Testing for Yield Persistency: Is It Skill or is It Luck?

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Abstract

This study uses corn yield data from McLean County, Illinois to test whether farmer skill influences yields. This analysis is conducted by performing persistency tests on unadjusted, soil productivity adjusted (PA), and productivity and input intensity adjusted (PIA) yields. Correlation analysis and winner/loser tables indicate that unadjusted, PA, and PIA yields exhibit persistency across time. PIA yields exhibiting persistency is consistent with farmer skill influencing yield. Hence, our results support the hypothesis that farmer skill influences yields.

There often is an implicit or explicit assumption that farmers can influence yield performance through skill. Recently, for example, Goodwin et. al. hypothesized that as farmers introduce new crops on their operations they will "learn-by-doing" and increase yield over time as they gain experience with the crop. Their econometric results support this hypothesis. The "learning-by-doing" hypothesis also suggests that skill can vary across farmers. If a farmer can learn, it is also quite possible that farmers can learn at different rates. Learning at different rates implies that some farmers could get consistently higher yields than other farmers given the same soil resources and use of inputs. This yield difference can be attributed to farmer skill.

The degree to which farmers have different skill levels in growing crops is important for a number of agencies and groups. If yields differ systematically across farms, this information should be used to accurately set rates for crop insurance products; hence, the Federal government and crop insurance companies have an interest in the question (Goodwin et. al.). Lenders and other investors sometimes use yield levels as a proxy for management. Yields, for example, are used in credit scoring models that rate farmers' credit worthiness (Zech and Pederson). Moreover, agricultural economists have used yields for proxies in management studies (Sonka, et. al.). Lenders and agricultural economists will be interested in the degree to which skill influences yields, thereby providing evidence concerning the usefulness of the yield proxy.

This research addresses the following question: Can some farmers continuingly outperform other farmers in terms of yields because of skill? To our knowledge, no formal research study has addressed this question. In addressing this question, factors such as soil productivity and input use are controlled for when conducting tests to see if some farmers have continually higher yields than other farmers. The testing approach uses well known methods used in the financial literature to see if performance of some financial instruments continually outperforms other financial instruments. More detail on the approach is provided in the following section. Then the dataset used to conduct the test is described. Results and conclusions follow.

Conceptual Approach

In this study, yields are thought of as being conceptually influenced by three sets of factors: soil productivity, input use intensity, and farmer skill. In other words, yield (y) can be written using the following production function:

$$y = f(\text{soil productivity, input use, farmer skill}) \tag{1}$$

where $f(\cdot)$ is a production function. Some soils are inherently more productive than other soils. Hence, given the same input use, a more productive soil will yield more than a less productive soil. Input use relates to input such as fertilizer, seed, and chemicals. Different levels of input use will result in different yields. Farmer skill relates to the ability of a farmer to combine soil resource and inputs in an efficient manner. A farmer with higher skill will have more yield than a farmer with lower yield given the same soil resources and input use.

A major problem with implement an investigation using a production function in (1) is specifying a variable that can proxy for farmer skill. There are no immediately available variables to measure farmer skill. Many variables that would proxy for skill involve profit. However, profit is an accounting identity that includes yield as one of its determinants. Hence, including profit as an independent variable would include the dependent variable as a regressor in an econometric model. Another potential variable is costs. However, costs are related to input use and hence you would have a collineraty problem with the input use variables.

Instead of approaching the issue as a production function problem, well established methods are employed that have been used to examine whether commodity and mutual funds exhibit persistent returns over time (e.g., Elton, Gruber and Rentzler, 1987; Irwin, Zulauf and Ward, 1994; Lakonishok, Shleifer and Vishny, 1992; Malkiel, 1995). In these approaches, returns from a series of investments can first be adjusted to reflect the impacts that other factors have on returns. In mutual funds, for example, adjustments can be made for risk. Then, returns from one time-period are compared to another time period using methods such as correlation analysis and contingency tables. If funds consistently outperform other funds over times, then there is performance persistence that is often attributable to skill.

