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Macroeconomic surprise, forecast uncertainty, and stock prices

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Macroeconomic Surprise, Forecast Uncertainty, and Stock Prices

By

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Statement of Research Thesis

This paper evaluates the effect of surprises in economic data on stock prices. "Surprises in economic data" refer to the difference between the forecast and initial release actual values relative to the sample forecast error. The analysis addresses three questions. Do surprises in economic data affect stock prices? If there is an effect, is the magnitude of that effect symmetrical for positive and negative surprises? If surprises affect stock prices, how does market forecast uncertainty affect the magnitude of the effect on stock prices?

Significance of Research Thesis

In theory, stock prices are determined by discounting future cash flows. The reality, however, is more nuanced. While theory typically focuses on asset "fundamentals" (e.g. dividends and growth for stocks), there are also many participants in financial markets who speculate on potential market shocks and on short-term changes in prices. However, market participants using both strategies confront the imperfections of real markets. Asymmetric information and limited forecasting ability are among the greatest problems in real markets.

Studying how markets react to new information is worthwhile on three fronts. What information do markets value? Are markets rational? What is the degree of efficiency in real markets? Information valuable to markets is identified by a market reaction. A market adjustment to new information implies that the information has significance in determining stock prices. With regard to whether or not markets are rational, two examples of irrationality are asymmetric market reactions to positive and negative shocks and exaggerated initial market reactions. Efficiency refers to the immediacy with which markets adjust to incorporate new information. This paper does not attempt to evaluate this aspect of markets.

This paper focuses on market reactions to announcements of macroeconomic data. Robust, regular data detailing both market expectations and the announced values are available for nine key macroeconomic indicators: the consumer price index (CPI), nonfarm payroll employment, industrial production (IP), ISM manufacturing (NAPM), real GDP growth, new home sales, retail sales, personal consumption, and orders of durable goods. The data allow for a measure of the surprise to be computed and regressed against a number of approximations for stock prices.

Literature Review

Many papers address the link between economic news and stock prices. One of the earliest, Waud (1970), concludes that stock prices react immediately to changes in the discount rate. Although this study does not distinguish between expected and unexpected changes, it is among the first quantitative studies to verify a link between stock prices and economic news.

Castanias (1979) takes a more focused look at this link and finds that the variance of stock prices increases during trading days surrounding certain macroeconomic announcements. This study is crude in that it uses only dummy variables to denote announcement days. Nevertheless, Castanias (1979) offers support for the hypothesis that economic news affects stock prices. This hypothesis originates from the theory that stock prices incorporate all relevant information. Assuming macroeconomic news is relevant information and that it often differs from expectations, macroeconomic releases should then affect stocks.

Pearce and Roley (1983) is one of the first studies to focus directly on the effects of unanticipated economic news. They find that changes in money supply only affect stock prices when their magnitude or direction is unanticipated. They also find that these market adjustments are complete by the morning of the trading day after the announcement. The paper is limited by

the fact that it only evaluates the market reaction to the money supply. In a subsequent paper, Pearce and Roley (1985) broaden their scope to examine the effects of surprises in the money stock, as well as the consumer price index (CPI), the producer price index (PPI), the unemployment rate, industrial production, and the discount rate.

Chen, Roll, and Ross (1986) examine the extent to which surprises in economic news pose systematic risk to the market. They find that certain macroeconomic announcement surprises influence expected stock returns. However, neither Pearce and Roley (1985) nor Chen, Roll, and Ross (1986) standardize the surprises in economic data. Balduzzi, Elton, and Green (2001) demonstrate that standardization is necessary to allow for direct comparison of the magnitudes of the regression coefficients across different announcements. For example, standardization allows for surprises in nonfarm payroll employment, which is measured in thousands, to be compared to year-over-year (YoY) changes in the consumer price index (CPI), which is reported in percentage terms. Furthermore, it allows for surprises in changes in the CPI to be compared with the real annualized gross domestic product (GDP) growth rate. This is significant because, though both measures of CPI and GDP are in percentage terms, the accuracy with which they are forecasted vary significantly.

Balduzzi, Elton, and Green (2001) find that the releases of 17 macroeconomic variables have a significant impact on certain assets in the bond market. Additionally, they find that bond prices adjust within the first minute following an announcement. Trading volume and volatility increase immediately and remain elevated for up to an hour. Although these findings relate to the bond market rather than the stock market, they support the hypothesis that certain macroeconomic announcements affect asset prices and that markets are perhaps efficient in their response to new information.

Gilbert, Scotti, Strasser, and Vega (2010) examine which qualities of the data and announcements determine the relevance of particular economic releases to financial markets. Specifically, they assess how timeliness, precision, and intrinsic value affect the significance of the effect of economic news on asset prices. Timeliness refers to the median reporting lag[1]. Precision is a gauge of how closely the initial release mirrors later revisions. Intrinsic value is a measure of the correlation between individual macroeconomic variables and the state of the economy.

This paper extends the literature in three respects. 1) It improves upon the previous measure of standardized surprise. 2) It examines the symmetry of market reactions to positive and negative news. 3) It evaluates the relationship between forecast uncertainty and the effect of surprises in economic news.

