Response of Stock Market to Macroeconomic News Announcements

Mykola Pinchuk*

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Abstract

This paper examines effect of macroeconomic news announcements (MNA) on stock market. Stocks exhibit strong positive reaction to major MNA: 1 standard deviation of MNA surprise causes 11-25 bps higher returns. This response is highly time-varying and is weaker during periods of high monetary uncertainty. I proxy for monetary uncertainty by implied volatility of T-notes and decompose this response into cash flow and discount rate channels. 1 standard deviation of good MNA surprise leads to 30 bps returns from cash flow channel and minus 23 bps per 100% of monetary uncertainty from monetary channel. High levels of monetary uncertainty mask strong positive response of stocks to MNA, which explains why past research failed to detect this relation.

*Simon Business School, University of Rochester. Email: Mykola.Pinchuk@ur.rochester.edu.
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1 Introduction

Price of an asset is a function of the information set of investors. Any movement in price must be driven by the arrival of a new information. One example of such information is news about the state of the economy, i.e., macroeconomic news announcements (MNA). Counterintuitively, an extensive body of research over the recent decades failed to find large directional response of stock prices to MNA. Lack of this evidence is puzzling, since it raises questions on the relevance of macroeconomic conditions to stock prices and contradicts intuition of practitioners and academics.

The aim of this paper is to establish a set of stylized facts on the response of financial assets to MNA and to use this evidence to refine our thinking about asset prices. Utilizing crisper identification and high-frequency data allows to detect patterns of price response to MNA, which eluded researchers for decades. My results suggest large positive response of both stocks and risk-free rates to MNA surprise and reaffirm strong link between macroeconomic conditions and prices of financial assets.

First, I document that several types of MNA have large effect on both volatility and direction of aggregate stock returns. In a tight window around these announcements, 9-20% of movement in stock prices is explained by MNA surprises. Response to these MNA alone is as large as 35%-70% of price variation during periods without MNA. Stocks exhibit strong positive reaction to major MNA: 1 standard deviation of good surprise causes 11-25 bps higher returns. Unsurprisingly, these are MNA, closely followed by financial press: non-farm payroll, PMI, retail sales and consumer confidence.

Second, I report that the response of stocks to MNA crucially depends on the level of uncertainty about monetary policy. This allows us to reinterpret puzzling findings that stocks tend to react somewhat negatively to positive growth news (Boyd, Hu, Jagannathan 2005). Good growth news implies both higher expected dividends and higher future risk-free rate. Therefore, these two channels affect stock prices in the opposite directions. Intuitively, implied volatility of T-notes can instrument for the strength of monetary channel. When such implied volatility is low, risk-free rate is not expected to vary a lot, making risk-free rate less sensitive to changes in economic environment.

I show that positive reaction of stocks to good (i.e., higher growth) MNA surprise is much stronger when monetary uncertainty is low. High level of monetary uncertainty makes positive response of stocks to MNA weaker. At high enough level of monetary uncertainty, the relation between stock returns and MNA surprise may even reverse due to larger strength of monetary channel. Very high monetary uncertainty during 1970s-1980s is likely to be the reason previous research failed to find positive response of stocks to MNA surprise. Simple statistical framework allows me to quantitatively assess contribution of these two channels to the reaction of aggregate stock prices to most types of MNA. After controlling for monetary channel, 1 standard deviation surprise in major MNA causes 30 bps higher returns, i.e., price movement, equal to 90% of standard deviation of returns during similar 30-minute periods on days without MNA.

Third, I document that none of major MNA surprises is priced in the cross-section of expected stock returns. I use MNA surprise as a proxy for macroeconomic shock, associated with each MNA type and estimate sensitivities of individual stocks to these shocks. None of 4 major MNA shocks produces significant return spread. This finding is consistent with the idea that risk premium is not significantly affected by MNA, implying that most of changes in discount rate come from risk-free rate. The whole yield curve appears to shift up or down in response to MNA surprise.

The literature on behavior of stock prices during periods of MNA dates back at least to Schwert (1981). Pearce and Roley (1985) find that money supply is the only MNA, which affects stock returns. Cutler, Poterba and Summers (1989) uses vector autoregression on monthly data to quantify fraction of returns, driven by macroeconomic news. McQueen and Roley (1993) suggest that response of stock market to MNA may depend on business cycle. They find positive reaction to good news during periods of low growth and negative reaction during boom. Flannery and Protopapadakis (2002) argue that nonlinearity and time dependence of effects of MNA makes them hard to detect. They focus on response of market volatility to MNA and find that money supply and inflation are the most important MNA. Boyd, Hu and Jagannathan (2005) study market response to unemployment news and find that on average bad unemployment news have positive effect on stocks. They explain this result by the hypothesis that during expansions market perceives unemployment news as news about interest rate rather than economic growth. Law, Song and Yaron (2020) use New Keynesian model to argue that stock response to MNA surprise is the strongest during the periods of low output gap. My paper reinterprets the results in the papers above by showing that monetary uncertainty is the driver of state dependence of stock response to MNA. Since monetary uncertainty is the lowest during early recovery, previous research misattributed time variation in this response to business cycles rather than monetary uncertainty. I show that stage of business cycle has little explanatory power after controlling for monetary uncertainty.

By uncovering and quantifying large monetary channel of stock response to major MNA, this paper contributes to monetary economics. The last two decades saw increased interest in asset pricing effects of monetary policy. Bernanke and Kuttner (2005) used high-frequency identification to argue that stocks react negatively to Fed Funds rate surprises. There is growing body of research on the implications of zero lower bound (ZLB) for monetary transmission and asset prices. Swanson and Williams (2013, 2014) and Zhou (2014) focus on response of forward rates to monetary news at ZLB.

The paper is organized as follows. Section 2 explains advantages of event studies for identifying relation between asset prices and macroeconomic conditions. Section 3 discusses data sources, identifies types of MNA and discusses construction of monetary uncertainty proxy. Section 4 focuses on the response of stocks to major MNA. Section 5 decomposes this response into cash flow and monetary channels using simple statistical framework. Section 6 explores cross-section of stocks by their response to major MNA. Section 7 concludes.