These methods are applied to three different sets of yield series. The first set is raw yields. Raw yields are expected to exhibit to exhibit persistency across time which can be attributed to any of the three factors in the production function in (1): soil productivity, input use intensity, and farmer skill. The second set of yields is soil productivity adjusted yields (*pay*). Productivity adjusted yields are determined by first estimating a regression model relating yields to soil productivity (*spr*):

$$y = f(spr) \tag{2}$$

and then calculating a productivity adjusted yield for each farm *i* at time *t* ($pay_{i,t}$) in the following manner

$$pay_{i,t} = y_{i,t} + f(spr_{a,t}) - f(spr_{i,t}) \tag{3}$$

where $y_{i,t}$ is yield of farm i in year t, $spr_{a,t}$ is the average soil productivity ratings of the all farms at time t and $spr_{i,t}$ is soil productivity of farm i at time t. Persistence in *pay* implies that either input use intensity of farmer skill results in some farmers have higher yields than other farmers. Since farmers have control over input use, this analysis indicates whether yield persistence is related to farmer controllable factors. The third set of yields is productivity and input intensity adjusted yields (*piay*). Productivity and intensity adjusted yieds are determined by estimating a regression model relating yields to soil productivity and a vector of input variables (*inp*):

$$y = f(spr, inp) \tag{4}$$

and then calculating a productivity and input intensity adjusted farm for each farm *i* at time *t* ($piay_{i,t}$):

$$piay_{i,t} = y_{i,t} + f(spr_{a,t}, inp_{a,t}) - f(spr_{i,t}, inp_{i,t}). \tag{5}$$

Persistence of productivity and input intensity adjusted yields indicates that farmer skill influences yields.

In order to analyze whether some farmers consistently outperforms their peers, Spearman rank correlation and Pearson correlation between adjacent periods will be computed. A positive correlation coefficient between year *t* and year *t* + 1 would indicate that farmers with high yield last year are likely to achieve high yields next year as well. This analysis will show persistency in the short run only. This study will also examine whether persistency is a longer term phenomenon. Average yields of two- and three-year will be computed, and then the correlations between adjacent two and three year periods will be calculated. This would indicate whether the average performance of the last years is indicative of the average performance in the coming years.

An alternative way of analyzing persistency is to see which percentage of farmers win or lose in competition with their peers. In this our analysis, winning (losing) farmer are defined as those who achieve above-median (below-median) yields in any given year. Percentages of repeated winners for a single two-year period are computed.

Data and Econometric Estimation

Data for this analysis come from Illinois Farm Business Farm Management (FBFM), a record-keeping and financial analysis service that operates in Illinois. Data were obtained for one county in Illinois to minimize the impacts of geography and weather on yields. Limiting these factors allows focus on farmer skill. The county selected for the analysis is McLean County, a county near the center of Illinois. McLean County was selected because FBFM has a large number of farmers enrolled in this county. Thus, this choice allows for a high number of observations.

Corn and soybeans are the predominate crops grown in McLean County. It was decided to focus attention on corn. Corn was selected over soybeans because of the commonly held perception that corn requires more management than soybeans. Hence, skill is more likely to be observed in corn production than in soybean production. In terms of yield per acre, McLean County is an above average county in the state and the nation. For 1996 through 2002, the average corn yield in McLean County was 153 bushels per acres, compared to 140 bushels per acre for Illinois and 132 bushels per acre for the United States.

Yields were obtained for farms for the years between 1996 through 2002. FBFM data prior to 1996 is summarized in a different manner; hence, there are comparability issues between data before 1996 and after 1996. Because of these comparability issues the analysis only goes to 1996. Yields are for the total farm and not for a specific field. Hence, as farms change acreages, farmland that is used to calculate yield per acre changes.

For its farms, FBFM calculates a soil productivity rating (*SPR*). The *SPR* is based on maps of soil types on each farm. In Illinois, each soil type is given a yield potential. The *SPR* is an average of yield potential on a farm weighted by the soil types within the farm. The *SPR* is an index that ranges from 40 to 100, with 100 being representative of the most productive soils. A farm's *SPR* will not change unless the acres in its farming operation changes. If the acres change, a new *SPR* is calculated.

The *SPR* was used in the regression relating yield to soil productivity (equation (2)). A polynomial expression relating *SPR* to yield was chosen because of the flexibility of the polynomial in fitting yields. Higher order polynomials were estimated and the quadratic was judged as the best fitting model. Data across years were pooled and dummy variables were included for variables to allow for differences in weather to influence yields. The final estimating equation is:

$$y_{i,t} = \alpha_o + \alpha_1 SPR_{i,t} + \alpha_2 SPR_{i,t}^2 + \sum_{t=1997}^{2002} \beta_t Dum_t + u_{i,t} \qquad (6)$$

where α and β are parameters to be estimated, *Dum* is a dummy variable for year, and $u_{i,t}$ is an error term.

