Momentum Anomaly in Agribusiness Stocks

Abstract

Using financial and stock return data of agribusiness firms from 1973 to 2011, we find evidence of momentum anomaly in the agribusiness industry, but only from small cap stocks, and only during the period 1980 to 2000. The most statistically and economically significant abnormal returns of 90 bps per month are from Jegadeesh and Titman (1993) strategies *J*-9/*K*-6 and *J*-12/*K*-3 where stocks are ranked using their 9-month (12-month) past returns to form portfolio deciles that are held for 6 months (3 months). Consistent with prior studies, our results confirm that the momentum abnormal returns are not fully explained by risk-based models such as the Fama and French three-factor model.

Keywords: Asset pricing; Information and market efficiency; Financial anomaly

JEL Classification: G12, G14

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1. Introduction

Jegadeesh and Titman (1993) report a tendency of rising prices to continue rising and falling prices to keep falling. They describe a "momentum strategy", in which portfolios of stocks with the highest past returns (winners) outperform portfolios of stocks with the lowest past returns (losers). This is an anomalous instance of stock returns predictability that contributes to the on-going list of counter-examples against the Efficient Market Hypothesis of Fama (1965).

Although the predictability of past winners to outperform past losers continues to be discussed extensively, there is no consensus in explaining what drives this momentum anomaly. Tentative explanations include behavioral bias and rational response to market constraints with respect to firm characteristics, investment styles, industry characteristics, and country characteristics. Jegadeesh and Titman (1993) conclude that exposure of the firm to market risk alone cannot explain the momentum anomaly. The momentum anomaly over U.S. market stocks has been aptly evidenced although not fully explained.

This study investigates the momentum anomaly in the agribusiness industry by focusing on market capitalization and time-related technological shocks. There is a clear intuition that links technological innovation, change in business conditions, and time varying economic conditions. In turn, common technology shocks within industry may account for a component of momentum profits. Agricultural productivity has been increasing due to technological innovations. Agribusiness products now spans from food, beverages, clothing and other manufactured goods, to biofuels.

We examine whether agribusiness stocks present the momentum anomaly for the period 1974 to 2011 and whether the trends reported in the literature hold in the agribusiness industry.

Our motivation is in line with the suggestion of Gorman et al. (1986) that there is a need in the agribusiness industry for research concerning methods of attracting external equity financing.

We find evidence of momentum anomaly in the agribusiness industry, but only from small cap stocks and only during the period 1980 to 2000. The most statistically and economically significant monthly abnormal return of 90 bps is from strategies where small cap stocks are ranked using their 9-month (12-month) past returns to form portfolio deciles that are held for 6 months (3 months). Consistent with prior studies, our results confirm that the momentum abnormal returns are not fully explained by risk-based models such as the Fama and French three-factor model.

The remainder of this paper is organized as follows. The next section briefly reviews the related literature. We explain our methodological approach in Section 3. Section 4 describes the data and sample selection criteria. We report our main empirical findings in Section 5 and conclude in Section 6.

2. Literature review

Market constraints based explanation of financial anomalies says that cross-sectional variations in risk and expected stock returns generate momentum profits. However, the source of the momentum profits is debatable because the body of empirical results produces inconsistent evidence. The behavioral based explanation states that cognitive biases lead investors to either underreact or overreact to market information. Some studies, such as those of Daniel, Hirshleifer, and Subrahmanyam (1998) and Hong and Stein (1999) bring evidence that investors do aggregate overconfidence following market gains. This is to say that, frequently investors collectively attribute successes to their own skills while they attribute failures to market based

risk factors. This collective overconfidence attitude of investors may generate greater momentum in up markets.

Jegadeesh and Titman (2001), Moskowitz and Grinblatt (1999), and Grundy and Martin (2001) among others provide evidence of momentum anomaly for emerging financial markets, in addition to European and U.S. markets. At the country level, most of the European and North American countries exhibit strong momentum, while the Asian countries display much weaker momentum effects. In line with the market risk based explanation, Cooper, Gutierrez, and Hameed (2004) utilize U.S. equity market data to confirm that momentum profits depend on whether the financial market is up or down.

Some studies have also examined industry characteristics for possible explanation of momentum anomaly. For instance, Moskowitz and Grinblatt (1999) utilize U.S. data from the Center for Research in Security Prices (CRSP) to show that industry-focused momentum strategies are significantly more profitable than industry-neutral momentum strategies. However, Grundy and Martin (2001) use CRSP data with equally weighted portfolios to conclude that industry effects are not the primary cause of momentum profits. O'Neal (2000) examines 31 US sector funds (Fidelity Select Portfolios) on market capitalization strategy to find significant profits from industry momentum strategy.

These previous studies document a prevalent momentum effect in cross-industry strategies which buy stocks from past winning industries and sell stocks from past losing industries. In this study, we investigate strategies based on buying past winning stocks and selling past losing stocks within the same industry, namely the U.S. agribusiness industry.

3. Methodology

To investigate the presence of anomalous patterns related to the "momentum effect", we utilize three methods with a sample of U.S. agribusiness firms. The first method consists of a "sort" method derived from the "*J*-month/*K*-month sort strategy" introduced by Jegadeesh and Titman (1993), the "size strategy" used by Fama and French (2008), and a variation of the "time strategy" hinted by Davis (1994). We reutilize the sort method multiple times to identify the combination of size and time period most favorable to the occurrence of the momentum effect. In the second method, we use the two-step Fama and MacBeth regressions to ascertain whether the future returns of agribusiness stocks are related to the momentum effect, controlling for size, book-to-market ratio, and U.S. agribusiness classification effects. Conversely, we utilize the Fama and French (1993) three-factor asset pricing model to test whether common risk factors explain the momentum generated returns in the third method.