2 Estimation of the response using event study

Asset pricing has long tradition of estimating exposures of financial assets to macroeconomic variables. Most studies use low-frequency regressions to perform such estimation. For example, to estimate exposure of a stock to consumption growth, we usually regress its returns on contemporaneous consumption growth at monthly (quarterly) frequency. While simplicity of this approach makes it very appealing, it suffers from some drawbacks. Examples of such limitations are a lack of causal interpretation of estimates, low statistical power, inability to distinguish between similar macroeconomic variables. Another problem of this approach is its inability to account for market expectations in a reasonably precise way. As emphasised by Brunnermeier et al. (2021), since returns of financial assets should be driven by changes in expectations, controlling for the expectations is critically important. Traditional approach usually uses either first differences or residuals from some time-series model, such as VAR, in order to measure innovations in macroeconomic variables. Multiple studies (Ang et al., 2007, Rossi and Sekhposyan, 2015) suggest that investors‘ surveys provide better proxy for expectations, compared to time series models. To the best of my knowledge, there are no investors’ forecasts, made during the last days of the month t-1 for macroeconomic variables in month t. Thus controlling for investors‘ expectations is not feasible within traditional framework.

High-frequency event studies provide somewhat overlooked alternative to the traditional approach for estimating exposures of financial assets to macroeconomic variables. Event studies in finance date back at least to Fama, Fisher, Jensen and Roll (1969) and Ball and Brown (1968). As intraday data and investors‘ surveys became available during the last 25 years, we can use event study methodology to estimate responses of asset prices to macroeconomic variables in a way, which mitigates most of limitations of traditional approach. Such high-frequency event study involves regressing asset returns during short intraday window, centered on news announcement, on announcement surprise. Announcement surprise is a difference between announced value of macroeconomic variable and mean(median) value from investors‘ survey.

Such high-frequency event studies have a number of advantages over traditional low-frequency analysis:

1. Higher signal-to-noise ratio.
2. Controlling for market expectations.
3. Ability to distinguish between the effects of highly correlated macroeconomic variables.
4. Higher statistical power from combining multiple MNA of the same type.
5. More causal interpretation of results.

Measuring the response of asset prices to MNA over short intraday window allows to isolate out only the shock, associated with MNA surprise. This leads to higher statistical power and enables us to detect asset price responses, previously obscured by noise in asset returns.

Brunnermeier et al. (2021) emphasises importance of accounting for market expectations when analyzing asset price movements. Since multiple entities (Bloomberg, Reuters) conduct investors‘ surveys immediately before release of MNA, it is possible to measure response of asset prices to actual change in market expectations.

Most macroeconomic variables are measured at monthly or quarterly frequency. Since many assets do not have long time series of their returns, this often results in small sample size. Hence estimating exposure of financial assets to macroeconomic variables often suffers from low statistical power. Combining multiple MNA of the similar type (e.g., economic growth or inflation) allows to effectively increase sample size by the factor of 2-10 and achieve higher statistical power.

One of the problems with low-frequency analysis, commonly used to estimate loadings of an asset on macroeconomic variables, is high correlation between most macroeconomic variables. This makes it difficult to distinguish between the effects of correlated macroeconomic variables. Since most of MNA releases do not coincide in time, it becomes trivial to identify the most relevant MNA. By definition, irrelevant MNA do not induce any market reaction upon release.

Finally, estimates of the exposure of financial assets to macroeconomic variables using traditional analysis are just correlations. Since at low frequency many macroeconomic variables may be affected by financial market movements, such estimates suffer from reverse causality. Furthermore, the previous paragraph explained that these estimates may be hard to attribute to specific macroeconomic variable. Using high-frequency event studies allows to mitigate these endogeneity concerns and give causal flavour to such estimates.

3 Data and News Types

I obtain MNA data from Bloomberg. Over 1997-2019 I download all MNA for variables, which are collected at monthly frequency. Together with Federal Open Market Committee (FOMC) meetings, there are 20 such anouncements. Table 1 describes types and exact times when these MNA are released. In a few cases macroeconomic variables were not released for some month, so there is small variation in the number of announcements for each MNA. For most MNA, my sample includes 272-278 news releases.

Since asset prices reflect beliefs about future, in order to capture their forward-looking nature, I need some proxy for expectations. I use Bloomberg survey data to proxy for values of these macroeconomic variables before MNA release. Bloomberg collects these data for 2 weeks before a news release, with most forecasts made within 5 days before announcement. This allows me to compute news surprise as a difference between announced variable and its survey median.

Table 1 shows that many MNA are released at 8:30 am, when stock exchanges are closed. Therefore, in order to estimate a reaction of financial assets to such announcements, I use futures, which are traded around the clock. To proxy for aggregate stock market, I use E-Mini S&P 500 futures. To gauge reaction of risk-free rate, I use Fed Funds futures as well as Treasury rates at maturities of 2, 5 and 10 years. My sample of Fed Fund futures and Treasury rates starts in 1997.

I use S&P 500 futures, Fed Funds futures and Treasury rates data at 1-minute frequency. As I show in Section 4, using high-frequency data is critically important to identify response of asset prices to MNA. In addition to aggregate data, I download prices of constituents of SP500 from TAQ. These data span 1997-2019 and are aggregated at 5-minute frequency. One potential drawback of using TAQ is that trades data starts at 9:30 am, making it somewhat difficult to estimate stock response to early-morning MNA.

I use Bloomberg data on Black implied volatilities of US LIBOR rate swaptions in order to proxy for implied volatilities of Treasury rates. For example, to proxy for implied volatility of 2-year Treasury rate, I use Black implied volatility of swaptions with 1-year maturity and 2-year tenor. Then I multiply this implied volatility by the level of 2-year Treasury rate. This paper uses implied volatility of 2-year Treasury as a proxy for monetary uncertainty. Figure 1 describes time variation of monetary uncertainty.

4 Stock Market Response to MNA

Ernst et al. (2020) show that any study which explores large set of MNA could suffer from data mining problem. To avoid multiple hypothesis testing concerns, I first identify a set of MNA, which have significant effect on the market and then study only those MNA.

To be relevant for financial markets, MNA must lead to increased volatility immediately after announcement. To measure such increase, I look at absolute value of market returns during 30-minutes window around news release. Unless stated otherwise, all analysis in this paper uses the window, starting 10 minutes before the announcement and ending 20 minutes after it. Then I compare average absolute returns within this window to average absolute returns during the same time of day over days without MNA. Relevant MNA should produce significantly higher absolute value of returns compared to no-news baseline.

Table 2 describes this volatility. To test whether MNA generates increased variation in returns, I run both T-test and Mann-Whitney-Wilcoxon tests between MNA and no-news periods. In order to be considered relevant, MNA must have p-value below 0.05 in T-test. According to this metric, there are 7 relevant MNA:

- Non-farm payroll (NFP).
- ISM Manufacturing (PMI).
- Retail Sales.
- Construction Spending.
- Consumer Price Index (CPI).
- Producer Price Index (PPI).
- Conference Board Consumer Confidence.

