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Is Seeing Believing? How Television Advertisements Influence Investment Decisions

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Abstract

Stock returns are influenced by many factors. Finance scholars have attempted to examine the potential causes of stock price changes by comparing the observed returns of stocks after an event with the predicted returns they should have experienced had the event not occurred. The current "Super Bowl-Stock Returns" studies tend to find conflicting results regarding whether the returns of Super Bowl advertisers' stocks deviate from their predicted values during the trading days following the Super Bowl, as well as the direction in which these returns deviate and why they deviate. This study uses a more precise model for estimating predicted stock prices than those used in previous studies to find that the returns of Super Bowl advertisers' stocks tend to not deviate from the predicted returns they would have experienced should the Super Bowl advertising not have happened. This study finds that the variance in abnormal returns is not correlated with measures of behavioral biases previously explored.

Introduction

For a company to advertise in the 2023 Super Bowl, a thirty-second television slot would cost a nominal $7 million on average. This is a 218% increase from the $2.2 million price tag in 2002 (Statista, 2023). When looking at the average cost over the past 10 years alone (see Figure 1), one can see that the average cost of a 30-second television advertisement window in the Super Bowl rises nine times year over year between 2013 and 2023 (Statista, 2023). The steadily

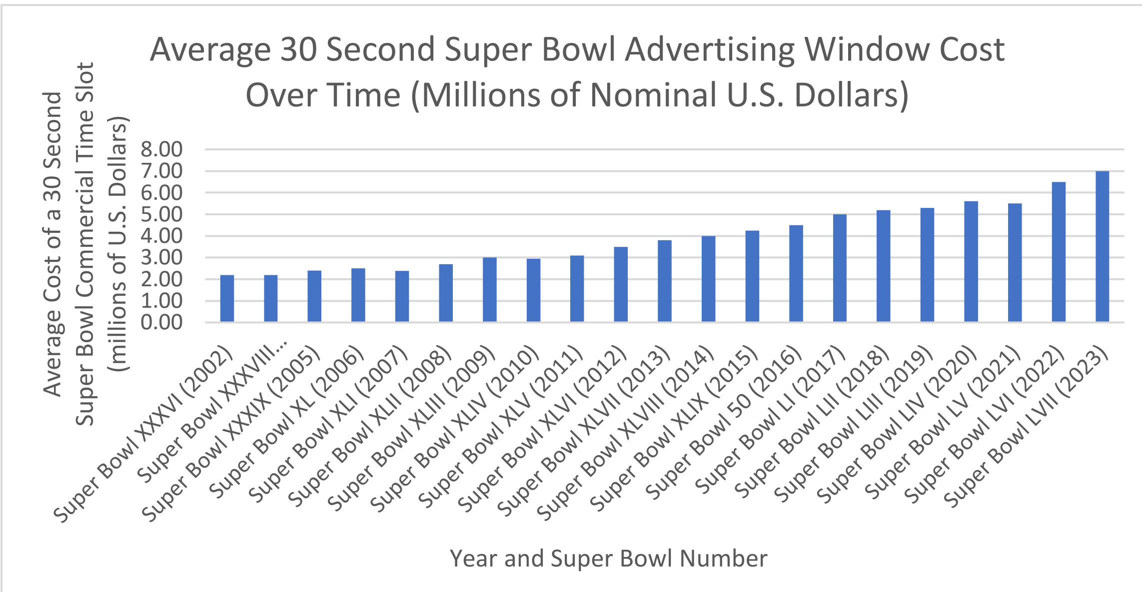

Figure 1

increasing costs of Super Bowl advertisements have led journalists at media companies such as Forbes, MarketPlace, Temple Now, and The New York Times to research why companies are willing to spend so much money on these advertisement slots (Nerkar, 2024; Nguyen, 2023; Orbanek, 2022; Rucker, 2024). The research from these articles has reached the general conclusion that airing television advertisements during the Super Bowl is likely beneficial due to the large number of people, typically 70 to 90 million people, who all see the advertisement at the same time. Glennon, a professor in Temple University's Department of Advertising, argues in an interview for the *Temple Now* newspaper that the Super Bowl has remained as an event where people are more inclined to watch advertisements rather than ignore them and that there is a special brand-building power that can come from having a large number of people viewing an advertisement at the same time (Nguyen, 2023; Orbanek, 2022). Heftman, the vice president of the ad consortium Ampersand, argues in a New York Times article that Super Bowl commercials will always be in special demand among companies in new industries seeking brand awareness.

Companies understand how the opportunity to advertise in the Super Bowl can be used to improve brand awareness, public sentiment towards the company, and revenue, but these advertisements have been shown to also influence investors' decisions to buy and sell stocks (Fehle, Tsyplakov, & Zdorovtsov, 2005; Kim & Morris, 2003; Tomkovick, Yelkur, Rozumalski, Hofer, & Coulombe, 2011). A study by Kim and Morris (2003) uses an event study methodology to examine whether the prices of stocks belonging to Super Bowl advertisers experience abnormally high or low returns and whether any abnormal returns are correlated with the likability of the advertisements. Fehle et al. (2005) further this discussion, using a modified version of the methodology from Kim and Morris (2003) to capture the abnormal returns of Super Bowls advertisers' stocks and then regressing them against a series of variables to see if abnormal returns were statistically correlated with measures of behavioral biases in investors. Tomkovick et al. (2011) use a similar framework to Kim and Morris (2003) to test whether there are abnormal returns during the week before and after the Super Bowl and whether those abnormal returns are statistically correlated with advertisement likability and company industry. These three Super Bowl ad-stock price event studies each attempt to identify the effect of advertising on the returns of stocks belonging to Super Bowl advertisers over a set period and try to find factors that influence that effect. These studies collectively look for statistical evidence that supports the idea that the theories of price pressure hypothesis, signaling, higher level of viewer of involvement theory, and attribution bias are influencing abnormal returns attributed to Super Bowl stocks.

These concepts of price pressure hypothesis, signaling, higher level of viewer involvement theory, and attribution bias have been discussed in other literature focusing on topics other than investor responses to advertising. A study by Huberman and Regev (2001) highlighted a key principle of the price pressure hypothesis; sometimes stock prices may move without any new information about the company at all. Other research by Spence (1973) constructs a framework for how the concept of signaling can be used by employers and potential hires to help make up for asymmetric information in labor markets, which he intends to apply in other fields/markets. Baker and Powell (1999) surveyed dividend policy setters to better understand their view of the relevancy of dividend policy in conveying information, finding that dividend policy setts think signaling theory best describes the relationship between dividend changes and communication of future firm prospects. Furnham et al. (1998) use television programs and surveys to examine the relationship between television program involvement and viewers' ability to remember commercials, finding that program involvement is negatively correlated with a viewer's ability to remember advertisements shown during the program. Ambler and Burne (1999) examine how a television advertisement's ability to invoke emotions impacts a viewer's ability to remember the advertisement, finding that advertisements that invoke stronger emotions are typically remembered by more viewers. Shi and Wang (2013) find evidence that individual retail investors are subject to attribution bias by looking at brokerage account transactions. Dang and Lin (2016) examine market returns and market return dispersion to find evidence that at an aggregate level, traders are subject to herd mentality, finding that stock market return dispersion and the market index's return had a negative correlation coefficient.

Following the path of previous research, one can ask what role price pressure hypothesis, signaling, higher level of viewer involvement theory, advertisement affect, and attribution bias play in Super Bowl advertisements impacting investors' decisions to buy or sell stocks. To answer this question, this study explores whether investor behaviors related to advertisement likeability, price pressure hypothesis, higher level of viewer involvement theory, and attribution bias influence investors to buy and/or sell stocks based on recent advertisements they have seen. In addition, this study's regression introduces a new variable that could provide evidence suggesting that investors influenced by advertisements are exhibiting herd mentality; specifically looking at whether the extent to which an individual stock outperforms the market in the days before the Super Bowl can cause investors to buy that specific Super Bowl stock more than other Super Bowl stocks.

The contributions of past literature are discussed in more depth in the literature review. The methodology section will follow, which includes some of the research models and methods that this study will use. This is supplemented by a data section assessing the credibility of where the data was collected and explaining any transformations/manipulations of the data needed to undergo the analyses. An interpretation of the results of the study will follow. After that, the study concludes with a short restatement of the results, the implications for policymakers, and suggestions for future research.

Background

Researchers who wish to conduct event studies can examine how the prices of stocks react to a certain event by calculating the cumulative abnormal returns experienced by the studied stocks during the study period. A stock's cumulative abnormal return is the total percentage change in the price of a stock that should be attributable to the event, which serves as a way of quantifying the total effect of the event (Kim & Morris, 2003). To run these calculations for an individual stock, data must be collected on the returns of the stock, a market index, and the risk-free rate of return during a control period before the study period and the study period.

The daily returns, or daily percentage changes in price, of the stock examined in this study shall be sourced from financial data, technology, and news provider, Bloomberg. The returns of a market index shall be sourced from the Kenneth French data library. This study uses the average price of a value-weighted portfolio of common stocks belonging to all firms registered with the Center for Research in Security Prices (CRSP, pronounced “crisp”) as a market index (Fama and French, 2023). Value-weighted stock market indexes, such as this one, are typically market capitalization-weighted. This means that as the total market value of a firm increases, a percentage change in the price of the firm’s stock will cause a larger change in the index. Some event studies will use other indexes for measuring market returns, such as how Tomkovick et. al (2011) use the S&P500 index and Eastman et. al (2010) use the Russel 3000 index. Others, such as Kim and Morris (2003) and Fehle et. al (2005), use the CRSP value-weighted index because rather than including some of the stocks listed on U.S. exchanges, it includes all of the stocks listed on U.S. exchanges, thus providing a more accurate measurement of the market’s performance. Indexes such as the CRSP value-weighted index, the S&P500, the Russel 3000, and the Wilshire 5000 are tools created by financial services companies that are used to measure how the average price of a collection of corporation’s stocks in the market change over a set period (Young, 2023). The risk-free rate is the rate of return that investors can expect from an investment which requires them to bear no form of risk. Depending on the length of the period when stock returns are being estimated, the risk-free rate is equal to the current interest rate on a U.S. treasury bill, note, or bond. These debt instruments are considered risk-free or as close to risk-free investments as investors can get since it is highly unlikely that the U.S. government will fail to make payments to its creditors (the government can pay debts using tax revenue or money that comes from selling treasury bills/notes/bonds to the federal reserve). Once one has the returns of an individual stock and a market index, both during the control period and the study period, and the risk-free rate of return, the stock's cumulative abnormal returns can be calculated.

To calculate a stock's abnormal returns, some researchers will use the CAPM model (the capital asset pricing model) depicted in figure 2:

(2) $$R_{E_{it}} = R_{RF_{it}} + (R_{M_{it}})\beta_{1_{it}}$$

where $R_{E_{it}}$ is the extra return that the stock should have earned over the risk-free rate, $R_{RF_{it}}$ is the risk-free rate of return (taken from a U.S. treasury debt instrument), $R_{M_{it}}$ is the return of the market (provided by an index), and $\beta_{1_{it}}$ is the stock's beta value (represents how responsive the price of the stock is to systematic risks/trends throughout the stock market). Since the period under study is measured in days, observations of market returns, stock returns, and the risk-free rate will be taken daily.