3.1 Description of the sort method

J-month/K-month sort strategy

Jegadeesh and Titman (1993) study the efficiency of the stock market by using *J*-month/*K*-month sort strategies. Each decile portfolio is formed by ranking stocks by their J-month past returns. The momentum measure, *MOM*, is the cumulative continuously compounded return over the *J* months used to create the decile portfolios. The decile portfolios are held for *K* months. A hedge portfolio is adopted by taking a long position (buy) on past winners with the highest returns and an equally sized short position (sell) on past losers with the lowest returns.

As an example, Figure 1 illustrates the *J*-9/*K*-3 momentum strategy. Each month, decile portfolios are formed by ranking stocks using their 9-month past returns: $J = 9$. That is, the momentum measure, *MOM*, is the 9-month cumulative return. Portfolios are held for three

months: $K = 3$. Thus, the return on the hedge portfolio is evaluated three months after portfolio formation.

[Figure 1 about here]

Size strategy

To account for the size effect, we follow Fama and French (2008) in using the NYSE breakpoints to categorize firms by size. All NYSE stocks are ranked into decile portfolios based on market capitalization. *Micro*, *Small*, and *Big* cap stocks are defined as stocks in the 10^{th} and 20^{th} percentiles, 30^{th} to 50^{th} percentiles, and 60^{th} to 90^{th} percentiles, respectively at the end of each June. In other words, big cap stocks correspond to stocks larger than the median market cap NYSE stock. Professional investors use the NYSE breakpoints upon the underlying rationale that the sum of micro-cap stocks amount to a tiny share of the whole market capitalization while their number is a very large share of the total number of observations.

Time period strategy

Time varying economic conditions is linked to technological innovation and change in business conditions. Following Davis (1994), we account for the possible effect of time periods by considering the following macroeconomic events:

(1) Entire sample period, 1973-2011

Our study sample starts in 1973 to account for the introduction of NASDAQ in 1973, in addition to NYSE and AMEX. In comparison, the respective sample time period of some of the related financial anomaly studies are 1936-1975 for Banz (1981); 1965-1989 for Jegadeesh and Titman (1993); 1962-1993 for Carhart (1997); 1973-1994 for Barber and Lyon (1997); and 1963-2005 for Fama and French (2008).

(2) OPEC Oil Crises period, 1973-1979

The two OPEC oil crises of 1973 and 1979 are causes of crude oil crunch and energy price increases in 1973-1979. We consider the possible effect of energy price increases on the U.S. agribusiness industry when the underlying agriculture production function is intensively mechanized.

(3) Commodity price depression, 1980-2000

Catania and Alonzi (1998) report that the prices of raw materials such as agricultural products, crude oil and gold were depressed due to unfavorable volatility and interests rates. Moy (1985) analyses the unemployment trends of developed countries during the Early 1980s Recession (1980-1983 for the U.S. economy), which is attributed to a contractionary monetary policy implemented by the U.S. Federal Reserve System to control inflation. Sullivan and Sheffrin (2003) describe the Early 1990s Recession (1988-1993 for the U.S. economy), which is attributed to the stock collapse of the "Black Monday of October 1987" and the beginning of the Gulf War.

(4) Commodity price boom, 2001-2008

The 2000s commodities boom is attributed to the rise of global population and the rise of raw material demands by the global economy. The combined decline of food crop production and rise of biofuel crop production start the Food for Fuel Crisis in 2006; e.g. Catania and Alonzi (1998). Lowenstein (2004) describes the Dot-Com Bust of 2000-2001 (Information Technology Bubble and Bust), which witnesses some spectacularly sudden large loss of market capitalization as exemplified by the "Amazon stocks" that went from $107 to $7 per share in one day.

(5) Global Financial Crises, 2007-2012

Baily and Elliott (2009) provide a detailed narrative of the U.S. Financial and Economic Crisis over 2007-2009. Williams (2012) describes the global effects of the European sovereign debts crises.

We apply the sort method over stock selections per quarter (J = 12, 9, 6, 3 months) with varying holding periods per quarter (K = 3, 6, 9, 12 months) to form a total of 16 strategies per size category. For instance, the four size categories, *Micro, Small, Big,* and *All size* require testing 4×4×4 = 64 strategies.

3.2 Fama and MacBeth (1973) two-step regression method

We use the two-step Fama and MacBeth (1973) regressions to ascertain whether future returns are related to the momentum measure, controlling for size, book-to-market ratio, and U.S. agribusiness classification effects. Specifically, for each month, the dependent variable is the stock return at the end of the K-month holding period. The main independent variable MOM is the J-month lagged return. The control variable LNSIZE is the natural logarithm of market capitalization. The control variable B/M is the book-to-market ratio calculated as the book value of equity at the end of the fiscal year divided by market value of equity for the last month of the previous fiscal year. In its first step, the FMB procedure is performed for each month. The first step requires as many regressions as the number of months in the sample. The second step uses the Zellner's Seemingly Unrelated Regressions (SUR) estimation (Zellner, 1962) to find the final coefficient estimates, which are the averaged values of the coefficient estimates from the first step. The U.S. Department of Agriculture (USDA) Economic Research Service (ERS) classifies agribusiness firms into six groups: (1) production; (2) services, forestry, and fishing; (3) inputs; (4) processing and marketing; (5) wholesale and retail trade; and (6) indirect agribusiness. We control for the effects of these six groups, as well as year effects in all models.

3.3 Asset pricing model

Conversely, we utilize the Fama and French (1993) three-factor asset pricing model to test whether common risk factors explain the momentum generated returns in the third method. The hedge momentum portfolio return (*MOM12/K*) is regressed on the three factors of Fama and French (1993).

$$MOM12/K_{p,m} = alpha_p + \beta_p MKTRF_m + s_p SMB_m + h_p HML_m + \varepsilon_{p,m} \qquad (1)$$

In equation (1):

- $MOM12/K_{p,m}$ is the monthly return on the *Buy – Sell* portfolio *p*, where *Buy* and *Sell* are equally weighted portfolios formed based on 12-month lagged returns and held for *K* months,
- $MKRTF_m$ is the excess return on the market in month *m* (*K* months after portfolio formation)
- SMB_m is the difference between returns on small and big stocks in month *m*.
- HML_m is the difference between returns on high and low book-to-market portfolios in month *m*,
- the intercept $alpha_p$ estimates the eventual abnormal return on portfolio *p*. A statistically significant non-zero value of $alpha_p$ indicates that the model does not explain the return,
- the error term $\varepsilon_{p,m}$ is the residual risk of the estimation for portfolio *p* in month *m*;
- β_p is the estimate of the market risk on portfolio *p*;
- s_p is the estimate of risk from small cap portfolios on portfolio *p*;
- h_p is the estimate of risk from high book-to-market portfolios on portfolio *p*.