After identifying 7 types of MNA to explore, I report their summary statistics in Table 3. It documents distribution of aggregate stock returns during MNA, news surprises as well as levels of several macroeconomic variables, which will be used in subsequent analysis. For each MNA, I normalize its news surprise by its full-sample standard deviation.

Then I explore reaction of the market to these MNA. Since NFP and unemployment news are announced as a part of a single release, Table 4 contains 8 types of MNA. To assess this response, I run simple OLS:

$$R_t = a + b * Surprise_t + \epsilon_t. \tag{1}$$

Table 4 reports coefficient b and adjusted R^2 for each type of MNA. There are 5 types of MNA, which have large directional effect on the stocks: NFP, PMI, Retail Sales, Consumer Confidence and CPI. Their coefficient estimates are highly statistically significant with t-statistics above 4. More importantly, economic magnitudes are large: 1 standard deviation of good news leads to 11-25 bps higher returns. R^2 from these regressions imply that these 5 MNA surprises can explain 9-20% of return variation during announcement windows.

Another way to see large economic importance of these responses is to compare the magnitude of returns, caused by news surprise, to average price movement during similar periods without MNA. 1 standard deviation of S&P 500 returns over no-news window at 8:30 (10:00) is 34(37)bps. In other words, 1 standard deviation of MNA news surprise creates price movement, equal to 35-75% of price movement on comparable periods without MNA. Since inflation news releases contain information, conceptually different from the news about future growth (NFP, PMI, Retail), to facilitate interpretation of my results I focus on news about growth in the remainder of the paper.

Direction of stock response is another interesting result. While, intuitively, good (i.e., higher growth) macroeconomic news should lead to higher stock prices, past research (McQueen, Roley 1993, Flannery, Protopapadakis 2002, Boyd, Hu, Jagannathan 2005) failed to detect such relation. These papers do not find significant unconditional relation between stock returns and news surprises. Thus they focus on more complex relations such as effect of news on market volatility or differential effect of MNA surprises over business cycle. For example, Boyd, Hu, Jagannathan (2005) argue that, on average, good unemployment news are bad news for stocks, since such news are seen as bad news during expansions due to larger effect on expected interest rates than expected growth. But even when considering more complex relations, these papers struggle to find patterns with high statistical and economic significance.

My identification approach has 2 main advantages over these papers, which allows me to estimate the response more accurately.

First, using intraday data dramatically improves signal to noise ratio. Given high liquidity of stock market over the recent decades, it is reasonable to expect that most of important and widely followed news will be incorporated into prices within minutes. This is especially true for macroeconomic news due to their standardized and repetitive nature. While using 30-minutes or 1-hour window to measure effect of monetary policy changes on financial markets has been standard for more than 15 years (Gurkaynak, Sack and Swanson 2005), for some reason this approach is not yet dominant in the analysis of MNA.

Table 5 illustrates benefits of using 30-minutes window to identify effect of MNA on the example of PMI news. While moving from daily frequency to 30-minutes window (i.e., column 1 versus column 4) has little effect on the coefficient estimate, it dramatically reduces standard error. Using daily window, we would find barely significant positive response with R^2 of 1%. So it would appear that this pattern is too small to be worth studying. But using 30-minutes window allows us to uncover highly significant response with t-statistic of 5 and R^2 of 9%.

Second methodological improvement is using surveys of market participants to proxy for their expectations. Most papers, studying MNA, use either time-series models or low-frequency surveys to construct expectations, needed to compute news surprises. I use Bloomberg surveys, which are continuously updated up to 2 hours before MNA. Better proxy for market expectations leads to more accurate measure of news surprise.

Results in Table 4 suggest that unemployment, PPI and construction news do not have highly significant effect on aggregate stock returns. This evidence suggests that market views NFP as more important indicator of the state of labor market than unemployment. This result is consistent with the Congress Testimony of Alan Greenspan on Feb 11, 2004, when he suggested investors pay closer attention to NFP rather than unemployment. Unlike unemployment, NFP accounts for both labor force participation rate and the number of job-seekers. Thus focus on unemployment as opposed to NFP may be another reason why past research failed to uncover strong response of stocks to labor market news.

In the remainder of the paper, I restrict my analysis to 3 types on MNA, which induce large market reaction: NFP, PMI and Retail. Not surprisingly, these news are among the most closely-followed news by financial press.

After documenting large response of stocks to MNA surprises, I explore its dependence on economic environment. McQueen, Roley (1993), Flannery, Protopapadakis (2002), Boyd, Hu, Jagannathan (2005) and Law, Song and Yaron(2021) suggest that this reaction may vary across stages of business cycle. To test this hypothesis, I divide sample into 2 parts by the rates of economic growth, proxied by Chicago Fed National Activity Indicator. Additionally, I look at this response across samples with low and high interest rates.

Table 6 contains the results for 4 most important types of MNA (NFP, PMI, Retail and Consumer Confidence). This table reports estimates from regression (1) in subsamples, divided by growth and interest rates. For every MNA, we observe the following pattern. Unconditionally, news surprises have positive effect on stocks. This effect appears stronger during recessions, though this difference is not very large (6 bps). So far, the results are consistent with the past research.

The last two columns in Table 6 show that stock response to MNA surprise differs dramatically across periods of low monetary uncertainty versus high monetary uncertainty. While positive growth news are still good news for the market, the response is much weaker during the periods of high monetary uncertainty. The magnitude of this response is almost 3 times stronger during the period of low monetary uncertainty. In other words, when implied volatility of interest rates is very low, good macroeconomic news are interpreted very optimistically by the market. For example, in low monetary uncertainty subsample, NFP surprise explains 37% of variation in announcement-period return as opposed to mere 1% during the period of high monetary uncertainty. When monetary uncertainty is low, 1 standard deviation of good NFP surprise leads to 42 bps higher announcement returns.

Whereas these results are different from McQueen, Roley (1993), Flannery, Protopapadakis (2002), and Boyd, Hu, Jagannathan (2005), it is not hard to reconcile them. Dependence of stock response on the stage of business cycle appears to be a manifestation of monetary uncertainty effect. Post-recession recovery coincides with the periods of low rates and low monetary uncertainty. Thus previous findings of strong positive response during recession and recovery were likely driven by low interest rates uncertainty. Failure of these papers to find positive response of stocks to MNA surprise in their full sample was mostly due to very high interest rates in 1980s. My sample, starting in 1997, does not contain periods of monetary uncertainty, high enough to reverse the sign of the response.

