



Assessing Argentina Soybean Yield Risks: Historical Deviations from Trend

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We recently began a series of articles to evaluate the history of corn and soybean yields and deviations from trend yield in Brazil and Argentina. The objective of the yield analysis is to provide a basis for forming expectations about the likely yields of the 2017 crops. The first six articles focused on the alternative sources of historical yield estimates, the selection of the appropriate series to use in the analysis for both corn and soybeans, the selection of the best-fitting trend model for each commodity and country, trend yield deviations in each country for corn, and trend yield deviations in Brazil for soybeans (*farmdoc daily*, November 2, 2016; November 9, 2016; November 16, 2016; December 14, 2016; December 15, 2016; and January 12, 2016). Today's article examines soybean yield trend estimates and trend deviations for the Argentinian soybean crop. Since Argentina is the world's third largest producer of soybeans and is the largest exporter of soybean meal and oil, yield and production prospects have important price implications.

Background

We begin by providing some perspective on regional soybean production in Argentina. The [production map of Argentina](#) from the USDA/FAS gives a visual sense of the concentration. The top three soybean production provinces consist of Buenos Aires, Cordoba, and Santa Fe. Table 1 presents soybean production by country from 1971 through 2016 and gives an indication of overall growth in soybean production in the world, and Argentina in particular. Soybean production in Argentina grew rapidly in the early 2000's with a significant jump in 2001. Figure 1 presents the soybean acreage for Brazil and Argentina provided by USDA/FAS estimates from 1978-2016. Both nations exhibited large growth in soybean acreage over the sample period with Argentinian acreage leveling off at the end of the period. Current estimates place Argentina soybean acreage at 48.1 million acres this year.

Figure 2 presents the annual soybean yields in Argentina for the period 1978 through 2016. As previously discussed in the *farmdoc daily* article of [November 16, 2016](#), we chose a linear trend to fit the soybean yield data for Argentina. Note that these yield estimates are provided by the USDA's Foreign Agricultural Service (FAS) and are based on past trends, expert opinion, industry intelligence, and AgMin, the Argentinian Ministry of Agriculture, estimates. Yields have obviously trended higher over time. The linear trend indicates annual average yield increases 0.37 bushels for Argentina. A linear trend explains about 49 percent of the annual variation in actual yields in Argentina. The historical soybean yields in Argentina show large variation around the trend with an extended period of above trend yields from 1998-

