Stock Returns on Post-Macroeconomic Announcement Days

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Abstract

We document that on the two days following macroeconomic news announcements, the stock market has negative excess returns, and the security market line has a significantly negative slope. These findings concentrate on days after bad macroeconomic news, which indicates that the market does not fully incorporate negative macro shocks on the announcement day. The underreaction effect is stronger among stocks with higher information uncertainty, tighter short-selling constraints, and when intermediary capital is scarce, consistent with the theory of limits to arbitrage. Considering the underreaction effect, we argue that the risk premium on macroeconomic announcement days is lower than previously believed.

Keywords: Stock market return; Macroeconomic news announcement; Underreaction; Limits of arbitrage; Information uncertainty; Short-selling constraints

1. Introduction

Recent literature has documented high stock market returns and a positive beta-return relationship on days with important pre-scheduled macroeconomic announcements (see Savor and Wilson 2013; 2014). A common interpretation of these findings is that announcement days are fundamentally riskier than other days (Ai and Bansal 2018; Ai et al. 2019; Wachter and Zhu 2018). Therefore, investors demand a higher expected return on those days.

In this paper, we argue that the high average return on announcement days is a result of the market's slower incorporation of bad macroeconomic news (news that moves the market downwards) compared to good news.[1] In particular, we hypothesize that on days with bad macro news, stock prices do not decline enough to reflect the full extent of the shock, and therefore continue to fall on the following days. The slow absorption of bad news leads to a higher average return on announcement days and a lower average return on subsequent days. Moreover, this mechanism should be stronger for high-beta stocks that have a higher exposure to the market, which leads to an overestimation of the relationship between beta and returns on announcement days.

We find strong empirical evidence supporting the above hypothesis. Specifically, we show that the stock market tends to have lower returns on post-announcement days than on other trading days. High-beta stocks also underperform low-beta stocks on these days, leading to a negative slope of the security market line (SML). Moreover, the effect concentrates on days after bad macroeconomic announcements, which we identify based on the realized market return or the difference between the consensus forecast and the actual news release. These findings indicate that the market underreacts to bad macro news

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[1] Using firm-level news. Edmans, Goldstein, and Jiang (2015), Hong, Lim, and Stein (2000), Heston and Sinha (2017), and Cen, Wei, and Yang (2017) have shown that stock prices incorporate bad news more slowly than good news.

on the announcement day. To investigate the underlying mechanism, we find that the underreaction effect is stronger among stocks with more information uncertainty, greater short-selling constraints, and when the intermediary capital is scarce, consistent with the theory on limits to arbitrage. To take into account the underreaction effect, we show that the market return and the slope of the SML over the three-day announcement window are not significantly different from other trading days. This means that the effect of macro announcements on the market risk premium is much weaker than previously thought.

Our empirical analysis begins with identifying days with important macroeconomic news releases, which we label as A days. We follow Savor and Wilson (2014) and select those days with announcements about inflation, unemployment, and interest rate decision. We then define the two trading days after an announcement day as post-announcement days, which account for about one-fifth of all trading days in our sample. Throughout the paper, we refer to those post-announcement days as A+1 and A+2 day. We require post-announcement days to not overlap with another macro announcement day to avoid potential confounding effects.

We document that in our sample from 1964 to 2019, the average market return on post-announcement days is negative and significantly lower than other trading days. In particular, the daily CRSP valued-weighted market excess return is -1.07 basis points per day on post-announcement days, which is 4.61 basis points lower than on other days. Moreover, we find that the low returns concentrate on days after bad macroeconomic news. Specifically, we classify macroeconomic news as good or bad based on whether the announcement-day market return is above or below 0. The market return is -6.02 basis points on days after bad macroeconomic news, which is 9.55 basis points lower than other trading days, whereas after good news, the market return is not significantly different from other days. The low return after bad news is consistent with our hypothesis that the market does not fully reflect bad macro news on announcement days and continues to move downward on post-announcement days. Moreover, the return pattern after good news shows that the market fairly reflects good macroeconomic news.

As the market continues to decline after bad macro news on A+1 and A+2 days, one would expect that high-beta stocks, which are more sensitive to the market return, underperform compared to low-beta stocks. Therefore, the beta-return relationship should be negative on post-announcement days. We confirm this prediction and show that the slope of the SML on A+1 and A+2 days is negative, especially after bad macroeconomic news. Specifically, the SML has an average slope of -6.41 basis points per day over post-announcement days, with a t-statistic of -2.79. Especially, on days after bad news, the slope becomes -15.71 (t-statistic of -4.36). In contrast, the slope of the SML is 0.72 on days after good macroeconomic news, insignificantly different from 0.

Our results are robust to an alternative method to classify macroeconomic news. In particular, we compare the actual announcement with Bloomberg consensus forecast to determine whether a macroeconomic announcement is good or bad. Due to data limitations, we have a shorter sample period from 1997 to 2019. With this classification, the average market excess return is 10.38 basis points lower on post-announcement days after bad macroeconomic news (t-statistics of -2.13), while after good macroeconomic news, the market return is not significantly different from the other days. The results on the SML are also similar using this approach.

The finding of lower returns on post-announcement days is robust across portfolios sorted by size, book-to-market, and momentum. In particular, returns on all book-to-market deciles, all momentum deciles, and nine of the ten size deciles are significantly lower on post-announcement days after bad macroeconomic news. In contrast, the return after good news is not significantly different from the other days across all test portfolios. Moreover, the negative slope of the SML on post-announcement days is also robust to using a sample of 55 test portfolios including 10 beta-sorted portfolios, 25 size and book-to-market double-sorted portfolios, 10 momentum-sorted portfolios, and 10 Fama-French industry portfolios.

We next investigate the underlying mechanism that explains the underreaction to bad news. Barberis, Shleifer, and Vishny (1998), Daniel, Hirshleifer, and Subrahmanyam (1998), and Hong and Stein (1999) argue that behavioural biases like conservatism and overconfidence lead to an underreaction to information. Zhang (2006) shows evidence that the effect of the biases is stronger when investors are uncertain about the impact of news on stock valuation. Therefore, we expect that the underreaction effect is stronger among stocks that have greater information uncertainty. We use ROE volatility, cash flow volatility, and analyst forecast dispersion to proxy a firm's information uncertainty. We also show that stocks with greater information uncertainty experience lower returns after negative macro news. Moreover, we consider short-selling constraints as a major obstacle that arbitrageurs face when trading on bad news. We find that the underreaction effect is more pronounced for stocks with lower institutional ownership, which is a proxy for short-selling constraints. These results suggest that firm uncertainty and short-sales constraints delay the flow of information into stock prices, causing an underreaction to bad news.

To provide further support of the role of limits to arbitrage, we exploit the variation in funding conditions over time. We use the leverage index developed by Adrian, Etula, and Muir (2014) as a proxy of intermediary capital. The index measures shocks to the leverage of financial intermediaries, and a negative leverage shock arguably decreases the risk-bearing capacity and increases funding constraints, which reduces the incentive of arbitrageurs to correct mispricing. We find that when market-wide funding constraints are tighter, the pattern of high returns on A days and low returns on A+1 and A+2 days is more pronounced, indicating a greater degree of underreaction to bad news. In particular, over quarters after negative leverage shocks, the average market return on announcement days is 11.78 basis points higher than other trading days and the market return on post-announcement days is 6.75 basis points lower. In contrast, over quarters after positive leverage shocks, announcement-day and post-announcement-day average market returns are both insignificantly different from other trading days. The SML also exhibits similar patterns as the market return following intermediary leverage contraction and expansion. These findings suggest that when funding constraints tighten, the market has limited capacity to process and incorporate negative macroeconomic news.

The evidence that the stock market underreacts to bad macro news has important implications for estimating expected returns and the beta-return relationship on announcement days. Savor and Wilson (2013; 2014) find that the market return is extraordinarily high, and the slope of the SML is significantly positive on announcement days. However, if the market does not fully incorporate bad news on A days, the average realized market return will overstate the announcement-day expected return. Moreover, the impact will be stronger for stocks more sensitive to macro news and market returns, i.e., high-beta stocks, which leads to an overestimation of the relationship between beta and returns. To address the underreaction effect, we study market returns during the three-day announcement window, combining A days with both A+1 and A+2 days. We find that the three-day average market return and the slope of the SML are not significantly different from the other days. These results indicate that market underreaction to bad news plays an important role in the high return and positive beta-return relation on announcement days.