This data is then used to run an OLS regression between the stock and the market returns, which theoretically can be written as is in figure 3:

(3) $$R_{E_{it}} = R_{RF_{it}} + (R_{M_{it}})\beta_{1_{it}} + \varepsilon_{it}$$

where the new addition, ε_t, represents the error term. The capital asset pricing model can rarely perfectly predict a stock's return on any given day; the observed prices will almost always deviate from predicted prices by some amount. This can be seen if one applies the risk-free rate, the market return, and a stock's estimated beta on a given day to calculate a predicted value for the expected excess return over several days. The expected excess returns on any given day will likely be different from the observed actual price. When one subtracts the predicted price from the actual price on a given day, the resulting difference is called the abnormal return. This residual is the extra, if it is positive, or missing, if it is negative, return that the stock should have experienced due to systematic risks and trends associated with the market. Event studies contend that changes in the magnitude of a stock's abnormal returns over a day or a few weeks can be attributed to events that may impact the expected performance of the company, such as the release of a macroeconomic indicator figure, an announcement from the U.S. Federal Reserve, a sudden increase in publicity due to a news release or commercial, or other factors.

While some event studies use the Capital Asset Pricing Model, other studies will use an extended version of the Capital Asset Pricing Model called the Three Factor Model. This model, developed by Fama and French (1993), includes all of the components of the original capital asset pricing model:

$$R_{E_{it}} = R_{RF_{it}} + (R_{M_{it}})\beta_{1_{it}} \tag{2}$$

but then adds two more factors in addition to the market factor, called small minus big (SMB) and high minus low (HML):

$$R_{E_{it}} = R_{RF_{it}} + (R_{M_{it}})\beta_{1_{it}} + (SMB_{it})\beta_{2_{it}} + (HML_{it})\beta_{3_{it}} \tag{4}$$

which they have found further helps to explain variance in excess returns over time. The values for the SMB factor are the average returns on three portfolios of small market capitalization stocks minus the average return of three portfolios of large market capitalization stocks, with both portfolios including value and growth stocks. This is referred to as the size factor and is supposed to capture the fact that lower market capitalization stocks generally experience higher returns than higher market capitalization stocks. The values for the HML factor are equal to the average returns of two value portfolios minus the average returns of two growth portfolios, with all four of these portfolios containing stocks of varying market capitalizations. This factor is supposed to capture the fact that value stocks tend to outperform growth stocks. By expanding the CAPM model with these factors to capture the effects of differences in market capitalization and growth vs value, Fama and French (1993) were able to explain more of the variance in stock prices, suggesting a better predictive model than the CAPM. In the portfolios of stocks that they tested the CAPM and Three Factor Model on, Fama and French found that the CAPM model only produced an adjusted R-squared value of 0.9 in two out of the twenty-five portfolios, while the Three Factor Model produced adjusted R-squared values in twenty-one out of the twenty-five portfolios. This R-squared value can be interpreted as the percentage of variation in stock returns explained by the independent variables, Rm, SMB, and HML, adjusted for degrees of freedom associated with independent variables. The Three Factor Model's adjusted R-squared values being generally higher than the adjusted R-squared values from the CAPM model suggests that more variance in returns is captured by the Three Factor Model than the CAPM model. This can allow for more accurate predictions of stock prices, leading to more accurate predictions of abnormal returns that can be used for event studies.

After using the CAPM model or the Three Factor Model to determine the actual stock returns, there are multiple ways to go about analyzing the abnormal returns. Researchers choose how they analyze abnormal returns based on the details of their situation. For example, a researcher studying the effect of announcements discussing changes in management on the announcing firm's stock prices may choose to use abnormal returns from a short study period of 1 to 3 days. Other studies, such as one examining whether repeated advertisement on a television channel during Olympics broadcasts has an impact on stock prices, may choose a study period of three or four weeks for examining abnormal returns. As long as there is a pre-event period that can serve as a control when running the regression, the time when abnormal returns are studied to look for evidence of the event having an effect can vary based on when it is believed that there will be abnormal returns. Typically, though, abnormal returns tend to decrease in the days following the event day until they reach pre-event levels.

For conducting analyses on abnormal returns, daily values for abnormal returns can be used to examine effects on specific days. When an event's effect is spread out over several days, this can be better captured by one number by using the sum of the abnormal returns, or CARs. A cumulative abnormal return can be calculated as:

$$CARS_i = \sum_{t=T1}^{T_N} AR_{it} \tag{5}$$

After abnormal returns and cumulative abnormal returns are calculated, a two-sided hypothesis test can be run to determine whether the abnormal return on a specific day or a CAR experienced by a firm is statistically significantly different from 0. The hypothesis test consists of the null hypothesis, suggesting that the abnormal returns are not statistically different from 0, and the alternative hypothesis, which suggests that abnormal returns are statistically different from 0. Determining whether to reject the validity of the null hypothesis or not can be done using test statistics. Test statistics can be calculated for a day's abnormal return or CAR value using the formula:

(6) $$t^*_i = \frac{X_i - H_O}{STDEV}$$

where t* is the test statistic being calculated, X_i is the value for the observation being estimated, H_O is the null hypothesis value. For testing both abnormal returns and CARs, the null hypothesis value is set equal to 0 because if the event has no effect on stock prices, the observed abnormal return or CAR is expected to be equal to 0. STDEV is the standard deviation of the equation used to estimate the abnormal return when using the formula to analyze an abnormal return. When the formula is used with a CAR value, the standard deviation must be adjusted for the number of days contained in the CAR. This is done by turning the standard deviation from the estimation regression into a variance by squaring it, then multiplying by the number of days in the cumulative abnormal return being tested, and finally taking the square root of the new variance to turn it back into a standard deviation. This new standard deviation is then used in the formula for calculating the test statistic for the CAR value in place of the standard deviation from the estimation equation. The calculated test statistic for an abnormal return or CAR is then compared with a table statistic from a Fisher's t-Distribution table. If the absolute value of the calculated test statistic is greater than the value present on the Fisher's t-Distribution table for the number of total observations in the estimation model, then the null hypothesis is rejected at the confidence level indicated by the column from which the table statistic was taken. Most studies will use t-statistics from the columns for the 95% or 99% percent confidence levels when running t-tests. When the null hypothesis is rejected at the 95% (99%) confidence level, that implies that the researcher is 95% (99%) sure that the value being tested is statistically different from 0. This analysis can also be conducted using the average abnormal returns or average CAR values across firms on the same day, along with the average of the standard deviations from each firm's regression. This form of analysis tells the researcher whether abnormal returns were, on average for a specific day, statistically significantly different from 0.

Potential causes of variance in abnormal returns and CARs can also be identified by regressing the abnormal return(s) or CARs as the dependent variable against measures for any identified potential causes of variance. Fehle et al. (2005) and Eastman et al. (2010) both do this with their own sets of variables. Fehle et al. (2005) used firm-specific data on one-day abnormal returns as the dependent variable. For the independent variables, they use the number of advertisements a firm aired, a dummy variable that indicated whether the firm was identifiable from the content of its advertisement, the average return of a stock market index over twenty trading days before the Super Bowl, a ratio of the market capitalization of the firm to the average market capitalization of all CRSP registered firms, the percentage of the firm's advertisement budget spent on the Super Bowl ad(s), the firm's *USA Today* Admeter score, the Super Bowl's Nielsen rating, and the differential of the score in the quarter where the advertisement occurred. Eastman et al. (2010) run four regressions using company specific observations of a six-day CAR values, containing summed daily returns from three days before and after the Super Bowl, as the dependent variable. The independent variables are the firm's market capitalization, the number of ads the firm aired, the first quarter that any of the firm's advertisements aired in, and a variable made to represent the likability of the firm's most liked advertisement. Each of these four regressions uses a different measure for advertisement likeability. The possible explanations as to why some of these independent variables are correlated with abnormal returns are discussed by Fehle et al. (2005), Eastman et al. (2010), and Tomkovick et al. (2011), with these discussions often drawing on theories and results of past studies.

<u>Literature Review</u>

Numerous studies attempt to understand the relationship between Super Bowl advertising and stock price changes. These studies make developments in previously explored concepts including the price pressure hypothesis, signaling theory, higher level of viewer involvement theory, advertisement affect, attribution bias, and herd mentality. By examining these concepts and past methodologies, one can gain a better understanding of the current explanations of how television advertising impacts investor behavior.

The Price Pressure Hypothesis

Scholes developed the price pressure hypothesis theory, which argues that a stock's demand curve can experience a shift that is not caused by the release of new information, and the resulting change in the price of the stock will follow due to a demanded premium required by the providers of liquidity (1972). He examines how prices react to secondary distributions of stock by current shareholders through investment banks over the 24 hours following the distribution. His results offer little support for the theory of price pressure hypothesis. However, a later study by Harris and Gurel (1986) argues that Scholes was unable to adequately filter out transactions that may have conveyed information to the market that could cause changes to stock prices. Harris and Gurel (1986) account for this by instead studying the prices and trading volumes of stocks that are added to the S&P500, arguing being a stock being added to the S&P500 likely does not convey new information about the prospects of that stock. They find statistically significant increases in the trading volume of stocks exist on the day the stock's addition to the S&P500 is announced and during the following four trading days. The excess returns of the studied stocks during the latter half of the sample years, both during the first day of trading and the four subsequent trading days after the announcement, were found to be statistically significant from 0 with t-values ranging from 4.32 to 11.98. While the results of Scholes (1972) disagree with the results of Harris and Gurel (1986), there are other studies containing evidence that support the price pressure hypothesis, meaning that a stock's market price is capable of changing despite the release of no new information.

The results of the study Huberman and Regev's study (2001) also look at how increased attention can lead to increased stock prices. Huberman and Regev (2001) examine how a *New York Times* article presenting no new information to the market caused a firm's common stock price to increase 330 percent in a single day. The information released in this article was already factored into the stock price; it was presented to the markets in a *Nature* article published about 6 months earlier. The conclusion of this article states that prices of common equities probably can experience large price changes despite a lack of news and a lack of change in economic fundamentals. The conclusions of these articles support the price pressure hypothesis theory by providing evidence that investors' decisions can be influenced by increased attention to specific companies. Takeda and Yamazaki (2006) examine the price pressure hypothesis in the context of television commercials. They looked at whether stock prices of stocks changed after the parent firm was featured on a popular television show, Project X, which talked about successful Japanese companies and people. The study found statistically significant cumulative abnormal returns were present for company stocks in the week following the episode in which the company was featured. The authors conclude that one such explanation for their results is the price pressure hypothesis, since some of the information presented in the television show was not new to the public. However, Takeda and Yamazaki did not attempt to determine the extent to which the price pressure hypothesis impacted stock prices. The main concept that Huberman and Regev (2001) present, illustrated through the EntreMed, Inc. stock price jump of May 3, 1998, is that stock prices can move without the release of fundamental-based information. Takeda and

Yamazaki (2006) find evidence that reinforces the concept that a company's appearances in media can cause changes in the price of the company's stock but does not investigate the extent of this effect.

The price pressure hypothesis has been discussed in other studies that examine the impact of companies' television appearances on stock prices, with several of those articles examining the impact of Super Bowl advertisements. Tomkovick et al. (2011) question whether stocks belonging to corporations that advertised in the Super Bowl, named Super Bowl Stocks, would outperform the S&P500 index around the time of the Super Bowl. The performance of these stocks is compared to their estimated performance based on S&P500 returns for a ten-day trading period starting on the Monday of the trading week before the Super Bowl and ending on the Friday of the trading week after the Super Bowl. Using a one-way analysis of variance test to yield a p-value of 0.021, Tomkovick et al. found a statistically significant difference between the predicted and actual returns that Super Bowl stocks experienced. Tomkovick et al. (2011) argue that the price pressure hypothesis could be a possible explanation for the abnormal returns, but acknowledge that if the stocks' abnormal returns were a result of new information about the firms contained in the advertisements, the increases in stock price would then be a result of signaling.

