
RESEARCH ARTICLE

Do Economic Surprises Affect Stock Returns? The Role of Sentiment

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ABSTRACT

We test whether the effect of macroeconomic surprises on stock returns is impacted by positive or negative investor sentiment, proxied by daily sentiment by Federal Reserve Bank of San Francisco. We employ an event study methodology with separate regressions for six real economic indicators: GDP, industrial production, unemployment, retail sales, durable goods, and continuing jobless claims. We regress the daily stock returns for release dates of macroeconomic indicators on macroeconomic surprises. We test whether a bullish or bearish view about the stock market affects the portfolio choices of investors in response to unexpected macroeconomic news. We find evidence of an asymmetric effect of investor sentiment on the relation between macroeconomic surprises and stock returns.

KEYWORDS

Investor Sentiment, Economic Indicators, Unexpected Macroeconomic News, Asymmetric Effect, Stock Returns, US Stocks, Daily Sentiment by Federal Reserve Bank of San Francisco

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1. Introduction

According to asset pricing theory, variables like macroeconomic indicators that directly affect consumption level or investment opportunity set should alter asset prices (Breedon, 1979; Merton, 1973). The theory behind the possible effect of economy-related news on stock prices is related to the theoretical calculation of stock price as present value of all future corporate cash flows, discounted by risk-adjusted interest rate. News about the overall economy can impact corporate earnings and/or discount rate and consequently stock prices. According to the efficient market hypothesis, all known information is already incorporated in stock prices. An economic surprise or the unexpected component of economic announcement will have a substantial effect on stock returns on release dates of economic data. Most traditional finance research papers (Cutler et al., 1989; Hardouvelis, 1987; Schwert et al., 1981) show that investors in stock market do not respond to news about real economic study. We hypothesize that economic surprises can have significant effect on stock prices, only after controlling for behavioral factors like investor sentiment.

We hypothesize that bearish investors take a rational and cautious approach to investing and respond significantly to economic surprises whereas bullish investors take an irrational approach and do not make significant portfolio changes in response to macroeconomic news. We base our hypothesis on loss version and actual events from the recession of 2020. One motivation behind our initial hypothesis is loss aversion. Loss aversion is one element of the prospect theory, that has been used in empirical finance literature to explain the high historical equity premium and lack of participation by households in the stock market (Barberis et al., 2018). According to Barberis et al. (2018), loss aversion is a concept that people are significantly more sensitive to losses than to gains of the same magnitude. Kahneman and Tversky (1979) infer loss aversion from aversion to gambles like a 50:50 bet to gain \$110 or to lose \$100. Rabin (2000) proves that the traditional utility framework assumes that a person is risk-neutral over small-stake gambles and should accept this gamble with a positive expected value. However, a typical investor rejects this gamble due to loss aversion because instead of focusing on final expected wealth, he is concerned with gain of \$110 or loss of -\$100

and as he is much more sensitive to possible loss of \$100 than to possible gain of \$110, he turns down the gamble. We hypothesize that bearish investors choose to make significant portfolio changes, in response to economic surprises, unlike bullish investors because investors are loss averse. We argue that investors avoid possible losses and take a rational approach to investing in this case. Alternatively, bullish investors expect gains from stock market and take an irrational approach to investing in a similar scenario. Another motivation behind our initial claim of asymmetric effect of sentiment on how investors react to economic news, is actual events from recession of 2020. According to the renowned business news channel, CNBC's report on 05/07/2020, the number of workers who continued to collect unemployment benefits increased to higher-than-expected 22.6 million last week, with a rise in same day S&P500 index price of 1.14%. The bad unemployment news triggered a counter intuitive rise in stock returns on May 07, 2020. An opposing economic surprise of lower-than-expected 22.8 million continuing jobless claims, reported by CNBC for observation period 05/02/2020 and release date 05/14/2020, led to a similar 1.14% stock market return. We explored these economic surprises and stock returns for release dates in a recession phase and hypothesized that another factor like investor sentiment, rather than business cycle, can possibly explain such divergent events.

We contribute to existing literature by exploring the effect of a behavioral factor on economic surprises and stock returns relation. We find evidence of an asymmetric effect of sentiment on how investors respond to unexpected economic announcements like a higher-than-expected quarterly GDP announcement by Bureau of Economic Analysis. The remaining paper is organized as follows: Section 2 provides literature review, Section 3 presents methodology of event study and describes the data, Section 4 gives primary empirical results and robustness checks, and Section 5 includes conclusion and motivation for future research.

2. Literature Review

There has been a plethora of published research on the effect of news announcements on financial markets, since the 1970s. Most research papers are unable to establish a significant link between economic announcements and stock returns in U.S (Flannery & Protopapadakis, 2002; Ghent, 2010). Flannery and Protopapadakis (2002) examine 17 macro variables and find that news about real economic activity like GNP, retail sales, industrial production, and unemployment, does not significantly impact stock returns. Ghent (2010) does not find a significant relationship between GDP and unemployment surprises and stock returns.

