# 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. With this method we find that economic news can explain 24% of the variation in US treasury returns on announcement days. On days with announcements on the FOMC target rate, the employment report and the preliminary GDP the explanatory power increases to 56%, 46%, and 36%, respectively. Explanatory power varies over time. In the period with low bond market volatility in 2004 the explanatory power of economic news increases to 51%. The news is more important during recessions and when VIX is low. In expansions the importance of the news decreases with the level of VIX, while in recessions it increases. Economic news is less important when investor sentiment is positive and during periods of extreme sentiment changes.

**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. It would be logical if 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 fundaments 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]. 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 effect on daily returns (e.g. Vrugt, 2009 and Beber and Brandt, 2009). However, announcements are found to be much less important on a daily frequency.

We use a novel methodology to study the relation between economic news and US treasury returns. Reason to focus on treasuries is the conclusion that the relationship between macroeconomic news and treasuries is less ambiguous than that between news and equities or exchange rates. For example, the same news for equities is good during bad times, but bad during good times, see for example Andersen, Bollerslev, Diebold, and Vega (2007) or McQueen and Roley (1993). Therefore we avoid possibility that difference in conclusion arise from such ambiguity. Rather than using indirect information from surprises in macroeconomic announcements we make use of the return reaction in the 20 minutes around an announcement. For announcement days we regress the daily returns on these 20-minute returns following the news. Of course because this 20-minute return is part of the daily return even in a random process the beta of the regression would be 1 and the regression R-squared would be equal to the fraction of the 20-minute interval of the total time (based on a 24-hour day 1.4%; based on a 8:20-15:00 EST trading session 5%). Bootstrapping, however, can indicate when a beta does significantly deviate from one, and when an R-squared is significantly higher than that expected from the fraction of the day the 20-minute interval represents.

There are several advantages of our novel 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. Several specific 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 the market reaction as opposed to using the indirect measure of news surprises. This is crucial as we confirm earlier findings that regressing daily returns on surprises hardly gives any significant results. 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. A disadvantage of our

[1] A famous early example for currencies is Meese and Rogoff (1983).

[2] 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, Elder et al. (2013) energy, Green (2004) government bonds, Elder et al. (2012) metals, Evans (2011) Treasury note, currency and equity futures, and Hussain (2010) international equity indices.

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.

Based on 57 announcements we find that 24% of the variation of bond returns on announcement days[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 US macroeconomic announcements we also have surprise data our novel methodology finds that 24% of the variation in daily returns is explained by news announcements, whereas replacing the 20-minute returns by the surprises suggests only 8% of the variation in bond returns is explained by news.

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 128 FOMC announcement days), Employment reports (46%), Cost Civilian Workers (37%), GDP Advance[4] (36%) and GDP Preliminary (36%). In contrast based on regressing 20-minute bond returns on surprises the top five consists of ISM manufacturing (40%), Nonfarm Payrolls (37%)[5], Chicago PMI (36%), Conference Board consumer confidence (29%) and Durable Goods Excluding Transportation (26%). We find FOMC 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.

The explanatory power 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 2004. Second, the explanatory power is negatively related to uncertainty in the equity market (VIX). Third, we find the explanatory power of announcement returns to be higher in the recession periods. Fourth, conditioning on both VIX and business cycle we find in expansions news importance decreases with the level of VIX, while in recessions it increases. Finally, our findings lends support to Baker and Wurgler (2007) observation that relative influence of fundamentals and sentiment on aggregate market returns changes over time. We find that fundamental news is least important when the sentiment volatility is highest. Baker and Wurgler (2007) relate increased volatility of sentiment to the speculative episodes. We also find fundamental news is the most important when sentiment is negative, and least important when it is positive.

The remainder of this paper is organized as follows. Section 2 describes the 10-year bond futures data and the US macroeconomic and FOMC announcements. The methodology is presented in Section 3.

[3] Announcements occur on 76% of all trading days.

[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 drive bond returns. Payroll surprises are much more important (37%) than unemployment surprises (4%). Both announcements are part of the employment report.

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. We use real-time data on 57 U.S. macroeconomic announcements, collected from Bloomberg[6] 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 (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 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 international and U.S. announcements such as ADP Employment. 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. The majority (29) of the announcements are made at 8:30. For all announcements we report both the number of announcement instances and the number of the instances we have a consensus value for. 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.

