

# HAS PRICE BEHAVIOR OF MAJOR FARM PROGRAM CROPS CHANGED SINCE FAIR?

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## Abstract

Background discussion has begun on the next farm bill. A key issue is the behavior of prices. In general average annual prices of the eight major farm program crops are lower during the period since the *Federal Agriculture Improvement and Reform Act of 1996 (FAIR)* was enacted than during the pre-*FAIR* period containing the 1974/75 - 1995/96 crop years. In contrast, price variability does not differ statistically between the two periods. However, caution is in order as the variability of yield has been smaller for seven of the eight crops in the post-*FAIR* period. The decline in yield variability exceeds 50% for corn, cotton, and oats.

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### Introduction

Background discussion has begun on the next farm bill. A key component of the information set that will frame this discussion is the expected behavior of price. Price behavior is of particular interest because of the major farm policy changes authorized by The *Federal Agriculture Improvement and Reform Act of 1996 (FAIR)* and confirmed by the *Farm Security and Rural Investment Act of 2002*. *FAIR* eliminated annual acreage set aside programs and most government storage programs, key features of U.S. farm policy since its inception during the Great Economic Depression of the 1930s. The annual set aside program limited the number of acres that could be planted to a crop. Public stock programs accumulated stocks when price was low, and sold public stocks when price was high. *FAIR* also gave farmers more decision making freedom by allowing them to not plant their farm program acres or to plant program acres to any crop except fruits and vegetables. All three *FAIR* policy changes potentially affect the supply and thus price of a crop, especially farm program crops.

This article examines whether the average and variability of annual prices for the major farm program crops of barley, corn, cotton, oats, rice, sorghum, soybeans, and wheat have changed since *FAIR* was enacted. Many factors can change between two periods, including changes in policy, changes in demand, and different weather patterns. Therefore, this study does not ascribe causation to any factor, including *FAIR*. Instead, it provides an overview which in turn provides a foundation for future research and policy discussions.

The next section contains a brief discussion of the literature surrounding this topic and the analytical procedures used in this study. Findings of the analysis are then presented. The final section contains a summary.

## Literature and Procedures

The impact of *FAIR*'s policy changes on the variability of price was a topic of concern during the debate over *FAIR* (e.g., Collins and Glauber, 1998). Studies conducted since *FAIR* was enacted have uniformly concluded that the variability of cash prices have not increased (Lence and Hayes, 2002; Natcher and Weaver, 2000; Weaver and Natcher, 2000; and Zulauf and Blue, 2003). Only Lence and Hayes examined average price; finding that the price of corn and soybeans differed little between *FAIR* and pre-*FAIR* policy.

This study uses an event study approach (MacKinlay, 1997), where the event is the enactment of *FAIR*. Multiple studies of similar events are needed to determine if the event causes a similar type of change. However, there is only one *FAIR* event. Thus, this study cannot determine *FAIR*'s impact on price, but it can address a related and important question: "Has the behavior of price changed since *FAIR* was enacted?"

The study begins with the 1974/75 crop year. This year is commonly used as the beginning of a new regime of prices that emerged after the price upheavals of the early 1970s (e.g., Kenyon, Jones, and McGuirk, 1993). The years are divided into a period pre-dating the *FAIR* event, the 1974/75 - 1995/96 crop years, and a period after the *FAIR* event, the 1997/98 – 2004/05 crop years. Tests confirm that the 1974/75 - 1995/96 crop years can be considered as one period for this study even though farm policy changed over this period. The 1996/97 crop year is excluded because it was a transition year. *FAIR* was signed into law during April 1996 (U.S. Department of Agriculture (USDA), 1996), several months after the 1996 winter wheat crop was planted. The data used in this study are from USDA. The most recent data are from the December 2004 *World Agriculture Supply and Demand Estimates*.

Because of the small number of available observations, bootstrap methods are used. Bootstrap methods are a common procedure for improving the power of statistical tests when a small number of observations exist.

Considerable debate exists over whether price variability should be measured in absolute or relative terms (Hirschey, 1996, pp. 600-602). A common measure of absolute price variability is the standard deviation of the level of annual price. A common measure of relative price variability is the standard deviation of the percent change in annual price between adjacent years. Both measures were computed. While some differences exist, both measures present a similar picture of price variability. Therefore, only the relative price variability measure is discussed. The relative measure of variability also is used for the other variables examined in this paper.