There has been contribution in this literature by Boyd et al. (2005) and McQueen and Roley (1993), who argue that economic surprises can significantly impact stock returns, only after controlling for business cycle affects. McQueen and Roley (1993), employ an event study methodology for sample period from September 1977 till May 1988 and regress daily stock returns for release dates of economic surprises, controlling for different stages of business cycle. The low, high, and medium economic regimes are based on first step regression for natural log of monthly industrial production on its time trend, with lowest 25%, highest 25% and remaining 50% of residuals considered as low, high, and medium economic regime months, respectively. The main finding of the study is that investors consider good news as bad news in an expansion phase and good news as good news in a recession phase, with coefficients with opposite signs for low and high economic regimes. The rationale to explain such empirical results is whether stock market investors consider the effect of discount rate to be a dominant factor impacting stock prices, relative to cash flows or the other way around. When economy is doing well, investors consider a less than expected unemployment rate announced by BLS as bad news, due to the possibility of tightening by Fed and interest rate is a dominant factor in this scenario. Boyd et al. (2005) analyze how unemployment news affects stock returns differently in different phases of the business cycle. In this study, Boyd et.al. construct a different measure of economic surprise econometrically rather than directly take from MMS or Bloomberg, from January 1962 till December 2000 and focus on only one economic indicator: monthly unemployment rate announcement by BLS. Boyd et al. (2005) findings show that good news about unemployment, increases stock prices in NBER declared recessions, and decreases stock prices in expansions. However, this research has two shortcomings. Firstly, McQueen and Roley (1993) use an ad-hoc way of measuring low, high and medium economic regimes. The classification scheme for different levels of economic activity is arbitrary, as mentioned in other research papers. Secondly Boyd et al. (2005) and McQueen and Roley (1993) both argue that rationale behind their empirical results is whether investors' response to earnings reports or to future interest rate direction is dominant. It cannot be known, in any circumstances, if investors consider the Fed's policy of raising future interest rates as more important than better-than-expected earnings reports. We observe S&P500 index moving up in response to good unemployment news and bad unemployment news in the same phase of business cycle (e.g., S&P500 index gives 1.14% return on 05/07/2021 and 05/14/2021 in response to bad and good unemployment surprise respectively). Even if good macroeconomic news is bad news for stock market in an expansion phase, it will not be possible to show that investors consider Fed's monetary policy as a dominant factor that affects portfolio choices. The reasoning behind these empirical results is somewhat arbitrary. We address these criticisms by arguing that the missing link between economic surprises affecting stock market is a news-based sentiment measure, rather than an arbitrary classification of economic regimes. We motivate our hypothesis from loss aversion and real stock market events. We argue that behavioral factors play a key role in economic surprise and stock return relation, which has been ignored in the traditional finance literature.

There are few papers in behavioral finance literature, which analyze how investors respond to economic announcements (Birz & Lott, 2011). Birz and Lott (2011) argue that the missing link in effect of news about real economic activity on stock returns, is interpretation of news. In an event study methodology for sample period from 1991 till 2004, Birz and Lott find that standardized economic surprises have no significant effect on stock prices on announcement dates, for four economic indicators in sample; GDP, UNEMP, RS and DO, even after controlling for business cycle. The main finding is that GDP and UNEMP surprises significantly affect stock returns, only if a news index is added as a control variable to each of four regressions for real economic news. We hypothesize that interpretation of news is not the missing link as by Birz and Lott, in fact investors' bullish or bearish sentiment can directly impact, the response of investors to economic announcements on release dates. Our empirical findings show that there is an asymmetrical effect of investor sentiment on how stock returns fluctuate, in response to economic surprises.

There has been a lot of research on the effect of investor sentiment on stock returns, but there is no behavioral finance literature with a focus on role of sentiment in how investors respond to economic surprises. Verma et al. (2008) show that impact of rational sentiment is greater than that of irrational sentiment, on stock returns of S&P500 index and DJIA index, using VAR methodology. Uhl (2014) shows that investor sentiment measure, based on 3.6 million Reuters news articles can forecast stock returns, using VAR framework. Reed (2016) constructs a consumer sentiment measure, based on lexicographic analysis of Twitter data, and finds that sentiment has a significant negative effect on daily stock returns. Pan (2020) finds that investor sentiment forecasts stock bubble probability and bubble bursts, with higher chance of bubble followed by high investor sentiment period, using logistic regression analysis. We fill a gap in this sentiment literature and explore the role of sentiment, in how investors make portfolio changes in response to news about real economic activity and find empirical results that support our hypothesis.

3. Methodology

3.1 Event Study

A question that has been addressed in previous literature is will stock market investors react to macroeconomic surprises? In this paper, we want to test whether investor sentiment, proxied by daily sentiment index by Federal Reserve Bank of San Francisco, can affect the relation between macroeconomic surprises and stock returns in U.S. We employ an event study methodology and regress daily stock returns for release dates of six economic indicators in the sample, on macroeconomic surprises. We conduct a separate regression for each real economic indicator. As a further step, we test whether the coefficient of surprise and stock returns differs in magnitude or significance based on the prior to release date investor sentiment. We hypothesize the asymmetric effect of investor sentiment on the relation between macroeconomic surprises and stock returns.

We conduct a set of six regressions of the following form (1): $R_t = \alpha + \beta XX_t + u_t$

R_t represents stock market return on the day of announcement of real macroeconomic indicators.

We use six macroeconomic surprises for our analysis: Gross Domestic Product, Industrial Production, Retail Sales, Durable Goods, Monthly Unemployment Rate and Continuing Jobless Claims. The coefficient captures the effect of a one-unit increase/decrease in economic surprise on stock market returns. We conduct regression (1) for all six economic indicators and t is the announcement date that differs for each indicator.

