Revenues Below $700 per Acre Possible with Corn in 2017

Gary Schnitkey

Department of Agricultural and Consumer Economics
University of Illinois

For farmland having an expected corn yield of 190 bushels per acre, a reasonable expectation of 2017 gross revenue is $741 per acre. Obviously, revenue will vary from the $741 expectation depending on price and yield outcomes. In this article, possible 2017 crop revenues, crop insurance payments, and Agricultural Risk Coverage (ARC) payments are evaluated using the historical price and yield changes from 1975 to 2016. The analysis uses corn yields from Logan County, Illinois. For each year, the sum of crop revenue, crop insurance payments, and ARC payments equals gross revenue. The historical analysis suggests that 2017 gross revenues can range from a low in the mid-$600 range to a high of over $900 per acre.

Possible Revenues based on Historical Price and Yield Changes

Possible revenues are based on harvest prices, market year average (MYA) prices, and yields calculated given price and yield changes from 1975 to 2016. Table 1 shows harvest prices, MYA prices, and yields used in the analysis. Calculation of each price and yield are as follows:

- Harvest prices are calculated using percentage price changes for each year times the $3.96 projected price for 2017. In 1975, the projected price was $2.70 and the harvest price was $2.90, meaning that the harvest price is 7% higher than the projected price. The $4.25 harvest price is 7% higher than the $3.96 projected price (see Table 1).

- MYA prices are based on the difference between harvest prices and MYA prices. For example, the $2.54 MYA price for 1975 is $.36 lower than the $2.90 harvest price for 1975 (see appendix Table 1 for actual prices and yields for each year). To simulate 1975, a $3.89 MYA price is used, which is $.36 lower than the simulate 1975 harvest price of $4.25 per bushel.

- Logan county yields are stated in terms of 2017 yields. The average yearly increase in yields from 1975 to 2017 is 1.78 bushels per acre. This average times the years from 2017 are added to each actual yield. The 1975 actual yield, for example, as 136 bushel per acre. The year 1975 is 42 in the past (42 = 2017 - 1975) and 42 years times 1.78 result in 75 bushels per acre. Adding 75 bushels per acre to the 136 actual yield results in an estimated 211 bushel yield if 1975 weather conditions are repeated in 2017.

Table 1. Possible 2017 Revenues for Corn in Logan County Illinois

Year	Harvest Price	MYA Price	Logan Cty Yield	Crop Revenue	Crop Insurance	ARC	Gross Revenue
	$/bu.	$/bu.	Bu/acre	$/acre	$/acre	$/acre	$/acre
1975	4.25	3.89	211	821	0	0	821
1976	3.86	3.36	202	679	0	0	679
1977	3.03	2.96	198	586	46	66	698
1978	4.03	3.97	185	734	0	0	734
1979	4.25	3.99	200	798	0	0	798
1980	4.58	4.08	141	575	102	66	743
1981	3.06	2.65	198	525	40	66	631
1982	2.90	3.25	199	647	69	19	735
1983	4.79	4.52	157	710	30	0	740
1984	3.85	3.70	196	725	0	0	725
1985	3.32	3.32	212	704	0	0	704
1986	3.19	3.00	214	642	0	23	665
1987	4.29	4.40	200	880	0	0	880
1988	5.27	4.92	123	605	212	54	871
1989	3.49	3.46	189	654	0	13	667
1990	3.69	3.67	191	701	0	0	701
1991	3.84	3.70	192	710	0	0	710
1992	3.07	3.05	209	637	5	27	669
1993	4.11	4.12	192	791	0	0	791
1994	3.19	3.29	222	730	0	0	730
1995	4.98	4.99	157	783	31	0	814
1996	3.65	3.52	206	725	0	0	725
1997	4.08	3.70	173	640	0	25	665
1998	3.05	2.80	183	512	88	66	666
1999	3.32	3.13	190	595	15	63	673
2000	3.22	3.03	193	585	25	66	676
2001	3.35	3.24	180	583	43	66	692
2002	4.30	4.10	180	738	0	0	738
2003	3.70	3.86	214	826	0	0	826
2004	2.87	2.88	211	608	41	52	701
2005	3.45	3.43	165	566	77	66	709
2006	4.80	4.81	191	919	0	0	919
2007	3.49	4.11	215	884	0	0	884
2008	3.03	2.96	204	604	28	55	687
2009	3.57	3.40	202	687	0	0	687
2010	5.42	5.14	168	864	0	0	864
2011	4.16	4.06	184	747	0	0	747
2012	5.23	4.62	105	485	304	66	855
2013	3.08	3.15	205	646	15	20	681
2014	2.99	3.20	236	755	0	0	755
2015	3.65	3.52	176	620	4	42	666
2016	3.58	3.59	221	793	0	0	793
Average	3.79	3.68	190	691	28	22	741

