

# EFFECT OF FINANCIAL VARIABLES ON STOCK TRADING VOLUME AND BID-ASK SPREAD FOR COMPANIES ON THE STOCK MARKET

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## ABSTRACT

In this study, we investigate the relationships between a company's financial variables and its stock trade volume and spread. The financial variables considered were: return on equity per share, return on assets, total debt divided by total assets, cash and short term investment divided by total assets, current assets divided by current liabilities, total liabilities, and gross income of the company. Using time series analysis on stationary data, it was found that each of the independent financial variables was related sporadically to stock volume or stock spread. Results were company specific and none of the variables was universal in its relationship to volume or spread. The highest percentage of the companies where a variable was related to volume or spread was 28.9%. This sporadic relationship raises the question as to whether other variables such as macroeconomic variables or human motivation (psychological effect) play a more important role than the company's financial factors.

## INTRODUCTION

Two important measures regarding a stock on the stock market are trade volume of a stock and its bid-ask spread. Trade volume is the total quantity of shares traded for a specified security. Trade volume reflects the market's activity and the liquidity of the stock. Liquidity describes how quickly a stock can be bought or sold in the market or the ease of converting it to cash. Higher stock volume means higher liquidity and a market that is more active in connecting buyer and seller. Also, an increase in trade volume could indicate the direction of the stock market. Trade volume tends to vary during the day, from high near opening and closing times to low at midday (Kalok et al., 1995). There is some evidence that a stock trade volume is related to the stock return (Chen & Liu, 2015) and stock volatility (Naik et al., 2018)

The bid-ask spread is important in the marketplace. It is defined as the amount by which the ask price for a share exceeds its bid price. It can be viewed as the difference between what the buyer is willing to pay for a stock versus what the seller is willing to sell for. The ask price is usually

higher than the bid price. Therefore, the bid-ask spread is the profit an investor can make by buying at the bid price and selling at the ask price. The bid-ask price is a reflection of the market's liquidity and volatility. The smaller the spread, the higher the liquidity and the lower the volatility. In addition, the bid-ask spread is of importance in stock trading and is relevant in reducing transaction costs. Price of a stock can have an effect on the bid ask spread. A low stock price can translate into a larger bid-ask spread.

Determining the different financial factors that influence the trade volume and the bid-ask spread will help investors limit their risk by making more informed decisions on their investments. In this study, we investigate using time series analysis the influence of some financial factors (Table 1) on spread and volume for 45 companies in the U.S. marketplace.

## **LITERATURE REVIEW**

Lee and Rui (2000) examined the relationships between trading volume, stock return, and return volatility in four stock exchanges in China. It was found that trade volume did not Granger cause stock returns in any of the four markets. There was a feedback relationship among the four markets in stock return. Also, stock returns, volatility, and volume from financial markets in the US and Hong Kong were weak predictors for the Chinese financial market

Aitken and Frino (1996) examined the determinants of the bid-ask spread using data over a six-month period (June 1 to November 30, 1992) on the Australian Stock Exchange. The authors applied a log linear regression model where log of the percentage bid-ask spread was the dependent variable and log stock price, log trade activity, and log stock price volatility were the independent variables. The model explained 94% of the variability in log percent spread. Both log price and log volume were negatively related to log spread and log volatility was positively related to log spread.

Chen and Liu (2015) studied the relationship between stock price and trade volume in six international markets. They applied the Granger causality between price index and trading volume. The main result was that past information on trading volume helped predict the stock price.

Naik et al. (2018) reported on the relationship between trade volume and stock volatility for the Johannesburg Stock Exchange of South Africa using daily data over the period January 4, 2008 to August 31, 2016. Using the EGARCH and Granger causality models, the authors found that the relationship between volume and volatility was positive and contemporaneous.

Menyah and Paudyal (1996) examined factors that had an effect on the bid-ask spread on the London Stock Exchange. Using a log linear multiple regression analysis, they reported that stock price, stock trade volume, risk associated with stock return, and number of market makers explained 91 percent of the variation in spread.

Using monthly data for the 2005–2014-time period, Dodonova (2016), using least squares regression models, reported on the effect of lagged stock returns and lagged dispersion of stock

returns on trade volume. Dispersion of stock returns and absolute value of returns positively affected future trade volume. Also, extreme negative returns caused high future trade volume while extreme positive returns had no effect on future trading.

The relationship between trade volume and stock prices was investigated by Zerena and Konukb (2016) using panel causality test developed by Dumitrescu-Hurlin (2012) in 12 countries belonging to the Organization for Economic Co-operation and Development (OECD). Results of the study showed that stock price affected trade volume, but trade volume had no effect on stock price. This indicated that the cause effect relationship was in one direction (from stock price to trade volume) with no feedback effect.

The database from the Center for Research in Security Prices (CRSP) was used by Gold (2013) to examine the relationship between stock price and stock trade volume of all firms on the Dow Jones Industrial Average (DJIA) for the period 2007 to 2009. Results of the study supported the asymmetric information hypothesis, which proclaims that high trade volume leads to information asymmetry, in which investors differ in beliefs concerning the market. This leads to greater uncertainty in stock returns. This finding is of importance with regard to investment strategies.

