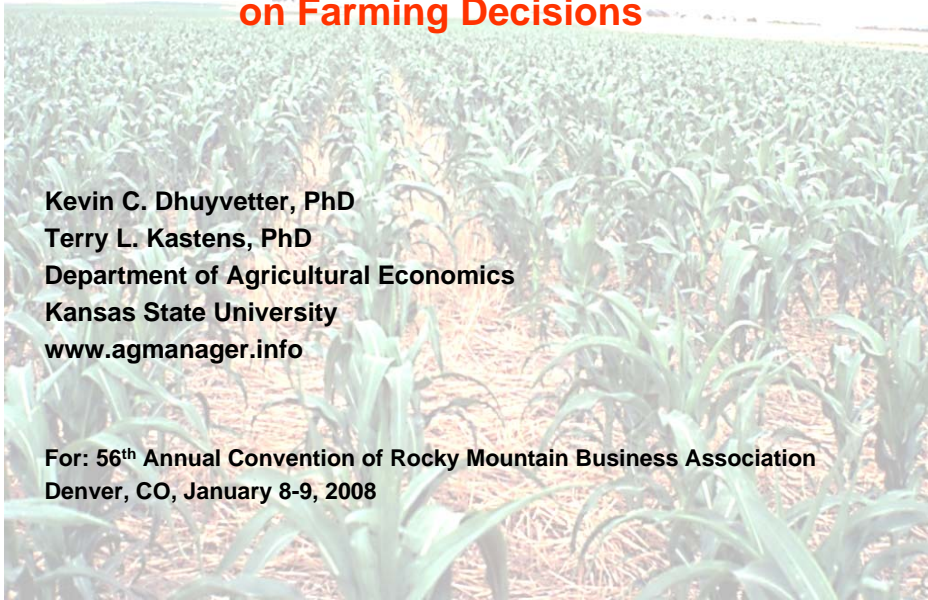


Impact of Biofuels on Farming Decisions



Kevin C. Dhuyvetter, PhD
Terry L. Kastens, PhD
Department of Agricultural Economics
Kansas State University
www.agmanager.info

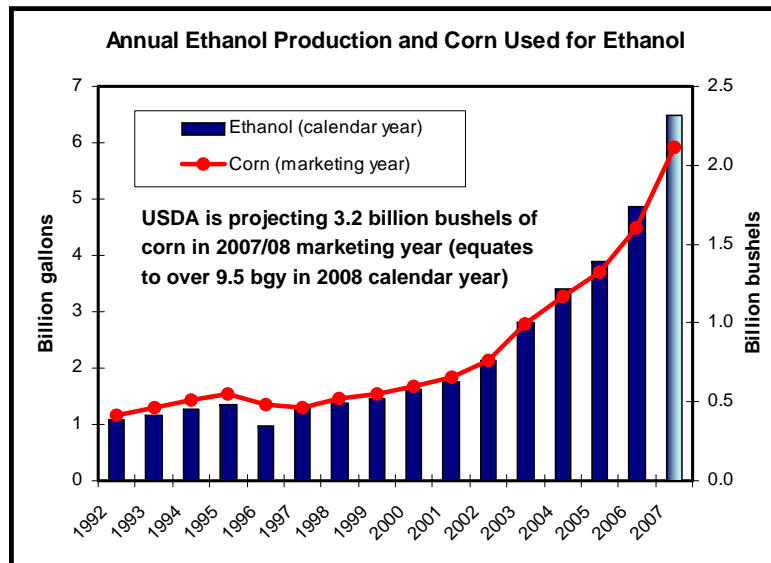
For: 56th Annual Convention of Rocky Mountain Business Association
Denver, CO, January 8-9, 2008

Drivers of the Biofuels Industry

- Ethanol
 - States ban or restrict MTBE
 - Phaseout began in 2000; production stopped in 2006
 - Subsidies
 - 4 cents/gal blending credit 1978; 51 cents started 2004
 - Federal & state mandates for ethanol inclusion
 - Fed: 4 bgy in 2006 and 7.5 bgy in 2012
 - 12/07 Energy Bill: 36 bgy by 2022 (21 from cellulose)
 - High energy prices
- Bio-diesel
 - Low sulfur requirements for diesel
 - Subsidies
 - High energy prices

5

Increases the demand for corn...

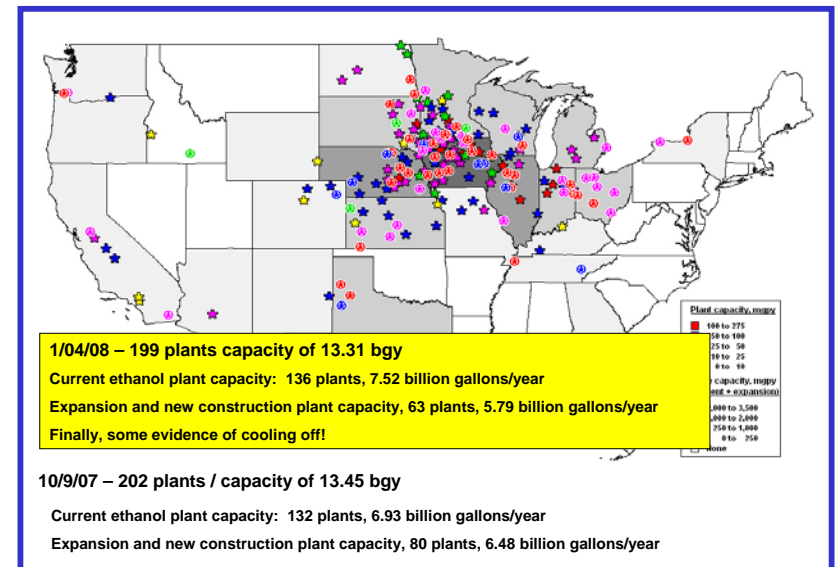


Source: Energy Information Administration (EIA), USDA NASS, and KSU

7

Existing and new ethanol plants

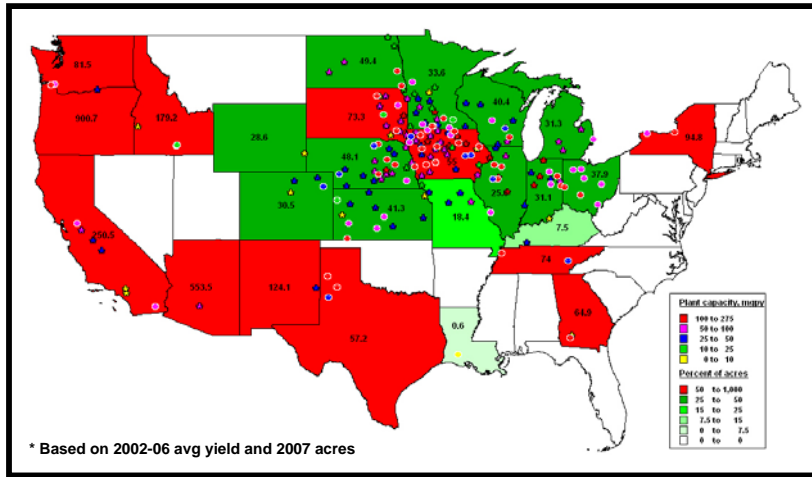
Source: Renewable Fuels Association (RFA)



8

% of Acres Needed for Current + Expansion Production*

Source: USDA NASS and KSU



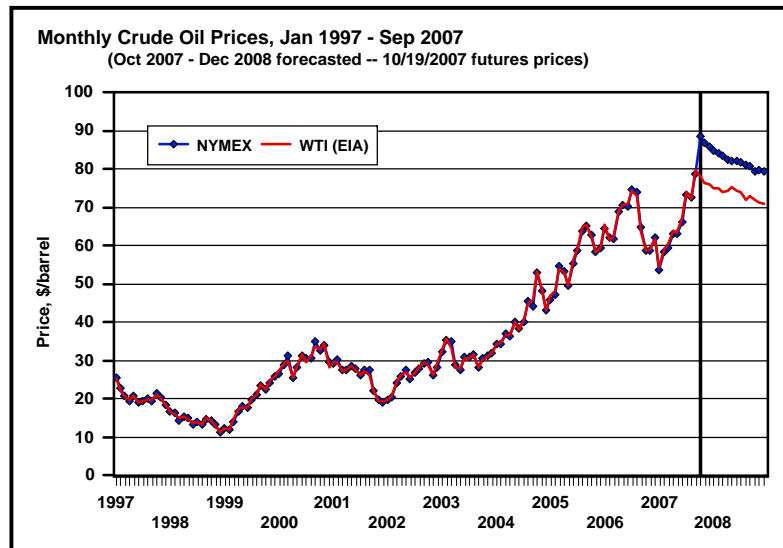
Ethanol expansion is going to create some interesting dynamics...

13

Prices, profitability, etc.

14

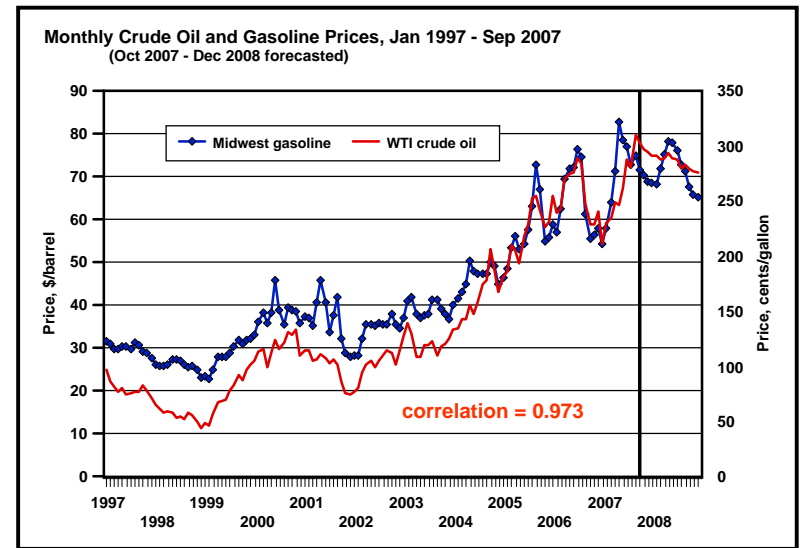
Crude oil prices are at historically high levels...



Source: Energy Information Administration (EIA) and KSU

15

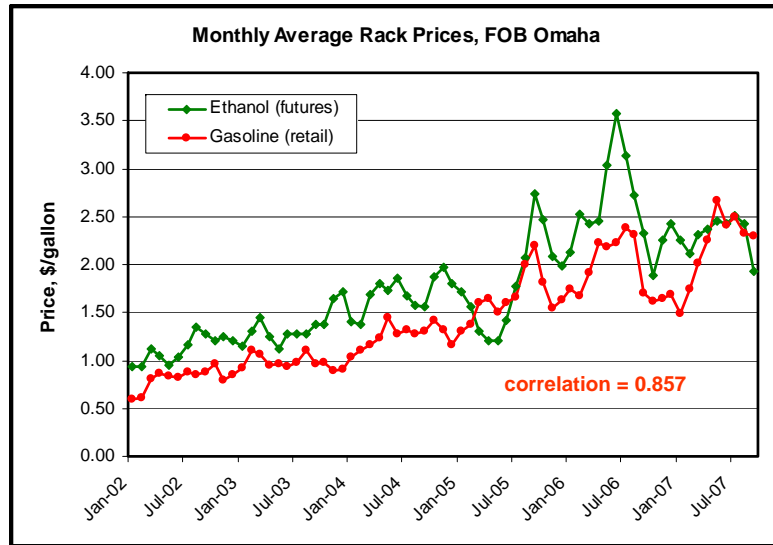
High oil prices translate into high gas prices...



