

The Signaling Effect of Margin Debt on Stock Market Returns

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ABSTRACT

The use of margin debt to exacerbate returns for investors is widely used during times of economic growth. It is also used as a tool for investors to take short positions on stocks when a decline is expected. This paper examines the relationship between the use of margin debt, labor market participation rates, Put/Call ratios, and Volatility Index as a signal for possible asset bubbles or market bottoms. By analyzing the amount of existing monthly margin debt, labor market participation rates, Put/Call ratio figures, and Volatility Index from 2003 through the present, we hypothesize that an increase in the labor market participation rate, margin debt, Put/Call ratio, Volatility Index (VIX), and Federal Funds rate will reach an equilibrium that can provide correlation to a stock market retracement. Additionally, we hypothesize that a decrease in the monthly labor participation rate, margin debt, Put/Call ratio, monthly VIX, and Federal Funds rate will reach an equilibrium that will correlate to eventual upward stock market movements.

The results of our study found a statistically significant correlation between the S and P 500 directional movement change as a percentage and the amount of margin debt change as a percentage and the VIX monthly change as a percentage. There is no statistically significant correlation between the S and P 500 directional movement change as a percentage and the labor market participation rate, the Put/Call ratio, or the Federal Funds rate as percentage changes month over month. The results are consistent with previous literature related to margin debt and the VIX. Further, our results provide new foundations to work for future research related to signaling related to market-wide risks such as labor market rates, option-based analysis, and central bank policy.

Finally, labor-market participation rates reflect timely employment data related to market sentiment and corporate hiring practices. As such, it serves as a better variable in this study than unemployment figures, which are not only lagging indicators but also allow for revision after the initial release.

This paper will explore the seminal works with a brief, albeit thorough literature review examining several key concepts in finance, accounting, economics, and investment theory. Next, we will examine various methodologies used in the past that have explored the use of margin debt, Put/Call ratios, volatility, and labor-market participation. Then we will explain the methodology we will use in our empirical examination of data, as well as the sources of our data and rationale for its selection. Finally, analysis of our findings will be included along with a discussion of its impact.

Keywords: Margin debt; Stock market returns; Leverage; VIX

INTRODUCTION

Modern portfolio theory is based upon rational investors making decisions when facing uncertainty through the use of arbitrage, investors will replace assets with ones having a similar return

while offering less risk. The valuations of these assets are based upon the belief that their future value is greater than their current value. Additionally, financial models have been created with a rational investor in mind. The Capital Asset Pricing

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Model (CAPM), for instance, is often identified as a valuation model that utilizes variance and risk-free rates of return to identify the appropriate rate of return given specific market-based risk. Similarly, the Fama/French 3-factor model expands upon this work by adding weight, size, and market factors to the model and Carhart added a fourth factor (momentum) in 1997 [1].

Behavioral finance explores the notion that some investors may not be rational, thus causing markets or individual securities to overreact and underreact to particular bits of information. Seminal works by Werner, DeBondt, and Thaler such as "Does the Stock Market Overreact?" (1985), uncover significant weak-market form efficiencies. Similarly, when responding to new data, individuals have a tendency to overweight new data over old data, resulting in a representative heuristic. Further exploration of irrational investor behavior can be traced back to the 1950s, as empirically challenged the valuation of firms based upon the capital structure by using the now fully-accepted Fisherian approach to firm valuation using cash flows. Keynes identified this day to day overreaction as well, suggesting that the day-to-day volatility "have an excessive, and even an absurd, influence on the market. In short, irrationality coupled with severe overreaction or underreaction to information provides little predictability for investors hoping to gain insight.

Consequently, analysis of signaling by firms or markets has been explored in an attempt to capitalize on these movements. Notably, these signals often include stock splits, dividend announcements, stock repurchases, or executive changes. The most empirical analysis reflects that the stock prices of firms splitting shares, increasing the dividend, or announcing share buybacks do experience abnormal positive returns reflecting in investor overreaction.