The relationship between trade volume and stock prices was evaluated by Brown et al. (2009) using S&P 500 data on the largest 1,000 stock prices and measures of trade volume and turnover from January 1991 to December 2007. It was found that for these large stocks, which were relatively liquid, there was a positive relationship between trade volume and stock returns. Large stocks (with holding periods of 1-12 months) with higher trade volume and turnover had higher returns than those with lower trade volume. Furthermore, there was an indication that trade volume was a proxy for liquidity as well as momentum and information content.

The relationship between stock returns, volatility, and trade volume in the Brazilian stock market was investigated by De Medeiros and Van Doornik (2008). Data were obtained from January 3, 2000 through December, 29, 2005. The statistical methods used were the Garch (1,1) model, the Granger causality test, and a bivariate structural equations model involving return and volume for testing their relationship. Results from the structural equations model indicated that trade volume had a positive effect on stock return, but return had no effect on volume. The Granger test showed no relationship or causality between trade volume and stock return. On the other hand, it was found that trade volume granger caused volatility and volatility Granger caused trade volume.

A study to investigate the relationship between stock index futures and stock prices in Malaysia, Singapore, and London stock markets was undertaken by Azizan (2008). The study used the Granger causality test, the BDS (Broock–Dechert–Scheinkman) statistic to determine nonlinear behaviour in the trade volume, and the threshold auto-regressive model as a non-linear model. Results showed that trade volume had a nonlinear component. There was also a unidirectional relationship between trade volume and volatility. There was evidence, in Singapore and Malaysia, showing that stock markets with low trade volume exhibited better predictability (or less volatility) than highly liquid markets with high trade volume.

Groß-Klußmann and Hautsch (2013) used a long memory auto-regressive conditional Poisson model to forecast bid-ask spread for stocks traded on the NYSE and the NASDAQ. A property of

the Poisson model is its long-range dependence or long-range autocorrelation. Authors showed that forecasts from the Poisson model outperformed forecasts from other models, namely AR(p), ARMA (p q), ARIMA (p d q), auto-regressive conditional duration (ACD) and an exponentially weighted moving average (EWMA) model.

In a similar study, Cattivelli and Pirinoa (2019) used a Poisson process (with an intensity that is a function of two factors, a seasonal intraday pattern and a heterogeneous autoregressive component, to model and forecast the bid-ask spread on the NYSE stocks. The model was applicable to time series with long-term memory and seasonality. The authors showed how the model could be used to reduce the total cost incurred by investors.

Chen (2012) investigated the relationship between stock returns and trade volume for bull and bear markets. Using monthly data for the S&P 500 over the period 1973 to 2008, the author showed that stock returns predicted trade volume in both bull and bear markets. However, the evidence for trade volume predicting stock return was weaker.

Minardi et al. (2006) in a study on the São Paulo Stock Exchange (BOVESPA) used least square regression analysis to investigate the relationship between bid-ask spread and stock returns and liquidity measures. Authors reported a negative relationship between bid-ask spread and liquidity and a weak positive relationship between bid-ask spreads and stock returns. These same relationships existed in other markets where trading was different from that in Brazil, where participants trade directly without the benefit of dealers and brokers.

As can be seen from the literature, investigations were mostly limited to volume, spread, price, volatility and their relationships. There is a lack of investigations examining the effects of financial factors on spread and trade volume. This study helps in filling this gap.

## **DATA**

Forty-five companies were selected over the years 1998 to 2017, based on having complete quarterly financial data, utilizing the Wharton Research Data Services (WRDS). Also, from WRDS, we obtained for each company its quarterly trade volume and spread over the same years.

## **METHOD**

### **Time series analysis**

In this study, we use the transfer function approach in time series to relate stationary input time series (independent variables) to a stationary output time series (dependent variable). We demonstrate the model for one input series. The model relating a stationary output series  $y_t$  to a stationary input series  $x_i$  is expressed as

$$y_t = v(B) x_t + a_t, \tag{1}$$

where  $a_t$  is the residual and

$$v(B) = w(B)B^c/d(B).$$

$$\text{Here, } w(B) = w_0 - w_1B - \dots - w_sB^s$$

$$d(B) = 1 - d_1B - \dots - d_rB^r.$$

and  $c$  represents the time delay (or lag) until the input variable  $x_t$  produces an effect on the output variable  $y_t$ .

We assume that the input series follows an ARMA process,  $\frac{\varphi(B)}{\theta(B)} x_t$ . The function  $v(B)$  with its lags is determined from the cross correlations between the white noise input series  $\frac{\varphi(B)}{\theta(B)} x_t$  and the filtered output series  $\frac{\varphi(B)}{\theta(B)} y_t$  (Wei, 2006). For instance, if the correlation is significant at only lag 0, then Equation (1) becomes

$y_t = w_0x_t + a_t$ . On the other hand, if the correlation is significant at only lag 1, then one has

$$y_t = w_0x_{t-1} + a_t$$

Once  $v(B)$  is identified, one can express  $a_t$  in Eq. (1) as

$$a_t = y_t - v(B) x_t \tag{2}$$

and identify the appropriate time series model for Eq. (2). With  $a_t$  known, one can determine the final model in Eq. (1). In this analysis  $a_t$  was identified as an AR (1) or AR (2).