Source: Energy Information Administration (EIA)

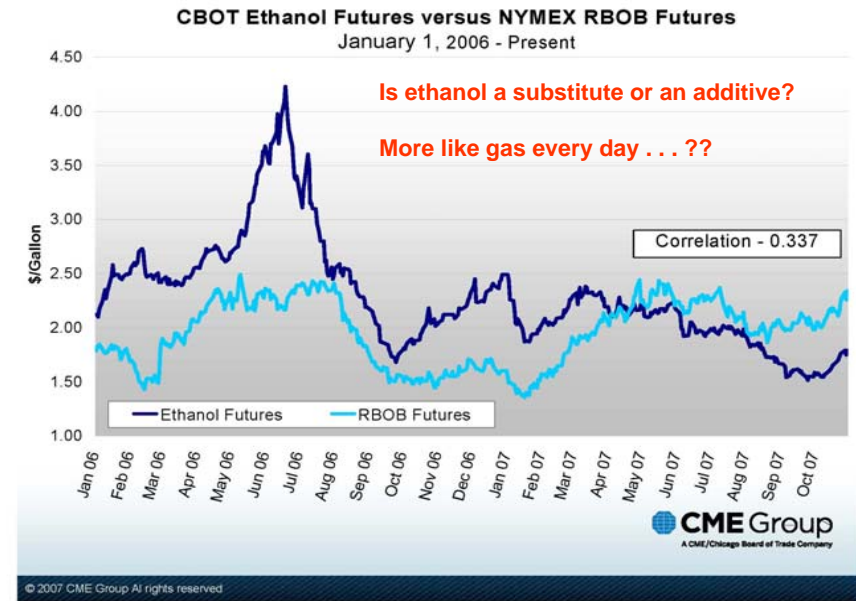
16

Positive correlation → higher gas prices leads to higher ethanol prices...

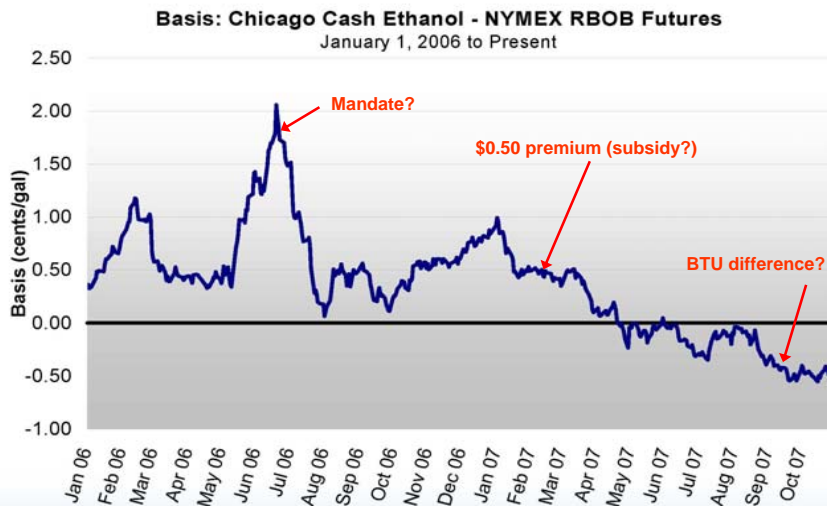


Source: Nebraska Ethanol Board and Nebraska Energy Office, <http://www.neo.ne.gov/statsthtml/66.html>

17



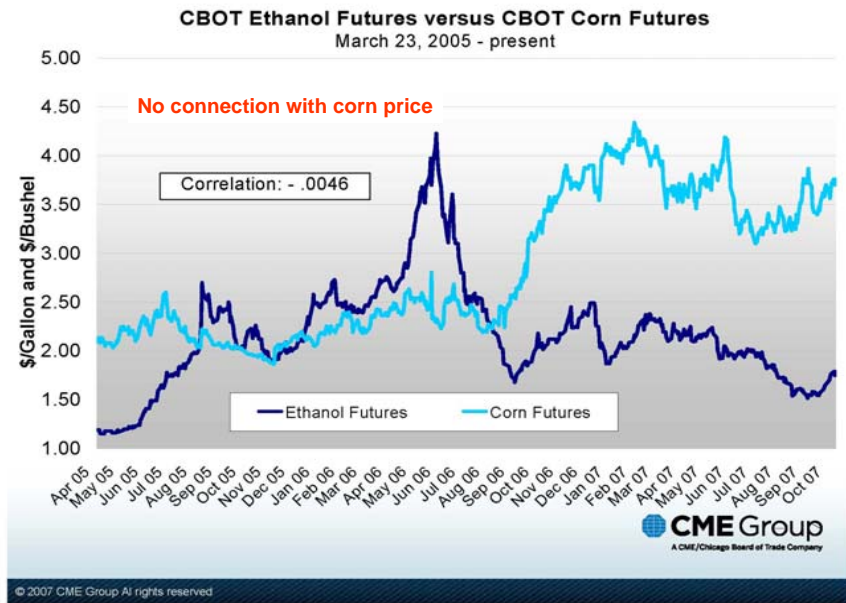
RBOB (reformulated blendstock for oxygenate blending)



Evolution of industry: left with energy difference plus subsidy (at \$3 gas unsubsidized ethanol should be \$2)? But, could get worse due to infrastructure issues.

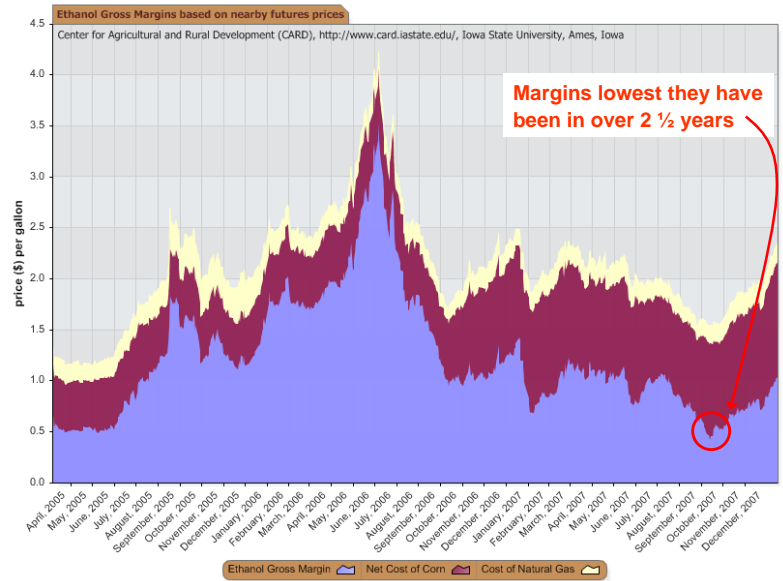
CME Group
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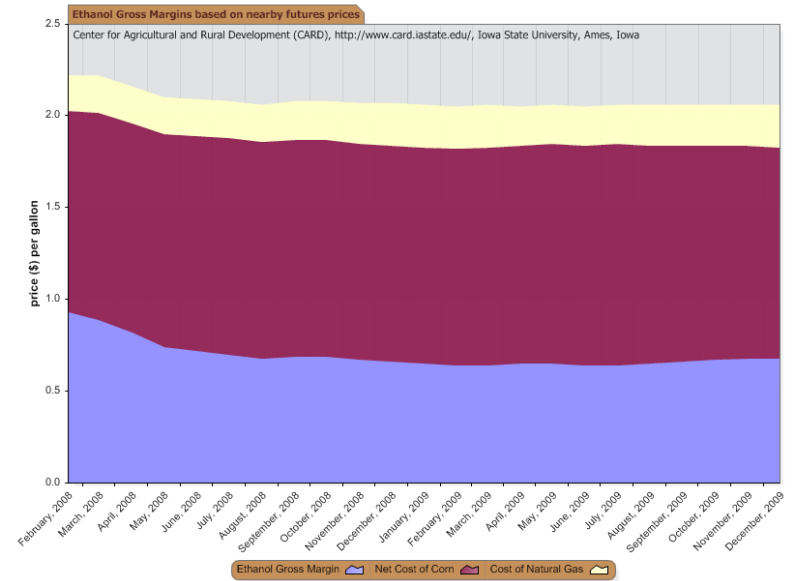
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Historical ethanol margins



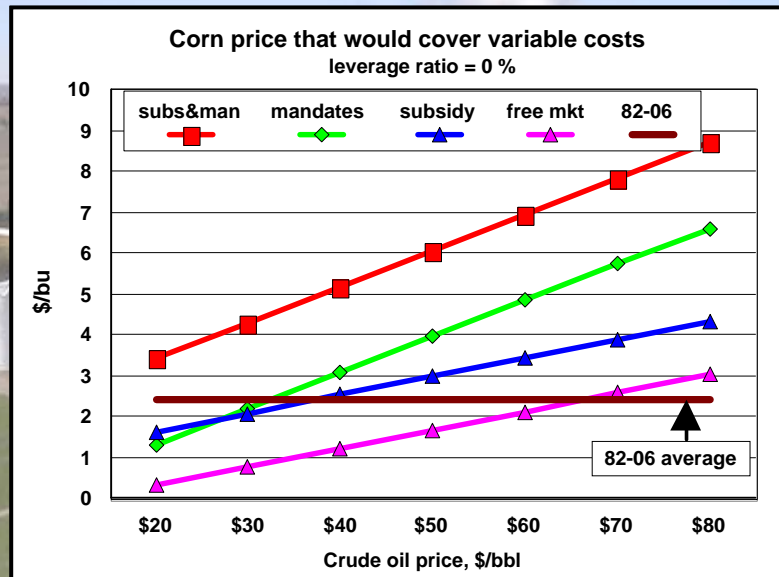
from Iowa State CARD website (updated 1/5/08)

Ethanol margin forecasts → Expansion?



from Iowa State CARD website (updated 1/5/08)

Ethanol Profitability...

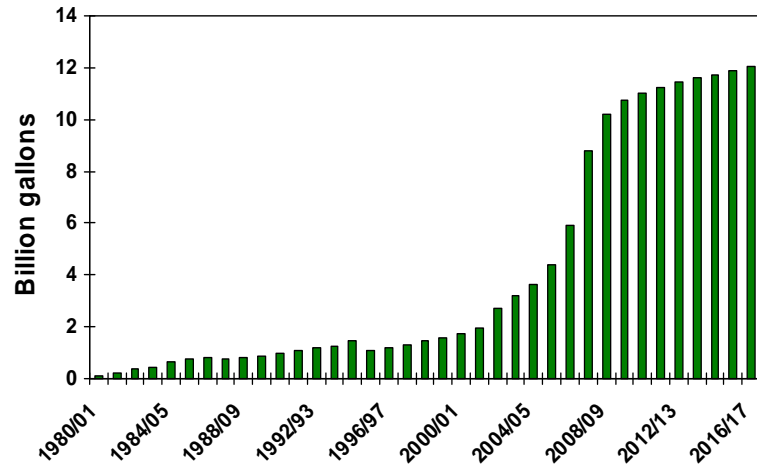


If mothballing costs are high, effective breakeven prices are higher

How much ethanol will be produced going forward?