**[Insert Table 1 about here]**

[6]MMS is a popular source of macroeconomic forecast data in the studies covering period before 2003. However in September 2003 Informa acquired MMS, a popular source of survey data, 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. 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. For this and consistency of the data provider we choose to use Bloomberg.

[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.

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

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

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. Trick volume is the number of price changes, which indicates the trade activity of a contract. We also use total close-to-close daily futures returns in our analysis. The close is defined as close of open outcry trading (15:00 Eastern Standard Time). 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.

Two streams of literature use different frequency returns. The first one uses high frequency intraday returns around macroeconomic news (see for example Andersen et al., 2003 and Faust et al., 2007). Proponents of this approach argue 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.

We propose a new methodology to investigate the importance of the news arrival. The current approach in the literature states that news is important if a strong and significant relation is found between the surprises in news announcements and returns (in the minutes after the announcement; or daily). Usually the relation is much weaker when daily returns are used. The explanation is that the daily returns are contaminated with non-news information. Our proposed methodology uses the market reaction around news arrivals 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) or time-

varying (e.g. Brazys and Martens, 2013) or, the forecasts used to calculate the surprises may not proxy the consensus of the market participants.

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

$$R_{k,t} = \alpha_k + \beta_k S_{k,t} + \varepsilon_t, \quad (2)$$

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 $\beta_k$ 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 ($R_{total_k,t}$) 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 after the announcement, $R_{k,t}$:

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

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 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 $\beta_k$ coefficients tell us something about the persistence of the price reaction immediately following the news. First $\beta_k = 0$ implies that 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

[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.

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 regression $R^2$ 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 macroeconomic news impact 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 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 an random process where news plays no role. In such a random world, if also having constant volatility, regressing the total daily return on the intraday return also 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 inference we establish statistical properties of $\beta_k$ and $R^2$ of the regression in equation (3) by simulation in Section 3.3.

*3.3 Simulations*

How much of the total daily return do intraday returns explain if the news related returns are as (un)important as other returns? Assume the bond price evolves as a Brownian motion process with no drift and constant volatility. We then expect the $R^2$ to be the fraction of the time the news return account in the total day. A 20-minutes announcement window accounts for 1/72 of the 24 hour day, thus $R^2$ is approximately 1.4% in this case. Since bond returns are neither distributed normally[9] nor have constant volatility (Bollerslev et al., 2000) we use a data-driven bootstrap procedure to estimate the properties of equation (3).

We now describe the data-driven bootstrap procedure to derive the statistical properties of $\beta_k$ 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 returns that are not related to macroeconomic announcements. 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.

[9] Jarque-Bera test both on daily and 1-minute returns rejects the normality hypothesis.

The simulation procedure includes two steps. In the first step we replace each of the announcement returns $R_{k,t_1}, R_{k,t_2}, \ldots, R_{k,t_{N_k}}$ with similar non-announcement returns. The replacement returns should satisfy three 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, the return is not on the day when announcement $k$ is made. The latter condition is important for the announcements with changes in announcement times. For example Business Inventories announcement is made both at 8.30 and 10.00 (see Table 1). If we did not exclude this announcement days we could include 8.30 return in the regression while the announcement on that day was made at 10.00. Further, each intraday return $R_{k,t_i}$ is paired with the same day total daily return. Note that total announcement return 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 $\beta^{*}_k$ and $R^2$ .This forms bootstrapped distributions that are used for inference. The bootstrap includes two-step procedure to assure our sample is representative for the full period analyzed.

Figure 1 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. Volatility is not constant during the day (Bollerslev et al., 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.

**[Insert Figure 1 about here]**

Take 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 if the $R^2$ is larger than 14.6% (95% confidence bound for sample size 195 in Figure 1). Similarly, the $\beta_k$ is said to be statistically different from the theoretical value of 1 if the estimated $\beta_k$ is lower than -0.25 or larger than 2.26. This wide confidence interval indicates that it is unlikely we find $\beta_k$ to be statistically significant 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[10]. We then estimate the regression

$$R_{total_k,t} = \alpha_k + \beta_k R_{ann,t} + \varepsilon_t. \quad (4)$$

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. New Methodology Results

*4.1 Individual announcements*

Table 2 shows the results of estimating equation (3) for all 57 individual announcements. We find $R^2$ is significant for 26 announcements. After accounting for the double counting of the announcements that occur at the same time, there are 15 significant announcements.