For this analysis, each dependent and independent variable was tested for stationarity using the Phillips-Perron test and the augmented Dickey-Fuller test. Where a variable was not stationary, we used its first difference, which was stationary. Thus, all variables that entered the model were stationary. The backward elimination variable selection technique (Montgomery et al., 2001) was used so that the final model included only the independent variables that were significantly related at the 5% level to the dependent variable.

**TABLE 1. LIST OF INDEPENDENT VARIABLES USED IN THE TIME SERIES ANALYSES WHERE A COMPANY'S STOCK VOLUME OR SPREAD WAS THE DEPENDENT VARIABLE.**

ROEPS	Return on equity per share
ROA_	Return on assets
R2= leverage	Total debt divided by total assets
R4	Cash and short-term investment divided by total assets
Liability	Total liabilities
Cratio	Current assets divided by current liabilities
Income	Gross income

## RESULTS AND DISCUSSION

Table 2 presents the financial variables for each company that were significantly related at the 5% level to volume or spread. This is summarized from Tables 3 and 4 in the Appendix. It is seen that the financial variables that relate to volume or spread are company specific. There was no variable that was predominantly related to volume or spread over all companies. Also, the signs of the coefficients varied over variables and were mixed (except for Cratio), positive for some companies and negative for others. Table 2 shows frequency (N) and percentage (%) of each independent variable, over the 45 companies, that showed a significant relationship with the dependent variable (stock volume or stock spread). The sign of the relationships is indicated with (+) or (-)

**TABLE 2. FINANCIAL VARIABLES THAT WERE SIGNIFICANTLY RELATED AT THE 5% LEVEL TO VOLUME OR SPREAD**

Dependent variable	Independent variables						
	ROEPS	ROA	leverage	R4	Liability	Cratio	Income
Volume	N %	N %	N %	N %	N %	N %	N %
	13 (28.9)	6 (13.3)	11 (24.4)	10 (22.2)	9 (20)	5 (11.1)	9 (20)
	4 (+)	3 (+)	5 (+)	6 (+)	6 (+)	0 (+)	5 (+)
	9 (-)	3 (-)	6 (-)	4 (-)	3 (-)	5 (-)	4 (-)
Spread	N %	N %	N %	N %	N %	N %	N %
	12 (26.7)	7 (15.6)	13 (28.9)	11 (24.4)	7 (15.6)	12 (26.7)	6 (13.3)
	5 (+)	4 (+)	5 (+)	5 (+)	7 (+)	8 (+)	2 (+)
	7 (-)	3 (-)	8 (-)	6 (-)	0 (-)	4 (-)	4 (-)

## Volume

As is seen from Table 2 for volume that the percentages varied between 28.9% and 11.1%. This indicates that the financial variables do not seem to be related substantially to volume. Return on equity per share (ROEPS) was significantly related to volume in 28.9% of the companies. This was the highest percentage among all the variables. The variable Cratio was the lowest contributor with a percentage of 11.1. Return on assets (ROA) was significantly related to volume for 6 (13.3%) companies. Leverage was related to volume in 11 (24.4%) out of the 45 companies. Cash and short-term investment divided by total assets (R4) was related to volume in 10 (22.2%) of the companies. Liability was related to volume in 9 (20%) of the companies. Gross income was significantly related to volume in 9 (20%) companies.

Table 3 in the Appendix presents the time series model for each company. Each row gives the time series linear model relating the independent variables to volume, the dependent variable.

The parameters  $\emptyset_1$  and  $\emptyset_2$  refer to the AR(2) model for the residual,  $a_t$ . This is expressed as

$$a_t = \emptyset_1 a_{t-1} + \emptyset_2 a_{t-2} + e, \quad (3)$$

where  $e$  is the random error term.

Equation (2) can be written as

$$a_t = e / (1 - \emptyset_1 B - \emptyset_2 B^2) \quad (4)$$

where  $B$  is the backward operator ( $Ba = a_{t-1}$  and  $B^2 a = a_{t-2}$ ).

As an example, the model in Table 3 for the Chase company can be expressed as

$$\text{Volume}(t) = 2307.4 + 464.40 \Delta R2(t) + e_t / (1 - 0.389 B - 0.399 B^2) \quad (5)$$

Multiplying both sides of the equation by  $(1 - 0.389 B - 0.399 B^2)$  and simplifying, one obtains the expression

$$\begin{aligned} \text{Volume}(t) = & 489.16 + 0.389 \text{Volume}(t-1) + 0.399 \text{Volume}(t-2) + 464.40 \Delta R2(t) \\ & - 180.65 \Delta R2(t-1) - 185.39 \Delta R2(t-2) + e_t \end{aligned} \quad (6)$$

As can be seen, Volume at time  $t$  is related to its two lags and to  $\Delta R2(t)$  and its two lags. Here,  $\Delta R2$  is the first difference of leverage.

The models for each company can be read in a similar way. Where  $\emptyset_1$  or  $\emptyset_2$  in Table 3 is blank, it is not significantly different from zero and does not appear in the linear model.