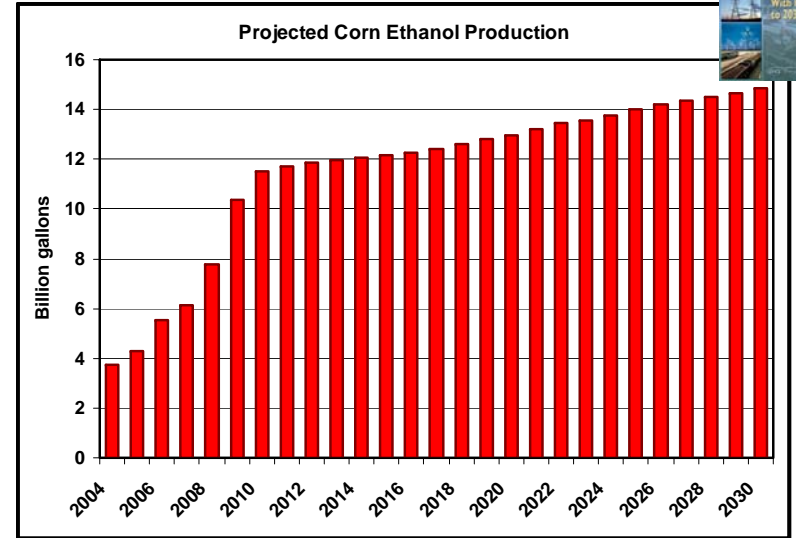
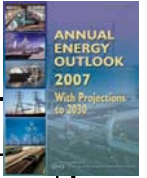
Projected Corn Ethanol Production

expect 12 bil. gal. in 2016/17– 30% of corn crop



Source: Collins, K. "The New World of Biofuels: Implications for Agriculture and Energy." EIA Energy Outlook, Modeling, and Data Conference, March 28, 2007

34

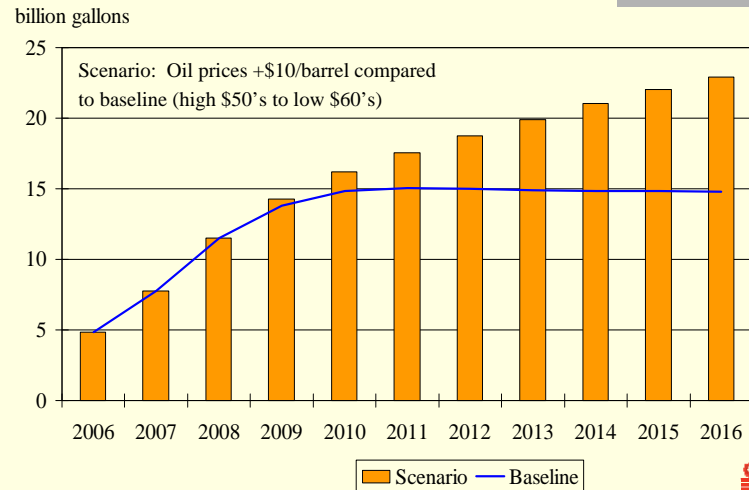


Source: Energy Information Administration, Report #DOE/EIA-0383(2007), February 2007

35

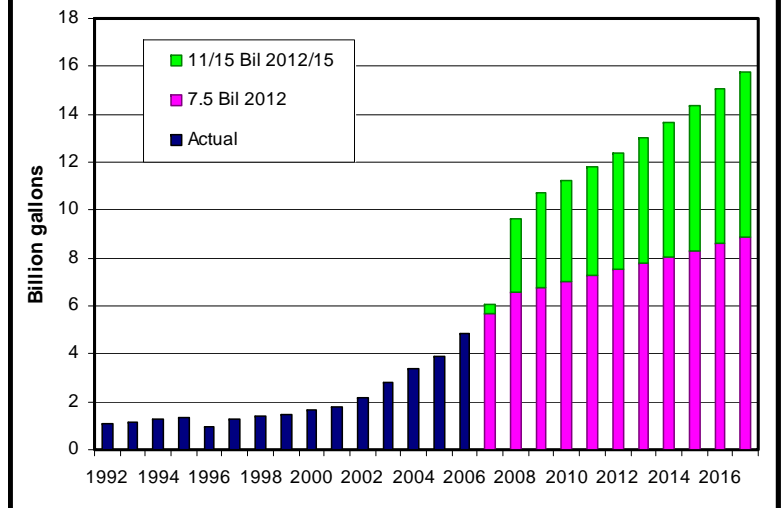
Projected U.S. Ethanol Production

Source: Chad Hart, CARD, Iowa State University – Spring 2007

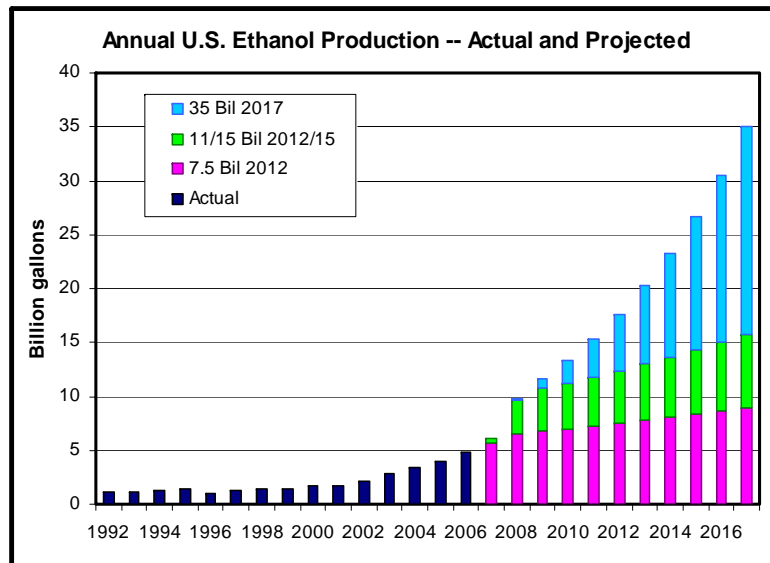


37

Annual U.S. Ethanol Production -- Actual and Projected



37



38

Biofuels are catching the eye of oil companies

- “Every option, from developing unconventional fossil fuel resources to pursuing renewable and other alternatives, will need to be pursued if the world expects to meet its growing energy demand through 2030, the **National Petroleum Council** concluded in a recent study.”

... Oil & Gas Journal, Aug. 6, 2007

... much of this journal issue was devoted to agrifuels

... a far cry from the “mood” of the oil industry regarding renewable energy even just 6 months ago

- Biofuels are NOT going away

39

Some negatives are creeping in . . .

- **Corn for ethanol increases food prices**
 - Probably okay on this one (at least in U.S.)
 - CARD: 30% higher corn price: 1.1% higher food prices
- **Ethanol production is dirty environmentally**
 - Probably okay on this one (i.e., fairly clean)
- **Livestock producers getting louder**
- **Infrastructure & technical issues**
 - Ethanol/gasoline separation, small refineries
 - Cars can use 10% (14 bgy); 5% (7bgy) easily
 - <3% cars FFV; Big3 says half in 2012 – but still only 25% of new cars will be FFV since foreign car makers aren’t making that pledge (they sell half the cars)

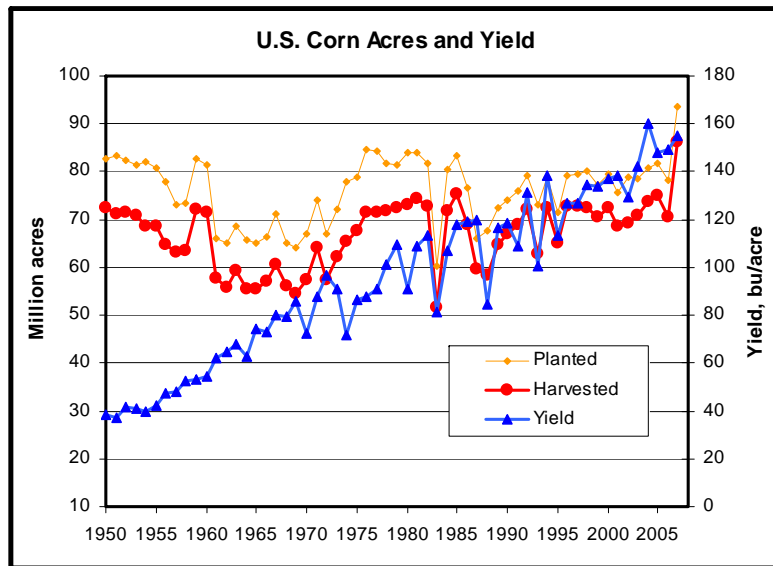
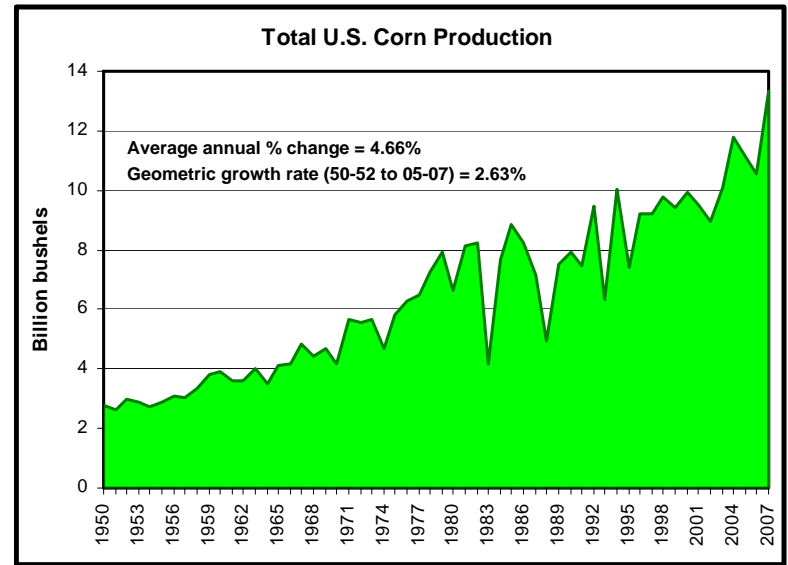
40

Future ethanol production?

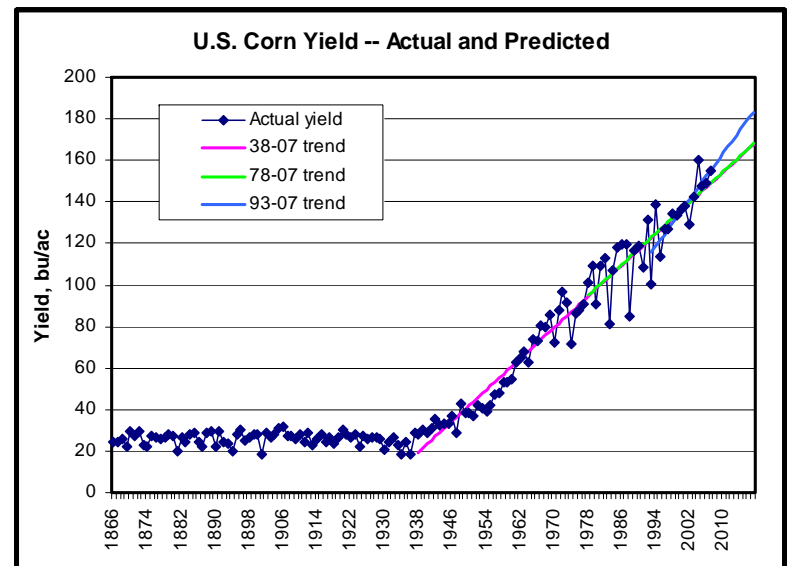
- **Not sure who’s crystal ball to believe**
 - Today’s 7 bgy easy to sustain; Next 7 bgy reasonable over time; beyond ???
 - Hard to predict politics
- **Impact of cellulosic ethanol?**
 - Maintaining SOM will allow only 6.5 bgy from corn stover; alternatives will be slowwww
- **Most predictions in the 11-15 bgy range over the next 3-5 years**
 - Reflects current actual + planned capacity
 - Approximates E-10 nationwide
 - What does this mean for corn acres?

