

Impact of the 1996 Act on the U.S. Major Field Crops Sector

This section describes simulations based on the Policy Analysis System-Economic Research Service (POLYSYS-ERS) model jointly developed by ERS and the Agricultural Policy Analysis Center, University of Tennessee, and discusses impacts of increased planting flexibility under the 1996 Act on the major U.S. field crops.

POLYSYS Simulation Procedures

POLYSYS is a simulation modeling framework that provides policy analysts and researchers with an analytical tool for estimating a variety of impacts resulting from policy, economic, environmental, or other changes. Based on a systems approach to modeling, POLYSYS operates an umbrella framework, facilitating the interaction of agricultural supply, demand, and income modules (Ray and others). POLYSYS is designed to anchor its analysis to a baseline of projections for all model variables. This design, along with reliance on predetermined price-response parameters, allows POLYSYS to produce detailed and complex estimates quickly.

Within the linear programming (LP) supply framework of POLYSYS, agricultural production response and resource use indicators are disaggregated to 305 regions, each of which is characterized by homogeneous production characteristics within the region. Based on expected prices, the supply module—a set of 305 regional LP models maximizing returns above variable costs—estimates planted and harvested acres, yields, and production costs. The aggregation of crop production by region results in national crop production which, together with beginning stocks and any imports, provides an estimate of supply. The demand module estimates domestic demand, exports, and ending stocks at the national level for each crop. Supply of the commodity is then fed into the demand component of POLYSYS as a fixed number to generate the market-clearing price based on a set of price flexibility functions for each crop. The market-clearing price is then recursively fed into LP models to solve for planted and harvested acres for the following year and the simulation process continues through the year 2005.

In this analysis, the impact of the 1996 Act (through planting flexibility) at both the national and regional levels is determined by comparing the results of the baseline that reflects the 1990 Act with an alternate

scenario that reflects the increased planting flexibility under the 1996 Act. The 1996 Act scenario explicitly incorporates the acreage price elasticities under the new legislation (reported earlier) and completely revises the price flexibility functions for U.S. wheat, corn, other feed grains, soybeans, cotton, and rice previously reported by Ray and others so that they are consistent with the current policy environment (appendix table 22).

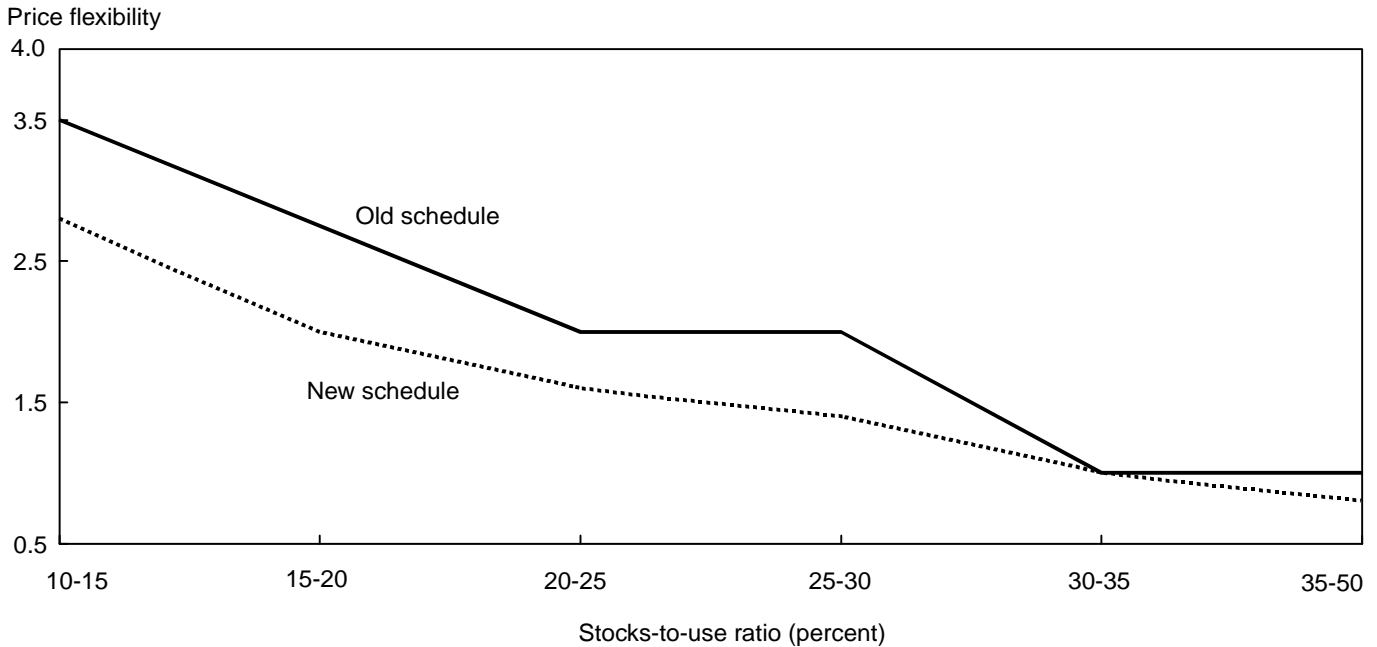
“Price flexibility” refers to the percentage change in commodity farm prices associated with a 1-percent change in quantity demanded, moving along the demand function. The slope of the price flexibility function may vary, depending on the stocks-to-use ratio. More specifically, a higher slope is associated with the stocks-price relationship at a low stocks-to-use ratio, and a lower slope occurs at a high stocks-to-use ratio. Price flexibility functions for corn, wheat, soybeans, cotton, and rice are estimated using the following steps: (1) obtain the stocks-to-price relationships for corn, as estimated by Westcott and Hoffman, that are consistent with the current policy environment of lower loan rates and only small Government-owned stocks; (2) estimate the stocks-to-use relationships for wheat, soybeans, cotton, and rice, following the same basic approach as used in estimating corn by Westcott and Hoffman; and (3) calculate price flexibilities at various stocks-to-use ratios based on the stocks-price relationships obtained in step 1 and estimated in step 2. The newly estimated price flexibility functions lie below the ones embedded in the earlier version of POLYSYS (fig. 9). For example, at a stocks-to-use ratio of 19 percent (a point in the 15- to 20-percent range as shown in appendix table 22) for U.S. corn, a price flexibility of -2.00 is estimated according to the newly estimated price flexibility function for corn, compared with the -2.75 used in the earlier version of POLYSYS.

Several important changes are made in the POLYSYS framework to include the new supply response structure used in the simulation analyses presented here. Also, various specific assumptions are employed in the simulation analysis. The key steps (and assumptions) in the POLYSYS simulation include:

- Use the February 1996 USDA baseline (the last baseline that reflects the 1990 Farm Act) as the base scenario for this analysis. This baseline, reflecting stronger market conditions for major field crops than more recent, low-price markets, serves as the benchmark for compar-

Figure 9

Price flexibility functions for U.S. corn: Old vs. new schedule



Price flexibilities are negative.

