EFFECTS OF MACROECONOMIC VARIABLES ON STOCK PRICE, TRADING VOLUME, AND SPREAD FOR COMPANIES ON THE U.S. STOCK MARKET

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ABSTRACT

The purpose of this study is to determine the relationships between different macroeconomic variables and stock price, trading volume, and bid-ask spread for 45 companies listed on the U.S. stock market. Price, volume, and spread are important measures for investors to consider when making investment decisions. The variables considered were the gross domestic product, central bank interest rate, ten-year bond rate, unemployment rate, industrial production index, trade balance of payments, global price of Brent Crude in US dollars per barrel, money supply (M2), savings in commercial banks, federal debt, and inflation rate. Results showed that each of the independent variables had an effect on stock price, volume, or spread. The effect, however, was sporadic. The number of companies for which an independent variable was significant was within the range 1-16 (2.22%- 35.56%). These results may indicate that investors do not depend substantially on macroeconomic factors in making investment decisions.

INTRODUCTION

Stock price, stock volume, and stock spread are three important measures that characterize a stock on the stock market. Stock price reflects a company’s market value. It is the trading value of a stock. Stock price goes up with more buyers and down with more sellers. There are psychological implications that affect the price of a stock, but perhaps of more importance is the value of the company, which can be ascertained from the financial statements. Stock price can have an impact on a company by affecting its solvency. A sharp stock decline can cause a sharp increase in the cost of capital, which can lead to the closure of the business. Investors often look at the price of a company’s stock in their investment decision making. This can be misleading because share price may not be a true reflection of a company’s fundamentals. Stock price can be significantly changed by a company, through stock splits, reverse splits, stock dividends, and stock buyback, without a change in the company’s value.

Stock volume, or trading volume, represents the number of shares traded and, for futures and options, the number of contracts traded. Volume can be used as an indicator of market strength or weakness. Volume can be useful in identifying a bullish market. A rising volume is an indication of a rising and healthy market. A small trade volume is not a healthy indicator of a stock's performance. Volume can be an indicator of price reversal. If the price of a stock does not show much movement, but stock volume is high, this might be an indication that price reversal is forthcoming. Of importance is the fact that volume is an indicator of a stock's liquidity. Stocks with high volume are viewed as the best for trading, since there are many buyers and sellers ready to trade

Stock spread is defined as the difference between the bid and ask prices of a stock, which is known as bid-ask spread. Spread is an indicator of liquidity of the stock. A small stock spread is an indication that the stock is highly liquid with a substantial trading volume. Also, spread can be an indicator of volatility. The smaller the spread, the lower is the volatility. In addition, the bid–ask spread is of importance in stock trading and is relevant in reducing transaction costs (https://www.investopedia.com/).

Price, volume and spread are useful as a guide an investor needs in order to make the best financial decisions. Knowing the factors that may predict price, volume, or spread of a stock is important in helping the investor make the right investment decisions. Hence, the interest in this study is to determine, using statistical methodology, the macroeconomic variables that relate to stock price, spread, and trade volume for companies on the U.S. stock market.

LITERATURE REVIEW

In a study on how aging in New Zealand affects the stock market, Hettihewa et al. (2018) showed that aging had no significant effect on the market. However, real GDP and foreign direct investment had a positive effect on the stock market. The authors concluded that skilled migration policies, international factor mobility, and growth in technology-based productivity can boost the markets.

Mubarek and Javid (2017) investigated, using non-linear seemingly unrelated regression, the effect of macroeconomic factors on stock returns in fifty firms on the Pakistani stock market. They reported that money supply had a significant positive effect on stock returns and industrial production, inflation, exchange rate, call rate, and term structure shocks had negative effects on stock prices.

Similar results were reported by Mangala and Rani (2015) in an earlier study on the Indian stock market for the period of April 2005 to March 2014. Results from the Johansen co-integration test and analysis showed that exchange rate, inflation rate, and index of industrial production had significant negative effects on stock returns. On the other hand, money supply and yield on treasury bills had significant positive effects. Results from the Vector Error Correction Model showed that there was a significant short run causality from exchange rate to the Nifty index and from Nifty to money supply and inflation rate. Also, there was a long-term causality from Nifty to money supply and short-term interest rate.

Ahmed et al. (2017) investigated the long-term association between stock prices and macroeconomic variables on the Karachi Stock Exchange 100 Index (KSE 100) using monthly data from January 1992 to November 2015. Results from the Johansen co-integration analysis showed a long-term association between stock prices and exchange rate, inflation, and interest rate. The Granger test showed a unidirectional causality from interest rate to KSE 100. The authors concluded that predictability of the KSE 100 index relied substantially on interest rate, inflation, and exchange rate.