## **Findings**

The average and variability of annual prices for the pre-*FAIR* and post-*FAIR* periods are presented in Figures 1 and 2, respectively. Except for barley, average price is lower during the post-*FAIR* period. Magnitude of the decline is 15% for corn, 14% for cotton, 5% for oats, 17% for rice, 13% for sorghum, 13% for soybeans, and 9% for wheat. Except for oats, these declines are significant at the 95% level of statistical confidence.

Price variability is lower during the post-*FAIR* period for most of the program crops. The exceptions are soybeans and cotton. The near doubling in the variability of cotton prices is the only statistically significant change.

In assessing the changes observed in average price and price variability, it is important to remember that many factors besides farm policy changed between the pre-*FAIR* and post-*FAIR* periods. They include (1) the devaluation of the Brazilian real and other currency realignments, (2) market and policy developments in China, (3) continuing evolution toward market economies in the former Soviet Union countries, (4) recent rapid expansion in U.S. demand for ethanol, (5) continuing expansion of soybean acres in South America, and (6) bilateral and multilateral international trade agreements, including those involving the U.S. In addition, the Asian currency crisis of the late 1990s contributed to the low prices that occurred

from 1998 through 2001. Periods of low prices occurred in the pre-*FAIR* period, but low price periods may account for a greater share of the shorter post-*FAIR* period. We illustrate the important concern about the impact of other factors by briefly examining two factors: changes in U.S. acres planted to the farm program crops and the variability of U.S. yields for these crops.

Comparing the post-*FAIR* to pre-*FAIR* period, acres planted to most of the crops changed substantively, ranging from -65% for oats to +19% for soybeans (see Figure 3). Acres planted to corn, cotton, rice and soybeans increased. Acres planted to the other four crops decreased. Except for corn, the changes in planted acres are statistically significant.

Not surprisingly, the changes in planted acres are inversely related to the changes in prices. Average price declined for the four crops with more planted acres (corn, cotton, rice, and soybeans). More acres translate into more supply and thus a lower price, all other factors remaining the same. In contrast, acres declined for both crops with insignificant changes in prices (barley and oats).

In assessing the relationship between changes in planted acres and average prices, it is important to note that acres planted to soybeans have been increasing since the 1920s, acres planted to oats have been declining since the mid 1950s, acres planted to sorghum have been declining since the mid 1970s, and acres planted to barley have been declining since the mid 1980s. Thus, many of the changes in acres observed after *FAIR* was enacted are a continuation of longer term trends. Therefore, while *FAIR*'s policy changes may have allowed planted acres to change more than they would have changed otherwise, the direction of change in planted acres likely would have occurred even without *FAIR*.

*FAIR* gave producers greater planting flexibility. An important question in understanding the future behavior of prices, especially their variability, is how this increased planting flexibility will impact farmers' willingness to adjust their planted acres to changes in crop prices. Figure 4 does not address this question, but it does provide an initial overview of the variability of acres planted to the eight farm program crops in the post-*FAIR* and pre-*FAIR* periods.

Excluding barley, the variability of annual planted acres has been less during the post-*FAIR* period. The decline is significant at the 95% level of statistical confidence for corn, cotton, oats, rice, soybeans, and wheat. In trying to understand this finding the impact of the 1983 crop year needs to be considered. In 1983, a large amount of acreage was removed from production in an attempt to reduce the large public stocks accumulated over the previous three years. Removing the impact of this crop year from the pre-*FAIR* period reduces the variability of planted acres for corn, cotton, oats, rice, and sorghum to 6%, 15%, 11%, 13%, and 13%, respectively. Little change occurs for the other three crops. Thus, even after removing the impact of the 1983 crop year, the variability in planted acres remains lower in the post-*FAIR* period for all crops except barley. Furthermore, the difference remains statistically significant for cotton, soybeans, and wheat. These findings suggest that the variability of planted acres and the responsiveness of planted acres to changes in price in the post-*FAIR* environment are topics with interesting research potential.

Yields are a major source of supply uncertainty. Yield variability has been lower during the post-*FAIR* period for all of the major farm program crops except wheat (see Figure 5). The decline is statistically significant for corn, cotton, and oats. For each of these crops the decline exceeds 50%, with corn having the largest decline at 70%.