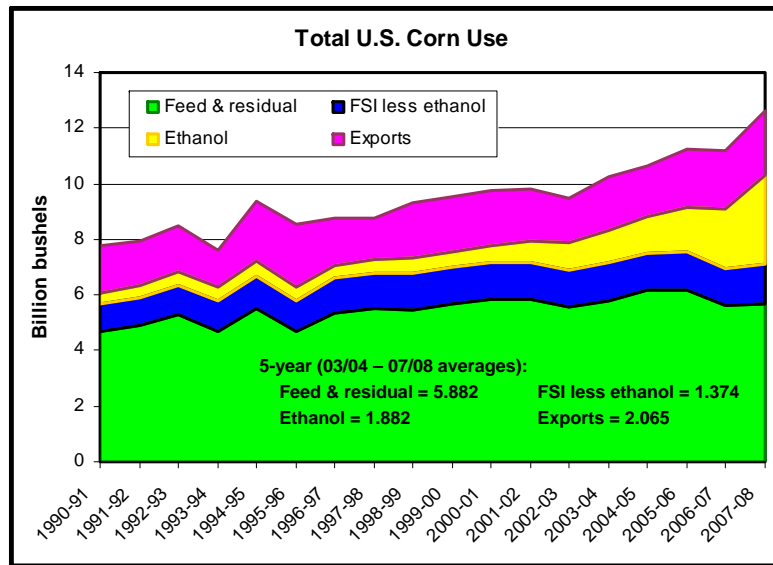
41

Corn acres, yields, etc.



Average annual % change = 0.49% (planted); 0.64% (harvested); 3.37% (yield)
Geometric growth rate (50-52 to 05-07) = 0.04% (planted); 0.14% (harvested); 2.49% (yield)



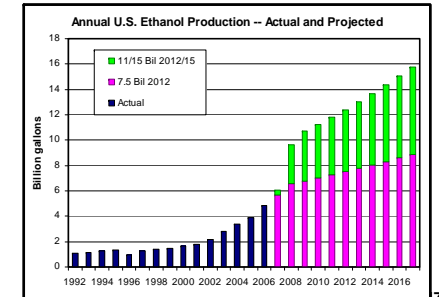
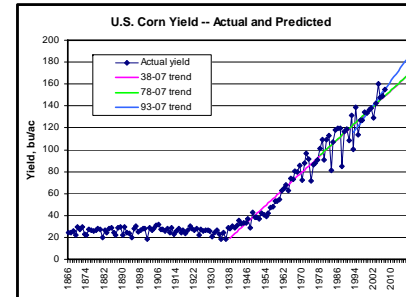


Source: USDA WASDE and KSU, 2006-07 is an estimate and 2007-08 is projection

Corn acres needed...

Assumptions:

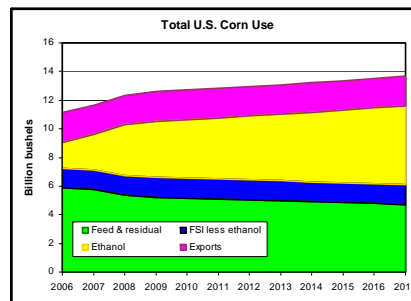
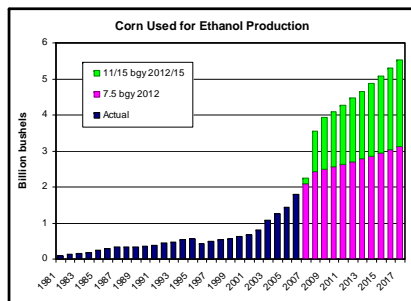
- Trend yield equal to average of 3 different trend lines (157.5 in 2010 173.0 in 2017)
- Ethanol production consistent with green bars (below)
- Exports, FSI less ethanol, and Feed & Residual held constant at 5-year average
- Maximum of 35% of corn bushels displaced with DDGS



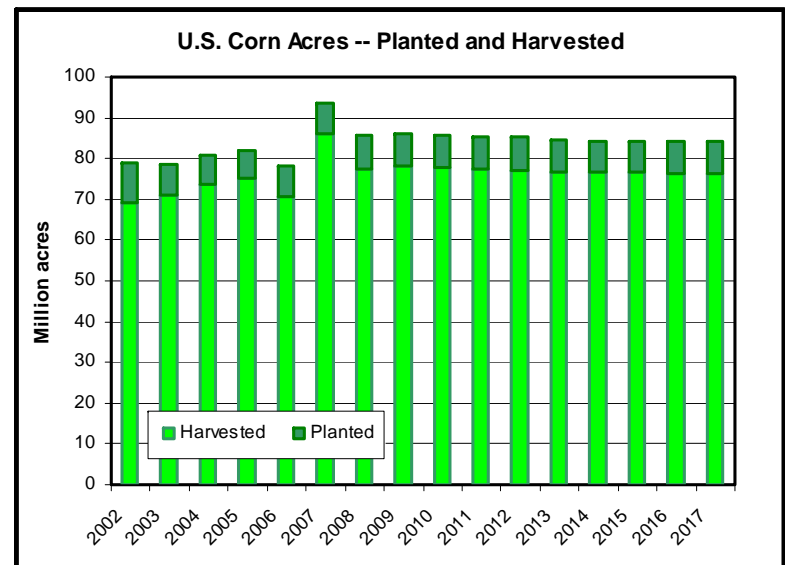
Corn acres needed...

Intermediate results:

- Corn used for ethanol based on total ethanol production and conversion rate of 2.7-2.9 gallons per bushel
- Corn used for Feed & Residual falls as more DDGS are fed to livestock
- Total corn use grows from 12.3 billion bushels in 2008 to 13.7 billion bushels in 2017



Yield growth covers increased ethanol needs...

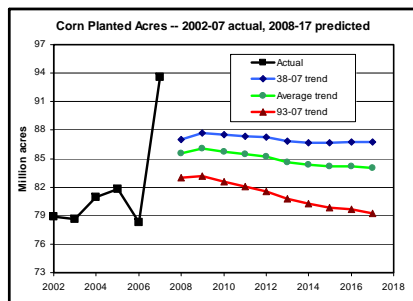
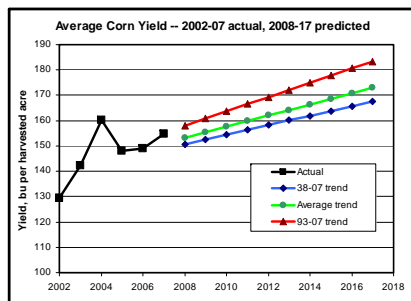


Source: 2002-07 USDA, 2008-2017 KSU projections

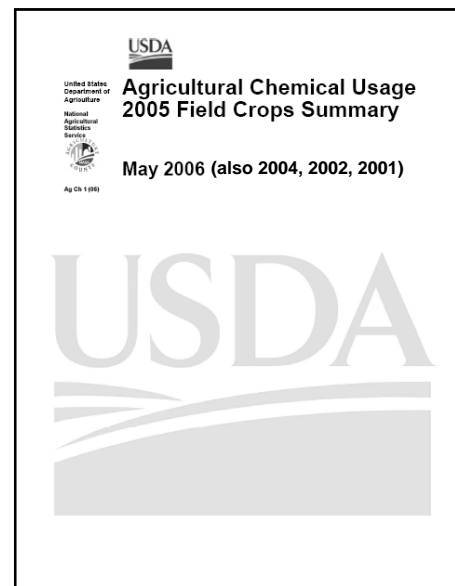
Corn acres needed...

Results are sensitive to yield trend assumptions

- Recent trend suggests planted acres can drop back to more "normal" levels (i.e., 79-82 million acres)
- Longer-term trend suggests the need to consistently plant 86-87 million acres
- Average trend suggests the need for 84-86 million acres - above historical levels, but below 2007



Corn acres and fertilizer demand...



USDA NASS surveyed 19 states (18 two of the years) regarding chemical usages on corn acres

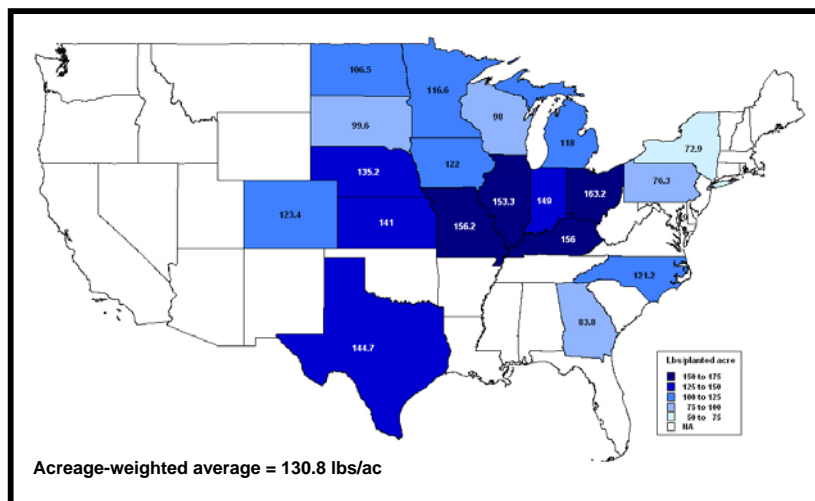
Report the following:

- Acres planted to corn
- Million pounds of N,P,K applied to corn

Calculated the following:

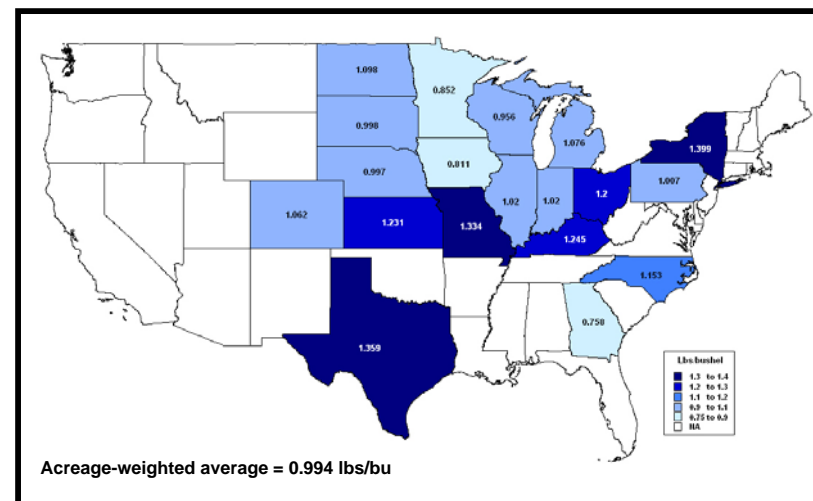
- Acre-weighted pounds applied per planted acre
- Bushel-weighted pounds applied per bushel

Nitrogen use per planted acre of corn...



Source: USDA Agricultural Chemical Usage - Field Crops Summary (2006, 2004, 2002, 2001)

Nitrogen use per bushel of corn...