The table also includes percentile of beta coefficient in bootstrapped distribution. We use this as a measure of announcement importance. Higher the percentile the more important announcement is. Measuring the importance of announcement this way we account for the number of observations. We rank announcements from the highest to the lowest. If multiple announcements occur at the same time we choose the one with the largest number of observations and assign the same rank for these announcements.

Our results indicate that FOMC rate announcement is the most important. On the 130 FOMC rate announcement days 55% of the variation in daily returns is explained by the return reaction to the announcement. It is significant at 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. Initial Jobless Claims is the third most important with explanatory power of 16%. It is much lower than FOMC or Employment report, but comes much more often. While there are only 8 scheduled FOMC rate and 12 Employment announcements per year, Initial Jobless Claims figures are

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

announced every week. Thus our ranking methodology account for both size of explanatory power, as well as the frequency of the announcement.

Interestingly, both GDP Advanced and GDP Preliminary announcements very similar in importance, each accounting for 36% of return variation. 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 common observation that market finds the later figures of the same group of announcements less important.

Forward Looking is the most important category. Six (seven if both ISM announcements are included) explain significant fraction of total daily return variation. 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 overlap 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 announcements are not significant at conventional levels.

**[Insert Table 2 about here]**

*4.2 Pooled announcements*

Using all 57 announcements and all trading days in equation (4) we find 20% of the total return variation is attributed to the macroeconomic news. 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 1.24% of the total return time, and only 1.8 % of the return time on the announcement days.

**[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 for further investigation of time variation in importance. We repeat the estimation of equation (3) in 24-month rolling windows. Figure 2 presents the regression $R^2$. In Panel A we present the results for Nonfarm payrolls announcement. Although for the full sample Nonfarm payroll announcement accounts for 46% of daily return variation (see Table 2),

there is considerable variation in 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 total daily return. From then the importance of Nonfarm employment increases reaching a max of 82.4% in 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 2 about here]**

Panel B shows the explanatory power of FOMC Rate announcement. 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% in April 2009. In the most recent period the explanatory power drops to 10%. The Fed was cutting its target rate from 2001 to 2003, the explanatory power of their announcements was 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 rates was in June 2006. In August 2007 the easing has started which ended in December 2008 with rates at 0-0.25 interval. Such pattern indicates the growing importance of the FOMC Rate announcement during hiking periods and the periods between hiking and easing.

To investigate the variation of the total news importance we estimate the regression (4) in rolling one-year windows. The $R^2$ of the regression varies from 5% in December 2000, to 51% in December 2004. In both cases the announcement time accounts for only 1% of total time.

**[Insert Figure 3 about here]**

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

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 news depends on the stage of business cycle. The same news depending on the state of business cycle can be both good and bad. Goldberg and Grisse (2013) show the reaction of government bonds to news is muted when VIX is high or Federal Funds futures rate is low. The illustration from the previous section also shows explanatory power is lower during the periods of FED easing. Finally, we investigate the relation between investor sentiment and importance of the news. We thus investigate these candidates as drivers of the variation in news importance.

Table 4 Panel A shows results of the regression in equation (4) where the sample is conditioned upon previous day level of VIX, MOVE (Meryll Option Volatility Estimate for Treasury futures), Baker and Wurgler (2006, 2007) sentiment index and Federal Funds Rate. The level of the VIX is negatively related to the explanatory power of the regression. News is most important when VIX is at its lowest. The importance decreases monotonically with increasing volatility. However at the highest VIX level $R^2$

slightly increases. However, the pattern is less clear for the conditioning the regression sample upon the MOVE index or Fed Funds futures rate.

The last two columns of Panel A investigates the relationship with two versions of Baker and Wurgler (2006, 2007) sentiment index. The indices are based on the first principal component of six (standardized) sentiment proxies, where each of the proxies has first been orthogonalized with respect to a set of macroeconomic conditions. The sentiment-level index uses levels and the sentiment-changes index uses changes of the proxies when extracting the principal component. We use sentiment-levels index to investigate the relation between the importance of the fundamental news and the state of sentiment, whereas sentiment-changes[11] index is use to test for the effect of changes in sentiment.

