How important is economic news for bond markets? *

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Abstract

We propose a novel methodology to estimate how much of the variation in bond returns can be attributed to macroeconomic news announcements. We find that economic news can explain 20% of the total daily variation in U.S. Treasury returns. On days with announcements on the FOMC target rate, the employment report and the preliminary GDP the explanatory power increases to 55%, 46%, and 36%, respectively. The importance of news varies over time. In the period with low bond market volatility in 2004 the explanatory power of economic news increases to 51%. News is more important when the VIX is low or investor sentiment is negative. Also, news that is contrary to the direction of FED rate changes is more important.

Keywords: Macroeconomic news announcements; FOMC; Treasury futures; High frequency data; Sentiment.

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1. Introduction

To what extent can price changes in financial markets be attributed to the arrival of new information? Understanding what drives asset prices is of key importance in financial economics. We expect asset prices react to macroeconomic news announcements or the outcome of FOMC meetings implying that investors update prices in response to new information. Yet many studies[1] find it very hard to establish any link between economic fundamentals and asset prices. The strongest exception is provided by event studies linking the returns in the minutes following the announcement to the surprise in this announcement[2]. Balduzzi, Elton, and Green (2001), for example, find that surprise component of the announcement explains up to 68% of bond price variation in small around the announcement. These studies, however, say nothing on how much of the *total* return variation can be attributed to (news on) fundamentals, or whether the initial price reaction reflects a permanent change in the price or just a transitory one. To address this issue, some studies investigate news effects on daily returns (e.g. Bernanke and Kuttner, 2005, Vrugt, 2009 and Beber and Brandt, 2009). However, announcements are found to be much less important at the daily frequency. Macroeconomic news can explain only up to 8% of daily bond variation (Hardouvelis, 1988, McQueen and Roley, 1993, Altavilla, Giannone, and Modugno, 2014).

We use a novel methodology to study the relation between economic news and 10-year U.S. Treasury returns. Rather than using indirect information from surprises in macroeconomic announcements we make use of the return reaction in the 20 minutes around an announcement. We regress the daily returns on these 20-minute returns following the news. There are several advantages of our approach. First, the regression R^2 gives a direct indication how much of the variation in daily returns can be attributed to news announcements. Second, we can analyze the importance of specific announcements for bond markets in terms of permanent price changes. Our novel method shows that several announcements are much more important than previously thought, whereas some news that comes out strong in surprise regressions turns out to be less important. Third, we directly measure news from the market reaction as opposed to using survey-based surprise measures. This is crucial as we confirm earlier findings that

[1] A famous early example for currencies is Meese and Rogoff (1983) where authors are unable to relate exchange rate moves to macroeconomic fundamentals.

[2] For example, Andersen et al. (2003) investigates currencies, Faust et al. (2007) currencies and interest rates, Balduzzi et al. (2001) and Fleming and Remolona (1999) bonds, Andersen et al. (2007) the joint reaction of T-bills, equities and exchange rates, Elder et al. (2013) energy commodities, Green (2004) government bonds, Elder et al. (2012) metals, Evans (2011) Treasury note, currency and equity futures, and Hussain (2010) international equity indices.

regressing daily returns on surprises hardly gives any significant results (average R^2 is only 3.3%). Fourth, we do not need surveys to compute surprises allowing us to take into account more announcements and use a longer sample. For example we can include the FOMC minutes in our analysis. Finally, we can easily aggregate over multiple announcements to provide a measure of how much of the bond returns can be attributed to news in general. A disadvantage of our approach is that other events on the same day provide noise on measuring the importance of news announcements. In that sense we provide a lower bound on the importance of news. Nevertheless we already find a much stronger relation between bond prices and news than other studies. Also if two announcements always occur at the same time we cannot tell which of the two announcements is most important. Here also analyzing intraday reactions to the surprises of the respective news announcements can provide a solution.

Macroeconomic news accounts for a large part of total return variation. Based on 57 announcements we find that 20% in the variation of daily bond returns[3] can be attributed to the news announcements. This is a much higher figure than previously found in the literature. For example Evans and Lyons (2008) infer from the results of Andersen et al. (2003) that not more than 2% of the total price variation is caused by news announcements. In fact, for the 55 U.S. macroeconomic announcements we have surprise data our novel methodology indicates news explains 20% of the variation in daily returns, whereas replacing the 20-minute returns by weighted (with hindsight) surprises suggests only 6% of the daily variation in bond returns is explained by news. This is in line with existing studies, showing that at most 8% of total daily bond return variation can be explained by the surprises (Hardouvelis, 1988, McQueen and Roley, 1993, Altavilla, Giannone, and Modugno, 2014).

Zooming in on individual announcements we find that the top five most important announcements from 1996 to 2013 are FOMC target rate announcements (explains 55% of the variation in daily bond returns on 130 FOMC announcement days), Employment report (46%), GDP Advance[4] (36%) and GDP Preliminary (36%), and Efficiency of Industrial Workers report (24%). In contrast, based on regressing daily bond returns on surprises the top five consists of Nonfarm Payrolls (21%)[5], ISM manufacturing (13%), Chicago PMI (11%), ISM non-manufacturing (11%) and Retail Sales (15%). We find FOMC

[3] Announcements occur on 76% of all trading days. Considering only announcement days announcements explain 24% of the bond return variation.

[4] Since Q1 2003 the GDP personal consumption advance and preliminary are released at the same time as the general GDP advance and GDP preliminary, respectively. For this shorter period the explained variation in bond returns rises to 53% and 59%, respectively.

[5] One advantage of the surprise regressions is that it shows which of multiple announcement surprises at the same time drives bond returns. Payroll surprises are much more important (21%) than unemployment surprises (1%). Both announcements are part of the employment report.

target rate announcements to be very important, whereas surprises suggest it is not. Also GDP advance and preliminary are much more important than what we would conclude from surprise regressions. Hence both FOMC target rate and GDP advance/preliminary announcements have a substantial and lasting impact on bond prices, whereas the effect of manufacturing surveys and retail sales announcements not as important as previously thought.

The importance of news for bond prices varies over time. First, using 1-year rolling windows we find the explanatory power is the lowest at 5% for the period ending in December 2000 and the highest at 51% for the period ending in December 2004. Second, news is less important when the VIX is high and Baker and Wurgler (2007) sentiment is positive. Third, we find news that is contrary to the direction of FED rate changes is more important. For example news with negative effect on yield is more important when FED rate is increasing. Fourth, news closer before the next FOMC meeting are more important than news immediately after the last meeting.

The remainder of this paper is organized as follows. Section 2 describes the 10-year bond futures data and the U.S. macroeconomic and FOMC announcements. The methodology is presented in Section 3. Section 4 discusses the results from our novel approach. The comparison with surprise data is provided in Section 5. Finally, Section 6 concludes.

2. Data

2.1 Macroeconomic data

We use an extensive set of U.S. macroeconomic news data. We use real-time data on 57 U.S. macroeconomic announcements, collected from Bloomberg which is a widely used data source by market participants. The data set includes announcement date, time, and for most of the announcements the consensus forecast[6] (median) and actual values of macroeconomic figures. Bloomberg screens display consensus and actual figures as they appear thus providing a point of reference for traders who react to

[6] MMS is a popular source of macroeconomic forecast data in the studies covering the period before 2003. However in September 2003 Informa acquired MMS and discontinued the survey. The resulting sharp increase of replies to Bloomberg surveys implies market participants regarded it as the new source of market consensus. Brenner, Pasquariello, and Subrahmanyam (2009) notes that joining several sources of survey data is not viable because of potentially different survey methodologies (e.g. the MMS survey is closed on the last Friday the week before the announcement, while Bloomberg's last chance to give a reply is 3 days before the announcement). In addition, the number of announcement types provided by MMS is limited. The importance of the consensus forecast is not crucial for the novel methodology. Bloomberg provides announcement times starting in October 1996, even if there is no consensus forecast. Thus we Bloomberg is preferred data source.

news. Vrugt (2009) verifies that Bloomberg consensus forecast data is efficient and unbiased. Announcements are included based on the history of the data (at least 40 observations) and availability up to the present.

We have Treasury futures tick data for the Chicago Mercantile Exchange open outcry trading hours (8:20-15:00 EST)[7]. Thus we limit our sample of the economic news to the ones announced during these hours. This limitation excludes other important U.S. announcements such as ADP Employment that is announced 8:15 EST. In our sample 76 percent of the trading days include at least one announcement. Our sample starts October 30, 1996 and ends March 28, 2013, amounting to 4223 trading days.

Table 1 provides a brief description of the U.S. economic data used in this paper. We show starting dates, number of observations, and announcement times of the announcements. Announcement data start October 30, 1996 (when Bloomberg starts reporting such data including time stamps) and cover the period until March 28, 2013. For more than half (31) of the announcements the data start in 1996 or 1997. About half of the announcements (29) are made at 8:30. For all announcements we report both the number of announcement instances and the number of the instances we have Bloomberg survey data. The table also indicates the announcements that often occur at the same time. For example Nonfarm Payrolls and Unemployment are always announced together. Some announcements, such as Beige Book, do not have consensus forecasts. Hence only the announcement frequency statistics are reported. Note that the novel methodology used in this paper allows us to investigate the importance of announcements that have no forecasts, i.e. FOMC minutes or Beige Book. More important, new methodology allows to evaluate the importance of other events, such as speeches or press conferences of government officials.

[Insert Table 1 about here]

The surprise part of the announcement is calculated as the difference between actual and consensus values. In order to compare the market impact across the announcements we standardize the surprises with the full sample standard deviation following Balduzzi et al. (2001). Hence standardized news for announcement k at time t is

$$S_{k,t} = \frac{A_{k,t} - E_{k,t}}{\hat{\sigma}_k}, \tag{1}$$

[7] From June 2003 onwards also overnight trading takes place. Hence for future research but for a shorter period it is possible to look at the impact of announcements outside the CME trading hours.

where $E_{k,t}$ is the expected and $A_{k,t}$ the announced figure of announcement k at time t, and $\hat{\sigma}_k$ is the full sample standard deviation of surprises $A_{k,t} - E_{k,t}$.

2.2 Treasury bond futures data

We use intraday data for 10-year Treasury bond futures from Tickdata.com. Throughout the paper we use 1-minute log returns providing 400 1-minute returns every trading day on the Chicago Mercantile Exchange, from 8:20 to 15:00 Eastern Standard Time (similar to Evans, 2011). The 1-minute prices used in the return calculations are determined as the price at which the last trade before the beginning of the minute was executed. The futures contract is rolled to the next contract when the daily day-session tick volume of the back-month contract exceeds the daily tick volume. Tick volume is the number of price changes, which indicates the trade activity of a contract. We also use total (including overnight return from 15:00 to 8:20 Eastern Standard Time) close-to-close daily futures returns in our analysis. The close is defined as close of open outcry trading (15:00 Eastern Standard Time). Thus daily returns are computed from the 15:00 of the previous trading day until 15:00 of the current day. All returns used in this paper are in basis points.

3. Methodology

In this section we introduce a novel methodology to measure the importance of macroeconomic news that does not rely upon the economic forecast data.