Analysis of margin debt is extensive and examines three primary topics-margin debt being impacted by interest rate changes, the relationship between margin debt and volatility, and margin debt as a predictor of an individual stock or overall market performance.

As stated previously Regulation T provides the Federal Reserve power to set margin debt limits. The central bank has not exercised this authority since 1974 when they set the limit at 50%. The Federal Reserve also is charged with adjusting interest rates depending upon macroeconomic measurements as a way to provide stability to the economy. Naturally, if the Fed elects to raise interest rates, the cost of borrowing (including margin accounts) increases. The converse is true if the central bank lowers interest rates.

Studies surrounding this market mechanism have concluded that margin debt borrowing actually increases when the Federal Reserve Bank raises interest rates, and margin debt borrowing decreases when the central bank lowers interest rates. This suggests that investors utilizing margin debt may, in fact, use the central bank interest rate movements as potential signals for the overall economy instead of being price-sensitive to borrowing costs. Conversely, other research has posited that the amount of margin debt actually reflects previous stock market returns rather than the cause of future market returns [2]. This may

support empirical research indicating that individual investors and noise-traders are the primary sources of margin debt reflecting less-sophisticated borrowing analysis than institutional investors such as hedge funds or private equity funds.

Further studies posit that margin debt responds to previous stock market changes, rather than margin debt influencing the future direction of the stock market [2]. Additionally, there are studies suggesting that most margin debt is actually used by individual investors and noise traders, as well as individual wealthy investors-not institutional traders.

We hypothesize that the use of margin debt can be a microscope to various investor perceptions toward the U.S. stock markets in general. The initial use of margin debt will reflect an investor's desire to leverage existing assets to make capital gains on stocks or write Put options (both protective Puts and naked Puts). However, as margin debt increases, an equilibrium can be discovered where margin debt will reflect the use of short-sellers or buyers of Put options/writers of Call options. The use of the Put/Call ratio on a monthly basis will be used as an independent variable impacting margin debt, as will the Volatility Index (VIX). Finally, labor market participation rates will also reflect over-exuberance prior to a market correction and lag behind the stock market increases. It is our belief that there will be a negative correlation between the two independent variables and the dependent variable (Margin Debt) and positive correlation between labor market participation rates, thus reflecting an ability to discover stock market peaks and troughs.

Investor sentiment data is often correlated to stock market returns. The Consumer Confidence Index (CCI) is often used as a gauge the U.S. consumer's attitude about the U.S. economy as a whole. Published monthly by The Conference Board, the figure analyzes the buying habits and attitudes of 5,000 households. However, many economists view the CCI as a lagging indicator, reflecting how previous business and economic events have impacted them, rather than a leading indicator. Because of this, our study will utilize the Put/Call ratio to act as the variable for measuring investor-specific confidence about the overall U.S. stock market provides empirical data supporting the use of investor sentiment to accurately predict short-term market returns, and provide evidence that cash inflows are predictable variables for investor sentiment.

Analyzing the types of cash inflows has further supported the idea that investor sentiment can signal future stock market returns. Using fixed annuity inflows as an instrument for investor return expectations and the Baker-Wurgler sentiment index as a proxy for speculative propensity, the authors show that speculative trading patterns exist. Investor optimism reinforces investors' desire to speculate while investor pessimism mitigates optimism [3]. Finally, analysis of puts and calls reflecting investor sentiment has been conducted as well. Results demonstrate that information and sentiment in the options market is useful for the estimation of stock market volatility. In particular, results indicate that call option trading has a stronger impact on stock volatility compared to put options [3]. Our analysis includes the U.S. labor market supply as a variable to reflect strength or weakness in the current economy. We believe

this is a better proxy than the Unemployment rate, which is a lagging indicator and also susceptible to recalculations 30, 60, and 90 days after the initial release. As such, we hypothesize that as labor market participation increases, U.S. equity markets would also increase.