4. Data and sample selection criteria

4.1 Data sources and sample

We start the data processing with firm level annual financial data from Standard & Poor's Compustat and monthly stock data from CRSP. The NASDAQ all series begins on December 14, 1972 and index levels of CRSP market indices are set to 100 on December 29, 1972. Compustat assigns the year of the *"data date"* variable to be the year in which the fiscal year begins if the fiscal year end is from January through May; and to be the year in which the fiscal year ends if the fiscal year end is from June through December. Annual Compustat data are matched month-to-month and year-to-year with monthly CRSP data.

We consider only agribusiness firms that trade U.S. domestic ordinary common stock shares (with share codes 10 or 11) on NYSE, AMEX, or NASDAQ. Of these firms, we keep those with necessary financial data items. We exclude financial institutions such as banks and insurance companies defined as firms with Standard Industrial Classification (SIC) codes in the range 6000 to 6999. Excluding financial institutions is a common practice for this type of financial anomaly study as such firms are highly regulated. In order to execute the $J = 12$ momentum strategies, all firms in the sample must have their 12-month past returns reported. Thus, our final sample includes 817 agribusiness firms for the period 1974 to 2011.

Table 1 presents the composition of the sample classified into the six groups by USDA ERS in Panel A. As shown, there are 3,204 firm-months observations. Of the (1) production; (2) services, forestry, and fishing; (3) inputs; (4) processing and marketing; (5) wholesale and retail trade; and (6) indirect agribusiness groups, the largest groups are processing and marketing (44.23%) and wholesale and retail trade (30.35%). At the end of each June, stocks are classified into three size groups (*Micro, Small, Big*) using NYSE breakpoints. As an example, we present

the classification for June 2005 in Panel B of Table 1. There are 101 micro-cap firms, 42 small cap firms, and 39 big cap firms.

4.2 Summary statistics

We present statistics on selected firm characteristics in Table 2. *LNSIZE* is the natural logarithm of market capitalization. *B/M* is the book-to-market ratio calculated as the book value of equity at the end of the fiscal year divided by market value of equity for the last month of the previous fiscal year. *MOM* is the momentum measure defined as the cumulated continuously compounded stock return for the months used to create momentum portfolios: J = 12 months in this table. *MRET* is the stock monthly return from CRSP.

Stocks are categorized into size groups (*Micro*, *Small*, and *Big*) determined using NYSE breakpoints at the end of each June. The entire sample contains 85,526 firm-month observations. There are 49,811 firm-month observations, 19,902 firm-month observations, and 17,817 firm-month observations in the *Micro*, *Small*, and *Big* cap group, respectively. While the mean stock monthly returns, displayed by the MRET variable, are the same in each size group at 1%, the mean momentum measure, displayed by the MOM variable, is the highest at 18% for micro-cap stocks, 16% for small cap stocks, and the lowest at 14% for big cap stocks.

5. Empirical Results

5.1 Results from *J*-month/*K*-month investment strategies by size

For one size group, say the *Small* cap group, this comparison involves 16 strategies since the ex-ante portfolio formation involves J = 12, 9, 6 and 3 month-periods and the ex-post holding periods are over K = 3, 6, 9, and 12 months. Overall, in unreported tests, we compare 80 (= 16 × 5) strategies, considering the entire sample (*All*), micro-cap stocks (*Micro*), small cap stocks

(*Small*), big cap stocks (*Big*), and all but small cap stocks. Fama and French (2008) find that for the entire U.S. stock market the *J*-month/*K*-month investment strategies produce abnormal returns in all size groups, highest in the *Micro* group and lowest in the *Big* size group. In contrast, we find that the *J*-month/*K*-month investment strategies result in statistically significant positive abnormal returns only in the *Small* size group in the agribusiness industry. We report the results for the *Small* size group in Table 3. The other four size groups of agribusiness stocks do not display statistically significant momentum generated anomalous returns over the period 1974 to 2011. Our finding is in contrast to the results by Israel and Moskowitz (2013) who find that the momentum premium is present and stable across all size groups over an entire 83-year (1926 to 2009) U.S. sample period. They document little evidence that momentum is stronger for small cap stocks.

[Table 3 about here]

Table 3 presents evidence of statistically significant abnormal returns on small cap agribusiness stocks due to momentum investment strategies *J*-3/*K*-9 and 12; *J*-6/*K*-6, 9, and 12; *J*-9/*K*-3, 6, 9, and 12; and *J*-12/*K*-3, and 6. Of these momentum induced abnormal returns, the most statistically and economically significant are from strategies *J*-9/*K*-6 with *t*-statistics of 2.15, and *J*-12/*K*-3 with *t*-statistics of 2.00. Both strategies provide monthly positive returns of 90 bps. In sum, there is evidence of momentum abnormal returns for the stocks of U.S. agribusiness firms in the small caps group.

5.2 Results from *J*-month/*K*-month investment strategies by time period for small caps

In the next step, we apply the time period strategy of Davis (1994) on small caps stocks since momentum profits appear to be present only for these stocks in the agribusiness industry. We use each *J*/*K* strategy controlling for each of the five periods described in Section 3.1.