Research Design and Methods

Measuring Surprise

Before models can be specified, a measure of surprise must be defined. Standardized surprise is used in Balduzzi, Elton, and Green (2001), Andersen, Bollerslev, Diebold, and Vega (2003), and Andersen, Bollerslev, Diebold, and Vega (2007). It refers to the surprise divided by the sample standard deviation. S_{kt} is a matrix representing the standardized surprise associated with indicator k at time t. Andersen, Bollerslev, Diebold, and Vega (2007) define standardized surprise for indicator k at time t as $S_{kt} = \frac{A_{kt} - F_{kt}}{\hat{\sigma}_k}$. A_{kt} denotes the announced value of indicator k at time t. F_{kt} refers to the market's expectation (forecast value) of indicator k at time t, and $\hat{\sigma}_k$ is the sample standard deviation of the surprise component, $A_{kt} - F_{kt}$. Because $\hat{\sigma}_k$ is constant for each indicator k, this standardization does not affect the statistical significance of the estimated

[1] Reporting lag is the time between the end of the reference period (e.g. end of the month or quarter) and the release of the actual indicator value.

response coefficients or the fit of the regressions compared to the results based on the 'raw' surprises. As stated earlier, standardization allows for coefficients to be compared across indicators. Furthermore, it accounts for forecast accuracy, thus making S_{kt} surprise rather than forecast error. Hence, when $|S_{kt}| = 1$, a "normal" surprise occurred for indicator k at time t. When $|S_{kt}| < 1$, a less than "normal" surprise occurred for indicator k at time t. Finally, when $|S_{kt}| > 1$, a greater than "normal" surprise occurred for indicator k at time t. "Normal" is placed in quotes because though here $A_{kt} - F_{kt}$ is divided by $\hat{\sigma}_k$, $A_{kt} - F_{kt}$ could also have been divided by any multiple of $\hat{\sigma}_k$ (e.g. $2\hat{\sigma}_k$ or $3\hat{\sigma}_k$).

Though the variable S_{kt} is a potentially useful representation of surprise, by itself it may not be the best representation. Hypothetically, if the actual GDP growth reported was 1% and the forecasted GDP growth was 2%, the unstandardized surprise ($A_{kt} - F_{kt}$) would equal -1%. Furthermore, if the actual GDP growth rate reported was 9% and the expected GDP growth rate was 10%, the unstandardized surprise would also equal -1%. It is obvious, however, that markets would likely react differently to these surprises.

Ideally, a proportional measure of surprise would replace S_{kt} or would be added in addition to S_{kt}. Unstandardized surprise would be specified as $\left(\frac{A_{kt}-F_{kt}}{F_{kt}}\right)$ rather than $(A_{kt} - F_{kt})$, as in S_{kt}. However, given that for certain indicators, k, there exists an $F_{kt} = 0$ value, this alternative cannot be employed. Instead, the interaction of surprise, S_{kt}, and the forecast value, F_{kt}, is incorporated into each model. The right-hand side of each model begins with the expression in Equation (1).

(1) $\beta_0 + \beta_1 S_{kt} + \beta_2 F_{kt} + \beta_3 S_{kt} F_{kt}$

Table 1: Equation (1) Variable Descriptions

Variable	Description
S_{kt}	Standardized Surprise
F_{kt}	Forecast Variable
$S_{kt}F_{kt}$	Interaction of Surprise and Forecast

As shown in Table 2 and Table 3[2], when β_1 and β_3 have opposite signs, the greater F_{kt}, the lesser the effect of S_{kt}; the lesser F_{kt}, the greater the effect of S_{kt}. When β_1 and β_3 share the same sign, the greater F_{kt}, the greater the effect of S_{kt}; the lesser F_{kt}, the lesser the effect of S_{kt}.

Table 2: Overall Sign for Surprise Term when β_1 is Positive

S (+)	(+)
S (-)	(-)

Table 3: Overall Sign for Interaction Term when β_3 is Negative

	F (+)	F (-)
S (+)	(-)	(+)
S (-)	(+)	(-)

Models

This paper evaluates three aspects of the relationship between economic announcements and stock prices. Consequently, three models are employed. The first model, specified in Equation (2), measures the impact of economic surprises on stock indices.

$$(2)\frac{P_{it}-P_{i(t-1)}}{P_{i(t-1)}} = \beta_0 + \beta_1 S_{kt} + \beta_2 F_{kt} + \beta_3 S_{kt} F_{kt} + \beta_4 V_t + \beta_5 W_{dt} + \beta_6 R_t + \beta_7 C_t + \beta_8 M_t + \varepsilon_t$$

Table 4: Equation (2) Variable Descriptions

Variable	Description
P_{it}	Stock Index Value
V_t	Volatility
W_{dt}	Weekday Dummy
R_t	Recession Dummy
C_t	FOMC Statements Dummy
M_t	FOMC Minutes Dummy

[2] Table 2 and Table 3 display the overall sign of the coefficient multiplied with the variable(s).

P_{it} is the index value of stock index i at the end of trading day t, and $P_{i(t-1)}$ is the index value of stock index i at the end of trading day $t-1$. V_t is a measure of volatility. The Chicago Board Options Exchange's (CBOE) VIX (S&P 500), VXD (Dow Jones Industrial Average), and VXN (NASDAQ 100) are employed when running regressions against their corresponding stock indices. (The VXN is used though it is actually regressed against the NASDAQ Composite rather than the NASDAQ 100.)