First, explanatory power of the macroeconomic news is negatively related to the sentiment-level index. $R^2$ is highest when the sentiment is at its lowest and monotonically deceases with increase of sentiment. This indicates that fundamental news is the most important when sentiment is negative. Second, the last column shows importance of fundamental news is lower at the extremes of sentiment-changes index, i.e. when sentiment volatility is highest. Baker and Wurgler (2007) visually observes that "the volatility of sentiment rises in a speculative episode. This pattern suggests that the relative influence of fundamentals and sentiment on aggregate market returns changes over time". Our findings lends quantitative support to Baker and Wurgler (2007) observation.

In Panel B of the Table 4 we also investigate the effect of two conditioning variables. First we examine the effect of Fed actions. We split the sample into easing and hiking periods. The easing (hiking) period is defined from the day of the first rate cut (increase) to the day of the first rate increase (cut). The results show the difference in news importance in these periods is small. Second, 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 ($R^2 = 0.23$).

However, note that the conditioning upon business cycle and Fed actions is related to the level of VIX. We find the average VIX levels in hiking and easing periods are statistically different (ANOVA F-value 644.2). VIX is lower in the easing periods, where the explanatory power is the higher (see Panel B in Table 4). Conditioning upon the Fed actions does not change the negative relationship between explanatory power and VIX. Contrary, conditioning upon business cycle reverses the relationship. The average VIX in recession is significantly higher (ANOVA F-value 813.2) than in expansion, while the $R^2$ is also higher during the recession. Figure 4 further investigates the switch of the relationship during recessions. We condition the regression upon the stage of business cycle and the level of VIX. The figure demonstrates that (1) explanatory power for the same level of VIX is higher during recessions, and (2) the higher VIX leads to the higher importance of the macroeconomic news.

**[Insert Table 4 about here]**

**[Insert Figure 4 about here]**

[11] The reason to form a separate sentiment-changes index is that the sentiment proxies have different noisiness in going from levels to changes (see Baker and Wurgler, 2007).

## 5. Novel vs. Current Methodology Results

*5.1 Individual announcements*

The literature finds macroeconomic news is especially important for the bond markets. One of the reasons is that bond pricing is simple thus market participants are more likely to agree on the interpretation of the news. In Table 5 we present results using two methodologies. We estimate the importance of the individual announcements using the novel return regression (3) and using the surprise regression (2) using both intraday and total daily return.

First, we find that the surprises of 39 (of 55) macroeconomic announcements have a significant (at the 10% confidence level) impact on the 10-year Treasury futures. 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 10% confidence. The maximum $R^2$ decreases to 21% (Non-farm Payrolls). The average $R^2$ also decreases from 10% to 3%.

Third, our methodology identifies 26 significant announcements. Using our methodology we are able to correctly rank announcements that are important for the market participants. For example, the FOMC target rate announcements are regarded as very important by market participants. However, FOMC rate decision surprise element is not found to be significantly related to the intraday returns and a weak relation is found with daily returns[12]. On the other hand the novel methodology points out the target rate announcement is the most important news announcement, accounting for 56% variation in the returns on target rate announcement days. Non-farm payroll employment is found to be the second most important announcement. Both the daily and intraday surprise regressions find this announcement to be among the most important.

Finally, the results using surprises in estimating impact on the market are inconclusive. Using intraday return in the surprise regression we find GDP Advance and Preliminary announcements significant, whereas impact of the surprises on daily return is insignificant. On the other hand the novel methodology identifies both announcements as highly significant explaining 36% of announcement day return variation.

Surprise regressions identify price announcements, Core PPI and CPI, being of high importance. Our results, however, indicate the announcements are less important than previously thought. Both announcements account for only 9% of announcement day variance. However this is not significant at conventional levels. On the other hand, Import Prices explain statistically significant part of the daily return variation. In surprise regression, on the contrary, we find no significant relation.

**[Insert Table 5 about here]**

[12] 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).