A study by Fehle et al. (2005) attempts to examine the impact of Super Bowl advertisements on stock prices like Tomkovick et al. (2011) but goes into more detail by looking for statistical correlations between the abnormal returns and proxies for multiple factors that could be related to the abnormal returns. Fehle et al. (2005) calculate the abnormal returns attributable to Super Bowl stocks using the capital asset pricing model and then regress those returns against a series of independent variables to examine behavioral theories which could provide possible explanations for why there are cumulative abnormal returns. To look for evidence supporting the price pressure hypothesis, Fehel et al. include a variable for the natural log of the number of ads aired by a firm and a dummy variable that described whether the firm was recognizable from the content of the advertisement. The variable for the number of ads was positive, as expected, in each of the estimated models it was included in, and significant in three of those models. The recognizability dummy variable was positive, as expected, and significant in all 5 of the models that it was estimated. The authors conclude that their results provide strong support for the possibility of the price pressure hypothesis explaining the link between the number of advertisements a firm airs and the abnormal returns its stock experiences.

Although Tomkovick et al. (2011) and Fehle et al. (2005) provide evidence supporting the possibility of the price pressure hypothesis explaining the link between firms' decisions to air Super Bowl advertisements and stock prices, this may not apply to all advertisements. The simple act of advertising or the contents of advertising may deliver information to the buyers that acts as a display of the advertising firm's financial strength. Tomkovick et al. (2011) and Fehle et al. (2005) state that another possible explanation for these abnormal returns could be signaling theory.

Signaling Theory

Signaling theory describes how information is exchanged between two different parties. Spence (1973) defines the concept of signaling and looks at its application in the job market. The contents of this essay are theoretical and do not use data belonging to any other institution(s) or person(s). This essay looks at how an employer requires information about a potential employee, which determines the implicit lottery involved in hiring, the offered wages, and in the end, the allocation of the jobs to people and people to jobs in the market. The article discusses how the ratio of the productivity of education (in making a person more qualified for a job) to the costs of pursuing that education influences how strong/weak of a signal (of candidate qualification) it is to employers.

Other studies, such as Baker and Powell (1999), looked at how signaling exists between corporate managers and investors. Baker and Powell conducted a survey where members of corporations who were responsible for setting dividend policy answered questions revealing their individual views of the general relevance of dividend policy and the theories that support the relevancy of dividend policy. The results show that the respondents typically thought that dividends conveyed some kind of unanticipated information, such as an increase in earnings expected by insiders, to stock markets and that investors use dividend announcements as a way of assessing a firm's common stock value. The authors conclude that these responses all suggest general agreement that there are signaling effects associated with dividends (Baker & Powell, 1999).

The importance of signaling is debated in the context of the relationship between abnormal returns experienced by stocks that belong to Super Bowl advertisers in the trading days following the Super Bowl. Fehle et al. (2005) discuss this, arguing that in the relationship between Super Bowl advertisements and stock prices, some investors may consider a corporation's decision to air a Super Bowl advertisement as a form of cash burning that acts as a display of the firm's current or future financial strength, as expected by corporate insiders. To test whether Super Bowl advertisements can lead to abnormal sales, which would suggest an increase or decrease in future financial strength, Fehle et al. (2005) calculate the abnormal percentage changes in sales experienced by Super Bowl advertisers' stocks using a firm matching technique. They found no statistically significant abnormal sales for Super Bowl advertisers and that corporations that were unrecognizable from their advertisements typically experienced larger abnormal sales than corporations that were recognizable from their commercials. This test reinforces their conclusion that any signaling effects are likely factored into stock prices when the company announces before the Super Bowl.

The possibility of signaling explaining the relationship between abnormal returns and the airing of Super Bowl advertisements is also discussed by Tomkovick et al. (2011) and Eastman et al. (2010), although they do not attempt to look for statistical correlations which would provide evidence to support or falsify the significance or insignificance of the role of signaling. Tomkovick et al. (2011) discuss that the degree of significance that signaling plays in determining abnormal returns is often debated between Super Bowl stock returns studies, while Eastman et al. (2010) argue that signaling is useful in explaining the impact of information that has been made public via the announcement or running on a Super Bowl advertisement(s). These articles cannot reach a consensus on the role and degree of signaling theory's significance in the context of Super Bowl-stock price event studies looking at post-event abnormal returns, but the abnormal returns have been theoretically linked to other factors related to investors' thoughts regarding televised advertisements and the programs which surround them.

Viewer Involvement Theory

The effect of involvement on the ability of viewers to recall the contents of advertisements while consuming media is called involvement theory (Furnham et al., 1998). These studies typically have conflicting results, arguably because measures of program involvement vary, with examples of these measures being scales of viewers' enjoyment, perceived quality, or interest in the program (Furnham et al., 1998). Some researchers also attribute the difference in results to inconsistencies between forced and naturalistic experiments

(Moorman et al., 2007). In addition, empirical definitions of the more specific measures of involvement, the most common three being enjoyment, entertainment, and involvement, tend to be vague and can vary from one study to the next. The more specific form of involvement implies that the media consumer finds that the media contains information that is relevant to him or her, while enjoyment and entertainment typically imply that the consumer of the media took some kind of joy in consuming the media. Studies have examined involvement theory in the context of newspapers, television shows, and televised sporting events (Furnham et al., 1998).

Norris and Colman (1992) examine whether reader involvement has an impact on the effectiveness of advertisements printed next to engaging editorial material in newspapers. They had 72 undergraduate psychology students read five magazine articles of varying subjects, with each article having six advertisements printed throughout the pages. Students filled out a survey after completely reading through each article, allowing data collection to gauge the respondents' involvement and memory of the advertisements. After running tests to verify that there were differences in the means of the article attributes, which were involvement, concentration, suspense, interest, enjoyment, absorption, and attention, correlation coefficients were calculated between the collected values for article attributes and advertisement recognizability and between article attributes and advertisement recallability. They find that entertainment and interest have statistically significant correlations with both advertisement recallability and recognition, while involvement does not have a statistically significant correlation with either advertisement recallability or recognition. This allowed the authors to conclude that when the subjects of the study were reading articles, greater difficulty remembering the advertisements that were shown is typically associated with the reader showing greater interest in the article by the advertisements.

The theories of involvement have also been examined in the context of televised programs and advertisements. Furnham et al. (1998) examine program involvement theory in the context of televised programs and advertisements by separating involvement into measures of enjoyment, entertainment, and involvement, with involvement describing how the effect of a program's personal relevance and enjoyment implying the extent of positive emotions experienced from viewing. They use data from 92 study participants who were placed into four treatment conditions. Here, they would view either a humorous or non-humorous show that lasted about 24 minutes, including a four-minute advertisement break at the halfway point including either a set of humorous or not humorous advertisements. Each of the study participants then filled out a series of surveys which assessed the participant’s ability to remember the advertisements and advertisers, as well as the participant’s involvement with the program. Furnham et al. conduct tests for second-order correlations between measures of involvement, enjoyment, and memory to check for statistical correlations. They find that overall, involvement has a statistically insignificant and negative relationship with advertisement recallability. Interest was statistically insignificant in 6 out of the seven recognition measures. Four of the seven measures for program enjoyment ratings were statistically insignificant and also negative. The authors conclude that the results suggest that program enjoyment of the televised program leads to poorer product and brand recognition for advertisers, and interest in the program leads to increased recollection of the contents of advertisements.

Involvement theory has also been applied in the context of the relationship between Super Bowl advertising and stock returns. Fehle et al. (2005) is the first study that attempts to examine the involvement theory’s role, although involvement theory is not referred to by name in their study. In their model which looks for statistical correlations between the abnormal returns attributable to the stocks of Super Bowl advertisers and proxies for potential explanations of those abnormal returns, Fehle et al. (2005) include the final score differential of the Super Bowl game. They expect this variable should have a positive coefficient because they think that Super Bowl games with higher score differentials will be less exciting and cause viewers to pay more attention to the advertisements. The estimated model which includes the score differential variable found the score differential to be positively related to abnormal returns, but a statistically insignificant factor. Fehle et al. (2005) state that the appearance of the expected sign provides support to their theory that as the game differential increases, the game becomes less interesting and causes viewers to pay more attention to the advertisements. However, the statistical insignificance of the variable suggests that it is not important in explaining the statistical variance of the abnormal returns. In a similar study, Tomkovick et al. (2011) later discuss involvement theory in the context of Super Bowl advertising's impact on stock prices. They argue that people who view Super Bowl games on television can become mentally/emotionally invested in the outcomes of the game. Then, when investors eventually see the commercials, their excitement and enjoyment for the program may spill over into the commercials and lead to a stronger liking for the advertising companies (Tomkovick, Yelkur, Rozumalski, Hofer, & Coulombe, 2011). Despite acknowledging that viewer involvement theory may explain the variance in abnormal returns, Tomkovick et al. do not look for statistical evidence to support or discredit their theory.

Fehle et al. (2005) and Tomkovick et al. (2011) argue that involvement in the televised program in which advertisements are embedded could play a statistically significant role in the relationship between advertising in the Super Bowl and stock prices, but the data from Fehle et al. (2005) does not support this theory. Another factor related to the perceptions of televised material which Fehle et al. (2005), Tomkovick et al. (2011), and Eastman et al. (2010) suggest could impact the abnormal returns of Super Bowl advertisers' stocks is the emotional impact of the advertisements.

Advertisement Contents: General Affects and Humor's Impact on Memory

Advertisement affect is sometimes defined as feelings reflective of a mental state, sometimes as emotions that lie behind actions, or as a combination of both (Ambler and Burner, 1999). The first literature that explores advertisement affects' relationship with memory typically involves trying to determine the relationship between measures of affect content in advertisements and the viewer's ability to recall or recognize the advertisement at a later time. One study that does such, conducted by Ambler and Burne (1999), attempts to explain this relationship using the definition of affect that includes emotions and feelings. They collected data by showing four groups of subjects a videotape of a 24-minute university course that was broken up by six minutes worth of advertising breaks, with varying commercial affect contents and some students' under the influence of beta blockers to reduce emotional reactions. Based on the results of the study, Ambler and Burne (1999) were able to conclude that strong affect content in advertisements helps to enhance the viewers' memory of the advertisement. Cline and Kellaris (2007) examine how another aspect of advertising, the strength of humor in advertisements, impacts viewers' ability to recall the details of advertisements. A group of undergraduate students viewed a collection of printed, fake advertisements featuring brands that the researchers thought most of the subjects had never heard of before. The advertisements had varying levels of humor which were pretested to establish the three levels of humor that the subjects' responses could be assigned. After the advertisements were taken away, the subjects filled out a survey that was screened for keywords that described the advertisement. Cline and

Kellaris (2007) state that for only humor that is related to the brand being advertised or the advertisement's message, stronger humor tends to lead to increased recallability with viewers of the advertisement. The results of Ambler and Burne (1999) and Cline and Kellaris (2007) illustrate how the contents of advertisements that are meant to have an emotional impact on the viewer can impact advertisement memory.