We calculate economic surprises like approach used by Andersen et al. (2003, 2007). We take the difference between actual (XX^a) and expected (XX^e) real macroeconomic indicators and then divide the difference by standard deviation of the difference (σ), where k is announcement and t is announcement date.

To test the effect of investor sentiment on economic surprise and stock return relation, we conduct the second set of six regressions of the following form (2): $R_t = \alpha + \beta^+ XX_t * P + \beta^- XX_t * N + u_t$

We divide the economic surprises XX_t into 2 separate variables based on prior to announcement date's ($t-1$) daily sentiment value. We use the same set of 6 macroeconomic indicators as in case of (1). The daily sentiment index is negative or 0.00 when investors are bearish about the stock market whereas it takes on a positive value as investors hold a bullish view about overall equity market in U.S. We interact the economic surprise with a dummy variable P and then another dummy variable N . $P = 1$ for all release dates t with a $t-1$ daily sentiment value greater than 0, and 0 otherwise. $N = 1$ for all release dates t with a $t-1$ daily sentiment value less than 0 or equivalent to 0.00, and 0 for the rest of values. β^+ measures the effect of one unit increase in standardized economic surprise on the same day's stock market return for bullish investors. β^- is the coefficient that captures the effect of economic surprises on announcement day stock returns for bearish investors. We analyze the magnitude and significance of β^+ and β^- to see if there is evidence of an asymmetric effect of investor sentiment on economic surprises and stock return relation.

We opt for standard Ordinary least squares (OLS) methodology for all economic surprises in sample because there is no evidence of autocorrelation or heteroskedasticity for regressions (2). We find no evidence of autocorrelation from the Durbin-Watson (DW) test in all the regressions except the monthly unemployment rate for regression (2). The p-value of 0.06 signals that we can reject the null hypothesis of no autocorrelation at 10% significance level. The Generalized least squares regression for unemployment rate shows no significant change in results. We confirm our results by comparing DW test statistic with range of critical values. All DW test statistics are close to 2, which is a sign of no autocorrelation. We conduct Breusch-Pagan test to test for heteroskedasticity. There is no evidence of heteroskedasticity in regressions for all economic surprises except industrial production for regression (2). The p-value of 0.001 shows that we can reject the null hypothesis of no heteroskedasticity with 1% significance level. The heteroskedasticity-consistent standard errors for this regression show no substantial change in magnitude of coefficients or the significance level. Therefore, we use standard OLS approach for all regressions.

Following Gibbons & Hess (1981), we include dummy variables ($D1-D4$) to control for effect of day of the week from Monday to Friday in regressions (2). This is a standard in research papers with a focus on daily stock returns and economic surprises like McQueen and Rokey (1993) and Birz and Lott (2011). Intercept α will be observation for Friday whereas $D1-D4$ will be differential observations from Monday through Thursday, respectively. For e.g., $D1 = 1$ if the release date for quarterly GDP is on Monday and 0 otherwise. We find no significant change in results due to the addition of day-of-the-week dummies. Therefore, we do not report these results, and they are available on request.

3.2 Data

We analyze how the impact of economic surprises on daily stock market returns can be affected by investor sentiment. We need an investor sentiment measure that is available at a daily frequency. We use daily sentiment from Federal Reserve Bank of San Francisco. Daily News Sentiment Index is explained in Buckman et al. (2020). Shapiro et al. (2020) construct sentiment scores from U.S. economy-related articles published in 24 major U.S. newspapers, including the New York Times and the Washington Post. Each article is categorized as U.S. economy related, based on at least 200 words on U.S. economy. SSW convert article scores into a daily time-series measure of news sentiment. SSW make statistical adjustments for changes in composition of newspaper articles over time and the weighted-average sentiment measure includes weights, declining as a function of the length of time since article's publication. Higher values of sentiment indicate a positive sentiment about the stock market and lower values indicate a bearish view about the overall U.S. stock market. Daily News Sentiment Index correlates with the University of Michigan consumer sentiment measure and the Conference Board's Consumer Confidence Index. The sentiment index moves with important historical events that have impacted financial markets, such as the Russian financial crisis in August 1998; the terrorist attacks of September 11, 2001; the financial recession of September 2008; the October 2013 federal government shutdown and the pandemic induced recession of March 2020. Daily sentiment index is a stationary time series, and it is available from January 1980 till July 2020. We utilize a sample period from January 2000 till July 2020, based on availability of other key variables in data set such as expected values of macroeconomic releases. The starting point of sample period coincides with availability of expected economic indexes by Bloomberg. We use prior day daily sentiment instead of release date sentiment because the same day sentiment will include the impact of the economic surprise already. For instance, investors will be bullish about the stock market on the day they get the news of less than expected monthly unemployment rate from the Bureau of Labor Statistics (BLS). We observed a rise in S&P500 index, Dow Jones Index and NASDAQ on March 05, 2021, as BLS reported a better-than-expected unemployment rate of 6.2% with 379,000 jobs added in February 2021. Dow Jones expected an addition of 210,000 jobs with an unemployment rate of 6.3% for February as reported by CNBC.