## Spread

Table 2 summarizes the data in Table 4 of the Appendix relating the independent variables to the dependent variable, bid-ask spread. Results on spread are similar to those on volume in the sense that financial variables that relate to spread are company specific and there was no variable that was predominantly related to spread over all companies. Also, the signs of the regression coefficients varied over companies and were company specific. The percentage (over the 45 companies) of the relationship of each independent variable to spread varied between 28.9 for leverage to 13.3 for income. Except for liability, the signs of the coefficients associated with each independent variable are mixed, positive and negative. Among the other variables, return on equity per share (ROEPS) was related to spread in 12 (26.7) companies. Return on assets (ROA) was related to spread in 7 (15.6%) companies. Cash and short-term investment divided by total assets (R4) was related to spread in 11 (24.4) companies. Liability was related to spread in 7 (15.6%) companies and Cratio had a relationship with spread in 12 (26.7%) companies.

Table 4 gives the time series model for each company. The interpretation of each model is the same as given above for volume.

For instance, the model for Chase is expressed as

$$\begin{aligned}\Delta\text{spread}(t) &= 0.056 - 0.106 \Delta R2(t) + e_t / (1 + 0.593B) \\ \Delta\text{spread}(t) &= 0.089 - 0.593 \Delta\text{spread}(t-1) - 0.106\Delta R2(t) - 0.063 \Delta R2(t-1) + e_t \\ \text{Spread}(t) &= 0.089 + 0.407\text{Spread}(t-1) + 0.593\text{Spread}(t-2) - 0.106R2(t) + 0.043 R2(t-1) \\ &\quad + .063R2(t-2) + e_t\end{aligned}\tag{7}$$

Equation (7) shows that spread is related to its two lags and the two lags of leverage (R2).

The results of this analysis showed that financial variables were not very influential in affecting stock volume or stock spread. This is seen by the fact that the most effective variables were return on equity per share in relation to volume and leverage in relation to spread and these were for only 28.9 % of the companies. It would seem that investors were by and large relying on other factors in decision making, factors not related to the company's financial data.

These results, showing that company's financial data have little substantial impact on its stock volume and spread, are in agreement with results reported by Ligocká (2018), Berglund and Bergman (2013), and Hassan et al. (2020) on stock price, a related entity. This lack of a major significant association between financial data and stock volume and spread may mean that investors are not relying heavily on companies' financial data in making decisions about investment in stocks. They could be relying perhaps on macro financial data in investment decision making or decisions are made, as Earl (1972) pointed out, based on human motivation and not company's financial results nor economic or political situations. Earl argued that of influence in stock investment were tips that circulate among investors regarding whether a share is going to

rise or fall. As a result, investment in stocks can be psychological and not significantly based on rational financial determination.

## CONCLUSION

The interest in this study was to determine which financial variables in a company might have a significant relationship to a company's stock trade volume and bid-ask spread. Trade volume reflects the market's activity and the liquidity of the stock. The bid-ask spread is the profit an investor can make by buying at the bid price and selling at the ask price. Spread is a reflection of the market's liquidity and volatility. The smaller the spread, the higher the liquidity and the lower the volatility. The financial variables considered in this study were: return on equity per share, return on assets, total debt divided by total assets, cash and short-term investment divided by total assets, gross income, total liabilities, and current assets divided by current liabilities.

Using time series analysis on stationary data, it was found that each of the independent financial variables was related to stock volume or stock spread. However, the relationships were sporadic in nature. None of the variables was universal in its effect on volume or spread. The variables with the highest representation over companies were return on equity per share and leverage. In 28.9% of the companies, return on equity per share was related to volume. Also, in 28.9% of the companies, leverage was related to spread. The percentages of the other variables were between 11.1% and 24.4% for volume and between 13.3% and 26.7% for spread.

These results seem to suggest that investors are not relying heavily on companies' financial data in making decisions about investment in stocks. These results are in agreement with Ligocká (2018), Berglund and Bergman (2013), and Hassan et al. (2020) with regard to stock price. Other factors could be in play when it comes to investment decisions. It could be that decisions are made, as Earl (1972) pointed out, based on human motivation (psychological in nature) and not company's financial results.

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## APPENDIX

**TABLE 3. PARAMETER ESTIMATES FROM TIME SERIES ANALYSIS OF STOCK VOLUME, AS THE DEPENDENT VARIABLE, ON FINANCIAL FACTORS, AS THE INDEPENDENT VARIABLES, FOR DIFFERENT COMPANIES ON THE STOCK MARKET. THE SYMBOL  $\Delta$  REFERS TO FIRST DIFFERENCE.**