Unreported results of the 4×4×5 = 80 strategies show that four of the five periods present some evidence of infrequent momentum induced abnormal returns. From Table 4, it is in the small caps under the period 1980 to 2000 that we find the most statistically and economically significant evidence of momentum abnormal returns for the stocks of U.S. agribusiness firms.

[Table 4 about here]

Panels A, B, C, and D of Table 4 present the strategies for ex-ante portfolio formation on J = 12, 9, 6, and 3 months respectively. The portfolios are held ex-post for K= 3, 6, 9, and 12 months after formation. The *Sell (Buy)* portfolio is the lowest (highest) past return decile. The last row presents the average returns of the J-month/K-month hedge portfolio (*Buy – Sell*).

In Panel A, the average monthly returns of small cap portfolios sorted on 3-month lagged returns present some economically and statistically significant momentum average abnormal positive returns of 70 bps (t-statistics 2.33) for K = 6; 80 bps (2.90) for K = 9; and 80 bps (3.11) for K = 12 month holding period. In Panel B, the average monthly returns of small cap portfolios sorted on 6-month lagged returns present also some economically and statistically significant momentum average abnormal positive returns of 100 bps (t-statistics 2.20) for K = 3; 140 bps (3.52) for K = 6; and 140 bps (3.79) for K = 9; and 120 bps (3.43) for K = 12 month holding period. The most economically and statistically significant results are in Panel C with J-9/K-9, with an average monthly returns of 150 bps (t-statistics 3.52); and in Panel D with J-12/K-3, with an average monthly returns of 170 bps (t-statistics 3.37). In comparison, Jegadeessh and Titman (1993) find that the J-6/K-6 strategy yielded the highest return.

Figure 2 displays the average monthly returns on small cap agribusiness hedge portfolio taking a long position in the lowest decile of momentum and an equal-sized short position in the highest decile of momentum using the J-month/K-month strategy. The portfolio is formed during

a 12-month period (J = 12) ending four months after the fiscal year end and held three months (K = 3) during the period 1980 to 2000.

[Figure 2 about here]

The period 1980-2000 is characterized by commodity price depression. Catania and Alonzi (1998) report that the prices of raw materials such as agricultural products, crude oil and gold were depressed due to unfavorable volatility and interests rates. In the U.S., there were a 1980-1983 (Moy, 1985) and a 1988-1993 (Sullivan and Sheffrin, 2003) economic recessions. It appears that under an economic regime of low commodity prices and economic depression, the small caps stocks of U.S. agribusiness firms become more sensitive to exploitation through momentum anomaly based strategies. This result is consistent with the literature from United Kingdom data for which Agarwal and Taffler (2008) find that financial distress risk drives the momentum anomaly. It is also consistent with the evidence from overall U.S. market data for which Lesmond, Schill, and Zhou (2004) conclude that most momentum profits are from the returns continuation of poor performers.

To provide a representative list of small caps agribusiness firms, we present in Table 5 the bottom 15 and top 15 small cap agribusiness stocks by size (in millions of U.S. dollars) in year 2000, in Panels A and B, respectively. Most of these small caps firms are in the following categories: (3) inputs, (4) processing and marketing, and (5) wholesale and retail trade categories.

[Table 5 about here]

5.3 Are the monthly returns of small caps U.S. agribusiness stocks explained by the momentum variable, firm size, time, and agribusiness classifications?

In Table 6, we present the results from FMB regressions of future monthly returns (three months later with *K*=3) for small cap agribusiness stocks in the period 1980 to 2000. According to Table 4, it is with the *J*-12/K-3 strategy that the anomalous momentum returns are the most economically and statistically significant. Thus, we base this test on *J* = 12. In the first step, for each month, a cross-sectional regression is performed. Then, in the second step, the final coefficient estimates are obtained as the average of the first step estimates. The main independent variable *MOM* is the momentum measure defined as the cumulative continuously compounded stock returns for the period ending in the month of observation (J = 12 months in Table 6). *LNSIZE* is the natural logarithm of market capitalization. *B/M* is the book-to-market ratio calculated as the book value of equity at the end of the fiscal year divided by market value of equity for the last month of the previous fiscal year. We control for year fixed effects in all models. Model 3 includes control for agribusiness classifications as defined in Table 1.

In Model 1 (Model 2, and Model 3), we find statistically significant evidence at the 1% level that a 1% point increase in the 12-month cumulated stock return corresponds on average to 5.2 % (5.4%, and 5.0%) points increase in the stock monthly return three months after the month of observation. Size and the three-month stock future return are negatively related. That is, the larger the firm, the lower returns are after three months. B/M does not have a statistically significant effect.

5.4 Do the Fama and French three loading factors explain the returns from momentum strategies on small cap agribusiness stocks?

Table 7 presents our results from regressions of the portfolio returns (*MOM12/K*) on the Fama and French three factors. *MOM12/K* is the monthly return on the *Buy – Sell* hedge portfolio, where *Buy* and *Sell* are equally weighted portfolios formed based on 12-month lagged returns and held for *K* months. The average monthly risk-adjusted return is the estimate of alpha. According to Table 4, it is in the $J = 12$ strategy that the anomalous momentum returns are the most economically and statistically significant. Thus, we run this test based on $J = 12$ with K=3, 6, 9, and 12 in Models 1, 2, 3, and 4., respectively. For each model, alpha is statistically significantly different from zero at the 1% level. This robustness check confirms that in the period 1980 to 2000, the small caps of U.S. agribusiness firms are prone to momentum anomaly. For each of the four models, the coefficient on the excess return on the market is not significant. This is evidence that market risk does not explain the abnormal positive returns of the *Buy – Sell* hedge portfolio. Moreover, size is statistically negatively related to the momentum variable while investing in long position on high book-to-market and short position in low book-to-market does not have any significant effect. In concordance to Fama and French (1996) and Avramov and Chordia (2006) for the U.S. market, the momentum-based abnormal returns on the small caps stocks of U.S. agribusiness firms in the period 1980 to 2000 are robustly evident and the three risk factors do not fully explain these returns.