There are two streams in the literature that use returns at different frequencies. Many studies use high frequency intraday returns around macroeconomic news (see for example Andersen et al., 2003 and Faust et al., 2007). Hardouvelis (1988), one of the first proponents of this approach, argues it is necessary to use short windows around macroeconomic news to avoid contamination with noise that is unrelated to the news analyzed. The second approach uses daily returns (e.g. Kuttner, 2001 and Vrugt, 2009) with an argument that if the news is important the effect of the news reaction remains at the end of the day. In both cases news is deemed important if a strong and significant relation is found between the surprises in news announcements and returns. Studies using high frequency returns around the announcement find strong results. But the relation is much weaker when daily returns are used. The explanation is that the daily returns are contaminated with non-news information. But this also means that the importance of news is short-lived and only leads to transitory effects on prices.

We propose a new methodology which completely alters the view on the importance of news for daily returns. Our proposed methodology uses the market reaction around news announcements as a proxy of new information. This is superior to using surprises as the relationship between information and returns could be non-linear (e.g. Andersen et al., 2003), time-varying (e.g. Brazys and Martens, 2013), or the

forecasts used to calculate the surprises may not be a good proxy of the consensus of all market participants. In Section 4 we show this leads to much stronger results for daily returns.

3.1 *News impact*

To provide evidence that economic fundamentals are relevant for asset prices a large and active event study literature has developed[8]. The basic tool in this literature is the following univariate regression

$$R_{k,t} = \alpha_k + \beta_k S_{k,t} + \varepsilon_t, \tag{2}$$

where $R_{k,t}$ is the change in the asset price in a small window following the announcement k at time t, and $S_{k,t}$ is the standardized surprise of the announcement at time t, see equation (1). The coefficient β_k measures the impact of the announcement k on the asset return. In this paper $R_{k,t}$ is a log return starting 5 minutes before and ending 15 minute after the announcement (consistent with Faust et al., 2007). This 20-minute interval is selected to account for the full reaction to the announcement. The window starts 5 minutes before the time recorded by Bloomberg to account for possible discrepancies between official and Bloomberg recorded times. We also use the total (close-to-close) daily return ($R_{total_k,t}$) in equation (2) to show that the relation between macroeconomic surprises and daily returns is weaker.

3.2 *The relation between the initial price reaction and the total daily return*

We use a novel approach to investigate the relationship between the return around macroeconomic news and the total return of the day. For each announcement k we regress the total announcement day return, $R_{total_k,t}$, on the return from 5 minutes before to 15 minutes[9] after the announcement, $R_{k,t}$:

$$R_{total_k,t} = \alpha_k + \beta_k R_{k,t} + \varepsilon_t. \tag{3}$$

We see several advantages of this approach. First, the regression R-squared gives a direct indication how much of the variation in daily returns can be attributed to news announcements. Second, we can analyze the importance of specific announcements for bond markets. Third, we directly measure the

[8] The literature studies impact of macroeconomic announcements on different asset classes. For example, Andersen et al. (2003) investigates currencies, Faust et al. (2007) currencies and interest rates, Balduzzi et al., (2001) bonds, Andersen et al. (2007) the joint reaction of T-bills, equities and exchange rates, Kilian and Vega (2011) energy commodities, and Elder et al. (2012) metals.

[9] Balduzzi, Elton, and Green (2001) finds that none of the announcements is significant after 15 minutes. We start the window 5 minutes before announcement to account for possibility that timestamp of the news is inaccurate.

market reaction as opposed to using the indirect measure of news surprises. Fourth, we do not need surveys to compute surprises allowing us to take into account more announcements and use a longer sample. A disadvantage of our approach is that other events on the same day provide noise on measuring the importance of news announcements. In that sense we provide a lower bound on the importance of news.

The β_k coefficients tell us something about the persistence of the price reaction immediately following the news. First, $\beta_k = 0$ implies that the immediate reaction to the news has no lasting effect. Second, $\beta_k = 1$ indicates the return earned at the time of the announcement is on average equal to the return at the end of the day. Third, $0 < \beta_k < 1$ means the market on average overreacts to the news and part of the initial reaction is reversed. Fourth, $\beta_k > 1$ means after the initial reaction the price drifts in the same direction. Finally, $\beta_k < 0$ means that the initial price move is more than offset by returns in the remaining part of the day.

The R^2 of the regression in equation (3) indicates how much of the daily variance in bond returns can be attributed to economic news.

Our methodology follows the argument of the literature studying the impact of macroeconomic news on daily returns (e.g. Kuttner, 2001 and Vrugt, 2009). The studies argue that if the news is important the effect of the news remains at the end of the day. We argue that the news is important if the initial reaction to the announcement remains at the end of the day. Furthermore, the news is more important if it accounts for a significant part of the daily return variation.

We have to be careful with the interpretation of the results from equation (3), because the intraday return, $R_{k,t}$, is part of the total day return, $R_{total_k,t}$.Theoretically $\beta_k = 1$ in a random process where news plays no role. In such a random world and with constant volatility, regressing the total daily return on the intraday return leads to a R^2 equal to the proportion of time the intraday interval represents relative to the total trading day. For the purpose of correct inference we establish statistical properties of β_k and R^2 of the regression in equation (3) by simulation in Section 3.3.2.

3.3 Correct inference

How much of the total daily return is explained by intraday returns if the news-related returns are as (un-)important as other returns? We first derive the outcome analytically under the assumption of constant volatility and normality of returns. Then we describe the bootstrap procedure to account for non-normal returns and time-varying volatility.

The methodology is intuitive. If we assume all returns contribute equally to the total return, then the contribution of any intraday interval would be equal to the ratio of this interval time to the total time. However, the contribution of some intraday returns is larger because of higher volatility during particular

times of the day (e.g. opening and closing times of the trading). To evaluate whether the return around a macroeconomic announcement contributes significantly more to the total return, we compare the contribution of the announcement return to similar returns with no announcement. A significantly larger contribution indicates announcement is important. In this subsection we first derive the properties when returns are normally distributed. We then use a bootstrap to account for the stylized facts of the data.

3.3.1 Normally distributed returns

Assume the bond price evolves as a Brownian motion process with no drift and constant volatility σ^2. The total daily return R_{total_k} is the sum of independent and identically distributed[10] intraday log returns r_i

$$R_{total_k} = \sum_{i=1}^{N} r_i\,, \qquad i.i.d\; r_i \sim N(0, \sigma^2).$$

A part of this total return is $R_k = \sum_{j\in\{i_1,\dots,i_M\}} r_j$, where $\{i_1, \dots, i_M\} \subset \{1, \dots, N\}$. We estimate the regression (3) for total daily returns on the return of part of that day. The total day return, R_{total_k}, can be rewritten as

$$R_{total_k} = \sum_{i=1}^{N} r_i = \sum_{j\in\{i_1,\dots,i_M\}} r_j + \sum_{j\notin\{i_1,\dots,i_M\}} r_j.$$

Then the β of the regression in equation (3) is

$$\beta = \frac{cov(R_{total_k}, R_k)}{var(R_{k,})} = \frac{cov(R_k + \sum_{j\notin\{i_1,\dots,i_M\}} r_j\,, R_k)}{var(R_k)} = 1 + \frac{cov(\sum_{j\notin\{i_1,\dots,i_M\}} r_j\,, R_k)}{var(R_k)},$$

and the regression R^2 is

$$R^2 = \frac{var(\beta R_k)}{var(R_{total_k})} = \beta^2 \frac{M\,\sigma^2}{N\,\sigma^2} = \beta^2 \frac{M}{N}.$$

[10] For simplicity we do not use subscript t, and assume daily returns are identically distributed.

Hence, in the case that announcement and non-announcement returns are independent and identically distributed, theoretically $\beta = 1$ and R^2 is the fraction of total time the return R_k accounts for.

However, if announcement and non-announcement returns are related, i.e. $cov(\sum_{j\notin\{i_1,\ldots,i_M\}} r_j, R_k) \neq 0$, then $\beta < 1$ if the correlation is negative, and $\beta > 1$ if the correlation is positive[11]. The R^2 accounts for less than a fraction of time if the correlation is negative, and more if it is positive.

In regression (3) we use 20-minute returns. A 20-minute announcement window accounts for 1/72 of the 24 hour day. Hence the R^2 is 1.4% if news returns and non-news returns are equally important[12].

The coefficients derived are population coefficients. However estimating the sample coefficients is more complicated. While the β estimate is unbiased, the R^2 is biased upwards in small samples. Consider for example a sample with just two observations. It is always possible to draw a line through two points, thus the R^2 is always 1, and the estimation of the true R^2 is not possible. Therefore we present simulation results for various sample sizes to grasp the impact of covariance and sample size on R^2 and β. In Figure 1 we present simulation results when announcement returns and the rest of the day returns are uncorrelated, and when there is a correlation of 0.2. The sample size varies from 10 to 820 observations to cover the range of observations in our news data set. For the largest sample size, the simulation result is as expected theoretically. The R^2 in the case of intraday return independence is 1.4% and β is 1. However in small samples the R^2 is upwards biased, and confidence intervals for both R^2 and β are wide. Imposing a positive correlation of 0.20 between announcement returns and the rest of the day returns leads to a higher R^2 and a higher β, with confidence intervals shifted accordingly. The β for the largest sample size is 2.69 $(1 + 0.2\sqrt{71})$ and the R^2 is 10% $(2.69^2/72)$.

[Insert Figure 1 about here]

If the assumption of constant volatility holds, the results can be used to test the hypothesis that a particular intraday return is equally important as other intraday returns. However the assumptions do not hold. First, intraday bond returns are neither distributed normally[13] nor have constant intraday volatility. Bollerslev et al. (2000) find a distinctive intraday volatility pattern where volatility is higher at the

[11] The sample correlation of our news returns to the rest of the day returns is 0.01 and is statistically insignificant.

[12] Of course the assumption that all returns are equally important is not realistic. Returns during a certain time of the day, e.g. trading hours, around opening and closing of pit trading are more volatile even without macroeconomic news. For example if we assume that trading session returns are n-times more volatile than overnight returns and trading session takes one third of the total time, we can show that 20 minutes of trading session accounts for $\frac{n}{24(n+2)}$ of the total variance. In case the trading session return is 10 times more volatile than overnight return, this means 20-minute trading session return accounts for 3.5% of total variation. In the following section our bootstrap procedure accounts for such cases.

[13] The Jarque-Bera test for both daily and 1-minute returns rejects the normality hypothesis.

opening and closing of the trading session. We cannot derive formulae for R^2 and β that account for the stylized facts of the bond market, thus we use a bootstrap procedure that uses bond market data to estimate the properties of equation (3). In the next section we describe the bootstrap procedure and the results from the bootstrap.

3.3.2 Bootstrap

We now describe the data-driven bootstrap procedure to derive the statistical properties of β_k and R^2 when there are no announcements. Estimating equation (3) on the days of announcement k we use intraday announcement returns, $R_{k,t_1}, R_{k,t_2}, \dots, R_{k,t_{N_k}}$, and daily returns $R_{total_k,t_1}, R_{total_k,t_2}, \dots, R_{total_k,t_{N_k}}$ on days t_1 to t_{N_k}. To establish properties of the regression in a world where news does not matter, the returns R_{k,t_i} and R_{total_k,t_i} are replaced with corresponding returns from days without announcements. Replacement return for intraday return R_{k,t_i} should not have any announcement during its calculation window. Because of the intraday volatility patterns in the Treasury market (Bollerslev et al., 2000) we replace returns around announcements with returns on other days at the same time.

