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Uncertainty and Value Premium: Evidence from the U.S. Agriculture Industry

Bruno Arthur and Ani L. Katchova*

We test the efficiency of the financial market for the stocks of publicly traded firms related to the largely subsidized U.S. agriculture industry. We study how the anomalous value premium appears in the stocks of participating firms. Our study of the value and growth anomalies of these stocks utilizes the sorting and the beta-premium regressions methods. The firm level data are obtained from merging the Center for Research in Security Prices (CRSP) data from NYSE, Amex, NASDAQ exchanges with the financial statements data from the Compustat database of Standard & Poor's. The results show that the beta of the lower deciles of the agriculture industry related firms are in the same volatility direction as the market but at a lesser degree. The "cash-flow-to-price trading" strategy in agriculture-related stocks appears to be profitable as a riskless hedge portfolio that longs high CF/P agriculture-related stocks and short low CF/P agriculture-related stocks generates, on average and all else equal, a positive and statistically significant abnormal return of 0.23% per year. Perhaps, these U.S. agriculture industry firms benefit some spill-over from farm Bills subsidies.

JEL classification: Q14, G12, G14

Keywords: Agricultural Finance, Asset Pricing, Information and Market Efficiency

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Uncertainty and Value Premium: Evidence from the U.S. Agriculture Industry

We test the efficient market hypothesis (EMH) relative to the stocks of publicly traded firms involved in the U.S. agriculture industry. The literature of the rational expectations theory (RET) states that the predictions of economic agents of the future value of economic variables are correct on average and are not systematically biased (Muth, 1961). The RET is the cornerstone in support of economic policymaking and the basis of the EMH in financial economics literature. The EMH states that stock market prices always incorporate and reflect all relevant information (Fama, 1970). The academic studies and the investors' practice have divided opinions between the underlying rational expectations of the financial markets and the scores of empirical studies that evidence anomalies in contradiction to market efficiency.

We study how the anomalous value premium appears in the stocks of U.S. agriculture industry participating firms. Among these puzzling anomalous facts are the value and growth financial anomalies. A "value stock" is characterized by high earnings-to-price ratio (E/P ; Basu, 1977) or high book-to-market ratio (BV/MV ; Fama and French, 1993). A value stock trades at a lower price relative to its fundamental financial characteristics such as dividends, earnings, sales, etc. Conversely, a low E/P is the characteristic of a "growth stock" (Basu, 1977). The low E/P of growth stock suggests the expectation of higher earnings growth as compared to the high E/P of value stock. In short, the "value premium" says that value stocks with high E/P earn significantly higher returns than growth stocks with low E/P . As early as the study of Basu (1977) and as recently as the study of Pastor and Veronesi (2012), a number of works have shown the anomalous persistence of the value premium. Besides the empirical evidence from the

academic studies, managers of relatively small funds and large institutional investors alike advertise value premium investment strategies.

We test the varying-risk explanation of the value premium with the market for the stocks of U.S. agriculture industry participating firms. Besides the persistence of the value premium anomaly, another puzzling situation is the absence of consensus on why value premium based investment strategies work, despite the premises of the RET and the EMH. To no surprise, the advocates of the EMH such as Fama and French (1992, 1993, 1996, 1998, and 2006) explain the value premium with the risk-return paradigm. They say that value firms are riskier. They are some of the advocates of rationality insisting that when the riskiness of value portfolios is properly accounted for, “there is no anomaly”. As an alternate explanation, other studies insist on persistent mispricing. Lakonishok, Shleifer and Vishny (1994) using size (small versus large market capitalization) adjusted returns, and Chan and Lakonishok (2004) insisting on institutional holdings, argue that arbitrage cannot eliminate the anomalous value premium because the power and the behavioral influences of large institutional investors create a market bias. They are some of the advocates of the behavioral explanation in lieu of the rational argument. Earlier studies such as the investigation of Lo and MacKinlay (1990) focus on findings value premium due to data-mining. The study of Chan, Hamao and Lakonishok (1991) with data from the Japanese stock markets; and Fama and French (1998) with varied international evidences contradict the data-mining explanation.

