Measuring Risk

"If you don't measure it, you can't manage it"

Outline Of This Session

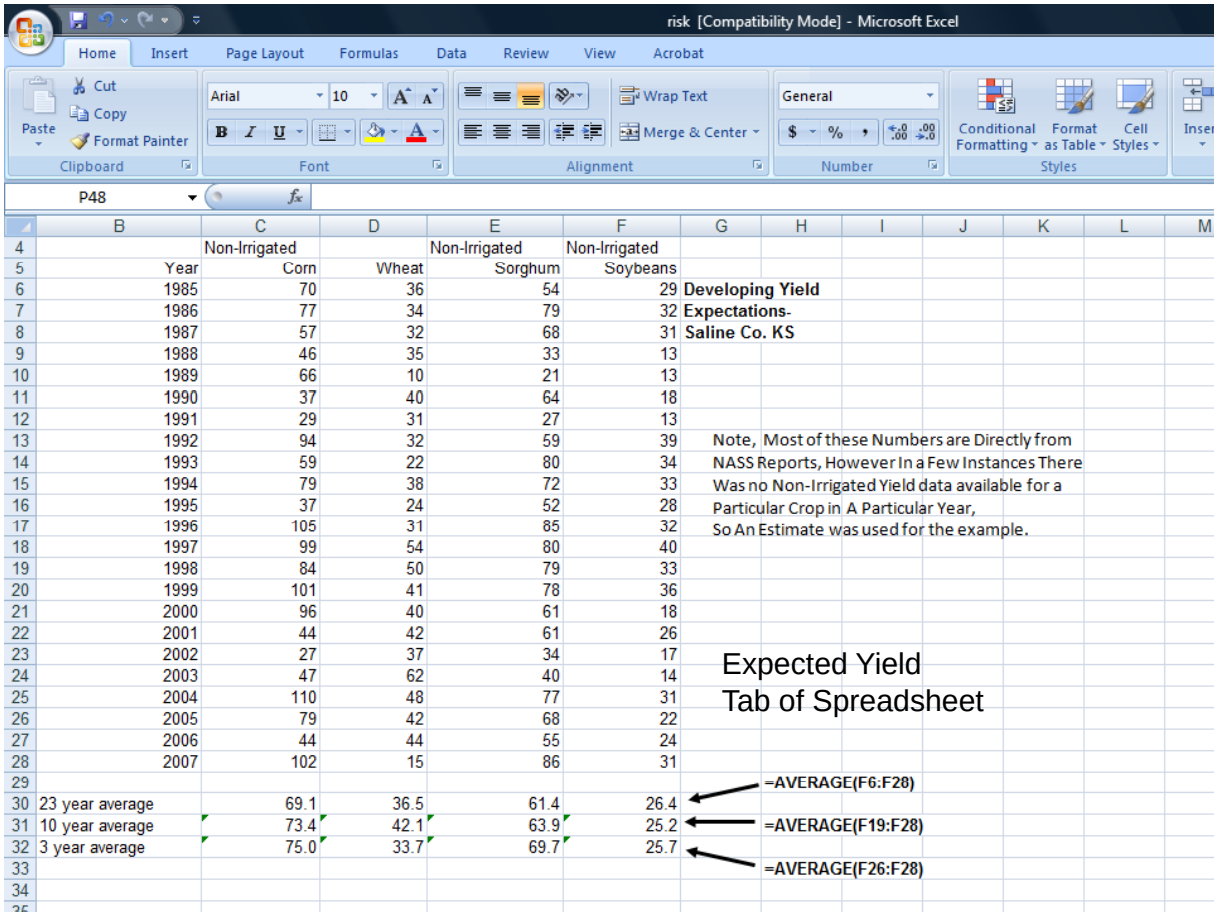
- Expected values
- Thinking about risk
- Variability
- Random vs. systematic variability
- De-trending
- Downside risk

Measuring Risk

- Risk must be quantified in order to evaluate the effect of various strategies in achieving risk management goals
- Risk measurement involves identifying the possible future outcomes, and their probability of occurring

Expected Values

- On the farm we all formulate some expectation about uncertain variables (yield, price, etc.)
- Approaches to developing expectations:
  - Guess
  - Use actual historical averages (various time frames)
  - Use adjusted or de-trended historical averages