- ing the revised supply response under the 1996 Act scenario with the 1990 Act baseline.
- Generate the regional acreage that corresponds with the February 1996 USDA baseline from the LP supply component to obtain the regional benchmarks. Estimates of acreage, input expenditures, crop yields, season average prices, and Government program variables in the February 1996 USDA baseline are disaggregated into the seven production regions. The regional LP models are used to allocate acreage in the February 1996 USDA baseline among the seven regions, given regional prices, yields, and costs of production (see Ray and others).¹⁹
- For the 1996 Act scenario, replace the linear programming (LP) supply component in the earlier POLYSYS with one based on the acreage price elasticities presented earlier in this report.

 - Use the intended acreage in USDA's *Prospective Plantings* report at the end of March 1996, as the planted acreage in the initial year of simulation (1996). Using acreage that reflects farmers' planting intentions removes the effect of nonprice factors on farmers' planting decisions.
 - Use farm prices lagged by 1 year as expected prices for the current year, and determine planted acreage for the current year by the change in expected prices and acreage price elasticities.
 - Determine market-clearing prices by adjusting the baseline numbers by multiplying the percentage change in total use by the revised price flexibilities (appendix table 22) estimated by ERS analysts.

Simulation Results

Simulation results presented show crop-specific and aggregate acreage impacts for individual regions and the national level. Price effects, which provide dynamic price-output linkages in the simulation model, are also presented.

¹⁹Using the regional LP models to allocate national acreage in the February 1996 USDA baseline among the seven regions could introduce measurement errors into the simulation results, because of the shift in model structure from an LP framework to an elasticity-driven approach. We have investigated this potential source of errors and found the errors, to the extent they exist, to be not significant.

Aggregate Area Planted to the Eight Major Field Crops

The simulation results reaffirm earlier studies indicating that aggregate area planted to the eight major field crops (wheat, corn, sorghum, barley, oats, soybeans, cotton, and rice) under the 1996 Act would not differ much from that under the 1990 Act (Young and Westcott). Plantings are projected to increase to 261.7 million acres by the year 2005 under the 1996 Act (fig. 10). In contrast, plantings would have been about 2 million acres higher (263.6 million acres) by the year 2005 if the 1990 Act provisions had continued in force.

Aggregate area planted to the eight major field crops in the simulations was initially about 1 million acres lower under the 1996 Act scenario than under the 1990 Act baseline in 1996, reflecting the discrepancy between acreage projected in the February 1996 USDA baseline (reflecting 1990 farm law) and farmers' 1996 crop planting intentions at the end of March 1996 (fig. 10). Then, for 1998 through 2002, aggregate area planted to the eight major field crops under the 1996 Act scenario exceeds that projected under the 1990 Act baseline, reflecting greater supply response to rising farm prices under the 1996 Act scenario. After 2002, aggregate planted area continues to rise under the 1990 Act baseline, but area under the 1996 Act scenario increases more slowly in response to more modest increases in farm prices for corn and

wheat—the two major program crops where acreage expands under the 1990 Act baseline. Thus, by 2005, aggregate planted area under the 1996 Act scenario is projected to be about 2 million acres less than planted under the 1990 Act baseline.

Wheat

Wheat acreage could be affected significantly by the size and composition of the Conservation Reserve Program (CRP), because a large portion of the cropland enrolled in the CRP is wheat land. However, because acreage enrolled under the CRP in the 1996 Act scenario remains unchanged from that under the 1990 Farm Act baseline, the impact of the 1996 Farm Act on the U.S. wheat sector mainly reflects the effect of enhanced planting flexibility, not the CRP.

The effect of changing farm legislation on the U.S. wheat industry appears to be less dramatic than its effect on the corn, soybeans, and cotton sectors. U.S. wheat planted acreage under the 1996 Act scenario is simulated to decline by 1-2 million acres during 1997-98, reflecting the significant reduction in Export Enhancement Program funding and consequently the reduction in wheat exports (fig. 11). Wheat plantings then regain strength to slightly exceed the 1990 Act baseline acreage during 2000-02, reflecting higher season average farm prices under the 1996 Act scenario during the 1998-99 crop years (fig. 12). Due to larger

Figure 10

Aggregate area planted to eight major field crops, 1990 Act baseline and 1996 Act

