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Performance of Publicly Traded Agricultural Companies Since 2000: Construction of the AgIndex

Gary Schnitkey and Clayton Kramer

The crop farming sector has been relatively profitable in the past several years, whereas the general economy has gone through a great deal of turmoil. In this research, we constructed an AgIndex, which tracked the stock prices of publicly traded companies dealing with agriculture performed since 2000. As a group, the market values of publicly traded firms within the AgIndex exceeded those of Standard & Poors 500 (S&P 500) since 2000. Returns were higher for agricultural firms compared with S&P 500 firms. Performance varied across agricultural sectors with fertilizer and seed companies performing the best.

Key Words: agricultural performance, AgIndex, publicly traded, returns

JEL Classification: R51

Our objective is to provide an assessment of the performance of publicly traded agricultural firms since 2000. In this assessment, we identified a set of publicly traded agricultural firms that either provided inputs to crop farmers or processed raw grains. An index, hereafter referred to as the AgIndex, was constructed for these firms. The AgIndex follows these firms' market values on a monthly basis beginning in January 2000. AgIndex values were calculated similar to the Standard & Poors 500 (S&P 500) index and were compared with this index. In addition, returns from AgIndex firms were calculated and compared with returns from S&P 500 firms in a capital asset pricing model framework. This approach allowed the risks of AgIndex firms to be compared relative to the market and allowed determination of whether AgIndex firms had comparable returns to "general" firms using Jensen's alpha. Return analyses were conducted for sub-period analysis: 1) one analysis evaluates whether the introduction of ethanol influenced returns and 2) the second analysis evaluates whether returns varied by sub-periods identified with the incidences of economic recessions.

Gary Schnitkey is professor and Clayton Kramer is a graduate student, Department of Agricultural and Consumer Economics, University of Illinois, Urbana, Illinois.

Motivation

There are two motivations for examining the financial performance of publicly traded agricultural firms. First, agricultural economists have not systematically examined the performance of publicly traded agricultural firms. A few studies have examined topics close to overall performance. In a study, Bjornson and Innes (1992) examined returns to agricultural and nonagricultural assets, finding that mean return on nonagricultural assets were significantly higher than agricultural assets. Bjornson and Klipfel (2000) examined the agricultural equipment industry and indicated that industry leaders likely would continue to grow. Enlow and Katchova (2011) found that agricultural companies with relatively large return on equities were less

impacted by recessions than companies with lower return on equities.

Not examining the performance of publicly traded agricultural companies is an important oversight. Publicly traded agricultural firms are important links in the agricultural economy as these firms provide many of the inputs used on farms and in processing much of the grain and livestock coming from farms. Moreover, as the public sector reduces its expenditures on agricultural research, publicly traded companies likely will be conducting more of the agricultural research that occurs. As such, the financial performance and ability of publicly traded agricultural firms to conduct research has important societal impacts moving forward.

The second motivation relates to the structural changes that have occurred in agriculture in the 21st century revolving around the increase in corn use in ethanol production. The increase in corn use in ethanol can be traced to the passage of the Energy Policy Act of 2005, which became law in July 2005. This act provided incentives for ethanol production, resulting in the construction of many ethanol plants throughout the midwest (Baker and Zahniser, 2006). Prior to 2003, ethanol corn use in the United States never exceeded a million bushels. Since 2003, use of corn in ethanol has grown, reaching 4.9 million bushels in 2010.

Passage of this act has generally been listed as a cause of the rise of commodity prices with the increased use of corn in ethanol (Babcock, 2008). These higher prices are documented in Good and Irwin (2008), who indicate that long-run prices likely have reached new plateaus. In corn, for example, prices did not exhibit trends between January 1997 through September 2006, and averaged $2.42 per bushel. Between January 2011 and March 2011, corn prices have averaged $4.60. Similar new plateaus appear to have been reached in soybeans ($6.15 average from January 1975 to September 2006 compared with $10.58 since September 2006) and wheat ($3.24 per bushel average between January 1975 to September 2006 compared with $5.36 per bushel since September 2006).