[1] See appendix table 1 for calculation.

[2] Crop revenue equals county yield times Market Year average price

[3] Based on an 85% RP policy with a $3.96 projected price and a 192 bushel guarantee yield

[4] ARC payments based on a $669 per acre ARC guarantee

The above procedures results in 42 price and yield combinations. Each combination represents the price and yield that would result if conditions in the respective year occurs in 2017. For example, if 1975 conditions are repeated in 2017, the harvest price would be $4.25 per bushel, the MYA price would be $3.89 per bushel, and Logan County yield would be 211 bushels per acre (see Table 1).

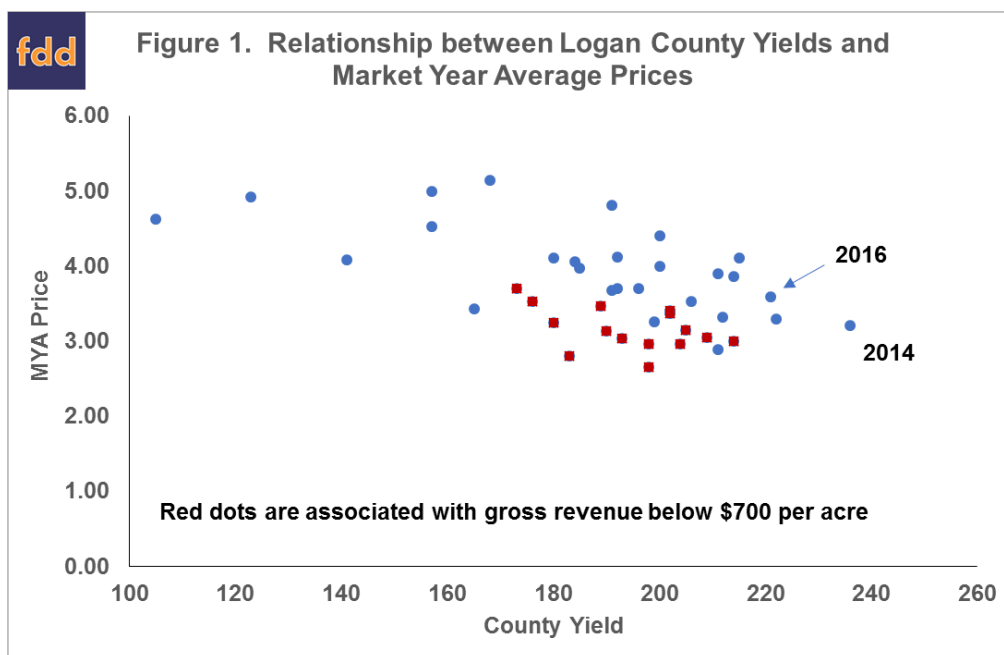From these prices and yields, the components of gross revenue are calculated:

- Crop revenue is estimated as MYA price times county yield.

- Crop insurance is calculated given a Revenue Protection (RP) policy at an 85% coverage level. The guarantee yield is 192 bushels per acre and the projected price is $3.96 per bushel.

- ARC payments are calculated for Logan County, Illinois. The estimated ARC guarantee for 2017 is $669 per acre. Note that ARC payments are based on base acres and not planted acres. Calculation of gross revenue assumes one base acre of corn for each planted acre of corn. This will not be the case on all farms.

Note that county yields are used in this study. Farm yields typically are more variable than county yields. AS a result, Use of farm yields would increase variability illustrated below. However, lowest revenues will not vary much from those shown here because crop insurance provide payments so that revenue does not decrease below the crop insurance guarantee.