Studies examining the impact of Super Bowl advertising on stock prices often attempt to examine the impact of advertisement likability on abnormal returns, concluding that advertisement likability does not have a statistically significant impact on the size of the abnormal returns (Fehle, Tsyplakov, & Zdorovtsov, 2005; Tomkovick, Yelkur, Rozumalski, Hofer, & Coulombe, 2011; Kim & Morris, 2003). Fehle et al. (2005) regressed their estimated abnormal returns against the USA today Admeter (AM) scores for specific firms to look for a statistical correlation. They used scores from the AM scores as a measure for mood and attention effects, and the results found that ad likability was statistically insignificant in explaining the variance of cumulative abnormal returns. Kim and Morris (2003) also tested for statistical correlation between AM scores and abnormal returns attributable to Super Bowl advertisers' stocks, stating that they used AM scores to capture the consumers' attitudes towards the ads. After conducting a correlation analysis on the estimated abnormal returns and the AM scores, Kim and Morris' (2003) results indicated that there was no statistical correlation. They then state that in their sample, advertisement likability did not impact investors' response to the Super Bowl advertisements. Tomkovick et al. (2011) run a Pearson correlation test between their observed abnormal returns and AM scores, finding the statistical relationship to be insignificant. Tomkovick et al. conclude that the relationship between advertisement likability and abnormal returns is insignificant.

While the studies by Tomkovick et al. (2011), Kim and Morris (2003), and Fehle et al. (2005) suggest that AM scores are statistically insignificant in explaining Super Bowl advertisers' abnormal returns, Eastman et al. (2010) conducts a regression analysis and finds a statistically significant relationship between Super Bowl advertisers' abnormal returns and a firm's highest-ranking advertisement on the AM ranking list in a given year. Eastman et al. (2010) also conduct a histogram analysis between only AM scores and abnormal returns, finding that the relationship is statistically insignificant between these two when examined without the influence of other variables. Eastman et al. (2010) summarize their findings by stating that the relationship between advertisement likability and abnormal returns is insignificant but positive. The insignificance of the AM ratings matches with the findings of Kim and Morris, Fehle et al. (2005), and Tomkovick et al. (2011)

Cognitive Biases: Confusing Brains with a Bull Market and Herd Mentality

Cognitive biases are systematic ways of thinking that can lead to irrational behavior (Mcleod and Guy-Evans, 2023). Studies in the fields of behavioral economics and behavioral finance research these biases to better learn where and why these biases impact the decision-making process of individuals. Two of the many biases to be discussed in this literature include attribution bias, which is sometimes referred to as "confusing brains with a bull market" in the context of investing, and herd mentality.

Attribution bias, or "confusing brains with a bull market," is where investors attribute their success in trading to their intuition rather than realizing that their returns are likely coming from something they have not accounted for (Shi and Wang, 2013). Shi and Wang (2013) look for statistical evidence to help determine whether or not attribution bias can lead to overconfidence in trading. They examine the number of trades executed and returns received in brokerage accounts belonging to 15,040 individual retail investors during bull and bear markets in the Shanghai Stock Exchange between 2005 and 2008. Shi and Wang consider market returns to be primarily driven by luck, using bull, neutral, and bear markets defined by a regime-switching model as their way of proxying for times when investors' returns are or are not attributable to luck. They compare the returns during bull, neutral, and bear markets using a bootstrapping technique to determine how significant the difference in returns was between stocks purchased and sold during the bull markets and stocks purchased and sold during neutral and bear markets. If the stocks that the investor purchased during the market condition, on average, underperformed the stocks that they sold during the market condition for the following one or three months, then the investor is considered overconfident in his or her ability to make investment decisions during that period. They found that the return on stocks bought by retail investors during bull markets was statistically significantly less than the returns on stocks sold by retail investors during bull markets, which suggests that investors are overconfident in their trading abilities during bull markets. In addition, the return on stocks sold during neutral and bear markets was not statistically significantly different from the returns of stocks bought during neutral and bear markets, suggesting that investors are not overconfident during neutral or bear markets. Shi and Wang (2013) suggest that this supports their idea that investors will trade more excessively during bull markets, which could be caused by the investors attributing the increasing value of their portfolio to their investment management skills rather than market conditions.

Herd mentality, in the context of trading stocks, is the tendency of investors to mimic the buying and selling behavior of other investors (Dang and Lin, 2016). Dang and Lin (2016) look for evidence of investors exhibiting herd mentality in the Ho Chi Minh stock exchange. By calculating correlations between the stock market's return dispersion and the squared returns attributable to the Vietnam index (a stock market index) over time, they find negative correlation coefficients between the stock market's return dispersion and squared market returns. This means that as the market's return got further above or below 0 percent on a given day in their samples, the returns influencing the market indicator become concentrated into fewer and fewer stocks. This supports the idea that investors can exhibit herd mentality when trading in the stock market. They conclude by saying that as the Ho Chi Minh stock exchange experiences large price movements in their sample, investors tend to follow the beliefs of other investors rather than their own and push stock market prices higher or lower while lowering return dispersion.

The impact of attribution bias has been looked at in the context of the relationship between Super Bowl advertisements and stock return by Fehle et al. (2005). They use the 20-day value-weighted CRSP index as a variable in their model which attempts to explain the statistical variations in Super Bowl advertisers' abnormal returns to see if investors were more likely to invest based on attention during times when the market experiences positive returns. The coefficient attached to the variable for recent market returns is positive and statistically significant at the 5% or 1% level in four of the six models that Fehle. et al (2005) tested and significant at the 10% level in one of the other two models, which supports the theory that investors are more prone to attention-driven buying when the stock market as a whole is experiencing positive returns. They do not comment on if they suspect abnormal returns to decrease if the market average return is negative, or a loss.

An explanation of herd mentality's role in the relationship between the abnormal returns attributable to Super Bowl advertisers' stocks and advertisements has not been found in the studies by Kim and Morris (2003), Fehle et al. (2005), Eastman et al. (2010), Tomkovick et al.

(2011), or any other literature examined in this study's review of past literature. This study attempts to search for statistical evidence that may explain the role of herd mentality in the relationship between abnormal returns attributable to Super Bowl advertisers' stocks in conjunction with the theories of price pressure hypothesis, signaling, viewer involvement, and attribution bias.

Methodology

The methodology of this study shall be similar to methods previously employed in similar studies by Kim and Morris (2003), Fehle et al. (2005), Eastman et al. (2010), and Tomkovich et al. (2011). All of these studies calculate the abnormal returns that stocks experience in the trading days following the Super Bowl and determine their statistical significance. Fehle et al. (2005) and Eastman et al. (2010) take this further by looking for statistical correlations between abnormal returns and variables proxying for factors that could impact the size of abnormal returns, such as the likability of the advertisement(s) the company aired, the number of people who viewed the program, whether the company airing the advertisement was recognizable from the content of its commercials, viewer involvement, and attribution bias. This study's analyses will be split into two portions. The first determines whether the abnormal returns or cumulative abnormal returns attributable to Super Bowl advertisers' stocks in the days following the Super Bowl are statistically significantly different from zero. The second part of the study will consist of several OLS regressions looking for statistical correlations between the abnormal returns and measures for potential factors that may influence the size of abnormal returns.

Abnormal returns are calculated using an event study methodology on a firm-by-firm basis for each year. This means that for a firm in a given year, a regression in the form of the

Fama-French three-factor model, displayed in Figure four, will be run. It will use 180 consecutive daily observations of a stock's excess return (calculated by subtracting the risk-free rate of return from the rate of return on firm *i*'s stock, both from day *t*) as the dependent variable and the market premium, SMB, and HML factors as the independent variables. These 180 days represent the estimation period, and it will always start 200 trading days before its corresponding Super Bowl and end twenty trading days before said Super Bowl. It only includes days on which the NYSE, NASDAQ, and AMEX are open for trading, and data is not taken on pre-hours or after-hours returns. The day that the event happens is called the event day, and it is not included in the estimation period because that is one of the days on which the observed stock prices shall be compared to actual prices to determine whether the event had an impact. This study's event under examination occurs on a Sunday when the market is outside of regular trading hours, so the day of the Super Bowl does not have stock returns data to be examined in the scope of this study. Similar to the method used by Kim and Morris (2003) and Fehle et al (2005), the event date will be set to the Monday after the Super Bowl. Abnormal returns are examined over the 9 trading days following the event day for a total of ten trading days post-Super Bowl, and 3-, 5-, 7-, and 10-day cumulative abnormal returns are examined as well. This is common in Super Bowl-stock returns studies because the effects of the Super Bowl advertisements on stock returns are hypothesized to last for more than just the event day (Kim & Morris, 2003; Fehle et al., 2005; Eastman et al., 2010; Tomkovick et al., 2011).

In typical event studies, the estimation period ends at the end of the day before the event being studied. This study's estimation period ends twenty days before the trading day after the event day because Super Bowl advertisers sometimes announce that they will be airing national advertisements in the Super Bowl as much, but not always, four weeks in advance of the game.

This has happened for a long time, with Super Bowl-stock returns studies, such as Kim and Morris (2003) and Fehle et al. (2005) acknowledging that Super Bowl advertisers will pre-announce their super bowl advertisements. This trend continues through modern day, with news companies such as NBC publishing lists of pre-announced Super Bowl advertisements weeks before the game (Abreu, 2024). If some investors make decisions to buy or sell a firm's stock based on information contained in these announcements, that could lead to increases or decreases in stock prices before the event day. Testing to see if Super Bowl advertisers' stocks experience abnormal returns statistically different from 0 in the twenty trading days preceding the Super Bowl could provide evidence suggesting that these announcements contain information that influences investment decisions. To test these twenty trading days preceding the Super Bowl, the estimation period must start before these twenty trading days. Including these returns in the estimation period could skew the estimated coefficients, producing inaccurate estimations of abnormal returns.

After generating abnormal returns and cumulative abnormal returns, t-tests are conducted to determine whether the abnormal returns are statistically different from zero (see section titled *Results of Significance Testing of ARs and CARs*). This is followed by the second portion of this study that analyzes variation in the abnormal returns. The regression model used by Fehle et al. (2005) will share some similarities with the regression models that this study will use. This study's models will use the cumulative abnormal returns companies' stocks experience in the trading days following the Super Bowl as the dependent variable, which is regressed against a series of variables meant to capture the effects of price pressure hypothesis, involvement, advertisement likability, attribution bias, and herd mentality. The models that part two uses are presented in Figures seven and eight, and the descriptions of the variables used in these models are listed in Table 1.0:

$$(7)\quad CARS_{it} = \alpha + \beta_1 \overset{+}{ADNUMBER_{it}} + \beta_2(\overset{+}{SCORED_{it}}) + \beta_3(\overset{+}{QRTR1_{it}}) + \beta_4(\overset{+}{QRTR2_{it}}) + \beta_5(\overset{+}{HT_{it}}) \overset{+}{} + \beta_6(\overset{+}{QRTR4_{it}}) + \beta_7(\overset{+}{ADMETER_{it}}) + \beta_8(\overset{+}{MARKETR_{it}}) + \beta_9(\overset{+}{STOCKR}) + \beta_{10}(\overset{+}{VIEW_{it}}) + \varepsilon_{it}$$

$$(8)\quad CARS_{it} = \alpha + \beta_1(\overset{+}{ADNUMBER_{it}}) + \beta_2(\overset{+}{ADNUMBER^2{}_{it}}) + \beta_3(\overset{-}{QRTR2_{it}}) + \beta_4(\overset{-}{QRTR3_{it}}) + \beta_5(\overset{-}{HT_{it}}) + \beta_6(\overset{+\quad -}{SCOREQRTR4_{it}}) + \beta_7(\overset{+}{ADMETER_{it}}) + \beta_8(\overset{+}{MARKETR_{it}}) + \beta_9(\overset{+}{BSTOCKR}) + \varepsilon_{it}$$

Variable	Definition
$CARS_{it}$	The cumulative abnormal return of a specific company's stock experienced in the trading days following a Super Bowl (will test 5- and 7-day CARs).
$ADNUMBER_{it}$	The number of advertisements the company *i* employed in year *t*'s Super Bowl.
$SCORED_{it}$	The score differential at the end of the football game.
$QRTR1_{it}$	A dummy variable equal to 1 if the company had one or more advertisements during the first quarter of the game, zero otherwise.
$QRTR2_{it}$	A dummy variable equal to 1 if the company had one or more advertisements during the second quarter of the game, zero otherwise.