These higher commodity prices caused higher incomes on crop farms in the latter half of the 2000s. For example, grain farms enrolled in Illinois Farm Business Farm Management have had an average net farm income of $163,000 per farm from 2006–2010, compared with $58,000 per farm from 2001–2005. Less is known about the impact that ethanol production has had on agricultural firms that supply crop farms with products and on firms that use grains as inputs. One would suspect that the agricultural supply and processing sectors would have experienced impacts with the introduction of increased ethanol production. Furthermore, a case could be made that the agricultural supply sector may have benefited from higher commodity prices, as their farmer customers may have more demand for inputs as a result of higher prices for crop farm outputs. Conversely, processors may have suffered as a result of the ethanol introduction, as processors' input prices have increased. Hence, tests were conducted to examine whether profit differences in agricultural firms can be found based on whether firms predominately provide inputs to farms or whether they process grain from farms.

Complicating this analysis are changes in the general economy since the 2000s. The National Bureau of Economic Research (NBER, 2010) identified two recessions since 2000: 1) the first lasting from March 2001 through November 2001 and 2) the second from December 2007 through June 2009. The later has been particularly difficult, including a deep drop in stock values and concerns about slow growth that have continued through 2011. To evaluate the impact of the general economy, results will be divided into three sub-periods that are bracketed by recessions. The first sub-period runs from January 2000 through November 2001 and includes the first recession during the 2000s. The second time period runs from December 2001 through December 2007 and includes a period of relative economic stability with no recessions. The third time period runs from January 2008 to the present and includes the recession, the substantial drop in stock prices, and the period of relative volatility since the 2008 recession began.

Construction of AgIndex

The guide used in developing the AgIndex was Standard & Poors. Standard & Poors maintains a number of indexes. One of its most quoted

indexes is the S&P 500, an index of 500 leading firms, and is considered reflective of the overall economy. The S&P 500 was chosen because it contained a large number of firms and is a widely followed stock index.

Both the AgIndex and S&P 500 reflect the aggregate market value of publicly traded companies. The market value of publicly traded firms represents the market's estimate of the present value of discounted earnings from those firms. Hence, increases in the index represent increased estimates of future earning of those firms. Conversely, declines in the index suggest reductions in the estimates of future returns from the firm.

The AgIndex was calculated at the beginning of each month using the following formula:

$$(1) \qquad index_j = \frac{\sum_i^n price_{i,j} \cdot shares_{i,j}}{divisor_j} \ ,$$

where *index* is the index value in month j, n is the number of firms in the index, $price_i$ is the stock price of share i in month j, $shares_i$ are shares outstanding in month j, and $divisor_j$ is a divisor. The numerator gives the total market value of all firms within the index.

For the AgIndex, the divisor was set so that in the first month the AgIndex equaled 100. After that, the divisor was not changed until there was an infusion or withdrawal of equity from the index. An example of this occurs when a new firm is added to the index. In the first month, the values for the additional firm became available, and the index value was calculated without the added firm. Then the numerator of Equation (1) was recalculated with the additional firm, and the divisor was adjusted so that the index value with the additional firm equaled the index value without the firm. The new divisor was then used forward through time until another equity change occurred.

Note that both the AgIndex and S&P 500 are based only on market values and do not include dividends in their calculations. As a result, the index reflects returns only from changes in market values. For both the AgIndex and S&P 500, the index values understate total returns. However, the market value of a stock conceptually equals the discounted present value of the firm's future earnings. Hence, both indexes represent the market estimates of future returns. As such, tracking index values over time provide useful estimates of the market estimates of future earnings.

Beta Analysis

In addition to the index calculation, returns from each AgIndex were calculated. Returns equaled capital changes from the above index changes plus dividends. For all firms within the AgIndex, the firm returns were weighted by the percent share of market value compared with the total market value of the AgIndex.

These returns were used to conduct an analysis using the Capital Asset Pricing Model (CAPM), which relates a specific asset's expected returns to the expected returns from the market portfolio in the following manner:

$$(2) \qquad E(R_i) = R_f + \beta\big(\big(E(R)_P\big) - R_f\big),$$

where $E(R_i)$ is the expected return from the specific asset, R_f is the return from the risk-free asset, β is a parameter measuring risk, and $(E(R)_P)$ is the expected return from the portfolio. In this model, β is specific to an asset and is a measure of risk. A β equal to one indicates that the asset has the same risk characteristic as the market portfolio. A β less than one indicates that the asset is less risky than the market and a β greater than one indicates that the asset adds more risk to the market.