Ranjani and Dharmadasa (2018) studied the effects of gross domestic product (GDP), interest rate (IR), and exchange rate (ER) on the Colombo stock market index ((S & P SL 20 index share price) using monthly data for the period of July 2012 - June 2017. The Johansen co-integration analysis did not show any long-term association between the macroeconomic variables. The data was analyzed using the Vector Autoregressive (VAR) approach. Results showed that there was a significant negative effect of previous month exchange rate on share price. GDP and interest rate had no significant effects on share price. The Granger test showed a unidirectional causality from exchange rate to share price.

Kraft and Kraft (2015) investigated the effects of percentage change in money supply, and Moody's AAA corporate bond rate on stock prices using time series analysis. Results indicated that there was no significant relationship between any of these variables and stock price.

Paresh et al. (2014) examined the effects of industrial production index, exchange rate (rupee in terms of U.S. dollar), and the nominal ninety-day interest rate in India on the share price index for thirteen major Indian commercial banks using panel regression on monthly data over the period 1998 to 2008. Results revealed that industrial production and exchange rate had significant positive effects on stock returns. On the other hand, interest rate had a significantly negative effect on stock price. Of the three independent variables, industrial production had the most effect on stock price. Panel causality using the Granger test was partially in agreement with the panel regression results in that only industrial production Granger-caused stock prices.

In a similar study to Paresh et al. (2015), Ali et al. (2018) used panel data to investigate the effects of interest rate, exchange rates, and stock market index on monthly stock prices of eight main banks in Pakistan. Data were gathered over the period January 2005 to December 2013. Results showed that currency depreciation and interest rate increase caused a decline in share prices. The Granger causality test showed that interest rate and bank stock prices exhibited a bi-directional causality. On the other hand, stock market index and exchange rates Granger caused bank stock prices and the effects were unidirectional.

Saldanli et al. (2017) studied the panel causality relationships of the industrial production index, exchange rates, and money supply with the stock prices of 19 deposit banks traded on the Istanbul stock exchange. Data used were monthly observations over the period June 2007 to October 2016. The analysis showed that the causality relationship between the industrial production index and stock price was not significant. On the other hand, Granger causalities from exchange rates and money supply to stock price were significant. This indicated that only money supply and exchange rate had an impact on bank stock prices.

Seetanah and Rojid (2012) investigated factors that may influence the bid-ask spread on the stock exchange of Mauritius (SEM) using data for 38 companies over the period January 4 to April 30, 2009. It was found that the bid-ask spread was determined by its lagged value. Also, there was a positive and significant relationship between spread and the closing stock price. However, there was a negative relationship between spread and each of trading volume and firm size.

Clark et al. (1992) reported on seasonality of bid-ask spreads for 540 stocks on the NYSE over the period 1982-1987. There was a decrease in bid-ask spreads from the end of December to the end of January of the following year. Cross sectional regression analysis did not reveal any relationship between changes in spread at the turn of the year and January stock prices.

Taylor (2002) applied the vector auto-regression (VAR) model to predict intraday h-step ahead forecasts of the bid-ask spreads of 50 stocks on the London Stock Exchange. Predicted spreads were used as guidelines for investors. The period of the day corresponding to the smallest expected spread from the model was regarded as the best time for trading by investors. The spreads from the model were 35% lower than the spreads incurred by investors who did not use the model.

Aitken and Frino (1996) investigated the determinants of bid-ask spread on the Australian Stock Exchange over the period June 1, 1992 to November 30, 1992. A log linear regression model was used on 98 smaller priced stocks and on 429 larger priced stocks. The dependent variable was the natural log of the percentage bid-ask spread and the independent variables were the natural logs of stock price, level of trading activity, and stock price volatility. Results of the regression analysis showed that all three independent variables were significantly related to the log of percentage spread. Stock price and level of trading or volume had negative effects and price volatility had a positive effect. The adjusted R-squared for regression was 0.83 for the smaller priced socks and 0.94 for the larger priced stocks.

Howe and Lin (1992) investigated the relationship between dividend yield and spread for stocks traded over the counter (OTC) and NASDAQ over the period 1984 to 1987. Using regression analysis, the authors reported that dividend yield was negatively related to spread, after controlling for price, trade volume, number of market makers (the number of registered market makers for the stock at the end of the year), and to variance of returns.

