ACE 427
Spring 2009

Lecture 5

Forecasting Crop Prices Using Fundamental Analysis: Ending Stock Models

by
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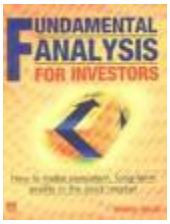
Required Reading:

Westcott, P.C. and L.A. Hoffman. "Price Determination for Corn and Wheat: The Role of Market Factors and Government Programs." US Department of Agriculture, Economic Research Service, 1999. (427 class website)

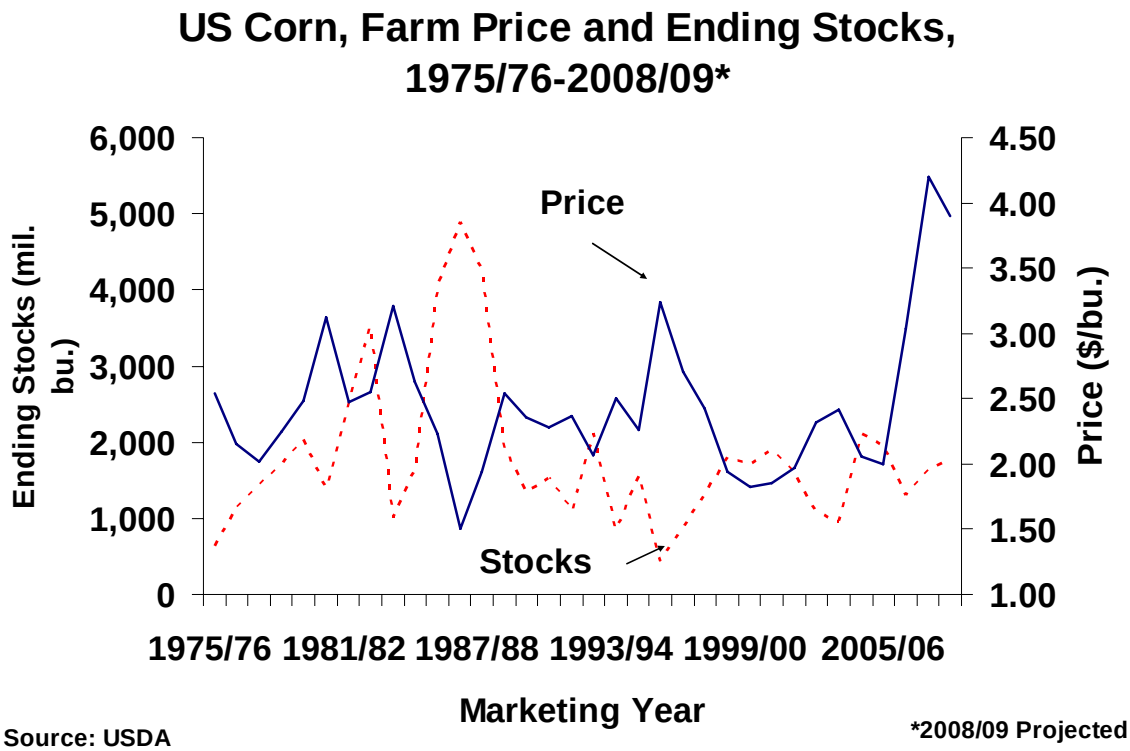
Fundamental Analysis

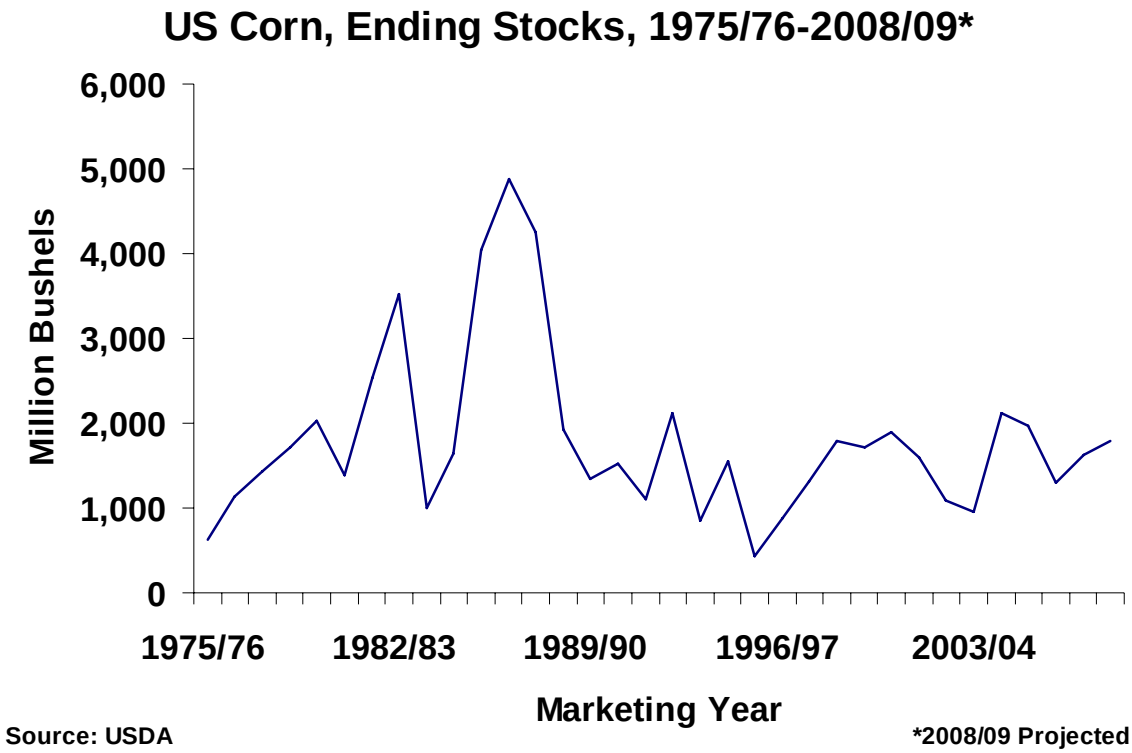


- Definition: An assessment of _____ based on the underlying _____ and _____ factors and the changes in those relationships
- Motivated by economic _____ of supply and demand
- The task of the market is to establish a price that will _____
- Fundamental analysis can be thought of as the process of anticipating the market clearing price
- Techniques: Subjective judgment to sophisticated statistical models
- Goal: Estimate _____ and compare to _____
  - Bullish: Value > Price
  - Bearish: Value < Price

Ending Stocks and Price

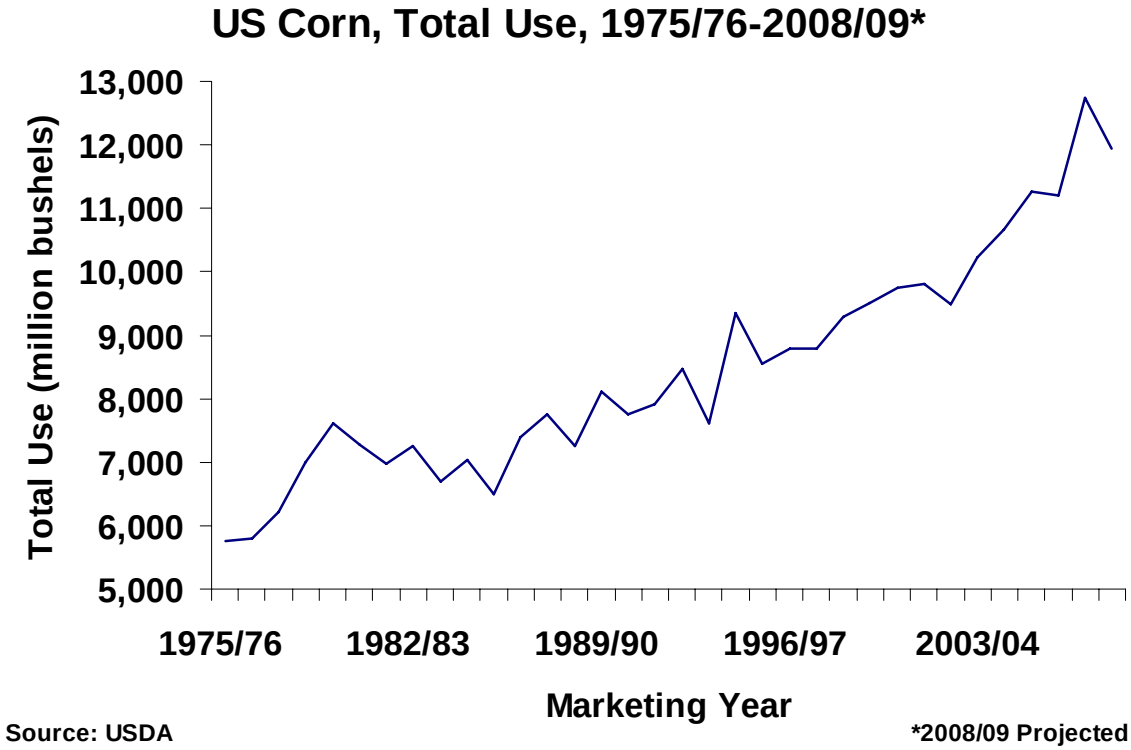
- Ending stocks indicate the _____ between supply and demand
- Ending stocks _____, price _____
- Ending stocks _____, price _____
- Relationship between ending stocks and price is often used to forecast prices