We contribute to three strands of literature. First, our paper contributes to the literature on stock return response to new information. It is well-known from the post-earnings announcement drift literature, e.g., Bernard and Thomas (1989), that earnings news is not always reflected in stock prices immediately after release. Chan (2003) shows that there is a subsequent drift in stock prices after a specific company was mentioned in news article headlines. Savor (2012) finds evidence of an underreaction to information conveyed in sell-side analyst reports. Using news stories about S&P 500 firms, Frank and Sanai (2018) show that investors typically overreact to good and underreact to bad firm-specific news. Edmans, Goldstein, and Jiang (2015), Hong, Lim, and Stein (2000), Heston and Sinha (2017), and Cen, Wei, and Yang (2017) find stronger return underreaction to bad news than good news at the firm-level. Johnson and So (2018) propose that asymmetric trading cost explains asymmetric return reactions to earnings news. Brooks et al. (2018)'s findings show that bond returns underreact to new information from interest rate changes. Several papers study the implication of delayed reactions to news on stock returns. Dimson (1979) first shows that an estimated beta is biased when the stock price does not reflect new information immediately. Boguth et al. (2016) show that an estimated alpha of a portfolio can be biased when stock prices have slow reactions to information. We contribute to this literature by documenting that the stock market has an asymmetric response to important macroeconomic news and that it causes a biased estimation of announcement-day risk premium and the slope of the SML.

Our paper is also related to the recent literature on asset price patterns around macroeconomic news announcements. Savor and Wilson (2013) document that the stock market has substantially higher returns and Sharpe ratios on days with announcements about employment situation, inflation, and FOMC meetings. Savor and Wilson (2014) show that the relation between market beta and stock returns is significantly positive on those macro announcement days. Focusing only on FOMC announcements, Lucca and Moench (2015) find large excess returns on US equities in the 24-hour window before the FOMC releases their decisions. Cieslak, Morse, and Vissing-Jorgensen (2019) find that the market has high returns in even weeks in an FOMC cycle and low returns in odd weeks. Our paper investigates stock returns on days after macroeconomic news announcements and proposes a new explanation for the high market return and positive beta-return relationship on announcement days.

Finally, our paper contributes to the large literature that studies the empirical failure of the CAPM. Fama and French (1992) provide convincing evidence that the unconditional CAPM is inadequate to explain stock returns in the cross-section. Lewellen and Nagel (2006) show that allowing for time-varying beta does not resurrect the CAPM. Frazzini and Pedersen (2014) develop a trading strategy to show that betting against the CAPM beta produces large abnormal returns. Christoffersen and Simutin (2017) document that delegated portfolio managers with a strong mandate to beat a benchmark prefer to invest in high-beta stocks. Also, Hong and Sraer (2018) find that speculators prefer to use high-beta stocks to make macroeconomic bets, increasing the price of high-beta stocks when aggregate disagreement is high. Furthermore, Favilukis and Zhang (2020) show that high-beta stocks have more momentum trading opportunities, attracting greater demand from momentum traders. Recently, several papers find evidence of the success of the CAPM in specific settings. Liu, Stambaugh, and Yu (2018) find that the CAPM beta positively predicts stock returns among stocks with low idiosyncratic volatility. A paper that is more related to ours is Hendershott, Livdan, and Rosch (2018), who find that the SML has a positive slope overnight. Our paper contributes to this literature by showing that high-beta stocks have a more delayed response to negative macroeconomic news, which causes the SML to have a positive slope on macro announcement days and a negative slope on post-announcement days.

2. Data and methodology

We collect dates with pre-scheduled macroeconomic news announcements about employment situation, inflation, and the Federal Open Market Committee (FOMC) meetings, consistent with Savor and Wilson (2013; 2014). News release dates for employment and inflation are from the Bureau of Labour Statistics (BLS) website. Following Savor and Wilson (2013), we use consumer price index (CPI) announcements as inflation news before February 1972 and use producer price index (PPI) thereafter. The reason is that PPI is released a few days earlier than CPI after 1972. News release dates for FOMC decisions are available from the Federal Reserve's website, starting from 1978. Before 1994, we assume that the FOMC decision is made on the first trading day after its meeting, as in Kuttner (2001). Our sample period starts from 1964 and ends in 2019, during which we have 654 employment announcements, 677 inflation announcements, and 340 FOMC announcements. Overall, we have a total of 1,621 days with at least one macroeconomic announcement during our sample period.

We define post-announcement days as the first (A+1) and second (A+2) days after a macro announcement day. We also require A+1 and A+2 days to not overlap with the next announcement day, avoiding any confounding effect. Our sample contains a total of 2,952 post-announcement days. Panel A of Table 1 provides a detailed breakdown of different types of trading days in our sample. As shown in the table, A days account for 11% of all trading days, and post-announcement days account for 21%. We also separate macro news into good or bad based on announcement-day market returns. In particular, a news announcement is good (bad) if the market return on the announcement day is above (below) zero. As a robustness check, we also use the Bloomberg consensus forecast to classify news.

Panel B of Table 1 reports the average market excess return on different types of trading days. On A days, the average return is 9.37 basis point and significantly positive. A+1 and A+2 days have an average return of -1.07 per day. On post-announcement days after bad news, the average return is -6.02, with a t-statistic of -1.82. The other days that are not announcement days nor post-announcement days have an average return of 2.54, with a t-statistic of 2.59. The results suggest that post-announcement days have an average return lower than not only announcement days, but the other days, especially after bad macro news.

We also obtain data on individual stock returns from the Center for Research in Security Prices (CRSP) database and accounting data from the COMPUSTAT. We obtain factors returns (e.g., market, HML, SMB, UMD), the risk-free rate, and returns of characteristics-sorted portfolios (e.g., 10 momentum, 10 industry, and 25 size and book-to-market portfolios) from Kenneth French's website. We construct the daily return series of beta-sorted portfolios. At the beginning of each month, we sort stocks into ten decile portfolios based on their pre-ranking CAPM beta according to NYSE breakpoints. We estimate each stock's pre-ranking beta based on its monthly returns in the past five years. We require a stock to have at least 36 non-missing returns during the estimation period. After forming these portfolios, we compute each portfolio's daily value-weighted returns. To estimate a portfolio's CAPM beta, we perform a rolling regression for each month that regresses the portfolio's past-60 monthly returns on the market return.

3. Post-macro announcement returns

3.1 Market excess returns

We first show that the average market excess return is significantly lower on post-announcement days compared to the other days. We perform regressions of market excess returns on dummy variables for announcement or post-announcement days. Table 2 reports the results. Column 1 shows that market returns are significantly lower on post-announcement days, with the coefficient being -4.61 basis points per day and a t-statistic of -2.15. With the intercept being

3.53, the market experiences lower returns on average on post-announcement days.

To further investigate the source of market decline on post-announcement days, we distinguish between good and bad macro news based on announcement-day market returns. In particular, a news announcement is good (bad) if the market return on the announcement day is above (below) zero (alternative breakpoints such as historical mean gives similar results). Column 2 shows that on days after bad macro news, the market return is significantly lower by -9.55, with a t-statistic of -2.78. In contrast, the coefficient for days following good news is close to zero and insignificant. Therefore, the low market returns on post-announcement days mainly occur on those after bad news. Column 3 includes an A day dummy and dummy variables indicating whether it is after good or bad macroeconomic announcements. Similar to Column 2, the results suggest that market returns on days after bad macro news are significantly and economically lower than on the other days.

Ernst, Gilbert, and Hrdlicka (2019) argue that macro-announcement days can have high returns not because they are special, but as a result of the timing within a month. Therefore, we control for day-of-month fixed effects in Column 4. The coefficient on the A+1 and A+2 days after bad news is still significantly negative, with a magnitude similar to Column 3. Therefore, the lower returns on days after bad news are robust to the timing within a month.