Lower yield variability translates into lower price variability if all other factors remain the same. While *FAIR* may have impacted yield variability, the widespread decline among crops whose production systems and core production areas vary widely suggests that more benign weather for crop production probably is at least part of the explanation.

## **Summary**

Before discussing the conclusions and implications of this analysis, two limitations need to be restated. First, the small number of observations limit the power of statistical tests to determine significant differences. Thus, the findings of this study may change as more years

are added to the data set. Second, many factors may have changed between the pre-*FAIR* and post-*FAIR* periods, including changes in policy, demand, and weather patterns. Despite these two limitations, managers and policy makers need information about on-going changes in order to make more informed decisions and to formulate key questions that need monitoring. Given the limitations, our conclusions and implications focus on the common themes that emerge from examining the eight major farm program crops as a group.

Except for barley, average prices are lower since the *Federal Agriculture Improvement and Reform Act of 1996 (FAIR)* was passed. The lower prices for corn, cotton, rice, sorghum, soybeans, and wheat during the post-*FAIR* period (1997/98–2004/05 crop years) are statistically significant. Beneficiaries of these lower prices include livestock producers, ethanol producers, importers, and domestic consumers.

Variability of the average annual price of the farm program crops, when considered as a group, does not differ between the pre-*FAIR* and post-*FAIR* periods. This conclusion is consistent with previous studies, but caution is warranted. Variability of yield is smaller during the post-*FAIR* period for the program crops except for wheat. It is statistically significantly lower for corn, cotton, and oats. More favorable weather seems likely to be at least part of the explanation for the lower yield variability observed during the post-*FAIR* period. This possibility suggests that considerable uncertainty likely surrounds the true level of price variability since *FAIR* was enacted.