The U.S. agriculture industry provides an interesting ground for testing financial anomalies because it is largely subsidized by Farm Bills from 1965 to date (cf. the Congressional Research Service). Usually, the E/P ratios are used in investment strategies

when compared relative to the E/P of large parts of the all participating firms, or relative to the E/P of one firm as compared to its historical values across time periods. These E/P ratios are also used in investment strategies as a relative discriminant among companies in the same industry. The U.S. agriculture industry is subsidized by Farm Bills that are designed in part to hedge for industrial organization risks. Thus, we are interested to test the risk-return paradigm explanation of the value premium with the market for the stocks of U.S. agriculture industry participating firms. It could be informative to learn if agriculture related value firms are more or less risky than other firms. It would be equally interesting and important to learn among the agriculture related firms if value portfolios are properly accounted for their corresponding risk level or if there is some mispricing. We are focused in the U.S. agriculture industry because of the possible spill-over effects of government policies on economic variables, such as stock prices and returns.

The objective of this study is to examine how the anomalous value premium appears in the stocks of U.S. agriculture industry participating firms. We test whether the participation in the Farm Bill subsidized U.S. agriculture industry affect the risk exposure and the stock prices of participating firms. We address the varying-risk explanation of value and growth stocks anomalies, and value premium investment strategy with two methods: a simple sorting procedure (e.g., Fama and French, 2006) and a formal beta-premium regressions method (e.g., Petkova and Zhang, 2005.) This study uses firm level data obtained from merging the Center for Research in Security Prices (CRSP) data from NYSE, Amex, NASDAQ exchanges with the financial statements data from the Compustat database of Standard & Poor's. For the sorting model, we compare the decile portfolio book-to-market ranking of the agriculture related firms with the U.S. full sample

firms. While the most significant variable for comparison is the risk variable “beta”, we also compare the values characteristics of book value of equity (BV), market value of equity (MV), earnings-to-price ratio (E/P), Cash flow-to-price ratio (CF/P), and dividend-to-price ratio (D/P i.e. dividend yield) of both groups. For the beta-premium regressions method, the most significant variable for comparison is the market premium, which we examine with three portfolio strategies: Book-to-Market Portfolios, Cash-flow-to-Price Portfolios, and Earnings-to-Price Portfolios. Our results help us learn the effects of the participation in the Farm Bill subsidized U.S. agriculture industry on the risk exposure and the stock prices of participating firms.

Methods

We study the value and growth anomalies of the stocks of U.S. agriculture industry according to the established literature with the sorting method (Fama and French, 2006; Petkova and Zhang, 2005) and the formal testing of risk and return paradigm (Fama and French 1993; Petkova and Zhang, 2005) with the Capital Asset Pricing Model (CAPM).

Sorting method

The sorting method is effectively used in academic research and real-life investment strategies to calculate for possible abnormal returns by sorting stocks into portfolios ranked by a certain variable such as a momentum variable (Jegadeesh and Titman, 1993), accruals variable (Sloan, 1996), and fundamental characteristics (Daniel and Titman, 1997). In these value premium investment strategies, we compare the mean (respectively median) of the risk factor “beta” of value stocks (high book-to-market ratios) and growth stocks (low book-to-market ratios), of book value of equity (BV), market value of equity (MV), earnings-to-price ratio (E/P), Cash flow-to-price ratio (CF/P), and dividend-to-

price ratio (D/P i.e. dividend yield). We rank stocks for each month every year into portfolio deciles using the sorting variable Book-to-Market. Stocks are equally weighted in each portfolio.

To measure systematic risk, we estimate “*Beta*” from a rolling regression of monthly raw returns on the CRSP Stock Market Index (NYSE/Amex/NASDAQ) equally weighted monthly returns, using 60-month return data ending four months after each firm’s fiscal year end. Beta is calculated every month of all years for each portfolio decile:

$$BMret_{ym} = Beta_{ym} \times MKTret_{ym} + \varepsilon_{ym} \quad (1)$$

In Equation (1), for each month m of year y , $BMret_{ym}$ and $MKTret_{ym}$ represent the monthly return of a decile portfolio and of the market, respectively.

We use equally weighted monthly returns; with 60-month return data ending four months after each firm’s fiscal year end. Value premium investment strategies consist of taking positions on hedge portfolios “high minus low” (value minus growth) designed according to E/P rankings.