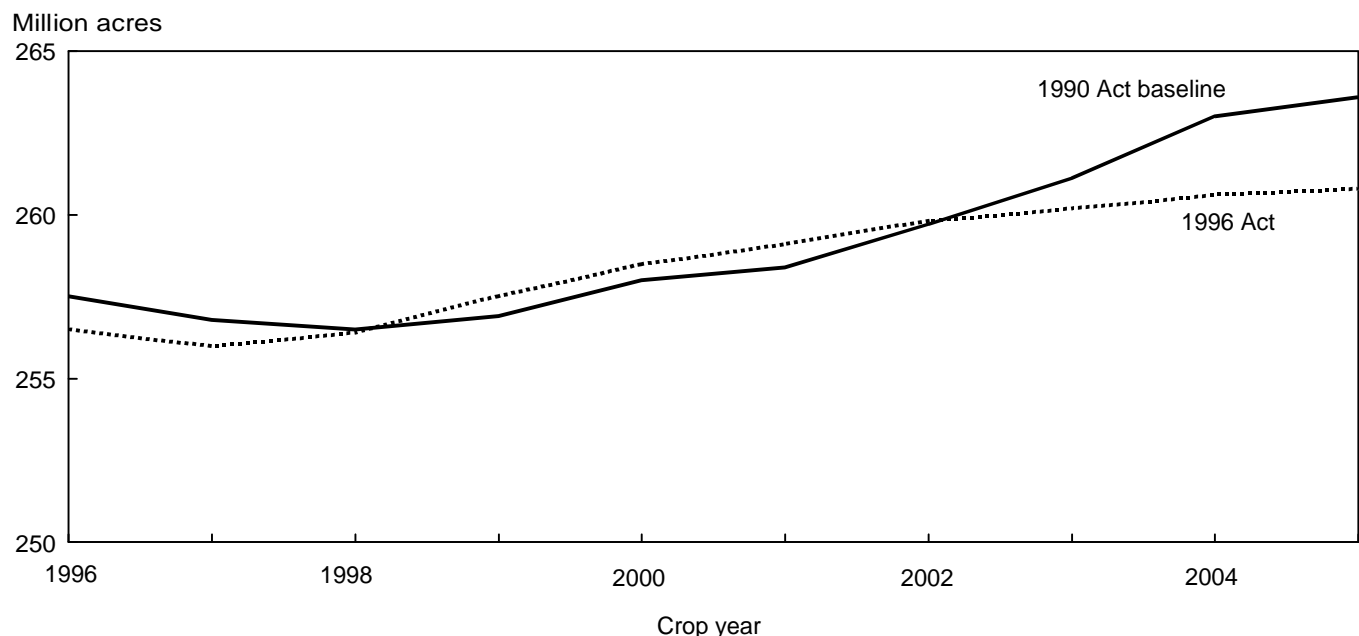


Figure 11
Wheat planted acreage, 1990 Act baseline and 1996 Act

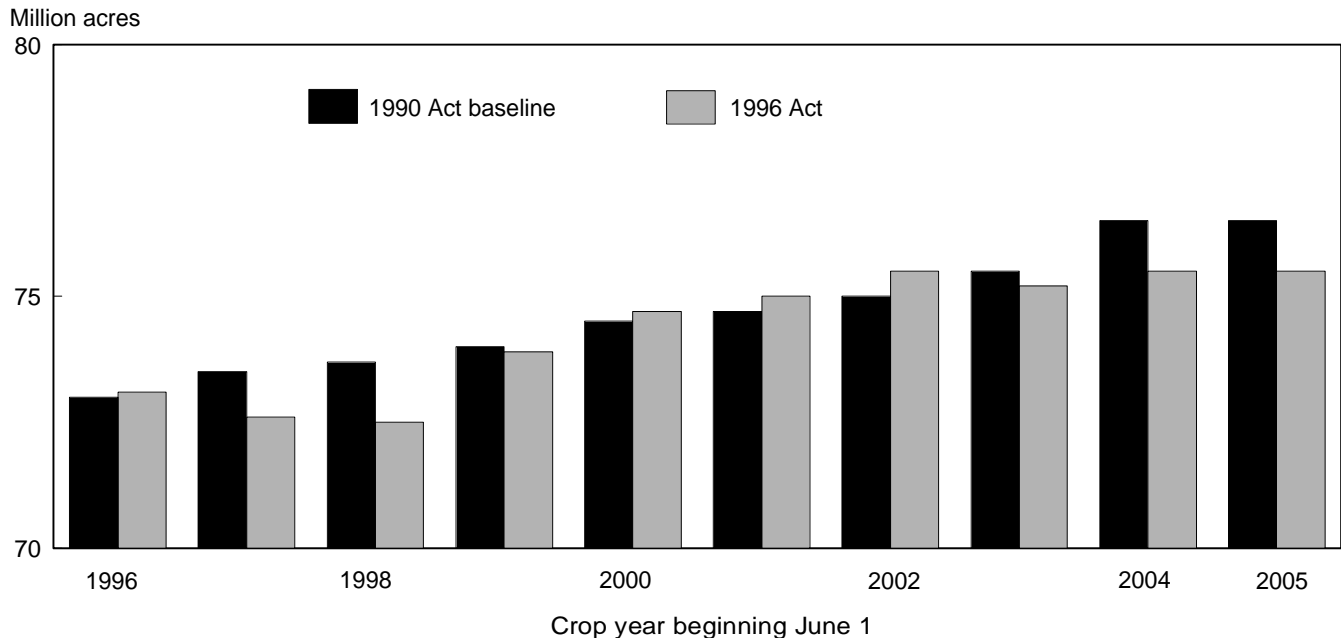
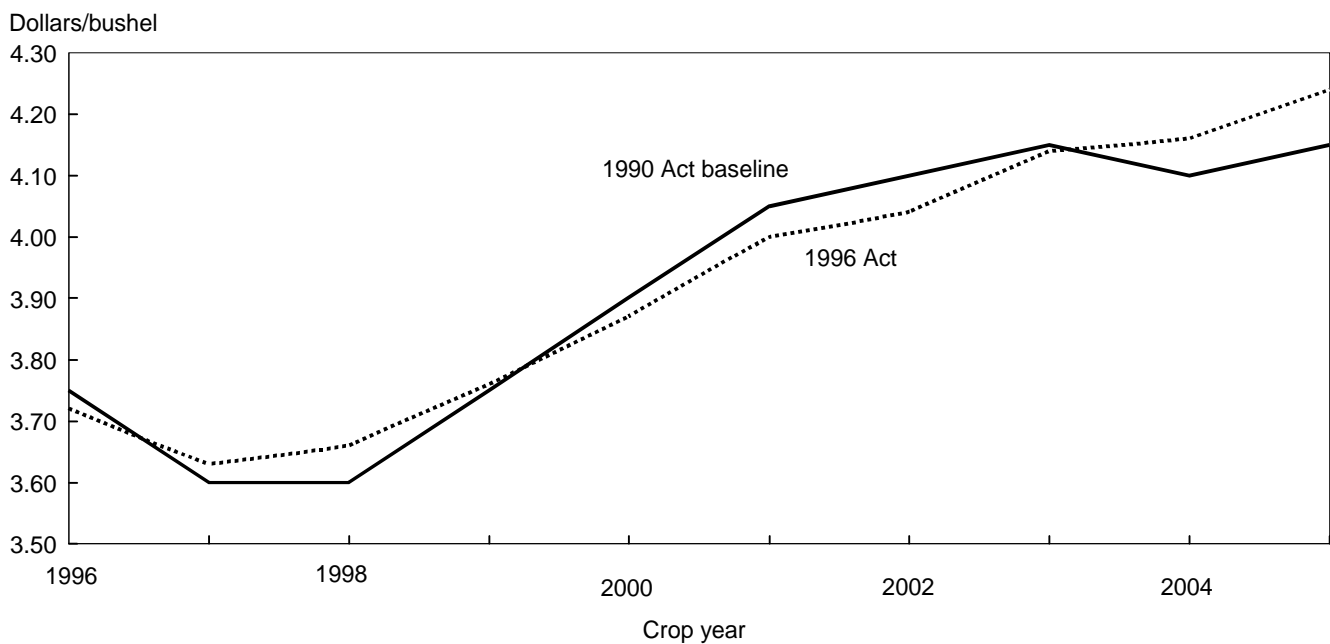


Figure 12
Farm prices of wheat, 1990 Act baseline and 1996 Act



acreage, market-clearing prices are simulated to fall, which triggers a decline in wheat planted acreage. By the year 2005, U.S. wheat acreage under the 1996 Act is simulated to be 0.8 million acres lower than under the 1990 Act.

This reduction in U.S. wheat acreage simulated under the 1996 Act has different incidences for major production regions. The reduction in wheat acreage is greatest in the Southern Plains, a decline of 0.67 million acres. Similarly, wheat acreage in the Central and Northern Plains is simulated to decrease by 0.45 million acres, about half of the 0.8-million-acre decline in

U.S. wheat planted acreage under the 1996 Act. This share reflects the 53.8 percent of wheat acreage accounted for by this region during 1994-95. In contrast, wheat acreage is shown to increase by 0.39 million acres under the 1996 Act in the North Central region.

U.S. wheat prices are simulated to be higher in the late 1990's under the 1996 Act scenario than under the 1990 Act baseline, reaching a 6-cent per bushel rise in the 1998 crop year. Wheat prices are projected to be lower during 2000-03 as planted acreage becomes larger than under the 1990 Act baseline, and then to increase by 6-10 cents per bushel during 2004-05. On average, U.S. wheat prices under the 1996 Act are comparable with those under the 1990 Act. This finding suggests that the current low wheat prices received by farmers (for example, cash grain bids of U.S. No. 1 hard red winter (HRW) wheat at country elevators in western Kansas were priced at \$2.17-\$2.25 per bushel as of April 12, 2000) are a phenomenon caused more by large wheat crop production in the United States and in foreign markets, and the financial crisis in Asia, than by implementation of the 1996 Act.

Due to small changes in acreage price elasticities between the 1996 Act and 1990 Act across production regions, regional production patterns for U.S. wheat would remain largely unchanged. The Central and Northern Plains remains the most important production region for U.S. wheat, and its share of U.S. wheat acreage under the 1996 Act stays about 54 percent.

