ADVANCES IN BUSINESS AND MANAGEMENT FORECASTING

Edited by Kenneth D. Lawrence and Ronald K. Klimberg

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VOLUME 14

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PART A

FORECASTING METHODS AND APPLICATIONS I

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THE PREDICTIVE POWER OF INVESTOR SENTIMENT ON US EQUITY MARKET PERFORMANCE

Matthew Steeves, Son Nguyen, John Quinn and Alan Olinsky

ABSTRACT

The purpose of this study is to determine which quantitative metrics are most representative of investor sentiment in the US equity markets. Sentiment is the aggregation of consumers', investors', and producers' thoughts and opinions about the future of the financial markets. By analyzing the change in popular economic indicators, financial market statistics, and sentiment reports, we can gain information on investor reactions. Furthermore, we will use machine learning techniques to develop predictive models that will attempt to forecast whether the stock market will go up or down based on the percent change in these indicators.

Keywords: Market sentiment; predictive modeling; random forests; gradient boosting; neural networks; market behavior

BACKGROUND

Traditional finance theory holds that firm value (FV) is derived from the sum of the present value of their future cash flows. Thus, prices of securities in the market are derived from investor perception of future cash flows. Since market participants can only project future performance, there is much subjectivity in determining asset prices. Each investor has their own perspective of future market and firm conditions, and we assume this perspective will be reflected in their trades. Therefore, asset prices in the market are the aggregate of all investor views, and

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the rise and fall of stock prices represent mass changes in investor outlook. Market sentiment, or the general prevailing attitude toward price development in a market, greatly influences asset prices and market behavior, as will be explored empirically in this chapter.

Market sentiment is represented by a variety of different factors. They include reactions to economic indicators, financial statistics, consumer sentiment reports, and recent market behavior. As investors trade off these factors, elements of human emotion and crowd psychology become very important and strongly impact individual's investment decisions. During times of economic prosperity, as demonstrated by positive economic reports or strong market performance, investors are more subject to overoptimism and even overconfidence. Likewise, when conditions are poor, pessimism and fear can consume the population. For each investor managing their own money, these emotions can cause an investment in risky or unfamiliar assets when they feel smart, then sell frantically when doubt starts to creep in about the fundamentals of the investment. Aggregating this behavior to an entire market of investors shows the link between emotions and overall market sentiment. Markets comprised millions of people who are exposed to these same emotions, and when sentiment shifts overwhelmingly in one direction, asset prices can experience sharp and unpredictable movements. The impact of crowd psychology in financial markets is great, as the already volatile emotions an investor may feel are magnified when they see their peers behaving in a universal manner. An element of this principle is the desire to not be left out of a trend. As such, there is an increase of buying when times are good and selling when fear sets in, which creates the snowball effect that inflates valuations and ultimately decreases stock prices. Ultimately, sentiment provides the link between the individual investor and overall market performance. Emotional responses to events, news, and indicators and the crowd environment of financial markets drive large shifts in asset prices, and ultimately a majority of all price changes. Additionally, we can theorize that asset prices are not completely rational, and that market swings are not fully based upon the collective outlook on a firm's future cash flows.

LITERATURE REVIEW

The impact of market sentiment on financial market performance has been widely studied in academic literature. The overall conclusion is that sentiment does play a significant role in market behavior. Because sentiment is the collective outlook of investors in the market and is highly subject to emotions, it is difficult to quantify. Authors have taken several different approaches to identifying methods to measure the mood of the market. Brown and Cliff (2004) focus on different macroeconomic factors that impact optimism and pessimism in the markets. These factors include changes to interest rates, unemployment, inflation, real gross domestic product (GDP) growth, and real estate sales. Strong economic performance does not lead directly to strong financial market performance, but it is clear that market participants are more likely to invest when the economy is

strong. Moreover, when economic indicators experience large movement, large swings in volatility often follow. This reinforces the point that investors emotions can be tied to how economic indicators behave in the short run. These two authors also cite other more direct, quantitative sentiment indicators that demonstrate shifts in behavior, such as the advance–decline ratio and short interest. These variables examine the degree to which investors are selling or short selling their positions and are a good way to examine swings in sentiment. Lemmon and Portniaguina (2006) examine the role of consumer sentiment in the behavior of market participants. Consumer sentiment is the outlook of households on the current economic and business landscape. It is a way of determining optimism and pessimism at a grassroots level and is an indicator of consumer's propensity to spend and invest. In their chapter, the authors introduce the Conference Board Survey of Consumer Confidence and the University of Michigan Survey of Consumer Confidence as a pair of important tools to measure consumer sentiment. These surveys ask questions about recent financial security, outlook on financial security in the near future, the performance of local businesses, and availability of jobs in their area. Consumer sentiment is high when the answers indicate optimism and low when the answers indicate pessimism. These surveys attempt to quantify sentiment by producing scores out of 100 based on answers to the questions. The higher the score, the more positive the sentiment is. All the survey results are aggregated to a single number which represents the overall mood of consumers toward the economy. The survey results are shown to be an important measure of sentiment and are linked to the performance of financial markets.