Source: USDA Agricultural Chemical Usage - Field Crops Summary (2006, 2004, 2002, 2001)

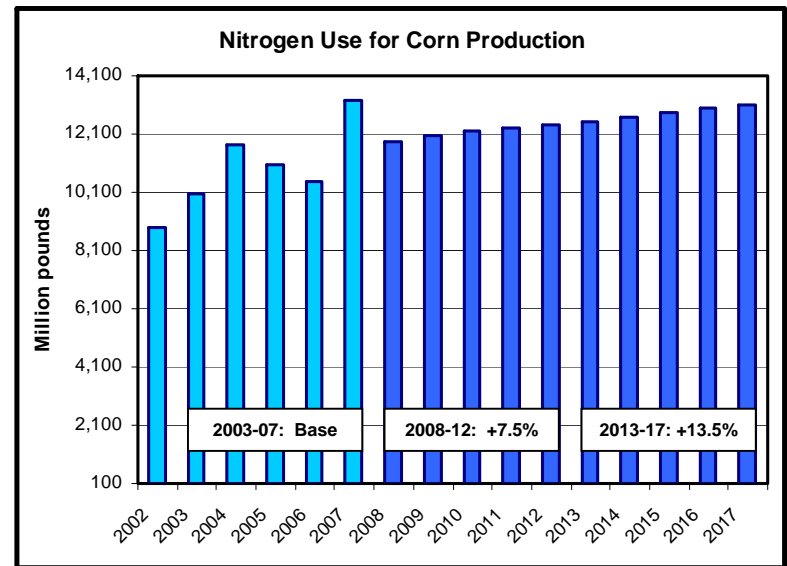
Estimated nutrient use/demand for corn...

Year of survey	2005	2003	2001	2000	Average
States in survey	19	18	19	18	
Weighted Averages					
Nitrogen					
Lbs/ac	132.3	131.9	127.3	131.6	130.8
Lbs/bu	0.953	1.004	0.992	1.027	0.994
Phosphate					
Lbs/ac	47.0	46.6	44.0	47.0	46.2
Lbs/bu	0.338	0.351	0.341	0.364	0.349
Potash					
Lbs/ac	54.1	53.8	53.6	51.5	53.3
Lbs/bu	0.390	0.401	0.412	0.392	0.399

Source: USDA Agricultural Chemical Usage – Field Crops Summary (various years) and KSU

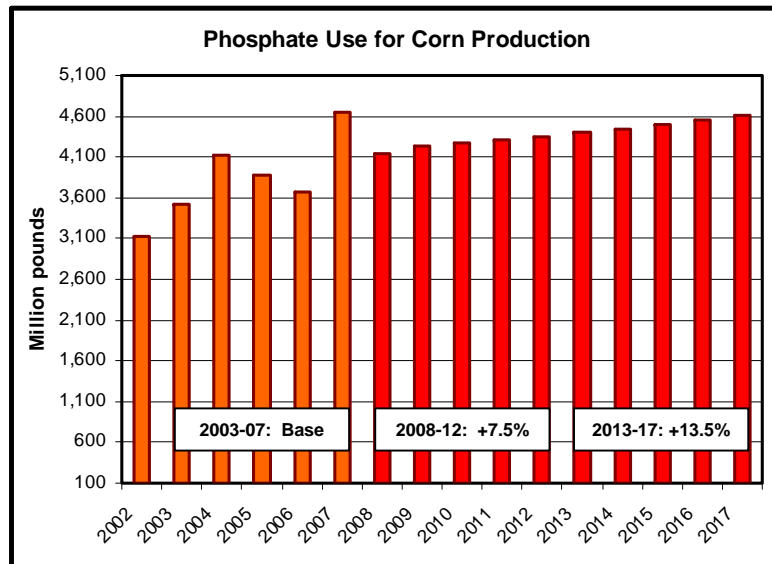
58

Nitrogen demand for corn...



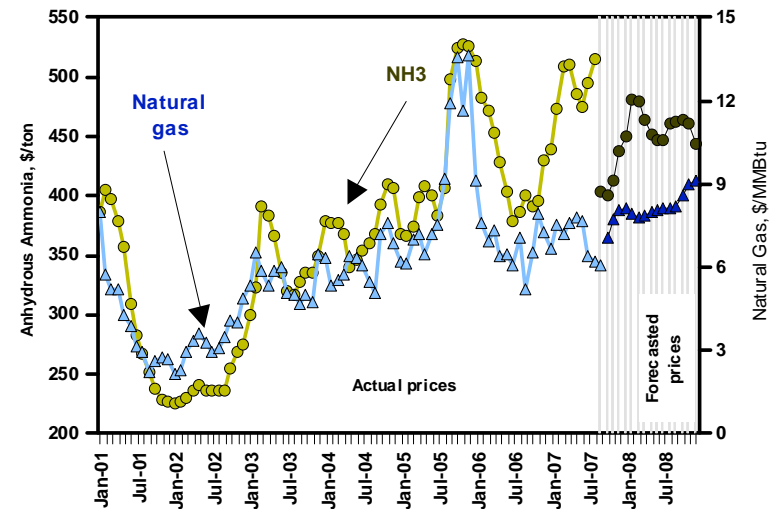
59

Phosphate demand for corn...



60

Monthly anhydrous ammonia prices, Corn Belt basis.



Currently, prices of NH₃ are not tied very close to cost of production (i.e., natural gas prices) . . . It's a demand driven market!

62

NYSE's best in 2007

Updated 3d 12h ago | Comment | Recommend 1

The best-performing stocks on the New York Stock Exchange for the :
more charts):

Company	2007 close	% gain
Mosaic	\$94.34	341.7%
CF Industries Holdings	\$110.06	329.3%
Terra Industries	\$47.76	298.7%
Mechel OAO	\$97.14	281.2%
China Southern Airlines	\$65.45	220.1%
PotashCorp	\$143.96	201.0%
Siderurgica Nacional	\$89.57	198.8%
Trina Solar	\$53.80	184.7%
Excel Maritime Carriers	\$40.19	175.1%
AK Steel Holding	\$46.24	173.6%
Owens Illinois	\$49.50	168.3%
Bally Technologies	\$49.72	166.2%
Vimpel-Communications	\$41.60	163.5%
Chipotle Mexican Grill	\$147.07	158.0%
GrafTech International	\$17.75	156.5%
Calgon Carbon	\$15.89	156.3%
Suntech Power Holdings	\$82.32	142.1%
CNH Global	\$65.82	141.1%
New Oriental Edu&Tchnlgy	\$80.59	140.3%
National Oilwell Varco	\$73.46	140.1%
Yanzhou Coal Mining	\$97.06	139.4%
Jacobs Engineering	\$95.61	134.5%
Aegean Marine Petrol Netwk	\$38.39	134.1%
McDermott International	\$59.03	132.1%
Agrium	\$72.21	129.3%
Alpha Natural Resources	\$32.48	128.3%

Great year to be in the
fertilizer business

Won't fertilizer demand drop with the
high fertilizer prices expected for 2008?

63

64

Nitrogen Recommendations for Wheat

Yield goal, bu/ac	40	50	60	70	80
KSU N rec, lbs/ac	46	70	94	118	142

N price	Price adjusted N rec, lbs/ac				
\$0.20	46	71	95	119	143
\$0.30	42	65	88	111	134
\$0.40	38	60	82	104	126
\$0.50	33	54	75	96	117
\$0.60	29	49	69	89	108

N price	Price adjusted N rec reduction				
\$0.20	-0.9%	-0.8%	-0.7%	-0.6%	-0.6%
\$0.30	8.4%	6.9%	6.2%	5.8%	5.5%
\$0.40	17.8%	14.6%	13.1%	12.1%	11.5%
\$0.50	27.2%	22.3%	19.9%	18.5%	17.6%
\$0.60	36.5%	30.0%	26.8%	24.9%	23.7%

SOM= 2.0; STN= 30; Wheat price= \$3.20

Yes, demand would fall if wheat price were \$3.20.

65

Nitrogen Recommendations for Wheat

Yield goal, bu/ac	40	50	60	70	80
KSU N rec, lbs/ac	46	70	94	118	142

N price	Price adjusted N rec, lbs/ac				
\$0.20	51	76	102	127	152
\$0.30	49	74	99	123	148
\$0.40	47	71	96	120	144
\$0.50	45	69	93	117	140
\$0.60	43	67	90	113	136

N price	Price adjusted N rec reduction				
\$0.20	-11.1%	-9.1%	-8.2%	-7.6%	-7.2%
\$0.30	-6.8%	-5.6%	-5.0%	-4.7%	-4.4%
\$0.40	-2.5%	-2.1%	-1.9%	-1.7%	-1.6%
\$0.50	1.7%	1.4%	1.3%	1.2%	1.1%
\$0.60	6.0%	4.9%	4.4%	4.1%	3.9%

SOM= 2.0; STN= 30; Wheat price= \$7.00

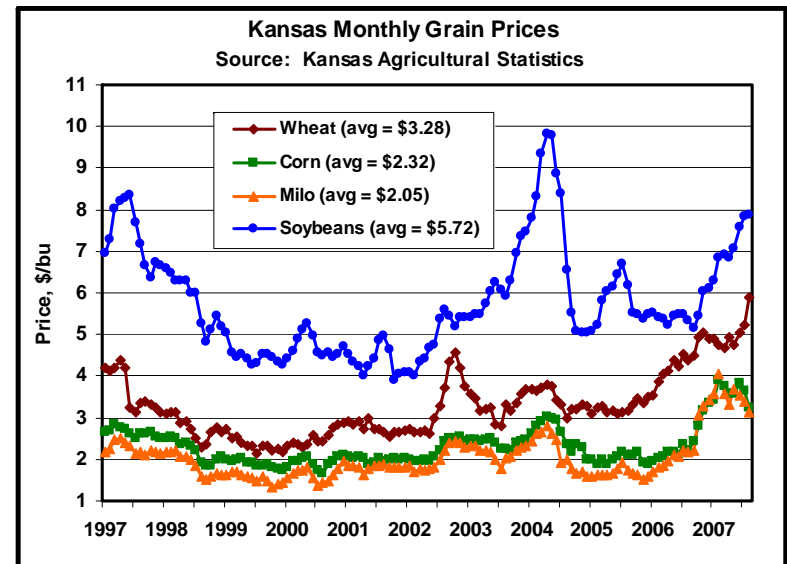
But, not at \$7.00 wheat!

66

Can the ethanol industry continue to pay high commodity prices?

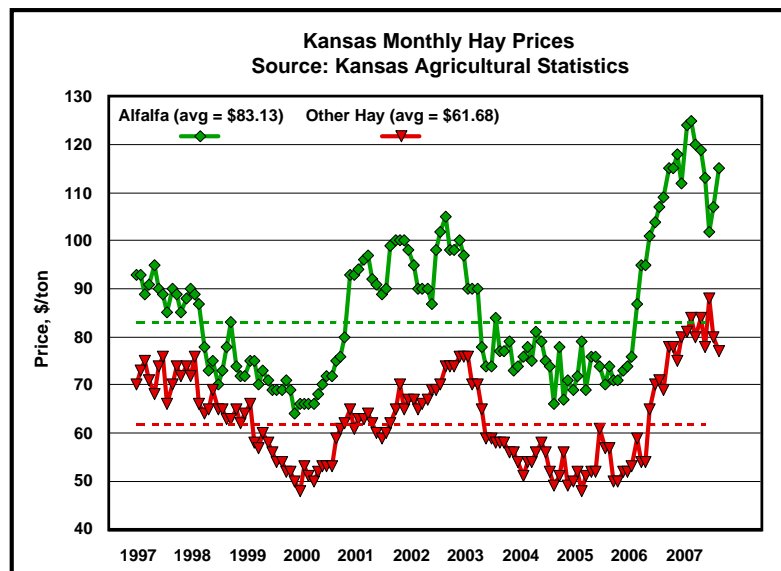
Put another way, how long will high prices last?

Crop prices are strong by historical standards...