	B	C	D	E	F	G
4		Non-Irrigated		Non-Irrigated	Non-Irrigated	
5	Year	Corn	Wheat	Sorghum	Soybeans	
6	1985	70	36	54	29	**Developing Yield**
7	1986	77	34	79	32	**Expectations-**
8	1987	57	32	68	31	**Saline Co. KS**
9	1988	46	35	33	13	
10	1989	66	10	21	13	
11	1990	37	40	64	18	
12	1991	29	31	27	13	
13	1992	94	32	59	39	Note, Most of these Numbers are Directly from
14	1993	59	22	80	34	NASS Reports, However In a Few Instances There
15	1994	79	38	72	33	Was no Non-Irrigated Yield data available for a
16	1995	37	24	52	28	Particular Crop in A Particular Year,
17	1996	105	31	85	32	So An Estimate was used for the example.
18	1997	99	54	80	40	
19	1998	84	50	79	33	
20	1999	101	41	78	36	
21	2000	96	40	61	18	
22	2001	44	42	61	26	
23	2002	27	37	34	17	
24	2003	47	62	40	14	
25	2004	110	48	77	31	
26	2005	79	42	68	22	
27	2006	44	44	55	24	
28	2007	102	15	86	31	
29						
30	23 year average	69.1	36.5	61.4	26.4	=AVERAGE(F6:F28)
31	10 year average	73.4	42.1	63.9	25.2	=AVERAGE(F19:F28)
32	3 year average	75.0	33.7	69.7	25.7	=AVERAGE(F26:F28)
33						
34						

Expected Yield
Tab of Spreadsheet

Developing Short Run Price Expectations

- Less than one year out
  - Use current futures quote for expected delivery time period adjusted for historical basis
  - If no futures market available – use current price adjusted for seasonal price patterns

Developing Long Run Price Expectations

- Historical rule has been use previous 5 year (+) average price for the commodity and location you are delivering to
- It is not clear that this is the “best” estimate during the current time of adjusting these markets to whatever new long-term levels are needed
  - It will become a good rule to use again when markets settle down

Developing Long Run Price Expectations

- Alternatively, use FAPRI estimates
- Use estimates of average cost of production

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Thinking about Risk

- Range of possibilities
- Probability of variable being below some critical level, or expected value (downside risk)
- Worst case scenario

Measures of Variability

- Variance and Standard Deviation (SD)
- Coefficient of Variation (CV)
- These measures are useful because they summarize variability into a single value
- They can easily be calculated in a spreadsheet