Source: USDA

*2008/09 Projected



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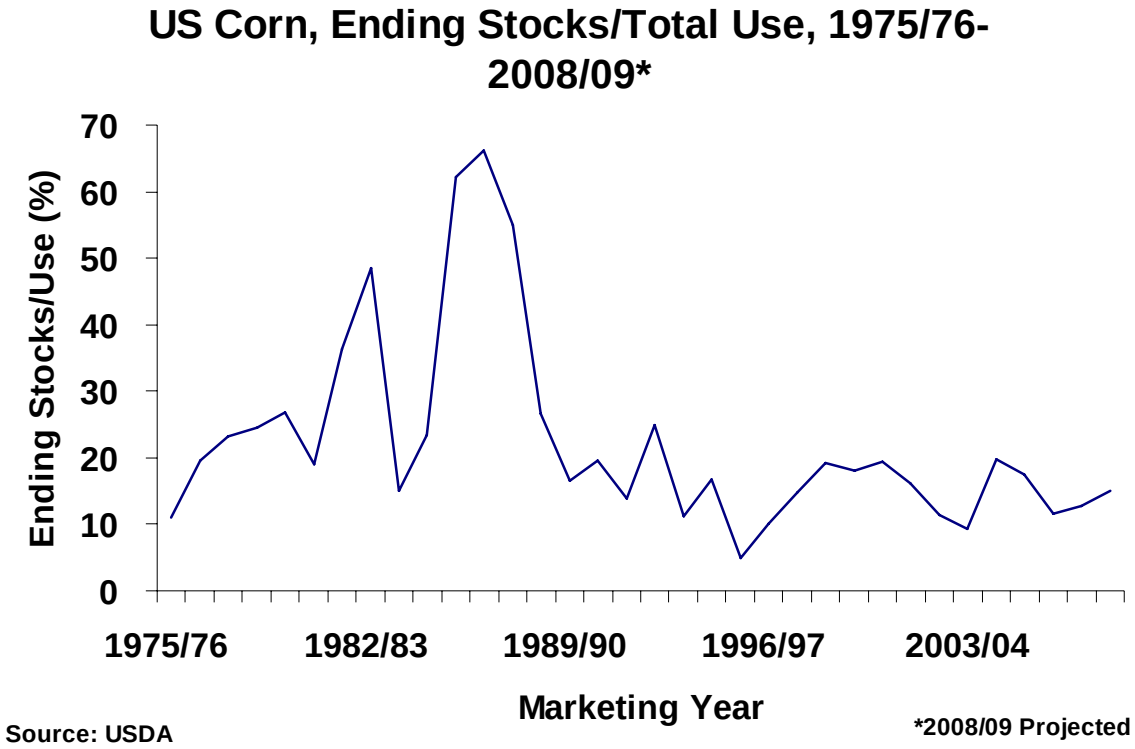

US Corn, Ending Stocks/Total Use, 1975/76-2008/09*
Ending Stocks/Use (%)
70
60
50
40
30
20
10
0
1975/76
1982/83
1989/90
1996/97
2003/04
Marketing Year
Source: USDA
*2008/09 Projected

Building an Economic Model

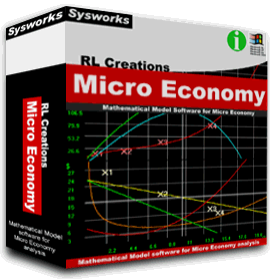
- A model is an _____ from the real world
- Must be _____ yet capture _____ economic relationships
- A model of a market can be thought of as one or more _____ that describe the important _____among the variables in the market

The Simplest Market Model

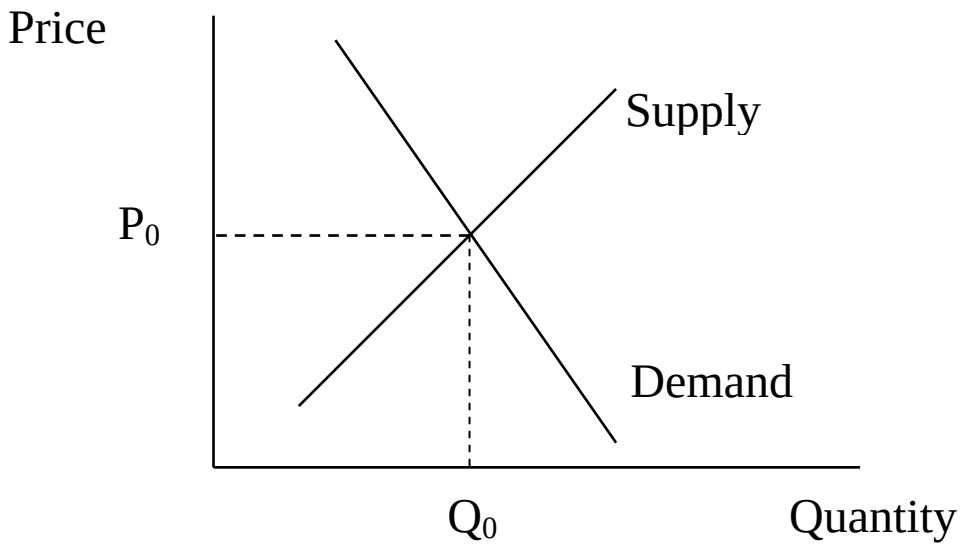
$QD_t = a - b\,P_t$ (Demand)

$QS_t = d + e\,P_t$ (Supply)

$QD_t = QS_t$ (Equilibrium)



Economic Model Underlying Balance Sheets before Planting



Adding Shifter Variables

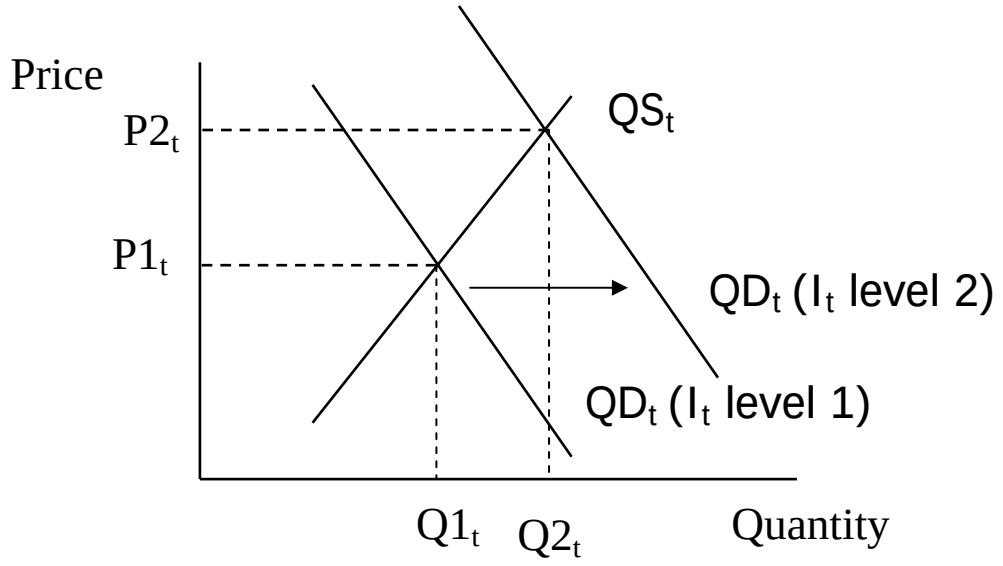
- In the simple model, there is only one _____ because nothing ever_____!
- In reality, we know that:
  - Demand curves shift due to changes in the _____, _____ and other variables
  - Supply curves shift due to changes in the _____, _____ and other variables
- Key point: Changing equilibrium prices and quantities are driven by changes in the level of _____

