Validation of Acreage Price Elasticities and Simulation Results

The validity of these simulation results would be greatly enhanced if (1) the acreage price elasticities embedded in the 1996 Act scenario accurately "forecast" producers' planting intentions for major field crops in 1997-99, and (2) the effect of change in the farm program (through increased planting flexibility) from the 1990 Act baseline to the 1996 Act scenario, as reported earlier in the simulation analysis section, remains unchanged when market conditions embedded in the February 1996 USDA baseline (high-priced) are replaced with market conditions that actually occurred during 1997/98 and 1998/99 (low-priced).

If the results track reasonably well, we anticipate that the program effects reported in the simulation results section, together with the market effect based on actual market conditions, will explain producers' planting intentions in cases where nonprice factors did not play an important role in affecting producers' planting decisions. In addition, if this is the case, then we have reason to believe that the program effect would remain largely the same despite the change in market conditions from the higher-price 1990 Act baseline (reflected in the February 1996 USDA baseline) to the low-price market situation of the late 1990's.

Comparisons Between Model Acreage Forecasts and March Planting Intentions, 1997-99

To assess the validity of the acreage price elasticities estimated in this study, those elasticities were used to forecast March planting intentions for major field crops under the 1996 Act policy environment. The change from 1995/96 to 1996/97 is difficult to replicate, in part, because the change in policy regime was taking place at the same time that many planting choices were being made. To avoid this difficulty, the comparison is confined to 1997-99. We compared acreage forecasts generated with the new acreage price elasticities and farmers' planting intentions released by USDA at the end of March. Model estimates use new-crop futures prices observed at planting time as the basis for price expectations.

Model acreage forecasts presented here are strictly based on acreage price elasticities estimated in this report, leaving the deviation between March intentions and model forecasts to be explained by nonprice factors and model errors. Comparisons for the 1999 crop are highlighted with illustrations here because they represent the most interesting test of the estimated acreage price elasticities in a low-price environment.

The acreage response model (based on the acreage price elasticities) generally performs well in forecasting (1) aggregate planting intentions for four major field crops and (2) plantings for individual field crops in cases where nonprice factors did not play an important role in producers' planting intentions.

In the aggregate, the acreage response model forecast 229.1 million acres of total plantings for the four major field crops (wheat, corn, soybeans, and cotton) in 1999, compared with the 228.3-million-acre planting intentions, as reported in USDA's March 1999 planting intentions report, a deviation of 0.35 percent (table 5). An important factor that might have contributed to the difference is a net increase of about 1.25 million acres enrolled in the Conservation Reserve Program (CRP) between 1998 and 1999. If the acreage model result is adjusted for the effects of the 1.25-million-acre increase in CRP enrollment on cropland availability, the adjusted model result would be 227.86 million acres, only 0.2 percent different from the March planting intentions. Based on new crop futures prices at planting time, farm prices for the four major field crops were expected to decline by an average of 14.6 percent from 1998 to 1999. The acreage response model indicated an expected decline of 1.7 percent in planting intentions for the four major field crops—to 229.11 million acres.

The model performs equally well for 1998, but the deviation between March intentions and model forecasts is greater for 1997, reaching 2.45 percent. A large portion of the deviation between the model forecasts and the March planting intentions is attributed to nonprice factors not reflected in the model. For example, agronomic practices, weather, and increased yield risk all played an important role in reducing winter wheat plantings in 1997.

Winter Wheat

Winter wheat seeded area in 1999 was estimated by USDA in the March planting intentions report to total 43.4 million acres—the smallest since 1972 and down 7 percent from the 46.6 million estimated for 1998 (USDA, 1999). The most significant factor contributing to the decline was a lower wheat price expected by producers, especially for soft red winter (SRW) wheat. Based on July 1999 new-crop futures prices at Kansas

Table 5—Comparisons between model acreage forecasts and March planting intentions

Crop	March intentions	Model forecast	Deviation
	Million acres		Percent
1997			
Winter wheat	48.23	49.94	+3.55
Spring wheat	20.96	20.23	- .73
Corn	81.42	78.77	- 3.25
Soybeans	68.80	63.60	- 7.56
Cotton	14.48	15.62	+7.87
Subtotal	233.89	228.16	- 2.45
1998			
Winter wheat	46.64	49.38	+2.74
Spring wheat	20.39	21.26	+4.27
Corn	80.78	81.79	+1.25
Soybeans	72.00	67.64	- 6.06
Cotton	13.22	14.19	+7.34
Subtotal	233.03	234.26	+ .61
1999			
Winter wheat	43.40	44.25	+1.96
Spring wheat	19.63	20.02	+1.99
Corn	78.22	79.76	+1.54
Soybeans	73.11	71.63	-2.02
Cotton	13.94	13.45	-3.50
Subtotal	228.30	229.11	+ .35

City in mid-October 1998, the expected harvesttime farm price for 1999-crop hard red winter (HRW) wheat was estimated to decline 13.6 percent from 1998. The expected price for soft red winter (SRW) wheat based on July 1999 new-crop futures at Chicago was projected to decline even more—19.6 percent. Thus, the weighted-average expected price for winter wheat was estimated to decline 15.4 percent. Given the own-price elasticity of 0.383 for winter wheat plantings (Lin, 1999a), the reduction in the expected wheat price implied a decline of about 6 percent in winter wheat seedings from 1998, or about 2.75 million acres (based only on own-price effects).