Empirical data, however, indicates that there is no correlation between labor market participation rates and stock market returns. Rather, labor market participation is primarily influenced by particular segments within the population acting in concert with macroeconomic events. As an example, multiple articles identified an ever-declining pension based business model and increasing social security eligibility age as primary drivers for workers 55+ to continue working [4,5]. Further, this same age-group is experiencing longer life expectancies, reduced access to employer-provided healthcare, and reduced savings-making them financially incapable of retiring early.

Reaffirming these theories posits that if the U.S. has the same age distribution in 2025 as it did in 2015, there will be 16 million more people age 65 and older and 3.7 million fewer people between 45-54. Consequently, the result would be a sharp drop in the labor force as older workers retire. Because of these demographic trends, labor force participation likely does not provide insight as a variable to our study.

The fundamentals of central bank policy posit that in an expanding economy (slowing economy) the Federal Reserve will exhibit behavior to slow (increase) growth in an attempt to avoid hyperinflation (disinflation). A natural correlation exists between an economy and equity markets. As such, studies have been conducted to determine if such a correlation exists. In particular, does increasing interest rates for borrowers and savers dampen growth? The research is inconclusive at this point.

One study examining the U.S. stock market between 2003 and 2013 using quantile regression found a significant correlation between stock market performance and federal interest rates [6]. The researchers also quantified the more pronounced impact of inflation and interest rates during extreme market conditions, as the study included the great U.S. economic recession of 2008.

Conversely [7] provide empirical evidence to support the hypothesis that in fact, the exact opposite holds true. The researchers examined interest rate increases and decreases during perceived stock market bubbles. Their evidence supports the idea that during prolonged periods of stock market growth, increasing interest rates have no impact on stock market performance.

Other studies examine specific classifications of stock, such as 'value' or 'growth.' Results from these empirical studies conclude that 'value' stocks (those with high book-to-market ratios) experience greater sensitivity to bond market yields than other types of firms [8].

METHODOLOGY

Our study will utilize multivariate regression to determine the correlation between the following variables:

Dependent variable: S and P 500 daily change as a percentage.

Independent variables will include Total margin debt as a percentage of change month-over-month; the percentage of change input/call ratio month-over-month, percentage of change in the VIX month-over-month, and change in labor market participation rate as a percentage month-over-month. Subsequently, our model used for this study is as follows:

$$\text{S and P 500 performance} = \beta_0 + \beta_1(\text{Margin Debt}) + \beta_2(\text{Put/Call Ratio}) + \beta_3(\text{VIX}) + \beta_4(\text{Labor Market Participation rate}) + \beta_5(\text{Federal Funds Rate}).$$

The data utilized in this study include monthly reports supplied by the Chicago Board of Options Exchange (CBOE), the United States Department of Treasury, FINRA/NYNex, and by Dow Jones Indices. The monthly data points used in this study were the first trading day of each new month.

In each instance the variables being used in this study encompass a month-over-month change beginning January 1, 2003, through February 1, 2019, resulting in 181 months of analysis and including 66 months prior to the great recession of 2008. Further, by selecting January 1, 2003, as our start point, it coincides with a 'market bottom' for the S and P 500 after the recession resulting from the terror attacks of 9-11. Further, this expands upon the timeframe by Jareno et. al by five additional years, allowing for possible market retracement or expansion. It also expounds upon their study by including the additional four additional variables.

During the 15-year analysis contained in this study, there were only two years of the negative market return. The great recession of 2008 resulted in a -37.00% return and in 2018 the S and P finished -6.20% for the year. Over this period, the average return for the S and P500 (ex. dividend) was 10.02%. Some analysts are suggesting this time period exhibited the longest consistent positive return for investors in the modern economy. However, it should be noted that this figure is consistent with a 90-year average, which has been approximately 9.8 since 1928 [9].