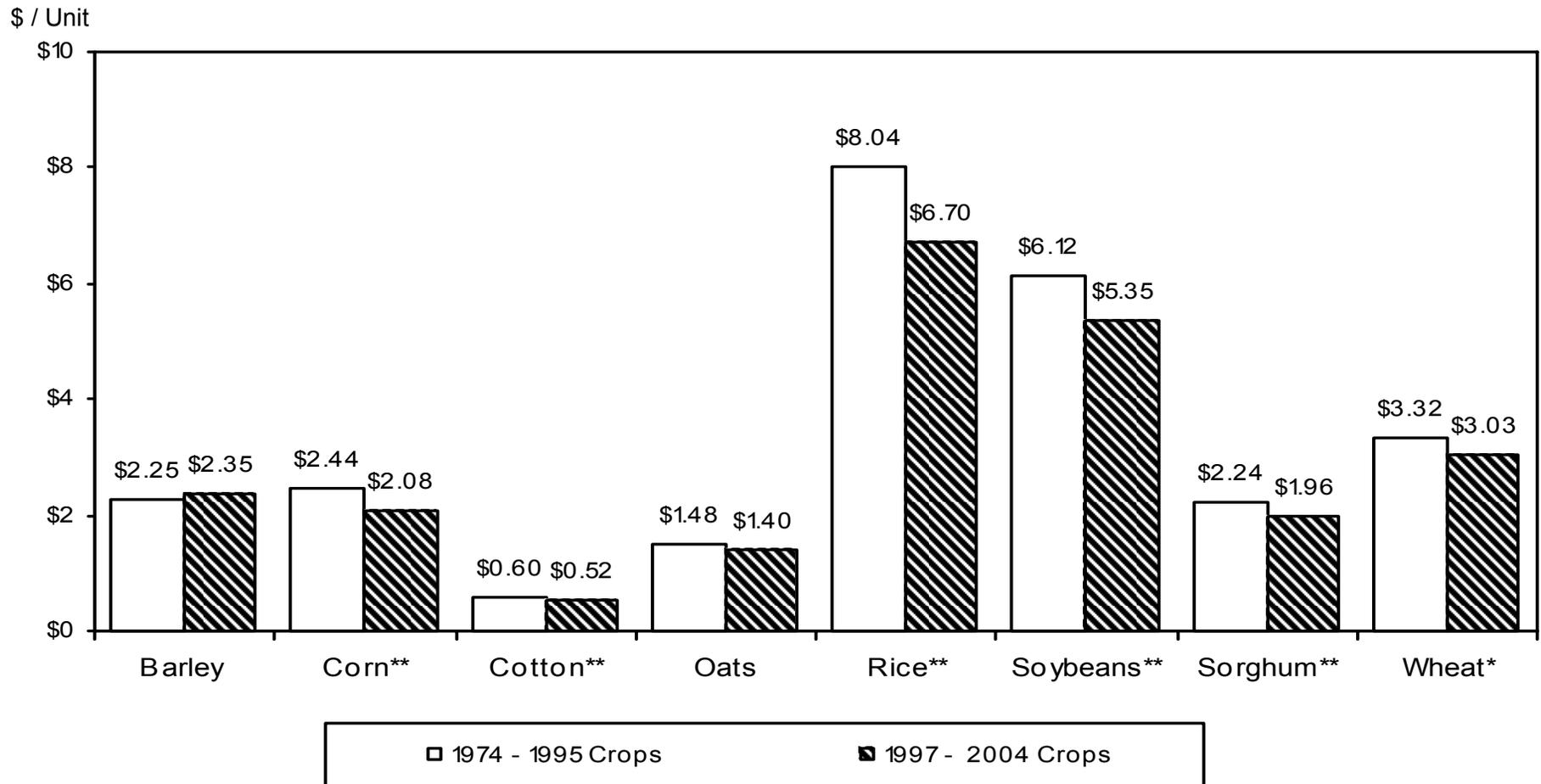
## References

- Collins, Keith J. and Glauber, Joseph W. 1998. "Will Policy Changes Usher in a New Era of Increased Agricultural Market Variability?" *Choices*. 13(no. 2): 26-29.
- Hirschey, Mark, 1996. *Managerial Economics*, 8<sup>th</sup> edition. Fort Worth, TX: The Dryden Press.
- Kenyon, David, Eluned Jones, and Anya McGuirk. May 1993. "Forecasting Performance of Corn and Soybean Harvest Futures Contracts." *American Journal of Agricultural Economics*. 75: 399-407.
- Lence, Sergio H. and Dermot J. Hayes. May 2002. "U.S. Farm Policy and the Volatility of Commodity Prices and Farm Revenues." *American Journal of Agricultural Economics*. 84: 335-351.
- Mackinlay, A. C. 1997. "Event Studies in Economics and Finance." *Journal of Economic Literature*. 35(March):13-39.
- Natcher, William C. and Robert D. Weaver. August 2000. "Have Market Reforms in U.S. Agriculture Induced Greater Price Volatility?" Paper presented at the annual meeting of the American Agricultural Economics Association, Tampa, FL.
- U.S. Department of Agriculture, Economic Research Service. September 1996. *Provisions of the Federal Agriculture Improvement and Reform Act of 1996*. Edited by Frederick J. Nelson and Lyle P. Schertz. Agriculture Information Bulletin No. 729.
- U.S. Department of Agriculture, Economic Research Service. March 2002. *The 2002 Farm Bill: Provisions and Economic Implications*. <http://www.ers.usda.gov/features/farmbill/>.
- U.S. Department of Agriculture, Office of the Chief Economist. December 10, 2004. *World Agriculture Supply and Demand Estimates*. WASDE 417.  
<http://www.usda.gov/oce/waob/wasde/wasde.htm>
- U.S. Department of Agriculture, National Agricultural Statistics Service. September 2004. "Quick Stats: Agricultural Statistics Data Base, U.S. and State Level Data."  
<http://www.nass.usda.gov/QuickStats/>

Weaver, Robert D. and William. C. Natcher. July/August 2000. "Has market reform exposed farmers to greater price volatility?" *Farm Economics*. Penn State Cooperative Extension, College of Agricultural Sciences.