The North Central region would likely marginally gain in its share of U.S. wheat acreage, by an average of 0.5 percentage point per year during 1996-2005, at the expense of the Southern Plains. Because of higher costs of production on a per bushel basis, the Southern Plains is likely to have a slightly reduced competitive edge in wheat production under the 1996 Act. The share of U.S. wheat acreage in the Southeast and Delta regions would remain unchanged.

Corn

The change in farm legislation from the 1990 Act to the 1996 Act will have a bigger impact on the U.S. corn industry than on the wheat industry. During the simulation period, 1996-2005, U.S. corn planted acreage under the 1996 Act scenario, on average, is projected to be 1-2 million acres lower than under the 1990 Act baseline (fig. 13). More important, U.S. corn acreage under the 1996 Act is simulated to be less than

under the 1990 Act baseline in every year of the 1996-2005 simulation period. By the years 2004-05, U.S. corn acreage under the 1996 Act scenario is projected to be about 2 million acres less than under the 1990 Act baseline. With greater supply response under the 1996 Act, producers can more readily make a switch from corn to soybeans, or other competing crops.

As a result of lower planted acreage, farm prices for U.S. corn under the 1996 Act scenario are projected to be 10-15 cents per bushel higher than under the 1990 Act baseline (fig. 14). In the initial years of the simulation period, corn prices under the 1996 Act are projected to be about 10 cents per bushel higher than under the 1990 Act baseline, reflecting a slightly lower stocks-to-use ratio (9 percent) under the 1996 Act scenario than under the 1990 Act baseline (10 percent). However, beginning in the early 2000's, the gap is projected to widen, reaching a difference of 16 cents per bushel by the year 2005. The stocks-to-use ratio is projected to be at 6 percent for that year under the 1996 Act scenario, compared with 7 percent under the 1990 Act baseline.

U.S. corn production will be slightly more concentrated in the North Central region, which accounts for nearly two-thirds of U.S. corn acreage. That region has a larger increase in own-price elasticity than in other regions, and projections indicate higher corn prices under the 1996 Act than under the previous legislation. Relative to the region's estimated elasticity of 0.173 for 1991-95 (Adams), the own-price elasticity estimated under the 1996 Act of 0.248 for this region indicates a 43.4-percent increase. This increase is the largest among major production regions. However, the change in the region's share of U.S. corn acreage is small. In addition, the Southeast and Delta regions are projected to gain a larger share of U.S. corn acreage at the expense of the Central and Northern Plains (fig. 15). In fact, corn acreage in the Central and Northern Plains is lower under the 1996 Act than under the 1990 Act baseline.

More specifically, corn plantings in the Central and Northern Plains are projected to continue their expansion trend in the 1990 Act baseline simulation, increasing from 17.4 million acres in the year 1996 to 18.4 million by 2005. However, the region's corn acreage is projected to be lower under the 1996 Act scenario, remaining near 16.9 million acres (fig. 16). Since U.S. corn acreage is projected to be smaller under the 1996 Act, planting flexibility would permit producers to switch from corn to competing crops (primarily soy-

