Consumer Confidence in the Food System, Media Coverage and Stock Prices of Food Companies: A Regression Analysis.

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Abstract

A series of recent and serious food safety incidents have generated a national debate over the significant costs that they impose on various stakeholders - consumers, industry, or the government. This paper examines the impact of media coverage of food safety and defense issues on consumer confidence in food safety, and measures the response of stock prices of food companies to changes in consumer confidence. Results show that, increases in media coverage have a negative impact on consumer confidence, and that decreases in the levels of consumer confidence on food safety have a negative impact on stock prices of food companies, in particular for the larger firms. These findings confirm that the financial performance of food the industry is negatively affected by category-specific food safety events, and the effects of media coverage on consumer confidence in the safety of the food system.

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INTRODUCTION

Historically, the U.S. food supply has been considered among the safest in the World, however a series of recent outbreaks and food scares has eroded consumer trust, and demonstrated the important challenges faced by industry and government authorities. Some of the most serious incidents, such as the tomato/jalapeno peppers and the peanut butter Salmonella outbreaks in 2009, were linked to illness and deaths. Due to their severity and frequency, these events were covered by national media and raised concerns amongst consumers, industry leaders and policy makers. Previous studies have found evidence of changes in public opinion triggered by the media's focus on particular issues. Because most consumers are expected to acquire their information about food safety issue from mass media, they are also more likely to be influenced by news stories.

Besides the obvious negative impacts of food safety incidents on consumers, these events can also have financial consequences for the implicated firms. The bulk of all cases of food-

borne illness in the U.S. are likely originated from domestically produced foods because food imports make up only a small proportion of all foods consumer in the country (Buzby, 2001). This is not a trivial issue given the important economic role that the American food industry plays nationally. This sector alone contributes to about 20 percent of the U.S. Gross National Product, employs about 14 million individuals, and provides an additional four million jobs in related industries (CFSAN, 2010).

The changes in stock prices to announcements of economic events, and the linkages between consumer confidence and the performance of capital markets are recurrent topics in finance literature. However, to our knowledge, there has been no empirical research on the impacts that changes in consumer confidence in food safety and media coverage of food safety and defense events may have on stock prices of food companies. Unlike in other economic activity, all financial investors in the food sector are also consumers of food products[1]. This idiosyncrasy justifies a better understanding of the existing linkages between media, consumer confidence and the stock markets for the food sector. To conduct the empirical analysis, three indices are specifically constructed to measure each variable. Using regression analysis, this study attempts to first measure the impacts of media coverage of food safety and defense events on consumer-investor confidence in food safety. From this regression two different confidence components are derived, one influenced by media coverage and another by all other factors. Then, Dynamic OLS (DOLS) is used to estimate the effects of changes in these confidence measures on stock prices for food companies.

Results from this paper show that increases in media coverage of food safety and defense events do indeed erode consumer-investor confidence in food safety. Another important finding

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[1] Accordingly, consumer confidence is identified as consumer-investor confidence for the remainder of the paper.

is the positive relationship between consumer-investor confidence in the food system and stock prices of U.S. food producers.

The remainder of the paper is organized as follows. Section 2 discusses the literature on the linkages between media coverage, consumer confidence and stock prices. Section 3 presents the indices methodology and the theoretical framework. Section 4 explains the econometric methodology and section 5 the empirical results. Section 6 concludes.

THEORETICAL FRAMEWORK AND LITERATURE REVIEW

Theoretical Framework

For the construction of the theoretical framework of this study, concepts from mass communication and finance literature are utilized. In the examination of the relationship between mass media coverage and consumer-investor confidence, it is necessary to understand the role information plays in altering consumers' beliefs, attitudes and choices (Ajzen and Fishbein, 1980). According to the "agenda-setting" effect literature, mass media can influence the way people think about certain issues by the media's choice of what stories to consider newsworthy and how much prominence and space to give them (McCombs and Shaw, 1972; Thompson, 1995). In addition, the agenda-setting effect will depend on an issue's "obtrusiveness" – that is, the degree to which an individual has direct personal experience and/or knowledge about an issue. The less direct experience and/or knowledge an individual has about a particular issue, the more likely the individual will rely on media for information. In this case, it will be more likely that the individual will be influenced by the agenda-setting effect (Zucker, 1978). Because only a small share of the U.S. population is directly involved in food production and food safety protocols, these issues are believed to be relatively unobtrusive. Hence, consumers and investors

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are expected to acquire most of their information and knowledge about food safety incidents from mass media. The media literature also often points out the tendency of the news mass media to report negative news stories, which are more likely to capture an audience's attention. Based on these premises, this study presents the following hypothesis:

Hypothesis 1: Increased media coverage of food safety and defense events will have a negative effect on consumer-investor confidence in food safety.

