of +4.65 percent suggests an additional revision in October of +0.79 percent, which suggests a further upward revision in November and December, and so forth.

Table 2 presents the expected revision at each forecast month based on an initial one percent revision corresponding to that month. To illustrate this idea, the chain of revisions in each subsequent month due to a one percent upward revision is followed. For instance, a one percent upward revision in October implies an additional 1.79 percent increase in November, which would cause a 0.30 percent increase in December, a 0.46 percent increase in January, and a 0.18 percent decline in the final estimate. Summing up the incremental smoothing at each forecast month emanating from the initial one percent September revision is an additional 2.37 percent. The spreadsheet underlying Table 2 essentially calculates the expected revision at each horizon using the slope and intercept coefficients shown in Figures 1-5.

As shown in Table 2, the incremental adjustments vary at each forecasting month, depending on the amount of smoothing in subsequent forecasts. In the cotton production forecasts, the most smoothing follows the October revision (1.79%), which corresponds to the first forecast in which the USDA has objective cotton yield information. The total adjustment needed for each forecast due to smoothing ranges from -0.13 percent from the January forecast to 2.37 percent from the October forecast. Indeed, the adjustments required to correct smoothing can be quite large, and they could have a considerable impact on forecast accuracy. For producers and farm managers utilizing USDA forecasts, they should be able to improve their decision-making by incorporating these adjustments and improving forecast accuracy.

Accuracy Improvement

Correcting USDA forecasts for smoothing as described above should ultimately improve their accuracy and enhance forecast-driven decisions. To illustrate, the 2005 USDA actual and corrected forecasts are shown in Table 3. The 2005 data provide a good example of where the initial forecasts were revised upward in each successive month. The September forecast was a 4.65 percent upward revision of the August forecast. Therefore, using the information in Table 3, this forecast needs to be revised upward an additional 2.97 percent to 22,945. The USDA's October forecast was revised upward 1.95 percent to 22,717 which calls for an additional correction of 3.17 percent to 23,437. Each of these corrections raises the USDA's interim forecasts much closer to the final realized production of 23,890.

This procedure, as illustrated for 2005, is conducted for each year in the dataset to show the improvement that is provided by identifying and correcting for agency smoothing. The second line in Table 1 reports the MAPE's of the corrected forecasts to the MAPE's of the original forecasts in line one. Indeed, the MAPE's for the corrected forecasts are smaller at each horizon. In particular, adjusting the October revision for smoothing reduces the MAPE from 3.77 percent to 2.96 percent, a 21 percent reduction in the forecast error. Clearly, the smoothing of forecast revisions by government agencies can detract from their accuracy. Using the presented methods to test for and correct smoothing will help agribusiness decision makers better understand and more efficiently utilize agency forecasts.

Conclusions

Forecasts developed by the USDA and other government agencies provide an important and cost effective source of public forecast information. Indeed, USDA forecasts are often the only publically available forecasts for many economic variables. Therefore, agribusiness forecasters, farm managers, and producers frequently use agency forecasts to aid in planning and decision making. However, there is some evidence that agencies smooth their forecast revisions—resulting in gradual changes to forecasts. Here, we present a graphical technique for identifying and analyzing smoothing in forecast revisions. Simple scatter plots in Excel provide a test for the existence of smoothing, and the corresponding regression line provides the corrective adjustments needed to remove the impact of smoothing. An example of using USDA cotton production shows evidence of smoothing, and the corrected forecasts provide valuable improvements in forecast accuracy. The methods discussed and illustrated here provide a template for users of all USDA forecasts to identify smoothing and make the appropriate corrections, ultimately improving the accuracy of the forecasts and bettering their decision-making.

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Table 1. Mean absolute percentage error (MAPE) for USDA cotton production forecasts

	Forecast Month					
	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
Orginal Forecast	6.60%	5.09%	3.77%	2.57%	1.39%	0.60%
Corrected Forecast	6.60%	4.89%	2.96%	2.43%	1.18%	0.56%

Table 2. Smoothing impacts associated with USDA cotton production forecasts

			-----Cumulative Impact of a 1% Revision-----				
Months	Constant	Slope	Sept.	Oct.	Nov.	Dec.	Jan.
Aug. - Sept.			1.00%				
Sept. - Oct.	-0.0055	0.2871	-0.26%	1.00%			
Oct. - Nov.	0.0117	0.6206	1.01%	1.79%	1.00%		
Nov. - Dec.	-0.0017	0.2599	0.09%	0.30%	0.09%	1.00%	
Dec. - Jan.	0.0036	0.3406	0.39%	0.46%	0.39%	0.70%	1.00%
Jan. - Final	-0.0022	0.0892	-0.19%	-0.18%	-0.19%	-0.16%	-0.13%
Additional Correction Required			1.04%	2.37%	0.30%	0.54%	-0.13%