Beta-premium regressions method

At the heart of the financial economics literature testing the EMH is the Capital Asset Pricing Model (CAPM; Treynor, 1961; Sharpe, 1964; and Lintner, 1965). The CAPM is the benchmark model for asset pricing tests when considering the risk and return paradigm.

We calculate the *CAPM Alpha* as the estimated value of α from:

$$(R_{p,t} - R_{f,t}) = \alpha_p + \beta_p (R_{m,t} - R_{f,t}) + \varepsilon_{p,t} \quad (2)$$

In Equation (2):

$R_{p,t}$ = 12-month buy-and-hold return (BHR) to portfolio p in year t , including dividends and distributions. BHR for stock i in year t are calculated as

$$BHR_{i,t} = \prod_{j=1}^{J=12} (1 + r_{i,j}) - 1, \quad (3)$$

where $r_{i,j}$ is the monthly return on stock i , including dividends and distributions over month j , where $j=1$ corresponds to the fourth month after each financial report date.

$(R_{m,t} - R_{f,t})$ = Market premium, where

$R_{f,t}$ = Annual T-bill yield in year t .

$R_{m,t}$ = Market return, estimated by cumulating monthly returns on the equally-weighted NYSE/Amex/NASDAQ index. The 12-month return accumulation period begins four month after the financial report of year t .

Data

The economic investigation guides the selection of our data repositories. The choice of the sort and beta-premium regressions methods guides our data processing.

Data repositories

This study uses firm level data obtained from major sources. From the Center for Research in Security Prices (CRSP), we obtain the CRSP US Stock and index databases contents (CRSP stock data) covering the period 2002-2011. CRSP stock data includes data from NYSE, Amex, NASDAQ exchanges. While data from NYSE Arca exchange provided by Interactive Data Corporation (IDC) are added since March 2006, we still

refer to the data sources as NYSE/Amex/Nasdaq. From Standard & Poor's Compustat database, we obtain the financial fundamentals, statistical and market information on companies covering 2001-2010. Compustat provides all financial fundamentals data from financial statements of publicly traded firms. We use the NAICS version 2002 and 2007 repositories from the U.S. Census Bureau to tailor for firms involved with the U.S. agriculture industry. These databases provide detailed and reliable economic information trusted by academic research institutions, financial institutions, and a broad range of sophisticated economic agents of the financial markets

Data processing

We use the CUSIP 9-character alphanumeric code identifier of financial security operated by Standard & Poor's and the CRSP's unique permanent security identification number PERMNO to merge the financial markets prices of ordinary common shares from CRSP with the necessary financial statements data from Compustat. The full U.S. sample consists of 452,837 firm-month observations covering the CRSP stock data. These are the U.S. firms with available ordinary common stocks data on CRSP from July 2002 to December 2011, and a total of 42,244 firm-year observations from Compustat for fiscal years 2001 to 2010. We drop all firms who do not have sufficient financial data to compute book-to-market, cashflow-to-price ratio, earnings-to-price ratio, and dividend yield.

We consider the financial data from Compustat as of one fiscal year earlier than the stock returns from CRSP assuming that investors consider past fiscal year financial data in their decisions. For the study period 2002-2011, we collect CRSP returns covering 2002-2011 and Compustat past fundamentals to current fundamentals covering 2001-

2010. Specifically, when merging CRSP with Compustat, we move the month of report date (fiscal year end date) from Compustat forward by four months. It is also worth noting that if the reported month of fiscal year-end is of January to May, the data year reported on Compustat indicates the beginning of the fiscal year and if the reported month of fiscal year-end is of June to December, the data year indicates the end of the fiscal year. We use the industry taxonomies of the Standard Industrial Classification (SIC), the North American Industry Classification System (NAICS) and the Global Industry Classification Standard (GICS) as industry classification management methods to identify the universe of firms related to U.S. agriculture industry. There are 172 unique firms in the agriculture related sample. Therefore, our study's sample of agriculture-related firms includes 13,677 firm-month observations and 1,365 firm-year observations. Table 1 displays the mean (*median*) values of selected characteristics for decile portfolios sorted by Book-to-Market. Table 1, panel A, statistically describes the full U.S. sample. Table 1, panel B, statistically describes our U.S. agriculture industry sample and displays our results of the sort method.