Figure 13

Corn planted acreage, 1990 Act baseline and 1996 Act

Million acres

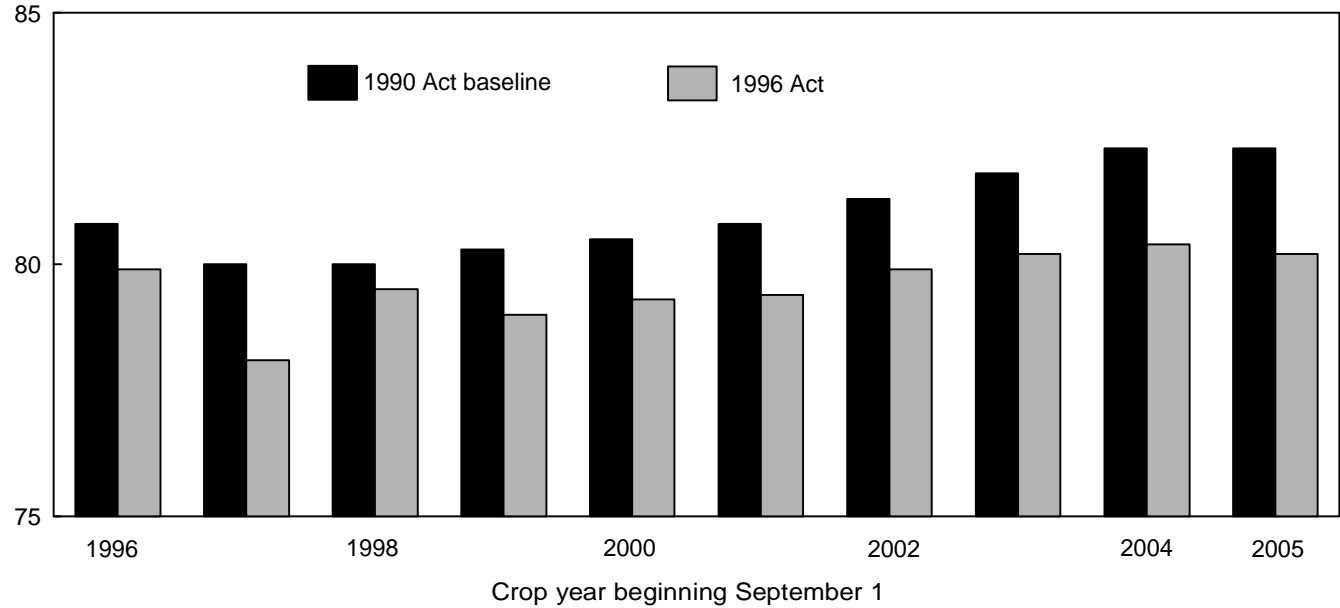


Figure 14

Farm prices of corn, 1990 Act baseline and 1996 Act

Dollars/bushel

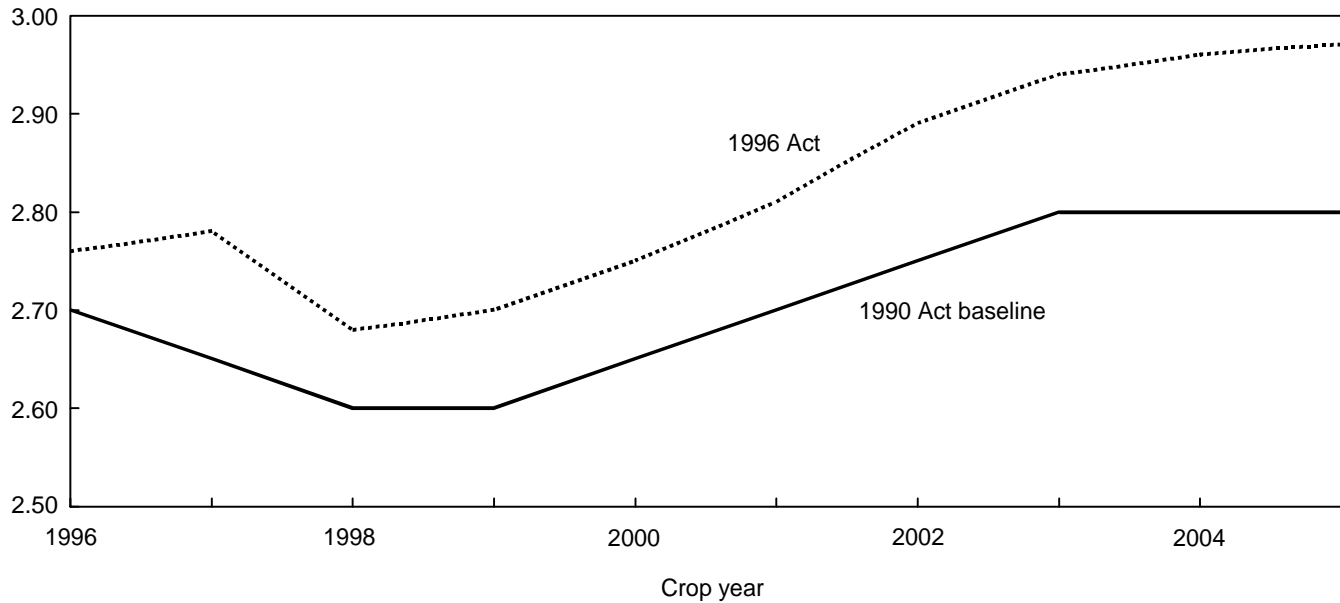
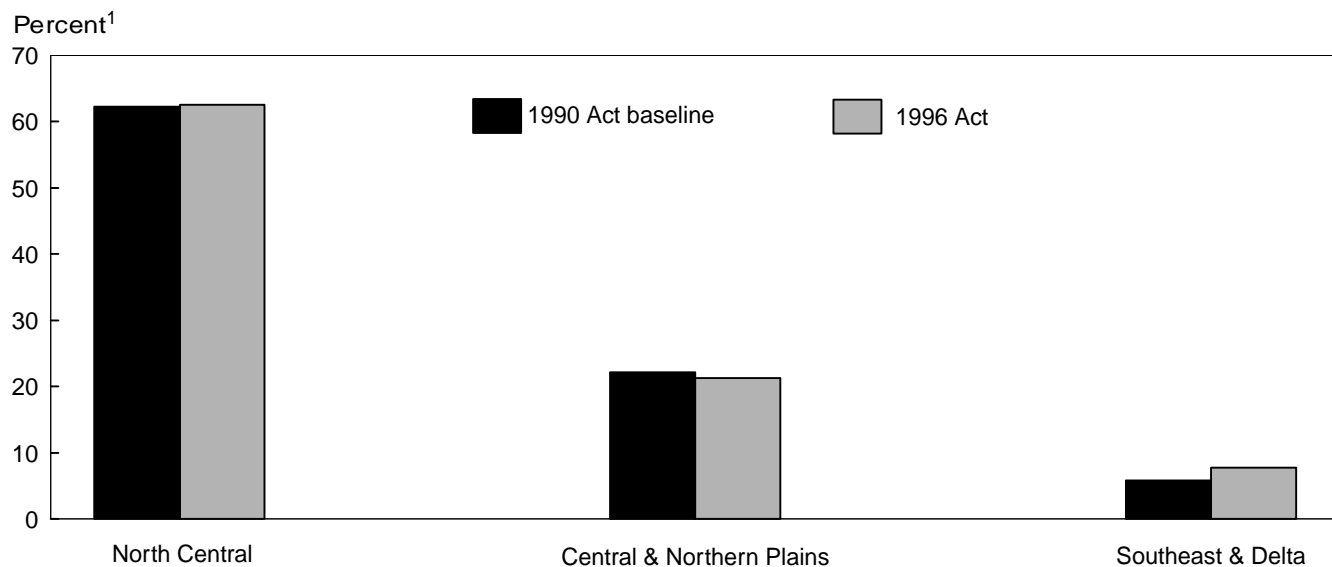


Figure 15

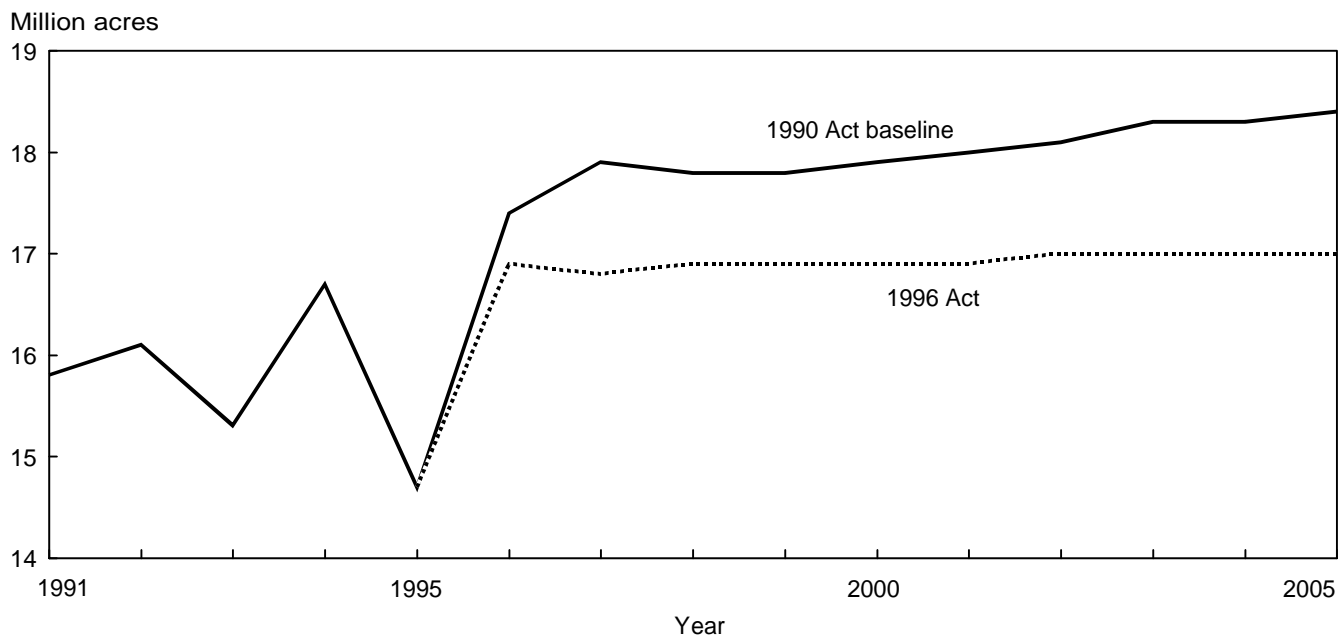
The 1996 Act continues corn production concentration in the North Central region, and the South gains a larger U.S. share



¹Average percentage of 1996-2005 planted acreage.

Figure 16

The 1996 Act slows corn-acreage expansion in the Central and Northern Plains



beans), if they are more profitable. As a result, corn acreage expansion projected to occur under the 1990 Act baseline would be substantially slowed under the 1996 Act scenario.

