# Modeling Acreage Response and US Farm Policy In a New Market Environment

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## ABSTRACT

**This study investigates the unprecedented degree of price volatility in recent years and its impact on major row crop acreage. This significant volatility and instability in markets resulted from the combination of many factors, the most prominent of which relates to fundamental changes in bio-energy policies that took place in 2007 and subsequent crop years. In particular, the U.S. Energy Independence and Security Act of 2007 established significant increases in mandated renewable fuel standards. The legislation mandated use of renewable fuels of at least 36 billion gallons by 2022—a level that was nearly 5 times bigger than the existing 7.5 billion gallon renewable fuel mandate for 2012 that had been established in the Energy Policy Act of 2005. Commodity markets reacted with unprecedented decreases in relative stocks and corresponding spikes in prices for all major crops (Figure 1). In addition, very high levels of price volatility (Figure 2) were realized in response to these shocks. Planted acres of the major U.S. row crops has increase by 12.9 million acres in 2011 compared with 2006 (Figure 3).**

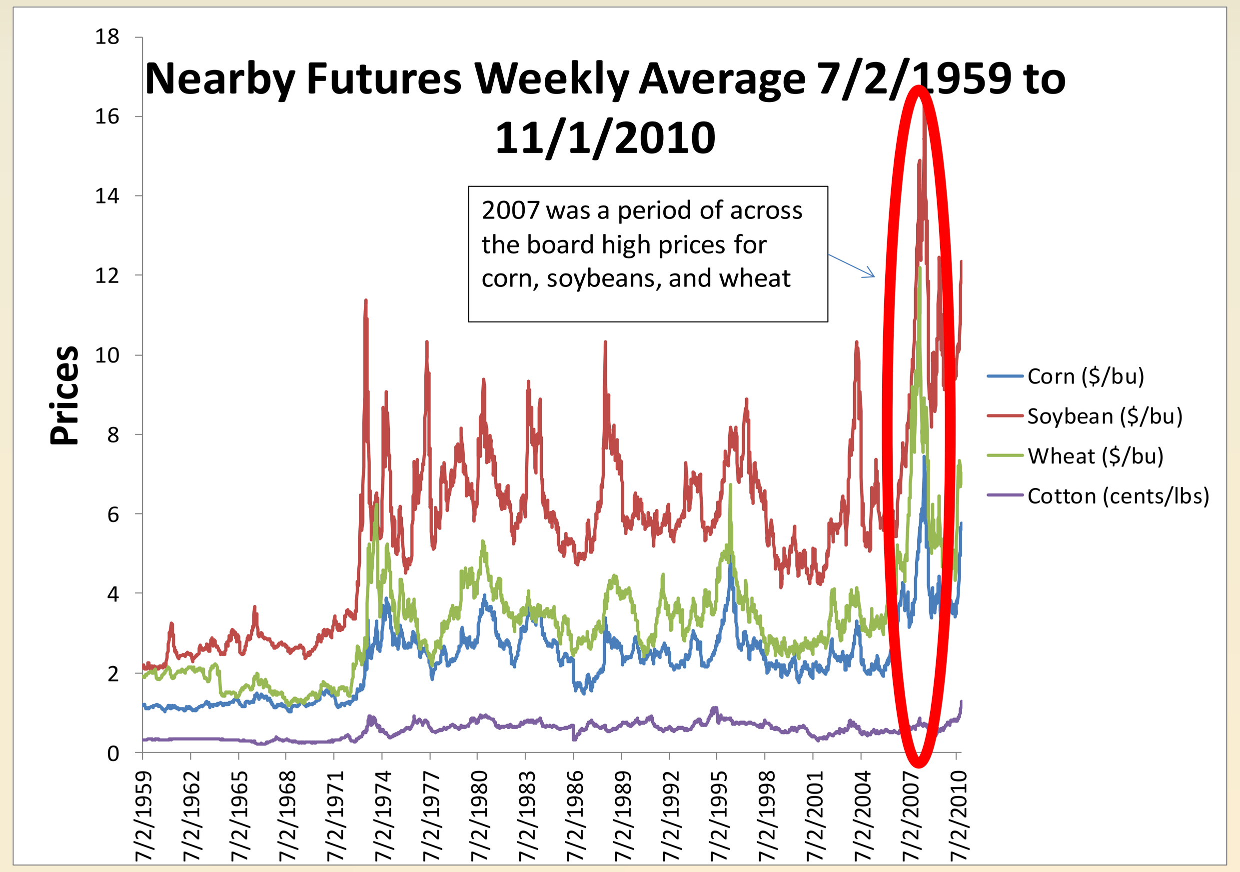
**Background**

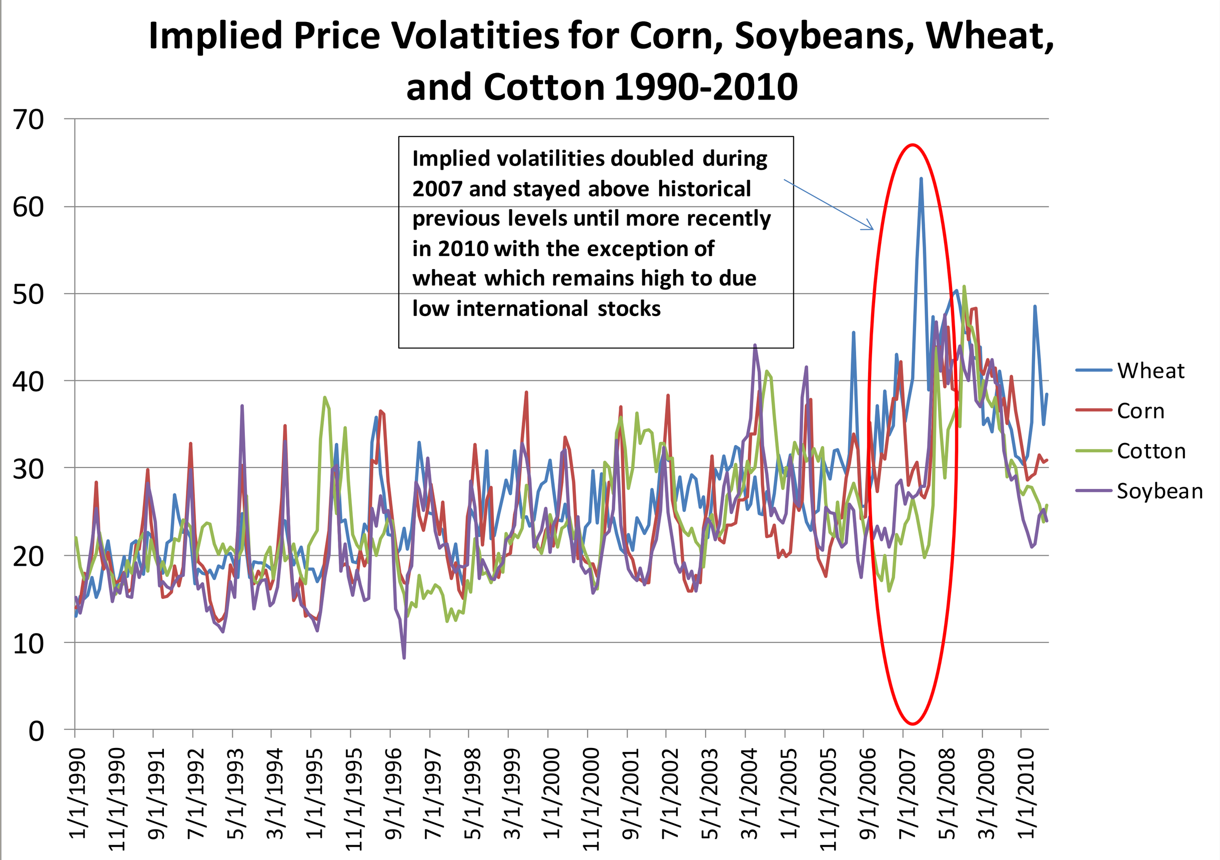
- **Statutory price supports, which largely adhere to the levels established under the 2002 and 2008 Farm Bills, are at levels that are far below market prices for most commodities. For most major commodities, no loan deficiency payments or counter-cyclical payments have been made in recent years. This raises important questions regarding the extent to which these policies impact current production decisions.**