Company	Dependent variable		Independent variables							
		Mean	$\Delta R4$ (t)	$\Delta R4$ (t-1)	$\Delta ROE$ PS (t)	$\Delta ROE$ PS (t-1)	ROE PS (t)	$\Delta R2$ (t)	$\emptyset_1$	$\emptyset_2$
<i>Bank of America</i>	Vt	-4346020.2	631735060	533385233					0.815	
<i>Bristol-Myers</i>	Vt	-399832.9			-36472.9				0.498	
<i>Caterpillar</i>	Vt	1031663.9			-32554.9				0.838	
<i>Chase</i>	Vt	2307.4					464.40		0.389	0.399
<i>Community health</i>	$\Delta Vt$	9646.7							-0.349	
<i>Diamond drilling</i>	Vt	390535.8			9402.9				0.483	
<i>DTE Energy</i>	Vt	146721.1							0.319	0.353
<i>Edwards life sciences</i>	Vt	161375.7					660290.3		0.477	0.398
<i>Eli Lilly</i>	Vt	880765.3							0.500	0.403
<i>First Energy</i>	$\Delta Vt$	9787.6			-2489.1				-0.559	-0.551
<i>Fiserv Inc.</i>	Vt	273942.4							0.654	
<i>G&amp;K Services</i>	Vt	1460.2							0.357	
<i>GAP Inc</i>	Vt	1135560.9			24773.4				0.570	0.303
<i>Hain Celestial</i>	Vt	160144.7							0.357	0.516
<i>Halliburton</i>	Vt	2043094.9							0.435	0.266
<i>Harris Corp</i>	Vt	162583.5							0.374	0.383
<i>Hershey</i>	Vt	202844.9	-522112.9						0.308	0.466
<i>I.D.Systems</i>	Vt	8624.8							0.349	
<i>ICU Medical</i>	Vt	34952.1							0.473	
<i>J.B.Hunt</i>	$\Delta Vt$	-274.563							-0.444	
<i>J.C. Penny</i>	Vt	2188405.2							0.418	
<i>Jewett-Cameron</i>	Vt	978.392							0.227	

<i>Kellog</i>	Vt	265179.3							0.786	
<i>Kewaunee Scientific</i>	Vt	986.87511							0.359	
<i>L.B. Foster</i>	Vt	11342.8							0.769	
<i>Laboratory Corp</i>	Vt	195247.6							0.303	
<i>M.D.C. Holding</i>	Vt	93212.0							0.396	0.524
<i>Manpower Group</i>	Vt	181260.1					-3739.8		0.403	
<i>Nanometrics</i>	Vt	113814.9						9309832.6		
<i>Nanophase</i>	Vt	23498.0							0.359	
<i>Ocean Biochemical</i>	Vt	3725.5				-520.356				
<i>Oceaneering International</i>	Vt	164445.5						671640.7	0.776	
<i>Panhandle Oil and Gas</i>	Vt	34.471							0.778	
<i>Par Technology</i>	Vt	3026.3							0.715	
<i>Quacker Chemicals</i>	Vt	16241.2							0.818	
<i>Quanta Service</i>	$\Delta$ Vt	301011.9							0.847	
<i>Radisys Corp</i>	Vt	20582.9		-168411.8					0.252	
<i>Rambus Inc</i>	Vt	406607.7					-5578.8		0.379	
<i>Salem Media Group Inc.</i>	Vt	28394.3								
<i>Take-Two Interactive Software</i>	Vt	395305.2					-1.794		0.289	
<i>Tampa Electric</i>	Vt	-238131.4							0.33	0.37
<i>UGI Corp</i>	$\Delta$ Vt	76761.6						-369655.8	0.75	
<i>W.R.Grace &amp; CO</i>	Vt	131015.0							0.50	
<i>Walt Disney</i>	Vt	1044559.6							0.61	
<i>WW Grainger Inc.</i>	Vt	119678.9							0.64	

Vt = Trade Volume, dependent variable

ROEPS = Return on equity per share

R2 = leverage = Total debt divided by total assets

R4 = Cash and short-term investment divided by total assets

**Table 3 (continued)**

<i>Company</i>	$\Delta$ ROA (t-2)	$\Delta$ ROA (t)	$\Delta$ Inc (t)	$\Delta$ Inc (t-1)	Liab (t)	CR (t)	CR (t-3)	liab (t-4)	R4 (t-2)
<i>Bank of America</i>									
<i>Bristol-Myers</i>									
<i>Caterpillar</i>									
<i>Chase</i>									
<i>Community health</i>	9646.7								
<i>Diamond drilling</i>		20294.4	0.0008196		0.000304	-22092.7			
<i>DTE Energy</i>						55942.0			
<i>Edwards life sciences</i>			0.0011820						
<i>Eli Lilly</i>			0.00014						
<i>First Energy</i>									
<i>Fiserv Inc.</i>									
<i>G&amp;K Services</i>			-0.000562					0.00014	
<i>GAP Inc</i>		-71867.9							
<i>Hain Celestial</i>				-0.00171					
<i>Halliburton</i>									
<i>Harris Corp</i>									
<i>Hershey</i>									
<i>I.D.Systems</i>									
<i>ICU Medical</i>									
<i>J.B.Hunt</i>									
<i>J.C. Penny</i>		-98540.8							
<i>Jewett-Cameron</i>									
<i>Kellog</i>									
<i>Kewaunee Scientific</i>									
<i>L.B. Foster</i>									
<i>Laboratory Corp</i>							-37507		1304868.5
<i>M.D.C. Holding</i>				-0.000189					
<i>Manpower Group</i>									
<i>Nanometrics</i>									
<i>Nanophase</i>									

<i>Ocean Biochemical</i>									
<i>Oceaneering International</i>									
<i>Panhandle Oil and Gas</i>									
<i>Par Technology</i>									
<i>Quacker Chemicals</i>									
<i>Quanta Service</i>									
<i>Radisys Corp</i>		-3829.6							
<i>Rambus Inc</i>									
<i>Salem Media Group Inc.</i>									
<i>Take-Two Interactive Software</i>					0.000393	378387.2			
<i>Tampa Electric</i>									
<i>UGI Corp</i>									
<i>W.R.Grace &amp; CO</i>									
<i>Walt Disney</i>									
<i>WW Grainger Inc.</i>									