Soybeans

The change in farm legislation from the 1990 Act to the 1996 Act will have its biggest acreage impact on soybeans, which shows an increase of over 2 million acres throughout the simulation period under the 1996 Act over the 1990 Act baseline (fig. 17). Nearly full planting flexibility allows corn producers to make a switch from corn to soybeans, which is based primarily on market signals in the simulations. This finding is consistent with the steady rising trend in the soybean share of U.S. soybean-corn acres in recent years, from nearly 44 percent in 1996 to 45.8 percent in 1997, and to nearly 49 percent in 1999.

In contrast to corn prices, soybean prices are projected to be lower under the 1996 Act by about 35 cents per bushel in 2000-05 (fig. 18). During this period, corn prices are projected to be 10-15 cents per bushel higher under the 1996 Act scenario. Soybean prices initially show a decline of about 10-20 cents per bushel during 1996-97. However, the gap is simulated to widen afterwards, reaching a difference of more than 20 cents per bushel in the 1998 crop year. The lower soybean prices reflect the projected increase in soybean acreage under the 1996 Act throughout the simulation period.

The 1996 Act would make soybean production slightly less concentrated in the North Central region. The own-price elasticity shows the largest increase (14 percent) under the 1996 Act when compared with 1991-95 in this region. Since the 1996 Act shows an expansion of soybean acreage and consequently a decline in soybean prices, the largest increase in the own-price elasticity for the North Central region suggests that U.S. soybean plantings would be less concentrated in that region. This region's share of U.S. soybean acreage is projected to be around 66.1 percent to 66.3 percent under the 1990 Act baseline, but would decline to 65.2 percent to 65.4 percent under the 1996 Act (fig. 19).

The 1996 Act would facilitate soybean expansion in the Central and Northern Plains (fig. 20). Under the 1996 Act scenario, soybean plantings in this region are projected to be 0.2-0.4 million acres higher than under the 1990 Act baseline. Planting flexibility would permit producers to switch from corn to soybean plantings, giving the result of lower U.S. corn acreage and larger soybean acreage projected under the 1996 Act scenario.

Cotton

During 1996-2005, upland cotton acreage on average is projected to be 15.2 million acres under the 1996 Act (fig. 21). Relative to the 1990 Act baseline, upland cotton acreage would average 0.7 million acres