Empirical results

For the sorting model, the full sample in Panel A consists of U.S. firms trading on NYSE, Amex, or NASDAQ. Size measured by market capitalization i.e. Market Value of Equity (MV) falls (except from Portfolio 1 to Portfolio 2) across the BV/MV deciles. The lowest BV/MV portfolio accounts for \$4,102 million in size while the highest BV/MV portfolio accounts for \$1,266 million, on average. We compare the decile portfolio book-to-market ranking of the agriculture related firms with the U.S. full sample firms. We look for possible abnormal returns by sorting stocks into portfolios ranked by the value premium

main variable. Table 1 reports the mean and median values for selected characteristics of Book-to-Market (BV/MV) deciles, where firms are ranked by BV/MV and sorted into ten portfolios. . At the 9th decile, both all U.S. group and U.S. agriculture industry groups have a BV/MV of 1.090 and 1.060, respectively. In fact, all deciles from the 2nd to the 9th are comparable for the two groups. This indicates on average, the firms in the agriculture industry are comparable to the all U.S. firms when their portfolio book-to-market are considered. However, these groups differ sharply at the extremes, the growth and the value stocks. For the full U.S. sample, the growth stock at the 1st decile has the lowest BV/MV of (-17.846) while the value stock at the 10th decile has the highest BV/MV of 27.120. In contrast, the firms of the U.S. agriculture industry considered as firms in the growth stock category are 0.113. The BV/MV of 105.210 of the 10th decile for agriculture group indicates that the firms in that group are much undervalued by the market. The beta of the portfolio indicates the correlation of the portfolio's volatility with the benchmark's, which benchmark is the entire market. When a beta is less than zero, it indicates a volatility moving opposite to the market. When a beta is greater than one, it indicates that the portfolio's volatility is in the same direction as the market's volatility, albeit at a greater rate. The striking difference is that the beta of the lower deciles of the agriculture industry related firms are in the same direction as the market but at a lesser movement. On average, these firms are more stable than the market firms in general, perhaps as a result of subsidies from the Farm Bill.

Table 2 presents the results from comparing ten portfolios formed by sorting the agriculture-related stocks based on BV/MV, CF/P, and E/P in Panels A, B, and C, respectively. We omit to present the results from sorting the stocks based on Dividend

yield because the lack of variations in this variable does not allow enough observations for the sort. Consistent with the results in Table 1, all three panels of Table 2 show that the portfolios with the lowest value of the ranking variable have lower systematic risk than the portfolios with the highest one. Systematic risk is the estimated value of beta, which is the coefficient of Market premium in Equation (2). In Panel A, while the three decile portfolios with the highest BV/MV present statistically significant positive abnormal returns (measured by CAPM alpha), a strategy that long high BV/MV stocks and short low BV/MV stocks does not provide a statistically significant abnormal return. Specifically, the CAPM alpha of this long-short portfolio is -0,156% per year. Similarly, as shown in Panel C, on average, for the E/P long-short portfolio ($H - L$), the CAPM alpha is 0.179% per year but this value is not statistically significant at the conventional levels. These two results appear to imply that agriculture-related stocks do not present a value premium. However, we have a striking result in Panel B. A "Cash-flow-to-price trading" strategy in agriculture-related stocks appears to be profitable. A riskless hedge portfolio that longs high CF/P agriculture-related stocks and short low CF/P agriculture-related stocks generates, on average and all else equal, a positive and statistically significant abnormal return of 0.23% per year. On average, trading the stocks of these agriculture firms gives positive returns indicating that these firms are rewarding, perhaps due to their subsidized industrial organization.