Food safety incidents can pose high financial costs on industries and their shareholders. This is because, expenses associated with food recalls or food safety incidents are borne by the producing company and they represent unanticipated effects on corporate earnings. In particular, the firms will incur direct costs that include money spent on advertising to compensate for reputation damage, plant closures and clean-up, and expenses related to recovering, disposing of, or reconditioning contaminated products already placed on the market. Indirect costs can also arise from food safety incidents and, are often associated with the loss of future sales. Bad publicity resulting from these events can lead to reductions in product demand and may erode prior investments in reputation and brand capital for the implicated firm. This is a result of highly publicized food scares that lead to lasting changes in consumers' perceptions about food safety and their food purchasing patterns. Ultimately, adverse effects on future earnings of implicated food companies will be also reflected in adverse stock price movements. Litigation product liability expenditures are also indirect costs that may arise especially when they are numerous illnesses, injury or even deaths associated with the incident. At the international level, implicated multinational firms are likely to see their exports reduced or banned due to food safety concerns by the importing countries. In sum, all these costs will have negative impacts on

the profitability of the affected firm, and consumer-investors may anticipate reductions in future dividends to be paid to the shareholders and fear potential negative spillovers across other for food firms. Thus, more concerned consumer-investors may opt to reduce the presence of food producers in their investment portfolios depressing the equity prices of those companies.

> *Hypothesis 2: Changes in consumer-confidence in the safety of the food system has a positive effect on stock prices of food producers.*

Literature Review

There are a growing number of empirical studies that have investigated the stock market's reaction to product recall announcements for several industries. According to Jarrell and Peltzman (1985), negative abnormal returns associated with recalls can act as a deterrent to a manager knowingly producing substandard products. This is particular important for the food industry given the direct linkages between food products and public health. Earlier studies have looked to the automobile sector and analyzed the impact of automotive recalls on producers' stock returns. Jarrell and Peltzman (1985) find evidence that automotive recalls are associated with significant and negative abnormal stock returns, while other studies have found statistically insignificant or modest negative returns that proved to be too small to be a sufficient deterrent (Bromiley and Marcus, 1989; Hoffer *et al.*, 1988). In a seminal study Pruitt and Peterson (1986) look at nonautomotive recalls, and indentified significant negative abnormal return associated with recall announcements. Recent research has evaluated the reaction of the stock market to food products recalls. Several studies find significant shareholder losses and increases in volatility when a food company is implicated in a recall involving serious food safety hazards (Thomsem and McKenzie, 2001; Salin and Hooker, 2001), while others show only a limited impact (Wang et al., 2002).

The finance literature has also explored the time-series relationships between economic news, consumer/investor sentiment, and stock markets with mixed results (Jansen and Nahuis, 2003; Lemmon and Portniaguina, 2006). Other empirical studies find evidence of stock prices responding to the economic news stories and their content (Pearce and Roley, 1985; Tetlock, 2007). The present study differs from past research by examining simultaneously the impact of national and local media coverage of food safety and defense events on consumer-investor confidence in food safety, and the change in stock prices for food companies due to changes in consumer-investor confidence.

INDICES METHODOLOGIES AND THEORETICAL FRAMEWORK

Continuous food safety tracking index (CFST)

As a measure of consumer-investor confidence in food safety, we use the continuous food safety tracking index (CFST) from Kinsey et al. (2009). This index is constructed based on information from a consumer survey administered by The Food Industry Center with the funding from the National Center for Food Protection and Defense, a Homeland Security Center of Excellence. A nationally representative sample is selected in a weekly basis, and respondents answer to a group of questions about consumer's attitudes toward terrorism in general and about safety and food defense. The survey design follows the methodology used in computation of the Consumer Sentiment Index from the University of Michigan (Curtain, 1973).