6. Conclusion

Overall, we find that the momentum anomaly exists for U.S. agribusiness stocks, but only for small cap firms. Of the momentum induced abnormal returns on small caps, the most statistically and economically significant strategies are the J=9/K=6 and the J =12/K=3. Both strategies provide economically significant monthly positive returns of 90 bps. In term of

economic conditions, it is during the period 1980 to 2000 characterized by commodity price depression and economic recessions when the exploitation of a momentum strategy based investment is most suitable for the stocks U.S. agribusiness firms. Consistent with prior studies, we confirm that market risk (even after controlling for size and growth) does not fully explain the abnormal positive returns of the momentum hedge portfolio. Moreover, we find that size is statistically negatively related to the momentum variable while investing in long position on high book-to-market and short position in low book-to-market does not have any effect. Similar to results from studies based on overall U.S. market and United Kingdom data, momentum profits are from the returns continuation of poor performers in the stocks of U.S. agribusiness firms.

Table 1: Sample composition (1974-2011)

Table 1 presents the composition of the sample of 817 agribusiness firms used in this study. We define agribusiness firms as firms with lines of business related to agriculture. The sample is obtained from the intersection of Compustat annual financial data and CRSP monthly stock data for the period 1973 through 2011. Only firms trading U.S. common stocks on NYSE, AMEX, and NASDAQ with the financial data and stock data required for the study are retained in the sample. Agribusiness firms are classified into six groups. Panel A shows the composition of the entire sample (1974-2011). At the end of each June, stocks are classified into three size groups (*Micro, Small, Big*) using NYSE breakpoints[1]. Panel B presents such classification for June 2005.

Panel A. Agribusiness firms

	Firms	Observations (Firm-months)	Percentage of observations
1. Production	43	3,204	3.66%
2. Services, forestry, and fishing	7	703	0.80%
3. Inputs	89	8,902	10.17%
4. Processing and marketing	335	38,716	44.23%
5. Wholesale and retail trade	253	26,562	30.35%
6. Indirect agribusiness	90	9,439	10.78%
Total	817	87,526	100%

Panel B. Micro, Small, and Big cap stocks at the end of June 2005

	Micro	Small	Big
1. Production	4	2	2
2. Services, forestry, and fishing	0	0	1
3. Inputs	14	3	3
4. Processing and marketing	33	12	16
5. Wholesale and retail trade	31	18	11
6. Indirect agribusiness	19	7	6
Total	101	42	39

[1] All NYSE stocks are ranked into decile portfolios based on their size (market capitalization). I define *Micro*, *Small*, *Big* stocks as stocks in the 10^{th} and 20^{th} percentiles, 30^{th} to 50^{th} percentiles, and 60^{th} to 90^{th} percentiles, respectively at the end of each June.

Table 2: Summary statistics on selected firm characteristics (1974-2011)

Table 2 presents statistics on selected firm characteristics for the sample of 817 agribusiness firms in the period 1974 to 2011. *LNSIZE* is the natural logarithm of market capitalization. *B/M* is the book-to-market ratio calculated as the book value of equity at the end of the fiscal year divided by market value of equity for the last month of the previous fiscal year. *MOM* is the momentum measure defined as the cumulated continuously compounded stock return for the months used to create momentum portfolios (12 months in this table). *MRET* is the stock monthly return from CRSP. Stocks are categorized into size groups (*Micro*, *Small*, and *Big*) determined using NYSE breakpoints at the end of each June. *N* indicates the number of form-month observations.

	Mean	Median	Standard deviation
All (N = 85,526)			
LNSIZE	11.50	11.34	2.26
B/M	1.08	0.72	2.22
MOM	0.17	0.10	0.59
MRET	0.01	0.00	0.15
Micro (N = 49,811)			
LNSIZE	10.07	10.05	1.43
B/M	1.32	0.95	1.52
MOM	0.18	0.07	0.69
MRET	0.01	0.00	0.17
Small (N = 19,902)			
LNSIZE	12.44	12.54	1.12
B/M	0.89	0.59	3.89
MOM	0.16	0.11	0.49
MRET	0.01	0.01	0.12
Big (N = 17,813)			
LNSIZE	14.43	14.40	1.61
B/M	0.62	0.46	0.59
MOM	0.14	0.12	0.33
MRET	0.01	0.01	0.09

Table 3: Results from portfolio sorts (1974-2011): Average returns on equally weighted momentum portfolios of small cap agribusiness stocks

Table 3 reports results from comparing ten equally weighted portfolios formed based on *J*-month lagged returns and held for *K* months. Stocks are categorized into size groups (*Micro*, *Small*, and *Big*) determined using NYSE breakpoints at the end of each June. The table presents the average monthly returns on the portfolios in the *Small* size group[2]. The *Sell* (*Buy*) portfolio is the portfolio in the lowest (highest) past return decile. The *Buy* - *Sell* portfolio is the hedge portfolio that takes a long position in *Buy* and a short position in *Sell*. We report *t*-statistics in parentheses.

	K =	3	6	9	12
J = 3	Sell	0.011	0.009	0.009	0.009
		(2.68)	(2.39)	(2.44)	(2.44)
	Buy	0.012	0.013	0.013	0.014
		(3.72)	(4.11)	(4.37)	(4.61)
	Buy-Sell	0.001	0.004	**0.004**	**0.005**
		(0.67)	(1.47)	**(1.77)**	**(2.16)**
J = 6	Sell	0.010	0.007	0.008	0.009
		(2.34)	(1.88)	(2.11)	(2.52)
	Buy	0.014	0.015	0.015	0.015
		(4.24)	(4.61)	(4.83)	(5.04)
	Buy-Sell	0.004	**0.007**	**0.007**	**0.006**
		(1.10)	**(2.20)**	**(2.21)**	**(2.13)**
J = 9	Sell	0.008	0.008	0.009	0.010
		(1.78)	(1.87)	(2.04)	(2.43)
	Buy	0.016	0.017	0.017	0.017
		(4.78)	(5.07)	(5.11)	(5.24)
	Buy-Sell	**0.008**	**0.009**	**0.008**	**0.006**
		(1.93)	**(2.15)**	**(1.94)**	**(1.72)**
J = 12	Sell	0.009	0.010	0.011	0.011
		(1.86)	(2.08)	(2.39)	(2.51)
	Buy	0.018	0.018	0.017	0.017
		(5.12)	(5.28)	(5.22)	(5.39)
	Buy-Sell	**0.009**	**0.008**	0.006	0.006
		(2.00)	**(1.89)**	(1.43)	(1.59)

[2] Results from the entire sample (*All*), the two other size groups (*Micro* and *Big*), and the *All but Small* group are unreported.