The results so far suggest that on A days the market underreacts to bad news. As a result, the market continues to decline during post-announcement days. Meanwhile, we note that on days after good macro news, the average market return is similar to the other days. It indicates that the market does not underreact (or overreact) to good macro news. Similar to our findings, Hong, Lim, and Stein (2000), Heston and Sinha (2017), and Cen, Wei, and Yang (2017) also find that bad company news receives a more delayed reaction than good news. We discuss in detail the asymmetry and the underlying mechanism in Section 4.

3.2 Beta and return relationship

As the average market return is negative on post-announcement days, we expect the relationship between beta and return to be negative as well on those days, in contrast to the positive relation on announcement days. We first employ beta-sorted decile portfolios and conduct a Fama-MacBeth regression of portfolio returns on different types of trading days. The returns of each portfolio are value-weighted. The independent variable is portfolio beta. We also use a pooled regression on beta and dummy variables indicating the type of trading days. The dummy variables allow us to directly test whether the coefficient on beta is significantly different on the announcement and post-announcement days. In the pooled regression we control for time fixed effects and cluster standard errors by trading days to adjust for the correlation of the residuals.

Table 3 presents the results. Column 1 and Column 2 of Panel A report the Fama-MacBeth regression. Column 1 shows that the coefficient on beta, i.e., the slope of the SML, on A days is 11.57 basis points with a t-statistic of 3.90. The intercept is -2.16 basis points and insignificantly different from 0. The positive slope and insignificant intercept are consistent with Savor and Wilson (2014). However, Column 2 shows that on post-announcement days the SML has a significantly negative slope of -6.41 basis points per day with a t-statistic of -2.79. Moreover, the cumulative magnitude of the negative slope on A+1 and A+2 days is as large as the positive slope on A days. In Column 3, the coefficient on the interaction of an announcement day dummy with beta is significantly positive at 7.37, consistent with Column 1 and the prior literature. However, the coefficient on the interaction of a post-announcement day dummy with beta is significantly negative at -7.67 with a t-statistic of -2.78. Therefore, high-beta stocks perform significantly poorer on post-announcement days than on any other day.

Since the low market return after macro announcements concentrates on days after bad news, we expect that the negative relationship between beta and return also concentrates on these days. Panel B confirms that prediction. Column 1 of Panel B shows that the beta coefficient on days after good news is only 0.72, with a t-statistic of 0.24. As Column 2 shows, however, on days after bad news the coefficient on market beta is -15.71 with a t-statistic of -4.36. Next, Column 3 conducts a pooled regression using all trading days. The coefficient on the interaction between dummy variable of days following bad news and beta is -14.97 with a t-statistic -3.69, while the interaction between days after good news and beta is insignificantly different from zero. Therefore, the negative relationship between beta and return concentrates on days after bad macro news.

Figure 1 plots the SML using 10 beta-sorted portfolios. In Panel A, the y-axis represents the average excess return of each portfolio on A days, post-announcement days (A+1 and A+2), or the other days. The x-axis represents the average estimated beta for each portfolio over the entire sample period from 1964 to 2019. This figure clearly shows a strong upward slope of the announcement-day SML and a strong downward slope of the post-announcement SML. As for the other days, the SML has a slope essentially close to zero. Panel B plots the SML on post-announcement days after good or bad macroeconomic news. It is clear from the graph that the slope of SML is strongly downward sloping after bad macroeconomic announcements. In particular, the return of the top beta-decile portfolio is below 15 basis points per day on the two days after bad macro-news. After good news, the SML is rather flat. The unconditional SML is the average of the two, which has a negative slope.

In summary, this section shows that the beta-return relationship is significantly negative on post-announcement days, especially after bad macro news. It is consistent with the idea that due to an underreaction to bad news on announcement days, share prices will decline on post-announcement days, especially for high-beta stocks that are more sensitive to macro news.

3.3 Robustness

In this section, we conduct robustness tests on our findings. We first use an alternative measure of good or bad macroeconomic announcements. We then examine if our results are robust across portfolios sorted on various characteristics.

Defining good or bad news based on the market reaction has the advantage that we do not need to make assumptions about how the market should interpret macroeconomic news, because interpreting the content of macroeconomic news is a complicated business. Law, Song, and Yaron (2018) show evidence that the impact of macro news announcements on stock returns depends on the stage of the economy. Still, we show that our results are robust to using actual news releases vs. consensus forecasts to identify the sign of the news. To do this test, we collect data from Bloomberg. The data we collect are the actual announcement release and median forecast before the release about CPI/PPI, non-farm payroll, and FOMC interest rate. We define bad news about employment if the actual non-farm payroll is lower than its median forecast. We define bad news about CPI/PPI and FOMC interest rate if the actual release is above the median forecast.

Due to data limitations, our sample period in this test is only from 1997 to 2019. Using this alternative definition of good and bad news, we report the results in Table 4. The results are similar to our main results. In Panel A, we report the market excess return on different days. On post-announcement days, the market return is reduced by 8.12 basis points (t-statistic of -2.13). Especially, the reduction concentrates on days after bad macro news, where the market return is lower by 10.38 basis points (t-statistic of -2.13). In Panel B, we estimate the SML on different days. Consistent with the results in the previous section, the slope of the SML is significantly negative on post-announcement days and days after bad macro news.

Next, we examine whether the finding of lower returns on post-announcement days holds for various characteristic-sorted portfolios. We use decile portfolios sorted on size, book-to-market, and momentum. We perform regressions of portfolio value-weighted excess returns on dummy variables for post-announcement days after good news or bad news. Panel A of Table 5 shows that returns on size-sorted portfolios are in general much lower on days after bad macroeconomic news. This finding holds in 9 out of 10 portfolios, with the only exception being the top size decile. This exception is in fact consistent with the mechanism we examine in Section 4 and we postpone the discussion there. Panel B and Panel C analyse book-to-market and momentum-sorted portfolios. All of the 20 portfolios have significantly lower returns after bad macroeconomic news. In sum, various test portfolios experience lower returns on post-announcement days after bad news.

To further examine the beta-return relation on post-announcement days, we use 10 beta-sorted portfolios, 25 size and book-to-market double-sorted portfolios, 10 momentum-sorted portfolios, and 10 Fama-French industry portfolios. As these portfolios are formed according to very different characteristics, this is an important test examining the robustness of our finding. Table 6 presents the results. The results are essentially the same as in Table 3. In particular, the slope of the SML on post-announcement days from the Fama-MacBeth regression is -6.16 (t-statistic of -3.25). On days after bad macro news, the slope coefficient becomes -17.20 and is also significantly negative. Using pooled regressions with time fixed effects leads to similar results. Overall, the negative relation between beta and returns on post-announcement days extends to portfolios formed on size, book-to-market, momentum, and industry.

4. Underlying Mechanisms

We have shown that the market tends to drift downward on days after bad macro news, suggesting that the market underreacts to bad news on announcement days. This section investigates the potential mechanisms behind our findings.

4.1 Firm uncertainty and limits to arbitrage

Studies from the behavioural finance literature, e.g., Barberis, Shleifer, and Vishny (1998), Daniel, Hirshleifer, and Subrahmanyam (1998), and Hong and Stein (1999) argue that behavioural biases like conservatism and overconfidence leads to an underreaction to information. Based on the literature, Zhang (2006) investigates the role of information uncertainty, which is the uncertainty about the implications of new information for a firm's value. Zhang (2006) shows evidence that information uncertainty amplifies the effect of behavioural biases, delays the flow of information into stock prices, and leads to price momentum. Following this line of reasoning, we hypothesize that an underreaction to bad news is more pronounced among stocks with high uncertainty. Moreover, results in Table 2 show significantly negative returns on days after bad macro news, but after good news, the return is economically and statistically close to zero. In other words, there is no evidence of an underreaction (or overreaction) to good news. We argue that the disparity between good and bad news is a result of more binding limits of arbitrage in selling stocks compared to buying stocks. In particular, when sophisticated investors observe an underreaction to good news, they can take long positions and push prices to fundamentals. In contrast, eliminating an underreaction to bad news may require short-sales. Shorting fees and arbitrage risk can deter arbitrageurs from taking short positions, especially in a downward market when the cost of short-selling can be much higher. Therefore, we expect the effect of an underreaction to be stronger among stocks that are related to a high cost of short-selling.