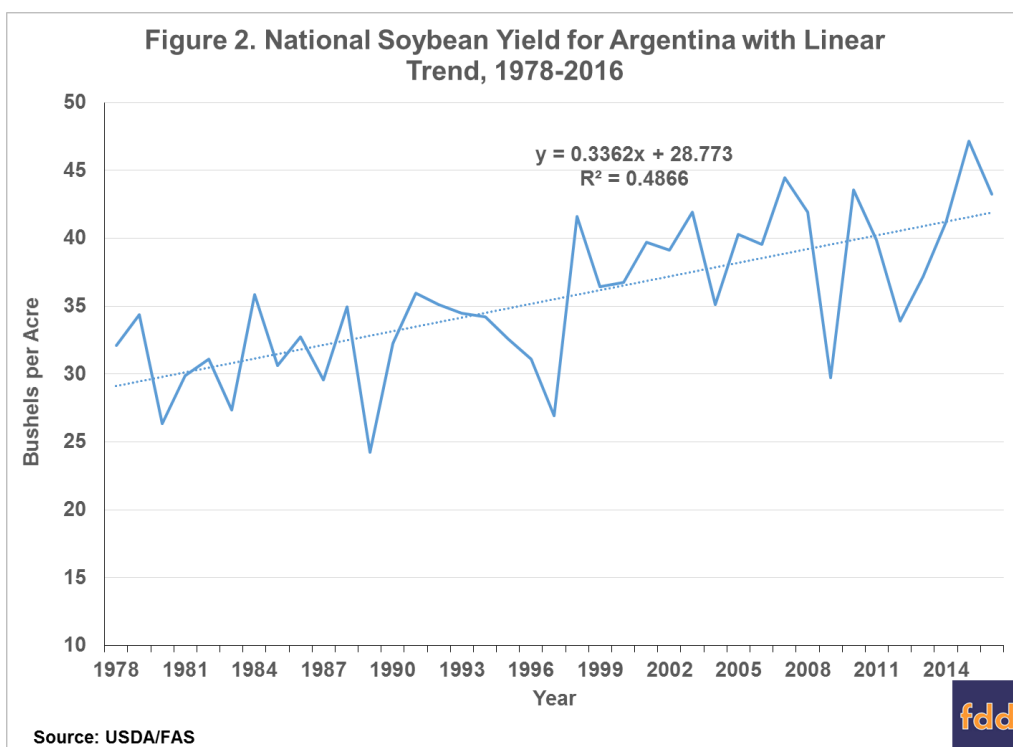
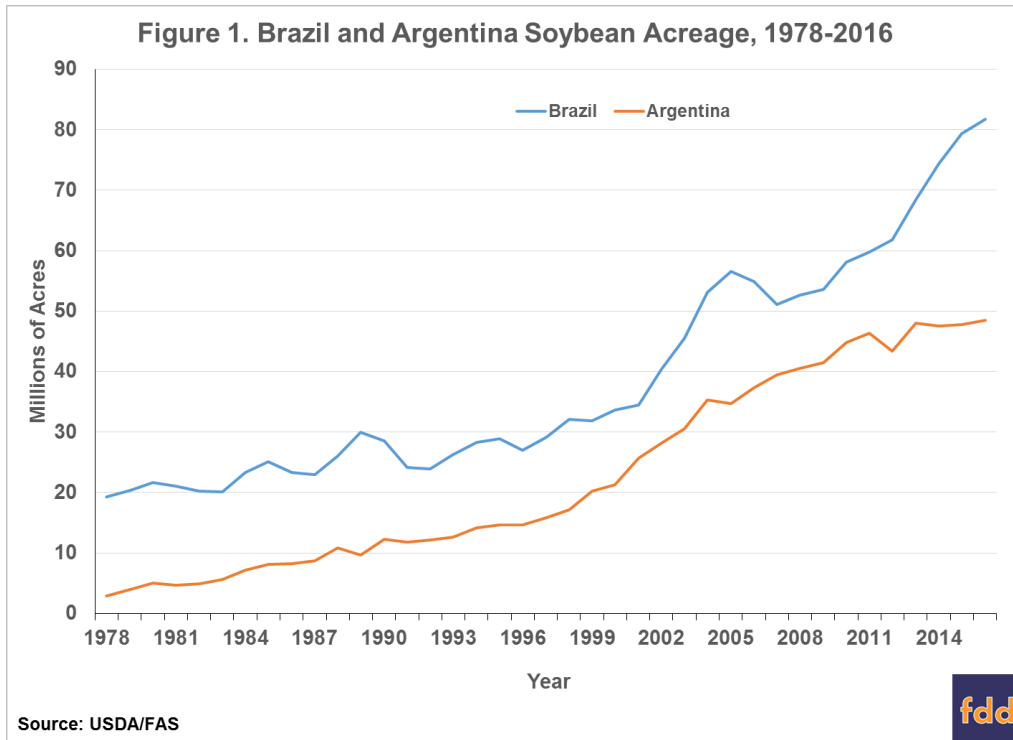
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2003. The linear trend since 1978 explains a much smaller percentage of yield variation than is the case for the U.S. (81 percent) and Brazil (79 percent).