Paresh et al. (2015) investigated the effects of trading volume, stock price, and stock price volatility on bid-ask spread using panel daily data. The analysis was based on 734 firms on the MYSE for the period January 1, 1998 to December 31, 2008. Results showed that trading volume had a significant positive relationship with spread. Volatility was negatively related to spread. Also, lagged spread was negatively related to spread. However, price had a mixed effect with some firms showing a positive effect on spread and others a negative effect. Firm size influenced the relationships between spread and volume, volatility, and price. The effect of price on spread was smaller for small sized firms than for large sized firm. On the other hand, price volatility had a larger effect on spread for small sized firms than for large sized firms. Also, the effect of lagged spread on spread was larger for small firms than for large firms.

Li et al. (2003), using regression analysis, investigated the effects of yield spread and stock returns on out of sample forecasts of GDP in the US, Italy, UK, and Germany. Four regression models were tested on quarterly data over the period 1961 to 1996. Results indicated that the ability of the yield spread and stock index return to predict the GDP differed across countries and over time, to the point where neither variable was consistent in predicting the GDP in these countries.

Lee and Rui (2001) investigated the effects of informational and non-informational trades on stock price and trade volume using daily data from the US, UK, and Japanese stock markets. In addition, daily data on five companies (Coca-Cola, Kodak, IBM, Amoco and Alcoa) were gathered. Informational trade was defined as being due to new information about market shocks that can influence investors' evaluation of the stock market. On the other hand, non-informational trade was due to information about the market obtained through interactions among different groups of investors. For their analysis, authors applied a bivariate moving average model of stock returns and trading volume with informational and non-informational shocks. Results indicated that trading volume was affected mainly by non-informational trade and stock price by informational trade. Further results indicated that increases in volatility, for both price and volume during and after the 1987 market crash, were mainly due to non-informational trading. In addition, there was evidence that non-informational trades determined the negative relationship found between trade volume and the first-order autocorrelation of stock returns.

Song et al. (2005) investigated the effects of trade number, trade size, and trade volume on volatility for the Shanghai stock market. Results showed that volatility was affected mainly by the number of trades. Also, the second largest trade size affected volatility more than other trade sizes. This was taken as evidence that informed traders camouflaged their information and behavior through the second largest trade size.

It is seen from the literature that more work is needed on determining the impact of macroeconomic variables on stock price, stock trade volume and bid-ask spread at the company level. Also, macroeconomic impacts may vary from market to market and from period to period. Hence, in this study we investigate the impacts of eleven macroeconomic variables on price, volume, and spread for different companies on the U.S. stock market.

DATA

Forty-five companies over the years 1998 to 2017 were selected, based on having complete quarterly financial data, utilizing the Wharton Research Data Services (WRDS). Also, from WRDS, we obtained for each company its quarterly stock price, stock trading volume, and stock spread over the years 1998 to 2017. Quarterly macroeconomic variables for the same years were obtained from the Saint Louis Federal Reserve economic data base.

METHODS

Statistical analysis

For each of the 45 companies, the auto-regression procedure in SAS was used to determine which macroeconomic variables were related to stock price, trading volume or bid-ask spread. The independent variables used in the analysis are listed in Table 1.

For each company, we tested all the independent and dependent variables for stationarity, using the Augmented Dickey-Fuller test and the Phillips-Perron test. Each variable that was not stationary became stationary upon first differencing. All the independent variables were non-stationary, but their first difference was stationary. The auto regression model on the stationary variables with the backward elimination scheme (Montgomery et al., 2001) was used in order to retain in the final model only those independent variables that were significant at the 5% or 10% level.

The auto regression model in Equation (1) considered the first-order autocorrelation that usually exist in time series data. The regression coefficients and the parameter of the first- order autocorrelation were estimated using maximum likelihood (ML). In the presence of autocorrelations among the errors, the estimates of the regression coefficients are more accurate than those of least squares in multiple regression and the model gives a better fit to the data with a higher R^2. In the case where autocorrelation is lacking, the ML estimates will be similar to the least square estimates from multiple linear regression and the model will be the same as that of multiple linear regression.

The auto-regression model used is expressed as

$$Y_t = a + b_1X_1 + b_2X_{2t} + .. + b_kX_{kt} + \eta_t \text{ ,} \qquad (1)$$

where Y and the X's are stationary

and the residual η_t is

$$\eta_t (1- øB) = e_t \text{ or}$$

$$\eta_t = e_t / (1- øB)$$

Here, η_t is expressed as a first-order autoregressive model, AR (1), representing the first-order autocorrelation of the residuals that usually exists in time series data., B is the backward shift operator ($BX_t = X_{t-1}$), and e_t is the random error term. The $b_{i's}$ are the regression coefficients associated with each independent variables X_i.

Equation (1) can be re-written as

$$Y_t = a + b_1X_{1t} + b_2X_{2t} + .. + b_kX_{kt} + e_t/(1- øB) \qquad (2)$$

If ø is significantly different from zero, the model in Equation (2), when both sides of the equation are multiplied by (1- øB), gives the final multiple linear regression equation.