Prices and Yields

MYA prices average $3.68 per bushel over the 42 simulated years, with a low of $2.65 and a high of $5.14. Again, these prices are calculating using historical price changes occurring in the past. In 12% of the simulated cases, MYA prices are below $3.00 per bushel. Therefore, historical changes suggest a chance of very low corn prices.

Logan county yield averages 190 bushels per acre over the simulated cases, with the low yield being 105 bushels per acre (occurring in a year like 2012) and the high yield being 236 bushels per acre (occurring in a year like 2014). Figure 1 shows that scatter of yields and prices for the simulated years. Each dot represents a year's yield and MYA price combination. Two of these dots are denoted by year: 2014 and 2016. These two years represent the first and third highest yield over the entire time period. Overall, yields have been high in recent years in Illinois, tempering income declines that occurred because of low prices. The historical analysis suggests continuing high yields like those in 2014 and 2016 should not be expected.

Figure 1. Relationship between Logan County Yields and Market Year Average Prices

Red dots are associated with gross revenue below $700 per acre

As expected, higher yields generally are associated with lower prices (see Figure 1). Logan County is in the heart of the Corn Belt and high yielding years generally indicate high corn supplies, leading to lower prices. While strong, this relationship also is not certain. There are situations in which yields and prices are not as direct, particularly when yields are within 15 bushels of the 190 bushel mean. In these cases, a wide range of prices has occurred in the past, suggesting a wide range is possible in 2017 if yields are near normal.

Revenue estimates

The average crop revenue across the 42 simulated years is $691 per acre (see Table 1). The lowest crop revenue is $485 per acre and occurs in the simulated year like 2012. In this year, the yield is 105 bushels per acre and the MYA price is $4.62 per bushel. Crop revenues in the high end are slightly over $900 per acre and occur in a year like 2006. In this year, the simulated yield is 191 bushels per acre and MYA price is $4.81 per bushel. A dramatic increase in price occurred in 2006, mostly associated with the introduction of more corn use in the production of ethanol.

An 85% RP policy makes payments in 43% of the simulated years. Average crop insurance payments, including the years in which RP does not make payments, is $28 per acre (see Table 1).

ARC makes payments in 43% of the years, a higher percentage than many may be expecting (see Table 1). Two types of situations result in ARC payments. The first are very low-yielding years. Three years in which yields were well below trend in Logan County are 1988, 2005, and 2012. Simulated ARC payments for two of these three years are at the maximum of $66 per acre, with the other year at $54 per acre. The second type of year that results in ARC payments are when MYA prices are projected to be below $3.25 (1977, 1981, 1998, 1999, 2000, 2001, and 2008). The average ARC payment for the 42 simulated years, including years in which ARC does not make payments, is $22 per acre.

Average gross revenue is $741 per acre (see Table 1). There is, however, a considerable range in possible revenues. Revenues above $850 per acre are possible and occur in six years (1987, 1988, 2007, 2007, 2010, and 2012). In all these years, MYA price is above $4.00 per bushel.

There also are 35% of the years in which revenue is projected to be below $700 per acre, with the lowest revenue projected at $631 per acre. The combination of crop insurance and ARC provides a safety net so that gross revenues below $630 per acre do not occur. The red dots in Figure 1 show the yield and price combinations associated with revenue below $700 per acre. In those simulated years, yields are not exceptionally large or small, generally within 15 bushels of the expected yield of 190 bushels per acre. Prices tend to be below $3.50 per bushel.

Commentary and Summary

As always is the case before planting, there is a considerable range of possible revenues. This analysis indicates that a reasonable expectation for corn land with expected yield of 190 bushels per acre is gross revenue of $741 per acre, with a range of possible gross revenues from around $650 per acre to just over $900 per acre. Similar ranges could be found for a different farmland productivity. Adding or subtracting the difference in expected yield times $3.70 per bushel would give a ballpark range for revenues. If expected yield is 200 bushels per acre, 10 bushels higher than used here, expected revenue would increase by about $37 per acre to $778 per acre.

