

Forecasting Production

**Price Analysis: A Fundamental
Approach to the Study of Commodity
Prices**

Highlights

- Learn the timeline and tools to estimate acreage and yield.
- Learn the relative price of corn versus soybeans contributes to acreage decisions, and thus production.
- Learn basic techniques for forecasting yield before and during the growing season.

Check Your Understanding

- Can you use NASS data for soybeans to forecast production in a similar manner shown for corn?

- We will focus our energy on more data and technical questions of actually forecasting elements of the balance sheet.
 - short term price changes using time-series econometric techniques.

- Our first task in forecasting a balance sheet will be to get a good estimate of production for the marketing year.
 - As we noted before, **Production = Acreage X Yield**. To begin, we will discuss the fundamentals of estimating acreage.

CORN

		<i>Million Acres</i>		
Area Planted	88.0	94.0	90.9	90.9
Area Harvested	80.8	86.7	83.5	83.5
		<i>Bushels</i>		
Yield per Harvested Acre	168.4	174.6	169.5	169.9
		<i>Million Bushels</i>		
Beginning Stocks	1,731	1,737	2,370	2,350
Production	13,602	15,148	14,153	14,184
Imports	68	55	50	50
Supply, Total	15,401	16,940	16,573	16,585

Estimating Acreage

- The forecasting depends on the time of year, we are making the forecast.
- Prior to planting season, we can rely on recent trends in acreage from previous years.
- And, relative profitability of planting competing crops as measured by relative futures prices.

Estimating Acreage (CONT...)

Historical acres planted and harvested can be found from USDA NASS.

- Steps to download historical acreage data:
 1. Go to [https://www.nass.usda.gov/Quick_Stats/Lite/index.php]
 2. Click **Crops** in the menu
 3. In the query, choose **Field Crops**
 4. Choose **Corn**
 5. Click **Acreage, Yield, Production, and Price**
 6. Select the years you want. Hold **Ctrl key** to select multiple.
 7. Click **Get Data**.

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Program

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
1	Program	Year	Period	Week End	Geo Level	State	State ANS	Ag District	Ag District	County	County AN	Zip Code	Region	watersher	Watershe	Commodi	Domain	Domain C	CORN - ACRES PLAN	CORN - AC	CORN, GRAIN - AC COR
2	SURVEY	2015	YEAR		NATIONAL	US TOTAL								0	CORN	TOTAL	NOT SPEC		88,897,000		81,101,000
3	SURVEY	2014	YEAR		NATIONAL	US TOTAL								0	CORN	TOTAL	NOT SPEC		90,597,000		83,136,000
4	SURVEY	2013	YEAR		NATIONAL	US TOTAL								0	CORN	TOTAL	NOT SPEC		95,365,000		87,451,000
5	SURVEY	2012	YEAR		NATIONAL	US TOTAL								0	CORN	TOTAL	NOT SPEC		97,291,000		87,365,000
6	SURVEY	2011	YEAR		NATIONAL	US TOTAL								0	CORN	TOTAL	NOT SPEC		91,936,000		83,879,000
7	SURVEY	2010	YEAR		NATIONAL	US TOTAL								0	CORN	TOTAL	NOT SPEC		88,192,000		81,446,000
8	SURVEY	2009	YEAR		NATIONAL	US TOTAL								0	CORN	TOTAL	NOT SPEC		86,382,000		79,490,000
9	SURVEY	2008	YEAR		NATIONAL	US TOTAL								0	CORN	TOTAL	NOT SPEC		85,982,000		78,570,000
10	SURVEY	2007	YEAR		NATIONAL	US TOTAL								0	CORN	TOTAL	NOT SPEC		93,527,000		86,520,000
11	SURVEY	2006	YEAR		NATIONAL	US TOTAL								0	CORN	TOTAL	NOT SPEC		78,327,000		70,638,000
12	SURVEY	2005	YEAR		NATIONAL	US TOTAL								0	CORN	TOTAL	NOT SPEC		81,779,000		75,117,000
13	SURVEY	2004	YEAR		NATIONAL	US TOTAL								0	CORN	TOTAL	NOT SPEC		80,929,000		73,631,000
14	SURVEY	2003	YEAR		NATIONAL	US TOTAL								0	CORN	TOTAL	NOT SPEC		78,603,000		70,944,000
15	SURVEY	2002	YEAR		NATIONAL	US TOTAL								0	CORN	TOTAL	NOT SPEC		78,894,000		69,330,000
16	SURVEY	2001	YEAR		NATIONAL	US TOTAL								0	CORN	TOTAL	NOT SPEC		75,702,000		68,768,000
17	SURVEY	2000	YEAR		NATIONAL	US TOTAL								0	CORN	TOTAL	NOT SPEC		79,551,000		72,440,000
18	SURVEY	1999	YEAR		NATIONAL	US TOTAL								0	CORN	TOTAL	NOT SPEC		77,386,000		70,487,000
19	SURVEY	1998	YEAR		NATIONAL	US TOTAL								0	CORN	TOTAL	NOT SPEC		80,165,000		72,589,000
20	SURVEY	1997	YEAR		NATIONAL	US TOTAL								0	CORN	TOTAL	NOT SPEC		79,537,000		72,671,000
21	SURVEY	1996	YEAR		NATIONAL	US TOTAL								0	CORN	TOTAL	NOT SPEC		79,229,000		72,644,000
22	SURVEY	1995	YEAR		NATIONAL	US TOTAL								0	CORN	TOTAL	NOT SPEC		71,479,000		65,210,000
23	SURVEY	1994	YEAR		NATIONAL	US TOTAL								0	CORN	TOTAL	NOT SPEC		78,921,000		72,514,000
24	SURVEY	1993	YEAR		NATIONAL	US TOTAL								0	CORN	TOTAL	NOT SPEC		73,239,000		62,933,000
25	SURVEY	1992	YEAR		NATIONAL	US TOTAL								0	CORN	TOTAL	NOT SPEC		79,311,000		72,077,000
26	SURVEY	1991	YEAR		NATIONAL	US TOTAL								0	CORN	TOTAL	NOT SPEC		75,957,000		68,822,000
27	SURVEY	1990	YEAR		NATIONAL	US TOTAL								0	CORN	TOTAL	NOT SPEC		74,166,000		66,952,000
28	SURVEY	1989	YEAR		NATIONAL	US TOTAL								0	CORN	TOTAL	NOT SPEC		72,322,000		64,783,000