Media tracking index (MTI)

To measure media coverage of food safety and defense events this study uses the food safety/defense media tracking index (MTI) developed also by Kinsey et al. 2009. This index was

constructed by investigators at the Louisiana State University AgCenter and is computed for the same weeks of the CFST. This index is based on the count of articles and transcripts containing at least one of the following keywords: *food safety, food defense, food terrorism, agricultural terrorism or agriterrorism, food poisoning, food contamination, food-borne diseases, food-borne illness,* and *food recall*. The search is done in 99 different media sources that include national and local newspapers, network and cable TV, radio, news magazines, and the internet. Figure 1 shows the changes of these two indices over the sample period, and it can be observed how during major food safety incidents the MTI spikes while the CFST is negatively impacted.

Food Industry Stock Price Index (FISI)

The most widely followed major markets indices in the U.S. are the Standard and Poor's (S&P500) and the Dow Jones Industrial Average (DOW). Stock price indices are also commonly used to summarize the historical performance of a particular economic sector. For the present analysis a market-capitalization weighted stock price index for the U.S. food and beverage companies is constructed by replicating the methodology used in the S&P500. The construction of this index involves two steps. First, following the Industry Classification Benchmark (ICB) definitions of food and beverage producers used by the NYSE, 39 firms are initially selected. Based on data availability at The Center for Research in Security Prices Daily Stock Prices Dataset, only 31 are included in the Food Industry Stock Price Index (FISI). As shown in table 1, the index is comprised of 29 food producers and 2 beverage producers (For a complete list of the selected companies see Appendix one). The second step consists of calculating and summing the market value of all index constituents. That is, a firm's security price is multiplied by the number of outstanding shares. Next, the final value of the FISI is calculated by dividing the total sum of all firms' market value by a *Divisor*. These operations are expressed by the following formula:

$$\text{FISI}_{\text{it}} = \frac{\sum_{i=1}^{n} P_{it} S_{it}}{Divisor} \qquad (1)$$

where P_{it} is the closing stock price of firm i in day t, and S_{it} is the number of outstanding shares of firm i in day t. The selected value of the *Divisor* is the sum of all market values registered in the first day of the sample period. This method takes into account the size of each firm in the index and weights each security accordingly. The FISI is initially calculated daily and then averaged over the same weekly periods used in the CFST and MTI.

Previous literature has shown that stock prices react differently to food safety incidents depending on size of the affected firm (Salin and Hooker, 2001). To explore these differences, three additional indices are computed based on the size of the firms in the index. A firm is categorized as large if it is a component of the S&P 500 index (FISI500), medium if it is a component of the S&P 1500 index but not of the S&P 500 index (FISI1500), and small otherwise (FISISMALL). Finally, dividend payments are not included in the index, thus it should regarded as a measure of price appreciation rather that of true investment return. It is reasonable to leave the dividends out of the index because of their constant and predictable nature. Thus, any changes in the index will account only for changes in the stock prices.

ECONOMETRIC METHODOLOGY

To undertake the empirical analysis, the time series properties of all the variables need to be examined first. A visual inspection to their plots suggests that some variables may be trending, and therefore are nonstationary. Furthermore, an examination of autocorrelation functions (ACF) and the partial autocorrelation functions (PACF) provide further evidence that some series may not be stationary in levels and may contain unit roots. That is, their variances and covariances are not finite or independent over time. As econometric theory shows, when

variables are nonstationary the standard ordinary least squares (OLS) model cannot be applied and there might be a spurious regression[2] (Granger and Newbold, 1974). The stationarity is also investigated by conducting the Augmented Dickey-Fuller test (ADF), the Phillips and Perron (1988) (PP), the Kwiatkowski et al. (1992) (KPSS), and the modified Dickey-Fuller (DFGLS) unit root tests.

The first regression analysis proposed in equation (2) is a simple OLS that estimates both the coefficient of the media impact on consumer confidence and the error term.

$$CFST_t = \theta + \sum_{i=0}^{n} \pi_1 MTI_{t-i} + \varepsilon_t \qquad (2)$$

Lags of the MTI are included in the right hand side of equation (2) to account for possible lagged effects of media coverage on consumer confidence. The estimated value of π_1 will represent the component of the consumer-investor confidence influenced by media (MCFST), while the estimated error term represents the component of consumer-investor confidence explained by other factors (OCFST). OCFST is treated as a component including factors such as demographic characteristics of the respondents, their core beliefs, attitudes and uncertainty about food safety.