Intuitively, MNA should affect stocks through 3 channels: expected cash flows, risk-free rate and risk premium. Good growth shock will raise expectations of dividends, but is likely to increase discount rate through its risk-free component. The next section discusses connection between this intuition and the results above.

5 Decomposition of the response

Previous section documented strong dependence of stock market response to MNA on the level of monetary uncertainty. This section will further explore this result and introduce simple framework to help interpret these findings.

According to (2), stock price is a function of expected dividends, risk-free rate and risk premium. Thus any price movement must come from one or more of these three channels. All 4 MNA above have natural interpretation as shocks to expected growth, i.e., cash flows. However, due to dual mandate of the Fed, it is supposed to use monetary policy to offset cyclical fluctuations. Therefore, any changes in macroeconomic expectations are likely to affect future monetary policy. Hence each MNA affects stocks through at least 2 channels: growth channel and monetary channel. Furthermore, if MNA is related to risk premium, it could reflect a combination of all

3 channels.

$$P_t = \frac{\mathbb{E}_t[D]}{R_f + RP}. \tag{2}$$

Presence of growth channel and risk-free rate channel complicates measurement of stock market response to MNA, since these two channels affect stocks in the opposite directions. For example, good employment surprise increases stock price via expected dividends channel. At the same time, such news is likely to increase probability of monetary tightening in the future, thus decreasing stock price through risk-free rate channel. This problem has long been recognized by literature (e.g., Boyd et al., 2005).

Table 7 reports the estimates of the coefficients in the regression with interaction term between MNA surprise and monetary uncertainty (MU):

$$R_t = a + b * Surprise_t + c * \mathrm{MU}_{t-1} + d * Surprise_t * \mathrm{MU}_{t-1} + \epsilon_t. \tag{3}$$

Controlling for an interaction between monetary uncertainty (implied volatility of 2-year interest rate 1 day before MNA) doubles coefficient on MNA surprise. The coefficient on the interaction term is negative (-23 bps) and highly significant (t-statistic above 4). Consistent with the results in Table 6, adding interaction term of surprise with a proxy for the stage of business cycle (Chicago Fed Index) does not affect results.

1 standard deviation of news surprise leads to 30 bps positive returns when the level of monetary uncertainty is zero. As monetary uncertainty increases, this positive response becomes weaker. When implied volatility of Treasury rate is equal to 1.3%, interaction term perfectly offsets positive channel and surprise does not affect stock prices. At levels of implied volatility of Treasury rate above 1.3% we are likely to see negative response: stocks will fall in response to good growth news.

These results lead to a hypothesis that the interaction term proxies for the strength of the monetary channel, while coefficient on MNA surprise captures the cash flow channel. Intuitively, at zero lower bound (ZLB), changes in macroeconomic conditions will have smaller effect on possible change in monetary policy and monetary uncertainty will be close to zero. This argument applies not only to downward movement in risk-free rate (it is unlikely to become negative), but to rate increases too. Experience of the past decade shows that whenever interest rate reaches zero, it is likely to stay at zero for some period of time. We can view zero interest rate as the period of time when Fed‘s desired rate is negative, but they are unable to decrease it due to ZLB. So even when good news arrive, it means that Fed‘s preferred rate becomes less negative and this does not cause rate hike. Thus it is natural to expect that the level of interest rates and monetary uncertainty could instrument for the strength of risk-free rate channel.

The last two columns in Table 7 show response of 2-year Treasury rate to MNA surprise. Following the literature (Hanson and Stein 2015), I use 2-year Treasury rate futures to proxy for changes in expectations. Results in column 4 mean that risk-free rate increases in response to good news. Risk-free rate changes by 2.2 bps in response to 1 standard deviation MNA surprise. 5-year and 10-year Treasury rates exhibit similarly strong response to MNA surprise (2-2.5 bps), suggesting that positive MNA surprise shifts the whole yield curve up. Positive interaction term in the last column implies that interest rate is more sensitive to MNA surprise when monetary uncertainty is farther from zero. Overall, these results are consistent with the hypothesis that monetary channel is stronger when the monetary uncertainty is higher.

I can formalize this intuition using simple framework as follows. Consider growth news ϵ_t, which does not affect risk premium. Then, according to log-linearized (2), it should move the price through expected cash flow and risk-free rate (ΔR_t^F) channels:

$$R_t = a_1 * \epsilon_t + a_2 * \Delta R_t^F + e_{1,t}. \tag{4}$$

Risk-free rate channel reflects changes in expected monetary policy due to growth news ϵ:

$$\Delta R_t^F = (\gamma_0 + \gamma_1 * MU_{t-1}) * \epsilon_t + e_{2,t}. \tag{5}$$

Plugging (5) into (4), rearranging the terms yields (6):

$$R_t = [a_1 + a_2 * \gamma_0] * \epsilon_t + [a_2\gamma_1] * MU_{t-1} * \epsilon_t + e_{3,t}. \tag{6}$$

We can view regressions in Table 7 as attempts to estimate (5) and (6) above. For example, column 5 of Table 7 implies that $\hat{\gamma_0} = 0$, so the estimates of coefficients on the MNA surprise in the column 2 are a_1 and $a_2 * \gamma_1$, i.e., risk-free rate channel and cash flow channel respectively. 1 standard deviation of positive MNA surprise raises stock prices by 30 bps due to higher expected cash flows. At the same time, 1 standard deviation of good MNA surprise decreases stock prices by 23 bps per each 1% of monetary uncertainty MU_{t-1}. This is an estimate of the strength of monetary channel.

This decomposition is based on two assumptions. First, I assume that MNA surprise does not affect risk premium. Section 6 will show that this assumption holds for all 4 major MNA. Second, I assume that cash flow channel of the response of stocks to growth shock ϵ_t does not depend on the level of monetary uncertainty. In unreported results, I show that MNA surprise has similar predictive power for future earnings during the periods of low and high monetary uncertainty. Thus, it does not seem that cash flow channel varies according to the level of monetary uncertainty.

The decomposition provides possible answer to why many papers (McQueen, Roley 1993, Flannery, Protopapadakis 2002, Boyd, Hu and Jagannathan 2005), analyzing MNA, failed to uncover large effect of MNA on stock market. The direction and magnitude of the response of stocks to MNA critically depend on the relative strength of cash flow and monetary channels. When interest rate and monetary uncertainty are high, monetary channel becomes stronger and can offset cash flow channel. When monetary uncertainty exceeds 1.3%, the direction of the response may even reverse.