Table 4: Sub-period analysis (1980-2000): Momentum portfolios of small cap agribusiness stocks

This table reports the average returns of equally weighted portfolios of small cap agribusiness stocks formed by sorting stocks on *J*-month lagged returns. The portfolios are held for *K* months after formation. Panels A, B, C, and D presents the strategies for *J* = 3, 6, 9, and 12, respectively. The *Sell (Buy)* portfolio is the lowest (highest) past return decile. The last row presents the average monthly returns of the *J*-month/*K*-month hedge portfolio (*Buy – Sell*) after K months of holding.

Panel A – Average monthly returns of small cap portfolios sorted on 3-month lagged returns

K =	3		6		9		12	
J = 3	Mean	*t*-statistic	Mean	*t*-statistic	Mean	*t*-statistic	Mean	*t*-statistic
(Sell) 1	0.008	1.61	0.006	1.34	0.006	1.43	0.007	1.69
2	0.011	3.05	0.012	3.38	0.011	3.45	0.012	3.78
3	0.016	4.53	0.015	4.40	0.014	4.40	0.014	4.32
4	0.014	4.09	0.014	4.38	0.014	4.55	0.014	4.61
5	0.016	4.77	0.016	5.05	0.016	5.10	0.015	4.91
6	0.014	4.41	0.014	4.65	0.015	4.82	0.015	4.89
7	0.017	5.06	0.016	5.00	0.016	4.99	0.015	4.92
8	0.013	4.02	0.014	4.59	0.015	4.85	0.015	4.93
9	0.015	4.20	0.014	4.26	0.015	4.52	0.016	4.70
(Buy) 10	0.012	2.96	0.013	3.50	0.014	3.80	0.015	4.06
Buy - Sell	0.004	1.01	**0.007**	2.33	**0.008**	2.90	**0.008**	3.11

Panel B – Average monthly returns of small cap portfolios sorted on 6-month lagged returns

K =	3		6		9		12	
J = 6	Mean	*t*-statistic	Mean	*t*-statistic	Mean	*t*-statistic	Mean	*t*-statistic
(Sell) 1	0.006	1.15	0.003	0.73	0.004	0.95	0.007	1.67
2	0.012	3.16	0.012	3.48	0.013	3.68	0.013	3.92
3	0.016	4.41	0.015	4.54	0.014	4.45	0.014	4.49
4	0.013	3.70	0.014	4.29	0.015	4.51	0.015	4.57
5	0.015	4.55	0.014	4.47	0.014	4.50	0.014	4.38
6	0.013	4.20	0.014	4.52	0.014	4.67	0.014	4.52
7	0.015	4.56	0.016	4.83	0.016	4.93	0.016	4.95
8	0.014	4.10	0.015	4.46	0.015	4.51	0.015	4.56
9	0.016	4.61	0.016	4.85	0.017	5.05	0.017	5.13
(Buy) 10	0.015	3.92	0.017	4.38	0.018	4.60	0.018	4.82
Buy - Sell	**0.010**	2.20	**0.014**	3.52	**0.014**	3.79	**0.012**	3.43

Table 4 (continued)

Panel C – Average monthly returns of small cap portfolios sorted on 9-month lagged returns

K =	3		6		9		12	
J = 9	Mean	*t*-statistic	Mean	*t*-statistic	Mean	*t*-statistic	Mean	*t*-statistic
(Sell) 1	0.005	0.92	0.005	0.96	0.004	0.97	0.007	1.61
2	0.013	3.44	0.014	3.87	0.015	4.36	0.016	4.56
3	0.011	3.25	0.012	3.54	0.012	3.87	0.013	4.27
4	0.013	3.69	0.015	4.37	0.014	4.49	0.014	4.59
5	0.014	4.33	0.014	4.45	0.014	4.42	0.013	4.42
6	0.015	4.76	0.015	4.74	0.014	4.69	0.014	4.61
7	0.018	5.56	0.016	5.07	0.016	4.93	0.015	4.64
8	0.015	4.63	0.015	4.78	0.016	4.82	0.015	4.72
9	0.017	4.58	0.017	4.64	0.017	4.70	0.017	4.83
(Buy) 10	0.018	4.16	0.020	4.77	0.019	4.76	0.020	4.90
Buy - Sell	**0.013**	2.69	**0.015**	3.36	**0.015**	3.52	**0.012**	3.10

Panel D – Average monthly returns of small cap portfolios sorted on 12-month lagged returns

K =	3		6		9		12	
J = 12	Mean	*t*-statistic	Mean	*t*-statistic	Mean	*t*-statistic	Mean	*t*-statistic
(Sell) 1	0.005	1.02	0.006	1.29	0.008	1.71	0.009	2.00
2	0.012	3.16	0.013	3.62	0.014	3.85	0.015	4.29
3	0.015	4.41	0.015	4.55	0.015	4.88	0.015	4.91
4	0.015	4.25	0.014	4.33	0.014	4.54	0.014	4.44
5	0.014	4.40	0.015	4.88	0.014	4.43	0.014	4.59
6	0.016	4.87	0.015	4.71	0.016	4.84	0.015	4.63
7	0.015	4.45	0.015	4.47	0.015	4.58	0.015	4.52
8	0.015	4.40	0.014	4.19	0.014	4.25	0.014	4.39
9	0.014	3.80	0.016	4.49	0.016	4.63	0.017	4.71
(Buy) 10	0.023	5.26	0.022	5.21	0.021	5.18	0.022	5.39
Buy - Sell	**0.017**	3.37	**0.016**	3.18	**0.013**	2.78	**0.012**	2.78

Table 5: Representative sample of small cap agribusiness stocks in year 2000

This table displays the bottom 15 and top 15 small cap agribusiness stocks by size (in millions of U.S. dollars) observed as of year 2000 in this study. *Size* is defined as market capitalization. All NYSE stocks are ranked into decile portfolios based on their size at the end of each June. We define small stocks as stocks in the 30^{th}, 40^{th}, and 50^{th} percentiles.