To measure firm-level information uncertainty, we use dispersion in analyst earnings forecasts (DISP), ROE volatility, and cash-flow volatility, the latter two measured as the standard deviation of ROE or cash flow from operations in the past 5 years, with a minimum of 3 years. To address the positive skewness of these variables, we take the natural logarithm of these variables. We use residual institutional ownership (RIO) to proxy for short-selling constraints, following Nagel (2005). In particular, we conduct quarterly Fama-MacBeth regression of institutional ownership of a stock (the logit transformation of the percentage of shares held by institutional investors) on the natural logarithm of size, i.e., market valuation, as well as the square of log size. The residual from the regression is the proxy for short-selling constraints.

Our hypothesis implies that on A+1 and A+2 days after bad macroeconomic news, stocks with high information uncertainty (IU) should have lower returns than those with low information uncertainty. Moreover, the magnitude of high IU stocks' underperformance should be larger on days after bad news than on other days. To test the two predictions, we run a time fixed effects regression as follows:

$$Ret_{i,t} = \alpha_t + \gamma_1 IU_{i,t-1} + \gamma_2 IU_{i,t-1} \times PostBad_t + controls + \epsilon_{i,t}$$

where the dependent variable is firm-level excess returns in percentage, $PostBad_t$ is a dummy variable equal to one on post-announcement days after bad macro news, and zero otherwise, $IU_{i,t-1}$ is the proxy for information uncertainty. Using the interaction of the dummy variable with information uncertainty, we are able to directly test whether the effect of information uncertainty on returns is different across various types of days. The hypothesis that information uncertainty leads to an underreaction to bad macro news predicts that the coefficient γ_2 is negative. We control for size (the log of market capitalization), book-to-market, Amihud illiquidity measure, momentum (the cumulative return from the past twelve months, skipping the most recent month), and the previous month's stock return. For each of these control variables, we also include its interaction with the dummy variable. We include all trading days in the regression.

Table 7 reports the results. The interaction terms between information uncertainty measures and dummy variables are all significantly negative. The economic significance is also substantial. In particular, one standard deviation increase in ROE volatility (e.g., 0.35) leads to a decrease in return of 2.59 basis points. Similarly, one standard deviation increase in cash-flow volatility leads to a return decrease of 3.09 basis points. However, on other trading days, variation in ROE or cash-flow volatility leads to either insignificant or small changes in returns. The analyst dispersion itself has a negative and significant coefficient of -5.07, suggesting that it has a negative relation with returns on other trading days. However, its effect is much stronger on days after bad news, with the coefficient on the interaction with the dummy variable being -13.31. Therefore, stocks with high information uncertainty tend to experience significantly lower returns compared to those with low information uncertainty. Moreover, consistent with our hypothesis, the effect focuses on post-announcement days after bad macroeconomic news. Note that the coefficients on the interaction between the dummy variable with controls are largely insignificant, except for beta and size.

Having established that high information uncertainty leads to low returns on days after bad macro news, we strive to understand the disparity in the results between good and bad news. In particular, we examine whether short-selling constraints have an impact on the role of information uncertainty. We perform Fama-MacBeth regressions of firm-level excess returns on A+1 and A+2 days after bad news, as follows:

$$Ret_{i,t} = \alpha_t + \gamma_1 IU_{i,t-1} + \gamma_2 RIO_{i,t-1} + \gamma_3 IU_{i,t-1} \times RIO_{i,t-1} + controls + \epsilon_{i,t}$$

Our hypothesis is that an underreaction to bad news is more pronounced among stocks with high short-selling constraints. Therefore, it predicts the coefficient on the interaction term $IU_{i,t-1} \times RIO_{i,t-1}$ to be positive. Columns 1 to 3 of Table 8 reports the result for each information uncertainty measure. Consistent with our hypothesis, the interaction between information uncertainty and institutional ownership is significantly positive across all three measures. To interpret the economic magnitude, we note that, for example, one standard deviation increase in ROE volatility leads to a lower return by 1.33 basis points for stocks with RIO of zero. Decreasing RIO by one standard deviation, which is 2.06, the effect of one standard deviation increase in ROE volatility becomes -3.11. Therefore, the negative relation between information uncertainty and returns is stronger for stocks with high short-selling constraints. It suggests that it is harder for arbitrageurs to eliminate an underreaction to bad news when they are faced with stronger short-selling constraints. Also, the coefficient on RIO is small and insignificant. It suggests that short-selling constraints have little impact on stock returns unless the company has high information uncertainty.

The control variables include beta, market capitalization, book-to-market, momentum, lag monthly return, and Amihud illiquidity. Note that the coefficient on beta is significantly negative. Therefore, high-beta stocks have particularly negative returns after bad news, consistent with the finding of a downward-sloping SML after bad news.

We next provide further support of the role of limits to arbitrage by exploiting the variation in funding conditions over time. When mispricing occurs in the market, sophisticated investors tend to act as arbitrageurs and move stock prices towards the fundamental value. In the case of an underreaction to bad news, arbitrageurs should take short positions on the announcement day, especially in high-beta stocks. As Shleifer and Vishny (1997) point out, any arbitrage activity requires arbitrageurs to supply their own capital, so constraints on their funding conditions result in limits of arbitrage. We expect the underreaction to bad news becomes more significant as funding conditions are tighter. Recent literature by

Adrian, Etula, and Muir (2014) proposes that the leverage of financial intermediaries reflects their funding condition and ability to trade in the market. In particular, a negative leverage shock arguably decreases the risk-bearing capacity and increases funding constraints. We use the same measure and test if an underreaction to bad macro news is more pronounced after a negative leverage shock. The data is from Tyler Muir's website, which is available from 1967 to 2017.

Specifically, we first divide our sample into two halves. One half includes quarters after an above-median leverage shock (intermediary leverage expansion), and the other half includes quarters after a below-median leverage shock (intermediary leverage contraction). Next, we conduct similar regressions as in Table 2 in each sub-sample period. Table 9 reports the results. Column 1 of Panel A shows that after leverage contraction, the market excess return is reduced by -6.75 basis points (t-statistic of -2.18) on post-announcement days. The market return after bad macroeconomic news decreases by -11.33 basis points per day (t-statistic of -2.53). Column 3 adds an announcement day dummy as control and the coefficient on days after bad news barely changes. Panel B looks at quarters after intermediary leverage expansion and shows that the market return on post-announcement days has a much smaller magnitude and is statistically insignificant in most cases. The results indicate that the magnitude of market underreaction to bad news is much smaller when arbitrage capital is more abundant.

Notably, the coefficient on an announcement day dummy is merely 2.69 and insignificant during times of above-median leverage shock. However, it becomes as high as 11.78 after below-median leverage shock. The substantial difference suggests that market underreaction to bad macro news leads to overstatement of expected returns on announcement days.

We also estimate the SML in each sub-sample period. Table 10 reports the results. A comparison between Panel A and Panel B shows that after leverage contraction, the slope of the SML is more positive on announcement days and more negative on post-announcement days compared to periods after leverage expansion. In addition, after leverage contraction, the slope of the SML after bad macro news is more than twice as negative as the slope after leverage expansion. There is no material difference in the post-announcement slope after good macroeconomic news in either sub-sample period. Overall, the results support the hypothesis that when arbitrage capital is limited, an underreaction to bad macro news becomes stronger. On post-announcement days, therefore, high-beta stocks underperform and the SML is more downward-sloping.

In sum, this section shows that information uncertainty and limits to arbitrage play important roles in the market underreacting to bad macro news. We next discuss risk-based explanations for our findings.

4.2 Risk-based explanation

After Savor and Wilson (2013; 2014) document strikingly high market returns and a positive slope of the SML on macroeconomic announcement days; several papers provide risk-based explanations to these findings (Savor and Wilson 2013; Ai and Bansal 2018; Wachter and Zhou 2018; Ai et al. 2019). A common theme of these studies is that uncertainty concerning macroeconomic news carries a positive risk premium. Specifically, these papers argue that investors receive important information about their future consumption on macro announcement days. For example, Wachter and Zhou (2018) assume that investors learn about the time-varying probability of rare disasters on those days. Ai et al. (2019) assume that investors learn about aggregate productivity on those days. If announcements change investors' belief about long-run consumption growth, these models show that, under recursive preferences, investors require a premium to hold any assets on announcement days if its return co-moves with macroeconomic news.