Since the papers above use a sample, starting in 1970s, the average risk-free rates in their sample exceed 6% and monetary uncertainty is likely to be above 1.3%. Hence my results can explain the finding of Boyd, Hu and Jagannathan (2005) that, on average, stocks react negatively to positive unemployment news. It is driven by the fact that in most of their sample risk-free rate channel dominates. But when interest rates are constrained by zero lower bound and monetary uncertainty is low, cash flow channel becomes a dominant channel, so we observe large positive response to good news. My results for 4 major MNA suggest that 1 standard deviation of good surprise leads to 30 bps positive returns from cash flow channel. When monetary uncertainty is equal to 1.3%, this good growth shock will additionally lead to the negative returns of the similar magnitude (23*1.3=30bps) from the monetary channel. Hence, simple OLS will fail to detect any response, while the total absolute response from these two channels will amount to 60 bps.

Another contribution of this framework is its implications for effects of monetary policy. Notice that it is possible to estimate all coefficients from (6) using the two regressions from Table 7. While a_1 and γ_1 are MNA-specific, a_2 should be the same for any MNA. I estimate a_2 equal to -8. This estimate is somewhat larger then the results in Bernanke and Kuttner (2005), who estimated sensitivity of aggregate stock market to risk-free rate around -5.

6 MNA surprise in the cross-section

This section uses surprises for 4 types of MNA to test whether these surprises are priced in the cross-section of expected returns. For each type of MNA, I use the same methodology. After estimating covariance of stock returns with MNA surprise, I divide stocks into quintile portfolios on this covariance and test whether there is significant return spread.

As mentioned in Section 3, accurate identification of stock response to MNA requires using intraday data. Since individual stocks are less liquid than S&P 500 and require more time to react to news, I decide to use the window from 10 minutes before news release to 2 hours after announcement. Since small stocks are likely to respond to news slower due to low liquidity and resulting lags, I focus on constituents of SP 500. In order to avoid effects due to inclusion/exclusion to S&P 500, in the year t I consider all stocks, which were constituents on S&P500 at the end of year t-1.

I estimate covariances of individual stock returns and MNA surprises using rolling window over 4 years. For each MNA and for each stock I run regression (7):

$$R_t = \alpha + \beta^{MNA} * Surprise_t + \beta * R_t^{SP500} + e_t. \tag{7}$$

Each month I sort stocks into quintile portfolios, based on their β^{MNA}. I compute returns of these decile portfolios and report them in Table 8. Tables 8 and 9 suggest that none of the 3 types of MNA are priced in the cross-section of expected stock returns. Long-short portfolios have returns between -10 and +21 bps with all t-statistics below 1. Abnormal return spreads of long-short portfolios are statistically and economically insignificant (-16 to + 3 bps).

One possible concern with this methodology is that I may be unable to get precise estimates of sensitivities of individual stocks to MNA surprises. Figure 2 explores whether investors could implement these trading strategies in real time. To implement them, investors must be able to use their ex ante estimates of β^{MNA} to predict its realized values. In other words, pre-ranking β^{MNA} must predict post-ranking β^{MNA}. I calculate post-ranking β^{MNA} as a coefficient from regression (7) over full sample for each quintile portfolio. Figure 1 shows that pre-ranking β^{NFP} is a strong predictor of post-ranking β^{NFP} with almost perfectly linear relation between these variables. Results are similar for predictability of post-ranking β^{PMI}.

These results seem to imply that changes in key macroeconomic variables do not have significant effect on risk premium. While theoretically puzzling, they are consistent with empirical research, which document similar findings using lower-frequency methodology (e.g., Herskovic, Moreira and Muir, 2019).

7 Conclusion

This paper explores a large set of macroeconomic news announcements (MNA). Availability of new data enables improvements in identification, which allows me to obtain three important results. First, stocks exhibit strong positive reaction to major MNA: 1 standard deviation of good surprise causes 11-25 bps higher returns. This response is the strongest for 4 commonly reported MNA: Non-farm payroll, PMI, Retail sales and Consumer Confidence.

Second, I use monetary uncertainty to proxy for the strength of monetary channel and decompose this response into cash flow and monetary components. 1 standard deviation of good MNA surprise leads to 30 bps returns from cash flow channel and minus 23 bps per 1% of monetary uncertainty from monetary channel. The positive response of stocks to MNA via cash flow channel is very large and amounts to 60%-180% of return variation during comparable no-news periods. Large monetary channel during periods of high monetary uncertainty masks strong positive response of stocks to MNA, which explains why past research failed to detect this relation.

Third, I explore response to major MNA in the cross-section of stock returns. Differential exposure to MNA shocks does not produce spread in the cross-section of expected returns. This result is consistent with previous findings and suggests that cash flow channel and risk-free rate channel are the main channels through which MNA affect stocks.

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9 Appendix

Figure 1: Implied volatility of 2-year Treasuries

The figure describes implied volatility of the rate on 2-year Treasury notes in percentage points. To proxy for this implied volatility I use Black implied volatility of swaptions with 1-year maturity and 2-year tenor. I rescale this implied volatility by the level of 2-year Treasury rate. For example, implied volatility of 100 bps in July 2002 is a product of swaption implied volatility of 42% and 2.4% level of 2-year Treasury rate.