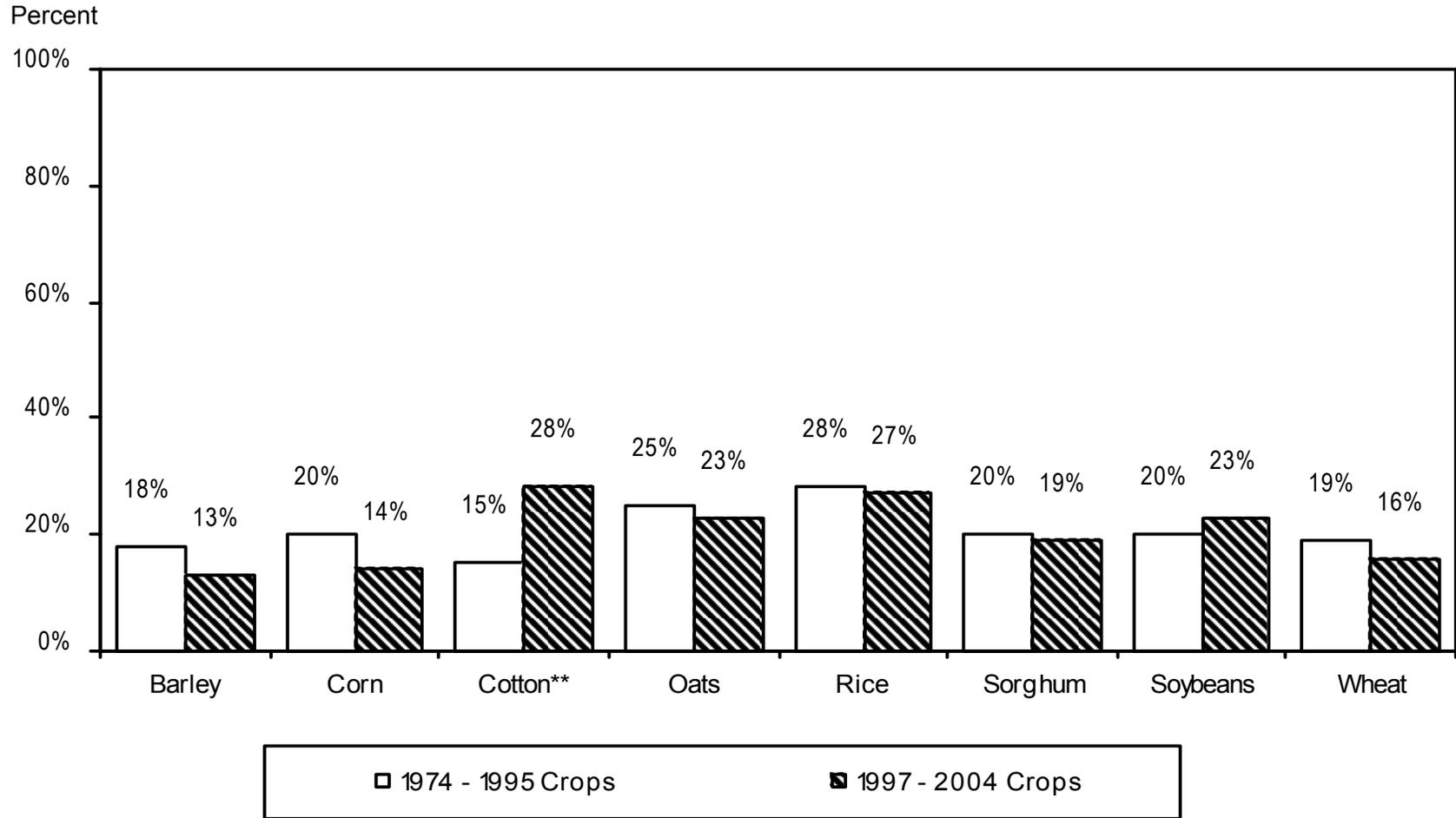
Zulauf, Carl and E. Neal Blue. 2003. "Has the Market's Estimate of Crop Price Variability Increased Since the 1996 Farm Bill?" *Review of Agricultural Economics*. 25(Number 1): 145-153.

Figure 1. Average Annual Price, U.S., 1974 – 2004 Crops



Notes: \*\* and \* indicate that a crop's average prices for the 1974-1995 and 1997-2004 periods differ significantly at the 99% and 95% levels of statistical confidence, respectively. Prices for barley, corn, oats, sorghum, soybeans, and wheat are in dollars per bushel. Prices for cotton are in dollars per pound. Prices for rice are in dollars per hundredweight.