The simulation procedure includes two steps. In the first step we replace each of the announcement returns $R_{k,t_1}, R_{k,t_2}, \dots, R_{k,t_{N_k}}$ with corresponding non-announcement returns. The replacement returns should satisfy two conditions. First, returns should come from the same intraday interval as the announcement returns. Second, there should be no announcement in this intraday interval. For instance, a candidate return to replace the announcement return starting 8:25 and ending 8:45 is the return for the same interval from a day with no announcement during this interval. Finally, each intraday return R_{k,t_i} is paired with the same day total daily return, R_{total_k,t_i}. Note that total announcement returns may include returns from other announcements.

In the second step, we bootstrap regression (3). First we estimate regression (3) using the returns sampled in the first step:

$$R^{NA}_{total_k,t} = \hat{\alpha}_k + \hat{\beta}_k R^{NA}_{k,t} + \hat{\varepsilon}_t,$$

where $R^{NA}_{k,t}$ and $R^{NA}_{total_k,t}$ are the replaced non-announcement returns.

We then resample the response variable $R_{total_k,t}$:

$$R^{*}_{total_k,t} = \hat{\alpha}_k + \hat{\beta}_k R_{k,t} + \hat{\varepsilon}^{*}_t,$$

where $\hat{\varepsilon}_t^*$ is resampled (with replacement) from $\hat{\varepsilon}_t$. Finally, we estimate regression

$$R^*_{total_k,t} = \alpha_k + \beta_k^* R_{k,t} + \varepsilon_t.$$

The first of the last two steps simulates daily returns, whereas the second step estimates the regression parameters for the simulated data.

Each step includes 1,000 repetitions, amounting to 1,000,000 simulations in total. From each repetition we collect estimates of β_k^* and R^2. This forms bootstrapped distributions that are used for inference. The bootstrap includes a two-step procedure to assure our sample is representative for the full period analyzed.

Figure 2 gives an example showing simulation results for an announcement that occurs at 8.30, for sample sizes from 10 to 820 – the largest number of observations for our announcement sample. The R^2 is positively biased in small samples where the regression is overfitted, but decreases and stabilizes at 4%. The figure is higher than the previously noted 1.4% where we assume constant volatility (see Figure 1). Volatility is not constant during the day (Bollerslev, Cai, and Song, 2000) and is higher at the beginning of the open outcry trading session (8.20 EST). This illustrates the necessity to account for the announcement time during the day. Higher R^2 could also be because of return correlation. However as Panel B demonstrates that β_k is not different from one. As illustrated in section 3.3.1 this implies return correlation is zero. Thus the resulting increase in R^2 is mainly due to seasonality in intraday volatility.

[Insert Figure 2 about here]

As an example we look at Nonfarm payrolls announcements that are announced at 8.30. With 195 observations (see Table 1) the R^2 of the regression in equation (3) will be significant at the 5% significance level if the R^2 is larger than 14.6% (the 95% confidence bound for sample size 195 in Figure 2). Similarly, the β_k is said to be statistically different from the theoretical value of 1 if the estimated β_k is lower than -0.25 or larger than 2.26. This wide confidence interval indicates that it is unlikely we find β_k to be significantly different from one. As expected confidence intervals shrink with sample size.

3.4 Total importance of the news

How important are the returns around macroeconomic announcements? To estimate the total importance of the news we aggregate intraday returns around macroeconomic announcements. Return, $R_{ann,t}$, is

formed aggregating intraday returns around 57 announcements, starting 5 minutes before and ending 15 minutes after the announcement[14] on day t. We then estimate the regression

$$R_{total_t} = \alpha + \beta R_{ann,t} + \varepsilon_t. \quad (4)$$

Regression is estimated both for the announcement days only and for all trading days. In latter case $R_{ann,t}$ is set to zero on the no-news days.

4. Results

4.1 Individual announcements

Table 2 shows the results of estimating equation (3) for all 57 individual announcements. For 26 announcements we find that the R^2 is significantly larger compared to the R^2 when there is no news. The critical values for the inference are bootstrapped as described in section 3.3.2. After accounting for the double counting of the announcements that occur at the same time, there are 17 significant announcements.

The last column of Table 2 presents the ranking of the announcements based on the R^2 of regression (3). We first rank the announcements with a significant R^2 (10% significance level) in descending order. Then we rank the insignificant announcements. If multiple announcements occur at the same time we cannot identify which one is causing return. For example PPI and PPI core announcements occur at the same time. The importance of both announcements is lower if we base our ranking on PPI (R^2=0.07) compared to ranking based on PPI Core (R^2=0.09). We therefore choose the one with the largest number of observations and assign the same rank for these announcements.

Based on the size of R^2 our results indicate that FOMC rate announcements are the most important. On the 130 FOMC rate announcement days 55% of the variation in announcement day returns is explained by the return reaction to the announcement. This is significant at the 1% confidence level. It is followed by the Employment report that includes both Nonfarm Payrolls and Unemployment figures. The Employment report accounts for 46% of the return variation on the days of Employment report.

Interestingly, both GDP Advanced and GDP Preliminary announcements are very similar in importance, each accounting for 36% of return variation, and ranking 3rd and 4th in importance. On the other hand the reaction to the GDP Final announcement is found to be not important, accounting for virtually none of the announcement day return variation. This is in line with the common observation that

[14]Announcement returns overlap if the announcements occur less than 20 minutes apart. We make sure the aggregating procedure includes returns only once.

the market finds the later figures of the same group of announcements less important, see for example Andersen et al. (2003).

Forward Looking is the most important category. Six announcements from this category (seven if both ISM announcements are included) explain a significant fraction of total daily return variation. Within this category ISM Manufacturing is the most important explaining 19% of its announcement day return variation. Import Prices is the most important in the Price category. The explanatory power of two significant announcements, Unit Labor Costs and Cost Civilian Workers, cannot be assigned exclusively to these announcements. The announcement time of these announcements overlaps with announcements from other categories. Consumption, Net Exports and Investment categories each have only one significant announcement.

Our methodology is able to evaluate the importance of the announcements without surprise data. FOMC Minutes are responsible for 11% of the daily return variation and is the second most important FOMC announcement. The Beige book announcement accounts for only 5% of announcement day return variation. Both these R^2s, however, are not statistically significant.

[Insert Table 2 about here]

4.2 Pooled announcements

Table 3 shows that using all 57 announcements and all trading days in equation (4) we find 20% of the total return variation is attributed to macroeconomic news and FOMC releases. Only including days with at least one announcement we find that macroeconomic news accounts for 24% of the return variation. In comparison, announcement return time is only 1.2% of the total return time, and only 1.8 % of the return time on the announcement days. We calculate announcement return time as the fraction of the total time. For example if announcement returns are computed over 1 hour and our time horizon is one day, then the fraction is 1/24.

The table also demonstrates the importance of news aggregation. Although the FOMC target rate announcements are very important on the days when it is announced (R^2 =55%) it only explains 3% of total return variation because these announcements only occur every 6 weeks. Including the next 4 most important announcements (as ranked in Table 2) adds another 5% to the R^2, while increasing the list further to include the top 10 announcements with the highest R^2 adds another 5%. The top 17 most important announcements (27 announcements in total, some overlapping) can explain 17% of the total daily return variation. Adding the remaining stand-alone insignificant announcements ranked 18 through 42 (30 announcements) increases the R^2 by a further 3%. Thus the effect on R^2 of including more announcements diminishes if the announcement is less important. The diminishing effect is also clear if

only announcement days are considered. In that case including less important announcements brings the R^2 down.

[Insert Table 3 about here]

4.3 Does the relation between total daily return and the initial return reaction to news vary?

Non-farm payrolls announcement is often dubbed the king of announcements (Andersen and Bollerslev, 1998). The FOMC Rate announcement is another closely watched announcement by market participants. Our new methodology also indicates these are the most important announcements for Treasuries. We thus choose these announcements to further investigate the time variation in importance. We repeat the estimation of equation (3) in 24-month rolling windows. With 8 scheduled FOMC meetings and 12 scheduled Employment reports each year, 24-month window includes 18 and 24 observations. Figure 3 presents the regression R^2. In Panel A we present the results for Employment Report (includes Non-Farm payrolls and Unemployment figures) announcements. Although for the full sample Non-farm payroll announcements account for 46% of the daily return variation (see Table 2), there is considerable variation in the explanatory power over time. Reaching almost 60% in 2000 the R^2 is steadily decreasing until July 2003 when it explains only 5.4% of the variation in daily returns. From July 2003 onwards the importance of Nonfarm employment increases to reach a maximum of 82.4% in the 2-year rolling window ending February 2006. Afterwards the swings in importance are smaller. Since May 2010 the importance of employment data has increased from 26% to 54% at the end of our sample.

[Insert Figure 3 about here]

Panel B shows the explanatory power of FOMC Rate announcements. As noted the announcement returns account for 55% of total announcement day return variation in the full sample. However, explanatory power varies from 1.6% in March 2003 to 86% for the 2-year period ending in April 2009. In the most recent period the explanatory power drops to 10%. During the period the Fed was cutting its target rate from 2001 to 2003 the explanatory power of their announcements is decreasing. The explanatory power was rising throughout 2003 with the rate unchanged until mid-2004 when the Fed initiated the hiking of the target rate. The last increase in the target rate was in June 2006. In August 2007 the easing has started which ended in December 2008 with the target rate at the 0-0.25 interval. These patterns indicate there might not be a relation between the importance of the news and FOMC hiking and easing periods.

To investigate the variation of the total news importance we estimate the regression (4) in rolling one-year windows. We have more observations thus we choose a shorter window to investigate the variation of news importance. Figure 4 shows that the R^2 of the regression varies from 5% in a one year period ending in December 2000, to 51% in a one year period ending in December 2004. In both cases the announcement time accounts for only 1% of total time.

[Insert Figure 4 about here]

4.4 What drives the time-variation in the importance of macroeconomic news?

Several studies find the relation between macroeconomic news and asset prices to be time-varying. Bacchetta and Van Wincoop (2004) propose a model where the importance of announcements varies over time. In their model the investors change their focus from one announcement to another. Boyd, Hu, and Jagannathan (2005) show that the impact of employment news depends on the stage of business cycle. For example, positive macroeconomic news can be perceived as good or bad depending on the state of the business cycle. Andersen et al. (2003) find that negative news has a larger price impact than positive news. Goldberg and Grisse (2013) show the reaction of government bonds to news is muted when the VIX is high or the Fed Funds futures rate is low. We also investigate the relation between investor sentiment and the importance of the news. For this we use the sentiment index of Baker and Wurgler (2006). Finally, Van Dijk, Lumsdaine, and van der Wel (2014) find that federal funds futures rate is more volatile and news have larger impact when next FOMC meeting is further away. We therefore investigate these candidates as drivers of the variation in news importance based on our novel method. In addition we study the combination of first conditioning upon the stage of business cycle and then upon the VIX and the sentiment indices.