A More Realistic Market Model

$$QD_t = a - b\,P_t + c\,I_t \quad \text{(Demand)}$$

$$QS_t = d + e\,P_t \quad \text{(Supply)}$$

$$QD_t = QS_t \quad \text{(Equilibrium)}$$

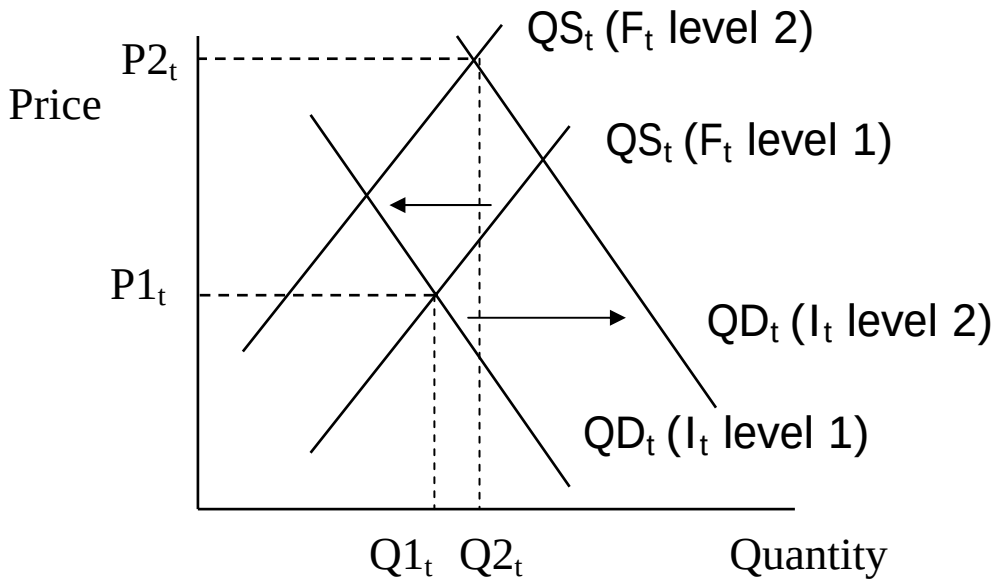


An Even More Realistic Market Model

$$QD_t = a - b\,P_t + c\,I_t \quad \text{(Demand)}$$

$$QS_t = d + e\,P_t - f\,F_t \quad \text{(Supply)}$$

$$QD_t = QS_t \quad \text{(Equilibrium)}$$



A Complete Pricing Model in Implicit Form

(1) $S_t = f(p_{t-1}, z_t)$ Supply

(2) $D_t = g(p_t, p_{t-1}, z_t)$ Domestic/Export Demand

(3) $K_t = h(p_t, z_t)$ Stock Demand

(4) $S_t = D_t + K_t$ Equilibrium Condition

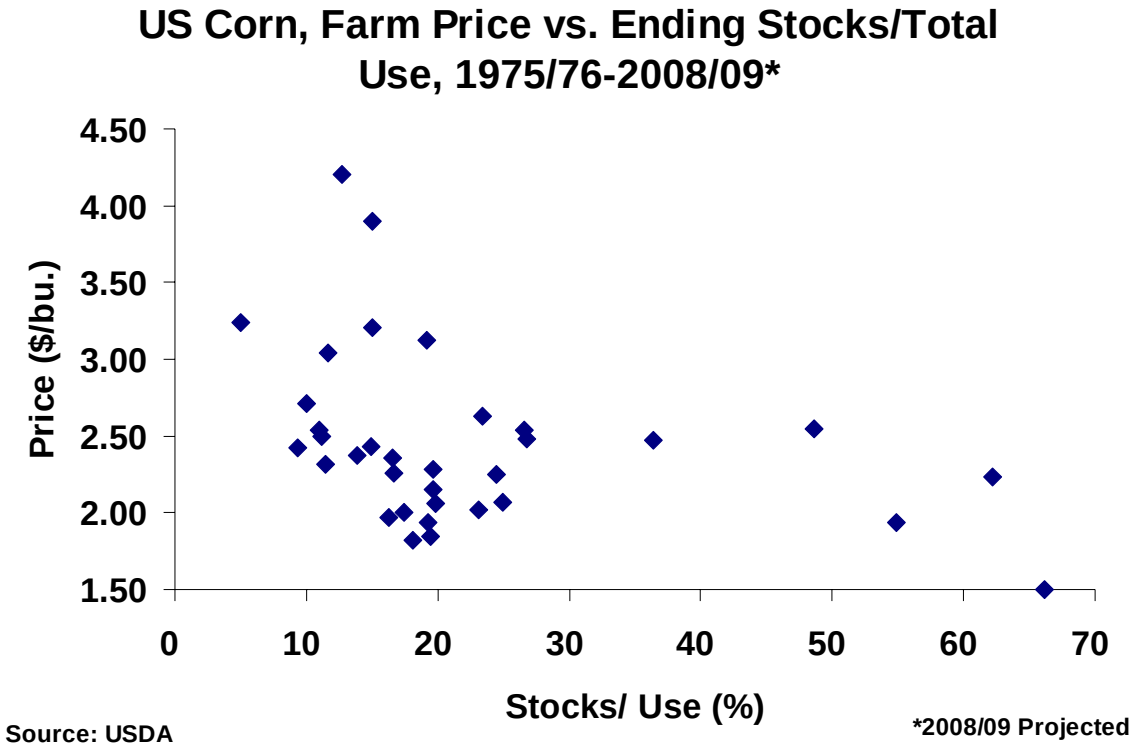
Forecasting with Pricing Model

- In equilibrium, the relationship between prices and ending stocks can be found by substituting (1), (2), and (4) into (3) and _____ the stock demand function (3):

$$p_t = h^{-1}(K_t, p_{t-1}, z_t)$$

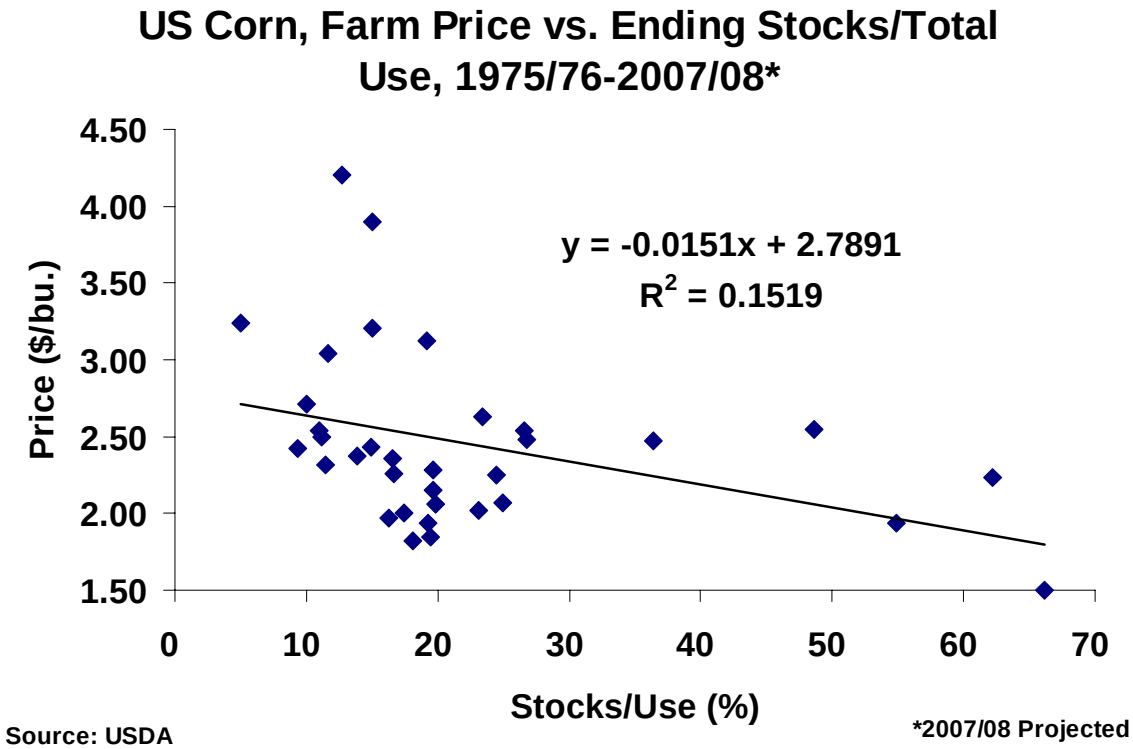
- Basic pricing function used by many market analysts

- Essential to note that this assumes ___ shifter variables are held _____!