Since expectations are not observable, the above equation was estimated using historical data in the following form:

$$(3) \qquad R_i' = \text{alpha} + \text{beta}R_p' + \varepsilon,$$

where R_i' is the excess return of asset i (return minus risk-free rate), alpha and beta are parameters, R_p' is the excess return from the market portfolio, and ε is an error term. The beta parameter in Equation (3) is an estimate of β. The alpha parameter is Jensen's alpha. According to CAPM, alpha should be equal to zero, as CAPM indicates that asset pricing should solely be based on risk characteristics. A positive alpha value indicates that there were excess returns for asset i above those implied by the market. Negative values indicate the reverse.

Equation (3) was estimated for returns of companies within the AgIndex using the S&P

500 as the market index. Beta estimates will be used as measures of the risk of the aggregate agricultural firms. Alpha will be used to measure if publicly traded firms have competitive returns with the market. This approach will allow for control of risk characteristics of the agricultural firms in those judgments.

Equation (3) was estimated for all firms in the AgIndex. It was also estimated for sectors within the AgIndex that represented various segments of input supply and grain processors.

Two additional models were estimated that are modifications of Equation (3). Both included dummy periods representing differing time periods. The first is called the biofuels model and included a dummy variable that took on the value of one for months after July 2005. In July 2005, the Energy Bill of 2005 became law. Hence, this model is testing whether returns varied with passage of the energy bill, which led to the additional use of corn in ethanol production. The second model includes two dummy variables and is designed to test whether returns varied between three economic sub-periods. The first sub-period is defined from January 2000 through November 2001. This period is generally viewed as an underperforming period, including the September 11th disaster, with NBER (2010) declaring the end of the recession in November 2001. The second period runs from December 2001 through December 2007 and is generally viewed as a period of growth without recessions. The final time period runs from January 2008 until the end of the analysis. NBER (2010) declared the beginning of the recession to be January 2008. This final period included the large declines in stock prices and a period of market volatility.

Companies in the AgIndex

The first task in comparing publicly traded agricultural companies to general companies is to outline the companies included within the AgIndex. In this research, the decision was made to include publicly traded companies that either sold products to crop farms or used unprocessed crops from farms. In some sense, this is a narrow definition, eliminating many food processing companies that others may include as agricultural companies. The narrow definition was chosen to focus on those firms that would be most likely affected by the farm economy.

Searches and discussions with individuals' knowledge with the agricultural companies were conducted so as to identify agricultural companies. After this search, 21 publicly traded companies were identified as having business segments that provided or used products from crop farms (Table 1).

The identified agricultural companies were further divided into sectors. The purpose of defining sectors was to see the performance within the AgIndex.

1. The fertilizer sector contains companies involved in the manufacturing and distribution of fertilizers, including Agrium Inc., CF Industries, Intrepid Potash, Mosaic Company, and Potash Corporation.
2. The equipment sector contains companies involved in the manufacturing of agricultural equipment including AGCO Corporation, Art's Way Manufacturing Company, Caterpillar Inc., CNH Global, Deere & Company, Kubota Corporation, and Lindsay Corporation.
3. The seed and genetics sector contains companies that produce seeds including Monsanto and Syngenta.
4. The crop protection sector contains companies that produce products aiding plant growth including Dow Chemical, DuPont, and FMC.
5. The first processor sector contains companies that are the first processors of corn and soybeans including Andersons, Archer Daniels Midland, Bunge, and Corn Products International.

Two notes are worth making about these companies and their classifications. First, companies range in specialization and focus on agriculture. Some companies, such as Monsanto, have a total focus on agriculture. Other companies, such as Dow Chemical Company, have many business entities outside of agriculture. Initially, attempts were made to separate total returns performance of non-specialized companies into agriculture and non-agriculture returns. This turned out to be extremely difficult, as it would require price changes to be disentangled among business segments. The decision was made to keep the non-specialized firms within the