Conclusion and Policy Implications

We test the efficiency of the financial market for the stocks of publicly traded firms related to the largely subsidized U.S. agriculture industry. We study how the anomalous value premium appears in the stocks participating firms. We test the varying-

risk explanation of the value premium with the market for the stocks of industry participating firms. We study the value and growth anomalies of the stocks according to the established literature with the sorting method and the formal testing of risk and return paradigm with the Capital Asset Pricing Model (CAPM). This study uses firm level data obtained from merging the Center for Research in Security Prices (CRSP) data from NYSE, Amex, NASDAQ exchanges with the financial statements data from the Compustat database of Standard & Poor's. The main results indicate that the beta of the lower BV/MV deciles of the agriculture industry related firms are in the same direction as the market but at a lesser movement. Another striking result in Panel B indicates that a "cash-flow-to-price trading" strategy in agriculture-related stocks appears to be profitable. A riskless hedge portfolio that longs high CF/P agriculture-related stocks and short low CF/P agriculture-related stocks generates, on average and all else equal, a positive and statistically significant abnormal return of 0.23% per year. These results indicate some policy implications. On average, trading the stocks of these agriculture related firms gives positive returns indicating that these firms are rewarding. On average, these firms are more stable than the all market firms in general. Perhaps, these results are related to the subsidies from the Farm Bills. The U.S. agriculture industry provides an interesting ground for testing financial anomalies because it is largely subsidized by Farm Bills.

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Table 1. Mean (*Median*) Values of Selected Characteristics for Decile Portfolios Sorted by Book-to-Market

	Portfolio Book-to-Market Ranking									
	Lowest	2	3	4	5	6	7	8	9	Highest
<i>Panel A: Full sample</i>										
BV (\$m)	785	1,622	1,749	2,012	2,195	2,230	2,254	2,069	2,094	1,678
	52	186	227	263	264	233	233	217	176	130
MV (\$m)	4,102	7,325	5,787	5,074	4,504	4,080	3,340	2,602	2,072	1,266
	327	842	741	672	548	414	342	263	169	76
BV/MV	-17.846	0.203	0.303	0.395	0.488	0.590	0.706	0.854	1.090	27.120
	0.057	0.197	0.285	0.363	0.447	0.537	0.639	0.765	0.974	1.612
E/P	-7.511	-0.028	-0.004	0.006	0.009	-0.011	-0.015	-0.029	-0.084	38.273
	-0.017	0.028	0.038	0.043	0.048	0.050	0.051	0.050	0.044	0.006
CF/P	-6.039	0.000	0.028	0.044	0.050	0.038	0.043	0.041	0.008	41.281
	0.012	0.041	0.058	0.066	0.073	0.079	0.085	0.088	0.091	0.091
D/P	1.194	0.877	0.930	1.081	1.329	1.545	1.660	1.685	1.784	2.191
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Beta	1.147	1.108	1.034	1.034	0.974	1.022	1.019	0.942	0.976	1.106
	1.155	1.090	1.034	1.020	0.973	1.017	1.012	0.935	0.949	1.074
N	4,220	4,224	4,226	4,225	4,224	4,227	4,225	4,226	4,224	4,223
<i>Panel B: Agriculture-related firms</i>										
BV (\$m)	602	826	864	595	1,049	746	670	508	584	427
	120	279	234	200	254	248	184	200	128	99
MV (\$m)	4,920	3,808	3,042	1,760	2,522	1,513	1,088	710	616	325
	1,202	1,300	854	521	542	531	341	266	144	54
BV/MV	0.113	0.215	0.293	0.368	0.456	0.543	0.648	0.793	1.060	105.210
	0.121	0.210	0.280	0.345	0.406	0.514	0.574	0.719	0.945	1.504
E/P	-0.003	0.021	0.032	-0.009	0.016	0.025	0.002	0.029	-0.125	19.126
	0.032	0.036	0.044	0.043	0.047	0.058	0.057	0.060	0.045	-0.003
CF/P	0.035	0.048	0.066	0.035	0.061	0.076	0.061	0.156	-0.012	49.132
	0.052	0.058	0.064	0.070	0.082	0.095	0.094	0.110	0.112	0.102
D/P	1.098	0.725	0.570	0.734	0.872	1.095	2.175	0.858	0.919	1.236
	0.000	0.000	0.000	0.000	0.000	0.350	0.000	0.000	0.000	0.000
Beta	0.897	0.926	0.914	0.918	0.933	0.924	0.888	1.079	1.078	1.082
	0.855	0.958	0.977	0.988	0.969	0.894	0.927	1.071	1.126	1.128
N	131	138	140	134	138	138	136	138	140	132

Notes: The full sample consists of 452,837 firm-month observations covering NYSE, AMEX and Nasdaq firms with available data on CRSP from July 2002 to December 2011, and a total of 42,244 firm-year observations from Compustat for fiscal years 2001 to 2009. The sample of agriculture-related firms includes 13,677 firm-month observations and 1,365 firm-year observations.