HT_{it}	A dummy variable equal to 1 if the company had one or more advertisements during the time between the end of the second quarter and the start of the third quarter of the game, 0 otherwise.
$QRTR3_{it}$	A dummy variable equal to 1 if the company had one or more advertisements during the third quarter of the game, zero otherwise.
$QRTR4_{it}$	A dummy variable equal to 1 if the company had one or more advertisements during the fourth quarter of the game, zero otherwise.
$SCOREQRTR4_{it}$	An interaction variable between the $SCORED_{it}$ and $QRTR4_{it}$ variables.
$ADMETER_{it}$	The likeability score that was given to a firm's advertisement by the USA Today Ad Meter survey. For firms with multiple advertisements, the average of all the advertisements' scores was taken.
$MARKETR_{it}$	The average daily return of the market over the 20 trading days before the Super Bowl.
$BSTOCKR_{it}$	The average daily return of the stock's price over the 20 trading days before the Super Bowl.
$VIEW_{it}$	The average number of people watching that observation's Super Bowl program during the quarter the advertisement aired. If the company aired advertisements during multiple quarters, take a weighted average of the viewership.

Table 1.0: Definitions of Variables in the Regression from Part 2 of the Data Analysis

The $ADNUMBER_{it}$ variable's coefficient is expected to be positive based on the price pressure hypothesis, by which a change in a firm's publicity should be able to cause an increase in stock price, as seen in studies by Harris and Gurel (1986) and Huberman and Regev (2001). It is expected that an increase in the number of advertisements aired by a company would lead to investors having the company more readily available in their mind and, ceteris paribus, could make investors more likely to consider buying that firm's stock when making investment decisions in the days following the Super Bowl.

The coefficient for the $SCORED_{it}$ variable, meant to test involvement theory, is expected to be positive. Some studies, like Norris and Colman (1992), find involvement to be statistically insignificantly correlated with advertisement memory, but find that measures for the extent that viewers found the program to be entertaining or interesting to be negatively correlated to advertisement memory at a statistically significant level. Furnham et al. (1998) find evidence suggesting that involvement and interest are statistically insignificant, while their tests for enjoyment found mixed results. They found that program involvement and enjoyment were negatively correlated with advertisement memorability, while interest was positively correlated with advertisement memorability. It is based on these results that the coefficient of score differential is hypothesized to be positive, suggesting that as the score differential decreases (the more involving/interesting the game), the game becomes more interesting and/or entertaining, drawing people's attention away from advertisements.

The expectations for the quarter dummy variables ($QRTR1_{it}$, $QRTR2_{it}$, $QRTR3_{it}$, $QRTR4_{it}$, $SCOREQRTR4_{it}$) are also formed based on the results of past literature on involvement theory. The coefficients for dummy variables representing quarters 1, 2, 3, and 4, are expected to have negative signs in both models, when included. This study hypothesizes that during each of these periods, viewers should be interested in the game to varying extents regardless of the score, distracting them from the advertisements to varying degrees and decreasing the odds of them paying attention to the advertisements. This idea is based on the results of studies of involvement theory, which typically find that most measures for program involvement such as program enjoyment and interest, are generally negatively statistically correlated with the memory of advertisements (Furnham, Gunter, & Walsh, 1999; Norris & Colman , 2013). The interaction variable between the quarter four dummy and the score differential, $SCOREQRTR4_{it}$, is supposed to capture the potentially varying nature of quarter 4. As the ending score differential decreases, the interaction variable should lead to a smaller positive abnormal return. Thus, a positive coefficient is predicted for $SCOREQRTR4_{it}$. The coefficient for HT_{it} is expected to be positive. This is because during the halftime break, the game stops and the attention of viewers shifts to the halftime show. This study hypothesizes that during the shifting of viewers' attention from the football game to the halftime show, they pay more attention to the advertisements that come before or after the halftime show, as opposed to the advertisements that break up the football game during the four quarters. The coefficient for $VIEW_{it}$ is expected to be positive on the basis that as more people view the Super Bowl in a given year, the more Super Bowl advertisers' stocks are traded in the days following the Super Bowl and the further prices increase.

The coefficient for the $ADMETER_{it}$ variable is expected to have a positive sign in both models. This suggests that the higher a company's average AM score in a given year, the more likable the firm is among viewers, and the larger the abnormal returns the firm experiences due to more investors looking to buy the stock. The results of Ambler and Burne (1999) conclude that advertisements that are meant to evoke emotion tend to be more memorable to viewers, and Cline and Kellaris (2007) find that advertisements featuring brand or message-related humor are more memorable to viewers. It is important to note that in most SB-stock returns studies, such as those by Fehle et al. (2005) and Tomkovick et al. (2011), the correlation between AM scores and abnormal returns are found to be statistically insignificant. Kim and Morris (2003) found the relationship to be statistically insignificant as well. However, Eastman et al. (2010) found the relationship between advertisement likeability and abnormal returns to be positive and significant when testing four different measures for advertisement likability, interchanging them between the same model. Even though the majority of Super Bowl-Stock Returns studies find insignificant correlations between AM scores and abnormal returns, this study will keep the hypothesized sign for $ADMETER_{it}$'s coefficient positive because it seems theoretically correct based on the results of Ambler and Burne (1999), Cline and Kellaris (2007), and Eastman et al. (2010).

The coefficient for the $MARKETR_{it}$ variable is expected to be positive in both models. This is based on the idea that the higher the average return of the stock market over the twenty trading days preceding the Super Bowl, the more confident traders will become. This increased confidence will cause traders to bid the prices of Super Bowl stocks higher, producing a larger abnormal returns/cumulative abnormal returns company *i* experiences. This is based on a bias called "confusing brains with a bull market," which is a specific type of attribution bias (Shi and Wang, 2013). Confusing brains with a bull market is when an investor falsely attributes the positive performance of his portfolio to his management skills when in reality, a market-wide trend(s) is (are) responsible for the observed change in the portfolio's increase in value. In their SB-stock return study, Fehle et al. (2005) find that the average daily percentage change of the value-weighted CRSP index over the 20 trading days before the Super Bowl is positively correlated with the size of abnormal returns firms experienced. However, using the percentage change of a stock market index to explain variation in abnormal returns that is partially influenced by a market index may be a form of "double counting" the index, producing a statistically significant variable that should not be included in the model. This variable is still included in the model, however, since examination of Pearson correlation coefficients revealed that $MARKETR_{it}$ is barely collinear with each of the different cumulative abnormal returns (the largest of these Pearson correlation coefficients was 0.1078, and it was between $MARKETR_{it}$ and the five-day cumulative abnormal return, $5CAR_{it}$).

The coefficient for the $BSTOCKR_{it}$ variable is expected to be positive in both models. This would suggest that the more a stock outperforms the market during the twenty trading days leading up to the Super Bowl, the larger the abnormal returns the stock experiences during the days following the Super Bowl. Dang and Lin (2016) discuss how on an aggregate level, patterns in investor behavior can cause stock prices to deviate from their approximate fundamental value. Their research suggests that investors in emerging markets will dismiss their private beliefs during large market movements for opinions similar to other traders, leading to decreased return dispersion as the market's average return increases. Based on the results that Dang and Lin (2016) present, this study hypothesizes that this tendency to take on the opinions of other traders and mimic their trades based on past performance could be present among investors who choose to invest in Super Bowl television advertisers in the days following the program. This would be reflected by the coefficient for the $BSTOCKR_{it}$ variable having a positive sign and being statistically significant.

Data

The first part of this study uses the data presented in Table 2.0 below:

Data Observations	Definition
Stock Returns ($R_{E_{it}}$)	The percentage change in the price of company *i's* stock between day *t* and day *t-1*.
Market Index Returns ($R_{M_{it}}$)	The percentage change of the market on day *t*, calculated as the daily percentage change in the value of a market capitalization-weighted portfolio of all firms registered with the CRSP that have common stock trading on the NYSE, NASDAQ, and AMEX.

Market Capitalization Factor SMB (SMB_{it})	The daily difference between the average performance of three portfolios of large market capitalization stocks and the average performance of three portfolios of small market capitalization stocks.
Growth vs Value Factor (HML_{it})	The daily difference between the average performance of two portfolios of growth stocks and the average performance of two portfolios of growth stocks.
Risk-Free Rate ($R_{RF_{it}}$)	The annual rate of return that investors can expect to earn if they invest their money in a risk-free financial asset during day *t*. This rate is equal to the current interest rate on a one-month treasury bill in the secondary market.

Table 2: Definitions of the Fama-French Three Factor Model Components

The returns of the stocks being studied will be sourced from Bloomberg. Bloomberg is a financial information, media, and software company that was established in 1981. They are a trusted source of information about financial markets, individual securities, and macroeconomic conditions. The widespread use of Bloomberg's information services, in addition to its 2700 journalists and analysts and 150 international news bureaus, demonstrates the popularity and trust professionals from the financial services industry have in Bloomberg's information.

The market Index returns, size factor, growth vs value factor, and risk-free rate shall be collected from the data library on Kenneth French's faculty page on Dartmouth College's website. Kenneth French is a Professor of Finance at the Tuck School of Business and has worked with financial economist Eugene Fama to develop the Fama-French Three Factor model (Fama & French , Common risk factors in the returns on stocks and bonds, 1993). Fama and French state that since they received so many requests for the data that they used in their study, they created a website where individuals can find not only the data from the years Fama and French studied but also from all years between 1926 and present-day (Fama & French, Production of U.S. Rm-Rf, SMB, and HML in the Fama-French Data Library, 2023). They state that the values for market capitalization, stock prices, and stock returns used to construct their market index, as well as the market capitalization and growth vs value portfolios, are from the CRSP. The CRSP is an organization associated with the University of Chicago that is dedicated to providing accurate financial data to academics, government officials, and professionals in finance (CRSP Employee, n.d.). The data on book-to-market equity values that Fama and French used to distinguish growth stocks from value stocks was collected from COMPUSTAT and Moody's Industrial Manuals, which are both reputable sources of financial data.

The descriptive statistics of the data this study will use from the Fama French library are presented in Table 3.0 in appendix A. Statistical outliers, or observations where a variable's value is further than three standard deviations from the variable's mean value, will not be removed from the data sourced from Fama and French's market index, market premium, SMB, HML, or risk-free rate values. This is due to the limited availability of data for firms that can be examined in parts one and two of this study.

The descriptive statistics for the abnormal returns and cumulative abnormal returns, calculated with the data on the factors and the risk-free rate of return from the Kenneth French Data Library and the stock returns from Bloomberg, are displayed in Table 4.0.