The decline in expected prices of competing crops partly offsets the effect on winter wheat seedings due to the decline in the expected price for winter wheat itself. For winter wheat producers, the decline in expected prices for competing crops based on new-crop futures prices in mid-October 1998 were 8 percent for sorghum and corn, 6 percent for barley, 13 percent for soybeans, and 2 percent for cotton.[21] The decline in the expected price of these competing crops altogether is estimated to add about 0.36 million acres to winter wheat seedings.

Including both own- and cross-price effects together, the acreage response model suggests a decline of 2.39 (2.75 - 0.36) million acres in winter wheat acreage from 1998, compared with a decline of 3.24 million acres estimated by USDA in March 1999. Thus, the model projected winter wheat acreage to total 44.25 million acres—2.0 percent more than the 43.4 million acres estimated by USDA in March. Because March planting intentions include producers' response to nonprice factors as well, the discrepancy could be attributed to the effect on wheat plantings of poor weather that would have prevented the seeding of some HRW acres and an increase in CRP enrollment from wheat land.

[21]The expected prices for sorghum and barley are linked to the expected price of corn based on historical relationships between sorghum and corn prices, and between barley and corn prices. As a result, the expected sorghum price is estimated to follow 100 percent of the change in the expected corn price, and the expected barley price follows 77.3 percent of the change in the expected corn price.

The deviation between model forecasts and March intentions was greater for 1997 and 1998 winter wheat plantings, reaching 3.6 and 2.7 percent, respectively. HRW wheat area seeded in 1998 declined from 1997 levels due primarily to unfavorable weather conditions and an increase of wheat land in CRP enrollment. Virtually all HRW States planted less 1998-crop wheat than they did in 1997. Poor weather prevented some plantings in Montana, which reduced 1998 winter wheat plantings to 1.4 million acres, down from 2.2 million in 1996 and 1.6 million in 1997. Heavy winterkill during 1995-96 and good returns for corn and soybeans reportedly reduced incentives to plant winter wheat (USDA, 1998a). HRW seeded area in Kansas alone was down 700,000 acres from 1997, reflecting chiefly weather-related effects. Several States "ranging from Arkansas to South Carolina did not get all of the previously intended winter wheat in because of wet weather..." (USDA, 1998b). In addition, wheat acres enrolled in the CRP reached 9.7 million acres, up from 9.1 million in 1997. The effects of these nonprice factors could have reduced winter wheat plantings by as much as 2.3 million acres—a large proportion of the deviation (2.7 million acres) between model forecasts and March intentions for 1998

For 1997-crop winter wheat, agronomic practices, weather, and increased yield risk all played an important role in reducing winter wheat plantings (as shown in the March intentions report) to 48.2 million acres, down from 52.0 million in 1996. Late row crop (soybeans in particular) harvest and wetness presented problems in the Plains States and major SRW wheat States. In addition, high yield risk in years prior to 1997 also discouraged producers from growing SRW wheat. These factors, which are not reflected in the acreage response model, might have explained a large proportion of the deviation between model forecasts and March intentions for 1997-crop winter wheat plantings.

Spring Wheat

Spring wheat (including durum) planting intentions in 1999 were estimated by USDA in March 1999 at 19.6 million acres—a decline of 0.8 million acres from 1998's planting intentions, but only 0.3 million acres less than actual 1998 plantings. This projected decline from 1998 intended acreage reflects a decline in the expected price not only for hard red spring (HRS) wheat but also for durum wheat. The acreage response model helps explain the reduction from the previous year's planting intentions.

As of March 15, 1999, the September futures price for HRS at the Minneapolis Grain Exchange settled at $3.56 per bushel—down 9.2 percent (in farm price equivalent) from the September futures price in March 1998. The farm price expected for durum wheat declined even more, by 17.4 percent. Thus, the weighted average price expected for total spring wheat declined by about 10.83 percent. This price decline implies a 3.15-percent decrease in total spring wheat acreage (about 0.64 million acres) based on the 0.291 own-price elasticity (Lin, 1999a). The 9.2-percent decline in 1999 new-crop futures price for HRS wheat was expected to lower HRS wheat plantings. In contrast, an attractive revenue insurance coverage guarantee for durum wheat in 1999 attracted durum plantings, despite the lower expected market price.