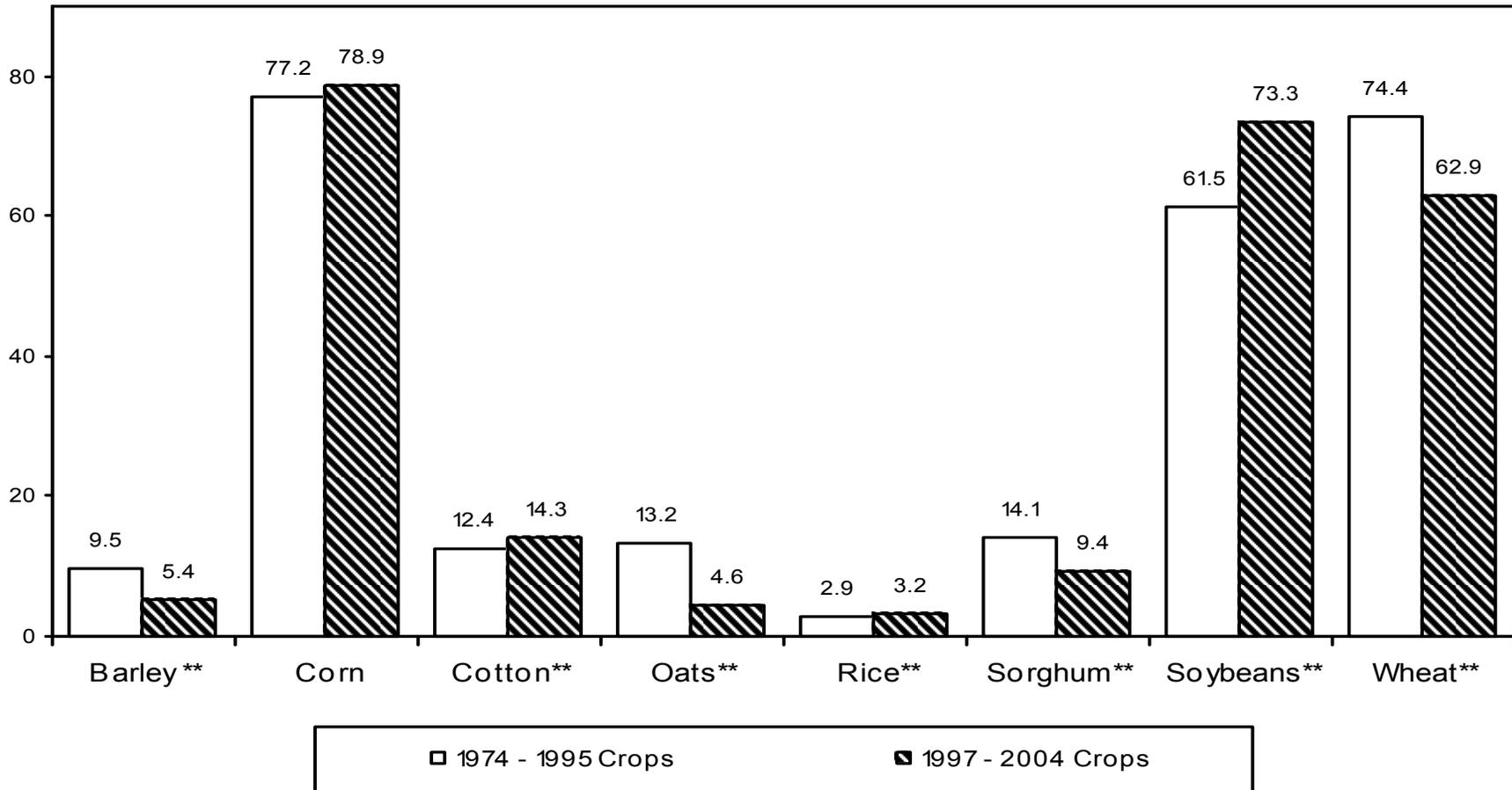
**Figure 2. Variability of Annual Average Price, U.S., 1974 - 2004 Crops**



Note: \*\* indicates that the variability of a crop's prices during the 1974-1995 and 1997-2004 periods differ significantly at the 99% level of statistical confidence. Variability is measured as the standard deviation of the percent change in annual price.