Estimating Acreage (CONT...)

- The graph of historical corn **Planted Acres** along with the ratio of **Average Prices Received by Farmers** for corn and soybeans.
- The graph of historical corn **Planted Acres and Harvested Acres** generated from the data described above from 2000 to 2014.
- The left axis shows planted and harvested acres while the right axis shows the difference between the two.
- Since 2000, corn acreage has been increasing steadily from 80 million acres to just above 90 million acres.
- Given this, prior to planting season we might expect a simple trend-line to forecast corn acreage fairly well.
- In a couple of instances, there were fairly large deviations from the trend-line.

Estimating Acreage (CONT...)

- Aside from historical trends, the average corn farmer makes decisions based on relative profitability of planting corn versus planting soybeans.
- In years where profitability favors corn, more corn-on-corn acres will be planted, thus increasing the total number of acres planted to corn.
- In years where profitability favors soybeans, less corn-on-corn acres will be planted, thus increasing soybean acres and reducing the total number of acres planted to soybeans.
- This pattern is demonstrated in 2008 and 2011 when an increase in the corn-to-soybean price ratio corresponded to an increase in planted acres.

Estimating Acreage (CONT...)

- Figure 4 shows, December 2017 and November 2017 corn and soybean futures prices ratio from 10/1/2016 to 5/1/2017.
- This roughly corresponds to the time frame when a farmer must make acreage decisions for the next crop year.
- The acreage decision begins in the fall of the prior year because fertilizer on corn ground is often applied in the fall.
- Assuming inputs costs were constant, forecasts of corn and soybean acreage for Spring 2017 should take into account the changing profitability.
- When corn/soy ratio is **high** and corn becomes more profitable relative to soybeans and vice versa.

Estimating Acreage (CONT...)

- Figure 4 shows, during the fall of 2016, the corn/soy price ratio was falling.
- The acreage expectations should have been shifting slightly from corn toward soybeans.
- In late spring 2017, the corn price gained relative to the soybean price.
- Some corn acres may have been added back at the last minute that were originally planned for soybean acres.
- If we compare the 2017 prospective plantings report (released on 3/21/2017) with the 2017 acreage report (released on 6/30/2017).
- USDA estimated corn acres to be 90 million, but the acreage report showed plantings were nearly 1 million acres higher at 90.9 million

Forecasting Harvested Acres

- After forecasting **Planted Acres** one still needs to provide a forecast for **Harvested Acres**.
- Figure 5 shows historical trends in **Harvested Acres** relative to **Planted Acres**.
- The difference between these two variables is provided in gray with units along with the right axis for convenience.
- Harvested acres tends to be fairly stable number, averaging 7.6 million acres between 2000 and 2014.

Forecasting Harvested Acres (CONT...)