Can risk-based mechanisms also explain our findings on post-announcement days? Given the facts that we have shown, we argue that there are many challenges. First, market returns on post-announcement days are predictable based on the content of the macro news. Return predictability during such a short time frame is more likely to be caused by market inefficiency rather than time-varying risk premium. Second, to the extent that high-beta stocks are riskier stocks, a risk-based explanation is inconsistent with the strong and negative beta-return relation on days after macro announcements.

Lastly, we do not find any significant change in the risk of beta-sorted portfolios across different trading days. In Panel A of Table 11, we report the market beta for the top beta decile portfolio, the bottom beta decile portfolio, and their difference for various types of trading days. Column 1 reports beta on post-announcement days. Column 2 reports beta on all the other days. Column 3 and Column 4 report market beta on post-announcement days after bad and good macro news. As shown in the table, market betas for the top and bottom beta decile portfolios are fairly constant across various types of days. Moreover, we do not find any significant change in the market beta of the top-minus-bottom returns. In Panel B of Table 11, we report the volatility in the returns of top-beta, bottom-beta, top-minus-bottom, and the market portfolios. In fact, volatility on post-announcement days is slightly higher than on the other days. On days after bad news, the volatility is also higher than on days after good news. Overall, the evidence from Table 11 is inconsistent with the idea that risk premium significantly decreases on days after bad macro news.

5. The equity risk premium on announcement days

An important empirical question is whether the market risk premium is significantly higher on some special days, such as days with macroeconomic announcements. The answer to this question can help to distinguish between different classes of asset pricing models (Ai and Bansal 2018). However, risk premium is not observable. Therefore, to use average realized return as a proxy for risk premium, one has to assume that the average unexpected return is zero.

We have shown that on post-announcement days the stock market has significantly lower returns and the relation between beta and returns is strongly negative, especially after bad macro news. Our explanation is that the stock market underreacts to bad macro news on A days and therefore continues to decline on the days following such news. We argue that as a result of the underreaction to bad news, realized returns on announcement days do not accurately reflect the market risk premium on those days. Specifically, if we express A day excess return R_A as the sum of risk premium RP_A and macro news shock e_A,

$$R_A = RP_A + e_A$$

the average R_A would be larger than the risk premium RP_A, because the average of e_A is greater than zero due to market underreaction to bad news.

To address the underreaction effect, we examine stock returns over a three-day window from A day to A+2 day. Formally, we decompose the cumulative three-day excess return into a risk premium component and macro news shocks:

$$R_{A:A+2} = RP_{A:A+2} + e_{A:A+2}$$

We believe that with a longer window, $e_{A:A+2}$ is more likely to have an average of zero, compared to the shock within a single day. Therefore, the average of cumulative return on A to A+2 days, $R_{A:A+2}$, serves as a more reliable measure of the three-day risk premium. If we make a weak assumption that the risk premium is at least positive on A+1 and A+2 days, then the average cumulative return $R_{A:A+2}$ should be an upper bound of the risk premium on announcement days, RP_A.

To estimate the average $R_{A:A+2}$, we create a dummy variable equal to one on A day, A+1 and A+2 days, and zero otherwise. We regress market excess returns on the dummy variable. Panel A of Table 12 presents the result. Column 1 shows that the coefficient on the dummy variable of the three-day announcement window is 0.09 with a t-statistics of 0.05. It indicates that the risk premium on A to A+2 days are not significantly different from other days. Moreover, the constant is 2.54 basis points, meaning the average cumulative excess return over the three-day window of (0.09+2.54) × 3 = 7.89 basis points, which is an upper bound of the risk premium on announcement days. Assuming a relatively low daily risk premium of 1.5 basis points on A+1 and A+2 days, the A day risk premium is then 7.89 – 1.5 × 2 = 4.89, which is around half of the average A day excess return of 9.37 basis points (Table 1). Therefore, we argue that the average realized return on the announcement day overstates its risk premium. Column 2 controls for day-of-month fixed effects and the results still point to a similar magnitude of the average three-day cumulative return. Also, the small and insignificant coefficient on the dummy of the three-day window suggests that the cumulative risk premium from A day to A+2 day is not different from any other three-day period.

Next, we estimate the beta-return relation over the three-day window from A day to A+2 day. The results are presented in Panel B of Table 12. Column 1 and Column 2 conduct Fama-MacBeth regressions of three-day return on beta for 10 beta-sorted portfolios and 55 portfolios (10 beta-sorted portfolios, 25 size and book-to-market double-sorted portfolios, 10 momentum-sorted portfolios, and 10 Fama-French industry portfolios), respectively. Column 3 and Column 4 conduct pooled regressions using all trading days for the 10 and 55 test portfolios, respectively. The independent variables include beta, the dummy variable of the three-day window, and their interaction. We also control for time-fixed effects and cluster standard errors by trading days to adjust for the time-series correlation of the residuals.

Column 1 and Column 2 of Panel B show that the beta-return relation is close to zero during the three-day announcement window. The beta coefficient is -0.04 using 10 beta-sorted portfolios and -0.58 for 55 portfolios, in both cases statistically insignificant. This is in contrast to the strong and positive relation between beta and returns on A days. The interaction coefficients in Column 3 and Column 4 are also both insignificant. The results indicate that the beta-return relation during the three-day window is not significantly different from the other days. Overall, the results in Table 12 suggest that after considering the underreaction effect, the risk premium on macro announcement days is much lower than previously believed.

6. Conclusion

The recent literature documents interesting phenomena about stock returns on days with important macroeconomic announcements. Savor and Wilson (2013) show that the aggregate market return is significantly higher on announcement days than on the other days. Savor and Wilson (2014) also find that the SML has a significantly positive slope and insignificant intercept on those days, validating the classical Capital Asset Pricing Model. The exceptional returns of the market and high-beta stocks on macroeconomic announcement days can potentially shed new light on the risk-return relation, if they indeed reflect greater systematic risk on those days. However, we demonstrate evidence that the announcement-day high returns are a result of a slow market reaction to new information.

We show that the market observes significantly lower returns on post-announcement days. High-beta stocks also strongly underperform on these days relative to low-beta stocks. Moreover, the poor performance of the market and high-beta stocks mainly occur on days after negative macro news. In contrast, days after positive macroeconomic news do not show significantly different returns than on other days. Our results are consistent with the market underreaction to negative news. We further show that the underreaction is stronger among stocks with greater information uncertainty and short-selling constraints, and when arbitrage capital is scarce, consistent with the theory of limit to arbitrage. Our paper suggests that the market has limited capacity to process and incorporate negative macroeconomic news into asset prices.

Failure to account for the underreaction effect would overestimate the macroeconomic risk premium and the beta-return relationship. In particular, as bad news is reflected in stock prices more slowly than good news, stock prices will on average move up on announcement days and then decline on post-announcement days. To address the underreaction effect, we use a three-day announcement window and find strong evidence that the magnitude of risk premium on announcement days is much smaller than previously thought and insignificantly different from other days.

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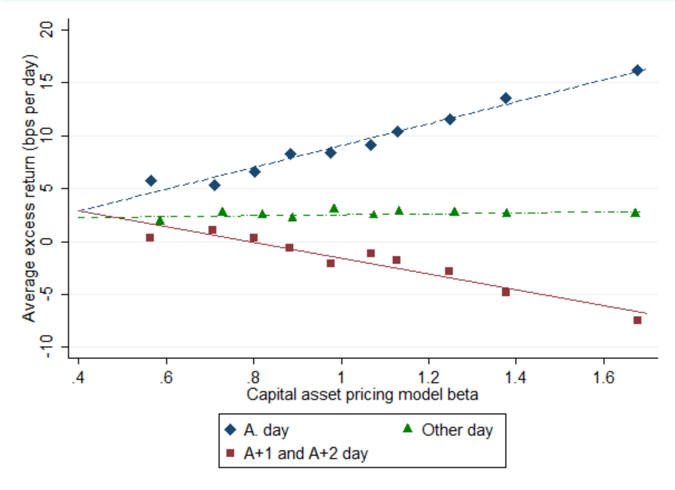
Figure 1. Security market line around macroeconomic announcements

This figure plots the security market line on days with macroeconomic announcements regarding inflation, employment, and FOMC decision (A day), the two days after a macroeconomic announcement (A+1 and A+2 day), and other trading days (Other days). The y-axis is the daily excess return of a portfolio in basis points. The x-axis is the average beta of a portfolio over the entire sample period from 1964 to 2019. The test portfolios are 10 beta-sorted portfolios.