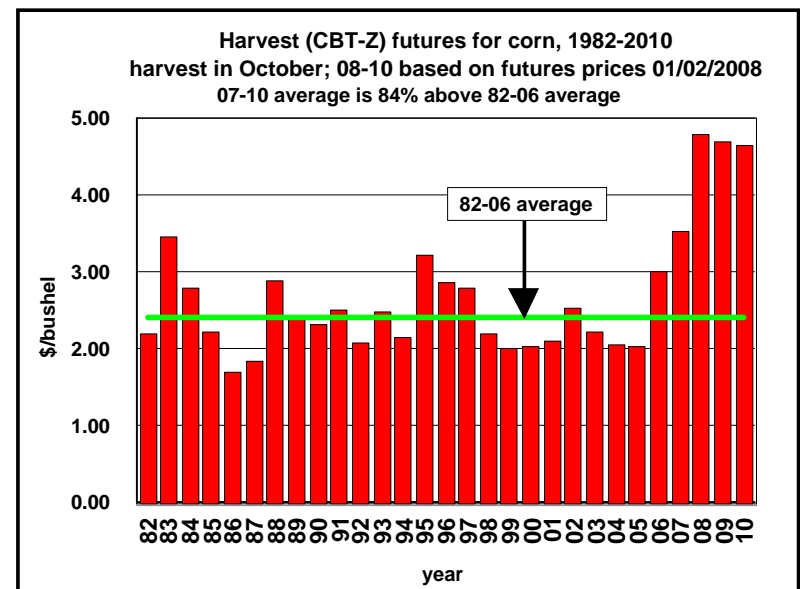
It's not just corn!

Strength in crop markets impacts hay prices...

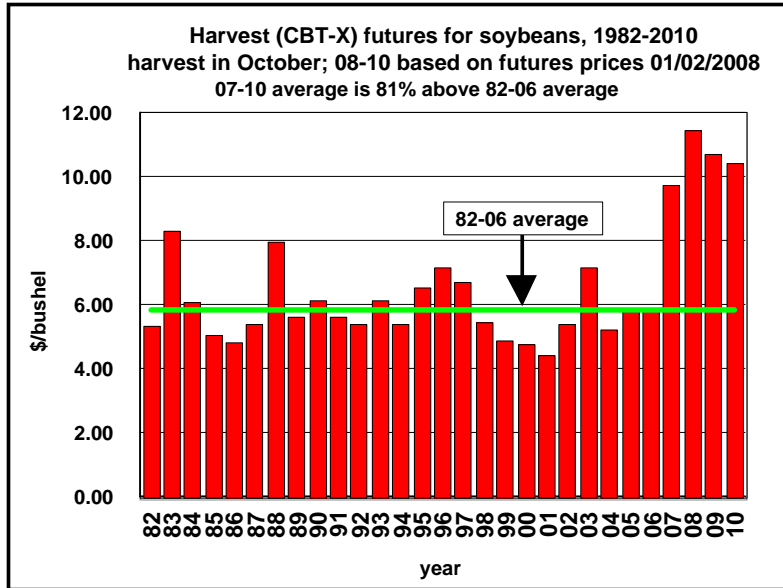


It's not just grains!

How long will strong prices stick around?

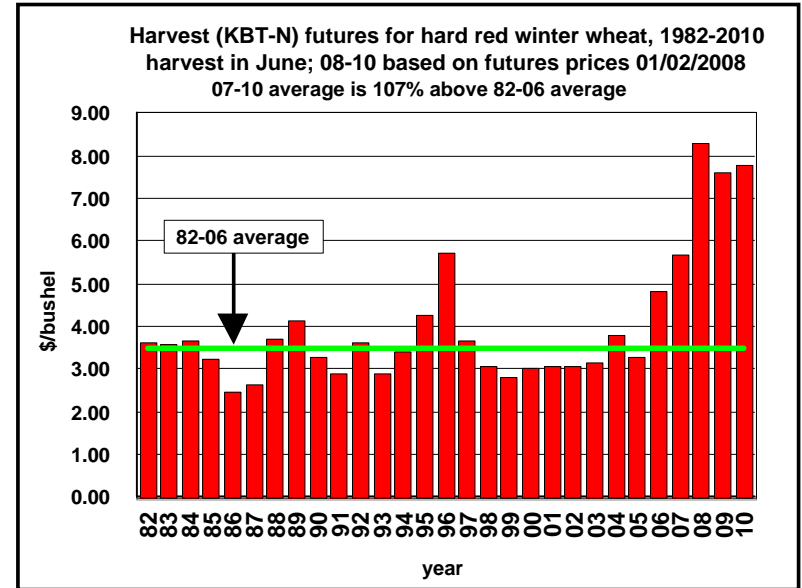


How long will strong prices stick around?



73

How long will strong prices stick around?



74

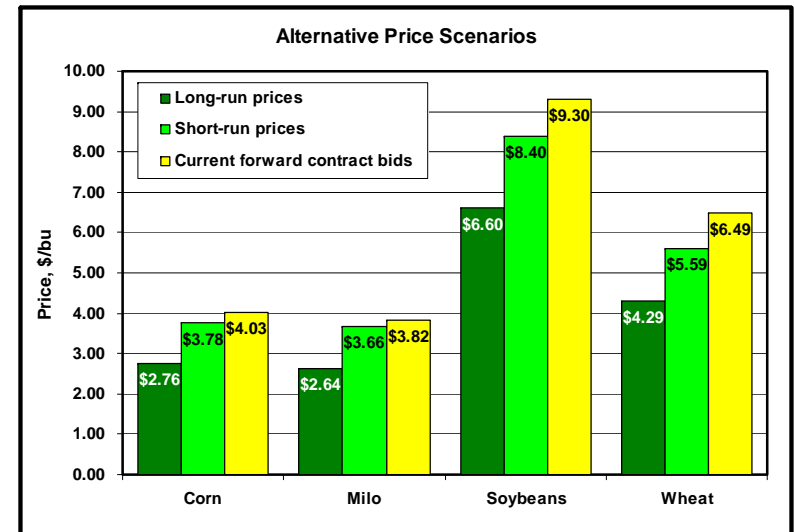
KSU study of impact of high commodity prices on rental rates

Two approaches:

- Crop budgets & KSU-Lease
- Historical relationships

75

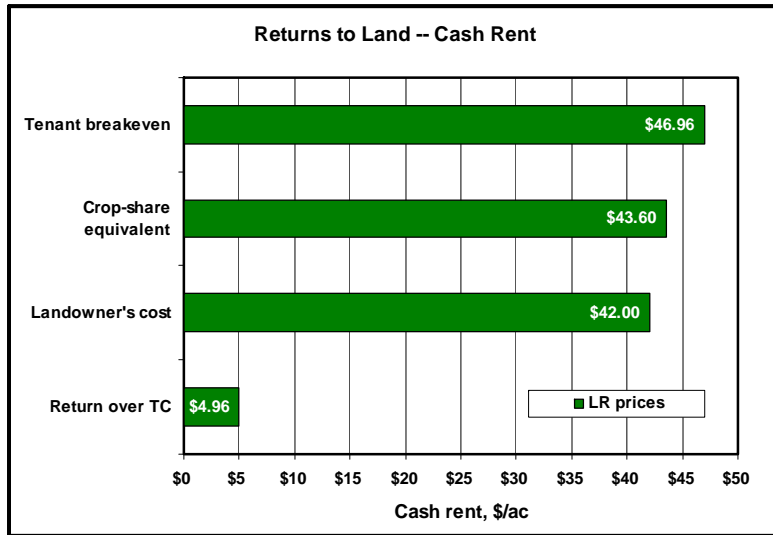
Alternative Prices to Consider for Central Kansas



Long-run (08-12) and short-run (08) from MF-1013, current bids for Newton, KS (11/16/07)

76

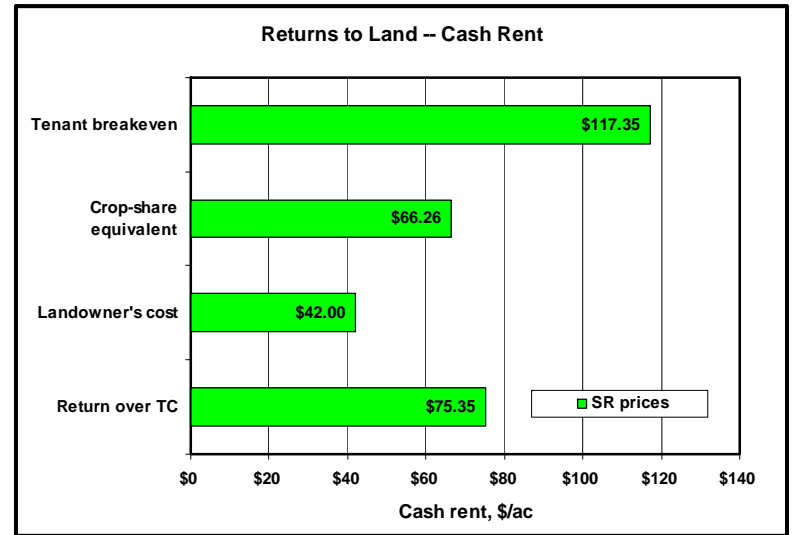
**Estimated cash rents for Central Kansas [long run
(2008-2012) projected prices]**



Based on KSU Farm Management Guides (November 2007) and KSU-Lease.xls (available at www.agmanager.info)

77

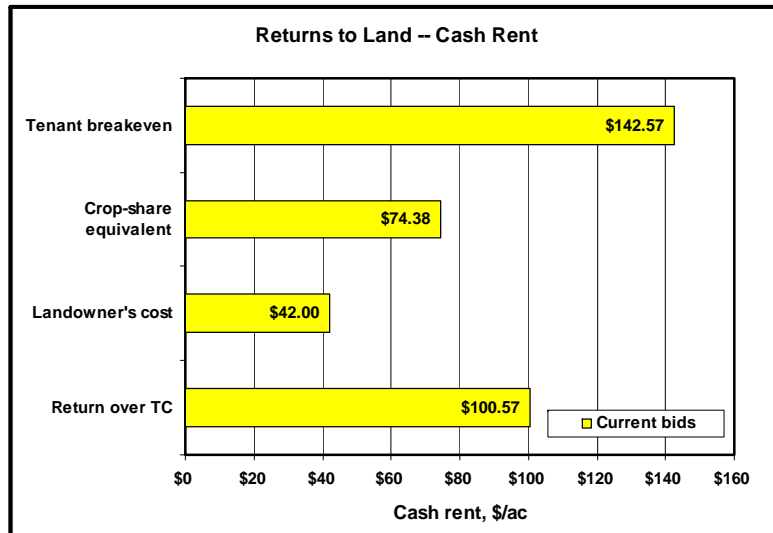
**Estimated cash rents for Central Kansas [short-run
(2008) projected prices]**



Based on KSU Farm Management Guides (November 2007) and KSU-Lease.xls (available at www.agmanager.info)

78

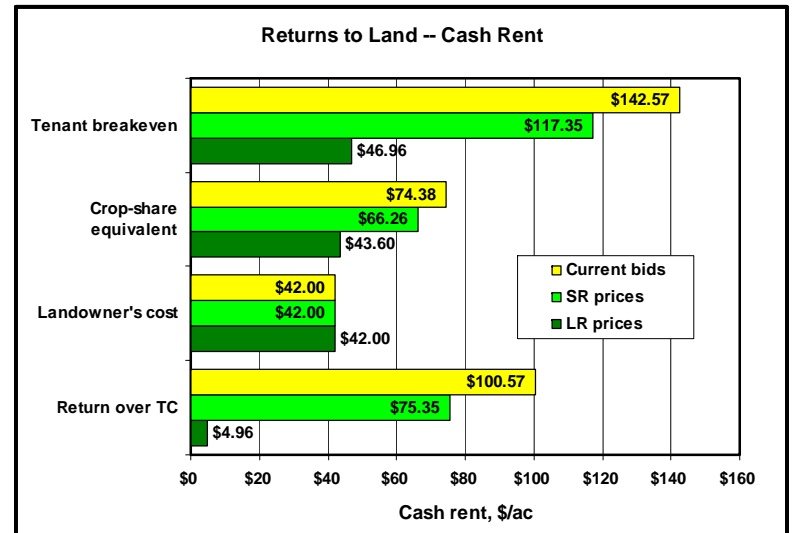
**Estimated cash rents for Central Kansas [forward
contract bids (11/16/07) for 2008 harvest delivery]**