Source: USDA

*2008/09 Projected



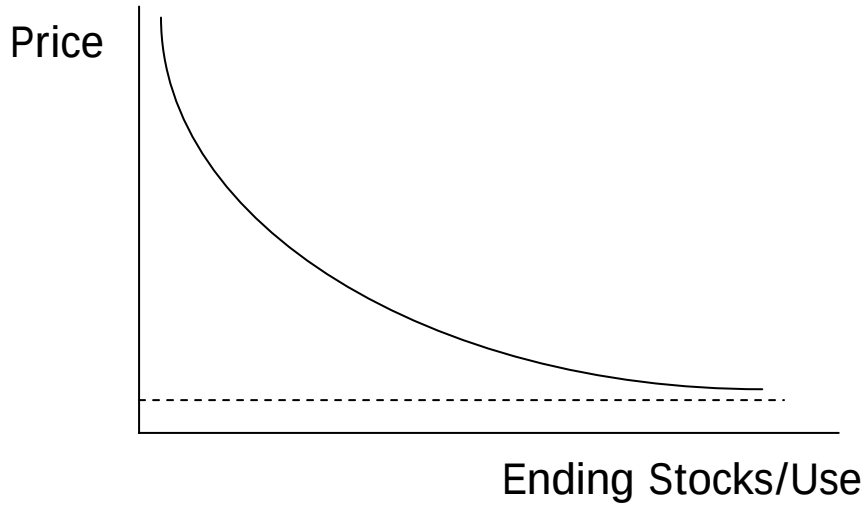
Source: USDA

*2007/08 Projected

Logical Characteristics of Relationship between Price and Stocks

- As ending stocks approach ____, theoretically, there is no _____ for price
- As ending stocks get very large, price is unlikely to go below some minimum _____ level

Theoretical Functional Form between Price and Ending Stocks



Transformations and Least Squares Regression

- All is not lost when the relationship between *x* and *y* is _____
- LS regression "works" for any non-linear transformation of the _____
- We can take logs, divide or multiply variables
- Valid as long as we do not transform _____ (e.g. square, cube, etc.)

Regression Functional Forms between Price and Ending Stocks That Account for Non-Linearity

- Double-log functional form:

$$ln(y) = b_1 + b_2\, ln(x)$$

- Reciprocal functional form:

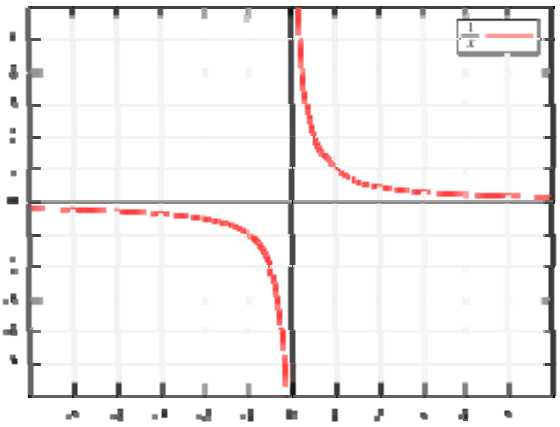
$$y = b_1 + b_2\, (1/x)$$

Properties of the Reciprocal Functional Form

$$y = b_1 + b_2\,(1/x)$$

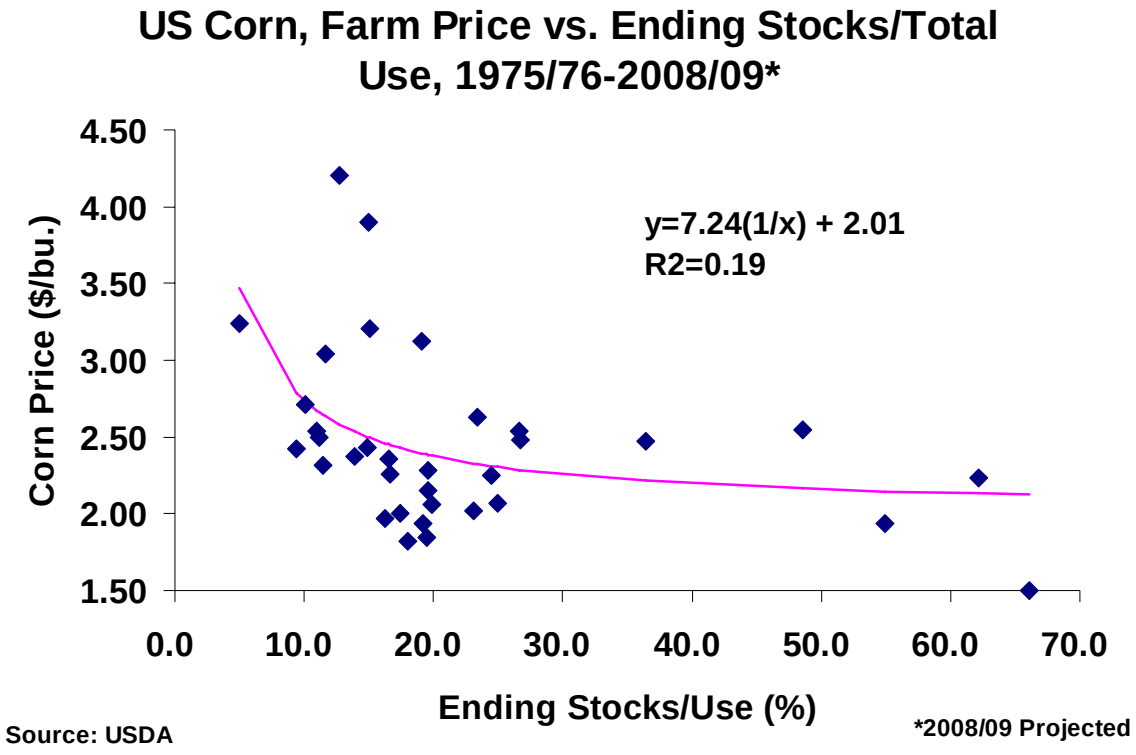
- b_1 measures the _____ (or maximum) level of y
- b_2 does not measure change in y for a one-unit change in x, but instead change for a one unit change in $1/x$
- Hence, the slope (change in y for a one unit change in x) _____ for different _____ of x

$$\Delta y/\Delta x = dy/dx = -b_2\,(1/x^2)$$



Corn: Setting Up the Data for a Reciprocal Model in Excel

		Total	Ending	x=Stocks/		y=Corn
	Year	Use	Stocks	Use (%)	1/x	Price
1	1975/76	5767	633	11.0	0.09	2.54
2	1976/77	5789	1136	19.6	0.05	2.15
3	1977/78	6207	1436	23.1	0.04	2.02
4	1978/79	6995	1710	24.4	0.04	2.25
5	1979/80	7604	2034	26.7	0.04	2.48
6	1980/81	7282	1392	19.1	0.05	3.12
7	1981/82	6975	2537	36.4	0.03	2.47
8	1982/83	7249	3523	48.6	0.02	2.55
9	1983/84	6693	1006	15.0	0.07	3.21
10	1984/85	7032	1648	23.4	0.04	2.63

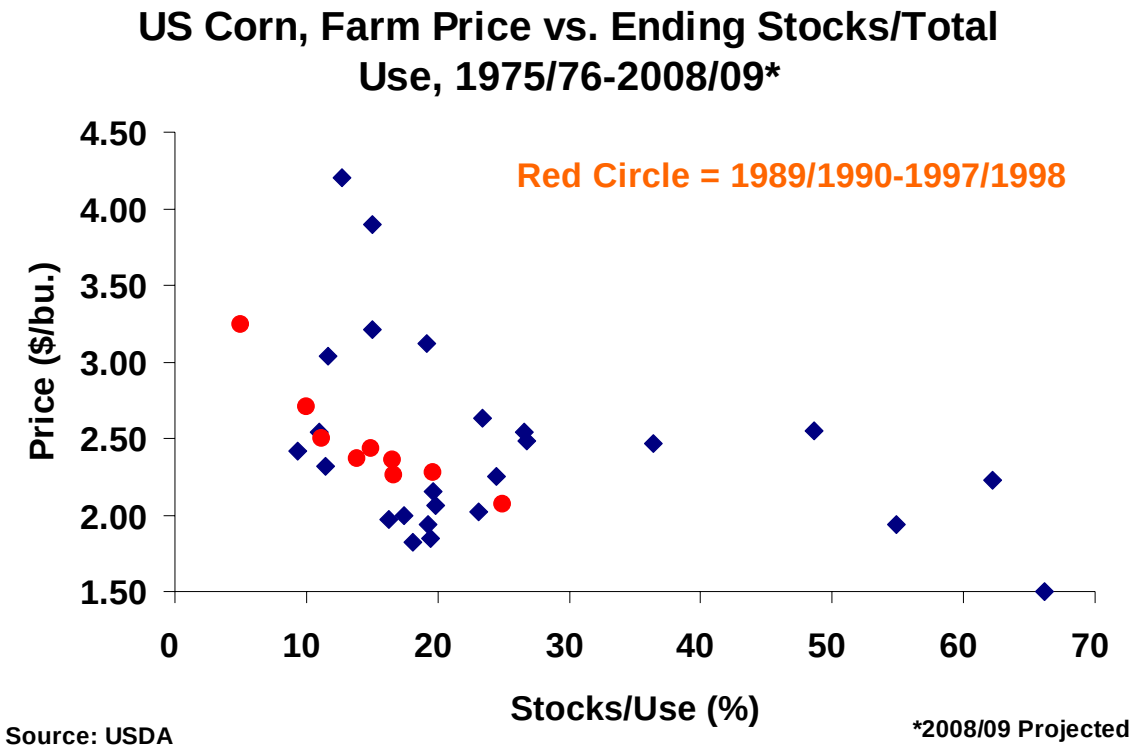


Different Approaches to Account for Shifts in Relationship

- Include _____ variables directly in the pricing model and estimate ____ model for the entire sample period