Table 1. Soybean Production by Country, 1971-2016

Year	United States	Brazil	Argentina	Paraguay	China	Other	World	All Foreign
million bushels								
1971	1,127	76	2	3	254	165	1,627	500
1972	1,176	135	3	4	290	126	1,734	558
1973	1,283	184	10	4	320	66	1,867	584
1974	1,547	289	18	7	367	64	2,292	745
1975	1,215	363	18	8	349	54	2,007	792
1976	1,547	413	26	10	367	46	2,409	862
1977	1,288	460	51	14	242	128	2,183	895
1978	1,762	350	99	12	266	154	2,643	881
1979	1,870	557	136	20	278	167	2,847	977
1980	2,261	376	132	21	274	191	3,255	994
1981	1,798	558	129	22	292	176	2,975	1,177
1982	1,989	471	152	22	342	186	3,162	1,173
1983	2,190	542	154	19	332	200	3,437	1,247
1984	1,636	571	257	20	359	213	3,056	1,420
1985	1,861	672	248	35	356	248	3,421	1,561
1986	2,099	518	268	22	386	272	3,565	1,466
1987	1,943	636	257	35	427	303	3,601	1,658
1988	1,938	662	356	40	457	359	3,812	1,874
1989	1,549	852	235	60	428	387	3,506	1,957
1990	1,924	747	395	58	376	445	3,945	2,020
1991	1,926	579	423	48	404	446	3,826	1,900
1992	1,987	709	410	48	357	435	3,946	1,959
1993	2,188	827	417	64	378	434	4,308	2,120
1994	1,871	908	456	66	563	454	4,318	2,447
1995	2,517	952	459	81	588	460	5,057	2,540
1996	2,177	887	457	88	496	487	4,591	2,415
1997	2,380	1,003	412	102	486	474	4,857	2,477
1998	2,689	1,194	717	110	551	545	5,806	3,117
1999	2,741	1,150	735	112	557	577	5,872	3,131
2000	2,654	1,257	779	107	525	527	5,875	3,221
2001	2,758	1,433	1,021	129	566	525	6,432	3,674
2002	2,891	1,598	1,102	130	566	506	6,793	3,902
2003	2,756	1,911	1,304	165	607	500	7,243	4,487
2004	2,454	1,874	1,212	144	565	613	6,862	4,408
2005	3,124	1,947	1,433	149	639	635	7,927	4,803
2006	3,068	2,094	1,488	134	601	723	8,108	5,040
2007	3,197	2,168	1,793	228	587	755	8,728	5,531
2008	2,677	2,241	1,698	254	514	744	8,128	5,451
2009	2,967	2,124	1,176	147	571	803	7,788	4,822
2010	3,359	2,535	2,003	271	550	875	9,593	6,234
2011	3,329	2,767	1,800	262	555	984	9,697	6,368
2012	3,094	2,443	1,473	148	532	1,113	8,803	5,709
2013	3,042	3,013	1,811	301	480	1,229	9,876	6,834
2014	3,358	3,186	1,962	301	439	1,138	10,384	7,026
2015	3,927	3,571	2,256	299	446	1,251	11,750	7,823
2016	3,926	3,546	2,087	331	433	1,189	11,512	7,586