W_{dt} is a dummy variable for the day of the week. Gibbons and Hess (1981) find day-of-the-week effects on assets[3]. R_t is a dummy variable for Great Recession effects. R_t is included to account for any broad changes in market behavior that may have resulted from the Great Recession. $R_t = 1$ for all days t between September 15, 2008 and September 20, 2010; otherwise, $R_t = 0$. September 15, 2008 is the date Lehman Brothers filed for Chapter 11 bankruptcy protection; this marked the beginning of a dramatic drop in stock prices. It can be argued that this date marks the day markets first understood a significant recession was imminent. September 20, 2010 is the date the National Bureau of Economic Research (NBER) announced that the recession had ended in June of 2010. September 20th was chosen rather than a date in June because even in September the markets had serious doubts about the strength of the economy. In particular, there was considerable concern about a possible double-dip recession. C_t is a dummy variable denoting days that the Federal Open Market Committee (FOMC) released statements. $C_t = 1$ for all release dates; otherwise, $C_t = 0$. M_t is a dummy variable indicating days that the minutes of the FOMC were released. $M_t = 1$ for all release dates; otherwise, $M_t = 0$. ε_t is the error term at time t.

[3] Inclusion of this dummy precludes the study of weekly economic releases (e.g. initial jobless claims).

The second model is specified in Equation (3). The model tests whether or not the magnitude of stock market responses are symmetric for positive and negative surprises. This model is similar to Equation (2) except it O_{kt} and N_{kt} replace S_{kt}. O_{kt} contains only the positive surprises of indicator k at time t. Negative surprises are assigned a zero value for O_{kt}. N_{kt} includes only the negative surprises of indicator k at time t. Positive surprises are assigned a zero value for N_{kt}. If markets are risk-neutral, the difference between β_1 and β_2 should be statistically insignificant.

$$(3)\frac{P_{it}-P_{i(t-1)}}{P_{i(t-1)}} = \beta_0 + \beta_1 O_{kt} + \beta_2 N_{kt} + \beta_3 F_{kt} + \beta_4 S_{kt} F_{kt} + \beta_5 V_t + \beta_6 W_{dt} + \beta_7 R_t + \beta_8 C_t + \beta_9 M_t + \varepsilon_t$$

Table 5: Equation (3) Variable Descriptions

Variable	Description
O_{kt}	Positive Surprises
N_{kt}	Negative Surprises

The third model is specified in Equation (4). This model tests the relationship between forecast uncertainty and the effect of surprises in macroeconomic announcements on stock indices. It evaluates the question: if surprises affect stock prices, how does market forecast uncertainty affect the magnitude of the effect of surprises in economic data on stock prices? This model is similar to Equation (2) except U_{kt} and $S_{kt}U_{kt}$ are added. U_{kt} is a standardized measure of forecast uncertainty. Similar to S_{kt}, U_{kt} is defined as $U_{kt} = \frac{H_{kt}-L_{kt}}{\hat{\alpha}_k}$. H_{kt} is the survey high value, and L_{kt} is the survey low value. $\hat{\alpha}_k$ is the sample standard deviation of $H_{kt} - L_{kt}$. Though this is a flawed measure of forecast uncertainty and a better measure would be strongly preferred, this measure was chosen due to data limitations. (Ideally, the variance of the forecast survey responses for each indicator at time t would have been used for U_{kt}.)

$$(4)\frac{P_{it}-P_{i(t-1)}}{P_{i(t-1)}} = \beta_0 + \beta_1 S_{kt} + \beta_2 F_{kt} + \beta_3 S_{kt} F_{kt} + \beta_4 U_{kt} + \beta_5 S_{kt} U_{kt} + \beta_6 V_t + \beta_7 W_{dt} + \beta_8 R_t + \beta_9 C_t + \beta_{10} M_t + \varepsilon_t$$

Table 6: Equation (4) Variable Descriptions

Variable	Description
U_{kt}	Standardized Uncertainty
$S_{kt}U_{kt}$	Interaction of Surprise and Uncertainty

Indicators

The models consider nine economic indicators: the CPI, nonfarm payroll employment, industrial production (IP), ISM manufacturing (NAPM), real annualized gross domestic product (GDP)[4], new home sales, retail sales, personal consumption, and durable goods. Descriptions of the indicators are in Table 7. Most of these variables span the work of Pearce and Roley (1985), Chen, Roll, and Ross (1986), Balduzzi, Elton, and Green (2001), and Gilbert, Scotti, Strasser, and Vega (2010). They have been repeatedly studied because each of their releases are believed to trigger a market reaction and are heavily covered by financial media. This reaction stems from the timeliness, precision, and intrinsic value of each indicator. (Recall that intrinsic value is a measure of the correlation between individual macroeconomic variables and the state of the economy.)

Table 7: Full Indicator Descriptions

Full Description
CPI Urban Consumers Less Food & Energy YoY % Change NSA
Nonfarm Payrolls Total MoM Net Change in 000s SA
Industrial Production MoM % Change 2007=100 SA
ISM Manufacturing PMI SA
GDP Chained 2009 Dollars QoQ % Change SAAR – Advanced Release Only
New Single Family Houses Sold Annual Total in 000s SAAR
Adjusted Retail & Food Services Sales MoM % Change SA
Personal Consumption Expenditures Nominal Dollars MoM % Change SA
Durable Goods New Orders Industries MoM % Change SA

[4] Only the advanced release will be studied.