	Min	1st Quartile	Median	Mean	3rd Quartile	Max	Standard Deviation
Day1AR	-4.495	-0.828	-0.061	-0.090	0.717	5.147	1.4358
Day2AR	-6.432	-0.725	-0.077	-0.243	0.523	4.496	1.4950
Day3AR	-2.429	-0.505	0.019	0.285	0.644	12.097	1.8474
Day4AR	-9.086	-1.121	-0.228	-0.298	0.617	5.475	2.0173
Day5AR	-5.048	-0.932	-0.071	-0.110	0.745	8.241	1.6895
Day6AR	-3.517	-0.490	0.109	0.008	0.424	3.209	1.1450
Day7AR	-2.785	-0.579	0.071	0.311	0.623	11.748	1.6874
Day8AR	-4.375	-0.633	-0.179	0.080	0.515	15.069	2.1784
Day9AR	-4.990	-0.825	-0.013	0.012	0.821	4.656	1.5139
Day10AR	-6.311	-0.884	-0.232	-0.227	0.436	4.853	1.5663
3DayCAR	-4.883	-1.431	0.042	-0.048	1.286	7.739	2.1620
5DayCAR	-8.189	-2.483	-0.220	-0.456	1.4758	8.608	3.1882
7DayCAR	-7.751	-2.867	0.218	-0.137	1.537	15.14	3.7650
10DayCAR	-11.96	-3.529	-0.044	-0.297	1.883	23.761	5.3457
The "Day1AR" through "Day10AR" variables represent firm by firm, year by year abnormal returns that occurred on trading day X after the Super Bowl. The "3DayCAR" through "10DayCAR" variables represent firm by firm, year by year cumulative abnormal returns for the returns over the X days after the Super Bowl. There are a total of 98 observations per variable, spread across 10 years for 18 companies.							

Table 4.0: Descriptive Statistics for the Daily Abnormal Returns and 3-, 5-, 7-, and 10-Day CARS

After conducting analysis of abnormal returns, regression analyses will be used to examine the variance in the 5-day and 7-day abnormal returns. The descriptive statistics for the variables used in these regression analyses can be found in table 5.0:

	Min	1st Quartile	Median	Mean	3rd Quartile	Max	Standard Deviation
Year	2014	2016	2019	2019	2021	2023	2.9006
$5CAR_{it}$	-8.1893	-2.4832	-0.2198	-0.4556	1.4758	8.6078	3.1882
$7CAR_{it}$	-7.7508	-2.8671	0.2179	-0.1368	1.5371	15.1411	3.7650
$ADMETER_{it}$	3.970	5.090	5.550	5.537	6.0000	6.770	0.6611

$ADNUMBER_{it}$	1.000	1.000	1.000	2.067	3.000	9.000	1.5136
$QRTR1_{it}$	0.0000	0.0000	0.0000	0.3034	1.0000	1.0000	0.4623
$QRTR2_{it}$	0.000	0.000	1.000	0.573	1.000	1.000	0.4974
HT_{it}	0.000	0.000	0.000	0.0562	0.000	1.000	0.2316
$QRTR3_{it}$	0.000	0.000	0.000	0.4719	1.000	1.000	0.5020
$QRTR4_{it}$	0.000	0.000	0.000	0.3596	1.000	1.000	0.4826
$VIEW_{it}$	101.6	113.6	115.1	116.2	119.9	126.3	6.4131
$MARKETR_{it}$	-0.2554	-0.1336	0.0228	0.0272	0.1134	0.5081	0.2039
$BSTOCKR_{it}$	-0.8875	-0.2232	0.0309	0.0236	0.2375	1.2890	0.4008
$SCORED_{it}$	3.00	4.00	8.00	11.42	14.00	35.00	9.4422
$QRTR4SCORE_{it}$	0.000	0.000	0.000	4.382	6.000	35.000	8.4819
There are a total of 98 observations , spread across 10 years for 18 companies.							

Table 5.0: Descriptive statistics of data used for regression analysis in Part 2 of the data analysis, with variable names.

The values for the AM scores, periods in which advertisements appeared, and the number of advertisements a firm aired were manually entered into the dataset by looking at *USA Today*'s yearly Admeter survey results pages. These surveys take data from thousands of respondents, whose responses are sorted by employees and AI programs to find and remove repeated entries from the same participant or entries from artificial intelligence. Therefore, this data is believed to be an accurate reflection of the survey participants' responses. This study compared observations of periods in which the advertisements appeared, and the number of advertisements a given firm aired with the values found in AdAge's Super Bowl commercial archive to confirm that all values were recorded correctly. Adage is a media company that publishes online and print articles discussing trends and statistics in advertising. They are a trusted source of information related to advertising. The average values for the dummy variables reflect how often the dummy variable was equal to one. Viewership totals were sourced from Sports Media Watch, a media company that publishes news related to college and national sports leagues and collects data on viewership totals and demographics for televised sporting events. The returns of the S&P500 index and the individual stocks used to calculate the $MARKETR_{it}$ and $BSTOCKR_{it}$ variables were sourced from Bloomberg. These are returns are percentages, where a one percent return would be written as “1.00”.

This data was checked for statistical outliers by determining whether the maximum and minimum values for a given variable fell within three standard deviations of the variables’ mean value. The descriptive statistics reveal there are no observations that contain statistical outliers for $ADMETER_{it}$, $VIEW_{it}$, $QRTR1_{it}$, $QRTR2_{it}$, $QRTR3_{it}$, $QRTR4_{it}$, or $MARKETR_{it}$. The variable $ADNUMBER_{it}$ contained one outlier at the upper end. The variable $BSTOCKR_{it}$ contained one statistical outlier at the upper end. The variable $QRTR4SCORE_{it}$ contained four statistical outliers at the upper end. Due to the limited availability of data, observations containing values that are statistical outliers, for any of the variables, are not removed from the analyses.

Results of Significance Testing of ARs and CARs

The results of the first part of the data analyses found that overall, abnormal returns on any given day were typically statistically insignificantly different from 0. Table 6.0 shows the total number of significant returns experienced by individual firms across all years on each of the first ten days after a Super Bowl. For any one of the ten days after the Super Bowl across all years, there were never more than fourteen company-specific observations where abnormal returns were statistically significant at the 95% confidence level on a given day. When taking into consideration that each day had a total of 89 observations, how infrequently company-specific significant abnormal returns appear becomes clearer. This suggests that, on average, firms typically do not experience abnormal returns significantly different from 0 in the days following the Super Bowl.

Day After Super Bowl	Number of Significant Observations
1 (Monday)	7
2 (Tuesday)	9
3 (Wednesday)	8
4 (Thursday)	14
5 (Friday)	13
6 (Monday)	5
7 (Tuesday)	6
8 (Wednesday)	10
9 (Thursday)	13
10 (Friday)	10

Table 6.0: The number of firm specific abnormal returns across all years on the Xth day after the Super Bowl.

Table 7 displays the test statistics calculated for the average abnormal returns from days 1 through 10. To conduct the t-test, the values were compared to a table statistic from a Fisher's T-statistic table that indicates which abnormal returns were statistically different from 0, either positive or negative, at the 95% confidence level. If the test statistic was equal to or greater than the table statistic, the null hypothesis is rejected and the abnormal return is deemed statistically different from 0. Significant average abnormal returns would be marked by an asterisk if there were any. Since none of the average abnormal returns yielded a test statistic greater than or equal to the table statistic of 1.960, the null hypothesis is not rejected in any of the daily hypothesis tests and abnormal returns are considered to be equal to zero.

Day After Super Bowl	Average AR Test Statistic
1 (Monday)	-0.0716
2 (Tuesday)	-0.1946
3 (Wednesday)	0.2279
4 (Thursday)	-0.2380
5 (Friday)	-0.0881
6 (Monday)	0.0064
7 (Tuesday)	0.2485
8 (Wednesday)	0.0637
9 (Thursday)	-0.0099
10 (Friday)	-0.1817

Table 7.0: The test statistics for the average of the abnormal returns for each of the first ten days after the Super Bowl.

In addition to analyzing the daily abnormal returns, the average cumulative abnormal returns across all firms in all years were analyzed over the 3-, 5-, 7-, and 10-day timespans after the Super Bowl. If an average CAR value comes up statistically significant, that suggests that the CAR value across all firms is, on average, statistically significantly different from 0. The test statistics for the CAR values averaged across all firms in all years are presented in Table 8.0. None of the average CARs were statistically significant at the 95% confidence level, which further supports the conclusion that on average, companies that advertise in the Super Bowl do not experience statistically significant abnormal returns. If there were CARs statistically significant at the 95% confidence level, they would be marked with an asterisk.

CAR:	CAR Test Statistic
3-Day CAR	-0.0716
5-Day CAR	-0.0221
7-Day CAR	-0.1629
10-Day CAR	-0.0413

Table 8.0: The test statistics for the average of the CARs for the 3-, 5-, 7-, and 10-day timespans after a Super Bowl.

Results of Regressions Testing for Influences of AR and CARs

The regression results can be found in Tables 9.0 and 10.0. Model 1, which uses the 5-day CAR as the dependent variable, has an adjusted R squared value of 0.0974. This means that the dependent variables in the model explain about ten percent of the variance in the 5-day CARs; the model is a poor fit. The only statistically significant variables are $QRTR2_{it}$, $QRTR4_{it}$, and $ADMETER_{it}$. Of those variables, only $ADMETER_{it}$ has an unexpected sign. $ADMETER_{it}$ is statistically significant at the 90 percent confidence level and has a negative coefficient, but it was expected to be positive. This coefficient suggests that an increase of one in a firm's AM score results in the 5-day CAR decreasing by -0.9812 percent. The $QRTR2_{it}$ and $QRTR4_{it}$ variables are both statistically significant at the 90 percent confidence level and have negative coefficients, as expected. The coefficient for $QRTR2_{it}$ suggests that a company that airs at least one advertisement during the second quarter of the game experiences, on average, a 5-day CAR that is 1.4148 percent smaller than that of a company that does not advertise during the second quarter. The coefficient for $QRTR4_{it}$ suggests that a company that airs at least one advertisement during the fourth quarter of the game experiences, on average, a 5-day CAR that is 1.7432 percent smaller than that of firms that do not advertise during the fourth quarter.

Model two, which uses the 7-day CAR as the dependent variable, has an adjusted R squared value of 0.0441. The dependent variables explain even less of the variance in the 7-day CARs than the 5-day CARs. $ADMETER_{it}$ is the only statistically significant variable, being significant at the 95 percent confidence level. Its coefficient does not have the predicted sign, and it suggests that an increase in a firm's AM score of one will lead to the 7-day CAR decreasing by 1.4010 percent.

Models One and Two		
Independent Variables	Model One: Dependent Variable: 5-Day CAR	Model Two: Dependent Variable: 7-Day CAR
	Coefficient:	Coefficient:
$ADNUMBER_{it}$	0.3604	0.0369
$SCORED_{it}$	-0.0484	-0.0531
$QRTR1_{it}$	-1.4377	-1.1633
$QRTR2_{it}$	-1.4148*	-1.3717
HT_{it}	1.6383	2.5848
$QRTR4_{it}$	-1.7423*	-0.7758
$ADMETER_{it}$	-0.9812*	-1.4010**
$MARKETR_{it}$	-1.6223	0.4994
$BSTOCKR_{it}$	-0.9841	-1.3054
$VIEW_{it}$	0.0469	-0.0284
Observations	89	89
Adjusted R Squared	0.0974	0.0441
Asterisks (*) next to a coefficient indicate the coefficient's level of significance. One asterisk implies significance at the 90% confidence level, two implies at the 95% confidence level, and 3 implies at the 99% confidence level.		

Table 9.0: The coefficients and significance levels of the variables in models one and two.