A metric that researchers have extensively studied is the closed-end fund discount (CEFD), which has been widely linked to investor sentiment. Closed-end funds are pooled investment funds with a fixed amount of capital that can be bought and sold as stock. Retail investors comprise the overwhelming majority in these funds. Neal and Wheatley (1998) state that the degree to which closed-end funds sell at a discount to their net asset value is a reflection of overall market sentiment. They cite Weisenberger (1991), where it is stated that "pessimism is at its peak when discounts are largest." This infers that the discount comes from people selling their positions and a low trading volume. They continue to cite Weisenberger with: "when investor confidence is at a high point… discounts tend to narrow." This is a result of more investors buying the funds. As such, CEFD data can be a direct indicator of market sentiment. Unfortunately, these data are difficult to collect, but in future research, it would be a strong metric in analyzing the impact of sentiment on market performance.

Anusakumar, Ali, and Wooi (2017) studied both investor sentiment and market sentiment with respect to stock returns in eight countries in Asia. In their conclusions, they remarked:

> Specifically, there is significant and positive relationship between stock specific sentiment and returns for all eight countries and for overall sample. On the other hand, we find that the effect of market wide sentiment varies vastly from country to country. Market wide sentiment is negatively related to returns for half of the sample countries. Nevertheless, a positive association can be observed for the overall sample and three of the individual countries.

In another study, Corredor, Ferrer, and Santamaria (2015) investigated investor sentiment in the Czech Republic, Poland and Hungary. They discovered that the effects of investor sentiment were stronger in the Czech Republic and Poland. One of their conclusions was "that sentiment is a twofold (global and local) phenomenon, in which the global dimension has much greater impact than the local dimension, at least in the markets considered." They also stated, "that sentiment is transmitted through a behavioral mechanism."

Baker and Wurgler (2006) analyze the different roles that market sentiment affects companies of different market capitalizations. There are multiple hypotheses on how large-cap and small-cap firms will react to large shifts in sentiment. On one hand, there is much more information available on large, well-known firms. Investors can more effectively make predictions about the behavior of these companies, so it is reasonable that they would have more conviction about their investments and be less willing to sell when sentiment shifts negatively. Investments in smaller-cap firms are seen as being more speculative, and market participants would be more likely to sell these stocks first. Therefore, we could conclude that large shifts in market sentiment would have more of an impact on small-cap stocks than large-cap. From another standpoint, investors may have more conviction investing in small-cap firms if they believe that they are developing innovative new products that will have major impacts on the world, seen frequently in the information technology sector. In this case, they may be less likely to divest when the sentiment is low and be less likely to let economic indicators influence their investments. These two authors discuss this question in-depth and investigate how sentiment impacts companies based on many different attributes – market capitalization, degree of volatility, dividend policy, and growth strategy versus value strategy. They conclude that sentiment certainly impacts different types of firms in different manners. According to their research, sentiment impacts small-cap companies more than it does large-cap. Empirically, we will investigate whether market sentiment indicators can better predict market movements in large-cap stocks or small-cap stocks.

Qiu and Welch (2004) discuss measuring sentiment where they propose that when analyzing economic and financial indicators, the change in these variables over time is more revealing than simply the level of the variable. This technique will be adopted in this research, as the shifts in variables themselves represent how sentiment changes in the market. Additionally, they advocate for lagging the market performance variable in order to ascertain the impact that sentiment has on market performance immediately following economic reports.

Besides the investor sentiment literature, Jiang, Lee, Martin, and Zhou (2019) researched the role of manager sentiment with respect to stock returns. They investigated corporate financial disclosures and found that "manager sentiment is a strong negative predictor of future aggregate stock market returns … Its predictive power is economically comparable and is informationally complementary to existing measures of investor sentiment." Gupta (2019) also examined manager sentiment with respect to stocks. In the conclusions, it was found that "our results

confirm the main hypothesis of our paper that manager sentiment can predict stock market volatility (barring at the extreme upper end of the conditional distribution), besides returns …"

DATA

Monthly data from December 1989 through December 2018, comprising 349 individual observations, were used in this research. The data were collected from various sources, including FRED (Federal Reserve Economic Database), Yahoo! Finance, and several other financial data websites. The links to these financial data sources are provided in the Data Source Links.