Nomenclature of Variable

BV = Book value of equity. BV is the book value of stockholders' equity, plus balance sheet deferred tax and investment tax credit (if available), minus the book value of preferred stock. Depending on availability, the book value of preferred stock is the redemption value, the liquidation value, or the carrying value.

MV = Market value of equity. MV is the fiscal year end closing price times shares outstanding

BV/MV = Book-to-Market

E/P = Earnings/Price ratio. E/P is the total earnings before extraordinary items divided by MV

CF/P = Cashflow/Price ratio. Cashflow is the total earnings before extraordinary items, plus depreciation, plus deferred taxes (if available). CF/P is Cashflow divided by MV

D/P = Dividend yield. D/P is the dividends per share for which the ex-dividend dates occurred during the reporting period, divided by the fiscal year end closing price

Beta is estimated from a regression of monthly raw returns on the CRSP Stock Market Index (NYSE/AMEX/Nasdaq/Arca) equally weighted monthly returns, using 60-month return data ending four months after each firm's fiscal year end.

Table 2. Do Agriculture-Related Value Stocks Generate Better Returns?

Panel A. Book-to-Market Portfolios

	Lowest (L)	2	3	4	5	6	7	8	9	Highest (L)	H - L
Market premium	3.937* (1.95)	0.600*** (5.09)	0.686*** (6.48)	0.491* (2.29)	0.825*** (7.47)	0.641*** (4.87)	0.669*** (6.35)	0.814*** (5.27)	1.337*** (7.96)	2.255*** (9.11)	-1.696 (-0.83)
CAPM alpha	0.344 (0.48)	-0.005 (-0.11)	0.001 (0.03)	0.082 (1.07)	0.053 (1.34)	0.041 (0.88)	0.060 (1.58)	0.127* (2.29)	0.135* (2.25)	.191* (2.19)	-0.156 (-0.21)
R-squared	0.322	0.764	0.840	0.395	0.875	0.748	0.835	0.777	0.888	0.912	0.080

Panel B. Cash-flow-to-Price Portfolios

	Lowest (L)	2	3	4	5	6	7	8	9	Highest (L)	H - L
Market premium	1.875*** (9.03)	0.748*** (3.82)	3.908* (2.01)	0.573** (3.20)	0.504*** (6.19)	0.623*** (5.36)	0.714*** (9.46)	0.787*** (5.82)	0.998*** (5.36)	1.476*** (9.10)	-0.376 (-1.57)
CAPM alpha	-0.003 (-0.04)	0.037 (0.53)	0.395 (0.57)	0.015 (0.24)	0.056* (1.93)	0.041 (0.98)	0.103*** (3.83)	0.035 (0.71)	0.124 (1.86)	0.227*** (3.88)	0.230** (2.70)
R-squared	0.911	0.645	0.336	0.562	0.827	0.782	0.918	0.809	0.782	0.912	0.235

Panel C. Earnings-to-Price Portfolios

	Lowest (L)	2	3	4	5	6	7	8	9	Highest (L)	H - L
Market premium	1.945*** (9.61)	0.743*** (3.71)	0.904*** (3.88)	3.919* (1.99)	0.805*** (5.32)	0.351* (2.00)	1.025*** (5.22)	0.560*** (6.75)	0.678*** (5.27)	1.234*** (4.59)	-0.699* (-2.17)
CAPM alpha	0.053 (0.74)	0.019 (0.27)	0.118 (1.42)	0.361 (0.51)	0.055 (1.02)	0.063 (1.00)	0.043 (0.60)	0.055 (1.84)	0.046 (0.99)	0.232** (2.41)	0.179 (1.57)
R-squared	0.920	0.633	0.653	0.332	0.780	0.333	0.773	0.851	0.776	0.725	0.372

Notes: ***, **, and * represent statistical significance at the 1%, 5%, and 10% level, respectively. *t*-statistics are in parentheses.