- **The Average Crop Revenue Program (ACRE) that eligible farmers could first elect to participate in the 2009 crop year does provide payments for revenue losses that automatically re-equilibrate to a considerable extent to recent prices, but in return for these payments, the farmer must give up some other program support, including a portion of the fixed Direct Payments that he would have received if he stayed with the "traditional" commodity support. Even with a meaningful possibility of ACRE revenue payments for 2009, only 13-14% of eligible farmers chose to enroll in ACRE.**
- **While significant paperwork and other transaction costs are one reason, the other is that once enrolled, the farmer is locked into ACRE through the 2012 crop year. Hence, the farmers' opinions on price movements over this period will play into the decision to forego a portion of Direct Payments with certainty in return for the possibility of payment based on losses with respect to expected revenue. Now that farmer's have a choice between "traditional" payment linked to statutory price targets and one whose revenue target is based on (an albeit simplified measure of) expected market prices, certainly the dynamic of the relationship between farm policy, market prices, and farmer decisions is different than before the current Farm Act. This new relationship is likely to continue and, perhaps, be magnified with the deliberations over the 2012 Farm Bill.**
- **This paper reports on research that attempts to provide a better understanding of the role of farm policy, market prices, and price volatility in shaping and affecting acreage planting decisions by individual farmers.**