In the case of this analysis, each independent variable was differenced for stationarity. This means that X_{it} in Equation (2) must be replace by (X_{it} –X_{it-1}). Also, where Y_t was differenced (see Tables 2-4), Y_t should be replaced by ($Y_t - Y_{t-1}$)

RESULTS AND DISCUSSION

Tables 2, 3, and 4 present the results of the auto-regression analysis for stock price, stock trading volume and bid-ask spread, respectively. Each row in the Tables represents the regression model for each company. The values in the Tables are the regression coefficients (b_i's) of the macroeconomic variables that entered the model and were significant at the 10% level (most of the variables were significant at the 5% level or less and few, indicated by an asterisk, were significant at the 10% level). Presented also are the R^2 values for each model and the auto-regressive parameter ø of Equation (2). Table 5 gives the number of companies where each independent variable was significantly related to stock price, volume, or spread.

Of interest from Tables 2-5 is the finding that the models are company specific. Not one economic factor was related to the dependent variable over all companies or the majority of companies. Table 5 shows the frequency and percent representation, over companies, for each macroeconomic variable, in as far as it relates to the dependent variable. For stock price, it is seen that the most significant variable was bond rate. It was significant in 11 (24.44%) of the companies. Of least significance were GDP, balance of trade, interest rate, money supply, and industrial production index. Each variable was significant in only 2 (4.44%) of the companies. Of interest is the finding that GDP and interest rate had little influence on an individual company's stock price.

Table 5 shows that, for trading volume as the dependent variable, unemployment rate had the most effect. It was significantly related to trading volume in 16 (35.56%) companies. The range of representation for the other variables was between 4.44%. and 20%. The least significant variable was interest rate, with 2 (4.44%) representation over the 45 companies.

For the bid-ask spread, Table 5 shows that debt was most significant and oil price and money supply (M2) least significant. Debt was significantly related to spread in 12 (26.67%) of the 45 companies. Oil price and money supply were significantly related to spread in only one company each.

It is clear from the above results that no macroeconomic variable was a predictor for stock price, volume or spread in all the companies. In fact, the relationships between the macroeconomic variables and stock price, stock volume, and bid-ask spread were sporadic, which may indicate that investors, in making investment decisions, do not depend substantially on macroeconomic factors. Similar results were reported in the literature concerning the relationship between stock price and a company's financial factors (Earl, 1972; Berglund & Bergman, 2013; Hassan et al., 2020; Ligocká, 2018a, 2018b).

TABLE 1. LIST OF INDEPENDENT VARIABLES USED IN THE AUTO-REGRESSION ANALYSIS WHERE A COMPANY'S STOCK PRICE, TRADING VOLUME, OR BID-ASK SPREAD WAS THE DEPENDENT VARIABLE

GDP	Gross domestic product in billions
Int	Central bank interest rate
Bond	Ten-year bond rate
Unemp	Unemployment rate
Indp	Industrial production index
Trade	Trade balance (balance of payment bases, negative) in millions
Oil	Global price of Brent Crude in US dollars per barrel
Money	Money Supply (M2) in billions
Savings	Savings in commercial banks in billions
Debt	Federal Debt in Millions
CPI	Inflation rate

TABLE 2. PARAMETER ESTIMATES FROM THE AUTO-REGRESSION OF STOCK PRICE AS THE DEPENDENT VARIABLE ON ECONOMIC FACTORS AS THE INDEPENDENT VARIABLES FOR THE DIFFERENT COMPANIES ON THE STOCK MARKET

Company	Dependent Variable	Independent Variables						
		Intercept	ΔBond-t	ΔUnemp-t	ΔCPI-t	ΔOil-t	ΔGDP-t	ΔDebt-t
Bank of America	ΔPrice-t	-0.376	5.476					
Bristol-Myers	Price-t	43.144	-4.172	-2.604				
Caterpillar	ΔPrice-t	5.7009			-11.716	0.7200		
Chase	ΔPrice-t	1.5392						
Community health	ΔPrice-t	-0.0539				0.253		
Diamond drilling	ΔPrice-t	2.9987			-7.967	0.934		
DTE Energy	ΔPrice-t	0.0263		-1.9728				
Edwards life sciences	ΔPrice-t							