We construct economic surprises by taking the difference between actual and expected values of macroeconomic indicators. We take the actual and expected macroeconomic releases from Bloomberg. We take expected economic indicators from Bloomberg as it provides the median of all survey estimates available for the current release of an economic index such as retail sales. The survey respondents are renowned economists, and the survey email is usually sent a week or a week and a half, before the actual release date. Survey is closed 2 days prior or as late as possible, before the release time, depending on the indicator. For instance, the expected value of annualized quarterly GDP for the second quarter of 2020 is -32.50% with an actual estimate of -31.7%, reported on 08/27/2020 at 8:30 am. The expected value of -32.50% is a median estimate from 62 survey economists by Bloomberg with highest estimate of -33.50% and lowest estimate of -28.50%. In this case, we would have a positive economic surprise because the actual value is greater than the expected value for quarterly GDP indicator. We use actual releases for macroeconomic indicators instead of 'preliminary' or 'revised' announcements because we have access to median expected values from Bloomberg for actual releases for all six indicators in the sample. Birz and Lott (2011) follow the same criteria and use government releases based on data availability of expected values. Following the convention in literature, we standardize the surprises by dividing each economic surprise by its standard deviation. We can compare all six indicators due to this standardization which assigns a unit variance to all economic surprises. This approach is used in many research papers like Birz and Lott (2011) and Singh et al. (2013).

We use six economic indicators in our sample to represent real economic activity: Gross Domestic Product, Industrial Production, Retail Sales, Durable Goods, Monthly Unemployment Rate and Continuing Jobless Claims. We have a similar set of economic indexes as by Birz and Lott (2011), with an addition of industrial production and continuing jobless claims. We add both indicators to get a higher frequency economic indicator to measure economic output and unemployment in U.S. Gross domestic product (GDP) measures the final market value of all goods and services produced within U.S. and it is reported by Bureau of Economic Analysis (BEA) on a quarterly basis at 8:30 am. GDP is measured by expenditure approach, and it is adjusted for inflation. Economic announcements for GDP are not made on any specific weekday and the sample period is from January 2000 till July 2020. For instance, the first economic surprise for GDP in sample is 1.406%. This is derived from an actual estimate of 6.9% with a median survey estimate of 6.5% for a release date of 02/25/2000 and an observation period of 9/30/1999 till 12/3/1999 from Bloomberg. The 0.40% positive economic surprise is standardized by dividing it by standard deviation of 0.28% for all economic surprises in sample. This is good news for a typical investor as the economy has grown more than expected. Industrial Production (IP) of U.S. is an economic indicator that measures output of the industrial sector of the economy. Industrial sectors include manufacturing, mining, and utilities. IP refers to seasonally adjusted monthly percentage change in industrial production. It is a commonly used monthly proxy for GDP and is reported by Federal Reserve at a monthly frequency at 9:15 am. Release dates for IP do not point towards a specific weekday and the sample period is from January 2000 till July 2020. For instance, the actual estimate for IP is 1.1% with a median survey estimate of 1% from 64 qualified economists for a release date of 11/17/2020 from Bloomberg. This indicates that the actual change in monthly industrial production is more than expected and we consider this data point as a positive economic surprise for investors. Durable goods economic index (DO) is monthly percentage change in the value of new orders received during the reference period. Orders are based on a legal settlement between two parties in which the seller will deliver goods or services to the purchaser at a certain date in the future. There is no specific weekday for DO data release and is reported by U.S. Census Bureau monthly at 10:00 am. The sample period is from January 2000 till July 2020. For instance, the actual estimate for DO is 1.90% with an exact equivalent expected value of 1.90% for a release date of 11/03/2020 from Bloomberg. This indicates that there is no economic surprise for investors in this month, as actual and expected values are equivalent. Retail sales (RS) track the resale of new and used goods in U.S., for personal or household consumption. It is calculated on the value of goods sold basis and is reported by U.S. Census Bureau monthly at 8:30 am. There is no specific weekday for retail sales data release, and it is reported as a monthly percentage change in retail sales orders. The sample period is from June 2001 till July 2020. For instance, the actual estimate for RS is 7.5% with a median survey estimate of 5% from 65 qualified economists for a release date of 07/16/2020 from Bloomberg. This shows that retail spending is much better than expected for the month of June in 2020, which is a positive economic surprise for any investor. The unemployment rate (UNEMP) refers to the official unemployment rate U-3, reported by the Bureau of Labor Statistics (BLS) at a monthly frequency on mostly Fridays at 8:30 am. The unemployment rate measures the number of unemployed persons as a percentage of the civilian labor force and the statistics come from a household labor force survey. For instance, the actual estimate for UNEMP is 10.2% with a survey estimate of 10.6% from Bloomberg for a release date of 08/07/2020. This indicates that the actual unemployment rate is 0.4% points lower than expected. A lower-than-expected unemployment rate is good news for the overall economy and the stock market. The continuing claims (CC) economic indicator tracks the total number of people who have filed jobless claims to receive unemployment benefits. This is considered high frequency unemployment data as it is reported by the Bureau of Labor Statistics (BLS) on a weekly basis on mostly Thursdays at 8:30 am. This is not a percentage data point, unlike other economic indexes in sample with the actual number of jobless claims in 1000s in the sample. The sample period is from July 2004 till July 2020. For instance, the actual estimate for CC is 6,786,000 with an expected CC of 6,825,000 for a release date of 11/12/2020 from Bloomberg. This indicates that actual jobless claims are less than expected and this is good news for a typical investor.

We use S&P500 index as representative of the stock market in U.S. because this index is consistently used in literature. We take the daily returns from yahoo finance for sample from January 2000 till July 2020. We use the daily stock returns for release dates of macroeconomic indicators as all the indicators in samples are released before the opening time 9:30 am EST or before the closing time of stock markets. If an indicator is released after 4:00 pm EST, then the day next to release date will show impact of economic surprise on stock indexes.