Table 4 Panel A shows the results of the regression in equation (4) where the sample is conditioned upon previous day levels of the VIX, the MOVE (Merrill Option Volatility Esti`mate for Treasury futures), the Baker and Wurgler (2006, 2007) sentiment index and Federal Funds Rate. Conditioning on the previous day levels of the indices accounts for possibility that news may cause the changes in the indices. The level of the VIX is negatively related to the explanatory power of the regression. This corresponds to Goldberg and Grisse (2013) finding that the reaction of government bonds to news is muted when the VIX is low. While the average VIX in the quintiles increases from 12.92 to 35.41 percent, the explanatory power decreases from 34% to 22%. News is most important when VIX is at its lowest. The importance decreases monotonically with increasing volatility, with the exception of the highest VIX level. However, the pattern is less clear when conditioning the regression sample upon the MOVE index or Federal Funds futures rate. For example, while the MOVE increases from 65.78 to

142.23 the R^2 only changes from 25% to 26% percent. The result for Federal funds futures rate is different from Goldberg and Grisse (2013). Although news importance in a small interval around the announcement changes, so can the importance of the non-fundamental events outside this small interval. For example, if the reaction to the news decreases when the Federal Funds futures is low, but also the price does not move outside of reaction window (zero volatility), the news is the only driver of the bond prices. Our methodology measures the importance of economic news in relation to total return, thus the results can only be the same if the Federal Funds rate and VIX affect all sources of return variation proportionally.

[Insert Table 4 about here]

The last two columns of Panel A show the relationship of the importance of news for bond prices with two versions[15] of the Baker and Wurgler (2006, 2007) sentiment index. The index summarizes information from variables believed to proxy for investor sentiment. We test whether sentiment makes fundamental information less important when sentiment (or it's changes) is extremely positive or negative. First, the explanatory power of macroeconomic news is negatively related to the sentiment-level index. The R^2 is highest when the sentiment index is at its lowest and monotonically deceases with increases in the sentiment index. This indicates that fundamental news is most important when sentiment is negative. Second, the relation between the sentiment-changes index and news importance is less clear. Our results do not lend direct support to the visual observation of Baker and Wurgler (2007) that "the volatility of sentiment rises in a speculative episodes[16]. This pattern suggests that the relative influence of fundamentals and sentiment on aggregate market returns changes over time". The regression R^2s as function of function of changes in the sentiment-changes index show a humped pattern with the peak at the moderate sentiment-changes index values, i.e. we expect news to be more important during less speculative periods. Thus our findings do not lend support to the observation that news is less important during more speculative periods as measured by Baker and Wurgler (2007) sentiment-changes index.

In Panel B of the Table 4 we also investigate the effect of two more conditioning variables. First, we split the sample into NBER dated recession and expansion periods. Our findings show that the news is more important during the recessions (R^2=0.30) than it is during expansions (R^2=0.23). Furthermore, conditioning upon the business cycle reverses the relation between news importance and the VIX, the MOVE, Federal Funds Rate and Baker and Wurgler (2006, 2007) sentiment index. Both the VIX and the

[15] For the description of two versions of the indices (the sentiment-level and sentiment-changes) see Baker and Wurgler, 2007.

[16] An example of what Baker and Wurgler (2007) see as speculative period is technology bubble at the end of 1990s.

MOVE are higher during recessions when the news is more important. The Federal Funds Rate is lower during recessions, while the sentiment-level is higher during recessions. All differences in means are statistically significant (results of the tests are not reported in the table).

Second, we split the sample into good (for the bond market) and bad news days. A day is defined as good news day if the total announcement return ($R_{ann,t}$ in equation 4) is positive; otherwise the day is defined as bad. The results in Table 4 show there is only 1% difference in explanatory power. Studies find that bad economic news (lower than expected growth or inflation) has larger effect on bonds than good news. However these studies only conclude that the market move in reaction to the bad news is larger, but tell nothing on how much of the total daily return it accounts for.

The results show that the split into good and bad news periods is not informative about the variation of news importance. It is possible that the importance of news depends on the stage of FED rate cycle. For example, when the rates are so low that they cannot go any lower good news (for bond returns) is not as important as bad. Therefore we investigate if good or bad news is more important during easing or hiking. In Table 5 we split the FED rate cycle into four periods: (1) easing, from the first rate cut until the last rate cut before the next rate increase; (2) hiking, from the first rate increase until the last rate increase before the next rate cut; (3) after easing, between easing and hiking; and, (4) after hiking, between hiking and easing. We further split the sample into good and bad news days as defined previously. Two key findings arise from such conditioning. First, without conditioning upon the news sign, the news is most important between easing and hiking period ($R^2 = 0.28$). The news is least important during easing ($R^2 = 0.21$).. The R^2 decreases monotonically from "after easing" until the end of easing period. Second, news that is contrary to the direction of FED rate changes is more important. For example good news (positive bond return) is much more important during hiking ($R^2 = 0.23$) than during easing period ($R^2 = 0.05$). Recent quick easing period (September 18, 2007 - December 16, 2008) and the null rate period that followed afterwards is of particular importance. Results in last two rows of Table 5 show that in bad news is slightly more important during quick easing period when compared to full sample easing periods. However good news is much more important in the null rate period compared to full sample 'after easing' periods (R^2 of 0.27 during null rate period vs. 0.23 during full sample 'after easing' period). Our results show that good and bad news are of different importance over the stage of FED rate cycle.

[Insert Table 5 about here]

Panels A through C of Figure 5 further investigate effect of the VIX, sentiment-level and sentiment-changes index over the business cycle. We first condition the regression upon the stage of business cycle and then the level of VIX or sentiment indices. The majority of the sample is an expansion period, thus

results for the expansions are closer to the sample results. First, Panel A demonstrates that the explanatory power for the same level of VIX is higher during recessions. Second, a higher level of sentiment is related to a decrease in the importance of the macroeconomic news. However Panel B shows that during recessions the explanatory power of the news is also high at extreme levels of positive sentiment. In recessions investors find the news to be more important, especially when the sentiment is very high or low. Finally, Panel C sheds some light on the causes of the flat relationship between sentiment-changes index and news importance. We find during recessions the news is more important when the sentiment-changes index is positive. But during expansions the news is more important when the sentiment-changes index is negative. The explanation for such a relationship is that during bad times (recession) negative sentiment changes makes investors more sentimental and less likely to value economic fundamentals. This is also true during good times (expansions) when the positive sentiment change makes investors more sentimental, thus putting less weight on economic news. Thus we add an additional dimension to Baker and Wurgler (2007) observation. Fundamental news is less important during extreme positive changes in expansions and extreme negative changes in recessions.

[Insert Figure 5 about here]

Finally, in panel D, we investigate news importance conditional upon the time between FOMC rate announcements. We split the days between FOMC announcement days in 5 equal periods. This is different than Van Dijk, Lumsdaine, and van der Wel (2014) where authors use number of FOMC meetings for the time horizon: for example between 3 and 4 meetings ago. Our approach assumes the macroeconomic information is the most relevant for the next FOMC rate decision. Our findings indicate macroeconomic news is least important immediately after the announcement and increasingly more important as the next FOMC meeting date approaches. Van Dijk, Lumsdaine, and van der Wel (2014) find decreasing macroeconomic news impact and decreasing Fed funds futures volatility.

We further split the sample into recessions and expansions based on the date of the FOMC meeting. In expansions the importance of the announcements increases closer to the FOMC date. Exception is the last week when the explanatory power decreases. Announcement importance is not monotonic in the recession sample. The news in the last week accounts for 49% or total return variation, while the second to last only 15% of total return variation.

5. Return vs. Surprise Regressions

5.1 Individual announcements

The literature finds macroeconomic news is especially important for bond markets (for a review of studies on bond markets see Fleming and Remolona, 1997). One of the reasons is that bond pricing is simple thus market participants are more likely to agree on the interpretation of the news (Fleming and Remolona, 1997). We estimate the importance of the individual announcements using equation (2) measuring the intraday response of bond prices to surprises in macroeconomic announcements. We also estimate equation (2) with the daily returns, $R_{total_k,t}$., as the dependent variable. The results are presented in Table 6. We also include the results from our novel method to make it easy to compare the results.

[Insert Table 6 about here]

First, we find for intraday returns that the surprises of 39 (of 55) macroeconomic announcements have a significant (at least at the 10% confidence level) impact on the 10-year Treasury futures returns. The most important announcements explain up to 40% (ISM Manufacturing) of the 20 minute return variation around the news. Second, results from estimating regression (2) are much weaker when daily returns are used. Only 21 announcements are significant at the 10% confidence level. The maximum R^2 decreases to 21% (Non-farm Payrolls). The decrease in average R^2 from 10% to 3% indicates surprises in announcements, on average, are not as important when daily returns are used. Third, our novel methodology identifies 26 significant announcements.

Using our methodology we are able to correctly rank announcements that are important for the market participants. We select the 5 most important announcements from both the surprise regression in equation (2) based on daily returns and our novel regression in equation (3). In both cases we rank significant announcements from the highest to the lowest R^2. Our novel method cannot distinguish which figure is most important if multiple figures are announced at the same time. Therefore we choose to assign the rank of announcement with most observations. The new methodology suggests a striking change in what are considered important announcements. First, the FOMC rate that is apparently not important in the surprise regression[17] is found to be the most important in our novel regression, accounting for 56% of the variation in the returns on target rate announcement days. This is a well-known issue in monetary policy surprise literature. Gurkaynak, Sack, and Swanson (2005b) argues that in many standard macroeconomic models macroeconomic or monetary shocks (surprises) have only transitory effect on future path of interest rates thus a limited response of long-term interest rates to such shocks. Gurkaynak, Sack, and

[17] We estimate the surprise regression using different methods to estimate FOMC target rate surprises. The status of the FOMC announcement remains "not important" using surprises estimated from both daily and intraday FED funds futures. Kuttner (2001) finds the importance of FOMC target rate announcement is the most important for 3-month T-bills and diminishes with the maturity.

Swanson (2005a) show that for longer term bonds both target rate surprise and future path surprise are needed to explain bond price variation. Thus our methodology can correctly identify the important announcements without correct specification of the surprise component.

Second, Employment Report, containing Non-farm Payrolls and Unemployment figures is the second most important announcement ($R^2 = 0.46$). Here we find surprises useful in deciding which announcement is more important. Regression using surprises shows that Non-farm Payroll (R^2 =0.37) announcement is much more important than Unemployment (R^2 =0.04). Third, the Employment report is followed by Advance and Preliminary GDP reports, both accounting for 36% of return variation. Further, it is surprising that the report on Efficiency of Industrial Workers, including Nonfarm Productivity and Unit Labor Costs figures, is the fifth most important announcement with an R^2 =0.24. It is, however, not found to be important with the surprise regression. Finally, ISM Manufacturing, Chicago PMI, Durable Orders excluding transportation and Conference Board Consumer Confidence figures are in top 5 most important announcements according to the surprise regression, but rank much lower in our novel regression. This indicates the announcements are much less important than previously believed, as they do not lead to sizeable permanent changes in bond prices.

5.2 Aggregated announcements

We continue with the comparison between return- and surprise-based regressions for aggregated news. It is straightforward to estimate the importance using the novel methodology. We aggregate intraday returns around macroeconomic news. However we cannot replace the returns in regression (4) with standardized surprises of the news. The return size around news already tells how important the announcement is, thus surprises are at disadvantage if the sign and size of the announcement impact is not accounted for. We weight the surprises (with hindsight) by their impact on high frequency bond price around macroeconomic news, thus accounting for the sign and size of the impact. We then aggregate surprises daily and estimate equation (4) on the announcement days when surprises are available.