FBFM does not collect levels of input use. It does however collect costs of per acre cost of various inputs. Hence, cost shares are used to proxy the input intensity variables. In this analysis, the following input intensity variables were collected:

1. *FERT* = per acre fertilizer costs. This is the average per acre amount the farm spends on fertilizer. Higher levels of fertilizer costs should indicate higher levels of fertility. Hence, the expected sign of this variable is positive.
2. *SEED* = per acre seed costs. This is the average per acre amount the farm spends on seed. Overall, higher level of seed expense may indicate higher quality of seed purchased or higher amounts of seed applied per acre. The expected sign is positive.
3. *PEST* = per acre pesticide costs. This is the average per acre amount the farm spends on pesticides including herbicides, insecticides, and fungicides. Higher levels may indicate more investment in crop protection which may translate into higher yields. The expected sign is positive.
4. *MACH* = per acre machine costs. This is the average per acres amount the farm spends on machinery related items (repairs, depreciation, machine hire). Higher amounts may indicate that the farm has a larger equipment complement that may allow for more timely planting and harvest. The expected sign is positive.
5. *ACRES* = number of tillable acres. Larger farms may have access to more technology and expertise than smaller farmers. Input suppliers likely will spend more time and

expend more effort servicing larger farmers. Hence, yields may exhibit a positive relationship with size.

The above input intensity variables were used in the regression equation estimating how soil productivity and input intensity variables influence yields. Input intensity variables were added in a linear fashion resulting in the final estimating equation:

$$\begin{aligned} y_{i,t} &= \alpha_o + \alpha_1 SPR_{i,t} + \alpha_2 SPR_{i,t}^2 \\ &+ \sum_{t=1996}^{2002} \beta_t Dum_t + \delta_i FERT_{i,t} + \delta_2 SEED_{i,t} + \delta_i PEST_{i,t} + \delta_2 MACH_{i,t} + \delta_5 ACRES_{i,t} + u_{i,t} \end{aligned} \tag{7}$$

where δ are parameters to be estimated.

The average number of farms present during the sampling period in the FBFM database is 265 and ranges from 235 to 280. A subset including only the farms present on all seven years was constructed. This subset includes 167 farms, giving a total of 1169 farm level observations for each variable. It is possible that farmers with low skills are naturally eliminated from our database as their farms go out of business. This might create substantial survivorship biases, filtering to the dataset only highly skilled farmers that are able to maintain high yields through time. Therefore, in the result section we discus the possibility of survivorship bias in our sample.

Results

Descriptive Statistics: Table 1 shows summary statistics for yields within the sample. Mean yields vary considerably from year-to-year. The highest mean yield of 168 bushels per acre occurred in 1999 while the lowest yield of 146 bushels per acre occurred in 1997. Mean yields in the sample closely track county average yield as reported by the

National Agricultural Statistical Service (NASS). Mean yields in the sample are between three and seven bushel higher than NASS-reported county yields.

Farm yields within a year vary considerable. The average standard deviation ranges from 14 (1997) up to 18 bushels (1996). Also reported for each year is the minimum and maximum farm yield. In 1996, for example the minimum yield was 94 bushels per acre and the maximum was 196 bushels per acre. This variable suggests that, even within a small geographical area, farm yields can vary considerably.

Survivorship Bias and Attrition Effects: It is well known in the finance literature that empirical measures of performance persistency may suffer from survivorship bias (Malkiel 1995; Carpenter and Lynch, 1999). This occurs because poor performers are eliminated from business and normally they are not included in most databases available for research. In our sample, this type of bias would likely cause an overstatement of yields obtained by farmers. However, this problem is typical of mutual fund database in which the entry and exit rate of funds is fairly high. Malkiel (1995) reports average mortality rates of 14.2% with a maximum rate of 17.8% when analyzing equity mutual funds. Carhart et al. (2002) uses a dataset including a total of 2071 mutual funds, of which only 1346 were still active by the end of their sampling period. In contrast, the sample used in this study is much more stable. Our average mortality rate is of only 6.9% with a maximum of 16.3%. Moreover, entry rates in our sample are equally low, with an average entry rate of 5.8% and a maximum of 10.9%.

Another major difference between financial persistency measures and the one developed here is the motivation for ceasing to be part of the data record. Usually, hedge, mutual or commodity funds exit the database because they go out of business. In the case of farmers, several reasons other than going bankrupt may cause them to exit our database. It can be easily verified that individuals exiting the sample are on average as good at farming as the ones remaining in throughout the sampling period by comparing the yields of the whole group with the yields of the ones present in all the years (Table 2).