RESULTS

Our study encompassed 181 months in total (15 years, 1 month) and included monthly percentage changes for the S and P500, the total amount of margin debt, the Volatility Index (VIX), Put/Call ratio, labor market participation rates, and Federal Funds rate. Consequently, these data points were not specific to one day in particular but instead calculated as a percentage of change from the previous month.

These 181 months also included two changes in U.S. Presidents (Bush to Obama, Obama to Trump) and changes in leadership within the House of Representatives twice. This provided data related to bi-partisan tax bills, which our study did not control for as a variable.

Descriptive Statistics In the Table 1 below please see the descriptive statistics for the S and P500, as well as the independent variables. This includes the average monthly change for each variable, a maximum monthly change,

minimum monthly change, median, mode, and standard deviation. The results can be seen below:

Table 1: Descriptive statistics.

	S and P500	Margin Debt	VIX	Labour Market	PC ratio	FF Rate
Mean	0.006	0.008	0.024	0	0.046	0.017
Standard Error	0.003	0.003	0.017	0	0.024	0.012
Median	0.011	0.011	-0.016	0	0.016	0
Mode	0.036	#N/A	-0.208	0	0.111	0
Standard Deviation	0.039	0.046	0.229	0.002	0.321	0.157
Sample Variance	0.002	0.002	0.052	0	0.103	0.025
Kurtosis	2.382	3.88	6.667	0.179	1.383	10.633
Skewness	-0.839	-0.916	1.813	-0.413	0.922	0.849
Range	0.277	0.352	1.731	0.011	1.925	1.598
Minimum	-0.169	-0.222	-0.385	-0.006	-0.566	-0.598
Maximum	0.108	0.13	1.346	0.005	1.36	1
Sum	1.004	1.49	4.399	-0.049	8.264	3.078
Count	181	181	181	181	181	181

Regression results

Our regression results, found in Tables 2 and 3 below, reflect an adjusted R2 value of 0.489 and standard error of 0.028. Further, both Margin Debt and Volatility Index (VIX) were statistically significant at >0.05 , with Margin Debt 0.0003 and VIX 0.0000. No statistically significant correlation was discovered between the S and P500 and Labor Market Participation rates, Put/Call ratios, and Federal Funds rate.

All of these findings are consistent with the literature or support previously conducted literature that analyzed each variable individually. Based upon our review of the literature, however, ours is the first study to integrate all five variables into a quantitative study in an effort to detect the correlation between multiple variables simultaneously.

Table 2: Regression results.

Regression statistics	
Multiple R	0.709
R square	0.503

Adjusted R square	0.489
Standard error	0.028
Observations	182

Table 3: Regression results.

	Coefficients	Standard Error	t Stat	P-value
Intercept	0.0069	0.0022	3.1994	0.0016
Margin Debt	0.1722	0.0466	3.6947	0.0003
VIX	-0.1215	0.0092	-13.175	0
Labor Market	0.2349	0.9818	0.2392	0.8112
Put/Call	0.0052	0.0066	0.7863	0.4327
Federal Funds	0.0123	0.0136	0.8997	0.3695

DISCUSSION AND CONCLUSION

While signaling theory, consumer sentiment, trading volume, and interest rates can be considered important elements used to assist in the measurement of equity markets, this study cannot conclude that the collective sum of market indicators provides correlation. Consequently, investors seeking an 'edge' in trading strategy through signals from these specific indicators may not experience exacerbated positive returns. Further, researchers utilizing this study may discover new variables to include, or replace, in our initial dataset.

Future research may also include analysis of possible trends using methods such as Granger's test for causality rather than correlation-type statistical analysis. Given the current state of trading, which includes algorithmic trading, computerized trading, and nanosecond technology, researchers with access to more frequent data points than the monthly points utilized in our study may garner additional information allowing statistical correlation to occur. These datasets may include additional volume measurements, dividend announcements, stock-split announcements, or other business related events. These studies could also lead to event-studies to determine if particular variables exhibit statistical significance.

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