Figure 17
Soybean planted acreage, 1990 Act baseline and 1996 Act

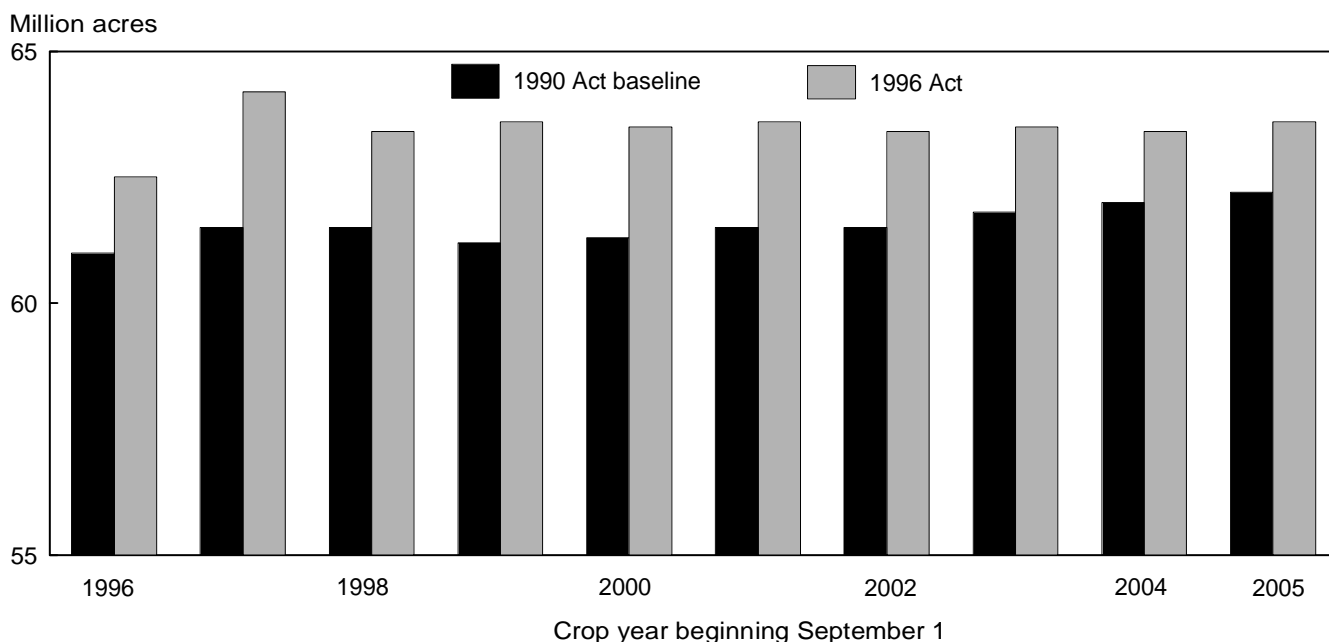


Figure 18
Farm prices of soybeans, 1990 Act baseline and 1996 Act

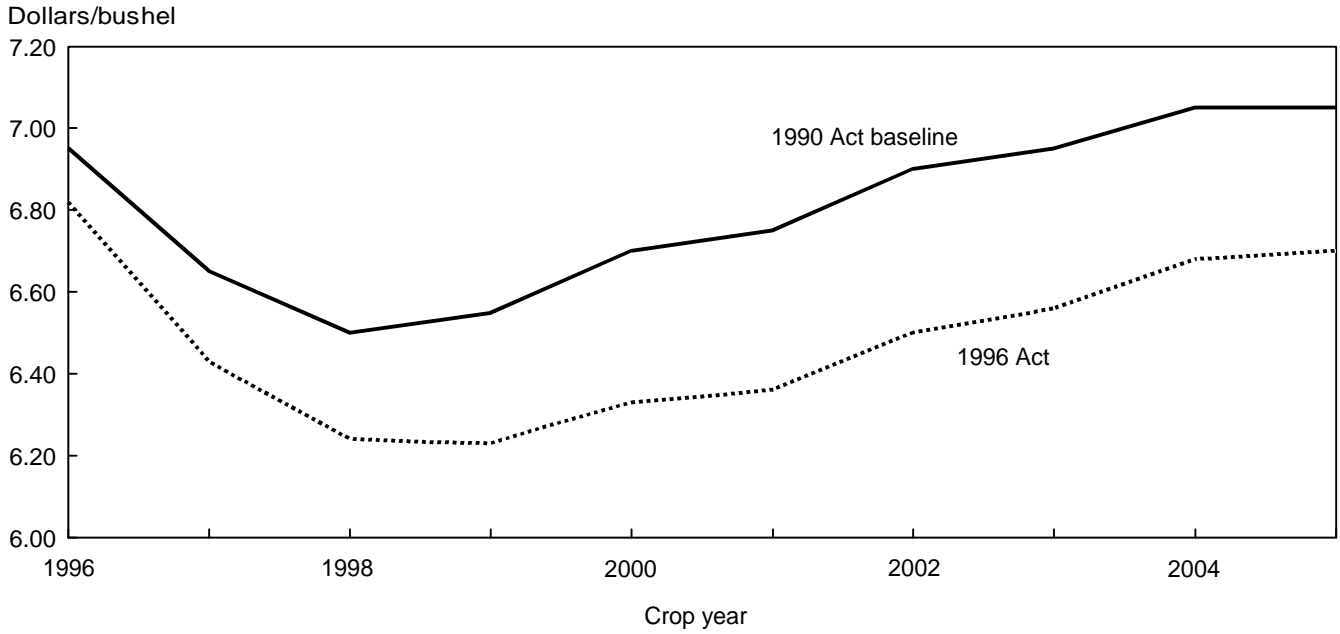
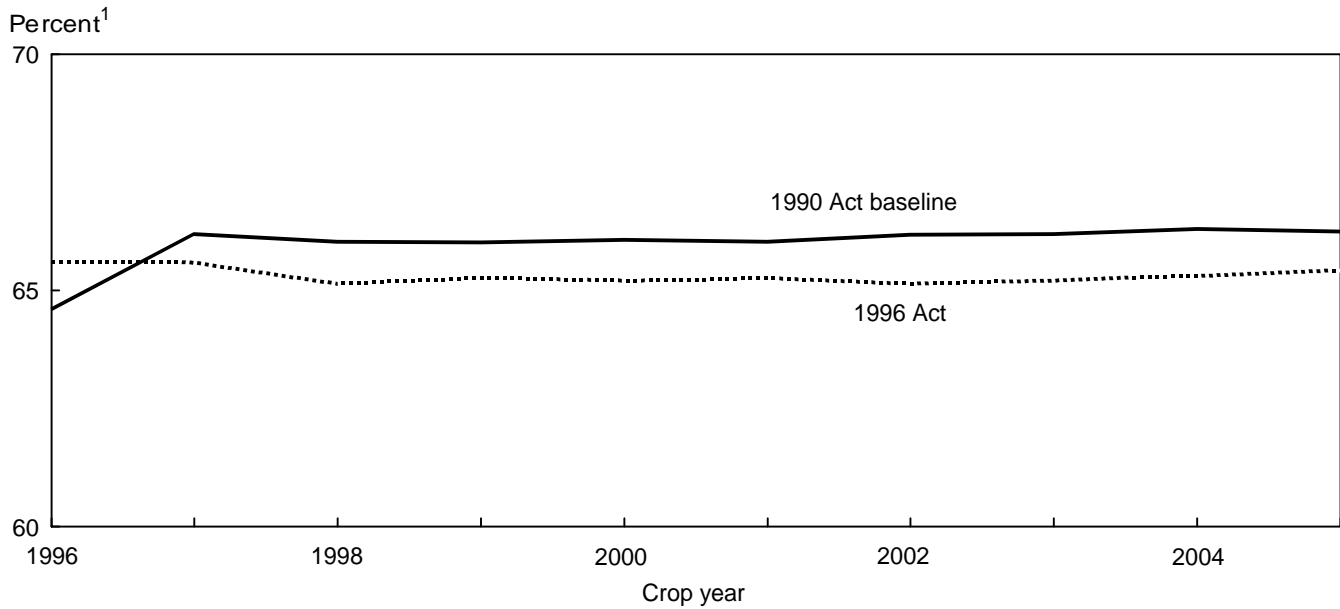


Figure 19
The 1996 Act makes soybean production slightly less concentrated in the North Central region



¹Percent of soybeans grown in the North Central region.

Figure 20

The 1996 Act facilitates soybean-acreage expansion in the Central and Northern Plains

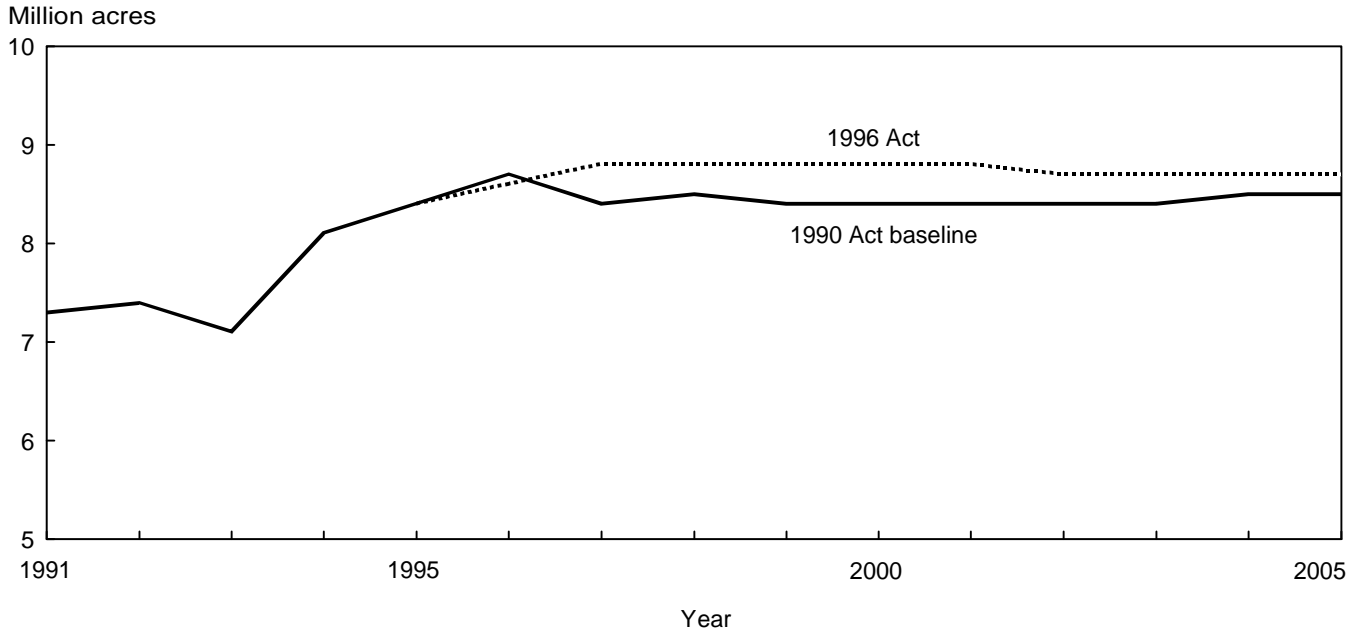
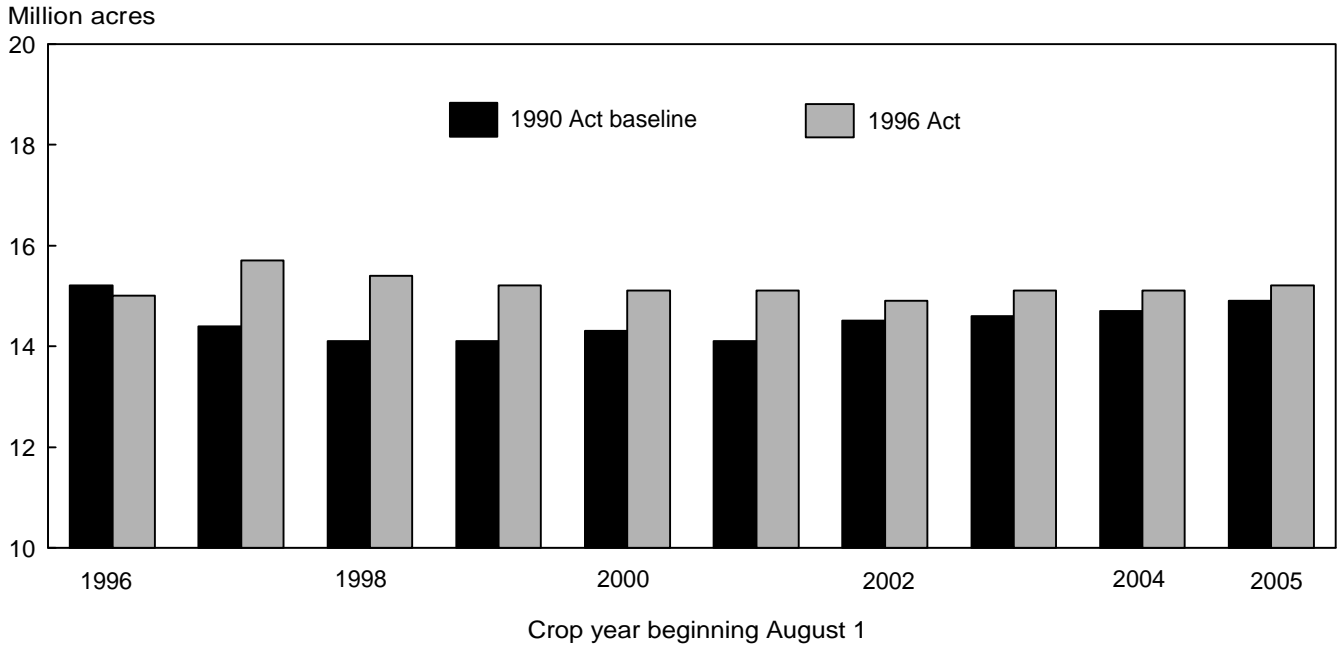