The decline in the expected price for competing crops (such as barley, corn, and soybeans) partly offsets the effect on spring wheat plantings due to the decline in the expected price for spring wheat itself, by adding about 0.28 million acres. Thus, including both own- and cross-price effects together, based on market conditions as of March 15, 1999, the acreage response model suggests a slight decline in 1999's spring wheat planting intentions from 1998, to 20.02 million acres—compared with the March planting intentions estimate of 19.63 million acres.

Corn

Planting intentions for corn were estimated by USDA to total 78.2 million acres in March 1999, down 2.6 million from 1998's intentions. The most significant factor contributing to the decline is the 15.3-percent decline in the expected harvesttime farm price for corn, based on December 1999 new-crop futures prices at Chicago in mid-March 1999. Given the own-price elasticity of 0.301 for corn, the decline in the expected corn price implies a decline of 4.6 percent in corn plantings from 1998, or about 3.73 million acres.

The decline in the expected price of competing crops only partly offsets the effect on corn plantings due to the decline in the expected corn price. For corn producers, the decline in expected prices for competing crops based on new-crop futures prices in mid-March 1999 were 16.5 percent for soybeans (calculated at the $5.26 per bushel loan rate), 13.2 percent for wheat, 15.3 percent for sorghum, and 11.3 percent for cotton. The decline in the expected price of these competing crops together is estimated to add about 2.71 million acres to corn plantings, of which 1.88 million were

attributed to the decline in the expected soybean price. Combining own- and cross-price effects suggests a model forecast of 79.8 million acres for 1999 corn planting intentions, compared with the 78.2 million-acre planting intentions estimate.

A large proportion of the deviation between the price-based model forecast and March intention for 1999 corn planting intentions might have been attributed to concerns over aflatoxin (a fungus in corn crops) in the South that reportedly could have lowered 1999 corn plantings by about 1 million acres.[22]

Soybeans

U.S. farmers intended to plant a record 73.1 million acres of soybeans in 1999, as reported by USDA's March 1999 *Prospective Plantings,* which reflects a continued steady upward trend in soybean acreage since implementation of the 1996 Act. On March 15, new-crop soybean futures (November contract) settled at $4.90 per bushel, down 25 percent from the March 1998 quote. So why did soybean acreage continue to expand when farmers faced a dramatic price decline? The increase in planting intentions from 72 million acres in 1998 to 73.1 in 1999 can be accounted for by three factors.

The change in the expected farm price for soybeans, including the incentive offered by marketing loan provisions, is the most important factor that affected 1999 soybean plantings (Lin, 1999b). Despite the 25-percent decline in new-crop soybean futures prices between 1998 and 1999, the soybean marketing loan program guaranteed farmers a price of approximately $5.26 per bushel. As a per-unit price guarantee, the program essentially reduces the decline in the expected soybean farm price to producers from 25.3 percent to 16.5 percent. Given the 0.268 own-price elasticity for U.S. soybeans, the change in soybean's own-price expectations means that 1999 soybean plantings would be reduced by 4.38 percent, or 3.15 million acres.

Partially offsetting this decline is the effect of lowered expected prices for competing crops, which encourage soybean plantings. The combined effect of lower prices for corn (down 15.3 percent), wheat (down 15.6 percent), sorghum (down 15.3 percent), and cotton (down 11.3 percent) resulted in a projected model increase of 2.76 million acres in soybean plantings in 1999, offsetting much of the soybean own-price effect. The expected corn price has the biggest impact (nearly 2.5 million acres), with the acreage price elasticity showing that soybean plantings rise 0.23 percent for each 1-percent decline in the price of corn. Combining own- and cross-price effects suggest a model forecast of 71.6 million acres for 1999 soybean planting intentions, compared with the 73.1 million estimated by USDA in the March 1999 intentions report.

Part of the 1.5-million-acre difference between the model forecast and reported planting intentions may reflect the fact that some farmers had greater cost savings in input use for soybeans than other crops, particularly with the recent introduction of herbicide-tolerant varieties.

Cotton

Planting intentions for the 1999 cotton were estimated by USDA in March 1999 to total 13.94 million acres, up 0.72 million from 1998's planting intentions report. The most significant factor contributing to the change in plantings was the lower cotton price expected by producers. As of March 15, 1999, December 1999 new crop futures had settled at 59.15 cents per pound in New York, for a 56.65 cents per pound farm price equivalent. The expected cotton farm price represents a 19.0-percent decline from the expected farm price based on March 1998 futures quotes. However, the 52 cents per pound loan rate plus the fact that domestic cotton prices could be 10 cents per pound higher than the world price suggest an effective price to producers of about 62 cents per pound. Hence, the effective cotton farm price in 1999 suggests only a decline of 11.3 percent in the expected producer price. Given the estimated price elasticity of 0.469, this decline in price implies a 5.3-percent (or 0.7 million acres) drop in cotton plantings.