ROA = Return on assets

Inc = Income

Liab = Liability

CR = Cratio

**Table 3 (continued)**

<i>Company</i>	$\Delta R2$ (t-2)	$\Delta Liab$ (t)	$\Delta R4$ (t-4)	$\Delta R4$ (t-5)	R4 (t)	ROEP S(t-1)	Liab (t-1)	$\Delta CR$ (t)
<i>Bank of America</i>								
<i>Bristol-Myers</i>								
<i>Caterpillar</i>								
<i>Chase</i>								
<i>Community health</i>								
<i>Diamond drilling</i>								
<i>DTE Energy</i>								
<i>Edwards life sciences</i>								
<i>Eli Lilly</i>								
<i>First Energy</i>								
<i>Fiserv Inc.</i>								
<i>G&amp;K Services</i>								
<i>GAP Inc</i>								
<i>Hain Celestial</i>								
<i>Halliburton</i>	-5045084	-0.0000444						
<i>Harris Corp</i>								
<i>Hershey</i>								
<i>I.D.Systems</i>								
<i>ICU Medical</i>			-24854.4					
<i>J.B.Hunt</i>						5157.4		
<i>J.C. Penny</i>		0.000448				-37281.1		
<i>Jewett-Cameron</i>								
<i>Kellog</i>								
<i>Kewaunee Scientific</i>				19877.0				
<i>L.B. Foster</i>								
<i>Laboratory Corp</i>								
<i>M.D.C. Holding</i>								
<i>Manpower Group</i>								
<i>Nanometric s</i>								

<i>Nanophase</i>								
<i>Ocean Biochemical</i>								
<i>Oceaneering International</i>		-0.000731						-161498.2
<i>Panhandle Oil and Gas</i>							0.000366	
<i>Par Technology</i>								
<i>Quacker Chemicals</i>								
<i>Quanta Service</i>		-0.0001051						
<i>Radisys Corp</i>						-1341.3		
<i>Rambus Inc</i>								
<i>Salem Media Group Inc.</i>						157.853		
<i>Take-Two Interactive Software</i>								
<i>Tampa Electric</i>								
<i>UGI Corp</i>								
<i>W.R.Grace &amp; CO</i>								
<i>Walt Disney</i>					17865535			
<i>WW Grainger Inc.</i>					-31782.5			

**Table 3 (continued)**

<i>Company</i>	<i>Inc (t-3)</i>	<i>Inc (t)</i>	<i>Inc (t-2)</i>	<i>R2 (t)</i>	<i>R2 (t-1)</i>	<i>R2 (t-3)</i>	<i>ΔLia b (t-5)</i>	<i>R4 (t-3)</i>	<i>ΔRO A (t-1)</i>
<i>Bank of America</i>									
<i>Bristol-Myers</i>									
<i>Caterpillar</i>									
<i>Chase</i>									
<i>Community health</i>									
<i>Diamond drilling</i>									
<i>DTE Energy</i>									
<i>Edwards life sciences</i>									
<i>Eli Lilli</i>									
<i>First Energy</i>									
<i>Fiserv Inc.</i>									
<i>G&amp;K Services</i>									
<i>GAP Inc</i>									
<i>Hain Celestial</i>									
<i>Halliburton</i>									
<i>Harris Corp</i>									
<i>Hershey</i>									
<i>I.D.Systems</i>									
<i>ICU Medical</i>									
<i>J.B.Hunt</i>									
<i>J.C. Penny</i>	- 0.000934			- 15883008	- 18295 322				
<i>Jewett-Cameron</i>							0.00099		
<i>Kellog</i>								2571484	
<i>Kewaunee Scientific</i>									
<i>L.B. Foster</i>									
<i>Laboratory Corp</i>									
<i>M.D.C. Holding</i>									

<i>Manpower Group</i>									
<i>Nanometrics</i>									
<i>Nanophase</i>									
<i>Ocean Biochemical</i>									1955.5
<i>Oceaneering International</i>									
<i>Panhandle Oil and Gas</i>		0.000268			9002				
<i>Par Technology</i>									
<i>Quacker Chemicals</i>						-40970.6			
<i>Quanta Service</i>									
<i>Radisys Corp</i>									
<i>Rambus Inc</i>									
<i>Salem Media Group Inc.</i>				-33290.0					
<i>Take-Two Interactive Software</i>									
<i>Tampa Electric</i>									
<i>UGI Corp</i>			0.000078						
<i>W.R.Grace &amp; CO</i>									
<i>Walt Disney</i>									
<i>WW Grainger Inc.</i>									

**TABLE 4. PARAMETER ESTIMATES FROM TIME SERIES ANALYSIS OF STOCK SPREAD, AS THE DEPENDENT VARIABLE, ON FINANCIAL FACTORS, AS THE INDEPENDENT VARIABLES, FOR DIFFERENT COMPANIES ON THE STOCK MARKET. THE SYMBOL  $\Delta$  REFERS TO FIRST DIFFERENCE.**