[Insert Table 7 about here]

For ease of comparison Table 7 Panel A repeats the estimation results when return-based news measure is used. Panel B shows the results when aggregated surprises are used. Weighted surprises are able to explain 8% of the total announcement day variation and only 6% of total return variation[18]. In

[18] We also test multiple regression with non-aggregated announcements. Adjusted R-squared in this regression is 8%. This is in line with Hardouvelis (1988) findings that economic news explain up to 7.6% of total daily bond yield

comparison, return-based news estimates are able to explain three times more variation (see Panel A, surprises explain 8%, whereas return-based news explains 24%) on announcements days. The ratio between explanatory powers increases further if all days are used (surprises explain 6%, whereas return-based news 20%). We also report results when only impact sign is used to weight the surprises. The R-squared drops from 8% to 5% on the news days, and from 6% to 4% when all trading days are used. This shows the importance of surprise weighting.

Panel C of Table 7 reports additional robustness test. We replace the surprises with the standardized changes of the macroeconomic variables. The changes in variables are standardized dividing changes by their sample standard deviations. As for surprises we weight the standardized changes by their impact on high frequency return around the announcement. In comparison to surprised based news, the explanatory power decreases further to 4%. If only the sign of the impact on the market is used, the explanatory power decreases to 3% on news days and mere 2% on all sample days.

The novel methodology demonstrates that macroeconomic news is much more important than previously thought. Both weighted surprises and weighted changes in macroeconomic variables explain less of the daily bond return variation. Note that in 'news-day' regressions we use a smaller sample excluding the days when surprises are not available. FOMC minutes and Beige book announcements are excluded for the same reason, thus our news importance is estimated using 55 of 57 announcements. This makes very little difference (R^2 is also 24%) since FOMC minutes and Beige book are previously found to be not important. This indicates our methodology is robust to inclusion of non-important news.

6. Conclusion

We introduce a novel methodology to evaluate the importance of news announcements for bond prices. Instead of using surprises in news announcements we regress daily returns on the 20-minute returns around macroeconomic news announcements. An announcement is considered important if the initial reaction is significantly related to the total announcement day return.

The new methodology has several advantages. First, the regression R-squared gives a direct indication how much of the variation in daily returns can be attributed to news announcements. Second, we can analyze the importance of individual announcements for bond markets in a new way with possibly different conclusions. Third, we directly measure the market reaction as opposed to using the indirect measure of news surprises. Fourth, we do not need surveys to compute surprises allowing us to take into account more announcements and use a longer sample.

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variation. The results are also in line with Altavilla, Giannone, and Modugno (2014) who find up to 8% can be explained by macroeconomic surprises.

We contribute to the literature in three ways. First, based on the novel methodology we find macroeconomic announcements account for 20% of the total daily bond return variation. In contrast the existing methodology based on news surprises indicates that only 6% of the total daily bond return variation is explained by news. Second, individually, the most important announcements are the FOMC target rate and employment reports. Whereas the importance of non-farm payrolls figure of employment report is well-known, we provide strong evidence of the importance of FOMC target rate announcements for long term bonds. In fact these announcements can explain 55% of the variation in bond returns on days that these announcements are made. This is in line with Gurkaynak, Sack, and Swanson (2005b) finding that FOMC statements rather than target rate surprises are important for long term government bonds. Our methodology is able to identify the important announcements even without a proxy for the content of the FOMC statements. Third, we find the importance of news varies over time. The news is less important when the VIX is high and Baker and Wurgler (2007) sentiment is positive. Further, we find news that is contrary to the direction of FED rate changes is more important

The shortcoming of our methodology is that we are not able to identify which announcement is triggering the market response if multiple figures are announced at the same time. This is where the relation between surprises and the 20-minute return around the announcement is still useful.

There are several potential directions for further research. First, we can review the studies that do not find a significant relation between economic news and asset prices. The traditional research agenda so far was to look for better measures of news in announcements[19] or a different source of the news (e.g. semantic analysis of news articles, Tetlock, 2007, or FOMC minutes, Boukus and Rosenberg, 2006). For example Kuttner (2001) is the first to use the FED funds futures change as monetary surprise. Gurkaynak, Sack, and Swanson (2005b) use a proxy for a surprise in future path of interest rates. Searching for the relation between the proposed news measures is a difficult task not having a prior knowledge if the news move market. Therefore, we propose first using our novel methodology to identify events that move market. Second, the new method makes it easy to evaluate the importance of announcements that do not have forecast values. Forecasts are available for many U.S. macroeconomic figures. However, forecast data for other countries is scarce. Our methodology can be used in these cases to evaluate the importance of macroeconomic announcements. Also it allows investigating the importance of news that has no explicit expectation and thus a surprise component cannot be calculated. For example the importance of speeches of Federal Reserve officials can now be evaluated.

[19] Early studies using forecasting models to infer the market expectation, later studies using survey data for expectations.

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Figures

Figure 1. Illustration of Simulation Results

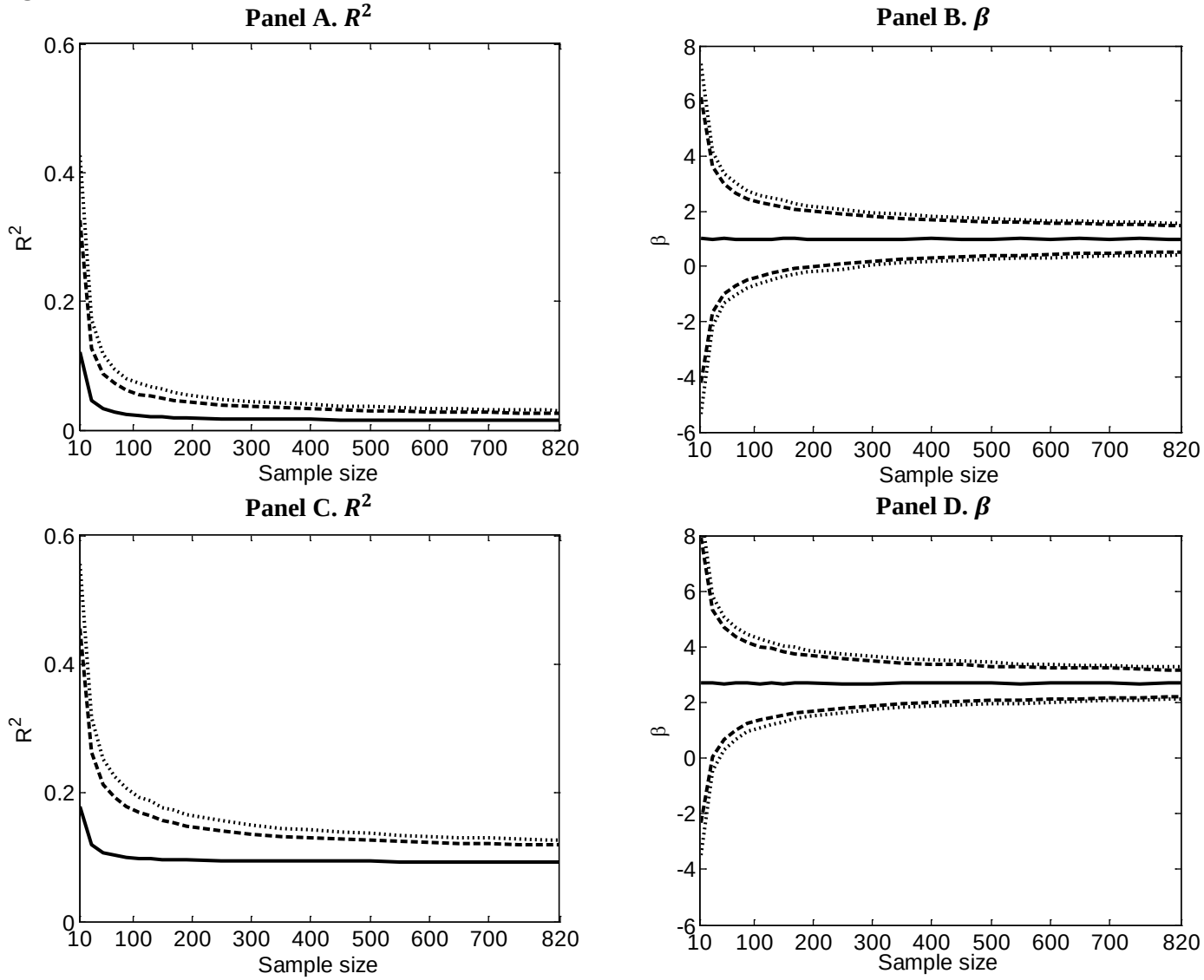
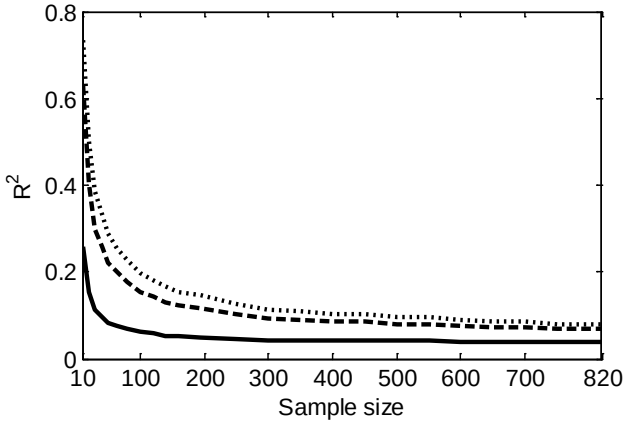


Figure shows results for regression $R_{total_k,t} = \alpha_k + \beta_k R_{k,t} + \varepsilon_t$, where log returns $R_{total_k,t}$ and $R_{k,t}$ are sampled from a standard normal distribution so that $R_{k,t}$ is part of $R_{total_k,t}$ and variance of $R_{total_k,t}$ is 72 times larger than $R_{k,t}$. The ratio of variances is selected to reflect 20 minute window is 1/72nd of the 24-hour day, assuming constant volatility of intraday returns. Panels A and B assume intraday return independence, while panels C and D show results assuming 0.2 correlation between announcement and non-announcement returns.

The results are given for the different sample sizes. Sample sizes are similar to the number of announcement observations. Panel A and C demonstrate the average R^2 of the regression (bold line) along with 90% (dotted) and 95% (dashed) quantiles. Panel B and D display similar graph for the β_k of the regression. Bold line indicates the average β_k. Dotted and dashed lines indicate 90% and 95% confidence bands respectively.