Table 1. Agricultural Firms Included in the AgIndex

Company	Stock Ticker	IPO Quarter[a]	Market Cap[b]
AGCO Corporation	AGCO		3.36
Agrium, Inc.	AGU		10.53
The Andersons, Inc.	ANDE		0.63
Archer –Daniels Midland Company	ADM		16.57
Art's Way Manufacturing Co., Inc.	ARTW		0.02
Bunge Limited	BG	Q3 2001	8.59
Caterpillar, Inc.	CAT		47.75
CF Industries Holding, Inc.	CF	Q3 2005	8.87
CNH Global N. V.	CNH		6.26
Corn Products International, Inc.	CPO		2.97
Deere & Company	DE		26.73
The Dow Chemical Company	DOW		26.54
E.I. Du Pont de Nemours and Company	DD		36.93
FMC Corporation	FMC		4.87
Intrepid Potash, Inc.	IPI	Q2 2008	1.87
Kubota Corporation	KUB		50.77
Lindsay Corporation	LNN		0.68
Monsanto Company	MON	Q4 2000	32.11
The Mosaic Company	MOS	Q4 2004	13.51
Potash Corporation of Saskatchewan, Inc.	POT		37.02
Syngenta AG	SYT	Q4 2000	23.91

[a] Only listed if IPO occurred from 2000–2011 (in billions).
[b] As of July 1, 2011.
IPO, initial public offering.

AgIndex due to their importance to agriculture. Given that non-agricultural businesses are included, the performance reflected by the AgIndex will be impacted in some degree by business segments outside of agriculture.

Second, the classification into sectors is not straightforward as some companies have products that span sectors. For example, DuPont produces both crop protection products and seeds through its subsidiary Pioneer. Similarly, Bunge Limited has grain processing interests as well as fertilizer interests. Firms therefore were placed in the sector where the business segment was the largest.

Several of the companies within the AgIndex had initial public offerings (IPO quarter in Table 1: Bunge, CF Industries Holding, Inc.; Intrepid Potash, Inc., Monsanto Company, The Mosaic Company, and Syngenta AG). As these companies became public, they were added to the AgIndex. Table 1 also shows the market capitalization of each company on July 1, 2011. Overall, companies with higher market capitalizations receive higher weight in the AgIndex.

Data

Stock prices and adjusted prices were obtained from Yahoo! Finance (2011). Prices were collected and used on the first trading day of each month for each year from January 2000 to November 2011. Shares outstanding were obtained from each company's quarterly filing with the U.S. Securities and Exchange Commission (2011). Three-month treasury bill data were collected from the Board of Governors of the Federal Reserve System (Federal Reserve Bank of St. Louis, 2011). Monthly total return data for the S&P 500 were collected from an online database compiling historical data from multiple sites (Historical S&P 500 Capital and Total Returns: 1970–2011, 2011).

AgIndex and S&P 500 Index Values

Figure 1 shows the AgIndex and S&P 500 index values from January 2000 to November 2011. During this time period, the AgIndex increased from 100 in January 2000 up to 169 in

November 2011, an increase of 68%. Furthermore, the 52% increase over the entire time period is equivalent to an annual increase of 4.5%. The S&P 500 decreased from 1,469 in January 2000 to 1,251 in November 2011, a decrease of 15%. The 15% decrease over the entire time period is equivalent to an annual, compounded rate of −1.2%. Overall, the market value of companies within the AgIndex increased while the market value of companies within the S&P 500 decreased.

For the first economic time period from January 2000 to November 2001, both the AgIndex and the S&P 500 declined. The AgIndex declined by 4% from 100 in January 2000 to 96 in November 2001. The S&P 500 decreased by 28% during this same time frame from 1,469 to 1,059. On an annualized basis, the AgIndex decreased by 1.2% and the S&P 500 decreased by 3.2%. For both indexes, much of the decline occurred from the middle of 2001 to November 2001.

In the second sub-period from October 2001 to December 2007, both indexes generally increased. The AgIndex increased from 96 in November 2001 up to 203 in December 2007, an increase of 112%. During this period, the S&P 500 increased by 40%.

The third sub-period beginning in January 2008 was characterized by extreme variability. During this period, stock values fell dramatically during 2008. Since 2008, stock prices have risen; however, there have been notable declines as well. The AgIndex and S&P 500 have tracked each other closely during this period. The correlation coefficient between AgIndex and S&P 500 was 0.88 during the third time period. This 0.88 correlation coefficient compares to a 0.47 correlation coefficient for the entire time period. Changes in market values were similar for the two indexes during this time period. The AgIndex declined by 17% while the S&P 500 decreased by 16%.