4. Results and Discussion

4.1 Primary Results ~ Economic Surprises and U.S. Stock Market Returns

In this section, we analyze the effect of sentiment on the relation between economic surprises and U.S. stock market returns. We conduct separate regression for each of our six economic indexes; GDP, IP, DO, RS, UNEMP and CC, as in (1) and analyze the effect of economic surprises on S&P500 index returns on release dates. We report the results in Table 1. As a second step, we separate prior to release date daily sentiment index into positive and negative sentiment and interact two dummies with economic surprises as in (2). We conduct six separate regressions and report the results in Table 2.

Table 1: OLS regression results for effect of economic surprises on daily stock returns (1).

Economic Surprise	β	Announcement Days	Sample Period
Gross Domestic Product	0.008 (0.114)	83	1/2000-7/2020
Industrial Production	-0.035 (0.073)	247	1/2000-7/2020
Durable Goods	0.085 (0.067)	247	1/2000-7/2020
Retail Sales	0.181** (0.082)	230	6/2001-7/2020
Unemployment Rate	-0.061** (0.026)	247	1/2000-7/2020
Continuing Claims	-0.074* (0.043)	834	7/2004-7/2020

Note: 0.10 (*), 0.05 (**) and 0.01 (***) significance levels reported for coefficients.

We find an insignificant effect of GDP, IP or DO surprises on stock market returns for release dates as shown in Table 1 above. However, we do find a significant effect of unexpected unemployment news on portfolios choices of stock market investors. A one standard deviation increase in difference between actual and expected unemployment rate, reported by BLS monthly, results in a 0.061% decline in S&P500 index return on the release date. Investors view a higher- than-expected unemployment rate as bad news for the overall economy, which can depress earnings for companies in the future. This can trigger a sell-off by stock market investors with a decrease in price for the overall S&P500 index. We find a similar result with negative and significant coefficient for higher frequency unemployment surprises. As individuals file more- than-expected jobless claims for a week, investors view this surprise as a negative signal for the market and S&P500 declines on release date. There is a significant and more pronounced effect of retail sales surprises on stock market returns for our sample period, relative to unemployment news. A one standard deviation increase in unexpected monthly change in retail sales orders, reported by U.S. Census Bureau, will raise S&P500 index returns by 0.181% on release date. This good news triggers investors to start re-investing in the market as retail spending is showing a positive signal for the overall economy.

Table 2: OLS regression results for effect of economic surprises on daily stock returns for S&P500 index, controlling for positive and negative investor sentiment (2).

Economic Surprise	β^+	β^-	Days with P = 1	Days with N = 1
Gross Domestic Product	-0.185 (0.18)	0.133 (0.145)	45	38
Industrial Production	0.013 (0.137)	-0.052 (0.087)	127	120
Durable Goods	0.092 (0.083)	0.072 (0.114)	139	108
Retail Sales	0.059 (0.257)	0.196** (0.087)	118	112

Unemployment Rate	0.0946 (0.112)	-0.069** (0.026)	138	109
Continuing Claims	0.156 (0.336)	-0.077* (0.043)	435	399

Note: 0.10 (*), 0.05 (**) and 0.01 (***) significance levels reported for coefficients.

We analyze the impact of sentiment on effect of economic surprises on stock returns and report primary results in Table 2 above. We find evidence of an asymmetric effect of sentiment on how economic surprises impact stock returns on announcement days. We do not find any significant results for GDP, IP & DO surprises. However, we find a significant effect of negative sentiment on the relation between retail sales, unemployment rate and continuing claims surprises with stock returns. When investors are bearish about the market, a day before announcement of unemployment rate by BLS, they react significantly to an economic surprise news the following- day and change their portfolio choices. A one standard deviation increase in unemployment rate surprise, decreases the stock market return by 0.069% on release date, at 5% significance level. Whereas the same investors react insignificantly to an unemployment rate surprise when they are bullish about the stock market prior to the announcement date. There is clear evidence of asymmetric effect of sentiment how investors react to macroeconomic news. We find a negative and significant coefficient for continuing claims surprises when investors are bearish about the stock market and an insignificant coefficient when investors hold a positive view about the overall stock market, prior to announcement day. We find a similar pattern for retail sales surprises as bearish investors react to more-than-expected retail spending by changing portfolio choices and S&P500 index returns rise by 0.196%, at 5% significance level. Primary results in Table 2 support our initial hypothesis that bearish investors, who expect a loss in the future, take a rational approach to investing and react to economic surprises whereas bullish investors, who expect the stock market to rise, take an irrational approach, and disregard macroeconomic news.

4.2 Robustness Checks ~ Economic Surprises and Other U.S. Stock Market Indexes

We conduct regressions for primary results for S&P500 Index, reported in Table 2. As a robustness check, we conduct regressions (1) and (2) for Russell 2000 (R2000), Nasdaq Composite (NASDAQ-C) and Wilshire 5000 (W5000) and report results in Table 3.

Table 3: OLS regression results for effect of economic surprises on daily stock returns for Nasdaq-C, Wilshire 5000, and Russell 2000 index, controlling for positive and negative investor sentiment.