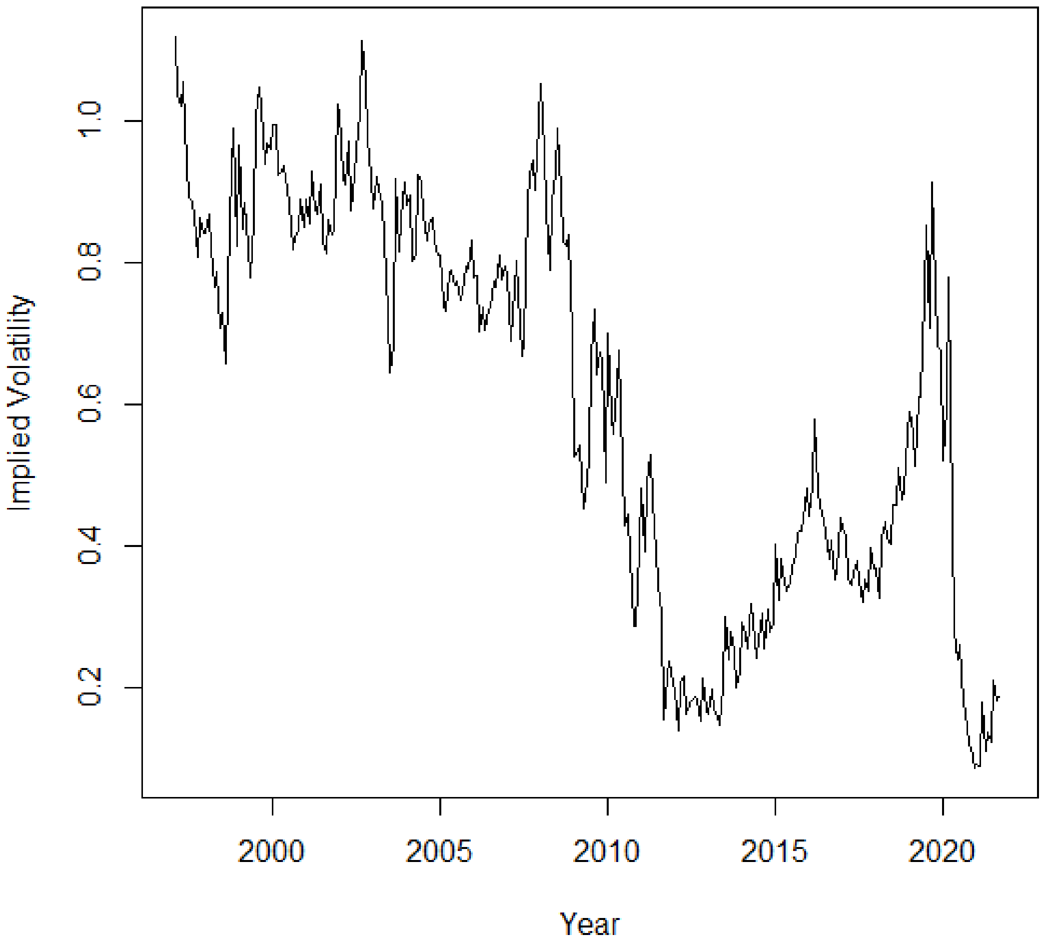

Figure 2: Pre-ranking and postranking betas

The figure describes pre-ranking and post-ranking betas of quintile portfolios, sorted on pre-ranking beta. For each panel, β_{MNA} is a coefficient from the regression of stock returns on MNA surprise for a certain type of MNA. I estimate post-ranking β_{MNA} using full sample for each quintile value-weighted portfolio, formed on pre-ranking β_{MNA}.

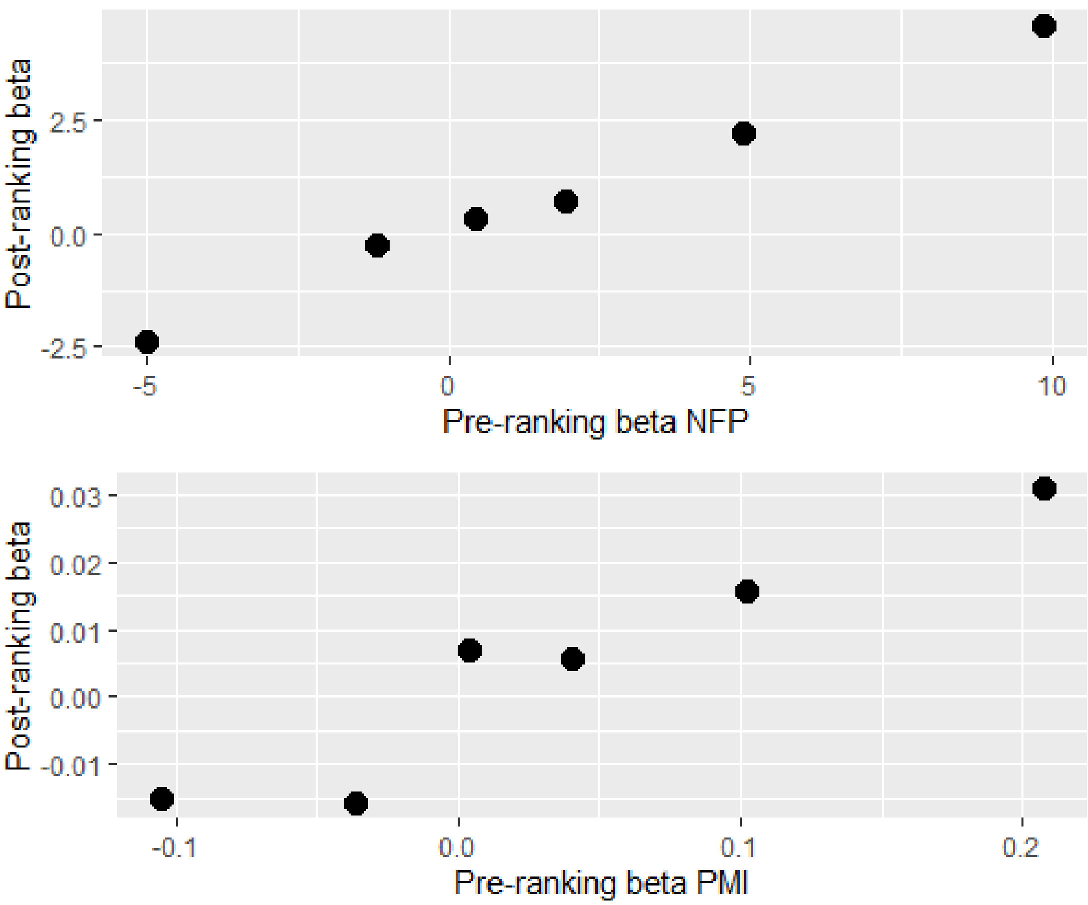

Table 1: Macroeconomic News Announcements

The table reports main details about all MNA at monthly frequency. N stands for the number of observations in the sample, while Day means business day of the month, when the news is released.

News	N	Time	Day
Non-Farm Payroll	276	8:30	1-5
ISM Manufacturing	278	10:00	1-2
Retail Sales Advance MoM	277	08:30	9-12
Construction Spending MoM	272	10:00	1-2
CPI MoM	278	08:30	7-12
PPI MoM	264	08:30	9-13
Conf. Board Consumer Confidence	275	10:00	18-21
Capacity Utilization	276	09:15	10-13
U. of Mich. Sentiment F	248	10:00	1-2, 16-21
Trade Balance	277	08:30	3-15
Business Inventories	270	10:00	9-12
Housing Starts	263	08:30	10-14
Factory Orders	279	10:00	2-4
Leading Index	274	10:00	1-3, 10-16
U. of Mich. Sentiment P	247	10:00	8-13
Monthly Budget Statement	278	14:00	8-17
New Home Sales	268	10:00	16-21
Durable Goods Orders	258	08:30	16-20
Consumer Credit	278	15:00	5

Table 2: Absolute returns during MNA

The table reports absolute value of returns of S&P 500 futures over 30-minutes window around MNA. I test hypothesis that absolute value of returns is higher during MNA window than during similar window on days without MNA. Mean absolute returns on non-MNA days range between 14 and 24 bps depending on the time. The last two columns report p-values from the two tests: T-test and Mann-Whitney-Wilcoxon test.