Based on KSU Farm Management Guides (November 2007) and KSU-Lease.xls (available at www.agmanager.info)

79

**Estimated cash rents for South Central Kansas
(alternative price scenarios)**



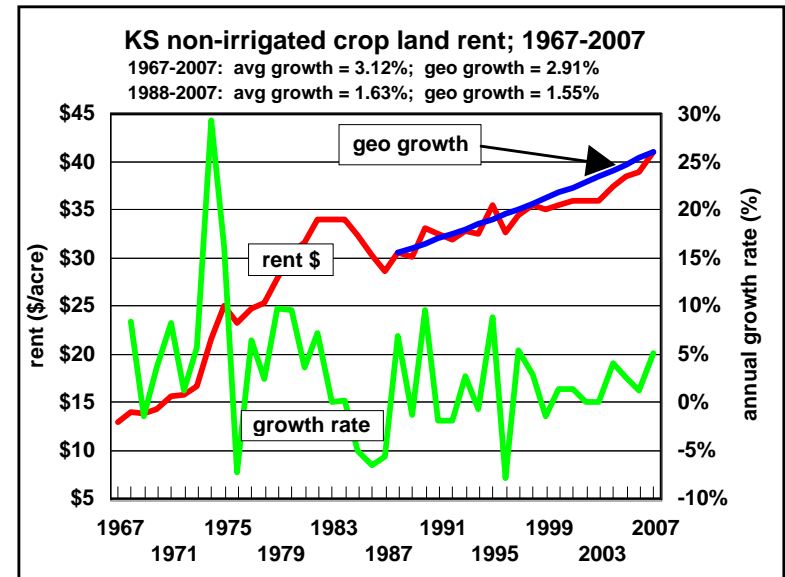
Based on KSU Farm Management Guides (October 2007) and KSU-Lease.xls (available at www.agmanager.info)

80

Really high rent potential . . .

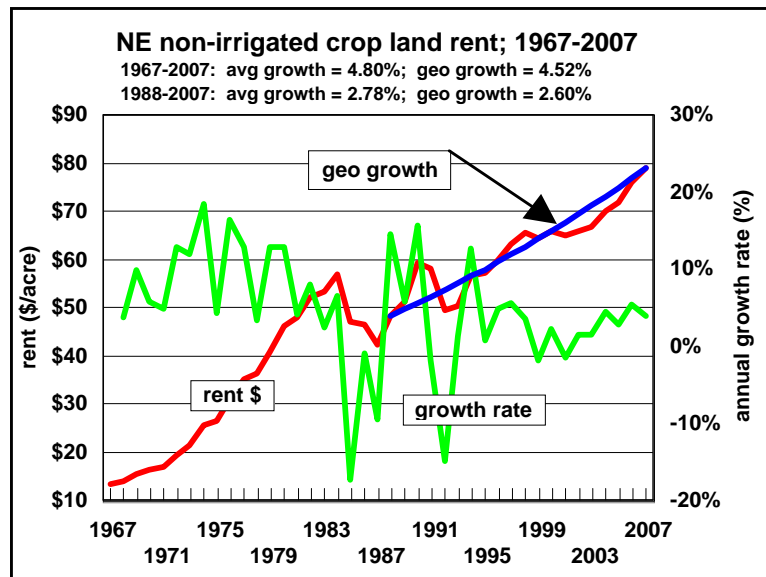
- Previous example suggested that a 50% increase in price could mean a rent increase up to 250% -- elasticity of 5.0
- Will this happen?
- No!
 - Farmers bid up production inputs as they try to increase acres or yield/a to get the high profits:
 - Fertilizer, chemicals, machinery, labor

81



Suggested expected ag growth rate = 2.75% (but if ethanol continues . . . ?)

82



Suggested expected ag growth rate = 4.29% (but if ethanol continues . . . ?)

84

A KSU study of three scenarios

- Scenario 1 – baseline (no ethanol)
 - Historical average growth rates of corn yield and price drive rents, which drive land values
- Scenario 2 – ethanol comes and stays
 - Corn price grows rapidly to new plateau by 2010, then follows normal growth thereafter
- Scenario 3 – ethanol comes and leaves
 - Corn price grows rapidly to new plateau by 2010, then falls back to growth path that would have occurred without ethanol

88

Assumptions in KSU study

- Growth in corn yield and price determines rent growth
 - Yield grows at historical (1950-2007) rate in all scenarios
 - Price grows at historical rate in baseline but different rates in other two scenarios
- Rent growth assigned to ag portion of land
- Non-ag portion of land value grows at 3%
- Miscellaneous assumptions:
 - start 1/1/06; 30-year land ownership analysis (show 12 years)
 - interest = 7%; income tax rate = 25%; cap gain = 15%
 - property tax = 0.4% of land value
 - 2010-to-2006 price ratio with ethanol is 1.50
 - starting rents, values, crop prices from USDA-NASS

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A KSU study in January 2008 (Kastens & Dhuyvetter)

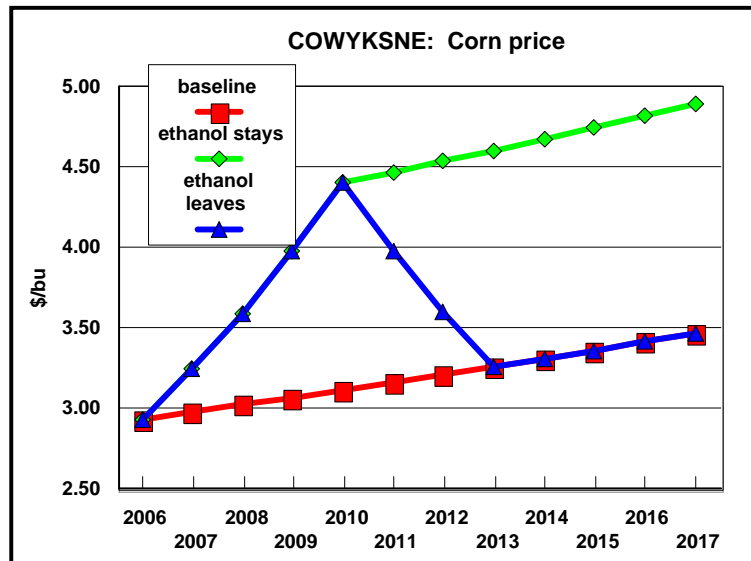
state	a 1% change in corn revenue					
	i.e., yield or price, leads to a change of this % in rent	1950-1972 avg rent-to-value ratio (ag cap rate, %)	2007 % of land value due to agriculture	1950-2007 avg ann. growth rate in %, for non-ag land value	1950-2007 avg ann. growth rate in %, for corn yield	1950-2007 avg ann. growth rate in %, for corn price
CO	1.04	8.08	31.28	11.63	2.88	1.47
KS	0.76	7.78	57.98	11.17	3.15	1.58
NE	1.07	8.06	60.37	7.12	2.88	1.51
WY	1.09	9.04	47.47	10.84	2.80	1.56
AL	0.99	8.37	14.51	15.85	2.98	1.67
ND	1.10	9.02	72.51	9.29	3.01	1.57

Notes:

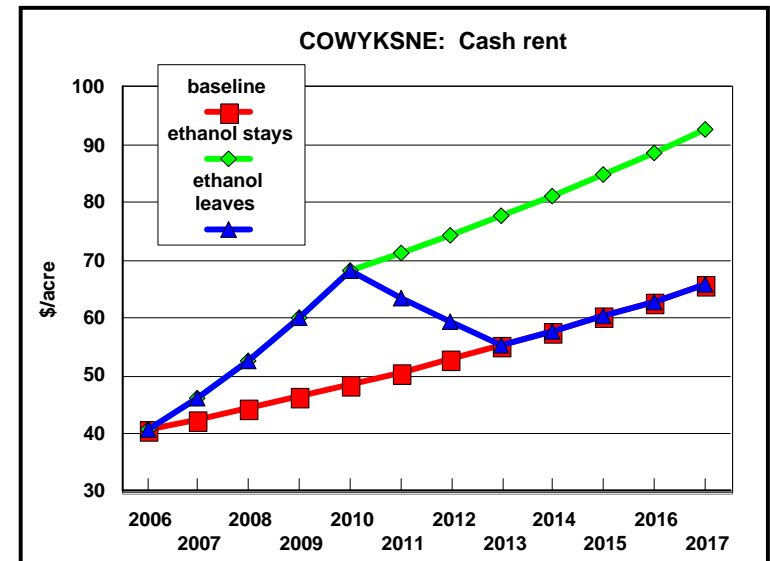
Results don't materially change if use w wheat or soybeans in analysis.
 Most mathematical models explained 85 to 95% of variation in dependent variable.
 Rent/(ag cap rate) equals agricultural portion of land market value.