Economic Surprise	β	β^+	β^-
		NASDAQ-C	
Gross Domestic Product	-0.081 (0.132)	-0.146 (0.211)	-0.039 (0.169)
Industrial Production	-0.052 (0.094)	0.099 (0.173)	-0.116 (0.112)
Durable Goods	0.115 (0.093)	0.088 (0.115)	0.168 (0.162)
Retail Sales	0.175* (0.094)	0.216 (0.289)	0.17* (0.099)
Unemployment Rate	-0.050 (0.037)	0.145 (0.152)	-0.061 (0.038)
Continuing Claims	-0.23** (0.097)	0.087 (0.354)	-0.256** (0.101)

WILSHIRE 5000			
Gross Domestic Product	-0.001 (0.113)	-0.166 (0.179)	0.104 (0.144)
Industrial Production	-0.033 (0.073)	0.021 (0.135)	-0.057 (0.087)
Durable Goods	0.08 (0.067)	0.077 (0.083)	0.085 (0.117)
Retail Sales	0.181** (0.082)	0.069 (0.254)	0.194** (0.087)
Unemployment Rate	-0.064 (0.044)	0.148 (0.339)	-0.068 (0.044)
Continuing Claims	-0.213** (0.092)	0.149 (0.335)	-0.243** (0.096)
RUSSELL 2000			
Gross Domestic Product	-0.038 (0.135)	-0.098 (0.216)	0.0003 (0.174)
Industrial Production	-0.015 (0.092)	0.036 (0.169)	-0.037 (0.109)
Durable Goods	0.082 (0.087)	0.058 (0.107)	0.129 (0.151)
Retail Sales	0.226** (0.106)	0.011 (0.326)	0.252** (0.112)
Unemployment Rate	-0.099*** (0.0348)	0.0299 (0.142)	-0.107*** (0.035)
Continuing Claims	-0.166 (0.119)	0.1 (0.432)	-0.188 (0.124)

Note: 0.10 (*), 0.05 (**) and 0.01 (***) significance levels reported for coefficients.

We take daily returns from yahoo finance for a sample period from 2000 till 2020. We replace the daily stock returns for economic announcements by S&P500 with these three key indexes. We find a pattern of a significant coefficient for economic surprises for pessimistic investors whereas an insignificant coefficient for optimistic investors. GDP, IP and DO surprises have an insignificant effect on all index returns like S&P500 returns. Small and mid-cap stock investors of R2000 index react significantly to an unexpected unemployment rate surprise whereas investors in technology sector and the overall W5000 index discard this economic surprise. There is a significant decline of 0.107% in R2000 return with one standard deviation increase in actual unemployment rate relative to median survey estimate by Bloomberg, for investors with a pessimistic view about the future of stock market. Bearish stock investors in technology sector and overall stocks in U.S. react to high frequency unemployment news like continuing claims and discard the monthly unemployment surprise. These investors seem to have already made their portfolio changes subject to weekly unemployment surprises and do not react to end-of-month unemployment news. Investors of all indexes, with a negative view about stock market, react to retail sales order surprises with a 5 or greater significance level. The small and mid-cap investors of R2000 and the overall market of W5000 respond in a more pronounced and significant way to RS surprises relative to technology investors of NASDAQ-C. There is a positive and significant coefficient of 0.252% and 0.194% for R2000 and W5000 respectively for bearish investors with a less than 0.05 p-value. A one standard deviation positive RS surprise

leads to 0.17% rise in NASDAQ-C return, at 10% significance level. There is no significant effect of any unexpected macroeconomic news on stock returns for bullish investors in our sample. Results for other stock market indexes than S&P500 index confirm our primary findings that pessimistic investors react rationally to economic news whereas optimistic investor discard macroeconomic announcements as trivial information.

4.3 Secondary Results ~ Economic Surprises and U.S. Portfolio Returns

We analyze if sentiment can play a role in effect of economic surprises on stock returns for different portfolios based on market cap and book-to-market ratio. We find evidence of an asymmetric effect of sentiment on how daily portfolio returns change in response to an economic surprise. We report results for portfolio returns in Table 4.

Table 4: OLS regression results for effect of economic surprises on daily stock returns for portfolios based on book- to-market ratio and market-cap, controlling for positive and negative investor sentiment.

Economic Surprise	β	β^+	β^-
VALUE STOCKS			
Gross Domestic Product	0.197 (0.145)	-0.194 (0.225)	0.45** (0.181)
Industrial Production	0.014 (0.089)	0.018 (0.164)	0.012 (0.106)
Durable Goods	0.122 (0.08)	0.078 (0.098)	0.208 (0.138)
Retail Sales	0.279*** (0.096)	-0.073 (0.296)	0.322*** (0.102)
Unemployment Rate	-0.107*** (0.032)	0.059 (0.134)	-0.117*** (0.033)
Continuing Claims	-0.166 (0.12)	0.205 (0.434)	-0.197 (0.124)
GROWTH STOCKS			
Gross Domestic Product	-0.048 (0.112)	-0.173 (0.177)	0.031 (0.143)
Industrial Production	-0.062 (0.073)	0.045 (0.134)	-0.107 (0.086)
Durable Goods	0.079 (0.068)	0.089 (0.083)	0.06 (0.117)
Retail Sales	0.16** (0.079)	0.12 (0.244)	0.165* (0.084)
Unemployment Rate	-0.048* (0.027)	0.03 (0.11)	-0.053* (0.027)
Continuing Claims	-0.225*** (0.086)	0.108 (0.313)	-0.253*** (0.09)