Eli Lilli	ΔPrice-t	-2.7031	-4.1768				0.0201	
First Energy	ΔPrice-t	-0.3006	-3.3425	-2.4060		0.2465		
Fiserv Inc.	ΔPrice-t							
G&K Services	ΔPrice-t							
GAP Inc	ΔPrice-t							
Hain Celestial	ΔPrice-t							
Halliburton	Price-t	38.3133				0.3275		
Harris Corp	ΔPrice-t	1.404	6.7817					
Hershey	ΔPrice-t							
I.D.Systems	ΔPrice-t	-0.0665						
ICU Medical	ΔPrice-t	3.9125		-4.0928				
J.B.Hunt	ΔPrice-t	-1.600					0.0219	
J.C. Penny	ΔPrice-t	-0.782	3.839*					
Jewett-Cameron	Price-t	3.8618		-2.707				
Kellog	ΔPrice-t	-0.6925			2.044			
Kewaunee Scientific	Price-t	8.0443						
L.B. Foster	ΔPrice-t	5.123		-3.063	-6.051	0.292		0.0000135
Laboratory Corp	ΔPrice-t	1.8781						
M.D.C. Holding	ΔPrice-t							
Manpower Group	ΔPrice-t	0.8827	9.266					
Nanometrics	Price-t	15.648						
Nanophase	Price-t	5.8354						-5.958E-6
Ocean Biochemical	Price-t	2.0345						
Oceaneering International	ΔPrice-t							
Panhandle Oil and Gas	Price-t	19.746						
Par Technology	ΔPrice-t							
Quacker Chemicals	ΔPrice-t	1.755	3.7886*	-3.0744				
Quanta Service	Price-t	23.1255	4.3108					
Radisys Corp	ΔPrice-t	-0.1896	3.4140					
Rambus Inc	Price-t	36.406						

Salem Media Group Inc.	ΔPrice-t	-0.4536		-2.0368				
Take-Two Interactive Software	ΔPrice-t							
Tampa Electric	ΔPrice-t	-0.0112		-0.999*				
UGI Corp	ΔPrice-t	0.248						
W.R.Grace & CO	ΔPrice-t	-1.699				0.1593		
Walt Disney	ΔPrice-t	0.2477	8.2677					
WW Grainger Inc.	ΔPrice-t	-1.9599				0.3333		0.0000194

the symbol (*) indicates significance at the 10% level
the symbol Δ represents the first difference

TABLE 2. STOCK PRICE (Continued)

Company	ΔTrade-t	ΔInt-t	ΔMoney-t	ΔSaving-t	ΔIndp-t	ø	R^2
Bank of America						- 0.198	0.105
Bristol-Myers						0.939	0.814
Caterpillar	-0.000758					-0.059 ns	0.204
Chase		3.773				- 0.484	0.262
Community health						0.334	0.214
Diamond drilling						0.034 ns	0.349
DTE Energy			-0.018	0.0310		-0.063 ns	0.238
Edwards life sciences							
Eli Lilli						-0.3280	0.179
First Energy						-0.1280 ns	0.332
Fiserv Inc.							
G&K Services							
GAP Inc							
Hain Celestial							
Halliburton						0.792	0.661

Harris Corp						-0.1333 ns	0.080
Hershey							
I.D.Systems	-0.000148					-0.257	0.108
ICU Medical						0.612	0.345
J.B.Hunt					-1.389	-0.124 ns	0.0879
J.C. Penny						0.071 ns	0.042
Jewett-Cameron						0.267	0.097
Kellog						-0.1204 ns	0.091
Kewaunee Scientific						0.370	0.177
L.B. Foster				-0.0524		-0.0944 ns	0.206
Laboratory Corp		10.327*				0.135 ns	0.073
M.D.C. Holding							
Manpower Group						0.0257 ns	0.101
Nanometrics						0.747	0.545
Nanophase						0.618	0.542
Ocean Biochemical				-0.0041*		0.828	0.615
Oceaneering International							
Panhandle Oil and Gas						0.728	0.507
Par Technology							
Quacker Chemicals						0.0341 ns	0.122
Quanta Service						0.819	0.689
Radisys Corp						0.00887 ns	0.0550
Rambus Inc				-0.1527		0.469	0.299
Salem Media Group Inc.			-0.0159	0.0263	-0.8585	0.0327 ns	0.274
Take-Two Interactive Software							

Tampa Electric						0.0233 ns	0.0396
UGI Corp						0.199*	0.040
W.R.Grace & CO				0.0271		0.082 ns	0.117
Walt Disney						0.0643 ns	0.073
WW Grainger Inc.						0.144 ns	0.108

the symbol (*) indicates significance at the 10% level
the symbol Δ represents the first difference
'ns' indicates not significant

TABLE 3. PARAMETER ESTIMATES FROM THE AUTO-REGRESSION OF STOCK VOLUME AS THE DEPENDENT VARIABLE ON ECONOMIC FACTORS AS THE INDEPENDENT VARIABLES FOR THE DIFFERENT COMPANIES ON THE STOCK MARKET