As expected differences in mean yield are negligible; none of these differences are statistically significant. Although obtaining high yields is not a sufficient condition to be a profitable producer, results in table 2 suggest that farmers exited out database because of reasons other than going out of business. The stability of our sample and the comparison of mean yields of farmers present in all years and the whole group of farmers imply that survivorship bias effects can be considered negligible.

Another possible effect, common in finance research, is that the accumulation of capital by the successful funds leads to the attrition of the poor performers, which in turn changes the composition of the sample. In our sample, attrition effects can be safely ignored given the low mortality rate recorded guarantees a stable composition of our dataset throughout the period analyzed.

SPR and Input Intensity Regressions: Regression results for equations (6) and (7) are shown in table 3. Both equations were estimated using weighted least squares because diagnostic statistics indicated that heteroscedasticity was a concern. For the model only including *SPR*, all coefficients except for the dummy variable for 2001 (Dum_{2001}) are significant. Dummy variables largely capture the difference in mean yields from the base year of 1996. Mean yields for 1996 and 2001 are virtually same (163 for 1996 and 2001 (see table 1)); hence, the dummy for 2001 is not significant. The intercept, *SPR*, and SPR^2 terms imply a concave relationship between yields and *SPR*. For the base year of 1999, regression coefficients indicate that a *SPR* of 80 has an expected yield of 156.6 bushels. Yields increase up to an SPR of 93 where expected yield is 167.0. All *SPR*s between 93 and 100 have expected yields between 167 and 167.5. The adjusted r-square is .2818.

The last two columns of table 3 show results for the regression model including both soil productivity and input intensity variables. Note that the *PEST* variable is not included in table 3. The PEST coefficient was insignificant and its sign was negative. Intuition behind a negative sign is counter-intuitive. Since the model is used to adjust yields, the *PEST* variable was dropped and the model was re-estimated. The *MACH*, and *ACRES* variables are positive and significant. While significant, magnitudes of *ACRES* and *MACH* do not suggest large economic implications. For example, a 1,000-acre increase in farm size results in a yield increase of only 2.3 bushels per acres. Overall, the input intensity explains little yield variability. The adjusted r-square of the SPR and input intensity regression is .2877, an increase .0059 from the model that only included soil productivity (see table 3).

Correlations: Spearman rank correlations for unadjusted, productivity adjusted (PA), and productivity and input adjusted (PIA) yields are shown in Table 4. Pearson correlations for the same series of yield are presented in Table 5. When the same qualitative conclusions can be drawn from any set of correlation coefficients, rank correlations have some statistical advantages (i.e., it does not assume a linear relationship between variables), thus our discussion is based solely on Spearman rank correlation.

As shown in Panel A, rank correlation coefficients between adjacent years are all significant and positive. Rank correlations for unadjusted yields vary between the adjacent years and have an overall average of .539. Rank correlations for PA yields average .556

and for PIA yields average .553. These results indicate that even after adjusting for soil productivity and input use intensity, some farms still have consistently higher yields than other farmers. These results strongly support farmer skill having an influence on yields.

Long term persistency tests are shown in Panels B and C. Note that there is an increase in rank correlations as the length of the averaging period increases. PIA yields, for example, have an average correlation of .553 for adjacent years, .683 for adjacent two-year periods, and .725 for adjacent three-year periods. These results indicate that persistency, and by inference farmer skill, lasts for relatively long periods.

Winner/Loser Analysis: In this section, persistency is analyzed by constructing two-way tables showing successful performance in subsequent years. In the tables that follow, a winner (loser) is defined as a farmer that has achieved corn yields above (below) the median yield for each year. Table 6 shows the number of winners and losers conditional on last's year performance based on unadjusted yields. On average, the percentage of repeated winners is higher than 67%, the null hypothesis that winner and loser are randomly determined is rejected in all years[1].

Similar results are obtained using PA yields (Table 7). In all year, the null hypothesis of randomly determined relative yields is rejected. On average, repeat winners average 68.44 percent, approximately equal to the 67% repeat winners for unadjusted yields. Similar analysis with PIA yields (Table 8) indicate that repeat winners average 67%. These results yield qualitatively the same conclusions as the correlation analysis shown in the previous section and support the hypothesis of farmer skill influencing yield.