**The Central Question**

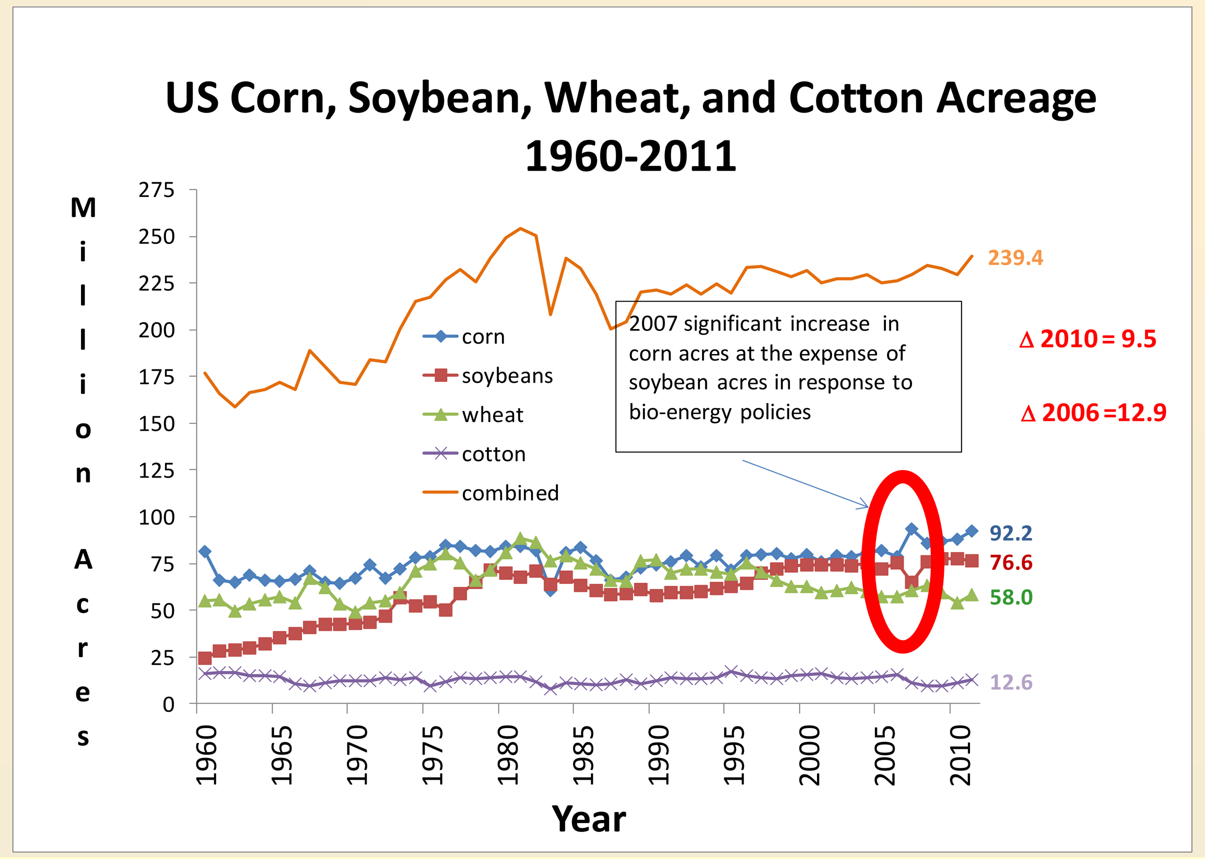
**Can we identify recent periods of structural change in US major row crop acreage plantings?**