Data

Most of the literature on effects of economic announcements uses data from Money Market Services (MMS). This paper will use forecast survey data from Bloomberg. This data was also used by Gilbert, Scotti, Strasser, and Vega (2010). The data are available on Bloomberg for all of the indicators noted above beginning in January 2004. Hence, the study is conducted for releases that occurred between January 1st, 2004 and December 31st, 2013. It is important to note that for the regressions, dates without releases were excluded from the sample. This produced a sample of 816 days over the 10-year period. Furthermore, for each indicator, observations on non-release dates are assigned zero values. Data for the stock prices are taken from the major stock indices: the Dow Jones Industrial Average, the NASDAQ Composite, and the S&P 500. Initially, the percent change in the indices from open to close on release days was to be used. However, because eight of the nine indicators are announced before 9:30 am ET, when the markets open, the percent change in the indices from close on the previous trading day to close on the release date is employed. This ensures that any market reaction is accounted for in the change in the stock indices. (The FTSE 100 was also studied but was found to be less responsive to US data.) Summary statistics are available in Tables 8 through 11.

Results

Model 1: Surprise

For each model, three regressions were estimated, one for each of the most commonly followed indices: the Dow Jones Industrial Average, the NASDAQ Composite, and the S&P 500. Regression results for Model 1 are presented in Tables 12 through 17. Beginning with the control variables, only the constant (β_0), the recession dummy (R_t), the FOMC statement dates (C_t), and the volatility indices (V_t) are of any significance. Interestingly, R_t has a positive

coefficient. Intuitively, this does not necessarily make sense. However, during this period, the mean percent change for each stock index on days the indices grew (Dow: 0.7148%, NASDAQ: 0.8284%, and S&P: 0.7269%) is higher than the same measure for the rest of the sample period (Dow: 0.6481%, NASDAQ: 0.8069%, and S&P: 0.6538%). Furthermore, with the exception of the S&P 500, the recession period had a higher proportion of days with positive changes (Dow: 55.56%, NASDAQ: 58.02%, and S&P: 54.32%) than the non-recession period (Dow: 55.35%, NASDAQ: 57.03%, and S&P: 58.41%). The FOMC statement dummy is only significant for the NASDAQ Composite, though it would be significant for the S&P 500 at the 6% confidence level. In both instances it is positive and translates to roughly a 0.5% increase in the stock index. Finally, volatility is always significant at the 0.1% confidence level. Across the board, a one-unit increase in volatility leads to roughly a .05% decrease in stock index growth.

With regard to S_{kt}, F_{kt}, and $S_{kt}F_{kt}$, mysteriously F_{kt} is significant for employment and personal consumption expenditure in each regression and for ISM Manufacturing for the NASDAQ Composite regression. It is difficult to conceive of a theoretical justification for this. Theoretically, stock prices immediately incorporate all available relevant information. Hence, it does not make sense that the forecast value by itself, which had been previously released, would affect stock index growth on the indicator announcement date. It is also difficult to interpret $S_{kt}F_{kt}$ for employment. Given both S_{kt} and F_{kt} can be either positive or negative, the interaction, $S_{kt}F_{kt}$, by itself has no clear meaning. The final puzzling Model 1 result is the significant, negative coefficient for surprise for IP. This implies that positive surprises in IP decreased stock index growth.

More in line with expectations, S_{kt} had significant, positive coefficients for retail sales and personal consumption across the three regressions. Additionally, $S_{kt}F_{kt}$ had a significant,

negative coefficient for retail sales. This means that the positive effects of positive surprises in retail sales were tempered by the magnitude of the forecast value. (This is an example of the interaction of surprise and the forecast value mimicking the behavior of a proportional surprise variable.) The results for retail sales and personal consumption are robust because they are consistent across the three regressions.

At the 10% confidence level, surprises in durable goods also become significant across the three regressions. (At the 5% confidence level, surprises in durable goods are only significant when regressed against the Dow Jones Industrial Average.) At the 15% confidence level, surprises in GDP become significant for all three regressions as well. At the 5% confidence level, surprise in GDP is only significant when regressed against the NASDAQ Composite. The interaction of surprise and the forecast value is always significant for GDP at the 5% confidence level. While the interpretation of the interaction coefficient is straightforward when surprise is also significant, the coefficient is more difficult to understand on its own, as is the case for two of the three regressions.

Model 2: Positive vs. Negative Surprise

The Model 2 regression results are similar to those of Model 1. Therefore, analysis of these results will focus exclusively on the positive and negative surprise coefficients. Regression results for Model 2 are displayed in Tables 18 through 23. Consistent throughout the three regressions, only negative surprises in IP are significant at the 5% confidence level, and only positive surprises in GDP are significant at the 10% confidence level. Hence, IP and GDP provide evidence that for at least some indicators, the markets react asymmetrically to positive and negative surprises. Retail sales and personal consumption provide evidence to the contrary. At the 6% confidence level, both positive and negative surprises in retail sales and personal

consumption are significant. (At the 5% confidence level, positive surprises in retail sales and personal consumption are not statistically significant when regressed against the S&P 500.)

Overall, the results suggest that whether or not markets react symmetrically to positive and negative surprises depends on the specific indicator. Thus, markets are not perfectly rational. As stated previously, perfectly rational markets would be risk-neutral and would consistently react symmetrically to positive and negative surprises.

Model 3: Uncertainty

The measure of forecast uncertainty employed in Model 3 is very weak. As stated when specifying the model, it was used for lack of a better measure. As a result, Model 3 regression results suggest little if any relationship between forecast uncertainty and changes in stock prices. Regression results for Model 3 are presented in Tables 24 through 29. Though it is possible that this is actually the case, given how crude U_{kt} is, it is improper to make any conclusions based on these results. Ideally, the variance of the forecast survey responses for each indicator at time t would have been used for U_{kt}.