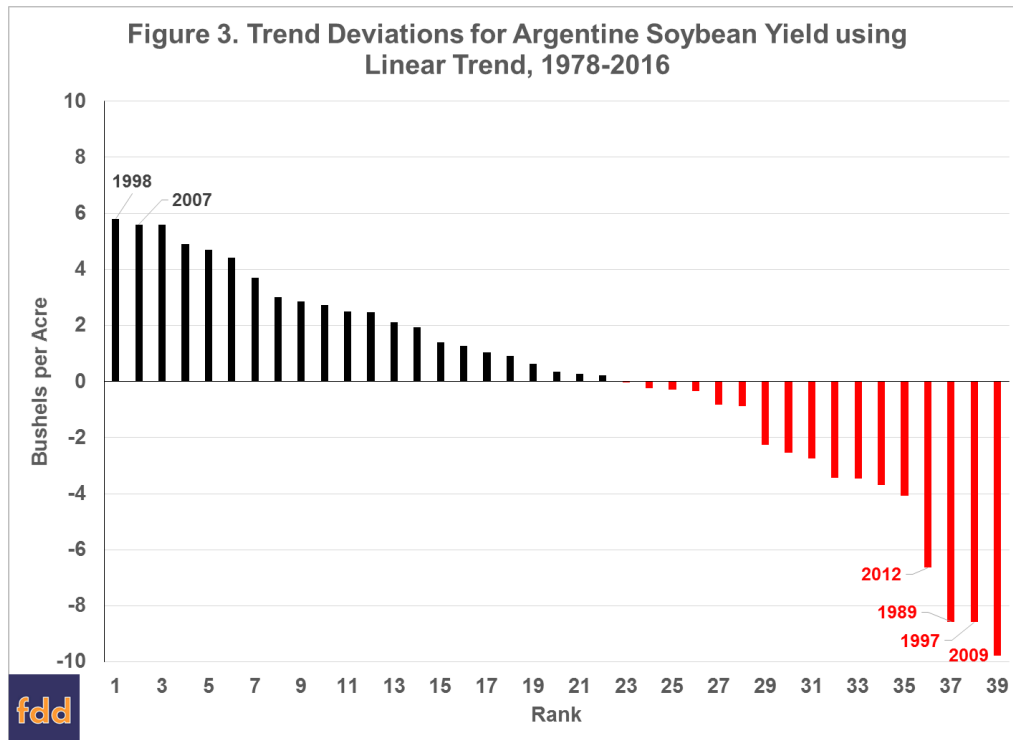
Source: USDA/FAS



Historical Deviations

Historical deviations for Argentine soybean yields for the period 1978 - 2016 are shown in Figure 3. Over the 39-year period, the average soybean yield in Argentina was above trend in 22 years and below trend in 17 years. The largest deviation below trend was 9.79 bushels per acre in 2009. The largest positive deviation from trend was 5.80 bushels per acre in 1998. The average positive deviation was 2.66 bushels while the average negative trend deviation was -3.44 bushels. The deviation from trend is asymmetric with more years of positive trend deviation and larger magnitudes associated with negative trend deviations. This differs substantially from soybean trend deviations for Brazil. Since 2012, Argentinian soybean yields demonstrate a wide variation around trend with significant yield loss in 2012 and a large positive deviation in 2015. Based on the historical trend deviations, the unconditional probability of a negative

deviation is 43.6 percent. If a negative deviation occurs, the unconditional probability of a negative deviation of greater than two bushels is 65 percent, and there is a 29 percent probability of a greater than four-bushel deviation. The probability of a negative yield deviation greater than two (four) bushels, then, is 28 (13) percent. Based on the historical trend deviations, the unconditional probability of a positive deviation of greater than two bushels is 59 percent, and there is a 23 percent probability of a greater than four-bushel deviation. The probability of a positive yield deviation greater than two (four) bushels, then, is 33 (13) percent.



Implications

An examination of the national average soybean yields in Argentina for the period 1978 through 2016 reveals an upward yield trend with substantial annual variation. The estimated linear yield trend points to a 2017 average soybean yield of 42.2 bushels per acre, 1.10 bushels below the 2016 average. Based on the projections of harvested acreage in the USDA's January 12, 2017 *World Agricultural Production* report, yield at trend value for Argentina points to a 2017 crop of 2.03 billion bushels, 57 million bushels (2.73 percent) smaller than the 2016 crop. Using estimates of the historical yield trend deviations, we estimate there is an unconditional probability of 62 percent of a two bushel trend deviation. A trend yield deviation of two bushels per acre would add or subtract approximately 96 million bushels to our projection of Argentina's 2017 production.

The USDA projects the 2017 Argentinian yield at 43.57 bushels per acre (1.37 bushels above the trend value) and production at 2.094 billion bushels, 7 million bushels larger than the 2016 crop. The USDA estimated production level for Argentine soybeans is 64 million bushels larger than implied by a trend yield. Recent reports in Argentina indicate severe flooding in many growing regions with the potential to reduce production by 100-150 million bushels. If the production reduction materializes in Argentina, 2017 will produce yields well below trend estimates. In the next article, we will examine the impact of La Nina events on Brazilian and Argentinian soybean and corn production.

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