	Dependent Variable	Independent Variables						
Company		Intercept	ΔUnemp-t	ΔMoney-t	ΔSaving-t	ΔGDP-t	ΔDebt-t	ΔIndp-t
Bank of America	ΔVol-t	-5293327	9135367	100917	-72337			
Bristol-Myers	Vol-**t**	1630149			7185	-2492		
Caterpillar	ΔVol-t	1816	340976	1700	-2335			
Chase	Vol-**t**	2272	-929.545					
Community health	ΔVol-t	6516	52610					
Diamond drilling	Vol-**t**	385888						
DTE Energy	Vol-**t**	185057					0.0840	
Edwards life sciences	Vol-t	128002						
Eli Lilli	Vol-t	850811		767.909				
First Energy	ΔVol-t	-36007		486.2513				
Fiserv Inc.	Vol-t	302063	46992	380.646	-1038			
G&K Services	Vol-t	20877				-0.0140	-0.0131	
GAP Inc	Vol-t	1112269	99838					
Hain Celestial	Vol-t	124997						

Halliburton	Vol-t	1620984					1.8490	
Harris Corp	Vol-t	163971	30587					
Hershey	Vol-t	197562					0.0521	
I.D.Systems	Vol-t	9219						
ICU Medical	Vol-t	21890						
J.B.Hunt	ΔVol-t	-27644	55368			201.334*		
J.C. Penny	Vol-t	1139920	274358*		4865*			
Jewett-Cameron	Vol-t							
Kellog	Vol-t	285990	25361	370.871			-0.223	
Kewaunee Scientific	Vol-t	966.779	-377.603					
L.B. Foster	Vol-t	12182						
Laboratory Corp	Vol-t	180918						-16357
M.D.C. Holding	Vol-t	101058	13280					
Manpower Group	Vol-t	118819					0.0805	
Nanometrics	Vol-t	24689				91.264		
Nanophase	Vol-t	23028						
Ocean Biochemical	Vol-t	2341					0.00759	
Oceaneering International	Vol-t	159982						
Panhandle Oil and Gas	Vol-t	3986						
Par Technology	Vol-t	8893	-2765			-26.357		938.088
Quacker Chemicals	Vol-t	7648		18.4916				
Quanta Service	Vol-t	360622	-41698			-449.476		
Radisys Corp	Vol-t	30679		83.3150	-113.995			
Rambus Inc	Vol-t	650144			-2261			
Salem Media Group Inc.	Vol-t	7812				27.878		
Take-Two Interactive Software	Vol-t	339063						
Tampa Electric	Vol-t	194176	30116	623.513				29735
UGI Corp	Vol-t	110429						-12653

W.R.Grace & CO	Vol-t	129470	-19065					
Walt Disney	Vol-t	1815497				-1701	0.9611	143075
WW Grainger Inc.	Vol-t	140129				-145.8754		

the symbol (*) indicates significance at the 10% level
the symbol Δ represents the first difference

TABLE 3. STOCK VOLUME (Continued)

Company	ΔBond-t	ΔCPI-t	ΔOil-t	ΔInt-t	ΔTrade-t	ø	R^2
Bank of America						- 0.374	0.4738
Bristol-Myers						0.261	0.256
Caterpillar						-0.102 ns	0.347
Chase						0.654	0.441
Community health						-0.360	0.199
Diamond drilling						0.542	0.302
DTE Energy						0.455	0.324
Edwards life sciences						0.666	0.445
Eli Lilli						0.812	0.698
First Energy	113293					-0.369	0.275
Fiserv Inc.						0.756	0.597
G&K Services						0.413	0.330
GAP Inc		141289				0.803	0.664
Hain Celestial						0.611	0.376
Halliburton						0.536	0.425
Harris Corp			1302			0.657	0.473
Hershey						0.508	0.305
I.D.Systems	7855					-0.534	0.352
ICU Medical	8775					0.5261	0.308
J.B.Hunt	-49434					-0.380	0.284
J.C. Penny						0.744	0.577
Jewett-Cameron							
Kellog						0.875	0.715