Central Illinois budgets suggest non-land costs of $530 per acre for corn. Adding a $240 cash rent results in a total cost of $770 per acre. Average gross revenues of $741 per acre are below those costs by $29 per acre. If gross revenue occurs at the high end of the range, corn production on central Illinois farmland will be profitable. On the other hand, revenues below $700 would result in losses. The historical analysis suggests the likely most likely scenario resulting in low gross revenue is when yields are within 15 bushels of normal and prices fall below $3.40 per bushel.

Actual revenues will depend on price and yield changes occurring this summer and fall. As always, planting progress, growing conditions, and demand changes will be of importance in determining revenues and incomes.

Appendix Table 1. Historic Price and Yields along with Possible 2017 Outcomes

Year	Projected Price[1]	Harvest Price[1]	MYA Price[2]	Logan Cty Corn yields	Possible 2017 Outcomes Harvest Price[3]	Possible 2017 Outcomes MYA Price[4]	Possible 2017 Outcomes Logan Cty Yield[5]
	$/bu.	$/bu.	$/bu.	Bu/acre	$/bu.	$/bu.	Bu/acre
1975	2.70	2.90	2.54	136	4.25	3.89	211
1976	2.72	2.65	2.15	129	3.86	3.36	202
1977	2.73	2.09	2.02	126	3.03	2.96	198
1978	2.27	2.31	2.25	115	4.03	3.97	185
1979	2.59	2.78	2.52	132	4.25	3.99	200
1980	3.12	3.61	3.11	75	4.58	4.08	141
1981	3.76	2.91	2.50	134	3.06	2.65	198
1982	3.00	2.20	2.55	136	2.90	3.25	199
1983	2.88	3.48	3.21	96	4.79	4.52	157
1984	2.86	2.78	2.63	137	3.85	3.70	196
1985	2.66	2.23	2.23	155	3.32	3.32	212
1986	2.10	1.69	1.50	159	3.19	3.00	214
1987	1.69	1.83	1.94	146	4.29	4.40	200
1988	2.17	2.89	2.54	71	5.27	4.92	123
1989	2.71	2.39	2.36	139	3.49	3.46	189
1990	2.47	2.30	2.28	143	3.69	3.67	191
1991	2.59	2.51	2.37	146	3.84	3.70	192
1992	2.70	2.09	2.07	164	3.07	3.05	209
1993	2.40	2.49	2.50	149	4.11	4.12	192
1994	2.68	2.16	2.26	181	3.19	3.29	222
1995	2.57	3.23	3.24	118	4.98	4.99	157
1996	3.08	2.84	2.71	168	3.65	3.52	206
1997	2.73	2.81	2.43	137	4.08	3.70	173
1998	2.84	2.19	1.94	149	3.05	2.80	183
1999	2.40	2.01	1.82	158	3.32	3.13	190
2000	2.51	2.04	1.85	163	3.22	3.03	193
2001	2.46	2.08	1.97	151	3.35	3.24	180
2002	2.32	2.52	2.32	153	4.30	4.10	180
2003	2.42	2.26	2.42	189	3.70	3.86	214
2004	2.83	2.05	2.06	188	2.87	2.88	211
2005	2.32	2.02	2.00	144	3.45	3.43	165
2006	2.50	3.03	3.04	171	4.80	4.81	191
2007	4.06	3.58	4.20	197	3.49	4.11	215
2008	5.40	4.13	4.06	188	3.03	2.96	204
2009	4.13	3.72	3.55	188	3.57	3.40	202
2010	3.99	5.46	5.18	156	5.42	5.14	168
2011	6.01	6.32	6.22	173	4.16	4.06	184
2012	5.68	7.50	6.89	97	5.23	4.62	105
2013	5.65	4.39	4.46	198	3.08	3.15	205
2014	4.62	3.49	3.70	231	2.99	3.20	236
2015	4.15	3.83	3.70	173	3.65	3.52	176
2016	3.86	3.49	3.50	219	3.58	3.59	221

[1] Projected and harvest prices used for crop insurance purposes

[2] Market year average price for the US

[3] Equals the $3.96 projected price times price change for year (1975: 3.96*(2.90/2.70))

[4] Equals possible harvest price plus MYA difference for year (1975: 4.25 - (2.54 -2.90))

[5] Equals Logan county corn yield times 1.78 bushel increase time no. of year form 2017 (1975: 211= 136 + 1.78 * (2017 -1975).