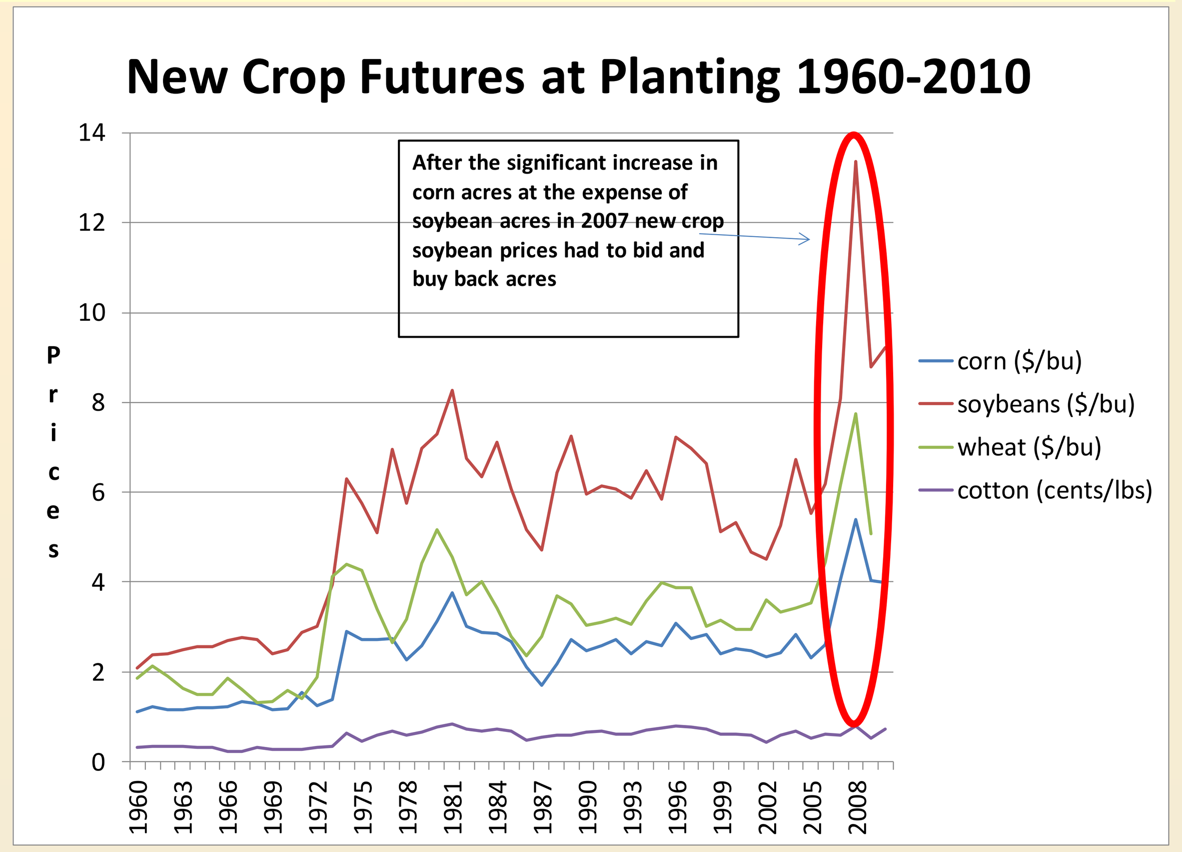
## Figures 1 & 2: US Major Row Crop Nearby Futures Prices Levels and Implied Volatilities