There are two observations relative to index values over time. First, the increase in the AgIndex relative to the S&P 500 occurred before 2008. Over the entire time period, the AgIndex increased at a 4.5% annualized rate compared with a −1.2% annualized rate for the S&P 500 (Table 2). From January 2008 to the present, annualized changes are −4.0% for the AgIndex and −3.8% for the S&P 500 (Table 2),

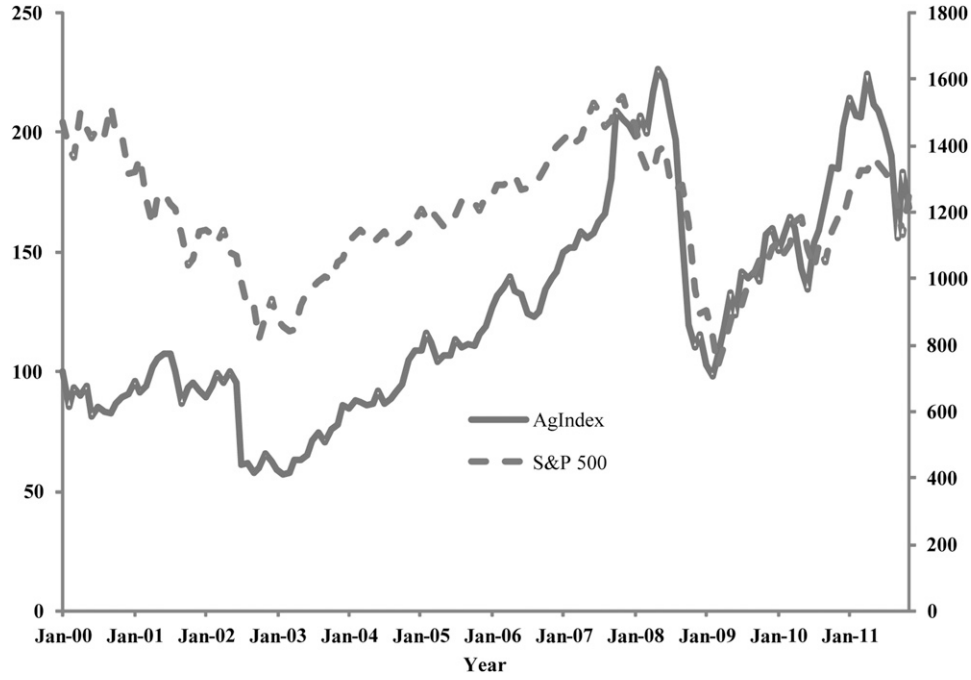

Figure 1. AgIndex and S&P 500 Index Values, January 2000 to November 2011

Table 2. Annualized Change in Index Values by Time Period

Time Period[a]	AgIndex (%)	S&P 500 (%)
Jan-00 to Aug-11	4.5	−1.2
Biofuel Periods		
Jan-00 to Jun-05	1.2	−3.2
July-05 to Nov-11	7.4	0.8
Economic Sub-periods		
Jan-00 to Nov-01	−2.3	−14.4
Dec-01 to Dec-07	13.2	5.7
Jan-08 to Nov-11	−4.0	−3.8

[a] Time period is denoted by month and year. Jan-00 indicates January 2000.

roughly the same annualized changes. For annualized changes from January 2000 to November 2001, the AgIndex decreased by 2.3% compared with −14.5 for the S&P 500. While both indexes declined, the AgIndex declined by less, resulting in a relative value gain for the AgIndex compared with the S&P 500. Between November 2001 and December 2007, the AgIndex increased at an annualized rate of 13.2% while the S&P 500 increased at a lower rate of 5.7%. Relative similar performance since 2008 does not support a long-lasting advantage accruing for publicly traded agricultural companies due to the introduction of biofuel requirements in the United States.

The second observation is the agricultural companies are impacted by overall adverse economic outcomes similar to publicly traded companies. In aggregate, companies within the AgIndex had a similar performance to the S&P 500 between January 2008 and November 2011, a period of economic upheaval. Similarly, both the AgIndex and S&P 500 decreased during the second time period, a period that included a recession. This suggests that publicly traded companies face the same risks from economic difficulties as do S&P 500 companies. The correlation coefficient between the AgIndex and S&P 500 Index was 0.746.