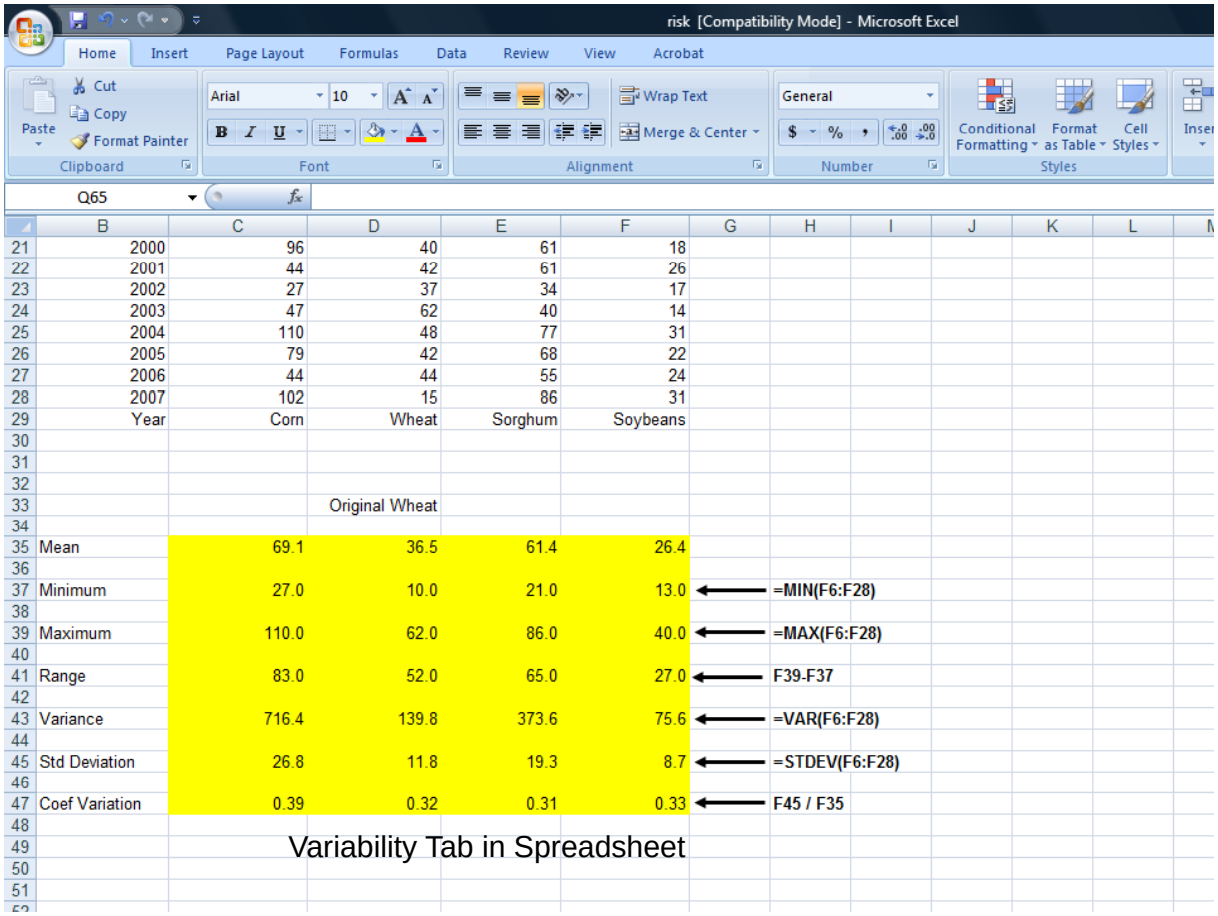
Standard Deviation

- Measure of how much variability a series of values has around it's mean
  - Higher SD --- more variability in the series
  - If the series is normally distributed, 1/3 of the outcomes will occur between the mean plus one SD, and 1/3 will occur between the mean minus one standard deviation
  - 95% will occur within +/- two SD's

Coefficient of Variation

- CV is a relative measure of risk, calculated by dividing the standard deviation by the mean of the series being examined

- Therefore, CV is unitless and can be compared across series measured in different units



	B	C	D	E	F	G	H
21	2000	96	40	61	18		
22	2001	44	42	61	26		
23	2002	27	37	34	17		
24	2003	47	62	40	14		
25	2004	110	48	77	31		
26	2005	79	42	68	22		
27	2006	44	44	55	24		
28	2007	102	15	86	31		
29	Year	Corn	Wheat	Sorghum	Soybeans		
30							
31							
32							
33			Original Wheat				
34							
35	Mean	69.1	36.5	61.4	26.4		
36							
37	Minimum	27.0	10.0	21.0	13.0	←	=MIN(F6:F28)
38							
39	Maximum	110.0	62.0	86.0	40.0	←	=MAX(F6:F28)
40							
41	Range	83.0	52.0	65.0	27.0	←	F39-F37
42							
43	Variance	716.4	139.8	373.6	75.6	←	=VAR(F6:F28)
44							
45	Std Deviation	26.8	11.8	19.3	8.7	←	=STDEV(F6:F28)
46							
47	Coef Variation	0.39	0.32	0.31	0.33	←	F45 / F35
48							
49							
50							
51							

Variability Tab in Spreadsheet

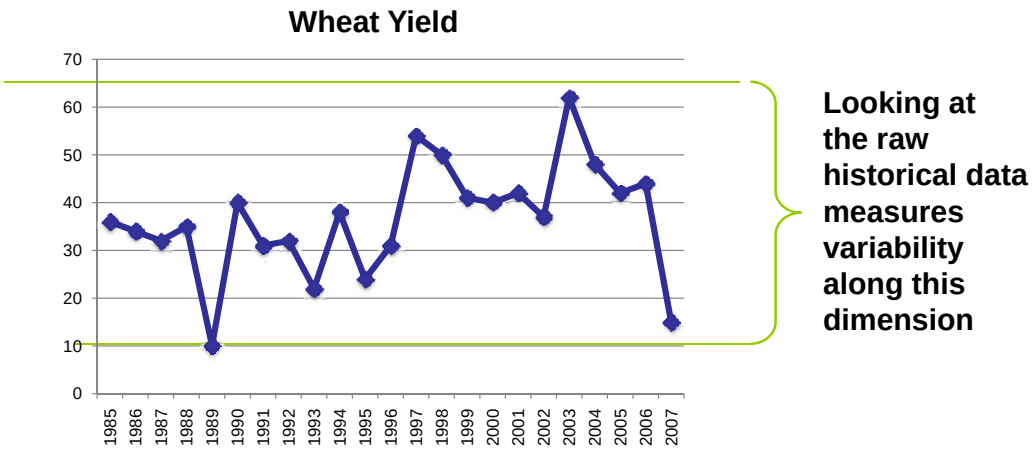
Overstating True Risk Using Historical Averages