		Independent Variables									
<i>Company</i>		Mean	$\Delta$ ROE PS (t)	ROE PS (t-1)	R4 (t)	R4 (t-1)	$\Delta$ R 4 (t)	$\Delta$ R 2 (t)	$\Delta$ R 2 (t-1)	$\emptyset_1$	$\emptyset_2$
<i>Bank of America</i>	SPt	-0.188								0.620	
<i>Bristol-Myers</i>	SPt		-0.0224		-3.121					0.511	
<i>Caterpillar</i>	SPt	-0.124					0.39			0.619	
<i>Chase</i>	$\Delta$ SPt	0.056						-0.11		-0.593	
<i>Community health</i>	SPt	-0.088						0.50	-0.56	0.777	
<i>Diamond drilling</i>	SPt	-0.277								0.634	0.345
<i>DTE Energy</i>	SPt	-0.413				28.49				0.399	
<i>Edwards life sciences</i>	SPt	1.725		-0.037						0.860	
<i>Eli Lilly</i>	SPt	0.583			-4.28					0.478	-0.282
<i>First Energy</i>	SPt	-0.089						-2.05		0.416	0.415
<i>Fiserv Inc.</i>	SPt	-0.016								0.219	
<i>G&amp;K Services</i>	SPt	0.149								0.036	
<i>GAP Inc</i>	SPt	-0.138		0.013				-0.92		0.843	
<i>Hain Celestial</i>	SPt	-0.016			-0.68						
<i>Halliburton</i>	SPt	-0.129			0.93			-1.16		0.727	
<i>Harris Corp</i>	SPt	-0.397	0.0349							0.191	0.241
<i>Hershey</i>	SPt	-0.091								0.854	
<i>I.D.Systems</i>	SPt	-0.034									
<i>ICU Medical</i>	SPt										
<i>J.B.Hunt</i>	SPt										
<i>J.C. Penny</i>	$\Delta$ SPt	-0.018								0.805	
<i>Jewett-Cameron</i>	SPt	-0.335								0.267	
<i>Kellog</i>	SPt	-1.311								0.999	
<i>Kewaunee Scientific</i>	SPt	0.046								0.485	

<i>L.B. Foster</i>	SPt	-0.117								0.334	
<i>Laboratory Corp</i>	SPt	-0.105								0.804	
<i>M.D.C. Holding</i>	SPt	-0.12110						1.96		0.784	
<i>Manpower Group</i>	SPt	-4.085			-3.02					0.884	
<i>Nanometrics</i>	SPt	-0.051	-0.030							0.365	
<i>Nanophase</i>	SPt	-0.137						-9.27			
<i>Ocean Biochemical</i>	SPt										
<i>Oceaneering International</i>	SPt	-0.140								0.221	
<i>Panhandle Oil and Gas</i>	SPt	-0.593									
<i>Par Technology</i>	SPt	-0.282								0.744	
<i>Quacker Chemicals</i>	SPt	-0.20125								0.635	
<i>Quanta Service</i>	SPt	-0.11713								0.361	0.451
<i>Radisys Corp</i>	SPt	-0.044								0.114	
<i>Rambus Inc</i>	SPt	-0.017									
<i>Salem Media Group Inc.</i>	SPt	-0.066			-1.00					0.326	
<i>Take-Two Interactive Software</i>	SPt	-0.058									
<i>Tampa Electric</i>	SPt	-0.347								0.288	
<i>UGI Corp</i>	SPt	-0.205								0.909	
<i>W.R.Grace &amp; CO</i>	SPt	-0.055								0.418	
<i>Walt Disney</i>	SPt	-0.148								0.785	-0.238
<i>WW Grainger Inc.</i>	SPt	-0.728			4.67					0.504	

SP = Spread, dependent variable

**Table 4 (continued)**

<i>Company</i>	CR (t)	ROA (t)	ΔLiab (t)	ΔLiab (t-4)	ROE PS (t)	ΔROA (t)	ΔROEP S (t-2)	ΔROA (t-1)	ΔCR (t)
<i>Bank of America</i>									
<i>Bristol-Myers</i>									
<i>Caterpillar</i>									
<i>Chase</i>									
<i>Community health</i>									
<i>Diamond drilling</i>	0.014								
<i>DTE Energy</i>	0.710	-0.162							
<i>Edwards life sciences</i>			2.273x E-9		-0.126	0.133			0.310
<i>Eli Lilly</i>									
<i>First Energy</i>		-0.012							
<i>Fiserv Inc.</i>				3.937 E-11					
<i>G&amp;K Services</i>								0.101	
<i>GAP Inc</i>	0.148								
<i>Hain Celestial</i>							0.00955		
<i>Halliburton</i>									
<i>Harris Corp</i>						-0.0843			
<i>Hershey</i>									
<i>I.D.Systems</i>	-0.0042								
<i>ICU Medical</i>									
<i>J.B.Hunt</i>									
<i>J.C. Penny</i>									
<i>Jewett-Cameron</i>									
<i>Kellog</i>									
<i>Kewaunee Scientific</i>									
<i>L.B. Foster</i>									
<i>Laboratory Corp</i>									
<i>M.D.C. Holding</i>									
<i>Manpower Group</i>	2.979		3.504 E-10						
<i>Nanometrics</i>						0.036			
<i>Nanophase</i>									