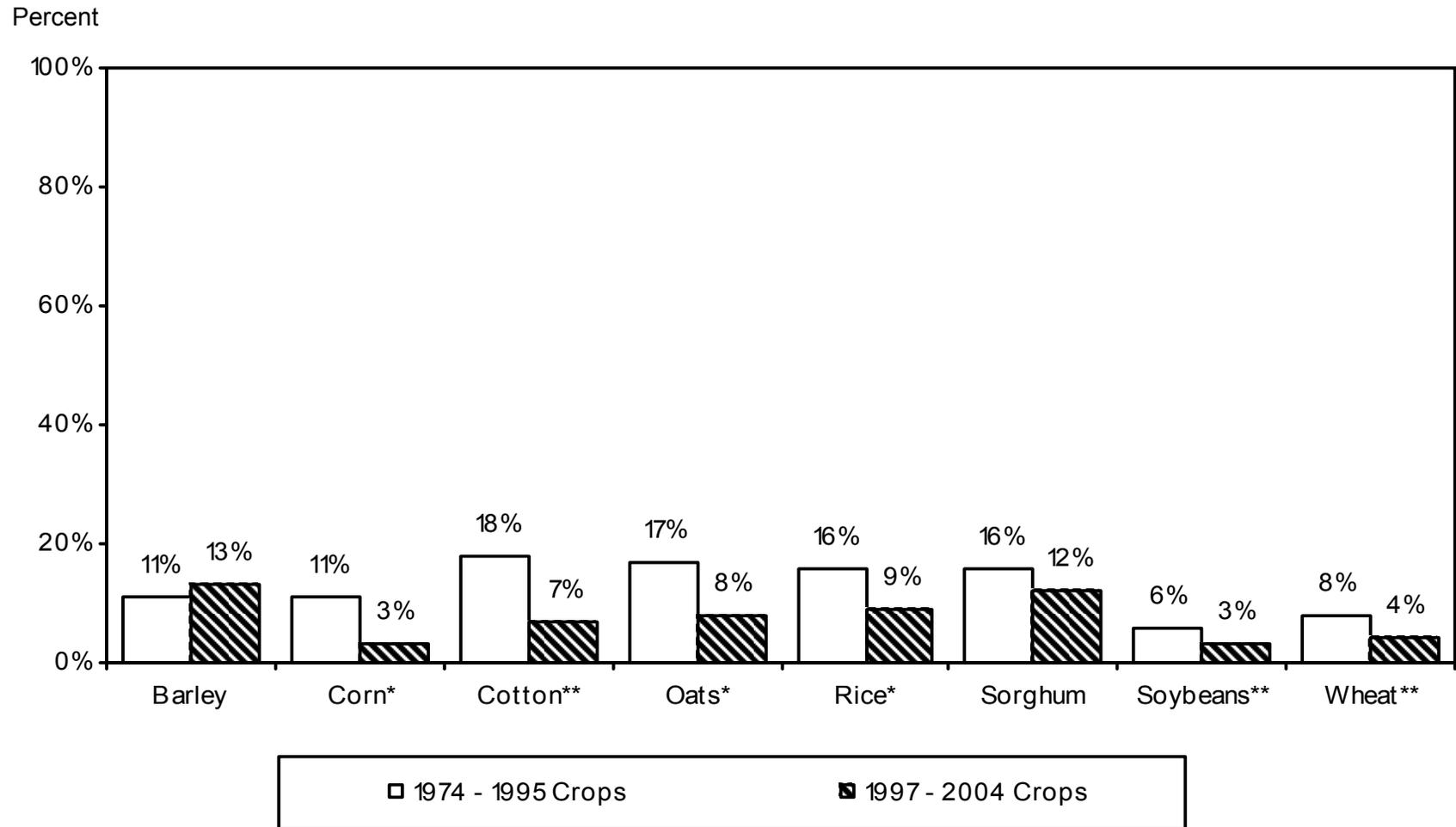
Figure 3. Average Annual Planted Acres, U.S., 1974 - 2004 Crops