- This variable deviates most from trend corresponds to years of exceptionally poor production.
- In figure 5, 2012 and 2002 as examples. These years marginal reductions in production are explained by reduced yield and abandoned acres.
- Forecasting the harvested acres number accurately becomes very important to accurately forecasting production in shortfall years.

Forecasting Yield

- In forecasting acreage, we have different procedures for forecasting yield prior to planting.
- Before summer, the growing season gets underway and trend yield is usually used.
- USDA has records on yield that go back to 1866.
- When forecasting, the old yield estimates are no longer useful for forecasting current yield.
- Technological progress caused yields to take off in the 1950's and they have been climbing ever since.

Forecasting Yield (CONT...)

- In the forecasting world, this is called **Structural Change** or a **Structural Break**.
- If **Structural Change** has occurred, the world looks so different now than it did before.
- The **Structural Change** the data from before the break which is not useful for forecasting going forward.
- If a trend-line estimate beginning with 1952, 1980, or with pretty much any date in between, you will get an estimate that is roughly similar.

Forecasting Yield (CONT...)

- For Example:
 - Using the trend-line beginning with 1952 to forecast yield we come up with $Yield^{2015} = 1.9066 * 2015 - 3677.9 = 163.899$.
 - While, using the trend-line beginning with 1980 to forecast yield we come up with $Yield^{2015} = 1.8619 * 2015 - 3588.9 = 162.8285$.
 - In other words, yields have been increasing by an average of just under 2 bushels per acre since the 1950's.

Growing Season Yield Forecasts

- The USDA undertakes an extensive effort to estimate yield during the growing season.
- Prior to August, they conduct the **Agricultural Yield Survey** (AYS) which surveys a large number of farmers and asks them to estimate yield.
- Beginning in August, the USDA conducts the **Objective Yield Survey**.
- They take samples from a relatively large number of fields and estimates yield in those fields based on various factors such as:
 - Counts of plants
 - Ears
 - And, pods (for soybeans)

Growing Season Yield Forecasts (CONT...)

- The commodity futures markets respond to new information in the USDA reports.
- Analysts employed by private advisory firms or proprietary trading shops will try to anticipate the USDA's yield forecast.
- It can be capitalized on superior private information by making a well advised business decision or earning speculative profits.
- This is difficult because an independent analyst will not have the same level of resources as the USDA does when it compiles its monthly yield estimates.
- They will have to rely on historical data and an understanding of weather is affecting crop yields across the geographically dispersed growing region.
- Figure 8 plots each year's deviation from trend yield since 1980.
- The first plot is in levels (i.e., $Yield_t - TrendYield_t$); whereas the second plot is in percent terms (i.e., $\ln Yield_t - \ln TrendYield_t$).

Growing Season Yield Forecasts (CONT...)

- Notice that the shape looks roughly the same, but the 2012 drought looks worse.
- Expressed in level deviations that the short crops of 1983, 1988, and 1993.
- The yield is trending higher.
- In percentage terms, the 2012 drought was equally as bad as 1983 and not quite as bad as 1988.

Growing Season Yield Forecasts (CONT...)

- An advanced agronomic model that can take into account planting date, precipitation, or ability to estimate yield from remote sensing technology.
- We will have to resort to the **Similar Year Approach**.
- Analysts often estimate deviations from trend yield by finding year similar to the current one in terms of weather.
- The assumption is, if the weather patterns were similar then the percent deviation from trend yield should be similar as well.
- Percent deviation is preferable so you do not need to adjust for increasing trend in yield as you look backward to a similar year.

Growing Season Yield Forecasts (CONT...)

- An alternative approach would be to use the **Crop Condition Report** and find a year in recent history.
- It had a similar percent of the crop rated **Good/Excellent**.
- Figure 9 shows how **Good + Excellent** crop condition ratings relating to the percent deviations in trend yield.
- They should be at least positively correlated, and in fact starting in the late 90's.
- This measure began to correlate strongly with the final yield.

Forecasting Production

- Once you have an estimate for acreage and yield, you can multiply them to give you an estimate of production for your balance sheet forecast.

Conclusion

- We reviewed the basics of forecasting production and forecasting acreage.
- Both Forecasting yields, before and during the growing season.
- We discovered that estimating yield percent deviations from trend better than the USDA is extremely difficult.
- Even anticipating whether the yield forecast will go up or down is not an easy task.
- The **Similar Year Method** has its limitations when used to find similar years in terms of weather or crop conditions ratings.

Exercises

1. Use NASS data for soybeans for forecast production in a similar manner we we did in class for corn.
2. Read and Discuss: **Early Planting and 2015 Corn Yield Prospects: How Much of an Increase?**

(<http://farmdocdaily.illinois.edu/2015/05/early-planting-and-2015-corn-yield-prospects.html>)

CHAPTER END