The dependent variable is a binary variable that indicates a positive or negative stock market return for the given month. Two sets of predictive models will be developed to test the ability to forecast market returns. Both sets comprised the same independent variables, with one analyzing large-cap stocks (represented by the monthly return of the Standard and Poor's (S&P) 500 index, which includes the 500 largest public companies in the market) and one analyzing small-cap stocks (represented by the monthly return of the Russell 2000 index, which includes the 2000 smallest public companies in the market). In the appendix, Exhibit 1 represents the S&P 500, and Exhibit 2 represents the Russell 2000. The variable will read as "0" if the return was negative and "1" if the return was positive. In other words, a value of "0" indicates the market went down and a value of "1" signifies the market went up. The reason the return is coded as a binary variable is to avoid overfitting the predictive model. Equity markets are ultimately very unpredictable and shift inexplicably at times. Rather than attempting to predict the magnitude and direction of the return, it is more reasonable to focus on the direction. Additionally, there will be a one period lag used in the model. For example, if the independent variables represent indicators from January, the dependent variable for that observation will be the market performance in February. This will allow us to conclude if changes in sentiment in one month impact the performance for the following month, after investors have had time to trade appropriately and update their perspectives. Finally, it is important to note that the target variables for both the S&P 500 and Russell 2000 data sets were very well balanced. For the S&P 500 (SPX), the index decreased in 50.1% of the observations and increased in 49.9% of them. Likewise, the Russell 2000 (RUT) decreased in 53.6% of the observations and increased in 46.4% of them. No resampling techniques were needed. Overall, the goal of the predictive model will be to forecast whether the stock market will go up or down based on the changes in sentiment indicators from the prior month. Additionally, we will analyze whether it is more appropriate to predict future market direction based on sentiment for large-cap or small-cap stocks.

Eighteen independent variables will be analyzed. These variables include select economic indicators, financial market statistics, and sentiment reports. Unless otherwise stated, all the variables will be calculated as the percentage change in the indicator from the prior month.

Economic Indicator Variables

GDP is the measurement of a nation's economic activity and represents the value of all finished goods and services produced in an economy. GDP is most commonly measured in percent change from the prior quarter. Since the information is released quarterly, the same GDP value will be represented for three straight months until the information is updated. The first quarter result will still be the most relevant GDP metric for an investor until the second quarter report is released. The expectation is that a positive change will indicate a positive shift in market sentiment, as it indicates more products are being sold and that the economy is strong. The personal consumption expenditure (PCE) measures price changes in consumer goods and services. This metric is representative of household spending habits and inflation. It is not exactly clear what the direct impact PCE will have on market sentiment, as an increase indicates a growth in demand for goods and services, but is also a warning sign of inflation. The U3 Unemployment Rate measures the percentage of people who are unemployed and actively searching for jobs, out of all people over 16 years old. While some economists argue that the U6 Unemployment Rate is a more accurate measure of true unemployment because it includes part-time and discouraged workers, the U3 rate is the "official" metric and is probably more well-known to retail investors. We expect sentiment to drop when the unemployment rate increases, as it signals an increase in the number of people without jobs or income. The next variable is the 3-month US Treasury Bill rate. This rate is the best proxy for the Federal Funds Rate, which is set every 6 weeks by the Federal Reserve in an attempt to regulate the money supply. When the Fed changes the Federal Funds Rate, it is with the intention of altering monetary policy to react to the changing economy. When the Federal Funds Rate increases, the Fed attempts to decrease the money supply due to an overheating economy, which is generally seen as a negative action. When the rate decreases, it is a positive sign for the economy because the cost of borrowing decreases, which persuades consumers to spend more and companies to invest more frequently in projects. Thus, when the rate decreases, market sentiment will most likely increase.

Financial Market Variables

The monthly trading volume of the S&P 500 will be analyzed. In general, when market volatility is high, there is an increase in trading volume, as investors anxiously buy and sell shares. When trading volume is relatively stable, it is a sign that the financial markets are working smoothly. Our expectation is that sentiment will be affected negatively when the magnitude of the change in trading volume is large compared to the previous month, and that a small magnitude will have a positive or neutral impact on sentiment. The next variables represent the performance of companies in different sectors of the market. Stocks whose performance directly follows the market cycle are called cyclical stocks. These firms generally produce goods and services that people spend discretionary income on and are generally located in the consumer discretionary, information technology, and communication services sectors. They perform well when the economy is