  - Approach taken by Westcott and Hoffman
  - 3 additional independent variables for corn
  - 5 additional independent variables for wheat

- Estimate _____ pricing models for ____ _____
  - Shifter variables have different levels across the sub-periods
  - The level of shifter variables is assumed to be relatively _____ within a sub-period



Source: USDA

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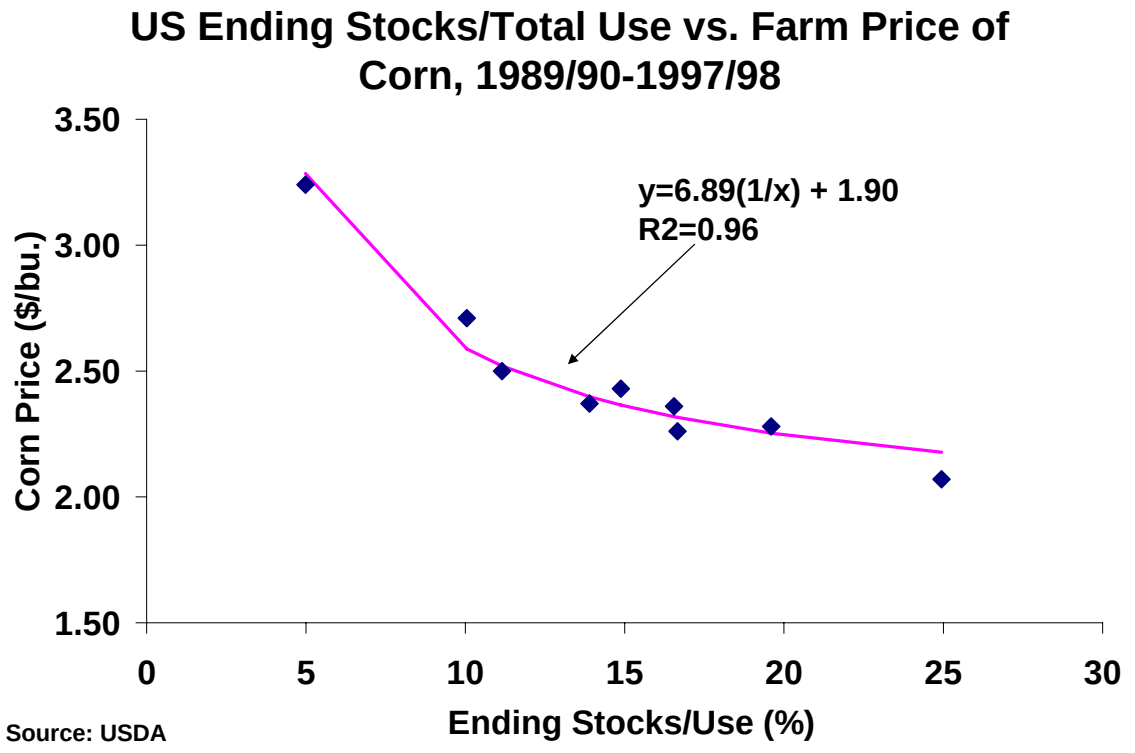

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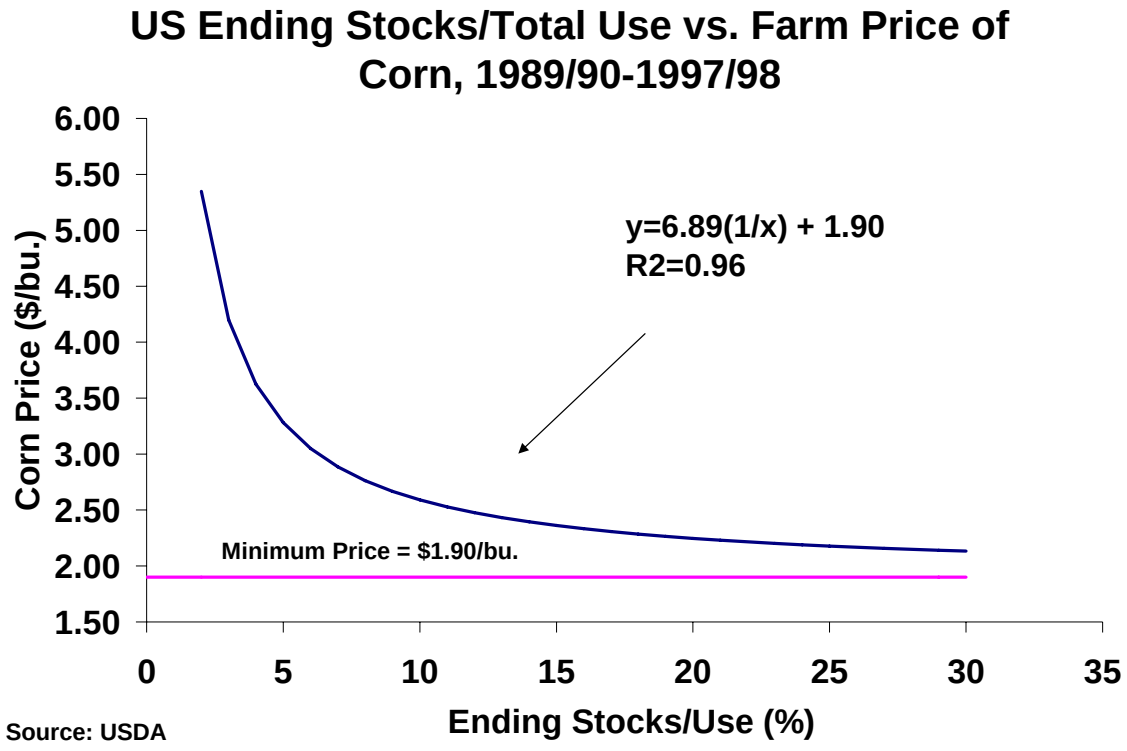
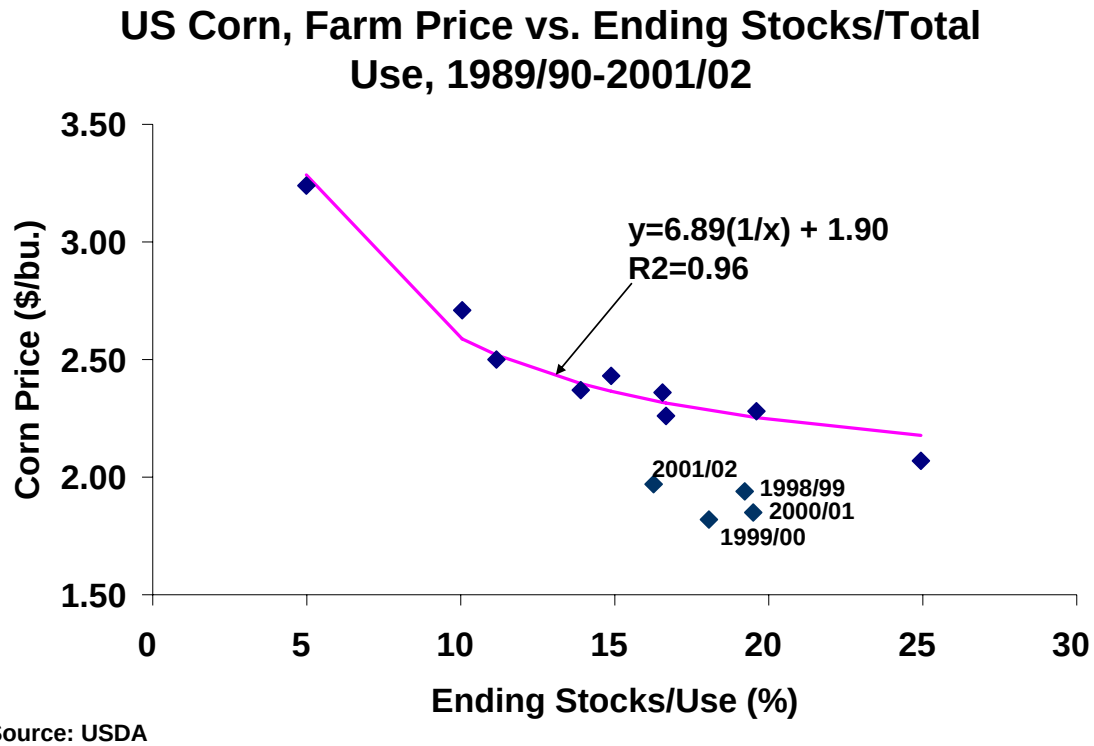


- Slope changes with *x*
  - Ending stocks/use = 5

    $\Delta y/\Delta x = -6.89\ (1/5^2) = -0.28$ \$/bu.
  - Ending stocks/use = 25

    $\Delta y/\Delta x = -6.89\ (1/25^2) = -0.01$ \$/bu.