News	Mean	Median	p-value (t)	p-value (MWW)
Non-Farm Payroll	0.41	0.29	0	0
ISM Manufacturing	0.36	0.27	0.0000	0
Retail Sales Advance MoM	0.21	0.13	0.0000	0
Construction Spending MoM	0.34	0.23	0.0000	0
CPI MoM	0.21	0.13	0.0001	0
PPI MoM	0.19	0.12	0.0002	0
Conf. Board Consumer Confidence	0.29	0.18	0.03	0.12
Capacity Utilization	0.17	0.10	0.14	0.37
U. of Mich. Sentiment F	0.27	0.18	0.28	0.17
Trade Balance	0.16	0.10	0.31	0.03
Business Inventories	0.23	0.16	0.40	0.53
Housing Starts	0.15	0.09	0.40	0.07
Factory Orders	0.24	0.17	0.46	0.97
Leading Index	0.26	0.19	0.47	0.29
U. of Mich. Sentiment P	0.26	0.16	0.76	0.66
Monthly Budget Statement	0.17	0.11	0.78	0.33
New Home Sales	0.25	0.16	0.79	0.86
Durable Goods Orders	0.14	0.09	0.84	0.17
Consumer Credit	0.20	0.12	0.91	0.66

Table 3: Summary statistics of returns and announcement surprises

The table reports summary statistics of macroeconomic variables, announcement surprises and announcement returns for each major MNA. px stands for x^{th} percentile. Returns are reported in percentage points, surprises are normalized to have standard deviation of 1.

News	Variable	Min	p1	p10	p25	Median	p75	p90	p99	Max	Mean	SD
All	CFNAI	-3.35	-2.68	-0.61	-0.31	0.02	0.28	0.50	0.94	1.21	-0.07	0.60
All	USREC	0	0	0	0	0	0	0	1	1	0.09	0.29
All	FFR_{t-1}	0.12	0.12	0.12	0.12	1.62	4.75	5.50	6.50	6.50	2.25	2.14
All	drate	-0.09	-0.05	-0.01	0	0	0	0.01	0.04	0.09	0	0.01
NFP	spx_ret	-2.03	-1.46	-0.66	-0.20	0.10	0.31	0.72	1.41	1.97	0.04	0.56
NFP	surprise	-3.93	-2.90	-1.31	-0.68	-0.06	0.44	1.02	2.19	3.22	-0.13	1
PMI	spx_ret	-3.26	-1.34	-0.57	-0.29	0.01	0.23	0.50	1.47	2.17	0	0.52
PMI	surprise	-3.23	-2.45	-1.13	-0.59	0	0.66	1.32	2.37	3.98	0.06	1
Retail	spx_ret	-1.49	-0.93	-0.30	-0.08	0.02	0.16	0.33	0.93	1.04	0.02	0.32
Retail	surprise	-3	-2.62	-0.94	-0.56	0	0.37	0.94	2.68	8.62	-0.02	1
Constr	spx_ret	-3.26	-1.23	-0.47	-0.24	0.03	0.22	0.50	1.45	2.17	0.02	0.50
Constr	surprise	-7.71	-2.18	-1.09	-0.51	0	0.45	0.86	2.17	4.20	-0.06	1
Unempl	spx_ret	-2.03	-1.46	-0.66	-0.20	0.10	0.31	0.72	1.41	1.97	0.04	0.56
Unempl	surprise	-3.52	-2.34	-1.41	-0.70	0	0.70	0.70	2.11	2.81	-0.18	1
CPI	spx_ret	-1.87	-0.95	-0.31	-0.11	0.02	0.13	0.35	0.80	2.47	0.01	0.35
CPI	surprise	-3.35	-2.52	-0.84	-0.84	0	0.84	0.84	2.52	3.35	-0.06	1.01
PPI	spx_ret	-1.43	-0.80	-0.30	-0.12	-0.01	0.12	0.27	0.84	0.97	-0.01	0.29
PPI	surprise	-2.91	-2.91	-0.97	-0.48	0	0.48	1.19	2.76	4.12	0.02	1

Table 4: Response of S&P500 to MNA, $R_t = a + bSurprise_t + \epsilon_t$.

The table reports response of S&P 500 futures to MNA surprises over 30-minutes announcement window. Each row reports results for different MNA. R^2 is adjusted R^2 from this regression.

Event	b	T-statistic(b)	R^2
Change in Nonfarm Payrolls	0.25	7.82	0.20
ISM Manufacturing	0.16	5.20	0.09
CPI MoM	-0.11	-5.84	0.12
Conf. Board Consumer Confidence	0.11	4.87	0.09
Retail Sales Advance MoM	0.11	5.87	0.12
Construction Spending MoM	0.07	2.44	0.02
Unemployment Rate	0.06	1.60	0.01
PPI MoM	-0.01	-0.71	-0.002

Table 5: Response of SP500 to PMI news announcement

The table documents response of S&P 500 futures to PMI news surprises. Each column reports estimates from the regression $R_t = a + bSurprise_t + \epsilon_t$. for different window width over which returns are measured. The first column reports regression, where dependent variable is daily return of CRSP value-weighted index. The dependent variable in the second column is S&P 500 futures at daily frequency. The third column uses S&P 500 futures returns between previous day 4pm and 20 minutes after news release. The last column reports estimates from the main specification with 30-minutes window and S&P 500 futures.

	Dependent variable:			
	vwretd	SP500	SP500	SP500
	(1)	(2)	(3)	(4)
PMI surprise	0.160^{**}	0.169^{**}	0.193^{***}	0.156^{***}
	[1.994]	[2.027]	[3.142]	[5.135]
Constant	0.163^{**}	0.165^{*}	0.105^{*}	-0.008
	[2.018]	[1.961]	[1.696]	[-0.260]
Announcement window	Day	Day	Half-day	30 minutes
Observations	276	266	266	266
Adjusted R^2	0.011	0.012	0.032	0.087
Note:				*p<0.1; **p<0.05; ***p<0.01

Table 6: Stock response to major MNA

The table documents response of S&P 500 futures to news surprises among 4 most important MNA: NFP, PMI, Consumer Confidence and Retail. Each column reports estimates from the regression $R_t = a + bSurprise_t + \epsilon_t$. for different subsamples: periods of recession or expansion, half-samples with low/high level of monetary uncertainty.