- Just looking at variability around the historical average can be misleading
- Sometimes other things are changing over time, making expectations hard to “pin down”
- You sometimes don’t know whether the observed variability is truly due to risk, or underlying trends.

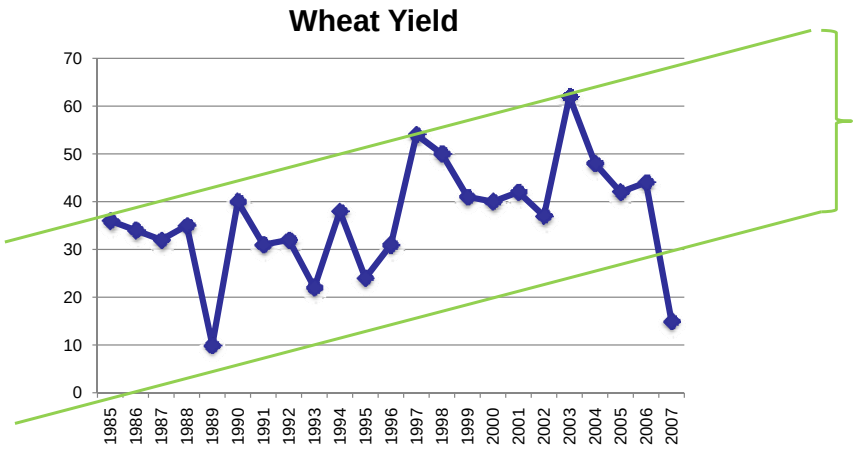
Overstating True Risk Using Historical Averages

- The earlier example depicted yield risk based on 23 years of historical data
- This approach can overstate the yield risk faced in the coming year
  - Why? Because the risk you face is limited to random variability
  - Thus, you need to separate random variability from systematic variability (trends)

The Trend Issue



The Trend Issue



In Obviously trending data what you really want to do is measure variability along this dimension