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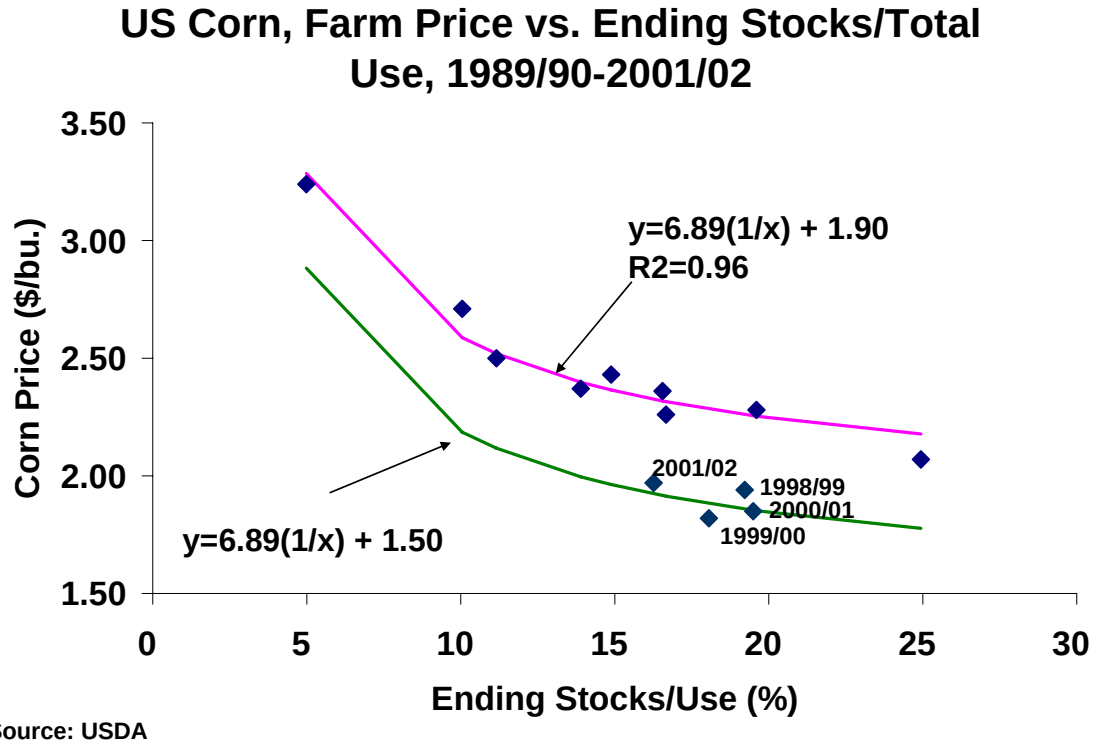


Source: USDA

What Changed During the 1998/99-2001/02 Marketing Years?

- All else equal, supply shifted to the _____

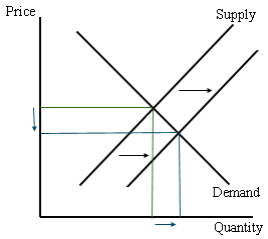
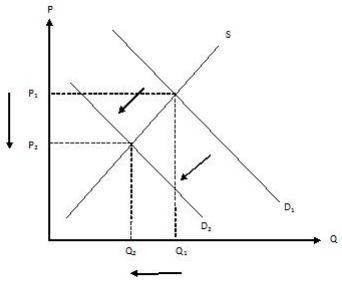


Figure 2.

  - US commodity programs changed in 1996 with passage of the "Freedom to Farm" Act
  - New legislation _____ acreage set-asides, and effectively, the non-recourse loan program

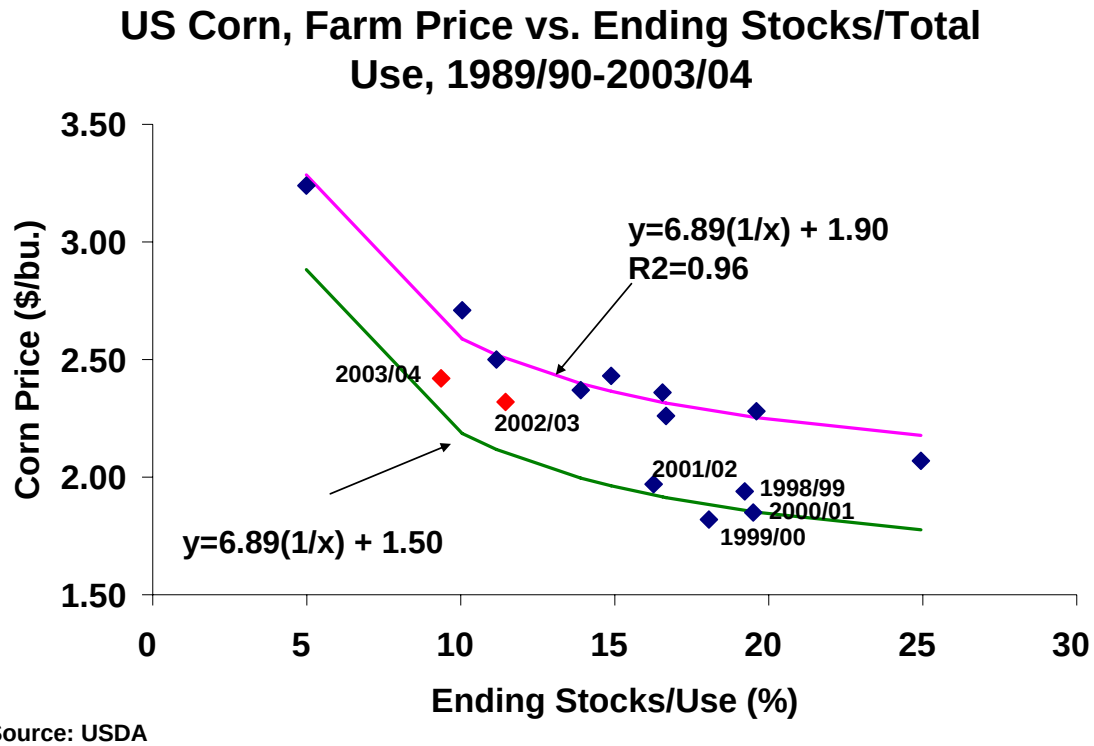
- Or, demand shifted to the _____

Figure 1: Diagram showing the shift of demand curve to the left.



  - FSI demand?
  - Export demand?
  - Feed demand?
  - Stock demand?