In a second regression, the DOLS method developed by Saikkonen (1991) and Stock and Watson (1993) is used to estimate the impact of the CFST, MCFST and OCFST variables on the four different stock price indices. This modeling procedure is selected for this study because of a series of advantages. First, evidence from Monte Carlo simulations shows that estimators from this procedure are superior to a number of alternative estimators of long-run parameters, including those proposed by Engle and Granger (1987), Johansen (1988) and Phillips and

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[2] Spurious regressions are normally characterized by having a high R^2 and statistically significant t-statistics; however, their results have no economic meaning

Hansen (1990). In addition, DOLS allows for estimation with variables of different integration

order, it allows for possible simultaneity bias within regressors, and guarantees valid estimates

even in the presence of endogenous independent variables. Finally, DOLS is asymptotically

equivalent to Johansen's maximum likelihood estimator, but it tends to perform well with small

samples like the one in this study. The DOLS procedure involves regressing any $I(1)$ variable on

other $I(1)$ variables, on $I(0)$ variables and on the leads and lags of the first differences of any $I(1)$

variables. The final equation of DOLS model is presented in the following section of the paper,

and it is constructed based on the results from the unit root tests for each series.

EMPIRICAL ESTIMATION

The results from the unit root tests indicate that MTI, CFST, MCFST and OCFST are

stationary variables, while all the stock price indices are integrated of order one[3]. Up to two

weeks lags were included in the OLS regression of the CFST on MTI, and the results are shown

in table 2. However, the addition of lags does not appear to improve the overall predictive power

of the model and does not lead to any qualitative changes in the results. Therefore, to preserve

degrees of freedom, the regression of the OLS model is estimated without any lags of MTI. As

hypothesized, increases in media coverage of food safety/defense incidents have a negative and

significant effect on consumer confidence.

DOLS is now used to estimate the linkages between the different measures of consumer

confidence on stock prices indices. First, as shown in equation (3), all stock prices indices are

regressed on the general measure of consumer-investor confidence, CFST. The second model

used predicted values of MCFST and OCFST from the first OLS model (equation 2). The

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[3] All unit root tests were conducted with and without a time trend term, and with different lags
structure. However, no qualitative different differences were found

predicted values and error estimates are included as explanatory variables in the stock price

model. The DOLS models are as follows:

$$\text{FISI}_{it} = \sigma + \beta_1 \text{CFST}_t + \sum_{k=-n}^{k=n} \beta_2 \Delta SP500_{t-k} + \omega_t \qquad (3)$$

$$\text{FISI}_{it} = \eta + \alpha_1 \text{MCFST}_t + \alpha_2 \text{OCFST}_t + \sum_{k=-n}^{k=n} \alpha_3 \Delta SP500_{t-k} + \xi_t \qquad (4)$$

where $\beta_1,$ α_1 and α_2 represent the long-run linkages. β_2 and α_3 are coefficients of leads and lags of

the first differences of the $I(1)$ regressors, and are treated as nuisance parameters to adjust for

possible endogeneity, autocorrelation, and nonnormal residuals. Given the theory of efficient

markets all currently available information is quickly reflected in stock prices, thus the DOLS

regressions are modeled one order leads and lags. Because of the wide use of the S&P500 index

in the financial literature to control for general economic and market conditions, this variable

was included in both regressions.

The results in table 3 show that, after controlling for overall market performance, changes

in consumer-investor confidence in food safety has a positive and significant effect on stock

prices with the exception of smaller firms. This supports the idea of a positive long-term

relationship between how consumers-investors feel about the safety of the food system and the

stock prices of food companies. After decomposing the CFST into explained and unexplained

components and applying the DOLS model (equation 4), the results in Table 4 show that the

component of consumer-investor confidence not influenced by media has a positive and

significant impact on FISI and FISI500. Furthermore, the component of consumer-investor

confidence that is shaped by media coverage is a positive and significant impact on the FISI500

at the 10 percent level.

In both regressions, stronger effects of changes in the consumer-investor confidence are evident for larger food producers. This may seem counterintuitive given that larger firms are likely to be more diversified (i.e. holding of nonfood assets), and thus more protected against food safety incidents. However, larger firms also tend to have a higher share of institutional ownership such as mutual, pension and hedge funds. The main goal of these institutional investors is to build their clients' assets over the long term. Given a pessimistic sentiment regarding the safety of the food system, institutional investors may choose to reduce the share of such stock in their portfolios, thus depressing prices.