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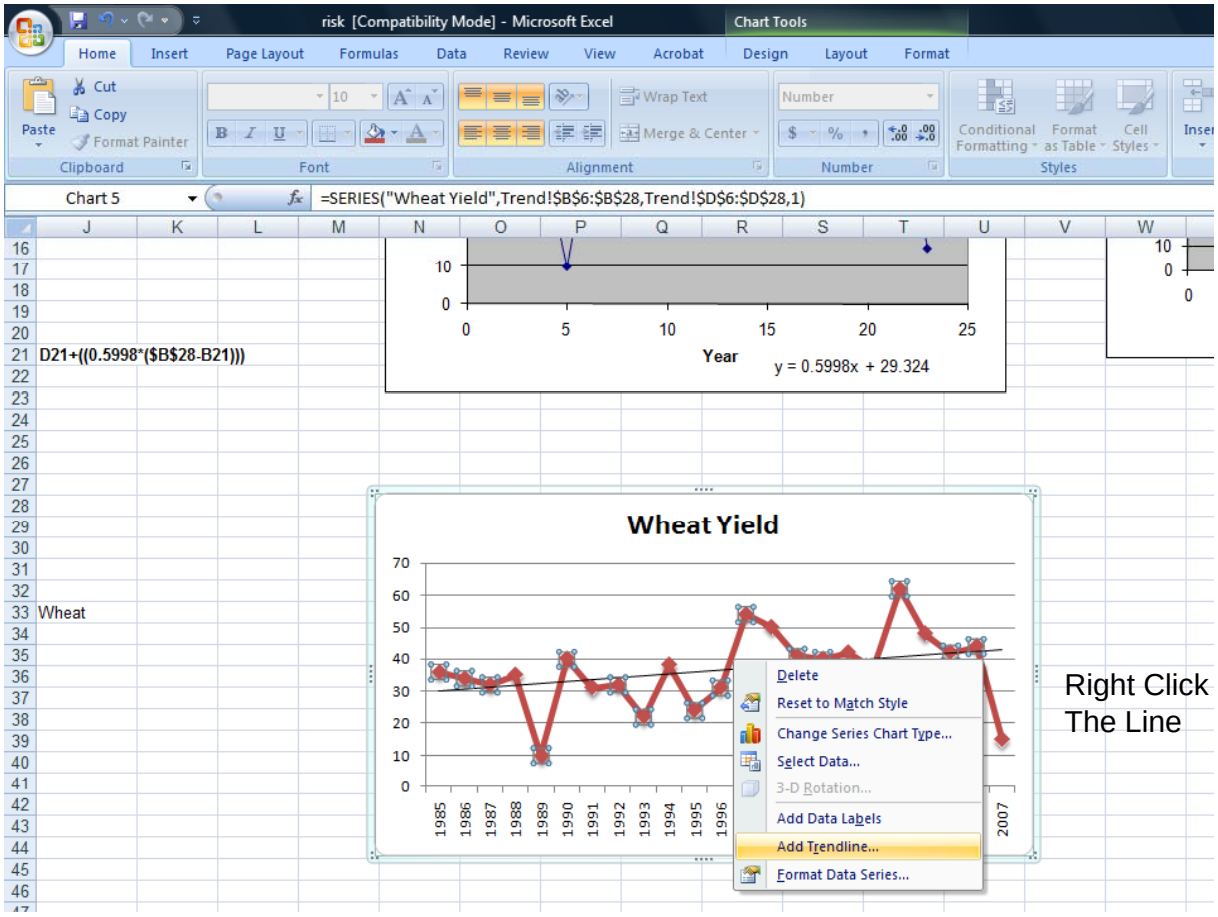
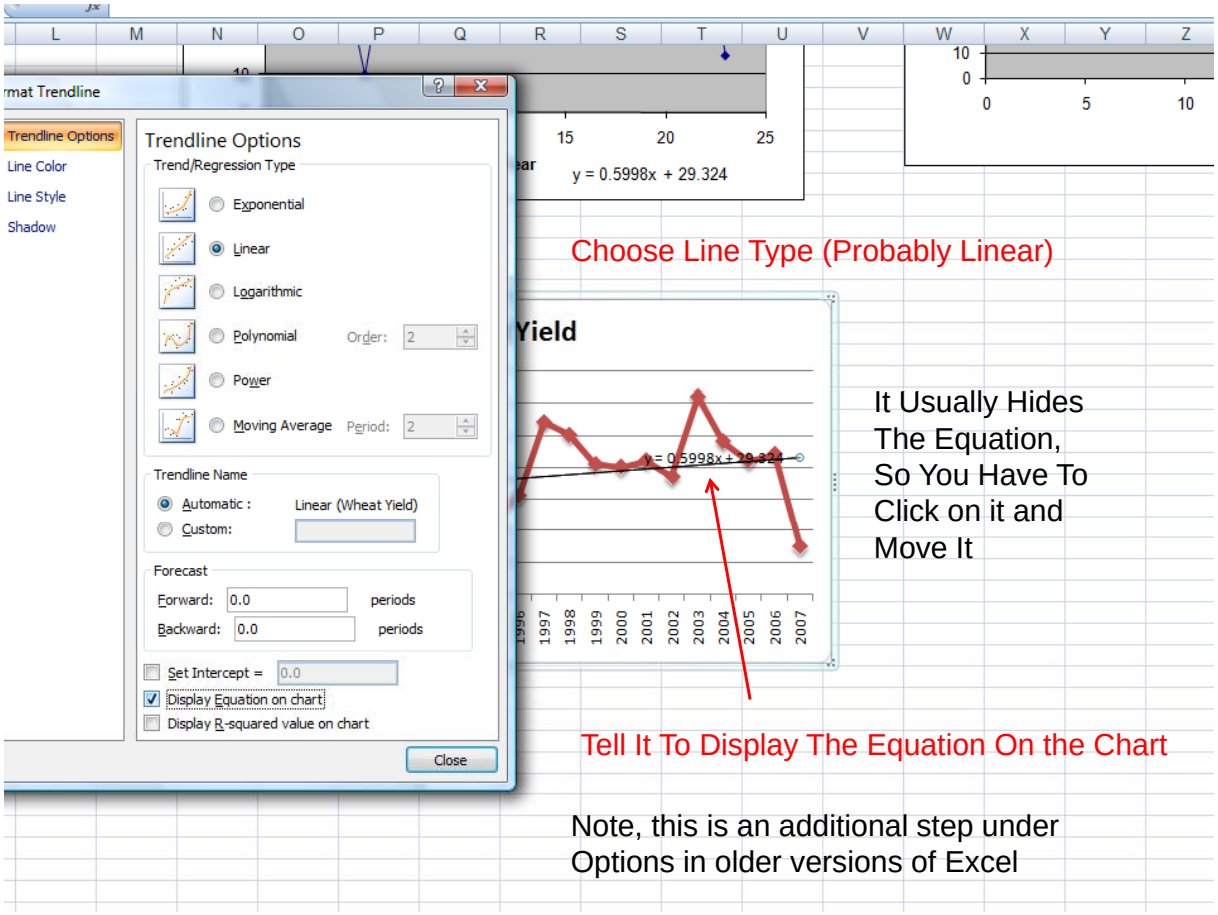