- Some _____ of supply and demand shifts



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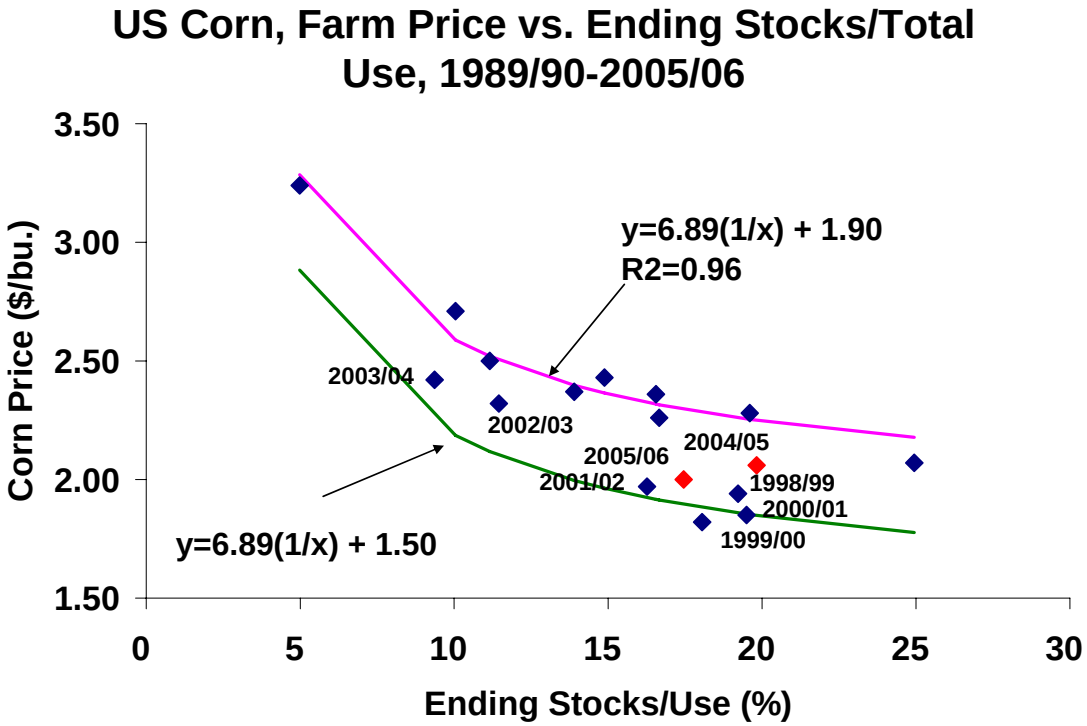

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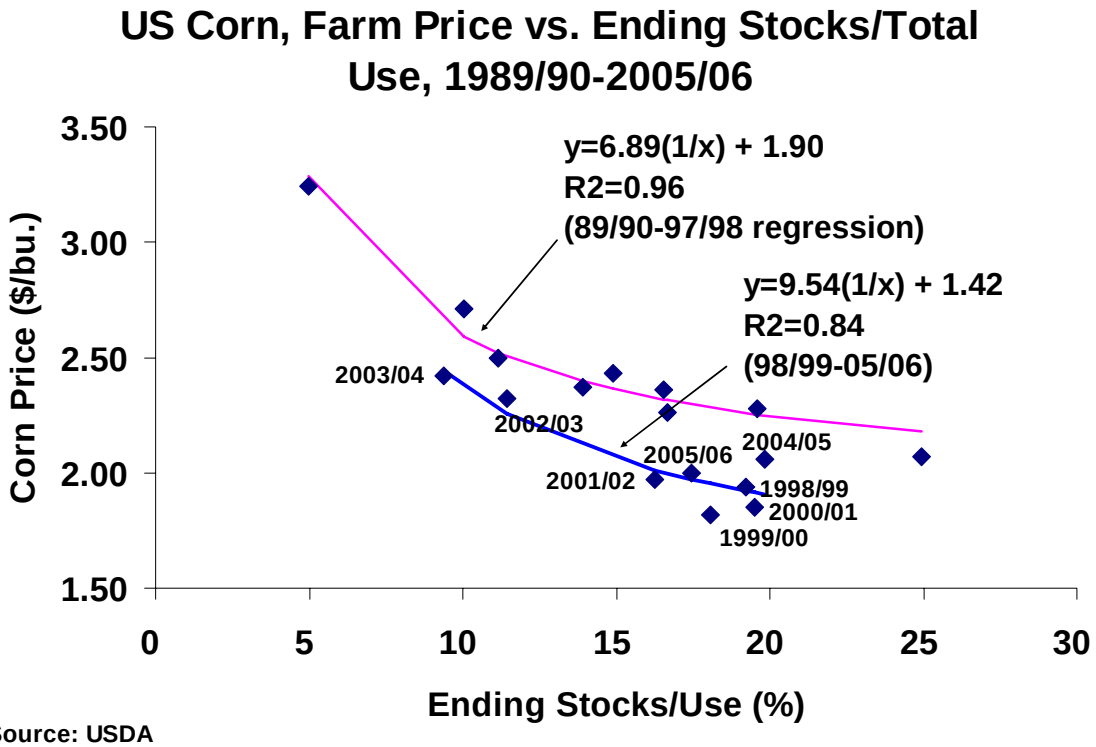

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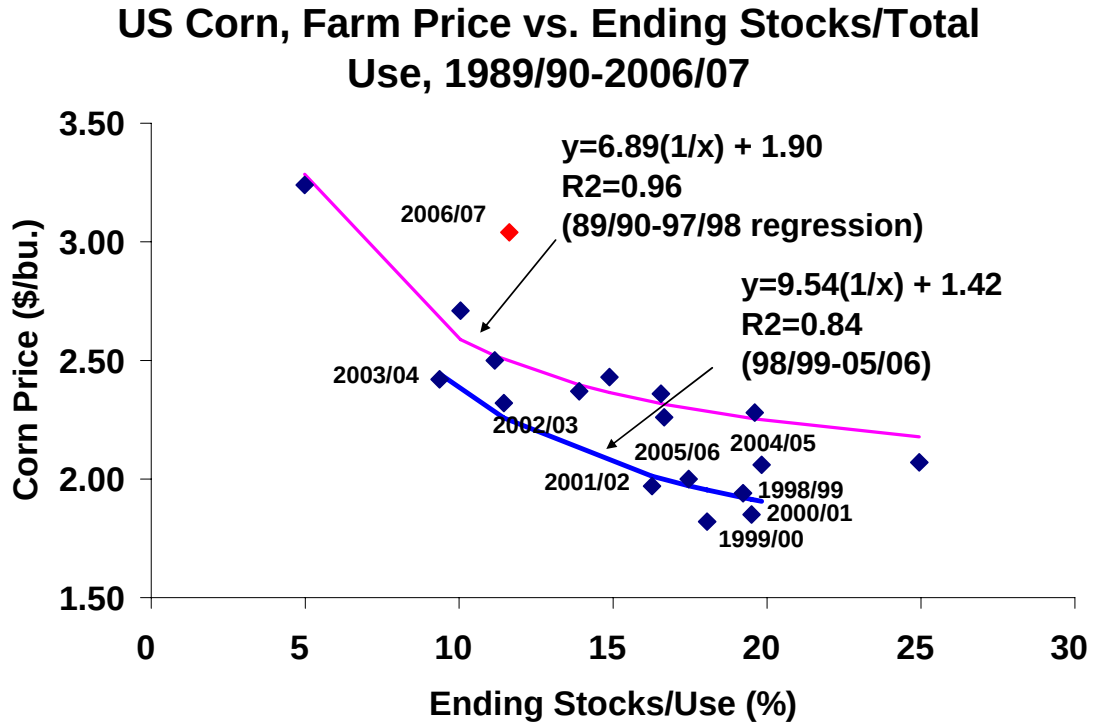

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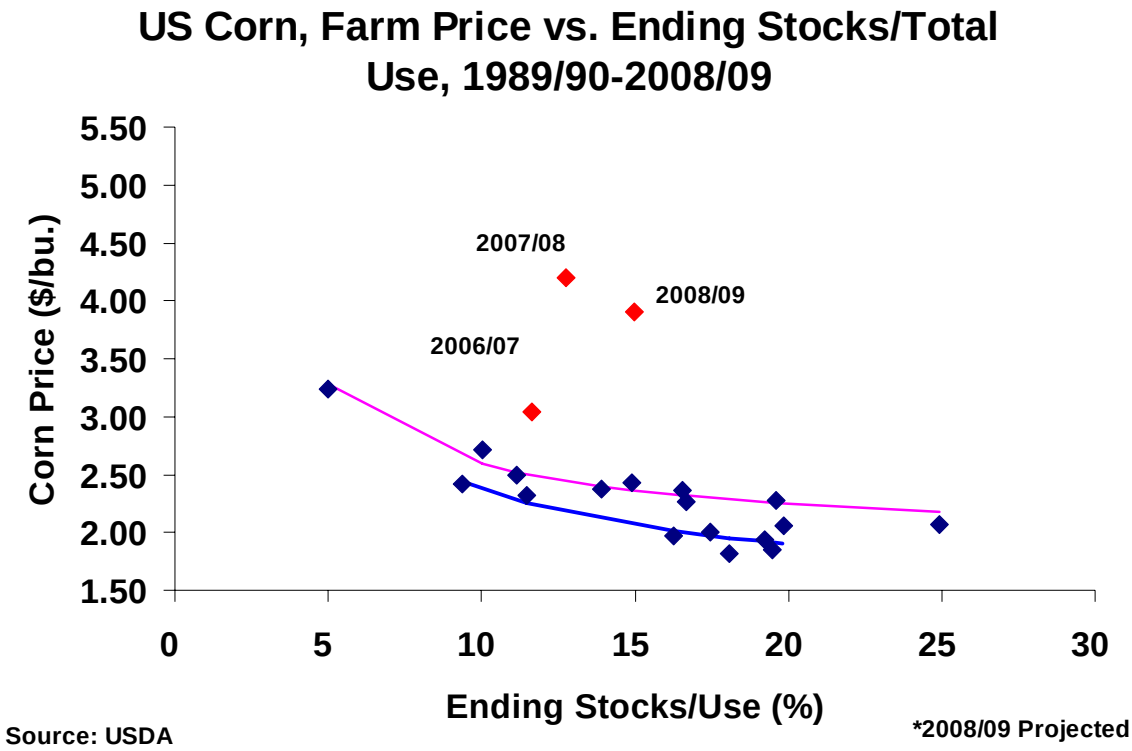