Table 3. Corrections for the August 2005 USDA cotton production forecasts

			----Cumulative Revision----					
Months	Constant	Slope	Sept.	Oct.	Nov.	Dec.	Jan.	Final
Aug. - Sept.			4.65%					
Sept. - Oct.	-0.0055	0.2871	0.79%	1.95%				
Oct. - Nov.	0.0117	0.6206	1.66%	2.38%	1.95%			
Nov. - Dec.	-0.0017	0.2599	0.26%	0.45%	0.34%	2.34%		
Dec. - Jan.	0.0036	0.3406	0.45%	0.51%	0.48%	1.16%	0.07%	
Jan. - Final	-0.0022	0.0892	-0.18%	-0.17%	-0.18%	-0.12%	-0.21%	
Additional Correction Required			2.97%	3.17%	0.64%	1.04%	-0.21%	
Orginal USDA Forecast			22,282	22,717	23,161	23,703	23,719	23,890
Corrected Forecast			22,945	23,437	23,308	23,950	23,668	

Figure 1. October vs. September revisions, USDA cotton production forecasts, 1971-2005.

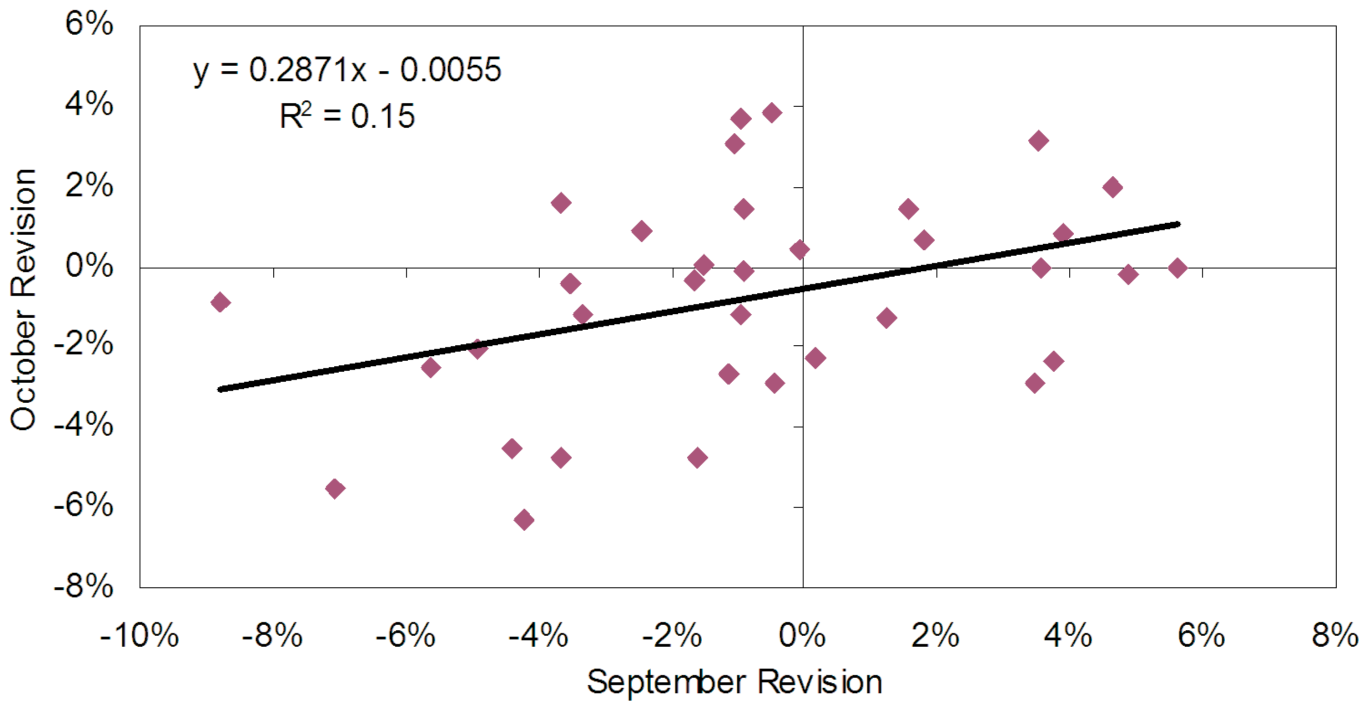

Figure 2. November vs. October revisions, USDA cotton production forecasts, 1971-2005.