Panel A. Security market line on different days.



Panel A. Security market line on post-announcement days

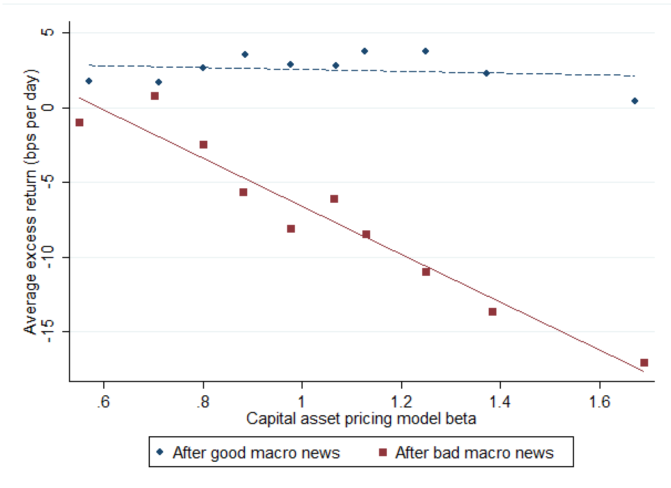


Table 1. Announcement and post announcement days

This table reports the summary statistics of variables used in this paper. Panel A provides a breakdown of different types of trading days during the sample period of 1964 to 2019. "A day" is the day when macroeconomic news about inflation, employment, and FOMC decision is scheduled to release. "A+1" and "A+2" denote as the first and second day after a macroeconomic announcement, if not overlapping with another announcement day. "Other day" represents all the remaining trading days. Panel B provides average market excess return in basis point on different types of days.

Panel A. Number of trading days for category

	Number of trading days	Percentage of all trading days
Employment	654	5%
Inflation	677	5%
FOMC	340	2%
A days	1,621	11%
A+1 and A+2 days	2,952	21%
The other days	9,524	68%
All trading days	14,097	100%

Panel B. Market return on different days

	Market excess return	t-statistic
A day	9.37	3.72
A+1 and A+2 day	-1.07	-0.56
A+1 and A+2 day after bad news	-6.02	-1.82
A+1 and A+2 day after good news	2.71	1.18
The other days	2.54	2.59

Table 2. Market returns on different trading days

This table regresses daily market excess return (in basis points) on dummy variables that indicate different trading days. A day is a dummy variable equal to one on the day when macroeconomic news about inflation, employment, or FOMC decision is scheduled to be announced. A+1 and A+2 day is a dummy variable equal to one on the first and second day after a macroeconomic announcement. A+1 and A+2 after good (bad) news is a dummy variable equal to one on the first and second day after a macroeconomic announcement, if the market excess return on the macroeconomic announcement day is positive (negative). The sample period is from 1964 to 2019. The t-statistics are reported in parentheses. Superscripts ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

	(1)	(2)	(3)	(4)
A+1 and A+2 day	-4.61**			
	(-2.15)			
A+1 and A+2 after good news		-0.82	0.17	0.81
		(-0.33)	(0.07)	(0.31)
A+1 and A+2 after bad news		-9.55***	-8.56**	-8.00**
		(-2.78)	(-2.48)	(-2.27)
A day			6.83**	6.49**
			(2.53)	(2.35)
Constant	3.53***	3.53***	2.54***	2.45**
	(3.86)	(3.86)	(2.59)	(2.47)
Day of month effect	NO	NO	NO	YES
Observations	14,097	14,097	14,097	14,097
Adjusted R-squared	0.000	0.001	0.001	0.004

Table 3. Beta-return relationship on different trading days

This table reports regressions of value-weighted daily excess returns on beta for beta-sorted portfolios. Column 1 and 2 of each panel apply Fama-MacBeth regressions on different trading days. Column 3 applies a pooled regression with time fixed effects and standard errors clustered by day. A day is a dummy variable equal to one on the day when macroeconomic news about inflation, employment, or FOMC decision is scheduled to be announced. A+1 and A+2 day is a dummy variable equal to one on the first and second day after a macroeconomic announcement. A+1 and A+2 after good (bad) news is a dummy variable equal to one on the first and second day after a macroeconomic announcement, if the market excess return on the macroeconomic announcement day is positive (negative). The sample period is from 1964 to 2019. The t-statistics are reported in parentheses. Superscripts ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

Panel A. Ten beta-sorted portfolios

	(1) A day	(2) A+1 and A+2 day	(3) Pooled
Beta	11.57***	-6.41***	0.54
	(3.90)	(-2.79)	(0.41)
A day × Beta			7.37**
			(2.12)
A+1 and A+2 day × Beta			-7.67***
			(-2.78)
Constant	-2.16	5.18***	3.01***
	(-1.02)	(3.14)	(2.61)
Observations	16,210	29,520	140,970
R-squared	0.385	0.382	0.817
Time effect	NO	NO	YES

Panel B. Ten beta-sorted portfolios after good and bad macroeconomic news

	(1) After good news	(2) After bad news	(3) Pooled
Beta	0.72	-15.71***	0.54
	(0.24)	(-4.36)	(0.41)
A day × Beta			7.37**
			(2.12)
A+1 and A+2 after good news × Beta			-1.77
			(-0.53)
A+1 and A+2 after bad news × Beta			-14.97***
			(-3.69)
Constant	1.77	9.61***	2.97***
	(0.84)	(3.67)	(2.58)
Observations	16,710	12,810	140,970
R-squared	0.372	0.394	0.817
Time FE	No	No	Yes

Table 4. Using announcement surprise to identify the sign of news

This table reports the robustness of our results using announcement surprises. The sample period is from 1997 to 2019. "A day" is the day when macroeconomic news about inflation, employment, and FOMC decision is scheduled to announce. "A+1 and A+2" are the first and second day after a macroeconomic announcement. Bad (good) news for inflation news is defined as the actual news release greater (smaller) than Bloomberg median forecast. Bad (good) news for employment news is defined as the actual change in nonfarm payroll smaller (greater) than Bloomberg median forecast. Bad (good) news for FOMC news is defined as the FOMC interest rate greater (smaller) than Bloomberg median forecast. Panel A regresses daily market return (in basis points) on different trading day dummies. Panel B estimates the security market line using 10 beta-sorted portfolios on different trading days. The t-statistics are reported in parentheses. Superscripts ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

Panel A. Market excess return on different trading days

	(1)	(2)	(3)	(4)
A+1 and A+2 day	-8.12**			
	(-2.13)			
A+1 and A+2 after good news		-4.99	-3.25	-4.14
		(-0.94)	(-0.60)	(-0.72)
A+1 and A+2 after bad news		-10.38**	-8.64*	-8.28*
		(-2.13)	(-1.76)	(-1.66)
A day			10.81**	9.81*
			(2.20)	(1.95)
Constant	5.12***	5.12***	3.39*	3.55*
	(2.89)	(2.89)	(1.76)	(1.80)
Day of month effect	NO	NO	NO	YES
Observations	5,788	5,788	5,788	5,788
Adjusted R-squared	0.001	0.001	0.001	0.005

Panel B. Security market line on different trading days

	(1)	(2)	(3)	(4)
			A+1 and A+2 day	
VARIABLES	A day	A+1 and A+2 day	After bad news	After good news
Beta	16.24***	-9.45**	-12.81**	-4.76
	(2.93)	(-2.24)	(-2.30)	(-0.74)
Constant	-2.21	6.35**	7.44*	4.85
	(-0.58)	(2.14)	(1.88)	(1.08)
Observations	7,160	13,220	7,690	5,530
R-squared	0.446	0.429	0.424	0.435
Number of days	716	1,322	769	553