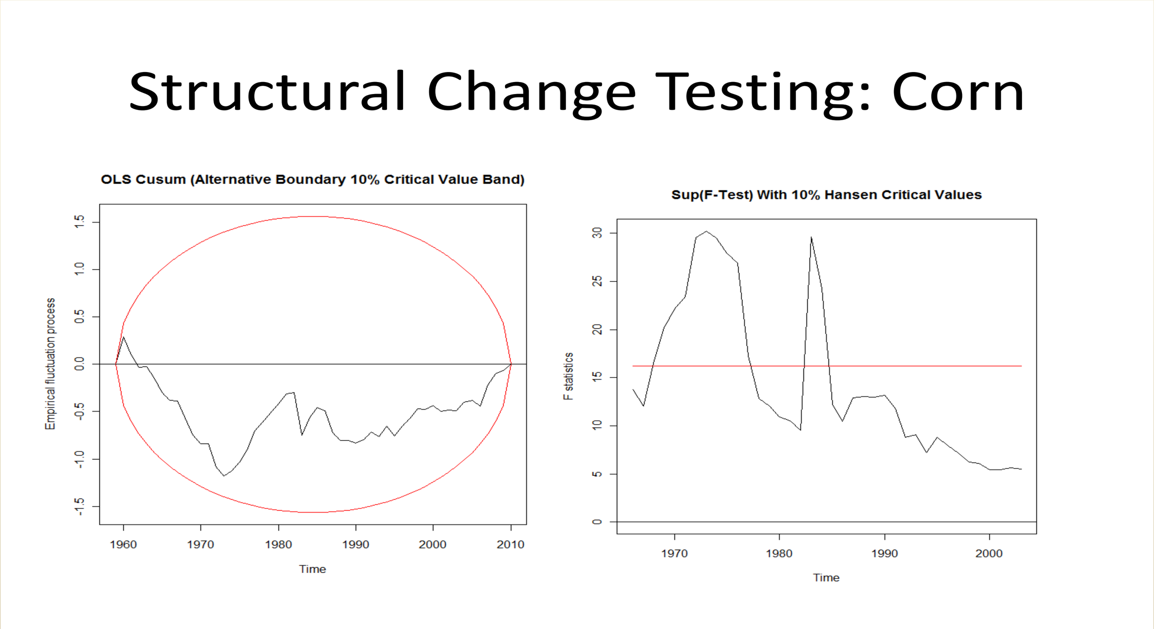




## Figures 3 & 4: US Major Row Crop Acreage and New Crop Futures at Planting

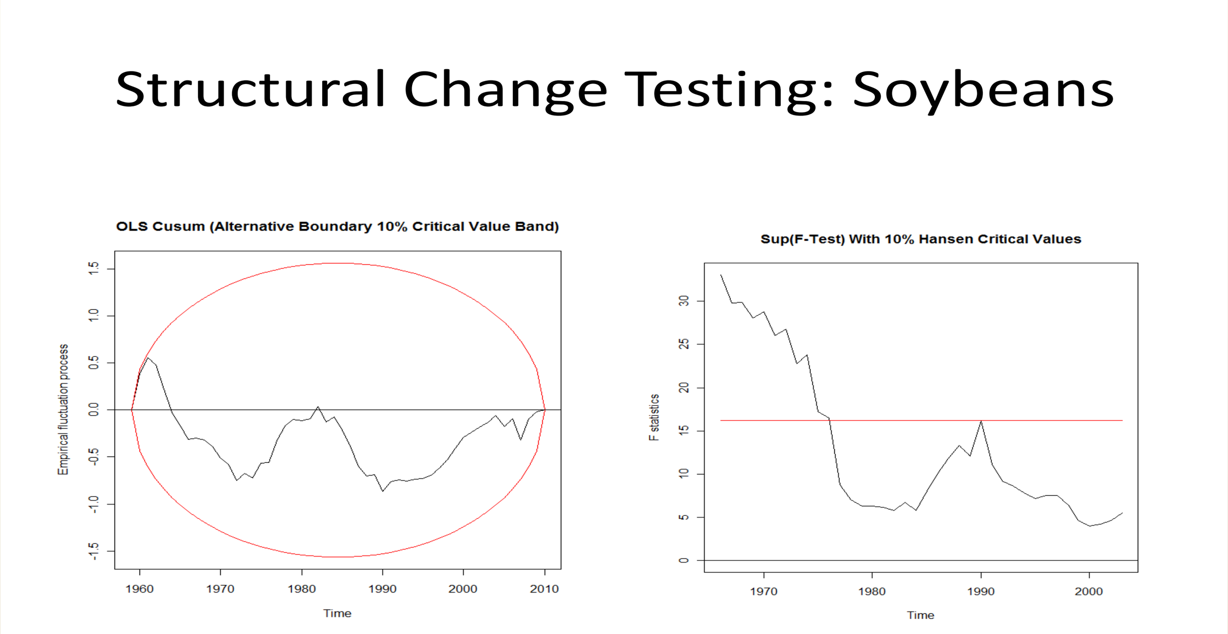



## Figure 5 & 6: Tests for Structural Change for Corn and Soybeans, 1960-2010




Poor fit for corn may suggest structural change and need for different model




Less evidence of change for soybeans, especially in later years

## METHODOLOGY

- **Employ aggregate annual data, 1960-2010, soybean and corn acreage**
- **Standard acreage response models that include**
  - **expected price (harvest time futures) (Figure 4),**
  - **expected price of competing crops for acreage (harvest time futures),**
  - **an index of input prices,**
  - **acreage in the previous period**
- **Apply a number of statistical approaches to test and date change**
  - **Andrews sup(F) test**
  - **Ploberger and Kramer OLS CUMSUM**
- **Initial application to annual data, to be applied to more micro-level data**
  - **We intend to employ data that will contain the following (for 2009 and 2010 and by crop) county-level total base acreage, acreage enrolled in the ACRE program, and acreage in the SURE program**

## RESULTS FOR STANDARD AGGREGATE ACREAGE RESPONSE

| Corn Acreage | | | | | Soybean Acreage | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Variable | Estimate | Std. Error | t-ratio | Pr(>\|t\|) | Variable | Estimate | Std. Error | t-ratio | Pr(>\|t\|) |
| Intercept | 8.478 | 1.279 | 6.629 | 0.000 | Intercept | 9.355 | 1.032 | 9.061 | 0.000 |
| E(Corn Price) | 0.101 | 0.132 | 0.765 | 0.448 | E(Corn Price) | -0.341 | 0.098 | -3.471 | 0.001 |
| E(Soybean Price) | -0.249 | 0.160 | -1.561 | 0.125 | E(Soybean Price) | 0.314 | 0.113 | 2.773 | 0.008 |