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[1] Following Malkiel, the *z*-test for repeated winners is constructed assuming that winner or loser is determined randomly. If so, we would expect the random variable "number of repeated winners", Y, to follow a binomial distribution. Accordingly, the *z*-test is constructed to test whether the probability of repeated winner, p, is consistently higher than 1/2. The variable $Z = (Y - np) / (np(1- p))^{0.5}$, will be approximately distributed as a standard normal, with our sample size.

Conclusions

This study has analyzed whether yield persistency exists in farmer yields. We have examined the possibility of having survivorship bias and attrition effects in our results. Once these effects have been rule out based on the characteristics of our sample, yields are adjusted to consider the impacts that soil productivity and input intensity has on yields. Persistency tests are conducted in unadjusted, productivity adjusted (PA), and productivity and input intensity adjusted (PIA) yields. Correlation coefficients and winner/lower tables indicate that all unadjusted, PA, and PIA yields exhibit persistency. The fact that PIA yields exhibit persistency strongly supports the hypothesis that farmer skill influences yields. Our findings also suggest that performance is persistent in the long term.

Farmer skill has a number of implications. First, training and learning, even on a well established crop such as corn, can lead to more efficient production. Second, farmer skill suggests that production function estimation, without including some variables to measure farmer skill, have missing variables. Third, agency such as crop insurance agencies and lenders are correct in focusing on yields as a measure of farmer ability.

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Table 1. Descriptive Statistics on Yields, McClean County, Illinois, 1996 - 2002.

Year	Mean	Standard Deviation	Minimum	Maximum
1996	163	18	94	196
1997	147	14	91	178
1998	152	16	83	187
1999	168	17	97	203
2000	159	14	115	189
2001	163	16	94	196
2002	150	17	83	190

Table 2. Comparison of Mean Yields Farmers Present in All Years and for All Farmers Present in the DataSet, McLean County, Illinois, 1996 - 2002.

Year	Farmers Present in all Years Mean Yield	All Farmers Present in the Dataset Mean Yield	Paired t-test for differences between the survivors and the whole group
1996	163	162	-0.376
1997	147	146	-0.080
1998	152	153	-0.485
1999	168	168	-0.302
2000	159	158	0.515
2001	163	163	-0.848
2002	150	149	-0.338

Table 3. Regressions of Soil Productivity and Input Intensity Variables on Yields, McLean County, Illinois, 1996 - 2002.

Variable Names[1]	SPR-only Coefficent	SPR-only Standard Error		SPR and Input Intensity Coefficent	SPR and Input Intensity Standard Error	
Constant	-195.4500	55.0500	*	-172.3400	53.4800	*
SPR	7.4967	1.2380	*	6.7436	1.2570	*
SPR^2	-0.0387	0.0722	*	-0.0344	0.0073	*
Dum_{1997}	-16.0380	1.5860	*	-16.2520	1.5890	*
Dum_{1998}	-10.6290	1.5870	*	-10.7480	1.6200	*
Dum_{1999}	5.4257	1.5880	*	5.7830	1.6700	*
Dum_{2000}	-4.0663	1.5870	*	-3.7028	1.6610	*
Dum_{2001}	-0.3021	1.5870		-0.3828	1.6480	
Dum_{2002}	-13.9960	1.5880	*	-13.8500	1.7220	*
FERT				0.0831	0.0425	
SEED				0.0685	0.0732	
MACH				0.0407	0.1795	*
ACRES				0.0024	0.0009	*
Std error of estimate		14.503			14.4430	
R-square		0.2867			0.2956	
Adjusted R-square		0.2818			0.2877	

[1] See text for description of variables

* Indicates significance at a 5-percent test level.

Table 4. Spearman Rank Correlations between Unadjusted Yields, Soil Productivity Adjusted (PA) Yields, and Productivity and Input Intensity Adjusted (PIA) Yields, McLean County, Illinois, 1996 - 2002.

Period[1]	Unadjusted Yields	PA Yields	PIA Yields
Panel A. Correlation Between Adjacent Years.[2]			
96 - 97	0.641	0.603	0.592
97 - 98	0.487	0.505	0.511
98 - 99	0.486	0.513	0.513
99 - 00	0.790	0.558	0.549
00 - 01	0.333	0.531	0.530
01 - 02	0.498	0.627	0.625
Average[3]	0.539	0.556	0.553
Panel B. Correlations Between Adjacent Two-Year Periods.[2]			
(96-97) - (98-99)	0.673	0.671	0.661
(97-98) - (99-00)	0.703	0.733	0.735
(98-99) - (00-01)	0.638	0.705	0.711
(99-00) - (01-02)	0.435	0.620	0.623
Average[3]	0.612	0.682	0.683
Panel C. Correlations Between Adjacent Three-Year Periods.[2]			
(96-98) - (99-01)	0.697	0.736	0.733
(97-99) - (00-02)	0.575	0.709	0.716
Average[3]	0.636	0.723	0.725

[1] Numbers indicate years. In Panel A, 96 - 97 indicates that the correlation is between yields in 1996 and 1997. In Panel B, (96-97) - (98-99) indicates that the correlation is between the average of yields in 1996 and 1997 and the average of yields in 1998 and 1999.