Conclusion

This paper aims to answer three questions. Do surprises in economic data affect stock prices? If there is an effect, is the magnitude of that effect symmetrical for positive and negative surprises? Finally, if surprises affect stock prices, how does market forecast uncertainty affect the magnitude of the effect of surprises in economic data on stock prices? This paper robustly shows that surprise in retail sales and personal consumption affect stock prices. Interestingly, it presents no evidence that surprises in nonfarm employment affect stock prices and only weak evidence of surprises in GDP affecting stock prices. This paper offers credible support for the notion that the market is not always perfectly rational; the markets reacted asymmetrically to

positive and negative surprises of some indicators (Industrial Production [IP] and Gross Domestic Product [GDP]). Finally, the paper concludes that given how crude U_{kt} is, it is improper to make any conclusions regarding forecasting uncertainty based on Model 3 regression results.

There are three possible explanations as to why financial media cover macroeconomic data releases so heavily while this paper's results suggest markets only react to a few of the indicators. 1) Surprises only have a limited effect on stock prices, and the media attention is a result of politicization of macroeconomic data, especially during times of economic uncertainty. 2) Surprises only affect prices for behavioral reasons. For example, it may be that investors know other investors will react to the surprise, so they react as well. This leads to an immediate change in stock prices following the announcement, but later in the day, investors return to their pre-surprise valuations. In this example, the media might cover the release because they anticipate a significant initial adjustment. 3) Surprises may have a significant impact on prices, but that effect may be muffled by the many other factors affecting prices. Given that the dependent variable is percent change between close of the previous trading day and close of the announcement date and given that all of the announcements occur by 10:00 am ET, many other factors are influencing prices in the six hours between the last release and the market close at 4:00 pm ET. To address this possibility, intra-day price data would be necessary.

In the future, this paper could be extended in three ways. First, intra-day price data could be introduced. Second, a longer sample period could be studied. (The current sample period was chosen because Bloomberg survey data first became consistent for these indicators at the beginning of the sample, just before January 2004.) If revisited in the future, the sample could be expanded to include the new data. Finally, additional controls could be added to the models.

Ideally, the models would control for every factor that influences the stock market. Practically speaking, though not everything can be controlled for, additions can be made to the current controls (e.g. a Hurricane Katrina dummy, a presidential election result dummy, a Libyan intervention dummy, etc.).

Table 8: Summary Statistics - Indicators

Description	Mean	Max	Min	Mean A-E	S=1[5]	n
CPI YoY NSA (%)	1.920	2.900	0.600	-0.003	0.091	120
Nonfarm Payrolls MoM SA (000s)	51.233	431.000	-663.000	-12.113	71.596	120
IP MoM 2007=100 SA (%)	0.150	1.300	-2.800	-0.065	0.415	120
ISM Manufacturing PMI SA	53.293	66.200	32.400	0.305	1.986	120
GDP Chained 2009 Dollars QoQ SAAR (%)	2.163	5.600	-6.300	-0.048	0.265	40
New Home Sales (000s)	675.600	1431.000	250.000	0.341	63.410	120
Retail Sales SA Total MoM Change (%)	0.263	2.700	-2.800	0.008	0.510	120
Personal Consumption MoM SA (%)	0.321	1.300	-1.000	-0.005	0.153	120
Durable Goods MoM SA (%)	0.097	9.900	-13.200	-0.203	2.339	120

Table 9: Summary Statistics - Variables

Description	Mean S	Max S	Min S	Mean H-L	Mean U
CPI YoY NSA (%)	-0.027	3.290	-2.194	0.327	0.878
Nonfarm Payrolls MoM SA (000s)	-0.169	2.626	-2.905	179.742	2.397
IP MoM 2007=100 SA (%)	-0.158	2.653	-4.823	1.112	2.150
ISM Manufacturing PMI SA	0.154	3.727	-3.022	5.017	3.161
GDP Chained 2009 Dollars QoQ SAAR (%)	-0.179	1.886	-2.264	0.738	1.934
New Home Sales (000s)	0.005	3.848	-2.618	107.120	0.915
Retail Sales SA Total MoM Change (%)	0.016	3.528	-2.940	1.508	1.847
Personal Consumption MoM SA (%)	-0.033	2.609	-3.914	0.703	2.579
Durable Goods MoM SA (%)	-0.087	2.522	-3.505	6.489	2.820

Table 10: Summary Statistics – Stock Indices (1/1/04 – 12/31/13)[6]

Description	Mean	Median	Max	Min
Dow Jones Industrial Average	0.0253%	0.0478%	11.0803%	-7.8733%
NASDAQ Composite	0.0388%	0.0887%	11.8059%	-9.1424%
S&P 500	0.0285%	0.0750%	11.5800%	-9.0350%

[5] The "S=1" column in Table 4 represents the $A_{kt} - F_{kt}$ value that equates to $S_{kt} = 1$. This is the magnitude of a "normal" surprise.
[6] Table 6 displays the summary statistics for every day between January 1, 2004 and December 31, 2013. It is not limited to the sample observations.