Figure 21

Cotton planted acreage, 1990 Act baseline and 1996 Act



higher under the 1996 Act scenario, largely reflecting the effect of eliminating the ARP, which was projected to account for between 0.3 to 1.0 million acres under the 1990 Act baseline.²⁰ During the 1996-2005 simulation period, about 0.6 million acres per year are projected to be idled under the ARP in the 1990 Act baseline. These idled acres would most likely return to cotton production under the 1996 Act scenario.

Larger upland cotton acreage under the 1996 Act results in higher stocks-to-use ratios for cotton under the current policy environment. The ratio is simulated to show a rapid upturn before the year 2000—increasing from 26 percent in 1996 to 43 percent in the year 1999—and then to gradually decline to 37 percent by the year 2005. In contrast, the ratio is projected to hover around the range of 27-31 percent under the 1990 Act baseline.

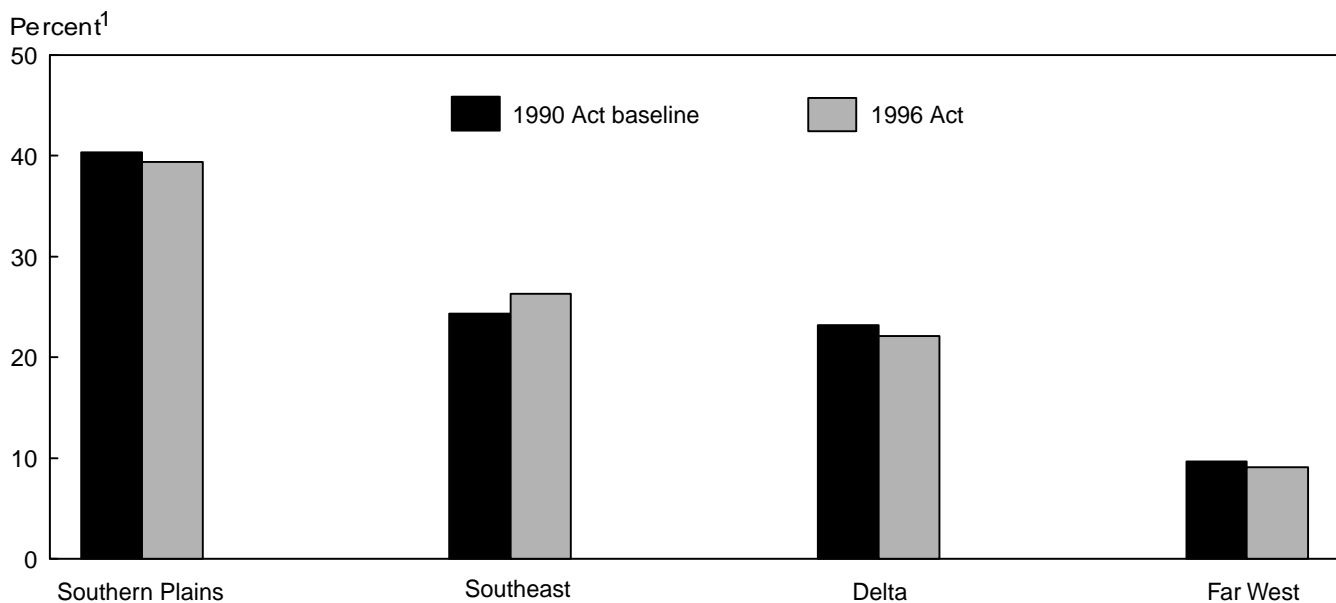
Due to higher stocks-to-use ratios under the 1996 Act scenario, cotton prices are simulated to remain lower than under the 1990 Act baseline. Despite lower prices, cotton acreage under the 1996 Act scenario remains consistently higher than the 1990 Act baseline because of the elimination of the ARP.

²⁰The effect of eliminating the ARP, which permits cotton acreage to return to production, is the key factor that contributes to higher cotton acreage under the 1996 Act scenario. The cross-price effect of competing crops on cotton acreage is relatively modest.

The 1996 Act is found to have a more noticeable impact on regional production patterns for cotton than for other major field crops. The Southeast stands to gain a larger share of U.S. cotton acreage under the 1996 Act—an increase of 2 percentage points over the 1990 Act level—at the expense of the Southern Plains and Delta, whose share is projected to decline by 1 percentage point each (fig. 22).

These changes in regional production patterns are consistent with the changes in cotton's own-price acreage elasticities. The Southeast gains share because the increase in the elasticity—from 0.419 estimated by Adams for 1991-95 under the 1990 Act to 0.435 under the 1996 Act—is smallest in this region (+0.016). This gives a small decline in this region's cotton acreage resulting from lower cotton prices projected under the 1996 Act. In contrast, the Southern Plains is projected to lose share because its own-price elasticity has the greatest increase (+0.217)—from 0.263 estimated by Adams for 1991-95 under the 1990 Act to 0.480 under the 1996 Act, resulting in a larger decline in this region's cotton acreage in response to lower projected cotton prices. In addition, the changes in regional production patterns are consistent with the costs of production—the Southeast is a low-cost region while the Southern Plains and Delta are higher cost regions.

Figure 22
The Southeast gains a larger share of U.S. cotton acreage under the 1996 Act



¹Average percentage of 1996-2005 planted acreage.