Right Click The Line



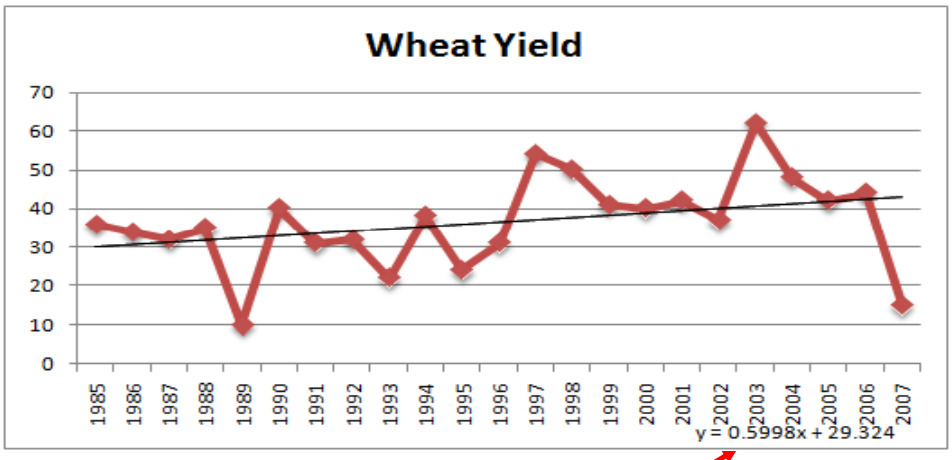
Choose Line Type (Probably Linear)