Table 11: Summary Statistics – Stock Indices (Sample Observations Only)

Description	Mean	Median	Max	Min
Dow Jones Industrial Average	0.0410%	0.1049%	4.6789%	-7.8733%
NASDAQ Composite	0.0544%	0.1440%	5.4891%	-9.1424%
S&P 500	0.0385%	0.1201%	5.1360%	-9.0350%

Table 12: Model 1: Dow Jones Industrial Average Regression Results - Controls

Adjusted R^2 = 0.129	Coefficient[7]	Sig.
Constant	**0.749†**	0.000
W: Tuesday	0.055	0.711
W: Wednesday	0.122	0.395
W: Thursday	0.025	0.861
W: Friday	0.109	0.406
R: Lehman – NBER	**0.240†**	0.044
C: FOMC Statements	0.261	0.233
M: FOMC Minutes	-0.208	0.366
V: Volatility (VXD)	**-0.044†**	0.000

Table 13: Model 1: Dow Jones Industrial Average Regression Results – Independent Variables

	Surprise		Forecast		Surprise*Forecast	
	Coefficient	Sig.	Coefficient	Sig.	Coefficient	Sig.
CPI	-0.016	0.963	0.011	0.845	0.023	0.898
Employment	0.100	0.319	**-0.002†**	0.000	**0.001†**	0.006
IP	**-0.196†**	0.049	-0.317	0.176	**0.641†**	0.001
ISM Manufacturing	-1.122	0.214	0.004	0.076	0.023	0.186
GDP (Advanced)	0.412	0.109	0.004	0.949	**-0.164†**	0.024
New Home Sales	-0.081	0.816	0.000	1.000	0.000	0.945
Retail Sales	**0.361†**	0.000	0.013	0.927	**-0.294†**	0.016
Personal Consumption	**0.387†**	0.006	**-0.602†**	0.011	-0.294	0.359
Durable Goods	**0.224†**	0.038	-0.090	0.096	0.013	0.752

[7] Bolding and a † is used to denote significance at the .05 significance level.

Table 14: Model 1: NASDAQ Composite Regression Results - Controls

Adjusted R^2 = 0.142	Coefficient	Sig.
Constant	**0.961†**	0.000
W: Tuesday	0.164	0.373
W: Wednesday	0.267	0.130
W: Thursday	0.175	0.320
W: Friday	0.274	0.090
R: Lehman – NBER	**0.278†**	0.050
C: FOMC Statements	**0.585†**	0.030
M: FOMC Minutes	-0.169	0.550
V: Volatility (VXN)	**-0.052†**	0.000

Table 15: Model 1: NASDAQ Composite Regression Results – Independent Variables

	Surprise		Forecast		Surprise*Forecast	
	Coefficient	Sig.	Coefficient	Sig.	Coefficient	Sig.
CPI	-0.402	0.338	-0.014	0.842	0.245	0.262
Employment	0.072	0.559	**-0.002†**	0.001	**0.002†**	0.002
IP	**-0.290†**	0.018	-0.069	0.809	**0.775†**	0.001
ISM Manufacturing	-0.396	0.721	**0.006†**	0.039	0.010	0.617
GDP (Advanced)	**0.731†**	0.020	0.043	0.550	**-0.247†**	0.006
New Home Sales	-0.074	0.863	0.000	0.390	0.000	0.943
Retail Sales	**0.412†**	0.001	-0.025	0.889	**-0.430†**	0.004
Personal Consumption	**0.483†**	0.006	**-0.761†**	0.009	-0.257	0.515
Durable Goods	0.219	0.098	-0.126	0.058	0.038	0.440

Table 16: Model 1: S&P 500 Regression Results - Controls

Adjusted R^2 = 0.135	Coefficient	Sig.
Constant	**0.832†**	0.000
W: Tuesday	0.099	0.548
W: Wednesday	0.169	0.287
W: Thursday	0.098	0.534
W: Friday	0.191	0.188
R: Lehman – NBER	**0.310†**	0.020
C: FOMC Statements	0.456	0.059
M: FOMC Minutes	-0.168	0.506
V: Volatility (VIX)	**-0.048†**	0.000

Table 17: Model 1: S&P 500 Regression Results – Independent Variables

	Surprise		Forecast		Surprise*Forecast	
	Coefficient	Sig.	Coefficient	Sig.	Coefficient	Sig.
CPI	-0.162	0.666	-0.013	0.841	0.113	0.563
Employment	0.050	0.655	**-0.002†**	0.000	**0.001†**	0.007
IP	-0.199	0.070	-0.255	0.324	**0.623†**	0.003
ISM Manufacturing	-0.725	0.467	0.004	0.073	0.016	0.396
GDP (Advanced)	0.442	0.118	-0.005	0.940	**-0.164†**	0.041
New Home Sales	-0.025	0.947	0.000	0.991	0.000	0.899
Retail Sales	**0.378†**	0.001	-0.026	0.873	**-0.358†**	0.008
Personal Consumption	**0.409†**	0.009	**-0.652†**	0.012	-0.279	0.431
Durable Goods	0.213	0.074	-0.103	0.084	0.025	0.577

Table 18: Model 2: Dow Jones Industrial Average Regression Results - Controls

Adjusted R^2 = 0.129	Coefficient	Sig.
Constant	**0.724†**	0.000
W: Tuesday	0.073	0.629
W: Wednesday	0.124	0.400
W: Thursday	0.039	0.789
W: Friday	0.080	0.562
R: Lehman – NBER	**0.251†**	0.038
C: FOMC Statements	0.276	0.212
M: FOMC Minutes	-0.196	0.397
V: Volatility (VXD)	**-0.045†**	0.000

