FARM BUSINESS MANAGEMENT

FARM ECONOMICS Facts & Opinions

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Corn Returns versus Soybean Returns: Do Farms Differ?

Farmers enrolled in Illinois Farm Business Farm Management (FBFM) have the option of receiving detailed enterprise reports by allocating whole-farm revenues and expenses to their various crop and livestock enterprises. This *Facts and Opinions* article summarizes results for farmers who produce corn and soybean enterprise reports. The goal of this summarization is to identify whether relative profits of corn and soybeans vary across farms. Also, factors that cause return differences are identified.

Data Used in the Report

Data are for the years from 1997 through 2003. For each year, farm numbers in the summaries vary, ranging from a low of 125 farms in 1997 up to a high of 173 farms in 2000 (see Table 1). These farm numbers are low and, as a result, caution should be used in extrapolating results to a larger population of farms. However, the analysis sheds light on profitability differences across farms in this study.

Enterprise results are reported in Table 1. Panel A shows results for corn and Panel B shows results for soybeans. In both panels, the respective crop's yield per acre and value per bushel are shown. Value per bushel includes all crop sales and loan deficiency payments (LDPs). Crop sales figures are summarized from enterprise reports. FBFM, however, does not divide LDPs between corn and soybean enterprises. LDPs in Table 1 are estimated based on average per bushel LDPs received in Illinois.

In Table 1, value per acre equals yield per acre times value per bushel. The goal in constructing value per acre is to include all revenue that varies with crop planted. Not included are revenues that do not vary with crop planted such as Agricultural Marketing Transition Act payments, direct payments, counter-cyclical payments, and patronage dividends.

Table 1 includes categories for crop costs (fertilizer, seed, pesticides, drying & storage), power costs (utilities, machine repair, machine hire, fuel & oil, light vehicle), and overhead costs (interest, hired labor, building repair, insurance, taxes, and miscellaneous costs). These costs are accrued expenses and do not include opportunity costs (e.g., unpaid labor, equity capital, or management fees). The interest charge in overhead is for interest on debt capital.

Return above non-land costs, the final line in each Panel, equals total value minus total non-land costs. This return provides a measure of the profits from each crop. Land costs are not included in the return because land costs do not vary whether corn or soybeans are grown.

"Return differences" are reported at the bottom of Table 1. Return differences equals return above non-land costs for corn minus return above non-land costs for soybeans. Positive values indicate that the corn enterprise is more profitable than the soybean enterprise while negative values indicate that the soybean enterprise is more profitable.

Table 1. Corn and Soybean Returns for Farms Enrolled in Illinois FBFM Who Allocate Returns and Costs to Corn and Soybean Enterprises, 1997 - 2003.

	Year						
	1997	1998	1999	2000	2001	2002	2003
No. of farms	125	141	168	173	168	144	154
Panel A. Corn							
Yield per acre	138	145	157	155	162	159	168
Value per bu.	2.54	2.19	2.16	2.24	2.16	2.36	2.31
	$ per acre						
Total value	$352	$317	$339	$346	$351	$375	$388
Crop costs	144	137	134	131	150	147	147
Power costs	58	42	60	70	67	70	58
Overhead costs	54	62	54	60	57	53	52
Total non-land costs	$256	$241	$248	$261	$274	$270	$257
Returns above non-land costs	$96	$76	$91	$85	$77	$105	$131
Panel B. Soybeans							
Yield per acre	49	48	50	48	49	52	37
Value per bu.	6.69	5.70	5.79	5.90	5.72	5.50	7.02
	$ per acre						
Total value	$331	$273	$288	$282	$281	$288	$263
Crop costs	75	79	73	71	70	71	70
Power costs	55	39	59	65	64	66	53
Overhead costs	51	57	53	57	57	50	49
Total non-land costs	$181	$175	$185	$193	$191	$187	$172
Returns above non-land costs	$150	$98	$103	$89	$90	$101	$91
Return Differences[1]	-$54	-$22	-$12	-$4	-$13	$4	$40

[1]Corn returns above non-land costs minus soybean returns above non-land costs.

Over time, corn's profitability has increased relative to soybeans (see Table 1). Return differences are negative during the first three years of the time period: -$53 in 1997, -$21 in 1998, and -$12 in 1999. The difference is positive in the last two years: $3 in 2002 and $40 in 2003. This trend is partially responsible for the discussion concerning whether farmers will switch to more corn in the future. More corn may be planted because corn is becoming more profitable than soybeans.