CONCLUSIONS AND POLICY IMPLICATIONS

The results from this paper present evidence that media does influence perceptions and believes of consumers-investors. After estimating two consumer-investor components related to media coverage and other factors, it was found that stock prices of the food industry react positively to changes in the latter. In addition, a marginally significant positive effect was found for the media component and the stock prices of larger food producers. Overall, the stock prices of larger firms are most affected by the consumer-investor confidence, which may be related to a larger ownership share of these firms' equity by institutional investors. These investors are primarily interested in their customers' wealth, and are likely to sell food industry stock when confidence in the safety of the food system diminishes. The findings from this paper also shed some light on how food companies should weigh the costs and benefits associated with the adoption of additional food safety protocols. With investments in safer production practice, firms may expect to reduce risks of a significant drop in stock values. Vertical integration and/or enhanced traceability may be a strategy to ensure quality and food safety. However, firms may

not have the economic incentives to invest in safer production practices because the benefits only accrue in the event of an outbreak. Based on evidence in this study, it may be of the best interest for the U.S. food companies to cooperate as sector to prevent individual food safety events that may get extensive coverage from the media and affect the entire industry. Such joint efforts could avert declines in the consumer-investor confidence in the food system and the consequent negative impacts on the firms' wealth.

Despite stricter safety standards some events are simply accidental or unavoidable, and in those cases food companies may minimize some of the negative effects through timely public announcements and advertising campaigns after the recall. This may reduce the amount of negative media coverage on the issue and its impact on consumer-investor confidence, which in turn may mitigate negative effects on stock prices. At the policy level, estimating the negative impacts of food safety incidents on food industry's wealth provides policy makers with additional information on whether or not the costs from these incidents surpass the benefits of regulating and implementing stricter and safer food production practices.

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TABLES AND FIGURES

Figure 1. Consumer Confidence index of food safety concern and media tracking index – weeks starting May 5, 2008 through January 3, 2010.

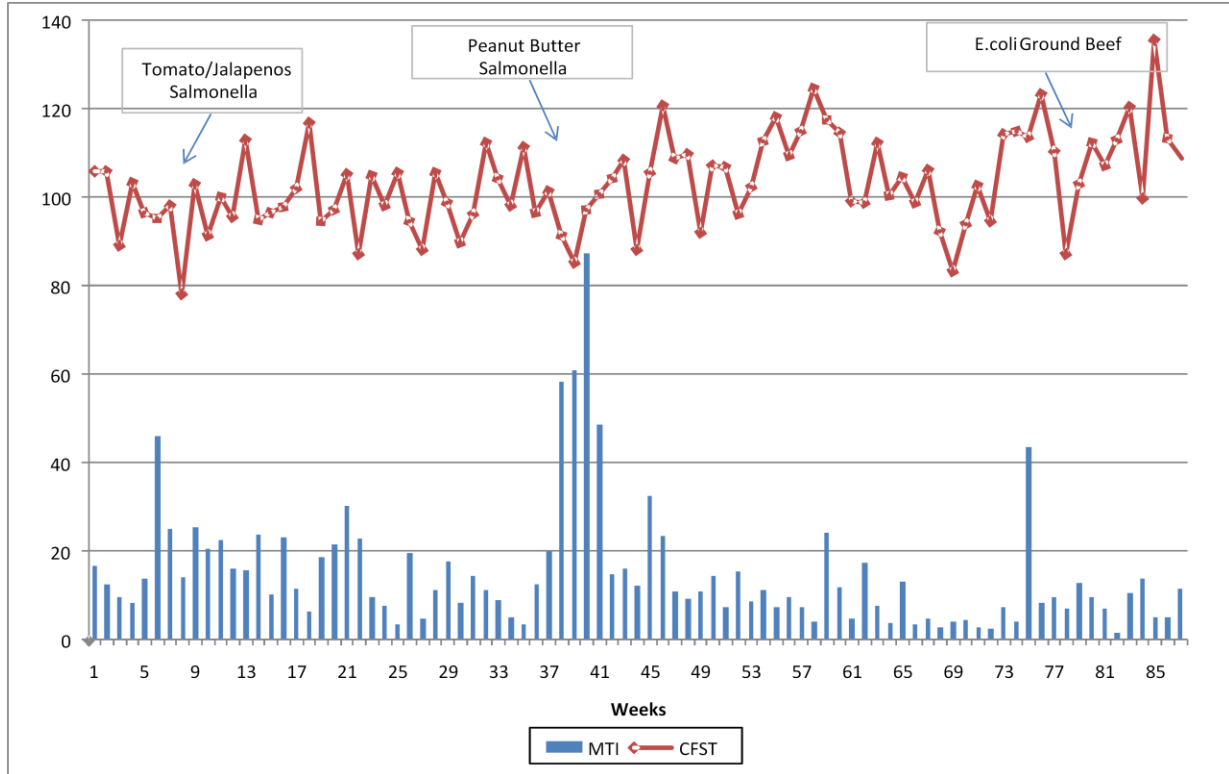**Table 1: Selected Constituents of Food Companies Stock Index**

Industry	Supersector	Sector	Subsector	Number of Companies Selected
Consumer Goods	Food & Beverage	Food Producers	Soft Drinks	2
Consumer Goods	Food & Beverage	Beverages	Food Products	29

Source: NYSE

Table 2. OLS regression of consumer confidence on media coverage.