Table 19: Model 2: Dow Jones Industrial Average Regression Results – Independent Variables

	Positive Surprise		Negative Surprise		Forecast		Surprise*Forecast	
	Coefficient	Sig.	Coefficient	Sig.	Coefficient	Sig.	Coefficient	Sig.
CPI	-0.021	0.951	0.154	0.736	0.041	0.583	-0.019	0.921
Employment	0.250	0.144	-0.022	0.881	**-0.002†**	0.000	**0.001†**	0.004
IP	0.044	0.847	**-0.301†**	0.024	-0.443	0.093	**0.490†**	0.032
ISM Manufacturing	-1.243	0.176	-1.113	0.226	0.005	0.090	0.024	0.167
GDP (Advanced)	0.532	0.078	0.199	0.645	-0.014	0.839	-0.133	0.147
New Home Sales	-0.159	0.697	-0.058	0.875	0.000	0.829	0.000	0.891
Retail Sales	**0.300†**	0.046	**0.419†**	0.005	0.043	0.774	**-0.273†**	0.028
Personal Consumption	**0.527†**	0.035	**0.323†**	0.042	**-0.670†**	0.016	-0.382	0.283
Durable Goods	0.317	0.091	0.154	0.340	-0.089	0.102	-0.004	0.936

Table 20: Model 2: NASDAQ Composite Regression Results - Controls

Adjusted R^2 = 0.129	Coefficient	Sig.
Constant	**0.923†**	0.000
W: Tuesday	0.178	0.338
W: Wednesday	0.251	0.165
W: Thursday	0.171	0.339
W: Friday	0.210	0.213
R: Lehman – NBER	0.280	0.053
C: FOMC Statements	**0.606†**	0.026
M: FOMC Minutes	-0.156	0.584
V: Volatility (VXN)	**-0.054†**	0.000

Table 21: Model 2: NASDAQ Composite Regression Results – Independent Variables

	Positive Surprise		Negative Surprise		Forecast		Surprise*Forecast	
	Coefficient	Sig.	Coefficient	Sig.	Coefficient	Sig.	Coefficient	Sig.
CPI	-0.411	0.328	-0.372	0.506	0.014	0.882	0.243	0.311
Employment	0.357	0.090	-0.162	0.376	**-0.002†**	0.001	**0.002†**	0.001
IP	-0.004	0.988	**-0.427†**	0.009	-0.182	0.572	**0.615†**	0.028
ISM Manufacturing	-0.522	0.644	-0.432	0.702	0.007	0.056	0.012	0.569
GDP (Advanced)	**0.855†**	0.021	0.628	0.237	0.045	0.604	**-0.240†**	0.033
New Home Sales	-0.246	0.623	-0.039	0.932	0.000	0.343	0.000	0.941
Retail Sales	**0.427†**	0.021	**0.384†**	0.038	-0.005	0.976	**-0.424†**	0.005
Personal Consumption	**0.652†**	0.033	**0.393†**	0.044	**-0.805†**	0.019	-0.352	0.420
Durable Goods	0.416	0.071	0.063	0.750	-0.126	0.059	0.009	0.883

Table 22: Model 2: S&P 500 Regression Results - Controls

Adjusted R^2 = 0.129	Coefficient	Sig.
Constant	**0.808†**	0.000
W: Tuesday	0.116	0.487
W: Wednesday	0.162	0.318
W: Thursday	0.105	0.515
W: Friday	0.153	0.311
R: Lehman – NBER	**0.317†**	0.019
C: FOMC Statements	0.470	0.054
M: FOMC Minutes	-0.156	0.543
V: Volatility (VIX)	**-0.049†**	0.000

Table 23: Model 2: S&P 500 Regression Results – Independent Variables

	Positive Surprise		Negative Surprise		Forecast		Surprise*Forecast	
	Coefficient	Sig.	Coefficient	Sig.	Coefficient	Sig.	Coefficient	Sig.
CPI	-0.169	0.654	-0.025	0.960	0.015	0.861	0.080	0.711
Employment	0.220	0.245	-0.089	0.588	**-0.002†**	0.000	**0.001†**	0.004
IP	0.060	0.811	**-0.314†**	0.032	-0.387	0.183	0.463	0.065
ISM Manufacturing	-0.804	0.428	-0.748	0.461	0.005	0.124	0.017	0.370
GDP (Advanced)	0.561	0.092	0.255	0.593	-0.019	0.809	-0.138	0.173
New Home Sales	-0.138	0.760	-0.005	0.989	0.000	0.832	0.000	0.984
Retail Sales	0.316	0.057	**0.435†**	0.009	0.004	0.981	**-0.337†**	0.014
Personal Consumption	0.517	0.060	**0.355†**	0.043	**-0.688†**	0.025	-0.341	0.385
Durable Goods	0.356	0.085	0.105	0.556	-0.104	0.085	0.001	0.989

Table 24: Model 3: Dow Jones Industrial Average Regression Results - Controls

Adjusted R^2 = 0.135	Coefficient	Sig.
Constant	**0.724†**	0.000
W: Tuesday	0.042	0.780
W: Wednesday	0.078	0.602
W: Thursday	-0.020	0.891
W: Friday	0.023	0.874
R: Lehman – NBER	0.219	0.072
C: FOMC Statements	0.265	0.231
M: FOMC Minutes	-0.252	0.280
V: Volatility (VXD)	**-0.043†**	0.000

Table 25: Model 3: Dow Jones Industrial Average Regression Results – Independent Variables