Due to the low adjusted R squared values and the lack of statistically significant variables, conclusions will not be drawn from models one and two. Changes are made to the functional form of models one and two to produce models three and four. The function form of the $ADNUMBER_{it}$ variable is changed into a quadratic, arguing that the more commercials a firm airs, the more of an impact those commercials will have on helping the consumer remember the company. The dummy variable $QRTR1_{it}$ was replaced with the dummy variable $QRTR3_{it}$ because $QRTR1_{it}$ had a variance inflation factor (VIF) that was substantially higher than the variance inflation factors of all other variables, excluding $ADNUMBER_{it}$. This change should help remove some collinearity from the model and deflate the standard errors used in determining the statistical significance of the coefficients. $VIEW_{it}$ was removed because it did not theoretically make sense for $VIEW_{it}$ to be in the model with the variables for periods of the game, since the period variables likely capture audience size effects similar to how $VIEW_{it}$

should. Models three and four use, respectively, the 5-Day CAR and 7-Day CAR as their dependent variables. Table 10.0 includes the output of models three and four.

Models Three and Four		
Independent Variables	Dependent Variable: 5-Day CAR	Dependent Variable: 7-Day CAR
	Coefficient:	Coefficient:
$ADNUMBER_{it}$	-1.4896*	-1.6136*
$ADNUMBERSQ_{it}$	0.1763*	0.1778*
$QRTR2_{it}$	-0.5466	-0.6458
HT_{it}	2.7677*	3.6078*
$QRTR3_{it}$	0.7424	-.5202
$QRTR4SCORE_{it}$	-0.0606	-0.0412
$ADMETER_{it}$	-1.0416**	-1.2906**
$MARKETR_{it}$	-1.8940	0.1060
$BSTOCKR_{it}$	-1.0940	-1.1893
Observations	89	89
Adjusted R Squared	0.1142	0.0688
Asterisks (*) next to a coefficient indicates the coefficient's level of significance. One asterisk implies significance at the 90% confidence level, two implies at the 95% confidence level, and 3 implies at the 99% confidence level.		

Table 10.0: The coefficients and significance levels of the variables in models one and two.

The $ADMETER_{it}$ variable is statistically significant in both models at the 90% confidence level now, as opposed to just only the second model before. This suggests that a one unit increase in a firm's AM score will cause a 1.0416 percent decrease in the firm's 5-Day CAR and a 1.2906 percent decrease in the firm's 7-Day CAR. $ADMETER_{it}$'s coefficient is statistically significant, but it does not have the predicted sign. This contradicts the results of Eastman et al. (2010), who find that for all of their statistically significant proxies of advertisement likeability, the sign is positive. Fehle et al. (2005) find that advertisement likeability is negatively correlated with abnormal returns, like the results presented above, but they find advertisement likeability to be statistically insignificant in explaining the variance of abnormal returns. The results of Ambler and Burne (1999) suggest that advertisements that invoke emotions in viewers tend to be better remembered, and Kline and Kellaris (2007) found that advertisements using humor related to the message of the advertisement or the featured brand typically were better remembered by viewers. Super Bowl advertisements often try to make a humorous or emotional appeal to consumers, featuring a positive message. Therefore, one could expect that as a firm's average AM score increases, the firm's advertisement likely was more memorable due to having a humorous or emotional appeal to viewers. The positive mood could be better remembered by investors and lead to better attitudes towards the firm, making the investors more likely to buy shares of the firm's stock. However, the negative sign for the coefficients of $ADMETER_{it}$ suggests that the more likable a firm's advertisement, the larger the negative abnormal return. This suggests that better attitudes towards firms potentially caused by advertisements could make investors more likely to sell their current stake in the company.

The coefficients for $ADNUMBER_{it}$ and $ADNUMBERSQ_{it}$ are significant at the 90% confidence level in models three and four. The coefficient of $ADNUMBER_{it}$ is negative, while the coefficient of $ADNUMBERSQ_{it}$ is positive. These signs suggest that as the number of advertisements a firm airs increases, the abnormal returns the firm experiences become more negative until the firm has aired more than four advertisements. After the eighth advertisement, abnormal returns attributable to the number of advertisements aired become positive. This increase in the number of advertisements being correlated with changes in abnormal returns may be likened to the event discussed by Huberman and Regev (2001), where the price of ENMD's stock saw a large increase after the release of the *New York Times* article discussing the company's potential new treatment for cancer. The New York Times article did not present new information, yet the company's stock price saw a large increase. The results of this study parallel Huberman and Regev's (2001) in that the results suggest as the number of advertisements, mostly containing no new information, a company airs during the Super Bowl increases, the smaller the abnormal returns. This supports the price pressure hypothesis because the sizes of the returns of stocks are statistically correlated with a factor that contains no new information about the company.

The sign of the coefficient for HT_{it} is positive and statistically significant at the 90% confidence level, suggesting firms that air one or more advertisements during halftime can expect, on average, a 5-Day CAR that is 2.7677 percent higher than that of firms that did not advertise during halftime. Firms that advertise during halftime can also expect to experience, on average, a 7-day CAR that is 3.6078 percent larger than firms that did not advertise during halftime. The hypothesized signs for the HT_{it} variable and the $QRTR2_{it}$, variables all matched the predicted signs. This supports the hypothesis that the game would become more interesting as it progressed, leading to less attention being paid to the advertisements and lower abnormal returns. The exception to this rule was the halftime variable, which was expected to be positive due to viewers' attention shifting to the halftime show. Since the advertisements during the halftime break do not break up the halftime show or the football game during this attention shift, they end up being better remembered.

The remaining variables were not statistically significant at or above the 90 percent confidence level. $MARKETR_{it}$, meant to detect whether viewers are subject to attribution bias, has a statistically insignificant relationship with cumulative abnormal returns in models three and four. This result does not support the idea that investors are confusing brains with a bull market, or more specifically, are not trading more due to falsely attributing any recent successful performance of their portfolios to their investment skills. This contradicts the findings of Fehle et al. (2005), who find their version of the $MARKETR_{it}$ variable statistically significant in all of their models. $BSTOCKR_{it}$ is statistically insignificant in models three and four, indicating that the average amount that a stock outperforms or underperforms the market average in the days preceding the Super Bowl is not significantly correlated with the size of the cumulative abnormal returns experienced by stocks in the days following the Super Bowl. This suggests that investors are not exhibiting herd mentality by dismissing their personal investment strategies and mimicking the successful trades of other investors.

Conclusions

This study asks whether the stocks of Super Bowl advertisers experience abnormal returns in the days following the Super Bowl and what role the theories of herd mentality, attribution bias, price pressure hypothesis, signaling, involvement theory, and advertisement affects play in determining the variance of those abnormal returns. The first part of this study finds that the stocks of Super Bowl advertisers do not typically experience statistically significant abnormal returns in the days following the Super Bowl. Abnormal returns average across all firms in all years are statistically insignificant at the 95% confidence level during the ten days following the Super Bowl. CAR values averaged across all firms and all years for the 3-, 5-, 7-, and 10-days following the Super Bowl are also all statistically insignificant.

The second part of this study runs two separate OLS regressions where the collected measures for advertisement affects, price pressure hypothesis, viewer involvement, attribution bias, and herd mentality are regressed as dependent variables against the 5-day and 7-day abnormal returns. The results of these regressions found correlations statistically significant at the 95 percent confidence level between company specific data on CARs and average AM score. In addition, the number of advertisements aired and whether or not a firm aired a commercial during the half time break were statistically correlated with variance in 5-day and 7-day abnormal returns at the 90 percent confidence level.

The results of this study provide lessons for both investors and investment advisors. It is important to realize that doing due diligence when researching which stocks to invest in is necessary since building a portfolio that performs equal to or better than the market is very difficult. The tendencies of investors, as suggested by this study's results, to make investment decisions based on their mood/attitude towards firms and which firms the investor encounters more frequently are likely not reliable grounds for predicting which stocks will provide the best return. In addition, the lack of abnormal returns statistically different from zero in the days following the Super Bowl suggests that the Super Bowl does not present an arbitrage opportunity as some past researchers have argued that it may possibly be (Fehle, Tsyplakov, & Zdorovtsov, 2005; Tomkovick, Yelkur, Rozumalski, Hofer, & Coulombe, 2011). With these results in mind, investors will better understand what factors may be influencing their investment decisions and attempt to adjust their thinking.

While the methods of this study have found an answer to the research question, this study is not perfect. Future research needs to examine whether abnormal returns exist during the twenty trading days before the Super Bowl. Tomkovick et al. (2011) find statistically significant abnormal returns during the ten trading days preceding the Super Bowl but do not go back any further. Whether these abnormal returns persist within the 10 preceding days when using the Fama-French Three Factor Model to predict abnormal returns, as opposed to the less accurate CAPM model, remains unanswered. In addition, finding a new variable to measure herd mentality that cannot be considered a form of "double counting" the returns of the market could help improve the theoretical robustness of any attempt at determining the impact of herd mentality.

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Appendix A: Descriptive Statistics for Fama French 3 Factor Model

	$(R_{RF_{it}})$	$(R_{M_{it}})$	(SMB_{it})	(HML_{it})
Minimum	0.0000	-5.9100	-2.0300	-5.0200
1st Quartile	0.000	-0.3725	-0.3600	-0.4000
Median	0.001	0.0800	-0.0100	-0.0300
Mean	0.0031	0.0572	-0.0048	-0.0044
3rd Quartile	0.0060	0.5600	0.3500	0.3600
Maximum	0.0180	5.6800	2.5200	6.7300
Standard Deviation	0.0043	0.9875	0.5810	0.8325

Table 2.0: Descriptive Statistics for observations of the 3 factors from Fama-French 3 Factor Model

Appendix B: An Overview of Econometric Testing

Since models three and four are OLS regression models, they must meet the classical assumptions that are required to ensure the model is the best linear, unbiased estimator of the dependent variables. Econometric tests will be used to see if models three and four meet these classical assumptions. Models three and four are run using panel data and are subject to specification error, severe multicollinearity, serial correlation, and heteroskedasticity; each a violation of one of the various classical assumptions.

Testing for multicollinearity is done using a matrix of Pearson correlation coefficients and VIFs. The correlation matrix for the independent and dependent variables can be found in Tables 11.0 and 11.1.

	5CAR	7CAR	ADNUMBER	ADNUMBER SQ	QRTR2	HT
5CAR	1	.8488	-0.1460	-0.0826	-0.1262	0.0828
7CAR	0.8488	1	-0.1551	-0.0963	-0.1362	0.1051
ADNUMBER	-0.1459	-0.1551	1	0.9426	0.2047	0.1512
ADNUMBERSQ	-0.0826	-0.0963	0.9426	1	0.1958	0.0718
QRTR2	-0.1262	-0.1362	0.2047	0.1958	1	-0.1840
HT	0.0828	0.1051	0.1512	0.0718	-0.1840	1
QRTR3	0.0629	0.0153	0.4362	0.3522	-0.1851	-0.0351
QRTR4SCORE	-0.2493	-0.1899	0.3405	0.2800	-0.1764	0.1452
ADMETER	-0.2551	-0.2405	0.1004	0.0523	-0.0094	0.1565

MARKETR	-0.1078	0.0019	0.1029	0.1434	0.0306	-0.0994
BSTOCKR	-0.0681	-0.0464	-0.0404	-0.0195	-0.1097	0.1600

Table 11.0: Pearson correlation coefficients for variables in models three and four.