	Dependent variable:			
	SPX_ret			
	(1)	(2)	(3)	(4)
Surprise	0.203***	0.141***	0.244***	0.094***
	[4.552]	[9.998]	[12.869]	[4.987]
Constant	−0.030	0.013	0.006	0.004
	[−0.444]	[1.014]	[0.384]	[0.206]
Subsample	Recession	Expansion	Low mon. uncert.	High mon. uncert.
Observations	96	891	514	473
Adjusted R^2	0.172	0.100	0.243	0.048
Note:				*p<0.1; **p<0.05; ***p<0.01

Table 7: Response to major MNA, interaction terms

The table documents response of stocks and 2-year Treasury rates to 4 major MNA surprises. The first three columns document response of S&P 500, the last two report the response of 2-year Treasury rates. All responses are measured over 30-minutes window around announcement. MU stands for monetary uncertainty, i.e., implied volatility of 2-year Teasury rate.

	Dependent variable:				
	SPX			$\Delta rate$	
	(1)	(2)	(3)	(4)	(5)
Surprise	0.15***	0.30***	0.29***	2.16***	0.17
	[11.29]	[7.82]	[7.35]	[17.35]	[0.47]
MU		−0.01	−0.02		0.46
		[−0.29]	[−0.29]		[0.98]
CFNAI			−0.02		
			[−0.66]		
Surprise:MU		−0.23***	−0.22***		2.93***
		[−4.18]	[−4.08]		[5.86]
Surprise:CFNAI			−0.05***		
			[−2.96]		
Constant	0.01	0.02	0.02	−0.01	−0.28
	[0.96]	[0.59]	[0.63]	[−0.08]	[−0.90]
Observations	978	978	978	1,008	1,005
Adjusted R^2	0.11	0.13	0.13	0.23	0.25

Note: *p<0.1; **p<0.05; ***p<0.01

Table 8: Average returns of quintile portfolios, sorted on β_{MNA}

The table reports equal-weighted and value-weighted returns of quintile portfolios, formed on β_{MNA}. Each panel corresponds to different type of MNA. I estimate β_{MNA} using rolling-window regression of stocks returns on MNA surprises. Long-short portfolio buys stocks with the highest beta (i.e., fifth quintile) and sells stocks with the lowest beta (first quintile)

Panel A: Non-Farm Payroll

	Q1	Q2	Q3	Q4	Q5	L/S
Mean ew	0.90**	0.84***	0.82***	0.83***	0.91**	0.01
T-stat ew	[2.47]	[2.74]	[2.73]	[2.71]	[2.40]	[0.03]
Mean vw	0.57*	0.77***	0.70***	0.74***	0.78**	0.21
T-stat vw	[1.65]	[2.85]	[2.78]	[2.74]	[2.39]	[0.82]

Panel B: PMI

	Q1	Q2	Q3	Q4	Q5	L/S
Mean ew	0.84**	0.86***	0.96***	0.85**	0.79**	-0.04
T-stat ew	[2.33]	[2.92]	[3.15]	[2.55]	[2.00]	[-0.24]
Mean vw	0.78**	0.80***	0.73***	0.59*	0.68**	-0.10
T-stat vw	[2.51]	[3.10]	[2.82]	[1.85]	[1.98]	[-0.51]

Panel C: Retail Sales

	Q1	Q2	Q3	Q4	Q5	L/S
Mean ew	0.96***	0.76**	0.89***	1.05***	1.03***	0.07
T-stat ew	[2.69]	[2.48]	[2.87]	[3.25]	[2.94]	[0.43]
Mean vw	0.86***	0.61**	0.52*	0.92***	0.98***	0.12
T-stat vw	[2.75]	[2.16]	[1.80]	[3.47]	[3.31]	[0.60]

Table 9: Abnormal returns of quintile portfolios, sorted on β_{MNA}

The table reports abnormal returns of long-short quintile portfolios, formed on β_{MNA}. Long-short portfolio buys stocks with the highest beta (i.e., fifth quintile) and sells stocks with the lowest beta (first quintile). Each panel corresponds to different type of MNA. MOM is momentum factor and STR is short-term reversal factor.

Panel A: Non-Farm Payroll

Statistic	Ret	α_{CAPM}	α_{FF3}	$\alpha_{Carhart}$	α_{FF5}	$\alpha_{FF5+UMD+STR}$
L/S	0.21	0.21	0.15	0.11	0.07	0.03
	[0.82]	[0.81]	[0.58]	[0.43]	[0.27]	[0.13]

Panel B: PMI

Statistic	Ret	α_{CAPM}	α_{FF3}	$\alpha_{Carhart}$	α_{FF5}	$\alpha_{FF5+UMD+STR}$
L/S	-0.10	-0.20	-0.15	-0.12	-0.19	-0.16
	[-0.51]	[-1.00]	[-0.79]	[-0.63]	[-0.95]	[-0.83]

Panel C: Retail Sales

Statistic	Ret	α_{CAPM}	α_{FF3}	$\alpha_{Carhart}$	α_{FF5}	$\alpha_{FF5+UMD+STR}$
L/S	0.12	0.15	0.16	0.15	0.03	0.02
	[0.60]	[0.74]	[0.80]	[0.75]	[0.13]	[0.09]

Table 10: Announcement premium and the drift before MNA

The table presents average returns before and during major MNA. The first 4 columns report pre-announcement drift and announcement returns. Pre-announcement window runs fom 4pm of the previous trading day up to 10 minutes before announcement. Announcement window is 30-minutes window around MNA release. The last column reports correlation between pre-announcement drift and announcement returns.

News	Return^{Annc}	T-stat	$\text{Return}^{Pre-Annc}$	T-stat	Correlation
NFP	0.03	0.92	0.10	3.51	0.05
PMI	0.0001	0.004	-0.01	-0.17	0.10
Construction	0.02	0.53	0.03	0.61	0.08
Retail	0.02	1.06	-0.01	-0.19	-0.09
CPI	0.02	0.71	-0.02	-0.58	0.05
PPI	-0.01	-0.61	-0.001	-0.03	-0.08
FOMC	-0.01	-0.29	0.29	5.25	-0.20