Returns and Beta Analysis of AgIndex

Returns data for the S&P 500 were available up to June 2011. Hence, returns and the beta analysis are presented from January 2000 through June 2011. During this period, the geometric mean was 0.6% for the S&P 500 index and 10.0% for the AgIndex (Table 3). The standard deviation was 55.9% for the S&P 500 and 75.4% for the AgIndex. Overall, the two indexes have a 0.746 correlation coefficient. The AgIndex had higher returns in all economic sub-periods. Differences in geometric means were 3.3% during the first time period (10.0% AgIndex geometric mean minus 0.6% S&P 500 geometric mean), 16.1% for the second economic time period, and 1.1% for the third time period.

Results from the linear regressions used to estimate the beta models are shown in Table 4. Tests for heteroscedasticity and serial related errors were conducted. Tests rejected the presence of heteroscedasticity and serially related errors. The base model had a 0.504 standard

Table 3. Index Value Change and Return Measures for Sectors within AgIndex

	Mean (%)	Returns Geometric Mean (%)	Standard Deviation (%)
Entire time period			
S&P 500	2.2	0.6	55.9
AgIndex	12.9	10.0	75.4
First economic sub-period (Jan-00 to Nov-01)			
S&P 500	–8.9	–10.9	64.2
AgIndex	–4.7	–7.6	76.4
Second economic sub-period (Dec-01 to Dec-07)			
S&P 500	5.5	4.7	42.0
AgIndex	22.2	20.8	54.2
Third economic sub-period (Jan-08 to Jun-11)			
S&P 500	2.5	–0.1	70.8
AgIndex	6.3	1.0	101.7

Table 4. Beta Estimates for AgIndex Returns

	Base	Biofuels	Economic Sub-Period
Alpha	0.130 (0.042)	0.136 (0.062)	0.089 (0.105)
Beta	1.003 (0.076)	1.003 (0.077)	0.998 (0.077)
Dum (post July-05)		–0.012 (0.086)	
Dum (Dec-01 to Dec-07)			0.104 (0.121)
Dum (Jan-08 to Aug-11)			–0.045 (0.131)
Standard error	0.504	0.506	0.503
R-square	0.555	0.555	0.564
Adjusted R-square	0.552	0.549	0.554

error and an adjusted R-square of 0.555. The base model had a beta estimate that was significantly different from zero and equaled 1.003. The AgIndex beta being near one indicated that the AgIndex has the same risk characteristics of the S&P 500.

The base model's alpha estimate of 0.107 is significant at the 5% test level. This positive alpha level indicates excess returns for the AgIndex. Firms within the AgIndex have performed better than the market given its risk level as implied by the market.

The biofuels model included the dummy variable that took on a value of one for the period following the passage of the 2005 Energy Bill (Table 3). The −0.012 value on the dummy variable for post July 2005 is insignificant, indicating that return levels did not differ before or after the passage of the 2005 Energy Bill. The economic sub-period model included two dummy variables from October 2001 through December 2007 and from January 2008 through August 2011 time periods. The values of the dummy variables had values of 0.084 for the October 01 to December 07 dummy variable and −0.032 for the January 08 to August 2011 dummy variable. However, these two variables were not significant.

Beta results support higher risk-adjusted returns for the AgIndex as compared with the S&P 500. However, the biofuels and economic time period model do not support identifying sub-periods in which higher returns existed. Results are consistent with higher returns for the AgIndex existing over the entire January 2000 through August 2011 time period.

AgIndex Sector Results

Sectors within the AgIndex performed differently (Figure 2). The overall AgIndex index had an annualized change of 4.5% from January 2000 through November 2011. The fertilizer sector had the largest increase, averaging an annualized increase of 27.8% from January 2000 through November 2011. The fertilizer index increased from 100 in January 2000 up to 1,812 in November 2012 (all sectors index begin at 100 in January 2000). The sector with the second highest increase was the seed sector, reaching 410 in November 2001 for an annualized increase of 13.8%. The food processor had the third highest increase, reaching 399 in November 2011, for an annualized increase of 9.8%. The equipment sector was the fourth ranked sector with a 118 index value in November 2008, for an annualized change of 1.4%. The crop protection sector was ranked fifth and had an index value decline to 84, for an annual decrease of 0.45.