Table 5. Returns across test portfolios

This table regresses the excess return (in basis points) of different portfolios on dummy variables that indicate different trading days. A+1 and A+2 after good (bad) news is a dummy variable equal to one on the first and second day after an announcement, if the market excess return on the macroeconomic announcement day is positive (negative). The dependent variable is the excess return of decile portfolios sorted on size, book-to-market, and momentum. The sample period is from 1964 to 2019. The t-statistics are reported in parentheses. Superscripts ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

Panel A. Size sorted portfolios

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
A+1 and A+2 after good news	1.37	-0.36	-0.20	0.19	-0.95	-0.71	-0.68	-1.22	-1.48	-1.33
	(0.61)	(-0.13)	(-0.07)	(0.07)	(-0.34)	(-0.28)	(-0.26)	(-0.48)	(-0.59)	(-0.53)
A+1 and A+2 after bad news	-20.72***	-17.52***	-17.32***	-15.57***	-16.69***	-17.67***	-16.78***	-14.13***	-11.86***	-4.25
	(-6.66)	(-4.66)	(-4.69)	(-4.25)	(-4.65)	(-5.16)	(-4.90)	(-4.09)	(-3.47)	(-1.19)
Constant	6.45***	6.57***	6.90***	6.47***	6.85***	6.73***	6.66***	6.41***	5.92***	4.73***
	(7.63)	(6.31)	(6.72)	(6.39)	(6.82)	(7.09)	(7.02)	(6.73)	(6.40)	(5.03)
Observations	14,097	14,097	14,097	14,097	14,097	14,097	14,097	14,097	14,097	14,097
Adjusted R-squared	0.004	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.000

Panel B. Book-to-market sorted portfolios

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
A+1 and A+2 after good news	0.05	0.62	-0.13	-2.48	-3.30	-2.25	-2.72	-4.45	-2.87	-2.25
	(0.02)	(0.25)	(-0.05)	(-0.96)	(-1.30)	(-0.93)	(-1.05)	(-1.58)	(-0.96)	(-0.67)
A+1 and A+2 after bad news	-7.80**	-7.57**	-8.80***	-9.85***	-10.65***	-10.78***	-7.43**	-9.64***	-9.84***	-13.44***
	(-2.07)	(-2.15)	(-2.59)	(-2.82)	(-3.17)	(-3.36)	(-2.18)	(-2.76)	(-2.66)	(-3.22)
Constant	4.80***	5.19***	5.48***	5.65***	5.89***	6.25***	5.63***	6.60***	7.07***	7.30***
	(4.59)	(5.43)	(5.98)	(5.99)	(6.38)	(7.05)	(6.13)	(6.90)	(6.94)	(6.29)
Observations	14,097	14,097	14,097	14,097	14,097	14,097	14,097	14,097	14,097	14,097
Adjusted R-squared	0.000	0.000	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001

Panel C. Momentum sorted portfolios

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
A+1 and A+2 after good news	-1.07	-2.14	-3.64	-2.04	-2.66	-0.14	-0.94	-0.97	-1.40	-0.90
	(-0.25)	(-0.61)	(-1.23)	(-0.75)	(-1.03)	(-0.06)	(-0.39)	(-0.40)	(-0.55)	(-0.29)
A+1 and A+2 after bad news	-18.16***	-11.07***	-7.88**	-9.09***	-8.88***	-7.45**	-8.75***	-7.77**	-10.12***	-17.34***
	(-3.64)	(-2.71)	(-2.19)	(-2.69)	(-2.73)	(-2.20)	(-2.63)	(-2.25)	(-2.79)	(-3.88)
Constant	2.87*	4.81***	5.42***	5.43***	5.14***	5.05***	5.35***	6.16***	6.14***	8.61***
	(1.91)	(3.98)	(5.22)	(5.54)	(5.48)	(5.62)	(5.97)	(6.74)	(6.29)	(7.10)
Observations	14,097	14,097	14,097	14,097	14,097	14,097	14,097	14,097	14,097	14,097
Adjusted R-squared	0.001	0.000	0.000	0.000	0.001	0.000	0.001	0.000	0.001	0.001

Table 6. Beta-return relationship across test portfolios

This table reports regressions of value-weighted daily excess returns on beta for characteristic-sorted portfolios. Column 1 and 2 of each panel apply Fama-MacBeth regressions on different trading days. Column 3 applies a pooled regression with time fixed effects and standard errors clustered by day. A day is a dummy variable equal to one on the day when macroeconomic news about inflation, employment, or FOMC decision is scheduled to be announced. A+1 and A+2 day is a dummy variable equal to one on the first and second day after an announcement. A+1 and A+2 after good (bad) news is a dummy variable equal to one on the first and second day after an announcement, if the market excess return on the macroeconomic announcement day is positive (negative). The sample period is from 1964 to 2019. The t-statistics are reported in parentheses. Superscripts ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

Panel A. Beta, industry, momentum, size and book-to-market portfolios

	(1) A Day	(2) A+1 and A+2 Day	(5) Pooled
Beta	9.57***	-6.16***	-0.26
	(3.93)	(-3.25)	(-0.24)
A day× Beta			7.12**
			(2.50)
A+1 and A+2 day × Beta			-6.36***
			(-2.83)
Constant	0.09	4.77***	3.78***
	(0.04)	(2.96)	(4.02)
Observations	89,155	162,360	775,335
R-squared	0.146	0.142	0.774
Time effect	NO	NO	YES

Panel B. Beta, industry, momentum, size and book-to-market portfolios after good and bad macroeconomic news

	(1) Days after good news	(2) Days after bad news	(3) Pooled
Beta	2.31	-17.20***	-0.26
	(0.94)	(-5.86)	(-0.24)
A day ×Beta			7.12**
			(2.50)
A+1 and A+2 after good news ×Beta			0.73
			(0.26)
A+1 and A+2 after bad news ×Beta			-15.20***
			(-4.64)
Constant	0.87	9.86***	3.74***
	(0.43)	(3.82)	(3.97)
Observations	91,905	70,455	775,335
R-squared	0.137	0.150	0.774
Time FE	No	No	Yes

Table 7. Information uncertainty and underreaction to news

This table reports the regression of individual stock returns on time dummy variables and firm characteristics. Dummy is equal to one if it is the A+1 and A+2 day after bad news. The sample contains returns on all trading days. ROE (Cash flow) VOL is the natural logarithm of the standard deviation of ROE (cash flow from operations) in the past 5 years (with a minimum of 3 years). Forecast dispersion (DISP) is the natural logarithm of the standard deviation of analyst forecasts in a month scaled by the mean of forecast values. The t-statistics are reported in parentheses. Superscripts ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

	(1)	(2)	(3)
Dummy × ROE VOL	-7.42***		
	(-4.44)		
Dummy × Cash flow VOL		-34.35***	
		(-4.76)	
Dummy × DISP			-13.31**
			(-2.47)
Dummy × Beta	-9.98***	-9.51***	-10.04***
	(-5.33)	(-5.15)	(-4.35)
Dummy × Size	2.53***	2.39***	1.73***
	(4.75)	(4.39)	(2.83)
Dummy × BE/ME	0.50	0.81	2.60*
	(0.67)	(1.09)	(1.86)
Dummy × Momentum	-0.01	-0.01	-0.16
	(-0.02)	(-0.02)	(-0.35)
Dummy × Lag return	0.15**	0.18**	0.15
	(2.08)	(2.40)	(1.44)
Dummy × Illiquidity	0.00	0.00	0.00
	(0.47)	(0.20)	(0.24)
ROE VOL	1.17**		
	(2.52)		
Cash flow VOL		0.85	
		(0.41)	
DISP			-5.07***
			(-3.14)
Beta	1.40***	1.50***	1.69**
	(2.66)	(2.89)	(2.56)
Size	-0.91***	-1.01***	-0.88***
	(-6.28)	(-6.86)	(-5.12)
BE/ME	0.66***	0.59***	0.38
	(3.04)	(2.79)	(0.99)
Momentum	-0.05	-0.09	0.21
	(-0.57)	(-0.94)	(1.47)
Lag return	-0.30***	-0.31***	-0.16***
	(-13.02)	(-13.45)	(-4.91)
Illiquidity	0.00***	0.00***	0.00***
	(24.56)	(27.24)	(3.05)
Constant	7.61***	8.35***	8.96***
	(6.90)	(7.34)	(6.17)
Observations	35,917,454	38,956,192	18,280,821
R-squared	0.052	0.048	0.129