| Input Prices | 0.606 | 0.283 | 2.143 | 0.037 | Input Prices | 0.084 | 0.233 | 0.360 | 0.720 |
| Acreage (t-1) | 0.030 | 0.016 | 1.848 | 0.071 | Acreage (t-1) | 0.315 | 0.017 | 18.473 | 0.000 |
| $R^2$ | 0.255 | | | | $R^2$ | 0.9595 | | | |
| F-statistic: | 3.937 | | | | F-statistic: | 272.1000 | | | |
| p-value: | 0.00787 | | | | p-value: | 0.0000 | | | |

## IMPLICATIONS

**AGGREGATE MODELS**

- **Poor fit for the corn equation (low $R^2$ and statistically insignificant parameters estimates suggest that standard acreage model may not be suitable.**
  - **Structural change tests reveal that there appears to be different structures after the mid 1980's (Figure 5). However, given the poor model fit, this may not be very robust.**
- **Better fit for the soybean equation (high $R^2$ and statistically significant parameter estimates) suggests that the standard acreage model fits reasonably well.**
  - **Structural change tests confirm that the model fits well, with less evidence of structural change after the early 1970's (Figure 6).**

**MICRO-LEVEL MODELS**

- **Examination of more micro–level data seems appropriate to better understand the acreage allocation decisions in the corn market and to also evaluate the robustness of the soybean acreage response.**
- **An empirical analysis of two important dimensions of the current farm legislation has also been initiated. This includes: an analysis of the factors associated with participation in the ACRE program and of the 2002 base acreage updating decision. Both issues are becoming critical in the ongoing Farm Bill deliberations.**

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