Average returns over the entire time period gave the same rankings, as did the changes in the index value (Table 5). The fertilizer sector had a 31.3% average return and a 27.8 increase. The rank order of the industries were: 1) fertilizer with a 31.3% return, 2) the seed sector with a 19.5% return, 3) food processing with a 16.0% return, 4) equipment with a 15.8% return, and 5) crop protection with a 6.8% return.

Sector returns varied considerably from the average index return of 12.9% returns. Note that four out of five sectors had returns above the AgIndex average, with only the crop production sector having a return below the AgIndex value.

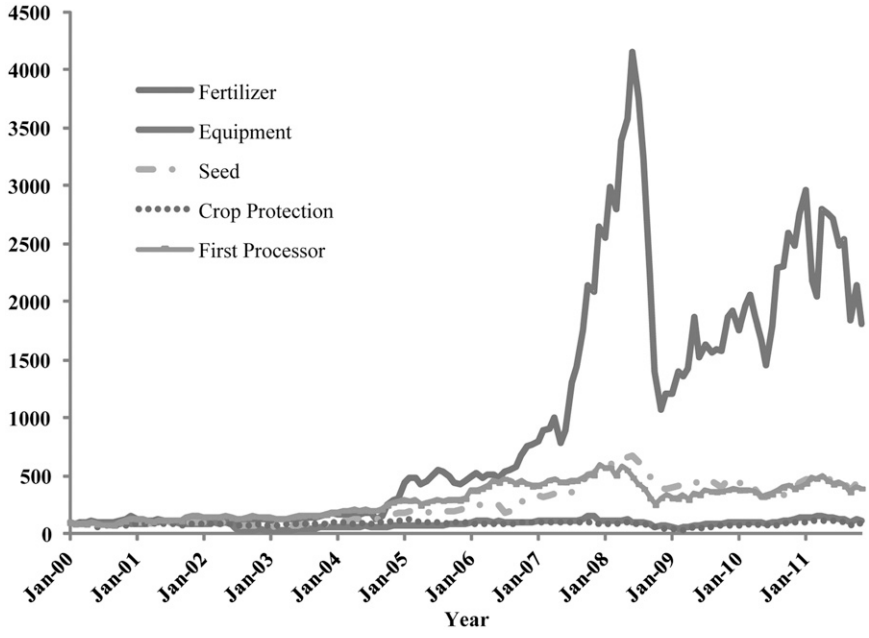

Figure 2. Index Values of Sectors within AgIndex, January 2000 to November 2011

This occurs mainly due to the weights each sector receives. Returns from each firm are weighted by their market capitalization. The two sectors with the lowest returns have the highest market capitalization. Over the entire time period, the average market capitalization of the equipment sector is 39% of the total in the AgIndex and the crop production sector is 27%. These two sectors account for over 50% of market capitalization and hence have a significantly high weight in the AgIndex average.

Beta estimation results are shown in Table 6. In the base model, all betas were significant. Two sectors had beta values above one, indicating that those sectors were more risky relative to the S&P 500. These sectors were crop production (1.267) and equipment (1.149). Three sectors had betas below one: fertilizer (0.868), seed (0.722), and first processor (0.535).

Alpha estimates were significant for four out of five sectors: fertilizer (0.314), equipment (0.158), and seed (0.187), and first processor (0.155). Estimates were positive, indicating that these sectors had excessive positive returns relative to their risk levels. The crop protection sectors did not have significant alpha statistics indicating that these sectors did not have excessive returns. Crop protection firms are largely chemical firms that provide products to many sectors outside agriculture. Agricultural performance may be a small part of these companies' total businesses. Hence, the financial performance of crop protection firms will be influenced more by the general economy than the agricultural economy.

Table 5. Index Value Change and Return Measures for Sectors within AgIndex

	Annualized Index Value Change (%)	Mean (%)	Returns Geometric Mean (%)	Standard Deviation (%)
AgIndex	4.5	12.9	10.0	75.4
Fertilizer	27.8	31.3	23.1	126.3
Equipment	1.4	15.8	11.2	94.7
Seed	13.8	19.5	16.1	83.1
Crop protection	−0.4	6.8	2.1	98.6
First processor	9.8	16.0	11.4	97.3

Models that included dummies for passage of the Energy Act are shown in Panel B of Table 6. Dummy variables were insignificant in all regressions. Models that included dummy variables for economic sub-periods are shown in Panel C of Table 6. Dummy variables were insignificant in all regressions. Our results do not support the passage of the 2005 Energy Act having impact on returns.