Panel A. Bottom 15 small agribusiness firms as of end of June 2000 ranking

Ticker	Name	Size	Classification
JILL	J JILL GROUP INC	41.21	5.Wholesale and retail trade
AOI	ALLIANCE ONE INTL INC	94.62	3. Inputs
DVERQ	DAN RIVER INC -CL A	106.36	4.Processing and marketing
AVDO	AVADO BRANDS INC	106.82	5.Wholesale and retail trade
KELLQ	KELLSTROM INDUSTRIES INC	108.69	3. Inputs
JJSF	J & J SNACK FOODS CORP	110.25	4.Processing and marketing
CJML	CONE MILLS CORP	114.69	4.Processing and marketing
UTCIQ	UNIROYAL TECHNOLOGY CORP	115.82	4.Processing and marketing
TRA	TERRA INDUSTRIES INC	117.67	3. Inputs
LUB	LUBYS INC	123.31	5.Wholesale and retail trade
MSPIQ	MISSISSIPPI CHEMICAL CORP	124.13	3. Inputs
IMKTA	INGLES MARKETS INC -CL A	130.60	5.Wholesale and retail trade
SAFM	SANDERSON FARMS INC	137.01	4.Processing and marketing
LSCO	LESCO INC	143.57	3. Inputs
ENCZQ	ENESCO GROUP INC	149.10	3. Inputs

Panel B. Top 15 small agribusiness firms as of end of June 2000 ranking

Ticker	Name	Size	Classification
SMG	SCOTTS MIRACLE-GRO CO	489.72	3. Inputs
MIKL	MICHAEL FOODS INC	499.94	4.Processing and marketing
AGX.1	AGRIBRANDS INTERNATIONAL INC	510.12	4.Processing and marketing
OATS	WILD OATS MARKETS INC	510.14	5.Wholesale and retail trade
AIPC	AMER ITALIAN PASTA CO -CL A	518.57	4.Processing and marketing
RML.1	RUSSELL CORP	553.72	4.Processing and marketing
SONC	SONIC CORP	559.76	5.Wholesale and retail trade
UVV	UNIVERSAL CORP/VA	596.44	4.Processing and marketing
CBRL	CRACKER BARREL OLD CTRY STOR	672.93	5.Wholesale and retail trade
CAKE	CHEESECAKE FACTORY INC	703.29	5.Wholesale and retail trade
BERW	BERINGER WINE EST HLD -CL B	762.17	4.Processing and marketing
BKI	BUCKEYE TECHNOLOGIES INC	766.19	6.Indirect agribusiness
CEC	CEC ENTERTAINMENT INC	768.09	5.Wholesale and retail trade
AGCO	AGCO CORP	800.15	3. Inputs
APPB	APPLEBEES INTL INC	803.31	5.Wholesale and retail trade
JACK	JACK IN THE BOX INC	821.59	5.Wholesale and retail trade

Table 6: Fama and MacBeth regressions (1980-2000): Does the momentum measure affect future returns on small agribusiness stocks?

Table 6 presents the results from Fama and MacBeth (1973) two-step regressions of future monthly returns (three months later in this table) of small agribusiness stocks in the period 1980 to 2000. In the first step, for each month a cross-sectional regression is performed. Then, in the second step, the final coefficient estimates are obtained as the average of the first step estimates. The main independent variable *MOM* is the momentum measure defined as the cumulative continuously compounded stock returns for the period ending in the month of observation (12 months in this table). *LNSIZE* is the natural logarithm of market capitalization. *B/M* is the book-to-market ratio calculated as the book value of equity at the end of the fiscal year divided by market value of equity for the last month of the previous fiscal year. We control for year fixed effects in all models. Model 3 includes control for agribusiness classifications as defined by USDA/ERS. The symbols ***, **, and * represent statistical significance at the 1%, 5%, and 10% level, respectively. We report *t*-statistics in parentheses.

Dependent variable = Stock monthly return three months after month of observation

	Model 1	Model 2	Model 3
MOM	0.052***	0.054***	0.050***
	(12.91)	(13.42)	(11.42)
LNSIZE		-0.007***	-0.005**
		(-3.01)	(-2.13)
B/M		0.000	-0.000
		(0.18)	(-0.04)
Intercept	0.006*	0.089***	0.068**
	(1.73)	(3.18)	(2.32)
Observations	10,181	10,181	10,181
R-squared	0.096	0.167	0.270
Year effects	Yes	Yes	Yes
Classification effects	No	No	Yes

Table 7: Average monthly risk-adjusted returns (1980-2000): Do the Fama and French three-factor model explain the returns from momentum strategies on small agribusiness stocks?

This table presents results from regressions of the momentum hedge portfolio returns (*MOM12/K*) on the Fama and French (1993) three factors. *MOM12/K* is the monthly return on the *Buy – Sell* strategy, where *Buy* and *Sell* are equally weighted portfolios formed based on 12-month lagged returns and held for *K* months. The average monthly risk-adjusted return is the estimate of alpha (in decimal, not percentage, form) from:

$$MOM12/K_{p,m} = alpha_p + \beta_p MKTRF_m + s_p SMB_m + h_p HML_m + \varepsilon_{p,m}$$

$MKRTF_m$ is the excess return on the market in month m.
SMB_m is the difference between returns on small and bid stocks in month m.
HML_m is the difference between returns on high and low book-to-market portfolios in month m.
The symbols *** and * represent statistical significance at the 1% and 10% level, respectively.
The standard errors are robust to heteroskedasticity. We report *t*-statistics in parentheses.