Variability in Return Differences

Considerable variability exists in the return differences across farms. In 1997, return differences averaged -$53 per acre for the 125 farms in the summary. Of the 125 farms, 20% had return difference below -$100 per acre, indicating that the soybean enterprises were $100 per acre more profitable than corn enterprises on these farms (see Table 2). At the same time, 18% of the farms had positive return differences indicating that corn enterprises on these farms were more profitable than soybean enterprises.

Table 2. Distribution of Corn Minus Soybean Returns, Illinois FBFM Farms Who Allocate Returns and Costs to Corn and Soybean Enterprises, 1997 - 2003.

	Year						
	1997	1998	1999	2000	2001	2002	2003
	Percent of Farms						
Less than -$100	20	14	8	3	5	5	3
-$100 to -$75	10	14	5	3	6	5	3
-$75 to -$50	20	13	10	8	16	7	6
-$50 to -$25	18	13	18	14	11	10	6
-$25 to $0	14	14	20	18	26	19	9
$0 to $25	10	13	16	25	15	22	13
$25 to $50	6	6	10	17	10	13	10
$50 to $75	2	2	6	5	5	7	21
$75 to $100	0	7	2	5	3	5	12
Greater than $100	0	4	5	2	3	7	17

As can be seen from Table 2, there is considerable variability in all years. In each year there are a significant number of farms whose corn enterprises are more profitable than soybean enterprises and vice versa. For example, return differences were positive for 18% of the farms in 1997, 32% in 1998, 39% in 1999, 54% in 2000, 36% in 2001, 54% in 2002, and 73% in 2003.

Dispersion of returns across farms points out the danger of only relying on averages to describe profitability differences between corn and soybeans. In any given year, some farms have more profitable soybean enterprises than corn enterprises and vice versa.

Consistency of Return Differences over Time

We examined whether farm's consistently have above or below average return differences over time. Consistency may indicate that some management or farm factor explains return differences. It could be that some farms are better soybean producers than corn producers, for example. On the other hand, if relative return differences are not consistent across farms, returns differences are likely due to random chance.

Contingency tables were constructed to examine this issue. In each year, farms were divided into two groups: one group with above average return differences and the other group with below average return differences. In each year, 50% of the farms were in the above average group and 50% were in the below average group. Percent of farms moving between groups were then calculated.

Results averaged over all years are shown in Table 3. The top row of the Table 3 shows transitions for the above-average return group. Of the farms in the above-average group, 59% ended in the above-average group in the next year while 41% transitioned to the below-average group. Of the farms in the below-average group, 59% ended in the below-average group and 41% in the above-average group.

In interpreting Table 3, a high-degree of consistency in return differences across farms would be indicated by having no transitions between groups. In other words, the above-average to above-average group transition and the below-average to below-average group transition would equal 100%. In Table 3, the upper-left and lower-right boxes would equal 100% and the upper-right and lower-left boxes would equal 0%. If there is no consistency, being in one group in the current year indicates nothing about the group in the following year. In this case, all boxes in Table 3 will contain 50%.

Percentages in Table 3 indicate mild consistency across years. Percentages in same group movements are closer to 50% than 100%. This indicates that management factors play some role in relative return differences. However random factors, such as relative yield and price changes, have more influence.

Table 3. Contingency Table of Return Differences, Illinois FBFM Farms, 1997 - 2003.

Difference Group in Current Year	Return Differences in Next Year: Above-Average	Return Differences in Next Year: Below-Average
Above-Average	59%	41%
Below-Average	41%	59%

Characteristics of Return Difference Groups

We next evaluated whether farm, yields, and cost characteristics vary with returns difference. This is accomplished by dividing farms into three groups. Each year, all farms are placed into one of three groups. The "High Corn Returns" group contains the one-third farms that have the highest return differences. The "High Soybean Returns" group contains the one-third farms with the lowest return differences. The "Mid" group is in the middle. Averages of soil productivity ratings, size, yields, and costs were calculated for each group and statistical tests were conducted to see if averages varied across groups. Results were calculated for each year separately, for all years as a group, and for a select group that was in the sample at least 4 years. Results were qualitatively the same for all different analysis; therefore, only results for the average of all years are presented in Table 4.

In Table 4, the "statistical different" column indicates whether averages across groups were different from a statistical standpoint. In the following discussion, values are not treated as different unless indicated by the statistical test.