<i>Ocean Biochemical</i>									
<i>Oceaneering International</i>									
<i>Panhandle Oil and Gas</i>									
<i>Par Technology</i>									
<i>Quacker Chemicals</i>									
<i>Quanta Service</i>									
<i>Radisys Corp</i>					-0.00081	0.00263			
<i>Rambus Inc</i>									
<i>Salem Media Group Inc.</i>									
<i>Take-Two Interactive Software</i>	0.016				6.88xE-7				
<i>Tampa Electric</i>	0.436								
<i>UGI Corp</i>									
<i>W.R.Grace &amp; CO</i>									
<i>Walt Disney</i>									
<i>WW Grainger Inc.</i>									

**Table 4 (continued)**

<i>Company</i>	$\Delta R2$ (t-2)	Inc (t)	Inc (t-1)	$\Delta Inc$ (t-1)	$\Delta Inc$ (t)	$\Delta CR$ (t-3)	$\Delta CR$ (t-1)	$\Delta CR$ (t-5)	ROE PS (t-4)	ROE PS (t-5)
<i>Bank of America</i>										
<i>Bristol-Myers</i>										
<i>Caterpillar</i>										
<i>Chase</i>										
<i>Community health</i>										
<i>Diamond drilling</i>										
<i>DTE Energy</i>										
<i>Edwards life sciences</i>										
<i>Eli Lilli</i>										
<i>First Energy</i>										
<i>Fiserv Inc.</i>										
<i>G&amp;K Services</i>										
<i>GAP Inc</i>										
<i>Hain Celestial</i>	0.814									
<i>Halliburton</i>		-1.256x E-10								
<i>Harris Corp</i>						-0.219				
<i>Hershey</i>							-0.056			
<i>I.D.Systems</i>										
<i>ICU Medical</i>										
<i>J.B.Hunt</i>										
<i>J.C. Penny</i>		-4.647x E-11								
<i>Jewett-Cameron</i>										
<i>Kellog</i>										
<i>Kewaunee Scientific</i>										
<i>L.B. Foster</i>	0.484									
<i>Laboratory Corp</i>										
<i>M.D.C. Holding</i>										
<i>Manpower Group</i>										
<i>Nanometric s</i>								-0.019		
<i>Nanophase</i>										

<i>Ocean Biochemical</i>										
<i>Oceaneering International</i>										
<i>Panhandle Oil and Gas</i>										
<i>Par Technology</i>										
<i>Quacker Chemicals</i>										
<i>Quanta Service</i>										
<i>Radisys Corp</i>										
<i>Rambus Inc</i>								0.00172		
<i>Salem Media Group Inc.</i>										-0.011
<i>Take-Two Interactive Software</i>										
<i>Tampa Electric</i>			3.10x E-10							
<i>UGI Corp</i>										
<i>W.R.Grace &amp; CO</i>				-1.29xE-9						
<i>Walt Disney</i>										
<i>WW Grainger Inc.</i>					3.45xE-10					

**Table 4 (continued)**

<i>Company</i>	$\Delta$ RO EPS (t-1)	R2 (t)	R2 (t-1)	$\Delta$ R4 (t-5)	$\Delta$ R4 (t-4)	Liab (t)	R2 (t-3)	CR (t-1)	$\Delta$ Inc (t-4)
<i>Bank of America</i>									
<i>Bristol-Myers</i>									
<i>Caterpillar</i>									
<i>Chase</i>									
<i>Community health</i>									
<i>Diamond drilling</i>									
<i>DTE Energy</i>									
<i>Edwards life sciences</i>									
<i>Eli Lilli</i>									
<i>First Energy</i>									
<i>Fiserv Inc.</i>									
<i>G&amp;K Services</i>									-5.39x E-8
<i>GAP Inc</i>									
<i>Hain Celestial</i>									
<i>Halliburton</i>									
<i>Harris Corp</i>									
<i>Hershey</i>									
<i>I.D.Systems</i>									
<i>ICU Medical</i>									
<i>J.B.Hunt</i>									
<i>J.C. Penny</i>									
<i>Jewett-Cameron</i>									
<i>Kellog</i>									
<i>Kewaunee Scientific</i>									
<i>L.B. Foster</i>									
<i>Laboratory Corp</i>	-0.017								
<i>M.D.C. Holding</i>									
<i>Manpower Group</i>		-2.652							
<i>Nanometrics</i>				-0.992					
<i>Nanophase</i>									
<i>Ocean Biochemical</i>									
<i>Oceaneering International</i>									
<i>Panhandle Oil and Gas</i>						3.19156E- 8		0.123	
<i>Par Technology</i>						4.21E-9			
<i>Quacker Chemicals</i>							0.586		
<i>Quanta Service</i>									
<i>Radisys Corp</i>									
<i>Rambus Inc</i>									
<i>Salem Media Group Inc.</i>						1.31x E-9			

<i>Take-Two Interactive Software</i>									
<i>Tampa Electric</i>			-0.934			2.29x E-10			
<i>UGI Corp</i>									
<i>W.R.Grace &amp; CO</i>					0.928				
<i>Walt Disney</i>									
<i>WW Grainger Inc.</i>									



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