Dependent variable = Monthly return on the "Buy – Sell" momentum portfolio

	Model 1 K=3	Model 2 K=6	Model 3 K=9	Model 4 K=12
Alpha	0.020***	0.017***	0.013***	0.012***
	(3.74)	(3.30)	(2.79)	(2.67)
MKTRF	-0.145	-0.030	0.072	0.099
	(-0.98)	(-0.21)	(0.55)	(0.75)
SMB	-0.282*	-0.293*	-0.302**	-0.255*
	(-1.70)	(-1.81)	(-2.01)	(-1.75)
HML	-0.354	-0.312	-0.273	-0.221
	(-1.49)	(-1.29)	(-1.15)	(-1.00)
R-squared	0.016	0.016	0.021	0.020

Figure 1: J-month/K-month sort strategy

This figure illustrates the J-9/K-3 sort strategy. Each month, stocks are ranked using their 9-month past returns (J = 9) to form equally weighted decile portfolios. The 9-month cumulative continuous compounded return is referred to as the momentum measure *MOM*. Portfolios are held for three months (K = 3). The momentum hedge portfolio has a long position in the portfolio in the highest *MOM* decile and an equally sized short position in the portfolio with the lowest *MOM* decile.

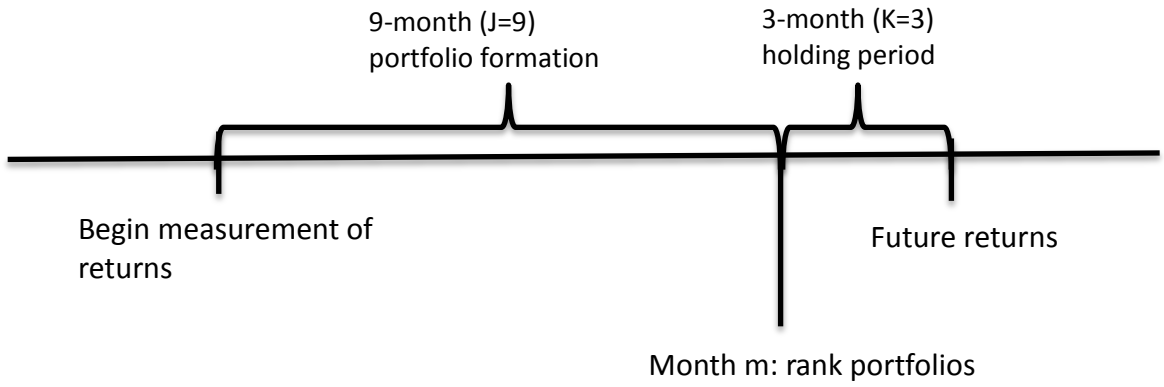
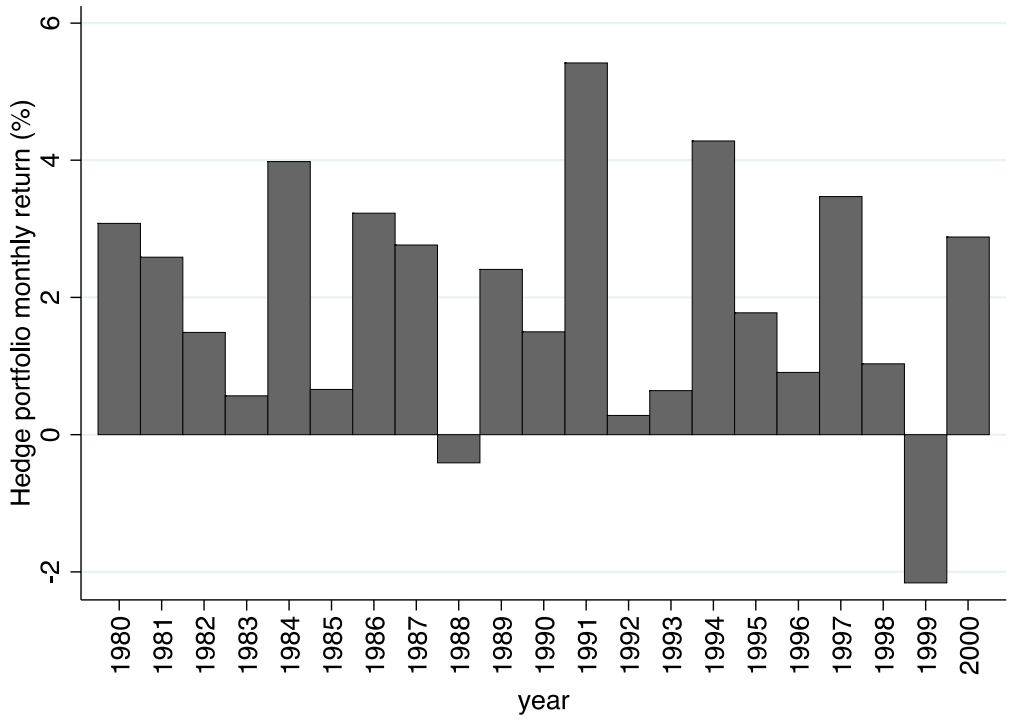


Figure 2: Average monthly returns on agribusiness small caps momentum hedge portfolio (1980-2000)

This figure displays the average monthly returns on a hedge portfolio taking a long position in the lowest decile of momentum and an equally sized short position in the highest decile of momentum using the J-month/K-month strategy. The portfolio is formed during a 12-month period (J = 12) prior each month and held three months (K = 3).



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