Relative to sector results there are two observations. Results suggest that four out of five sectors had returns above the market average. Results do not support differences in returns for input supply firms versus first processor firms. The only sector that did not have excess returns was the crop protection sector. Crop protection not having excess returns likely occurs because crop protection firms have many business segments not related to agriculture.

The second observation is relative to the fertilizer industry returns. The fertilizer industry has had exceptionally good returns. Averaging 31.3% returns over a 10-year period would be good performance for almost any industry. Future research understanding the reasons for this performance would be worthwhile.

Table 6. Beta Estimation Results for Sectors in AgIndex[a]

	Alpha	Beta	Dum (post July-05)	Dum (Dec-01 to Dec-07)	Dum (Jan-08 to Aug-11)	Standard Error	Adjusted R-square
Panel A. Beta models.							
Fertilizer	0.314*	0.868*				1.167	0.142
	(0.099)	(0.178)					
Equipment	0.158*	1.149*				0.687	0.465
	(0.058)	(0.104)					
Seed	0.187*	0.722*				0.721	0.232
	(0.064)	(0.115)					
Crop protection	0.068	1.267*				0.678	0.521
	(0.057)	(0.103)					
First processor	0.155*	0.535*				0.926	0.089
	(0.078)	(0.141)					
Panel B. Beta models for biofuels.							
Fertilizer	0.285*	0.866*	0.055			1.171	0.136
	(0.144)	(0.178)	(0.199)				
Equipment	0.182*	1.151*	−0.045			0.690	0.461
	(0.085)	(0.105)	0.387				
Seed	0.200*	0.723*	−0.023			0.724	0.226
	(0.098)	(0.116)	(0.130)				
Crop protection	0.080	1.267*	−0.022			0.680	0.517
	(0.083)	(0.103)	0.197				
First processor	0.235*	0.541*	−0.144			0.926	0.088
	(0.114)	(0.141)	(0.158)				
Panel C. Beta models with dummies for economic time periods.							
Fertilizer	0.257	0.862*		0.178	−0.121	1.160	0.141
	(0.244)	(0.179)		(0.280)	(0.304)		
Equipment	0.120	1.145*		0.085	−0.024	0.691	0.460
	(0.144)	(0.106)		(0.166)	(0.180)		
Seed	0.136	0.717*		0.180	−0.162	0.709	0.258
	(0.215)	(0.1146)		(0.230)	(0.241)		
Crop protection	0.114	1.271*		−0.083	−0.007	0.682	0.515
	(0.142)	(0.1046)		(0.164)	(0.177)		
First processor	0.335	0.549*		−0.116	−0.375	0.922	0.096
	(0.193)	(0.141)		(0.221)	(0.240)		

[a] Standard errors are given in parentheses

* Indicates significance at the 5% test level.

Summary and Conclusions

In this article, an AgIndex was constructed that followed the stocks of publicly traded agricultural companies. Compared with the S&P 500, the AgIndex increased more than the S&P 500 from January 2000 until November 2011. Beta models were estimated with the AgIndex as the dependent variable and the S&P 500 as the market portfolio. The AgIndex had similar risks to the S&P 500. Beta models indicated that AgIndex firms had excess, positive returns compared with the S&P 500. Except for the crop protection sector, all sectors also had excess returns. Firms within the crop protection sector may not have exhibited excess returns because these firms are chemical companies and have many linkages to firms outside the agricultural sector. These results suggest that agricultural companies are financially solid companies. Results suggest that agricultural companies should have the financial wherewithal to conduct research and be vibrant participants in the agricultural sector in the future.

Our results did not indicate that the relative performance of AgIndex firms changed as a result of the passage of the 2005 Energy Bill. Nor did relative performance vary over economic periods. Overall, agriculture companies have had above average return and stock growth performance between 2000 and 2011. This may result because many of the agricultural firms restructured before 2000, resulting in good performance since 2000. Future efforts could examine relative agricultural firm performance in the 1990s. Conducting this research could be difficult, as merger activities could make tracking agricultural firms through the 1990s difficult.

This research does not support relatively different performance for agricultural supply firms and first processor firms. Any disadvantage first process firms may have faced because of higher input costs was compensated for in other areas. Further research examining the dynamic of different sectors would be beneficial.

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