Soil productivity ratings are significantly different across groups (see Table 3). Farms in the "High Corn Profits" group had higher average soil ratings, indicating that their farmland had higher yield potential. Differences, however, are not large. The high corn profits group has a soil productivity index of 84 compared to 81 for the high soybean profits group.

Tillable acres are not significantly different across groups, indicating that size does not play a role in return groups. Livestock returns also do not vary with return group. Livestock returns equals livestock revenue minus feed costs divided by operator acres. Livestock returns were included to see if the inclusion of livestock on farms changes relative profitability of corn and soybeans. Insignificance indicates that livestock did not change relative profits.

Corn and soybean yields are significantly different across returns group. The "High Soybeans Profits" group had higher soybean yields (49 bushels) then the "High Corn Profits" group (46 bushels). Moreover, the "High Soybean Profits" group had lower corn yields (146 bushels) then the "High Corn Profits" group (162 bushels).

Also crop costs are significantly different across groups. Corn crop costs were higher for the "High Soybeans Profits" group ($151 per acre) compared to the "High Corn Profits" group ($130 per acre). Soybean crop costs were significantly lower for the "High Soybeans Profits" group ($57) compared to the "High Corn Profits" group ($81 per acre).

Table 4. Comparison of Farm, Yield, and Costs Characteristics Across Return Difference Groups, Illinois FBFM Farms, 1997- 2003.

		Group[1]			
	Unit	High Soybean Profits	Mid	High Corn Profits	Statistically Different[2]
Soil productivity rating	index	81	83	84	Yes
Tillable acres	acres	940	990	934	No
Livestock returns	$/acre	27	21	19	No
Corn yield	bu./acre	146	157	162	Yes
Soybean yield	bu./acre	49	48	46	Yes
Yield ratio		3.00	3.38	3.60	Yes
Corn crop cost	$ per acre	151	142	130	Yes
Soybean crop cost	$ per acre	66	71	81	Yes
Corn power cost	$ per acre	62	62	61	No
Soybean power cost	$ per acre	57	58	60	No
Corn overhead cost	$ per acre	57	56	56	No
Soybean overhead cost	$ per acre	53	53	57	No
Corn return less non-land costs	$ per acre	52	95	134	Yes
Soybean return less non-land costs	$ per acre	125	100	75	Yes
Return differences	$ per acre	-74	-6	58	Yes

[1] Each year, a farm is placed into groups containing one-third of the farms. The "High Corn Profits" group contains the one-third of the farms that have the highest corn minus soybean return and hence have relatively higher corn profits. The "High Soybeans Profits" contain one-third of the farms that have high soybean profits relative to corn profits.

[2] A statistical test was conducted to see if the profit groups have different means. A "Yes" indicates that the hypothesis of the same means is rejected.

Power cost and overhead costs are not significantly different across return difference groups. This indicates that returns differences are not due to power or variable costs.

Two implications are drawn from Table 1. First, farms with higher relative corn returns tended to have higher productivity farmland. Second, return differences are more influenced by yields and crop costs than by power and overhead costs. Power and overhead costs are more related to overall cost control, suggesting that cost control is not important in determining relative crop return differences. Yields and variable costs are influenced by production management. Hence, production management may play in relative crop enterprise profitability. However, yields and variable costs are also influenced by factors such as pest and weed pressures that may not persist over time. Thus, not all of the return differences between corn and soybeans can be attributed to management.

Summary and Implications

Variability and consistency of differences in corn and soybean returns are examined in this report. In addition, factors that cause farmers to have more profitable corn or soybean enterprises are examined. From this study, the following four implications are drawn:

1. Between 1997 and 2003, corn returns have increased relative to soybean returns. Whether or not this trend continues is an open question. The trend explains why some farmers are considering planting more corn. If the trend continues, more farmers should examine a switch to more corn.

2. Farms with farmland with higher productivity tend to have higher corn returns relative to soybean returns. This soil productivity and profitability link, however, is weak and does not apply to all farms.

3. Some farmers may be better corn producers than soybean producers and vice versa. One year of return results, however, should not be used to judge whether a producer is a better manager. Considerable variability exists in return differences across years.

4. We strongly suggest that farmers track yields and costs by corn and soybean enterprise. Sufficient evidence suggests that relative returns from corn and soybean enterprises may differ across farms. One year of enterprise reports, however, may not be sufficient to determine long-run returns because of the variability that exists in return differences.

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