	SMALL STOCKS		
Gross Domestic Product	-0.063 (0.134)	-0.169 (0.213)	0.004 (0.171)
Industrial Production	-0.021 (0.108)	0.047 (0.167)	-0.021 (0.108)
Durable Goods	0.078 (0.082)	0.057 (0.101)	0.118 (0.142)
Retail Sales	0.196* (0.1)	-0.025 (0.308)	0.222** (0.106)
Unemployment Rate	-0.095*** (0.032)	0.013 (0.131)	-0.101*** (0.033)
Continuing Claims	-0.151 (0.116)	0.105 (0.421)	-0.172 (0.121)
	BIG STOCKS		
Gross Domestic Product	0.037 (0.113)	-0.078 (0.179)	0.112 (0.114)
Industrial Production	-0.04 (0.072)	0.028 (0.134)	-0.069 (0.086)
Durable Goods	0.081 (0.067)	0.083 (0.082)	0.076 (0.116)
Retail Sales	0.174** (0.08)	0.09 (0.246)	0.184** (0.084)
Unemployment Rate	-0.057** (0.026)	0.044 (0.108)	-0.063** (0.027)
Continuing Claims	-0.214** (0.089)	0.16 (0.323)	-0.245*** (0.093)

Note: 0.10 (*), 0.05 (**) and 0.01 (***) significance levels reported for coefficients.

Growth and Value Stocks Portfolios

Fama and French construct the value and growth stocks portfolios based on book-to-market ratio of stocks. Stocks in the highest 30% percentile of book-to-market ratio are value stocks whereas stocks in the lowest 30% percentile of the same ratio form growth stocks portfolio. According to renowned investing advice firm, Motley Fool, value stocks are those companies which are currently trading at a lower price than their actual long-term earning potential. These stocks are selling at a discount in the market with usual firm traits like steady growth rates, stable revenue in the past, long history of making profits and paying dividends. For example, Berkshire Hathaway is a value stock in fiscal year 2020. Conversely, growth stocks are similar to expensive products in the goods market as they are trading at higher prices than their book values listed on balance sheets. Growth companies increase their earnings at a rate faster than the average business in the industry. For example, Tesla is a growth stock in fiscal year 2020. We report results for portfolio returns in Table 4. We find evidence of asymmetric effect of sentiment on how investors make portfolio changes in response to economic surprises.

We find consistent results relative to our primary results in Table 4 above as GDP, IP and DO surprises have all insignificant coefficients,

except the effect of GDP on value stock returns for bearish investors. There is 0.45% increase in value stock returns with one standard deviation rise in deviation between actual and expected GDP, reported by BEA. There is no significant coefficient for effect of surprises on stock returns for bullish investors in Table 4. As shown in Table 4, value and growth stocks portfolio returns are impacted by retail sales surprises and monthly unemployment rate surprises in case of pessimistic investors. There is a stronger effect of the above mentioned two surprises on value stock returns in comparison to growth stock returns as coefficients have a higher magnitude and greater significance level. For example, RS surprise brings a change of 0.16% for growth stock returns at 10% significance level, whereas the same surprise changes value stock returns by twice percentage points of 0.32% at 1% significance level (Table 4). A one standard deviation rise in higher frequency unemployment surprise of continuing jobless claims, causes a significant decline of 0.25% in growth stock returns with no significant change in value stock returns.

In Table 4, we find evidence of more surprises effecting stock returns for growth stocks than value stocks, for pessimistic investors. Our results show that investors with bearish sentiment, are more likely to make portfolio changes in growth stocks rather than value stocks in response to economic surprises. Investors with a positive view about stock market prior to data release date, discard all six economic surprises in our sample set as trivial news. A rationale behind these results could be the fact that growth stocks are firms that are difficult to value and are high risk and high volatility relative to value stocks, which are stable and mature firms. There is literature that shows how growth stocks are more sensitive to sentiment changes relative to value stocks (Baker & Wurgler, 2006; Brown & Cliff, 2005). Our findings are consistent with prior literature on sentiment and stock returns.

Small and Big Company Portfolios

We take daily returns for small and big companies for release dates of economic announcement from Fama and French website. They form portfolios based on market capitalization with highest 30% percentile forming the big companies' portfolio and lowest 30% percentile forming the small companies' portfolio. According to a well-known financial services firm, Fidelity, generally large-cap firms have less variability in quarterly profits and revenue streams than small-cap companies. Large companies may even have less volatile share prices than smaller firms and tend to be less sensitive to macroeconomic shocks than small-cap stocks. According to yahoo finance, Alamo group is a small-cap stock with market cap of \$1.89 billion and Square is a large-cap stock with market cap of \$89.66 billion as of 05/17/2021.

In Table 4, we find evidence of an asymmetric effect of sentiment on how large-cap and small-cap stock returns change in response to one standard deviation change in economic surprises. Portfolio results based on market cap are consistent with portfolio results based on book-to-market ratio and primary results. Bearish investors make significant portfolio changes in response to some surprises as opposed to GDP, IP and DO surprises. There is no significant coefficient for bullish investors for all economic announcements in sample. The results for large cap stocks are more like results from S&P500 relative to results for small cap stocks because three economic surprises (RS: 0.184, UNEMP: -0.063 and CC: 0.245) have significant coefficients for the former as opposed to two significant economic surprises (RS: 0.222 and UNEMP: -0.101) for the latter, for investors with prior-to-release-date negative sentiment. The results from Table 4 confirm our primary hypothesis that investors with a negative view about stock market, take a rational approach and react significantly to macroeconomic news whereas investors with bullish expectations from stock market, take an irrational approach and reject economic surprises as inconsequential information.