Figure 2. Illustration of Bootstrap Results

Panel A. R^2



Panel B. β

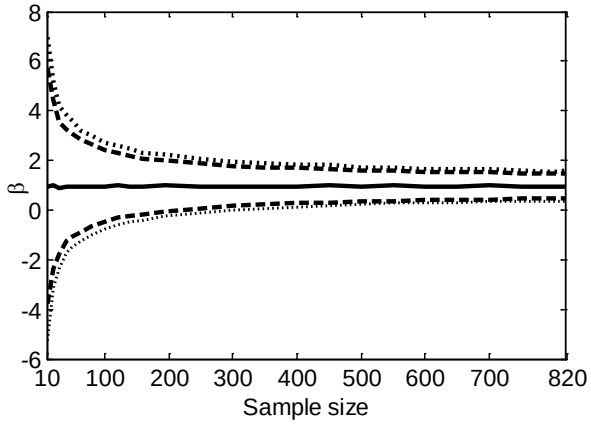
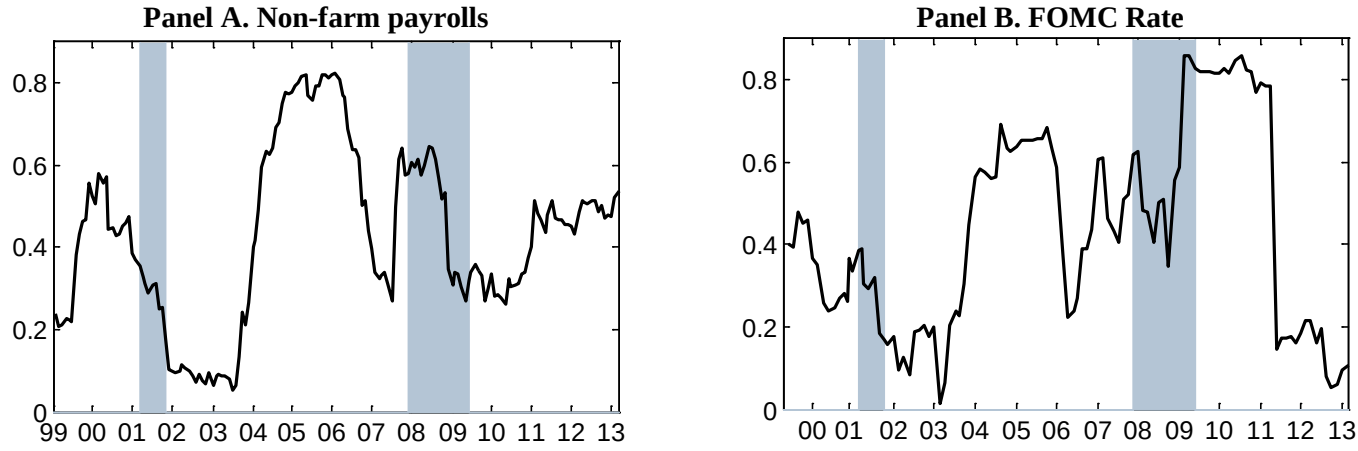


Figure shows results for bootstrapped regression $R_{total_k,t} = \alpha_k + \beta_k R_{k,t} + \varepsilon_t$, where $R_{total_k,t}$ is daily close to close return and $R_{k,t}$ is intraday return from 8.25 to 8.45 with no news announced in this window. The bootstrap results are given for the different sample sizes. Sample sizes are similar to the number of announcement observations. Panel A demonstrates the average R^2 of the regression (bold line) along with 90% (dotted) and 95% (dashed) quantiles. Panel B displays similar graph for the β_k of the regression. Bold line indicates the average β_k . Dotted and dashed lines indicate 90% and 95% confidence band respectively.

Figure 3. Varying Relation between Announcement and Total Day Return



The figure shows time-varying relation between the total announcement day return and the return accrued around non-farm payrolls announcement. Panel A displays R^2 of the regression $R_{total_k,t} = \alpha_k + \beta_k R_{k,t} + \varepsilon_t$ using 24 month rolling windows for Nonfarm payrolls. Panel B shows R^2 of the regression for FOMC Rate announcement. Shaded areas indicate NBER recession periods: March - November 2001 and December 2007 - June 2009.

Figure 4. Aggregated announcement importance

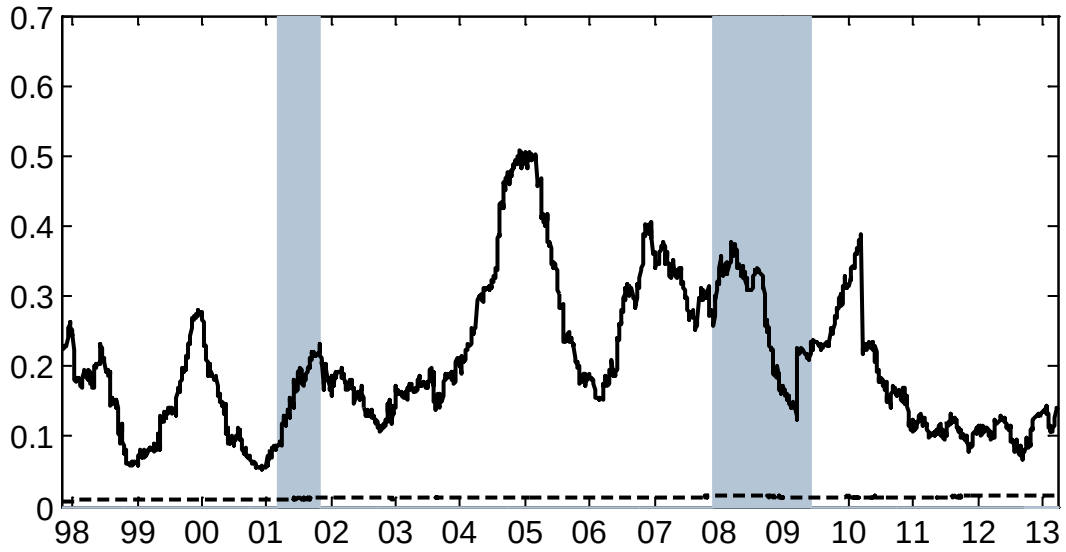


Figure demonstrates varying importance of the macroeconomic news. Bold line shows the variation of R^2 of the regression $R_{total_k,t} = \alpha_k + \beta_k R_{ann,t} + \varepsilon_t$, where $R_{total_k,t}$ is daily return from close to close of the open outcry trading session on day t, $R_{ann,t}$ is total intraday return around announcements on day t, starting 5 minutes before announcement and ending 15 minutes after announcement. The regression is estimated in rolling 1-year regression using daily returns. The dashed line shows the fraction of total time attributed to the news returns around announcements. Shaded areas indicate the NBER recessions.

Figure 5. Conditional News Importance

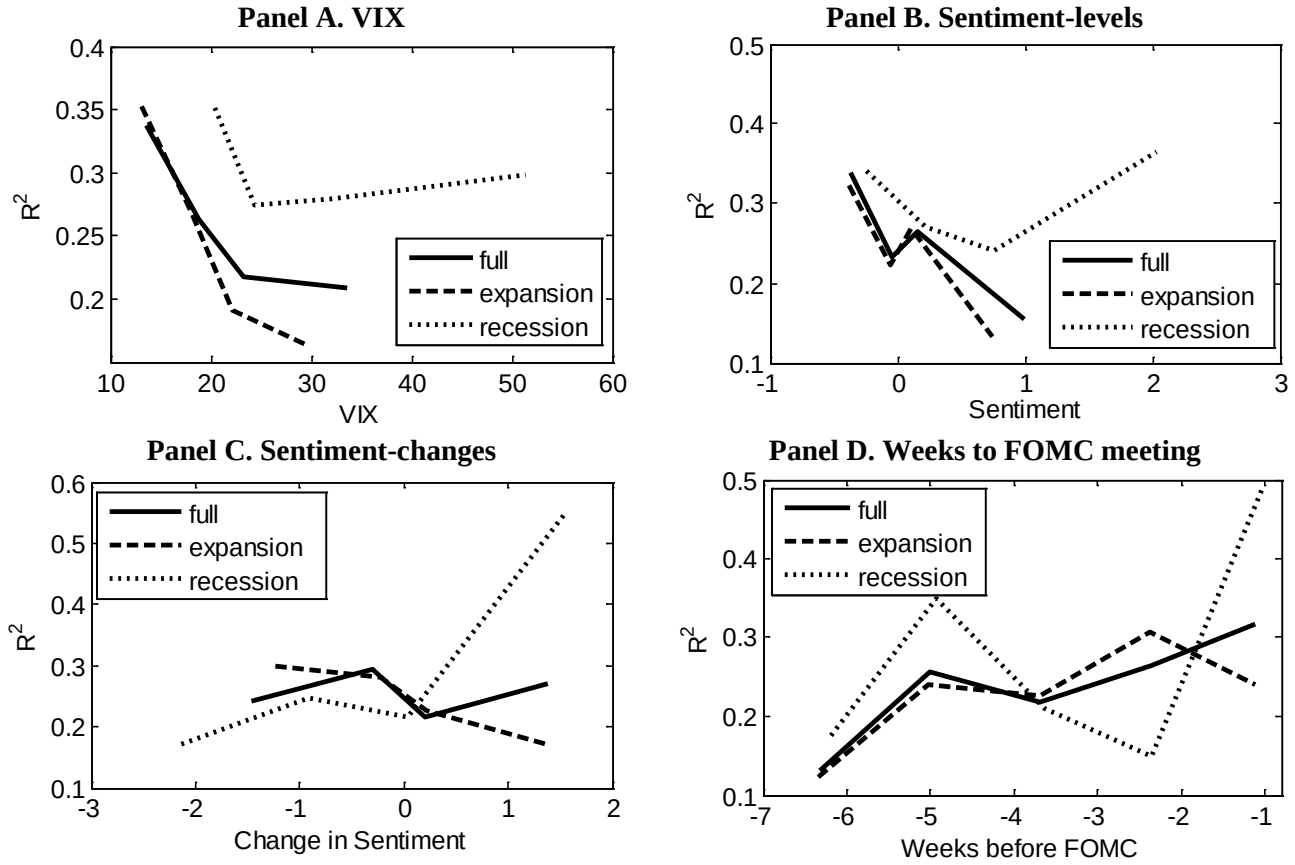


Figure shows R^2 of the regression $R_{total_k,t} = \alpha_k + \beta_k R_{ann,t} + \varepsilon_t$. with $R_{total_k,t}$ the total close to close daily return, $R_{ann,t}$ cumulative total return of the day around macroeconomic news. The sample is conditioned upon the NBER expansion-recession and then on the quantiles of the VIX (Panel A), Baker and Wurgler(2006,2007) sentiment level index (Panel B), sentiment changes index (Panel C), and time before the FOMC meeting (Panel D). Vertical axis demonstrates the average level of conditioning variable in each quantile. Solid line shows the R^2 for the full sample, while dashed and dotted lines show results for expansion and recession periods respectively. The split into recession expansion in Panel D is based on the date of the FOMC announcement.