Kewaunee Scientific				-779.392		0.358	0.203
L.B. Foster						0.750	0.569
Laboratory Corp					4.2113	0.355	0.308
M.D.C. Holding		13473*				0.829	0.695
Manpower Group						0.384	0.295
Nanometrics						0.579	0.376
Nanophase						0.388	0.148
Ocean Biochemical	4762					0.0655 ns	0.1304
Oceaneering International						0.785	0.599
Panhandle Oil and Gas						0.837	0.709
Par Technology			187.793		0.347	0.681	0.483
Quacker Chemicals		-2671*	146.112 *			0.789	.669
Quanta Service						0.853	0.744
Radisys Corp						0.416	0.289
Rambus Inc						0.269	0.172
Salem Media Group Inc.						0.219*	0.121
Take-Two Interactive Software						0.302	0.105
Tampa Electric						0.801	0.664
UGI Corp						0.821	0.681
W.R.Grace & CO			-1606			0.555	0.342
Walt Disney				-378593	28.586	0.460	0.503
WW Grainger Inc.					1.9987	0.571	0.491

the symbol (*) indicates significance at the 10% level
the symbol Δ represents the first difference
‘ns’ indicates not significant

TABLE 4. PARAMETER ESTIMATES FROM THE AUTO-REGRESSION OF BID-ASK SPREAD AS THE DEPENDENT VARIABLE ON ECONOMIC FACTORS AS THE INDEPENDENT VARIABLES FOR THE DIFFERENT COMPANIES ON THE STOCK MARKET

Company	Dependent Variable	Independent Variables						
		Intercept	ΔBond-t	ΔSaving-t	ΔIndp-t	ΔGDP-t	ΔInt-t	ΔUnemp-t
Bank of America	Spread-t	-0.1750	0.0858	0.000744				
Bristol-Myers	Spread-t	-0.2533						
Caterpillar	Spread-t	-0.121						
Chase	ΔSpread-t	0.00316			-0.020*			
Community health	Spread-t	-0.0960						
Diamond drilling	Spread-t	-0.1118				-0.00021	0.0598	
DTE Energy	Spread-t	-0.0550					-0.335	
Edwards life sciences	Spread-t							
Eli Lilli	Spread-t	-0.3339						
First Energy	Spread-t	-0.0613	-0.0675					
Fiserv Inc.	Spread-t							
G&K Services	Spread-t	0.128					-0.00029	
GAP Inc	Spread-t	-0.1060	-0.0899*					
Hain Celestial	Spread-t	-0.0858			0.0143			
Halliburton	Spread-t	-0.1486						
Harris Corp	Spread-t	-0.3576				0.000813*		
Hershey	Spread-t							
I.D.Systems	Spread-t	-0.1024						
ICU Medical	Spread-t	-0.1995					0.186	
J.B.Hunt	Spread-t	-0.0785					0.148	
J.C. Penny	ΔSpread-t	0.00451	0.0296					
Jewett-Cameron	Spread-t	-0.3330						
Kellog	Spread-t	-0.148						

Kewaunee Scientific	Spread-t	-0.226						
L.B. Foster	Spread-t	-0.1405	0.0619					
Laboratory Corp	Spread-t	-0.1098						
M.D.C. Holding	Spread-t	-0.1201						
Manpower Group	Spread-t	-0.1307						
Nanometrics	Spread-t	-0.0996					0.0821	
Nanophase	Spread-t	-0.2449					0.3564	
Ocean Biochemical	Spread-t	-0.0694		-0.00035				
Oceaneering International	Spread-t	-0.143			0.00167		0.277	
Panhandle Oil and Gas	Spread-t	-0.2896			0.0969		-0.171*	
Par Technology	Spread-t	-0.0970						
Quacker Chemicals	Spread-t	-0.1486		0.00049				
Quanta Service	Spread-t	-0.1273						0.0580
Radisys Corp	Spread-t	-0.0487						
Rambus Inc	Spread-t	-0.0646					0.1104	
Salem Media Group Inc.	Spread-t	-0.1244					0.1778	
Take-Two Interactive Software	Spread-t	-0.0507		0.00025				
Tampa Electric	Spread-t	-0.0882						
UGI Corp	Spread-t	-0.0966						-0.0177
W.R.Grace & CO	Spread-t	-0.0725						0.0466
Walt Disney	Spread-t	-0.0958						
WW Grainger Inc.	Spread-t	-0.1236		0.00081				

the symbol (*) indicates significance at the 10% level
the symbol Δ represents the first difference

TABLE 4. BID-ASK SPREAD (Continued)