It Usually Hides The Equation, So You Have To Click on it and Move It

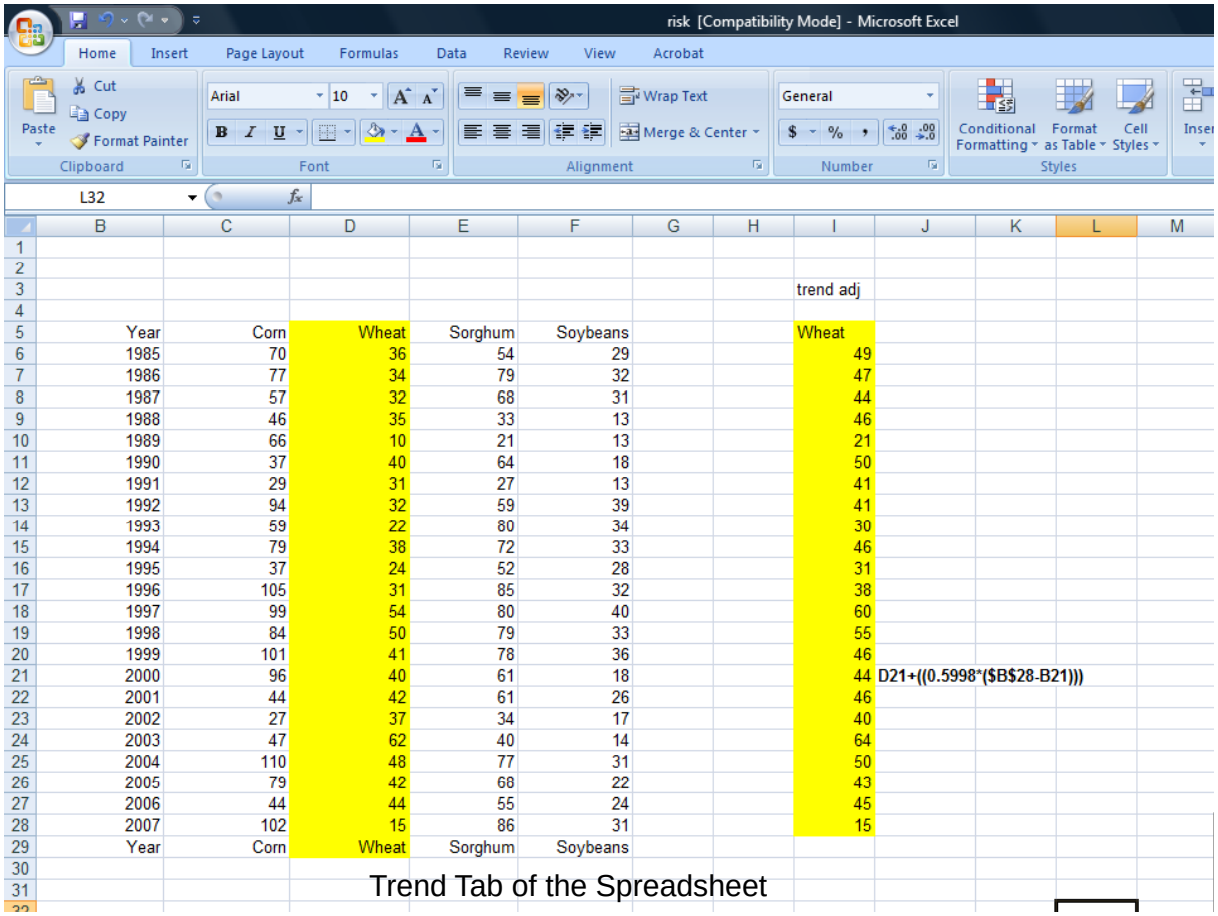
Tell It To Display The Equation On the Chart

Note, this is an additional step under Options in older versions of Excel

The Trend Issue



The result confirms that there is in fact a trend, and Provides us the coefficient necessary to "de-trend" The data



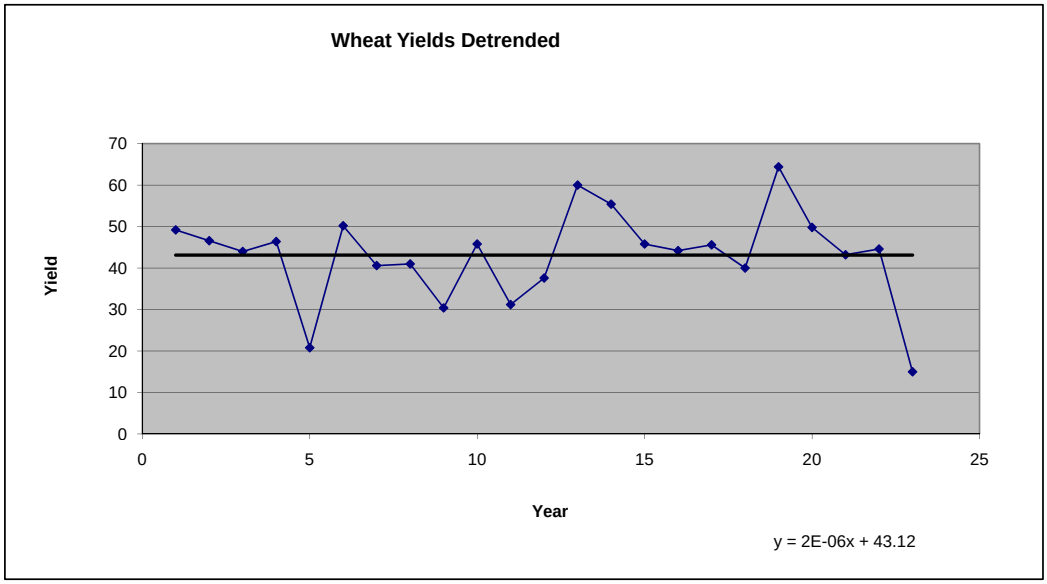
	B	C	D	E	F	G	H	I	J	K	L	M
1												
2												
3								trend adj				
4												
5	Year	Corn	Wheat	Sorghum	Soybeans			Wheat				
6	1985	70	36	54	29			49				
7	1986	77	34	79	32			47				
8	1987	57	32	68	31			44				
9	1988	46	35	33	13			46				
10	1989	66	10	21	13			21				
11	1990	37	40	64	18			50				
12	1991	29	31	27	13			41				
13	1992	94	32	59	39			41				
14	1993	59	22	80	34			30				
15	1994	79	38	72	33			46				
16	1995	37	24	52	28			31				
17	1996	105	31	85	32			38				
18	1997	99	54	80	40			60				
19	1998	84	50	79	33			55				
20	1999	101	41	78	36			46				
21	2000	96	40	61	18			44	D21+((0.5998*(B28-B21)))			
22	2001	44	42	61	26			46				
23	2002	27	37	34	17			40				
24	2003	47	62	40	14			64				
25	2004	110	48	77	31			50				
26	2005	79	42	68	22			43				
27	2006	44	44	55	24			45				
28	2007	102	15	86	31			15				
29	Year	Corn	Wheat	Sorghum	Soybeans							
30												
31												