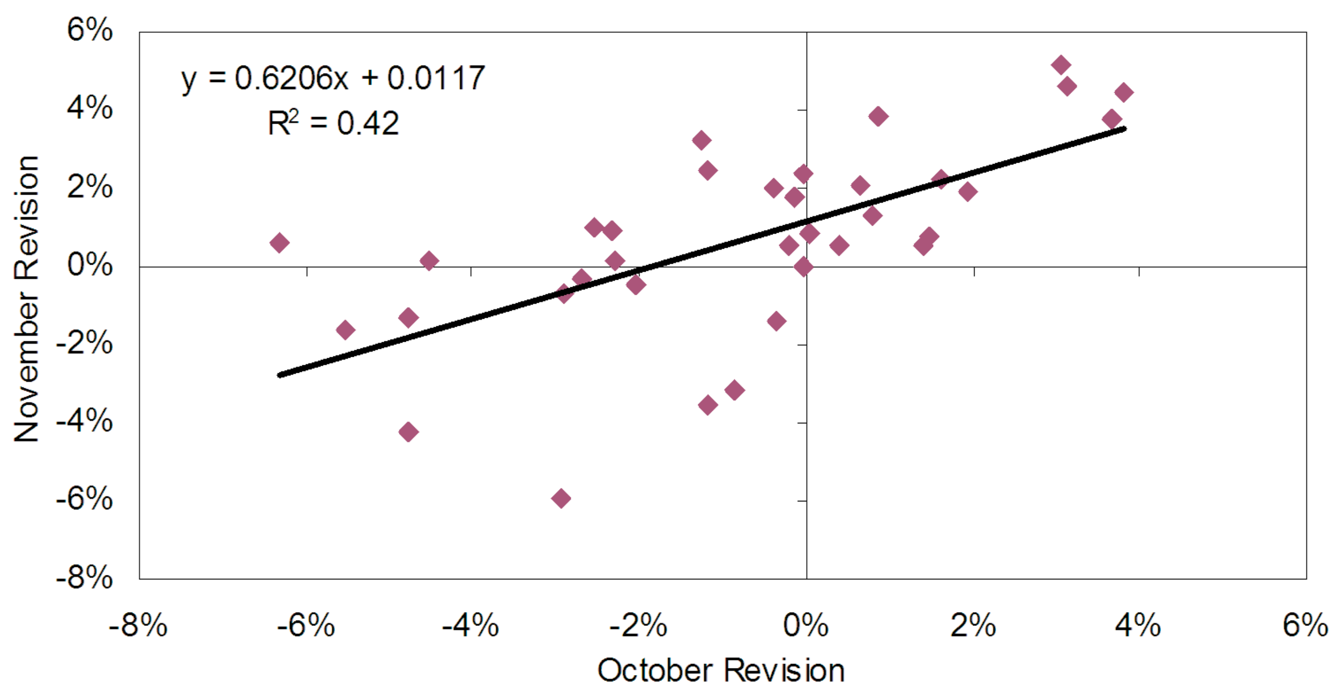

Figure 3. December vs. November revisions, USDA cotton production forecasts, 1971-2005