Company	ΔCPI-t	ΔOil-t	ΔTrade-t	ΔDebt-t	ΔMoney-t	ø	R^2
Bank of America						0.5489	0.395
Bristol-Myers						0.6133	0.423
Caterpillar						0.611	0.391
Chase						-0.417	0.196
Community health						0.801	0.612
Diamond drilling						0.903	0.739
DTE Energy						0.337	0.191
Edwards life sciences							
Eli Lilli						0.478	0.287
First Energy	-0.060	0.00337				0.667	0.462
Fiserv Inc.							
G&K Services			0.0000574			0.235*	0.632
GAP Inc						0.636	0.427
Hain Celestial				1.62E-7		0.032 ns	0.145
Halliburton						0.669	0.471
Harris Corp						0.648	0.356
Hershey							
I.D.Systems				1.33E-7*		-0.169 ns	0.084
ICU Medical				3.81E-7		0.087 ns	0.162
J.B.Hunt				1.94E-7		0.044 ns	0.169
J.C. Penny						0.503	0.269
Jewett-Cameron						0.230*	0.095
Kellog						0.666	0.482
Kewaunee Scientific				-3.48E-7		0.404	0.155
L.B. Foster				1.19E-7		0.243	0.184
Laboratory Corp						0.756	0.594
M.D.C. Holding						0.740	0.539

Manpower Group						0.857	0.738
Nanometrics				2.17E-7		0.0246 ns	0.162
Nanophase				8.179E-7		0.0454 ns	0.153
Ocean Biochemical				8.821E-8		0.118	0.102
Oceaneering International						0.646	0.714
Panhandle Oil and Gas			0.0000230	3.558E-7		0.133 ns	0.211
Par Technology	-0.0309					0.829	0.671
Quacker Chemicals						0.501	0.340
Quanta Service						0.652	0.429
Radisys Corp						0.522	0.274
Rambus Inc				1.734E-7		0.148 ns	0.151
Salem Media Group Inc.				2.545E-7*		0.0726 ns	0.138
Take-Two Interactive Software						0.238	0.173
Tampa Electric						0.785	0.619
UGI Corp						0.893	0.762
W.R.Grace & CO						0.504	0.265
Walt Disney						0.680	0.452
WW Grainger Inc.					-0.000461	0.559	0.368

the symbol (*) indicates significance at the 10% level
the symbol Δ represents the first difference
'ns' indicates not significant

TABLE 5. FREQUENCY AND PERCENT (OVER THE 45 COMPANIES) OF EACH INDEPENDENT VARIABLE THAT WAS SIGNIFICANTLY RELATED TO STOCK PRICE, STOCK VOLUME, AND BID-ASK SPREAD

Independent Variables		Stock Price	Stock Volume	Bid-Ask Spread
GDP	Gross domestic product in billions	2 (4.44%)	9 (20.0%)	2 (4.44)
Int	Central bank interest rate	2 (4.44%)	2 (4.44%)	11 (24.44%)
Bond	Ten-year bond rate	11 (24.44%)	5 (11.11%)	5 (11.11%)
Unemp	Unemployment rate	9 (20.0%)	16 (35.56%)	3 (6.67%)
Indp	Industrial production index	2 (4.44%)	5 (11.11)	4 (8.89%)
Trade	Trade balance (balance of payment bases, negative) in millions	2 (4.44%)	4 (8.89%)	2 (4.44%)
Oil	Global price of Brent Crude in US dollars per barrel	8 (17.78%)	4 (8.89%)	1 (2.22%)
Money	Money Supply (M2) in billions	2 (4.44%)	9 (20.0%)	1 (2.22%)
Savings	Savings in commercial banks in billions	6 (13.33%)	7 (15.56%)	5 (11.11%)
Debt	Federal Debt in Millions	3 (6.67%)	8 (17.78%)	12 (26.67%)
CPI	Inflation rate	4 (8.89%)	3 (6.67%)	2 (4.44%)

CONCLUSION

The purpose of this study was to identify the macroeconomic factors that had an effect on stock price, trading volume, and bid-ask spread for each of 45 companies listed on the U.S. stock market. The eleven macroeconomic variables included in this study were the gross domestic product, central bank interest rate, ten-year bond rate, unemployment rate, industrial production index, trade balance of payments, global price of Brent Crude in US dollars per barrel, money supply (M2), savings in commercial banks, federal debt, and inflation rate. The autocorrelation analysis approach, which considered the first-order autocorrelation for time series data, was utilized in regressing each of the dependent variables (stock price, trading volume, and bid-ask spread) on the eleven stationary independent macroeconomic variables. Results indicated that all variables had an effect on price, volume, and spread. However, the effect of each variable was company specific and limited to 36% or less of the companies. The percentage range was 4.44% to 24.44% for stock price, 4.44% to 35.56% for trading volume, and 2.22% to 26.67% for bid-ask spread. These results may imply that investors, in making investment decisions, do not rely substantially on macroeconomic factors. Similar results were reported in the literature concerning the relationship between stock price and a company's financial factors (Earl, 1972; Berglund & Bergman, 2013; Hassan et al., 2020; Ligocká, 2018a, 2018b).

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