The decline in the expected price of competing crops more than offsets the effect on cotton plantings due to the decline in expected cotton prices. For cotton producers, the decline in the expected price of competing crops (corn, wheat, sorghum, and soybeans) contributed to an increase of 0.93 million acres in cotton plantings. Combining own- and cross-price effects suggests a model forecast of 13.45 million acres for 1999 cotton planting intentions, compared with the

[22]In early February 1999, agronomists saw large cuts in corn acreage in the Delta, Southeast, and Southern Plains regions due to concerns over aflatoxin. They reported that "... All together production of early harvested corn should be sharply lower, with planted acreage from these southern States near 3.17 million, compared to 4.05 million in 1998" (*Knight-Ridder MoneyCenter,* Feb. 1, 1999).

13.94 million estimated by USDA in the March 1999 intentions report.

A large portion of the 0.5 million-acre deviation between the model forecast and March intention can be attributed to the effect of nonprice factors, such as aflatoxin for corn crops, on 1999 cotton plantings. Concerns over aflatoxin for corn crops in the South appeared to have caused farmers to switch a part of corn land into cotton plantings.

Comparisons of the POLYSYS Simulation Results Between "High-Price" and "Low-Price" Scenarios, 1997-98

The comparison between model acreage forecasts and March planting intentions reported above is intended to examine whether the acreage price elasticities accurately "forecast" planted acreage (in terms of planting intentions) for major field crops in 1997-99. In this section, the focus is shifted to address whether the effects of increased planting flexibility in the 1996 Act scenario (relative to the February 1996 USDA high-price baseline) on planted acreage, remain intact in low-price market conditions.

To address that issue, this section first compares the POLYSYS simulation results between the February 1996 USDA baseline and the 1996 Act scenario (through increased planting flexibility) under higher price market conditions reflected in the February 1996 USDA baseline, as reported earlier in the simulation analysis section of this report. Then, it compares the POLYSYS simulation results between the two policy scenarios under lower prices to analyze the effect of increased planting flexibility under the 1996 Act scenario on planted acreage with those market price conditions. Lower market prices are simulated in these scenarios by replacing projected crop yields and exports from the February 1996 USDA baseline with actual data in 1996 through 1998. Provisions of previous farm programs that could be triggered by lower prices, such as ARPs, are assumed in the simulations to be unchanged from the February 1996 USDA baseline.

Lower market prices in these scenarios are not reduced to levels that result in marketing loan benefits, thus allowing a comparison of planting flexibility impacts across a range of prices where supply response is based on market signals. For example, corn farm prices in 1998/99 are simulated at $2.34 per bushel under the 1990 Act scenario, lower-price conditions, compared with the $2.60 per bushel in the February 1996 USDA baseline (1990 Act baseline, higher-price conditions). Similarly, corn farm prices in 1998/99 are simulated at $2.40 per bushel under the 1996 Act scenario, lower-price conditions, compared with the $2.69 per bushel under the 1996 Act scenario, higher-price conditions.

Except for the wheat results in 1998, virtually all of the POLYSYS simulation results show that the program effect—the change in planted acreage as a result of increased planting flexibility under the 1996 Act scenario (relative to the 1990 Act baseline)—would remain quite similar in high-price and low-price scenarios (table 6). The program effect for wheat under the low-price scenario is estimated to reduce wheat plantings by 0.9 million acres, down from a reduction of 1.7 million acres under the high-price scenario.

Table 6—Comparisons of the POLYSYS simulation results between "high-price"and "low-price" scenarios, 1997-98

Crop (1)	Market condition (2)	1990 Act scenarios (3)	1996 Act scenarios (4)	Difference (5)=(4)-(3)
		Million acres		
1997				
Wheat	High-price	73.5	72.2	-1.3
	Low-price	74.2	72.9	-1.3
Corn	High-price	80.0	78.1	-1.9
	Low-price	79.2	77.4	-1.8
Soybeans	High-price	61.5	64.2	+2.7
	Low-price	62.7	65.1	+2.4
Cotton	High-price	14.4	15.6	+1.2
	Low-price	14.1	15.3	+1.2
1998				
Wheat	High-price	73.7	72.0	-1.7
	Low-price	71.3	70.4	- .9
Corn	High-price	80.0	79.2	- .8
	Low-price	78.7	78.1	- .6
Soybeans	High-price	61.5	63.2	+1.7
	Low-price	63.1	64.5	+1.4
Cotton	High-price	14.1	15.2	+1.1
	Low-price	14.1	15.4	+1.3