	QRTR3	QRTR4SCORE	ADMETER	MARKETR	BSTOCKR
5CAR	0.0629	-0.2493	-0.2551	-0.1078	-0.0681
7CAR	0.0154	-0.1899	-0.2405	0.0019	-0.0464
ADNUMBER	0.4362	0.3405	0.1004	0.1029	-0.0404
ADNUMBERSQ	0.3522	0.2800	0.0523	0.1434	-0.0195
QRTR2	-0.1851	-0.1764	-0.0094	0.0306	-0.1097
HT	-0.0351	0.1451	0.1565	-0.0994	0.1600
QRTR3	1	-0.0562	-0.0417	0.0956	-0.1618
QRTR4SCORE	-0.0562	1	0.2874	-0.0511	0.0110
ADMETER	-0.0417	0.2874	1	0.0054	-0.1399
MARKETR	0.0956	-0.0511	0.0054	1	-0.0153
BSTOCKR	-0.1618	0.0110	-0.1399	-0.0153	1

Table 11.1: Pearson correlation coefficients for variables in models three and four, continued.

None of the correlation coefficients have an absolute value greater than 0.44, with most falling less than 0.20. The only exception to this statement is the correlation coefficient between $ADNUMBER_{it}$ and $ADNUMBERSQ_{it}$ being 0.9426. This is expected and not a problem, since those two variables are meant to work together to put the number of advertisements into quadratic form. Overall, the Pearson correlation coefficients suggest that multicollinearity is not an issue. The VIFs for models three and four are the same since the independent variables do not change between the models. They are displayed in Table 12.0. $ADNUMBER_{it}$ and $ADNUMBERSQ_{it}$ have high VIFs, but that is because they are highly correlated with each other. All other VIFs are equal to or less than 1.5410, suggesting that there is little multicollinearity between the other variables. Like the Pearson correlation coefficients, the VIFs suggest that multicollinearity is not an issue in models 3 and four.

Variable	VIF
$ADNUMBER_{it}$	14.1531
$ADNUMBERSQ_{it}$	10.9121
$QRTR2_{it}$	1.5410
HT_{it}	1.2637
$QRTR3_{it}$	1.8862
$QRTR4SCORE_{it}$	1.5740
$ADMETER_{it}$	1.1529
$MARKETR_{it}$	1.0500
$BSTOCKR_{it}$	1.1097

Table 12.0: VIFs for independent variables from models three and four.

To check for serial correlation, a Breusch Godfrey (BG) test is run in R for both models three and four. The results can be found in table 13.0. The p-values for the BG tests are both greater than 0.05, indicating that first order serial correlation is not present in models three and four.

	Model 3	Model 4
P-Value from BG Test:	0.1484	0.5059

Table 13.0: The p-values from the Breusch Godrey tests on models three and four.

To check for heteroskedasticity, white tests are run on Models 3 and 4. The results can be found in table 14.0. The p-values for the white tests are both greater than 0.05, indicating that heteroskedasticity is not a problem in models three and four.

	Model 3	Model 4
P-value from White Test:	0.881	0.911

Table 14.0: The p-values from the White tests on models three and four.

After these four econometric tests, the results of models three and four remain as presented in Table 10.0. The R Studio code and test outputs can be found in appendix C.

Appendix C: Econometric Testing Output Screenshots

Model 1 Tests:

Ramsey's Reset Test (Specification Error):

```
        RESET test

data:  ModelCAR5
RESET = 1.3021, df1 = 2, df2 = 76, p-value = 0.278
```

VIFs (Multicollinearity):

```
> vif(ModelCAR5)
ADNUMBER   SCORED    QRTR1    QRTR2       HT    QRTR4  ADMETER  MARKETR  BSTOCKR     VIEW
3.131158 1.119072 2.144512 1.468788 1.184527 1.721903 1.179596 1.041244 1.153102 1.134150
>
```

Breusch Godfrey Test (Serial Correlation):

```
        Breusch-Godfrey test for serial correlation of order up to 1

data:  ModelCAR5
LM test = 1.288, df = 1, p-value = 0.2564
```

White Test (Heteroskedasticity):

```
> white(ModelCAR5)
# A tibble: 1 × 5
  statistic p.value parameter method       alternative
      <dbl>   <dbl>     <dbl> <chr>        <chr>
1      18.4   0.563        20 White's Test greater
```

Model 2 Tests:

Ramsey's Reset Test (Specification Error):

```
        RESET test

data:  ModelCAR7
RESET = 2.035, df1 = 2, df2 = 76, p-value = 0.1377
```

VIFs (Multicollinearity):

```
> vif(ModelCAR7)
ADNUMBER   SCORED    QRTR1    QRTR2       HT    QRTR4  ADMETER  MARKETR  BSTOCKR     VIEW
3.131158 1.119072 2.144512 1.468788 1.184527 1.721903 1.179596 1.041244 1.153102 1.134150
```

Breusch Godfrey Test (Serial Correlation):

```
        Breusch-Godfrey test for serial correlation of order up to 1

data:  ModelCAR7
LM test = 0.032834, df = 1, p-value = 0.8562
```

White Test (Heteroskedasticity):

```
> white(ModelCAR7)
# A tibble: 1 × 5
  statistic p.value parameter method       alternative
      <dbl>   <dbl>     <dbl> <chr>        <chr>
1      23.2   0.278        20 White's Test greater
```

Model 3 Tests:

Ramsey's Reset Test (Specification Error):

```
        RESET test

data:  ModelCAR5NVQ3AQ
RESET = 0.75594, df1 = 2, df2 = 77, p-value = 0.473
```

VIFs (Multicollinearity):

```
> vif(ModelCAR5NVQ3AQ)
 ADNUMBER ADNUMBERSQ      QRTR2         HT      QRTR3 QRTR4SCORE    ADMETER    MARKETR    BSTOCKR 
14.153090  10.912076   1.540961   1.263690   1.886175   1.574043   1.152885   1.049994   1.109678 
```

Breusch Godfrey Test (Serial Correlation):

```
	Breusch-Godfrey test for serial correlation of order up to 1

data:  ModelCAR5NVQ3AQ
LM test = 2.0882, df = 1, p-value = 0.1484
```

White Test (Heteroskedasticity):

```
> white(ModelCAR5NVQ3AQ)
# A tibble: 1 × 5
  statistic p.value parameter method       alternative
      <dbl>   <dbl>     <dbl> <chr>        <chr>      
1      11.3   0.881        18 White's Test greater    
```

Model 4 Tests:

Ramsey's Reset Test (Specification Error):

```
	RESET test

data:  ModelCAR7NVQ3AQ
RESET = 1.1297, df1 = 2, df2 = 77, p-value = 0.3284
```

VIFs (Multicollinearity):

```
> vif(ModelCAR7NVQ3AQ)
 ADNUMBER ADNUMBERSQ      QRTR2         HT      QRTR3 QRTR4SCORE    ADMETER    MARKETR    BSTOCKR 
14.153090  10.912076   1.540961   1.263690   1.886175   1.574043   1.152885   1.049994   1.109678 
```

Breusch Godfrey Test (Serial Correlation):

```
        Breusch-Godfrey test for serial correlation of order up to 1

data:  ModelCAR7NVQ3AQ
LM test = 0.44255, df = 1, p-value = 0.5059
```

White Test (Heteroskedasticity):

```
> white(ModelCAR7NVQ3AQ)
# A tibble: 1 × 5
  statistic p.value parameter method        alternative
      <dbl>   <dbl>     <dbl> <chr>         <chr>
1      10.6   0.911        18 White's Test greater
```

Appendix D: R-Studio Code

```
library(stargazer)
summary(Daily_AR)
summary(CARDS)
summary(QRTR4SCORE)
head.matrix(QRTR4SCORE)


summary(Fama_French_Data_Descriptive_Statistics)
sd(Fama_French_Data_Descriptive_Statistics$`Mkt-RF`)
sd(Fama_French_Data_Descriptive_Statistics$`SMB`)
sd(Fama_French_Data_Descriptive_Statistics$`HML`)
sd(Fama_French_Data_Descriptive_Statistics$`RF`)

sd(Daily_AR$`1AR`)
sd(Daily_AR$`2AR`)
sd(Daily_AR$`3AR`)
sd(Daily_AR$`4AR`)
sd(Daily_AR$`5AR`)
sd(Daily_AR$`6AR`)
sd(Daily_AR$`7AR`)
sd(Daily_AR$`8AR`)
sd(Daily_AR$`9AR`)
sd(Daily_AR$`10AR`)
sd(CARDS$CAR3)
sd(CARDS$CAR5)
sd(CARDS$CAR7)
sd(CARDS$CAR10)
```

```

summary(FR2, digits=4)
sd(FR2$ADNUMBER)
sd(FR2$Year)
sd(FR2$`1AR`)
sd(FR2$`3CAR`)
sd(FR2$`5CAR`)
sd(FR2$`7CAR`)
sd(FR2$`10 Car`)
sd(FR2$ADMETER)
sd(FR2$ADNUMBER)
sd(FR2$QRTR1)
sd(FR2$QRTR2)
sd(FR2$HT)
sd(FR2$QRTR3)
sd(FR2$QRTR4)
sd(FR2$VIEW)
sd(FR2$MARKETR)
sd(FR2$BSTOCKR)
sd(FR2$SCORED)
sd(QRTR4SCORE)

Frame2<-data.frame(FR2$`5CAR`,FR2$`7CAR`,FR2$ADNUMBER, ADNUMBERSQ,
                   FR2$QRTR2, FR2$HT, FR2$QRTR3, QRTR4SCORE, FR2$ADMETER, FR2$MARKETR, FR2$BSTOCKR, FR2$VIEW)
cor(Frame2)
```

```
#Base models:
ModelCAR5<-lm(`5CAR`~ ADNUMBER+SCORED+QRTR1+QRTR2+HT+QRTR4+ADMETER+MARKETR+BSTOCKR+VIEW, data=FR2)
ModelCAR7<-lm(`7CAR`~ ADNUMBER+SCORED+QRTR1+QRTR2+HT+QRTR4+ADMETER+MARKETR+BSTOCKR+VIEW, data=FR2)
stargazer(ModelCAR5, ModelCAR7, type="html", digits=4,title="Base Models", out="Starting Point Final.htm")

library(car)
library(lmtest)
library(skedastic)
resettest(ModelCAR5)
resettest(ModelCAR7)
vif(ModelCAR5)
vif(ModelCAR7)
bgtest(ModelCAR5)
bgtest(ModelCAR7)
white(ModelCAR5)
white(ModelCAR7)
```

```
#Final Models:
ADNUMBERSQ<-((FR2$ADNUMBER)^2)
QRTR4SCORE<-((FR2$QRTR4)*(FR2$SCORED))
ModelCAR5NVQ3AQ<-lm(`5CAR`~ ADNUMBER+ADNUMBERSQ+QRTR2+HT+QRTR3+QRTR4SCORE+ADMETER+MARKETR+BSTOCKR, data=FR2)
ModelCAR7NVQ3AQ<-lm(`7CAR`~ ADNUMBER+ADNUMBERSQ+QRTR2+HT+QRTR3+QRTR4SCORE+ADMETER+MARKETR+BSTOCKR, data=FR2)
stargazer(ModelCAR5NVQ3AQ, ModelCAR7NVQ3AQ, type="html", digits=4,title="Final Results", out="Final Results Final.htm")
stargazer(ModelCAR5NVQ3AQ, ModelCAR7NVQ3AQ, type="text", digits=4)


library(car)
library(lmtest)
library(skedastic)
resettest(ModelCAR5NVQ3AQ)
resettest(ModelCAR7NVQ3AQ)
vif(ModelCAR5NVQ3AQ)
vif(ModelCAR7NVQ3AQ)
bgtest(ModelCAR5NVQ3AQ)
bgtest(ModelCAR7NVQ3AQ)
white(ModelCAR5NVQ3AQ)
white(ModelCAR7NVQ3AQ)
```