Tables

Table 1. Summary of the US Macroeconomic Announcement Data

	Announcement	Start Date[1]	Ann. Obs.[2]	Surprise Obs.[3]	Time[4]
	Consumption				
1	Existing Home Sales	02/25/2005	98	97	10:00
2	New Home Sales	10/30/1996	197	197	10:00
3	PCE	02/03/1997	194	193	8:30
4	Pending Home Sales	05/02/2005	96	95	10:00
	FOMC				
5	Beige Book	03/08/2000	104	-	14:00
6	FOMC Rate	05/20/1997	134	128	14:15
7	FOMC Minutes	06/27/2002	84	-	14:00
	Forward Looking				
8	Dallas Manufacturing Activity	01/26/2009	51	50	10:30
9	Richmond Manufacturing	10/25/2005	90	89	10:00
10	Empire State Manufacturing	11/15/2002	125	125	8:30
11	NAHB Index	04/15/2003	120	120	13:00/10:00
12	Philadelphia Fed Survey	11/21/1996	196	192	10:00
13	CB Consumer Confidence	02/25/1997	194	193	10:00
14	Chicago PMI	11/27/1996	197	194	10:00/9:45
15	ISM Manufacturing[a]	11/01/1996	197	196	10:00
16	ISM Prices Paid[a]	07/03/2000	153	153	10:00
17	Building Permits[c]	08/16/2002	128	128	8:30
18	Housing Starts[c]	03/17/1998	181	181	8:30
19	Leading Indicators	12/30/1996	193	191	10:00
20	Michigan Consumer Sentiment Preliminary	05/14/1999	166	166	9:45-10:00
21	Michigan Consumer Sentiment Final	05/28/1999	167	167	9:45-10:00
22	IBD/TIPP Economic Optimism	07/11/2006	81	73	10:00
23	ISM Non-Manufacturing	12/03/1998	172	170	10:00
	GDP				
24	GDP Advance[d]	04/30/1997	64	64	8:30
25	GDP Preliminary[e]	11/27/1996	65	64	8:30
26	GDP Final[f]	03/26/1997	64	64	8:30
27	GDP Personal Consumption Advance[d]	01/30/2003	41	40	8:30
28	GDP Personal Consumption Preliminary[e]	02/28/2003	41	40	8:30
29	GDP Personal Consumption Final[f]	03/27/2003	41	41	8:30
	Government Purchases				
30	Nominal account	03/12/1998	61	61	8:30
31	Treasury Budget	11/22/1996	197	195	14:00

Table 1. Continued

	Announcement	Start Date[1]	Ann. Obs.[2]	Surprise Obs.[3]	Time[4]
	Investment				
32	Durable Goods Orders[n]	11/26/1997	185	185	8:30
33	Durable Goods Orders ex transportation[n]	12/28/2001	136	136	8:30
34	Construction Spending[a]	08/01/2003	116	116	10:00
35	Factory Orders	11/01/1996	197	197	10:00
36	Wholesale Inventories/wholesale trade	11/08/1996	197	195	10:00
37	Business Inventories	07/16/1997	189	188	10:00/8:30
	Net Exports				
38	Net Long-term TIC Flows	10/18/2004	102	97	9:00
39	Trade Balance	12/19/1996	196	196	8:30
	Prices				
40	Import Prices	08/13/1998	172	172	8:30
41	PPI[g]	12/12/1997	184	183	8:30
42	PPI Core[g]	12/11/1996	196	195	8:30
43	CPI[h]	12/12/1996	196	196	8:30
44	CPI Core[h]	01/14/1997	195	194	8:30
45	Cost Civilian Workers[d]	01/28/1997	64	64	8:30
46	Unit Labor Costs[b]	06/08/1999	111	109	8:30
47	Case Shiller House Price	12/26/2006	76	70	9:00
	Real Activity				
48	Nonfarm Payroll Employment[j]	01/10/1997	195	193	8:30
49	Unemployment[j]	01/10/1997	195	192	8:30
50	Retail Sales[k]	12/12/1996	194	194	8:30
51	Retail Sales Less Autos[k]	04/11/1997	191	189	8:30
52	Capacity Utilization[m]	01/17/1997	195	193	9:15
53	Industrial Production[m]	11/15/1996	197	196	9:15
54	Personal Income	10/31/1996	198	197	8:30
55	Nonfarm Productivity[b]	08/12/1997	124	121	8:30
56	Initial Jobless Claims[i]	01/04/1997	824	815	8:30
57	Continuing Jobless Claims[i]	07/25/2002	558	513	8:30

The table gives starting dates (mm/dd/yyyy), number of observation for the data that is collected from Bloomberg. Following Andersen et al. (2003) we group the U.S. announcements into eight categories: GDP, four components of GDP (consumption, investment, government purchases, and net exports), real activity, prices, and forward-looking. Superscripts [a,...,n] indicate the announcements that occur together more than half of the time.

Abbreviations: PCE - personal consumption expenditures, NAHB - National Association of Home Builders, CB - Conference Board, PMI - Purchasing Managers Index, ISM - Institute of Supply Management (former NAPM - National Association of Purchasing Managers), GDP - gross domestic product, PPI - producer price index, CPI - consumer price index, TIC – treasury international capital.

[1] Starting date when the first intraday stamp is available; [2] Number of observations when the timestamps are available; [3] Number of announcement observations with forecast available for surprise calculation; [4] Time of the day of the announcement (eastern standard time). Timestamps for some announcements change over time, in those cases we give a range, or list the times by number of observations.

Table 2. Importance of Macroeconomic News

	Name	α	β	R^2	Obs.	Percentile	Rank
	Consumption						
1	Existing Home Sales	-2.21	1.66	0.21**	98	0.96	8
2	New Home Sales	1.81	0.99	0.09	197	0.83	21
3	PCE	-1.20	0.99	0.07	193	0.71	31
4	Pending Home Sales	1.62	1.20	0.12	95	0.86	18
	FOMC						
5	Beige Book	-4.18	1.04	0.05	104	0.65	33
6	FOMC Rate	2.10	1.03	0.55***	130	1.00	1
7	FOMC Minutes	-4.99	1.09	0.11	84	0.82	20
	Forward Looking						
8	Dallas Manufacturing Activity	9.64	-1.50**	0.09	51	0.66	22
9	Richmond Manufacturing	7.13	0.60	0.03	90	0.39	39
10	Empire State Manufacturing	9.44**	1.54	0.21*	117	0.93	7
11	NAHB Index	2.45	1.61	0.08	120	0.74	24
12	Philadelphia Fed Survey	-3.43*	1.31	0.18***	196	0.99	11
13	CB Consumer Confidence	4.68	0.95	0.12**	194	0.96	17
14	Chicago PMI	10.86**	1.17	0.18***	197	0.99	10
15	ISM Manufacturing[a]	0.33	0.94	0.19***	197	1.00	9
16	ISM Prices Paid[a]	1.34	0.85	0.15**	153	0.97	9
17	Building Permits[c]	6.46	1.05	0.09	128	0.77	28
18	Housing Starts[c]	7.87**	0.89	0.07	181	0.73	28
19	Leading Indicators	2.44	0.67	0.03	193	0.50	37
20	Michigan Consumer Sentiment Preliminary	1.83	1.44	0.16**	166	0.97	13
21	Michigan Consumer Sentiment Final	5.05	0.85	0.07	166	0.84	27
22	IBD/TIPP Economic Optimism	0.37	2.08	0.11	79	0.76	19
23	ISM Non-Manufacturing	-3.80*	0.66	0.05	172	0.60	35
	GDP						
24	GDP Advance[d]	5.96	1.27	0.36**	64	0.99	3
25	GDP Preliminary[e]	8.25	2.16	0.36**	65	0.99	4
26	GDP Final[f]	2.99	0.07	0.00	64	0.05	42
27	GDP Personal Consumption Advance[d]	1.91	1.37	0.44**	41	0.98	3
28	GDP Personal Consumption Preliminary[e]	7.28	2.41	0.42**	41	0.99	4
29	GDP Personal Consumption Final[f]	4.40	0.31	0.01	41	0.19	42
	Government Purchases						
30	Nominal account	14.41**	1.15	0.04	61	0.45	36
31	Treasury Budget	-2.09	0.91	0.03	189	0.46	38

Table 2. Continued

	Name	α	β	R^2	Obs.	Percentile	Rank
	Investment						
32	Durable Goods Orders[n]	-2.77	1.14	0.15**	185	0.96	15
33	Durable Goods Orders ex transportation[n]	-3.26	1.03	0.14*	136	0.91	15
34	Construction Spending[a]	2.83	0.60	0.06	116	0.65	9
35	Factory Orders	2.13	0.58	0.03	196	0.38	40
36	Wholesale Inventories/wholesale trade	1.88	1.23	0.05	197	0.58	34
37	Business Inventories	-1.86	0.96	0.07	189	0.71	29
	Net Exports						
38	Net Long-term TIC Flows	6.08	1.03	0.05	102	0.57	32
39	Trade Balance	2.16	1.24	0.15**	196	0.96	16
	Prices						
40	Import Prices	2.64	1.57	0.23***	172	0.99	6
41	PPI[g]	0.53	0.66	0.07	183	0.74	23
42	PPI Core[g]	0.39	0.69	0.09	195	0.82	23
43	CPI[h]	5.14	0.81	0.08	196	0.82	25
44	CPI Core[h]	5.07	0.85	0.09	195	0.84	25
45	Cost Civilian Workers[d]	10.08*	1.05	0.37**	64	0.99	3
46	Unit Labor Costs[b]	4.28	1.81	0.25**	111	0.99	5
47	Case Shiller House Price	7.62	0.83	0.01	76	0.29	41
	Real Activity						
48	Nonfarm Payroll Employment[j]	-2.20	0.85	0.46***	195	1.00	2
49	Unemployment[j]	-2.20	0.85	0.46***	195	1.00	2
50	Retail Sales[k]	-3.40*	0.88	0.15**	194	0.96	14
51	Retail Sales Less Autos[k]	-2.60	0.87	0.14*	191	0.95	14
52	Capacity Utilization[m]	3.23	1.21	0.07	194	0.85	26
53	Industrial Production[m]	2.81	1.22	0.07	196	0.86	26
54	Personal Income	-0.87	1.00	0.07	197	0.71	30
55	Nonfarm Productivity[b]	4.50	1.77	0.24**	124	0.99	5
56	Initial Jobless Claims[i]	1.00	1.24	0.16***	820	1.00	12
57	Continuing Jobless Claims[i]	0.60	1.34	0.19***	557	1.00	12

Table gives the estimates for the regression of daily close to close return on the intraday return around a macroeconomic announcement. *, ** and *** indicate statistical significance at 10%, 5% and 1% levels, respectively, using the bootstrapped distribution of the parameters. Percentile of the bootstrapped distribution is given for the R^2estimate. The percentile is used in ranking announcement importance. The announcement often occurring at the same time are given the same rank of the announcement with the most observations. Superscripts [a,…,n] indicate the announcements that occur together more than half of the time.

Table 3. Aggregate News Importance

	News days		All days	
	R^2	Obs.	R^2	Obs.
FOMC Rate	0.55	130	0.03	4223
Top 5	0.41	596	0.08	4223
Top 10	0.42	1265	0.13	4223
Top 17 (significant)	0.26	2294	0.17	4223
All	0.24	3211	0.20	4223

Table shows the results of regressing daily return on the aggregated announcement time return. Announcement time return is return starting 5 minutes before and ending 15 minutes after each announcement on the announcement day. Rows give different set of announcements used in independent variable construction: from single most important FOMC Rate announcement to all announcements in our sample. Top 5, Top 10 and Top 17 indicate sets of announcements with largest significant R^2s. as ranked in Table 2. Columns 'News days' and 'All days' indicate only news or all days are included in the dependent variable

Table 4. Explaining the Variation in Explanatory Power

Panel A.