[2] All correlations are significant at a 1 percent test level.

[3] Is the average of the individual coefficients for each year, not a pooled average.

Table 5. Peason Correlations between Unadjusted Yields, Soil Productivity Adjusted (PA) Yields, and Productivity and Input Intensity Adjusted (PIA) Yields, McLean County, Illinois, 1996 - 2002.

Period[1]	Unadjusted Yields	PA Yields	PIA Yields
Panel A. Correlation Between Adjacent Years.[2]			
96 - 97	0.627	0.630	0.621
97 - 98	0.522	0.569	0.569
98 - 99	0.565	0.576	0.58
99 - 00	0.539	0.628	0.619
00 - 01	0.369	0.574	0.575
01 - 02	0.540	0.711	0.702
Average[3]	0.527	0.615	0.611
Panel B. Correlations Between Adjacent Two-Year Periods.[2]			
(96-97) - (98-99)	0.746	0.738	0.727
(97-98) - (99-00)	0.738	0.749	0.75
(98-99) - (00-01)	0.680	0.772	0.77
(99-00) - (01-02)	0.500	0.685	0.683
Average[3]	0.666	0.736	0.733
Panel C. Correlations Between Adjacent Three-Year Periods.[2]			
(96-98) - (99-01)	0.746	0.753	0.752
(97-99) - (00-02)	0.656	0.777	0.775
Average[3]	0.701	0.765	0.764

[1] Numbers indicate years. In Panel A, 96 - 97 indicates that the correlation is between yields in 1996 and 1997. In Panel B, (96-97) - (98-99) indicates that the correlation is between the average of yields in 1996 and 1997 and the average of yields in 1998 and 1999.

[2] All correlations are significant at a 1 percent test level.

[3] Is the average of the individual coefficients for each year, not a pooled average.

Table 6. Winner/Loser Tables of Unajusted Yields, McLean County, Illinois, 1996 - 2002.

Initial Year		Next Year		Percentage of Repeated Winners	Z-Test for Repeated Winners
		Winner	Loser		
1996	Winner	62	24	72.09	4.1
	Loser	23	58		
1997	Winner	58	27	68.24	3.4
	Loser	27	55		
1998	Winner	57	28	67.06	3.1
	Loser	27	55		
1999	Winner	57	27	67.86	3.3
	Loser	33	50		
2000	Winner	56	34	62.22	2.3
	Loser	32	45		
2001	Winner	57	31	64.77	2.8
	Loser	27	52		
	Average			67.04	

Table 7. Winner/Loser Tables of Productivity Adjusted (PA) Yields, McLean County, Illinois, 1996 - 2002.

Initial Year		Next Year: Winner	Next Year: Loser	Percentage of Repeated Winners	Z-Test for Repeated Winners
1996	Winner	58	26	69.05	3.5
	Loser	27	56		
1997	Winner	56	29	65.88	2.9
	Loser	29	53		
1998	Winner	53	32	62.35	2.3
	Loser	31	51		
1999	Winner	57	27	67.86	3.3
	Loser	28	55		
2000	Winner	65	20	76.47	4.9
	Loser	19	63		
2001	Winner	58	26	69.05	3.5
	Loser	26	57		
	Average			68.44	

Table 8. Winner/Loser Tables of Productivity and Input Intensity Adjusted (PIA) Yields, McLean County, Illinois, 1996 - 2002.

Initial Year		Next Year: Winner	Next Year: Loser	Percentage of Repeated Winners	Z-Test for Repeated Winners
1996	Winner	57	27	67.86	3.3
	Loser	27	56		
1997	Winner	54	30	64.29	2.6
	Loser	30	53		
1998	Winner	53	31	63.10	2.4
	Loser	31	52		
1999	Winner	56	28	66.67	3.1
	Loser	28	55		
2000	Winner	60	24	71.43	3.9
	Loser	24	59		
2001	Winner	60	24	71.43	3.9
	Loser	24	59		
	Average			67.46	