Independent Variables	Dependent Variables		
	$CFST_t$	$CFST_t$	$CFST_t$
MTI_t	-0.163b	-0.163c	-0.162c
	(0.065)	(0.094)	(0.095)
MTI_{t-1}	-	0.000	0.011
		(0.096)	(0.126)
MTI_{t-2}	-	-	-0.020
			(0.099)
N	87	86	85
R²	0.049	0.050	0.050

Note: Robust standard errors of estimated coefficients in parenthesis. a, b, c denote the rejection of the null hypothesis of a unit root at 1%, 5% and 10% level respectively.

Table 3. DOLS regression of stock price indices on consumer-investor confidence.

Independent Variables	Dependent Variables			
	(I)	(II)	(III)	(IV)
	$FISI_t$	$FISI500_t$	$FISI1500_t$	$FISISMALL_t$
$S\&P500_t$	0.047a	0.043a	0.060a	0.092a
	(0.001)	(0.002)	(0.003)	(0.004)
$CFST_t$	0.058b	0.101a	0.090c	0.078
	(0.026)	(0.036)	(0.053)	(0.062)
N	84	84	84	84
R²	0.92	0.85	0.84	0.88

Note: Robust standard errors of estimated coefficients in parenthesis. a, b, c denote the rejection of the null hypothesis of a unit root at 1%, 5% and 10% level respectively.

Table 4. DOLS regression stock price indices on media component of consumer-investor confidence and on the other factors affecting consumer-investor confidence.

Independent Variables	Dependent Variables			
	(I) $FISI_t$	(II) $FISI500_t$	(III) $FISI1500_t$	(IV) $FISIsmall_t$
$S\&P500_t$	0.047a	0.042a	0.059a	0.092a
	(0.001)	(0.002)	(0.003)	(0.005)
$MCCI_t$	0.101	0.241c	0.220	0.085
	(0.090)	(0.124)	(0.205)	(0.065)
$OCCI_t$	0.056b	0.094b	0.084	-0.076
	(0.027)	(0.037)	(0.056)	(0.243)
n	84	84	84	84
R^2	0.92	0.85	0.84	0.79

Note: Robust standard errors of estimated coefficients in parenthesis. a, b, c denote the rejection of the null hypothesis of a unit root at 1%, 5% and 10% level respectively.

APPENDIX 1

Table A1 . List of Food and Beverage Companies in the Stock Indices

Name of Food and Beverage Producers	Size Classification
Archer Daniels Midland Co	S&P 500
B&G Foods, Inc.	SMALL
Bunge Limited	SMALL
Campbell Soup Company	S&P 500
Chiquita Brands International Inc.	SMALL
ConAgra Foods Inc.	S&P 500
Corn Products International Inc.	S&P 1500
Darling International Inc.	S&P 1500
Dean Foods Company	S&P 500
Del Monte Foods Company	SMALL
Flowers Food Inc.	S&P 1500
General Mills, Inc.	S&P 500
H.J. Heinz Company	S&P 500
The Hershey Company	S&P 500
Hormel Foods Corporation	S&P 500
J. M. Smucker Company	S&P 500
Kellog Company	S&P 500
Kraft Foods Inc.	S&P 500
Medifast, Inc.	SMALL
NBTY, Inc.	S&P 1500
Nu Skin Enterprises Inc.	SMALL
Omega Protein Corporation	SMALL
Ralcorp Holding Inc.	S&P 1500
Sarah Lee Corp.	S&P 500
Schiff Nutrition International, Inc.	SMALL
Smithfield Foods Inc.	S&P 1500
Tootsie Roll Industries Inc.	S&P 1500
TreeHouse Foods, Inc.	S&P 1500
Tyson Foods Inc.	S&P 500
The Coca-Cola Company	S&P 501
PepsiCo, Inc	S&P 500

Source: NYSE