Table 8. Short-selling constraints

This table reports Fama-Macbeth regressions of individual stock returns on A+1 and A+2 days after bad news. We define news as good or bad news when the market excess return on the announcement day is above or below zero. ROE (Cash flow) VOL is the natural logarithm of the standard deviation of ROE (cash flow from operations) in the past 5 years (with a minimum of 3 years). Forecast dispersion (DISP) is the natural logarithm of the standard deviation of analyst forecasts in a month scaled by the mean of forecast values. RIO is the residual institutional ownership. The t-statistics are reported in parentheses. Superscripts ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

	(1)	(2)	(3)
ROE VOL	-3.81*		
	(-1.94)		
ROE VOL x RIO	2.46**		
	(2.58)		
Cash flow VOL		-24.12***	
		(-3.76)	
Cash flow VOL x RIO		10.37***	
		(3.99)	
DISP			-15.85***
			(-3.55)
DISP x RIO			4.56**
			(1.99)
RIO	-0.02	-0.35	-0.18
	(-0.08)	(-1.01)	(-0.55)
Beta	-7.29***	-6.47***	-7.67***
	(-4.38)	(-4.02)	(-4.26)
Size	1.51***	1.32**	1.25**
	(2.96)	(2.54)	(2.07)
BE/ME	0.90	1.06	3.09***
	(1.33)	(1.62)	(2.92)
Momentum	0.27	0.20	0.31
	(1.24)	(0.96)	(1.22)
Lag return	-0.19***	-0.18***	-0.07
	(-3.89)	(-3.90)	(-1.21)
Illiquidity	0.00***	0.00***	-0.00
	(6.33)	(6.88)	(-0.32)
Constant	-8.43***	-7.50**	-5.49
	(-2.79)	(-2.43)	(-1.19)
Observations	2,989,346	3,216,239	1,752,308
R-squared	0.029	0.027	0.045

Table 9. Market return and intermediary leverage

This table regresses daily market excess return (in basis points) on dummy variables that indicate different trading days. The sample period in Panel A (B) includes calendar quarters after a below-median (above-median) leverage index shock, where leverage index shock is the log of change in the leverage of financial intermediary leverage, constructed by Adrian, Etula, and Muir (2014). "A day" is a dummy variable equal to one on the day when macroeconomic news about inflation, employment, or FOMC decision is scheduled to announce. "A+1 and A+2 day" is a dummy variable equal to one on the first and second day after a macroeconomic announcement. "A+1 and A+2 after good news" is a dummy variable equal to one on the first and second day after a macroeconomic announcement if the market return excess on the macroeconomic announcement day is positive. "A+1 and A+2 after bad news" is a dummy variable equal to one on the first and second day after a macroeconomic announcement if the market return excess on the macroeconomic announcement day is negative. The sample period is from 1968 to 2017. The t-statistics are reported in parentheses. Superscripts ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

Panel A. Intermediary leverage contraction

	(1)	(2)	(3)
A+1 and A+2 day	-6.75**		
	(-2.18)		
A+1 and A+2 after good news		-2.76	-1.06
		(-0.72)	(-0.28)
A+1 and A+2 after bad news		-11.33**	-9.66**
		(-2.53)	(-2.14)
A day			11.78***
			(2.94)
Constant	3.48**	3.40**	1.66
	(2.44)	(2.39)	(1.08)
Observations	6,276	6,276	6,276
Adjusted R-squared	0.001	0.001	0.002

Panel B. Intermediary leverage expansion

	(1)	(2)	(3)
A+1 and A+2 day	-2.91		
	(-0.91)		
A+1 and A+2 after good news		-0.67	-0.28
		(-0.16)	(-0.07)
A+1 and A+2 after bad news		-6.18	-5.80
		(-1.41)	(-1.31)
A day			2.69
			(0.65)
Constant	3.68**	3.75**	3.35**
	(2.52)	(2.57)	(2.13)
Observations	6,248	6,248	6,248
Adjusted R-squared	-0.000	-0.000	-0.000

Table 10. Security market line and intermediary leverage

This table estimates the security market line on announcement and post-announcement days. Panel A estimates the security market line in periods after below-median leverage index shock. Panel B estimates the security market line in periods after above-median leverage index shock. Leverage index shock is the log of change in the leverage of financial intermediary leverage, constructed by Adrian, Etula, and Muir (2014). Each columns applies Fama-MacBeth regressions. Beta is estimated for each portfolio-month based on the portfolio's past 60 monthly returns. Test portfolios include 10 beta-sorted, 10 momentum-sorted, 10 Fama-French industry portfolios, and 25 size and book-to-market double sorted portfolios. The t-statistics are reported in parentheses. The sample period is from 1968 to 2017. Superscripts ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

Panel A. Intermediary leverage contraction

	(1)	(2)	(3)	(4)
			A+1 and A+2	
	A day	A+1 and A+2	After bad news	After good news
CAPM beta	13.39***	-10.88***	-27.01***	2.46
	(3.31)	(-3.22)	(-5.18)	(0.57)
Constant	-0.33	5.58*	12.53***	-0.16
	(-0.10)	(1.95)	(2.68)	(-0.05)
Observations	33,110	59,785	27,060	32,725
R-squared	0.140	0.143	0.154	0.135
Number of days	602	1,087	492	595

Panel B. Intermediary leverage expansion

	(1)	(2)	(3)	(4)
			A+1 and A+2	
VARIABLES	A day	A+1 and A+2	After bad news	After good news
CAPM beta	7.90*	-3.99	-12.17***	2.60
	(1.88)	(-1.23)	(-2.60)	(0.59)
Constant	0.96	4.55*	5.65	3.67
	(0.27)	(1.76)	(1.56)	(1.00)
Observations	33,770	61,160	27,280	33,880
R-squared	0.130	0.130	0.134	0.127
Number of days	614	1,112	496	616

Table 11. Measures of risk around announcement days

This table reports the beta (Panel A) and the volatility (Panel B) of different portfolios estimated on different types of trading days.

Panel A. CAPM beta

	(1)	(2)	(3)	(4)
			A+1 and A+2 day	
CAPM beta	A+1 and A+2	Other days	After bad news	After good news
Bottom beta decile	0.58	0.57	0.57	0.6
Top beta decile	1.53	1.61	1.46	1.62
Top minus bottom	0.95	1.03	0.89	1.02

Panel B. Volatility

	(1)	(2)	(3)	(4)
			A+1 and A+2 day	
Volatility	A+1 and A+2	Other days	After bad news	After good news
Bottom beta decile	76	70	81	71
Top beta decile	177	169	190	167
Top minus bottom	140	137	148	134
Market return	105	96	118	94

Table 12. Three-day announcement window

This table reports market excess return (in basis points) and the beta-return relation on the three-day announcement window. A to A+2 days is a dummy variable equal to one on the announcement day or on the first or second day after a macroeconomic announcement about inflation, employment, or FOMC decision. The sample period is from 1964 to 2019. 10 portfolios include the 10 beta-sorted portfolios. 55The t-statistics are reported in parentheses. Superscripts ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

Panel A: Stock market returns

	(1)	(2)
A to A+2 days	0.09	0.42
	(0.05)	(0.22)
Constant	2.54***	2.43**
	(2.59)	(2.36)
Day of month effect	NO	YES
Observations	14,097	14,097
Adjusted R-squared	-0.000	0.003

Panel B: Beta-return relationship

	(1)	(2)	(3)	(4)
	Fama-Macbeth		Pooled	
	10 portfolios	55 portfolios	10 portfolios	55 portfolios
Beta	-0.04	-0.58	0.54	-0.26
	(-0.02)	(-0.39)	(0.41)	(-0.24)
A to A+2 days × Beta			-2.36	-1.59
			(-1.00)	(-0.83)
Constant	2.57**	3.11**	3.02***	3.78***
	(1.97)	(2.43)	(2.62)	(4.02)
Observations	45,730	251,515	140,970	775,335
R-squared	0.383	0.144	0.817	0.774