	VIX_{t-1}		$MOVE_{t-1}$		FFR_t		$SENT^{\perp}$		$\Delta SENT^{\perp}$	
	R^2	mean	R^2	mean	R^2	mean	R^2	mean	R^2	mean
1	0.34	12.92	0.25	65.78	0.12	0.13	0.36	-0.43	0.23	-1.65
2	0.29	17.48	0.21	82.95	0.32	0.68	0.22	-0.10	0.28	-0.49
3	0.21	20.98	0.23	96.45	0.23	2.37	0.29	0.05	0.28	-0.04
4	0.22	24.68	0.24	108.92	0.33	4.84	0.20	0.26	0.22	0.40
5	0.22	35.41	0.26	142.23	0.15	5.77	0.16	1.15	0.27	1.56
Panel B.										
Expansion	0.23	20.72	0.23	93.31	0.23	2.84	0.24	0.09	0.24	0.02
Recession	0.30	32.08	0.30	136.25	0.30	2.15	0.30	0.64	0.30	-0.42
Good	0.15	22.35	0.15	99.56	0.15	2.60	0.15	0.16	0.15	-0.01
Bad	0.16	22.23	0.16	98.93	0.16	2.88	0.16	0.20	0.16	-0.09

Table shows R^2 of the regression $R_{total_k,t} = \alpha_k + \beta_k R_{ann,t} + \varepsilon_t$. with $R_{total_k,t}$ the total daily close to close return, $R_{ann,t}$ cumulative total return of the day around macroeconomic news. In Panel A we estimate 5 separate regressions with the sample period conditioned upon lagged level of VIX (VIX_{t-1}), of MOVE index ($MOVE_{t-1}$), of the level of Fed Funds rate (FFR_t), end of month Baker and Wurgler (2006, 2007) sentiment index of levels ($SENT^{\perp}$) and changes ($\Delta SENT^{\perp}$). The sentiment indices are based on the first principal component of six (standardized) sentiment proxies or their changes, where each of the proxies has first been orthogonalized with respect to a set of macroeconomic conditions. Numbers 1 through 5 indicate the quintiles of the conditioning data. Column 'mean' gives the average value of conditioning variable. Panel B splits the sample in the periods. First, we split into expansions and recessions of NBER business cycle. Second, we split into the good and bad news days, where the good news day is defined as a day with positive $R_{ann,t}$. All estimations are based on sample October 1996 – March 2013, except for sentiment indices where the data is available until the end of 2010.

Table 5. Explaining the Variation of News Importance over FED Policy Cycle

	Total		Good		Bad	
FED policy	R^2	Obs.	R^2	Obs.	R^2	Obs.
Easing	0.21	1069	0.05	503	0.21	566
After easing	0.28	1460	0.23	732	0.16	728
Hiking	0.26	568	0.23	260	0.09	308
After hiking	0.25	374	0.12	181	0.16	193
Quick ease	0.24	261	0.04	123	0.22	138
Null rate	0.23	909	0.27	472	0.08	437

Table shows R^2 of the regression $R_{total_{k,t}} = \alpha_k + \beta_k R_{ann,t} + \varepsilon_t$ in different subsamples, with $R_{total_{k,t}}$ the total daily close to close return, $R_{ann,t}$ cumulative total return of the day around macroeconomic news. The sample is first split into FED policy periods: easing, hiking etc. We then split the sample further into good and bad news days, where the good (bad) news day is defined as a day with positive (negative) $R_{ann,t}$.. The easing (hiking) period is defined as the period from the first interest rate cut (increase) after the last interest rate increase (cut) until the last interest rate cut (increase) before the next interest rate increase (cut). "After easing" ("after hiking") is the period after the easing ("hiking") period but before next hiking (easing). "Quick ease", is the period between 2007 September 18 - 2008 December 16 when the fed in a short time cut the target rate from 5.25% to 0-0.25%. "Null rate" period is the period after December 16, 2008 when the FED cut target rates to 0-0.25% range and stayed there. All estimations are based on sample October 1996 – March 2013

Table 6. Comparing the methodology

	y_t: daily r_t x_t: intraday r_t		daily r_t surprise S_t		intraday r_t surprise S_t		
	β	R^2	β	R^2	β	R^2	**Obs.**
	Consumption						
1	Existing Home Sales	1.66	0.20*	-8.84**	0.04	-4.95***	0.17	97
2	New Home Sales	0.99	0.09	-5.44**	0.02	-4.58***	0.15	197
3	PCE	0.99	0.07	-3.15	0.01	-1.34**	0.02	192
4	Pending Home Sales	1.23	0.13	-8.51*	0.05	-4.62***	0.16	94
	FOMC						
6	FOMC Rate	1.01	0.56***	-8.53*	0.03	-4.63	0.01	128
	Forward Looking						
8	Dallas Manufacturing Activity	-1.42**	0.08	5.20	0.03	-1.75	0.08	50
9	Richmond Manufacturing	0.58	0.02	-7.06	0.03	-2.77***	0.06	89
10	Empire State Manufacturing	1.54	0.21*	-4.82	0.01	-4.38***	0.12	117
11	NAHB Index	1.61	0.08	-5.90**	0.03	-1.09*	0.03	120
12	Philadelphia Fed Survey	1.32	0.18**	-11.75***	0.08	-5.97***	0.21	192
13	CB Consumer Confidence	0.95	0.12**	-5.40	0.02	-7.79***	0.29	193
14	Chicago PMI	1.14	0.17**	-13.66***	0.11	-8.90***	0.36	194
15	ISM Manufacturing[a]	0.95	0.18***	-16.90***	0.13	-13.07***	0.40	196
16	ISM Prices Paid[a]	0.85	0.15**	-8.26**	0.03	-6.00***	0.08	153
17	Building Permits[c]	1.05	0.09	-9.80**	0.06	-1.60	0.02	128
18	Housing Starts[c]	0.89	0.07	-0.17	0.00	-1.41*	0.01	181
19	Leading Indicators	0.66	0.03	-4.04	0.01	-2.16***	0.04	191
20	Michigan Consumer Sentiment Preliminary	1.44	0.16**	-8.71***	0.04	-3.59***	0.08	166
21	Michigan Consumer Sentiment Final	0.85	0.07	-0.93	0.00	-0.76	0.00	166
22	IBD/TIPP Economic Optimism	2.20	0.12	4.95	0.01	-0.24	0.00	71
23	ISM Non-Manufacturing	0.66	0.05	-13.27***	0.11	-5.85***	0.20	170
	GDP						
24	GDP Advance[d]	1.27	0.36**	-9.21	0.03	-8.86***	0.14	64
25	GDP Preliminary[e]	2.16	0.36**	0.32	0.00	-2.70**	0.06	64
26	GDP Final[f]	0.07	0.00	3.50	0.01	-1.51	0.03	64
27	GDP Personal Consumption Advance[d]	1.36	0.43**	-13.73*	0.08	-5.10*	0.04	40
28	GDP Personal Consumption Preliminary[e]	2.43	0.43**	-12.90	0.09	-5.52***	0.22	40
29	GDP Personal Consumption Final[f]	0.31	0.01	-6.50	0.03	-3.38**	0.12	41
	Government Purchases						
30	Nominal account	1.15	0.04	0.58	0.00	-0.13	0.00	61
31	Treasury Budget	0.91	0.03	2.04	0.00	0.00	0.00	187

Table 6. Continued

		y_t: daily r_t x_t: intraday r_t		daily r_t surprise S_t		intraday r_t surprise S_t		
		β	R^2	β	R^2	β	R^2	Obs.
	Investment							
32	Durable Goods Orders[n]	1.14	0.15**	-4.10	0.01	-3.82**	0.08	185
33	Durable Goods Orders ex transportation[n]	1.03	0.14*	-11.55***	0.08	-7.42***	0.26	136
34	Construction Spending[a]	0.60	0.06	-5.30	0.02	-0.28	0.00	116
35	Factory Orders	0.58	0.03	-2.10	0.00	-1.98**	0.03	196
36	Wholesale Inventories/wholesale trade	1.23	0.05	-4.26	0.01	-0.02	0.00	195
37	Business Inventories	0.96	0.07	-1.30	0.00	0.16	0.00	188
	Net Exports							
38	Net Long-term TIC Flows	0.97	0.05	2.03	0.00	0.62	0.01	97
39	Trade Balance	1.24	0.15**	-6.10**	0.03	-2.33***	0.04	196
	Prices							
40	Import Prices	1.57	0.23***	-0.53	0.00	-0.80	0.00	172
41	PPI[g]	0.66	0.07	-1.59	0.00	-5.10***	0.11	182
42	PPI Core[g]	0.69	0.09	-7.65***	0.04	-7.01***	0.18	194
43	CPI[h]	0.81	0.08	-5.77	0.01	-2.82*	0.03	196
44	CPI Core[h]	0.85	0.09	-5.76	0.01	-8.56***	0.23	194
45	Cost Civilian Workers[d]	1.05	0.37***	-5.42	0.02	-5.26*	0.05	64
46	Unit Labor Costs[b]	1.81	0.25**	0.60	0.00	-0.21	0.00	109
47	Case Shiller House Price	0.81	0.01	5.27	0.01	-1.75*	0.06	70
	Real Activity							
48	Nonfarm Payroll Employment[j]	0.86	0.46***	-25.20***	0.21	-26.87***	0.37	193
49	Unemployment[j]	0.85	0.46***	4.30	0.01	9.22***	0.04	192
50	Retail Sales[k]	0.88	0.15**	-13.29***	0.09	-7.54***	0.15	194
51	Retail Sales Less Autos[k]	0.85	0.14*	-10.12***	0.05	-8.47***	0.19	189
52	Capacity Utilization[m]	1.12	0.06	-8.12**	0.04	-2.52***	0.09	192
53	Industrial Production[m]	1.21	0.07	-4.36	0.01	-2.67***	0.09	195
54	Personal Income	1.00	0.07	0.75	0.00	-0.15	0.00	196
55	Nonfarm Productivity[b]	1.78	0.24**	3.05	0.01	-0.08	0.00	121
56	Initial Jobless Claims[i]	1.24	0.16***	8.90***	0.04	4.16***	0.10	814
57	Continuing Jobless Claims[i]	1.29	0.18***	2.51	0.00	1.96**	0.02	512

Table gives the estimates for the regression $y_t = \alpha + \beta x_t + \varepsilon_t$: (1) of daily close to close return on the intraday return around a macroeconomic announcement , on the surprise element of the announcement (2) and intraday return on the surprise (3) . *, ** and *** indicate statistical significance at 10%, 5% and 1% levels, respectively, using the bootstrapped distribution of the parameters for model (1), and HAC errors for models (2) and (3). Superscripts [a,…,n] indicate the announcements that occur together more than half of the time.

Table 7. Aggregate News Importance

	News days	All days
	R^2	R^2
Panel A. Announcement returns		
Returns	0.24	0.20
Panel B. Surprises		
Surprise (weighted)	0.08	0.06
Surprise (non-weighed)	0.05	0.04
Panel C. Changes in macroeconomic variables		
Changes (weighted)	0.04	0.04
Changes (non-weighted)	0.03	0.02

Table gives the regression R^2s of daily close to close return on the aggregated announcement time return (Panel A), surprises (Panel B) and changes in macroeconomic variables (Panel C). Announcement time includes windows starting 5 minutes before and ending 15 minutes after each announcement. Changes in macroeconomic variables are standardized by dividing the change by full sample standard deviation. Surprises are weighted ('weighted') by their full sample impact (beta in regression (2)) on high frequency prices, or only by the impact sign ('non-weighted'). Similarly, Standardized changes in macroeconomic variables are weighted ('weighted') by their full sample high frequency impact (beta in regression (2)) on bond prices. Or the standardized changes are weighed only by the impact sign ('non-weighted'). Column 'News days' reports R^2 of the days when there is at least one announcement. Column 'All days' reports R^2 of all days in sample.