Million Acres



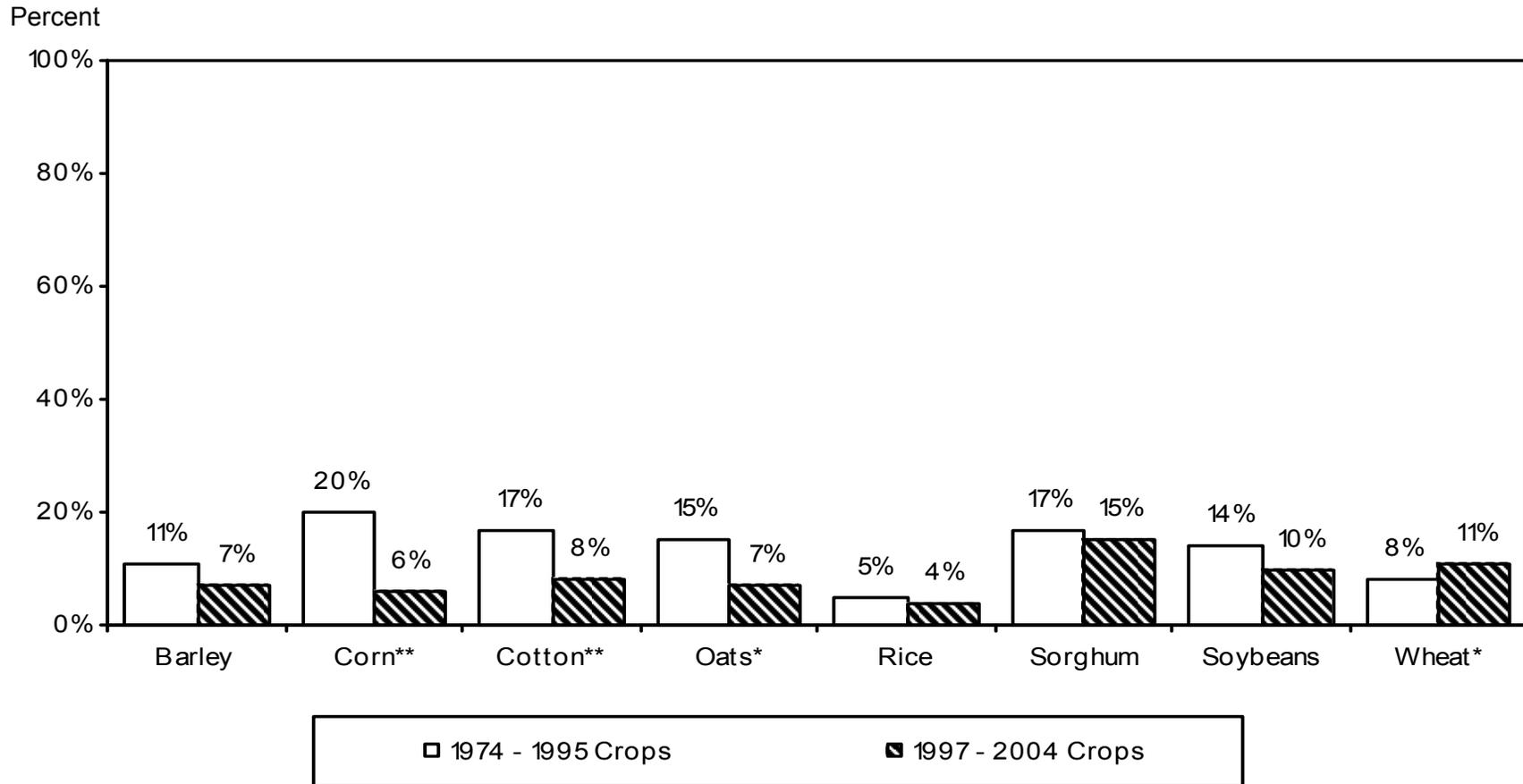
Note: \*\* indicates that the average acres planted to a crop during the 1974-1995 and 1997-2004 periods differ significantly at the 99% level of statistical confidence.

**Figure 4. Variability of Annual Planted Acres, U.S., 1974 - 2004 Crops**



Note: \*\* and \* indicate that the variability of the acres planted to a crop during the 1974-1995 and 1997-2004 periods differ significantly at the 99% and 95% levels of statistical confidence, respectively. Variability is measured as the standard deviation of the percent change in annual planted acres.

Figure 5. Variability of Yield, U.S., 1974 – 2004 Crops



Note: \*\* and \* indicate that the variability of a crop's yield during the 1974-1995 and 1997-2004 periods differ significantly at the 99% and 95% levels of statistical confidence, respectively. Variability is measured as the standard deviation of the percent change in yield.