AL and ND included as examples of high and low non-ag influence

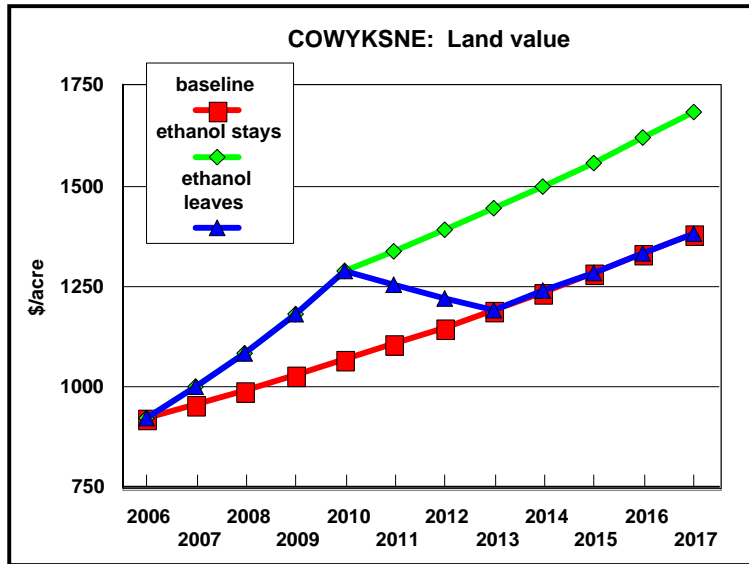
95



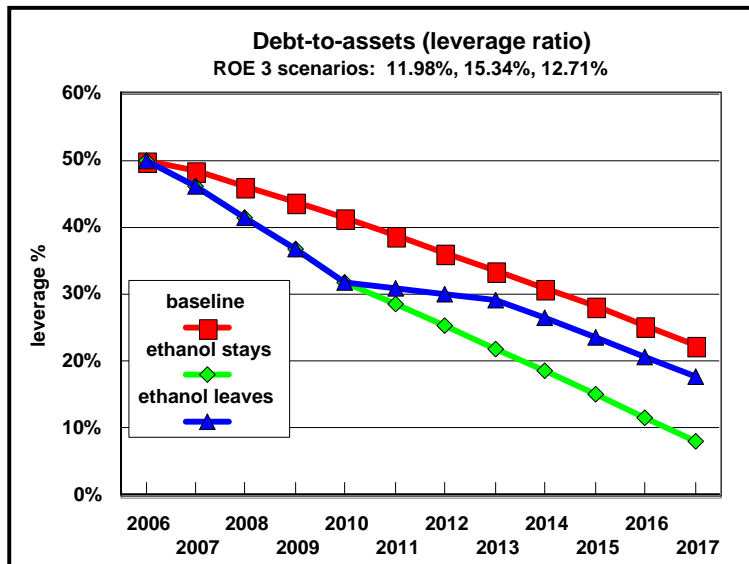
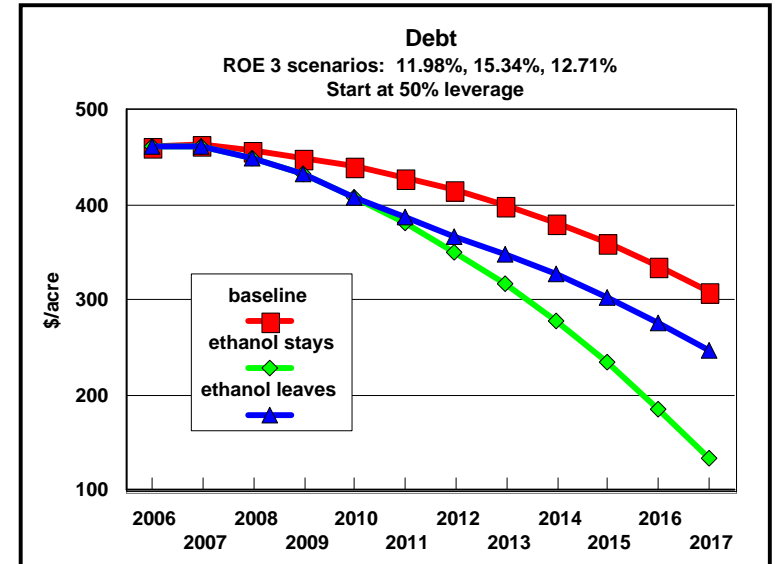
96



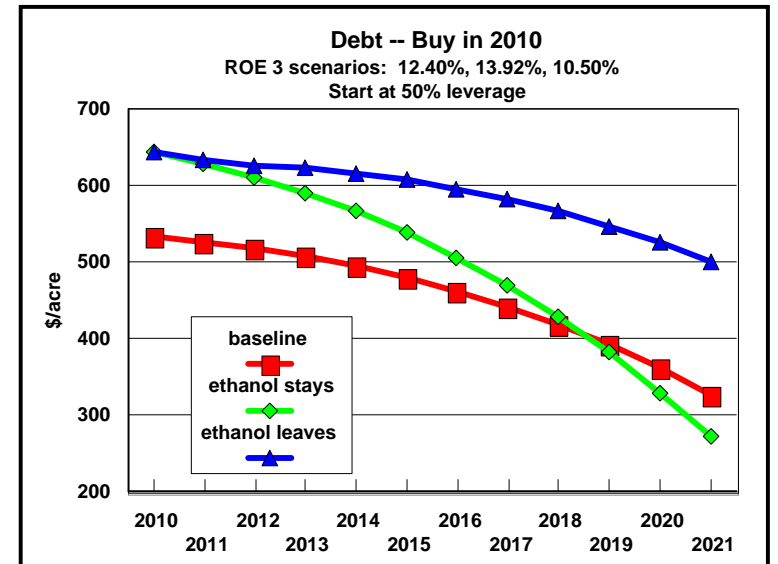
97



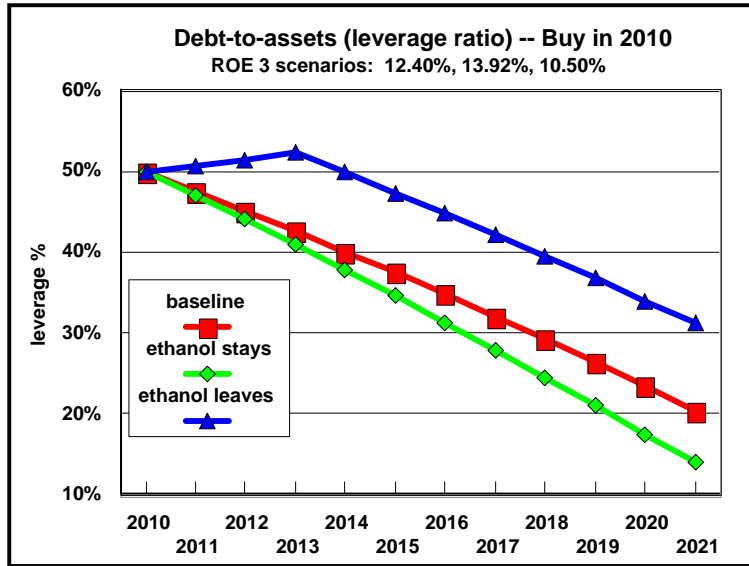
Elasticity of value wrt rent is 0.86, which is much lower than that implied by crop budget/KSU-Lease approach.



Late to game: don't buy until January 2010

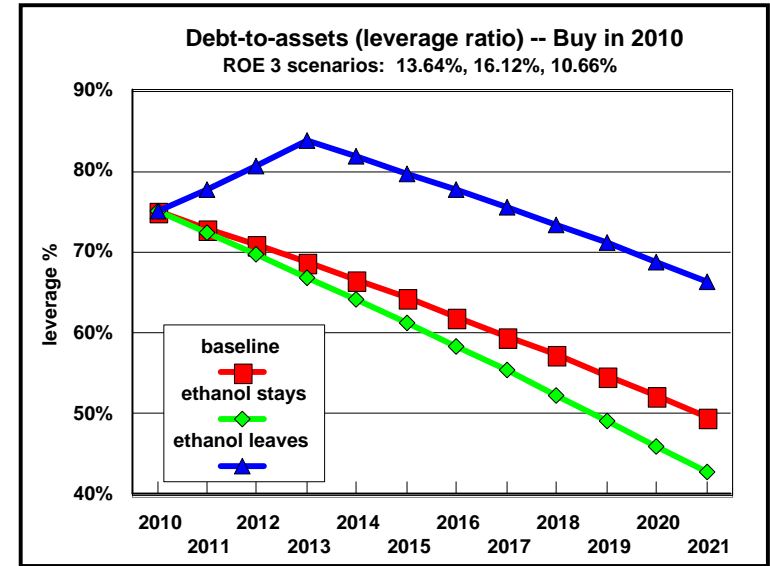


Late to game: don't buy until January 2010



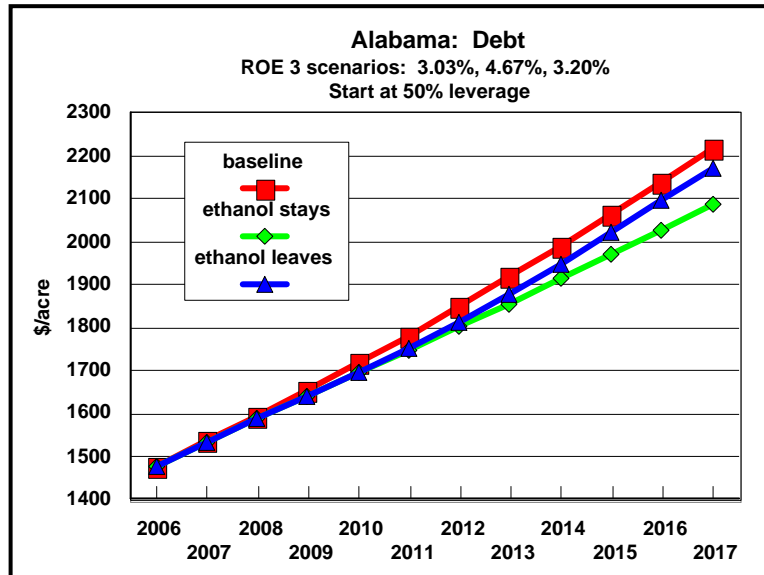
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Late to game AND LEVERAGE AT 75% rather than at 50%



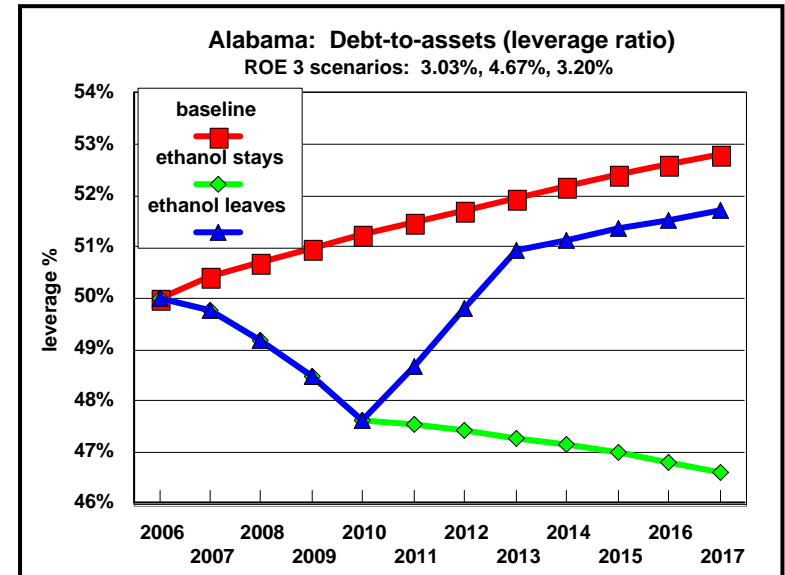
103

AL needs continued high non-ag growth for it to be a good investment



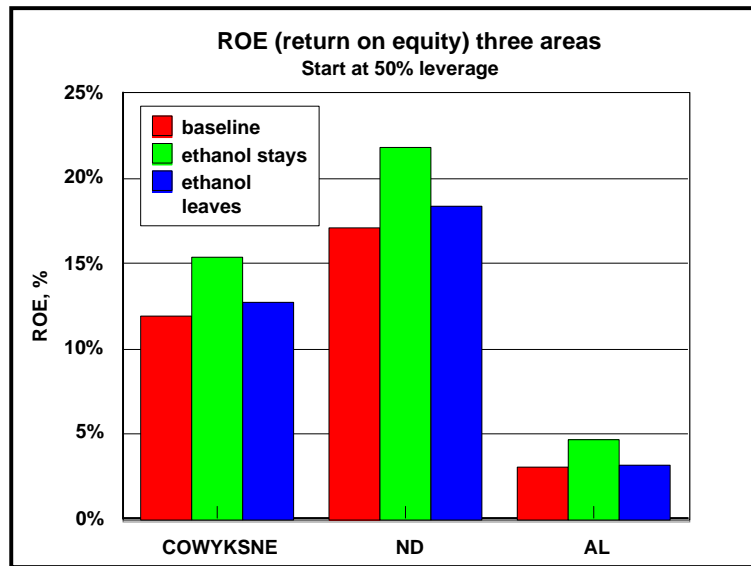
104

AL needs continued high non-ag growth for it to be a good investment



105

Ethanol will be good to states like ND, which is dominated by ag



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Summary...

- Ethanol production likely to stabilize around 12-15 bgy over next several years (limited “new” expansion)
- Corn acres to support ethanol production
 - Increase from historical levels
 - With trend yields can be less than 2007
- Fertilizer
 - Use on corn will increase 7.5% in 2008-12 and 13.5% in 2013-17 compared to 2003-07
 - Strong demand will support high fertilizer prices
- Futures prices suggest commodity prices will remain at historically high levels for next several years (more of a world S&D issue than domestic one)
 - Rents and land values are going up!

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Questions?

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