Trend Tab of the Spreadsheet

De-trended Expected Yield is Higher, and Less Variable

			Original Wheat					Detrended Wheat
Mean		69.1	36.5	61.4	26.4			43.1
Minimum		27.0	10.0	21.0	13.0			15.0
Maximum		110.0	62.0	86.0	40.0			64.4
Range		83.0	52.0	65.0	27.0			49.4
Variance		716.4	139.8	373.6	75.6			123.3
Std Deviation		26.8	11.8	19.3	8.7			11.1
Coef Variation		0.39	0.32	0.31	0.33			0.26

This Procedure Takes The Trend Out



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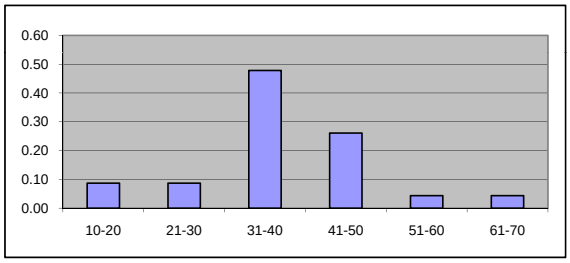
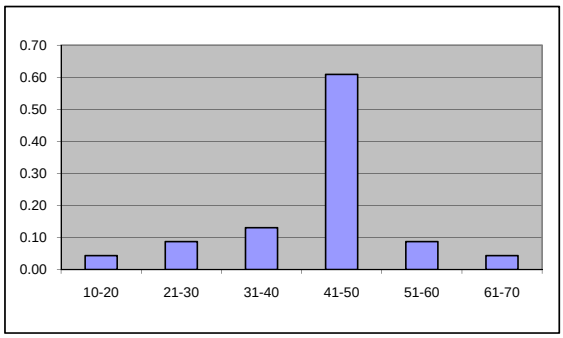
The Yield Expectation Distribution is Changed

Yield Histogram, Historical Wheat Yield Data



Yield Histogram, De-Trended Wheat Yield Data



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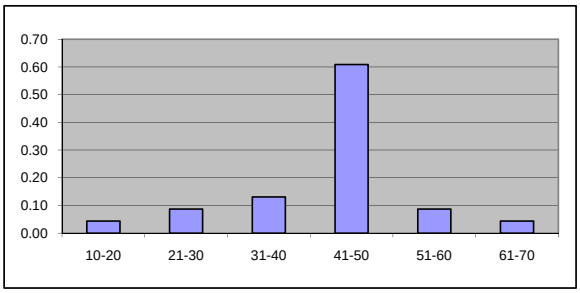
Downside Risk

	Interval Probability	Cumulative Probability
10-20	0.04	
21-30	0.09	0.13
31-40	0.13	0.26
41-50	0.61	0.87
51-60	0.09	0.96
61-70	0.04	1.00



- Using the de-trended data, there is a 13% chance that expected yield will fall below 30 bu. There is a 26% chance that expected yield will fall below 40 bu. for next year's crop.

Summary

- Expected values
- Thinking about risk
- Variability
- Random vs Systematic variability
- De-trending
- Downside risk