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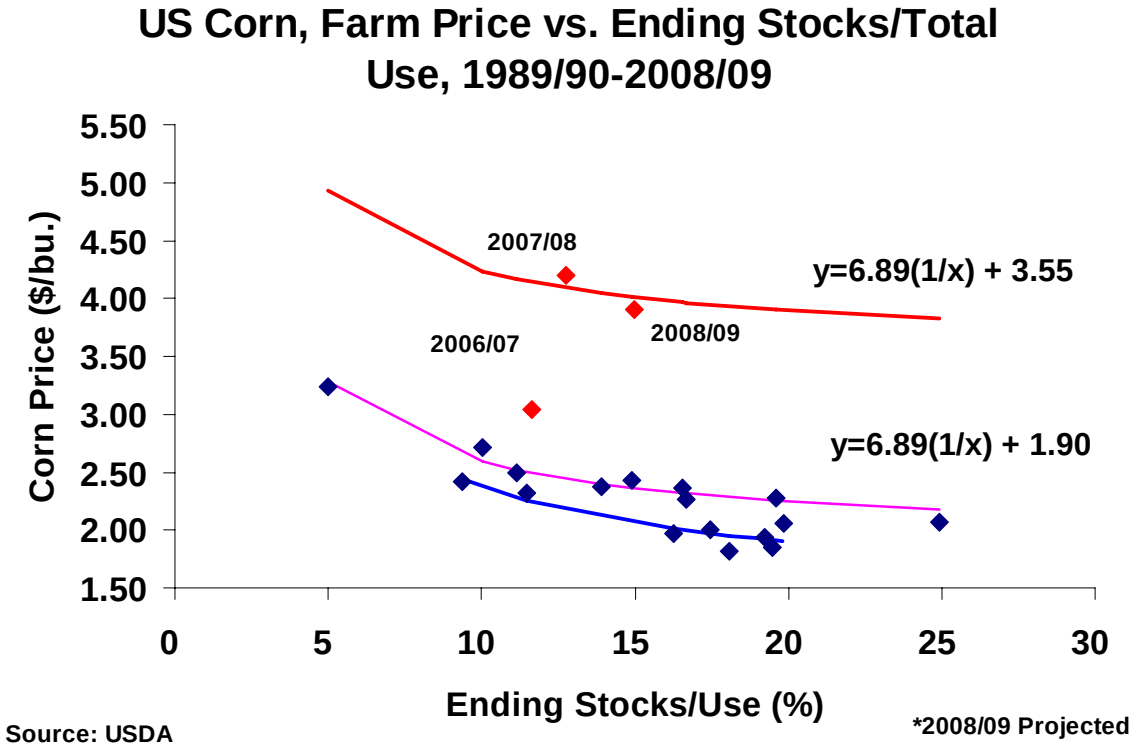


Source: USDA

*2008/09 Projected

First Balance Sheet Estimates for 2009/10

Item	USDA/WASDE 2007/08	USDA/WASDE 2008/09	ACE 427 2009/10
Planted Acreage (1,000 acres)	93,527	85,982	86,000
Harvested Acreage (1,000 acres)	86,520	78,640	78,800
Yield (Bushels / Acre)	151	154	153
Beginning Stocks (million bushels)	1,304	1,624	1,790
Total Production (million bushels)	13,038	12,101	12,017
Imports (million bushels)	20	15	15
Total Supply (million bushels)	14,362	13,740	13,822
Feed and Residual (million bushels)	5,938	5,300	5,175
Food, Seed, and Industrial (million bushels)	4,364	4,900	5,400
Ethanol (million bushels)	3,026	3,600	4,100
Exports (million bushels)	2,436	1,750	2,000
Total Consumption (million bushels)	12,737	11,950	12,575
Ending Stocks (million bushels)	1,624	1,790	1,247
Ending Stocks/Total Consumption (%)	12.8	15.0	9.9
Average Price ($/bu.)	4.20	3.90	???

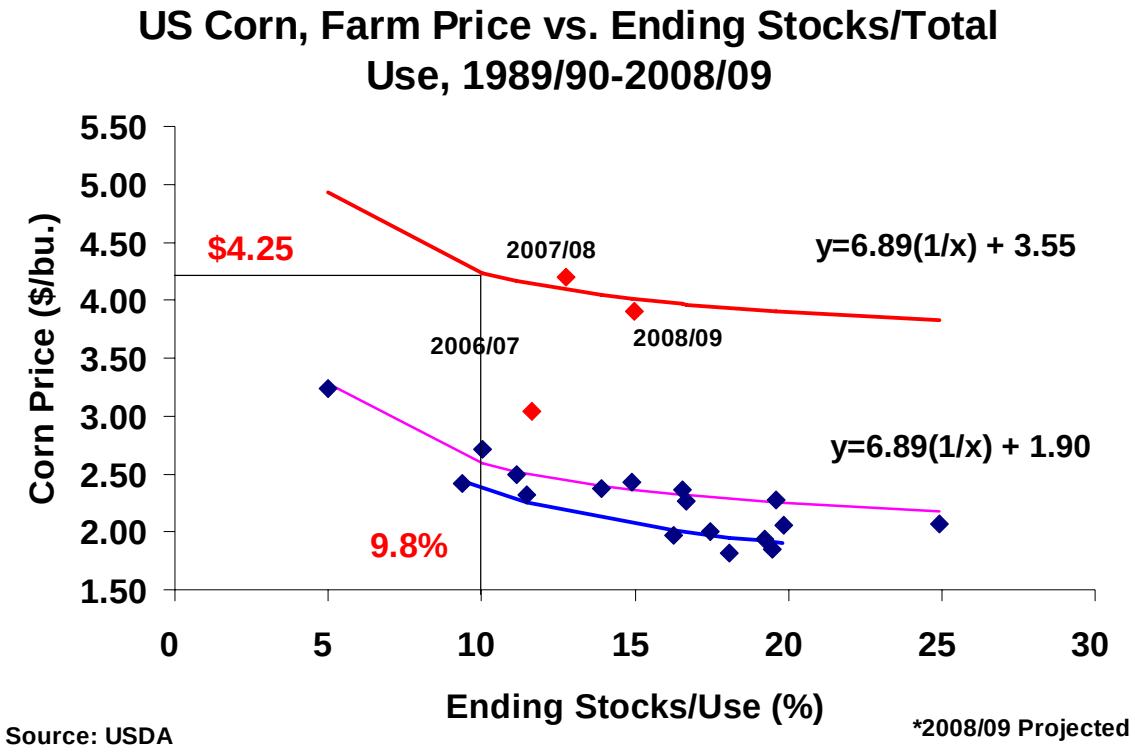
Note: USDA WASDE estimates were released in February 2009

- Ending Stocks/Use Forecast:

  (1,247/12,575)*100 = 9.9%

- Forecast price:

  y = 6.89 (1/9.9) + 3.55
  y = 6.89 (0.10) + 3.55
  y = $4.25/bu.



Final Thoughts

We must always keep in mind that price and ending stocks are determined _____

The true _____ relationship is:

Supply and Demand Shifter Variables	Price and Ending Stocks

In other words:

- It is not logical to specify the level of _____ _____ without knowing _____
- It is not logical to specify _____ without knowing the level of _____

Therefore, price and ending stocks models are only a _____ or _____ to forecasting crop prices

Knowledge of underlying _____ relationships is required to make more accurate price forecasts

In addition, forecasts from price and ending stocks models for _____ or _____ stock levels may be quite sensitive to the assumed _____ form

- Reciproal
- Double-log
- Log-linear

Bottom line: price and ending stock models may be a good starting point, but they should be used with a great deal of caution

For a more in-depth treatment of these issues, I highly recommend:

William G. Tomek and Kenneth L. Robinson. *Agricultural Product Prices, Fourth Edition.* Cornell University Press: Ithaca, NY, 2003.