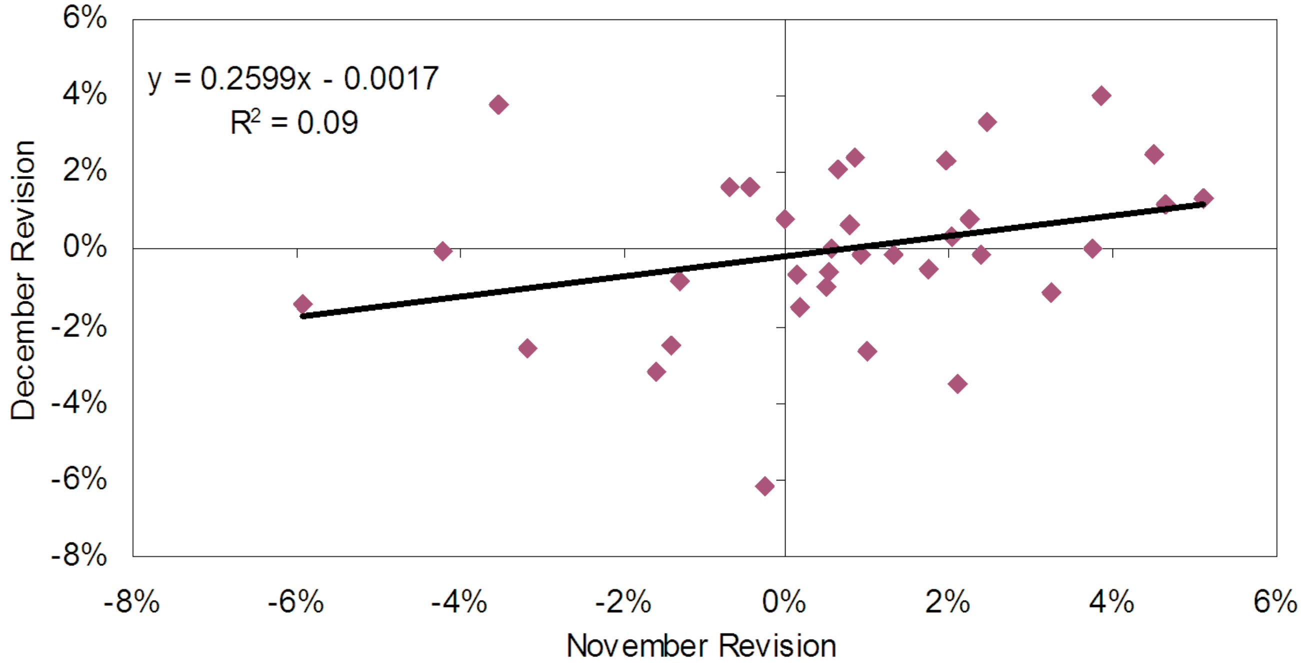

Figure 4. January vs. December revisions, USDA cotton production forecasts, 1971-2005

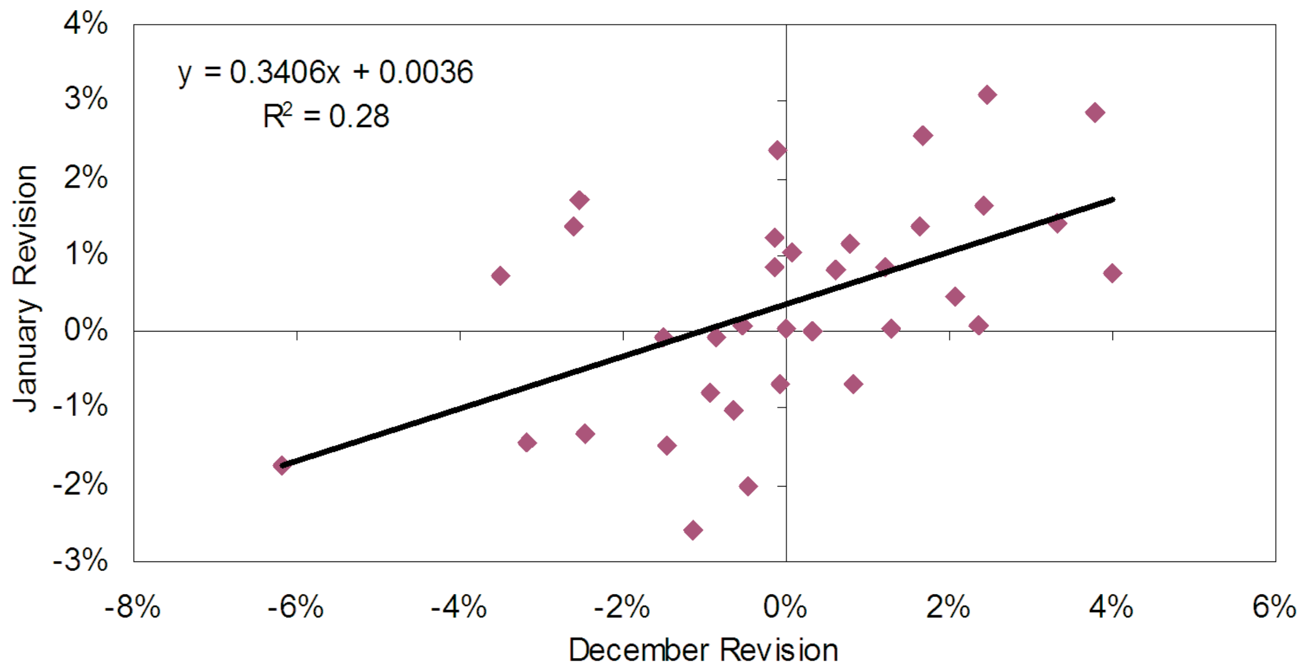

Figure 5. Final vs. January revisions, USDA cotton production forecasts, 1971-2005