	Surprise		Forecast		Surprise*Forecast		Uncertainty		Surprise*Uncertainty	
	Coefficient	Sig.	Coefficient	Sig.	Coefficient	Sig.	Coefficient	Sig.	Coefficient	Sig.
CPI	-0.084	0.817	-0.004	0.960	0.056	0.766	0.038	0.731	-0.001	0.988
Employment	0.035	0.898	**-0.002†**	0.000	**0.001†**	0.004	0.064	0.271	0.030	0.769
IP	**0.971†**	0.003	-0.365	0.139	-0.279	0.372	0.080	0.165	**-0.372†**	0.000
ISM Manufacturing	-1.068	0.288	0.003	0.628	0.025	0.149	0.020	0.825	-0.065	0.513
GDP (Advanced)	0.187	0.750	-0.019	0.800	-0.138	0.116	0.098	0.418	0.085	0.722
New Home Sales	-0.057	0.876	0.000	0.703	0.000	0.820	0.096	0.598	-0.070	0.701
Retail Sales	0.226	0.369	0.024	0.873	-0.228	0.155	-0.012	0.851	0.055	0.583
Personal Consumption	**0.918†**	0.007	**-0.686†**	0.020	-0.440	0.186	0.066	0.213	-0.179	0.099
Durable Goods	0.226	0.504	-0.088	0.147	0.001	0.986	0.025	0.615	0.000	0.999

Table 26: Model 3: NASDAQ Composite Regression Results - Controls

Adjusted R^2 = 0.151	Coefficient	Sig.
Constant	**0.919†**	0.000
W: Tuesday	0.143	0.441
W: Wednesday	0.216	0.239
W: Thursday	0.131	0.475
W: Friday	0.168	0.334
R: Lehman – NBER	0.213	0.141
C: FOMC Statements	**0.613†**	0.024
M: FOMC Minutes	-0.218	0.447
V: Volatility (VXN)	**-0.053†**	0.000

Table 27: Model 3: NASDAQ Composite Regression Results – Independent Variables

	Surprise		Forecast		Surprise*Forecast		Uncertainty		Surprise*Uncertainty	
	Coefficient	Sig.	Coefficient	Sig.	Coefficient	Sig.	Coefficient	Sig.	Coefficient	Sig.
CPI	-0.689	0.123	-0.071	0.460	0.345	0.133	0.216	0.110	0.084	0.298
Employment	0.148	0.657	**-0.002†**	0.001	**0.002†**	0.002	0.085	0.229	-0.029	0.813
IP	**0.954†**	0.016	-0.107	0.723	-0.182	0.635	0.095	0.183	**-0.395†**	0.001
ISM Manufacturing	-0.617	0.616	0.003	0.667	0.018	0.392	0.059	0.604	-0.068	0.578
GDP (Advanced)	0.693	0.335	0.048	0.597	**-0.258†**	0.016	0.061	0.679	0.041	0.889
New Home Sales	-0.085	0.849	0.000	0.960	0.000	0.984	0.147	0.512	-0.033	0.883
Retail Sales	0.032	0.917	-0.063	0.732	-0.264	0.178	0.060	0.434	0.163	0.186
Personal Consumption	**1.240†**	0.003	**-1.061†**	0.003	-0.529	0.194	**0.150†**	0.021	-0.245	0.065
Durable Goods	0.421	0.310	-0.107	0.147	0.005	0.936	0.045	0.455	-0.068	0.611

Table 28: Model 3: S&P 500 Regression Results - Controls

Adjusted R^2 = 0.138	Coefficient	Sig.
Constant	**0.785†**	0.000
W: Tuesday	0.082	0.623
W: Wednesday	0.125	0.449
W: Thursday	0.057	0.729
W: Friday	0.099	0.528
R: Lehman – NBER	**0.274†**	0.044
C: FOMC Statements	0.469	0.055
M: FOMC Minutes	-0.220	0.393
V: Volatility (VIX)	**-0.048†**	0.000

Table 29: Model 3: S&P 500 Regression Results – Independent Variables

	Surprise		Forecast		Surprise*Forecast		Uncertainty		Surprise*Uncertainty	
	Coefficient	Sig.	Coefficient	Sig.	Coefficient	Sig.	Coefficient	Sig.	Coefficient	Sig.
CPI	-0.311	0.440	-0.042	0.628	0.166	0.422	0.091	0.453	0.036	0.621
Employment	-0.041	0.890	**-0.002†**	0.000	**0.001†**	0.005	0.072	0.262	0.039	0.727
IP	**0.964†**	0.007	-0.317	0.244	-0.312	0.367	0.102	0.110	**-0.368†**	0.001
ISM Manufacturing	-0.731	0.510	0.004	0.522	0.020	0.313	0.012	0.903	-0.061	0.582
GDP (Advanced)	0.409	0.528	-0.021	0.795	-0.150	0.120	0.091	0.495	0.003	0.990
New Home Sales	-0.003	0.995	0.000	0.769	0.000	0.948	0.101	0.618	-0.082	0.684
Retail Sales	0.229	0.411	-0.018	0.912	-0.289	0.102	0.008	0.909	0.062	0.575
Personal Consumption	**1.063†**	0.004	**-0.776†**	0.017	-0.465	0.206	0.090	0.122	-0.219	0.067
Durable Goods	0.260	0.487	-0.097	0.146	0.010	0.864	0.032	0.552	-0.015	0.899

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