A rationale behind similar results for large-cap stocks and S&P500 can be the criteria behind selection of stocks for S&P500 index. According to S&P Global, the strict criteria for inclusion in S&P500 index include a restriction of market capitalization; a company should have a market cap of at least \$8.2 billion to be accepted in the index. The index selection committee has other criteria based on profitability and liquidity measures, that make this index relatively less volatile and less risky than other small cap stocks. As large cap stocks mirror S&P500 index rather than small stocks portfolio, we find large cap stocks' results matching our primary results. However, Russell 2000 index does have similarities to small stocks portfolio from Fama and French, as this index is heavy on small-and mid-cap stocks. Based on this rationale, we find similar results for Russell 2000 index and small stocks portfolio in Table 4 with significant coefficients for RS and UNEMP economic surprises. The coefficients have similar magnitude and significance level as one standard deviation rise in RS surprise increases small stock returns by 0.222% and R2000 index returns by 0.252% at 5% significance level, for pessimistic investors. One standard deviation rise in UNEMP surprises decreases small stock returns by 0.101% and R2000 index returns by 0.107% at 1% significance level, for investors with bearish sentiment. We find evidence in support of our primary findings, in case of other market indexes than S&P500 and portfolio returns based on market cap and book-to-market ratio.

Low, High, and Medium Sentiment

We find evidence of asymmetric effect of sentiment on how release date stock prices fluctuate as a response to economic announcements. As a robustness check, we form negative and positive investor sentiment in a different way relative to our primary

results. The new results confirm our primary results. We find that key results of this paper are not sensitive to our initial formulation of negative and positive investor sentiment.

We take our stationary daily sentiment measure from Federal Reserve Bank of San Francisco and divide it into low, medium, and high sentiment. The lowest 25% values constitute the low sentiment, highest 25% of the sample are considered high sentiment and the remaining 50% daily sentiment values form the medium sentiment. This is a diversion from our initial formulation of negative and positive sentiment with all values greater than or equal to zero considered as positive sentiment and the remaining considered as negative sentiment values. As a next step, we follow similar methodology as in case of regressions in (2). We form three dummy variables with $H = 1$ for all economic surprises with prior-to-release date sentiment in the high sentiment category, and $H = 0$ otherwise. In a similar fashion, $L = 1$ for all economic surprises at release date t with investors having a low sentiment at $t-1$ and $L = 0$ otherwise. $M = 1$ for economic announcements with medium sentiment and $M = 0$ otherwise. We perform regressions for all six economic indicators of the following form (3): $R_t = \alpha + \beta^L XX_t * L + \beta^H XX_t * H + \beta^M XX_t * M + u_t$

Table 5: OLS regression results for effect of economic surprises on daily stock returns, controlling for low, medium, and high investor sentiment (3).

Economic Surprise	β^L	β^H	β^M
Gross Domestic Product	0.166 (0.228)	0.036 (0.179)	-0.209 (0.227)
Industrial Production	-0.062 (0.105)	-0.02 (0.123)	0.017 (0.187)
Durable Goods	0.211 (0.141)	-0.031 (0.106)	0.135 (0.109)
Retail Sales	0.178** (0.089)	0.132 (0.264)	0.356 (0.402)
Unemployment Rate	-0.066** (0.027)	-0.06 (0.1)	0.227 (0.176)
Continuing Claims	-0.074* (0.044)	-0.535 (0.337)	0.411 (0.454)

Note: 0.10 (*), 0.05 (**) and 0.01 (***) significance levels reported for coefficients

We show results from regressions in (3) in Table 5. The results in Table 5 above confirm primary results as investors with sentiment in lowest 25th percentile of the daily sentiment range, respond to macroeconomic announcements whereas all other investors with medium or high sentiment discard economic news. There is no significant coefficient for GDP, IP & DO surprises for all investors as in Table 2. The significant coefficients for RS, UNEMP & CC surprises for investors, who expect the stock market to fall in the future, in Table 5 (0.178**, -0.066** and -0.074*) are like coefficients for investors with negative sentiment in Table 2 (0.196**, -0.069** and -0.077*). The magnitude and significance of coefficients for low sentiment investors and negative sentiment investors for RS, UNEMP and CC surprises are similar. The similar results in Table 2 and Table 5 confirm our initial hypothesis that investors with bearish view about the stock market, take a rational approach to investing and respond significantly to macroeconomic surprises.

5. Conclusion

We determine that effect of economic surprises on stock returns, is impacted by positive and negative investor sentiment, proxied by daily sentiment by Federal Reserve Bank of San Francisco. We find consistent results with significant coefficients for pessimistic investors, as they make portfolio changes in response to news, and insignificant coefficients for optimistic investors as they ignore news about real economic activity. We conclude that loss averse investors choose to take a cautious approach to investing when they are bearish about overall stock market, unlike when they are bullish about stock market. We find evidence of an asymmetric effect of investor sentiment on how investors respond to economic surprises for S&P500 index, that is confirmed by results for different stock market indexes like NASDAQ-C, R2000 and W5000, and stock portfolios based on book-to-market-ratio and market-cap. The key results hold for an alternative categorization of investor sentiment as low, high, and medium sentiment. The empirical results hold for six real economic indicators in sample; GDP, industrial production, unemployment, retail sales, durable

goods, and continuing jobless claims. There is scope for future research in which the role of sentiment can be explored in case of other real economic indicators.

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