*5.2 Aggregated announcements*

We provide the comparison between return- and surprise-based total importance of macroeconomic 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 standardized surprises need to be adjusted based on their impact on the market. For example one standardized surprise of Nonfarm Payroll announcement has -26.87 basis point impact on Treasury Note futures on average, whereas Unemployment moves the price by 9.22 bps (see Table 5). We weight the surprises by their impact on the market, thus accounting for the sign and size of the impact. We then aggregate surprises daily and estimate the regression (4) on the announcement days when surprises are available.

Table 6 Panel A shows the estimation results when aggregated surprises are used. Weighted surprises are able to explain only 8% of the total announcement day variation. In comparison, return-based news estimates are able to explain three times more variation (see Panel B). Note that both regressions we use a smaller sample excluding the returns 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.

**[Insert Table 6 about here]**

## 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 specific announcements for bond markets. 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.

We contribute to the literature in three ways. First, based on the novel methodology we find macroeconomic announcements account for 24% of the variation in announcement day bond returns. In contrast the existing methodology based on news surprises indicates that only 8% of the variation in announcement day bond returns 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 is well-known, we are the first to provide strong evidence of the importance of FOMC target rate announcements. In fact these announcements can explain 56% of the variation in bond returns on days that these announcements are made. Third, we find the importance of the aggregate

news varies over time. The explanatory power is higher during recessions and during periods of low equity market uncertainty. However conditioning upon the stage of business cycle reverses the relation. In expansions the importance of the news decreases with the level of VIX, while in recessions it increases. Economic news is less important when investor sentiment is positive and during periods of extreme sentiment changes.

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 5-minute return following the announcement is still useful. On the other hand we are able to evaluate the importance of announcements that do not have forecast values. Forecasts are available for many US 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. Most important our methodology allows investigating importance of news that have no explicit expectation and thus surprise component cannot be calculated. For example, the importance of speeches of Federal Reserve officials can now be evaluated.

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## Figures

**Figure 1. Illustration of Bootstrap Results**

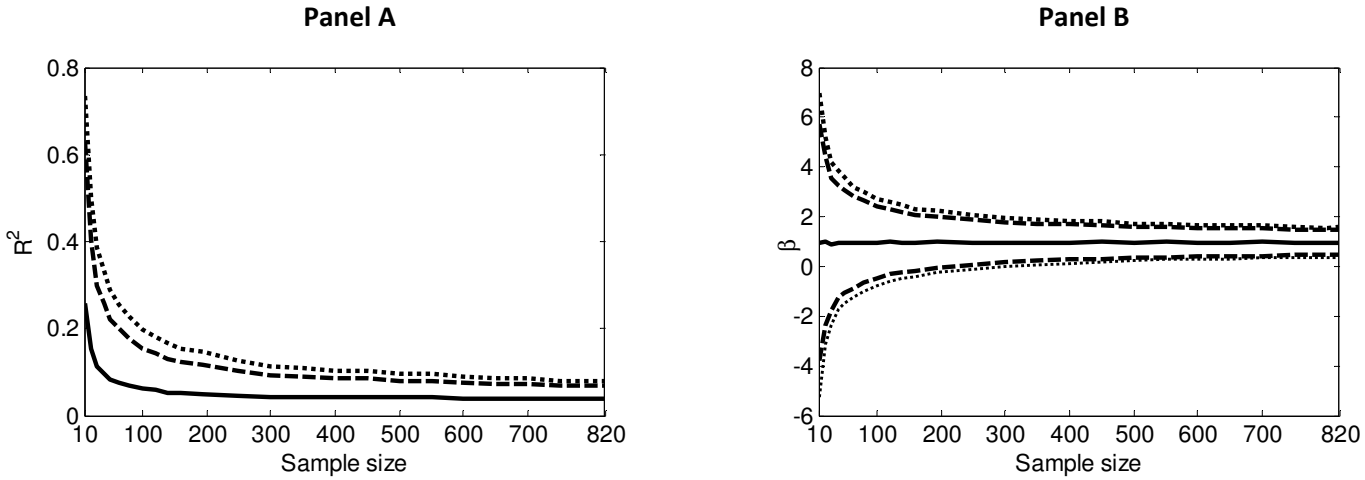
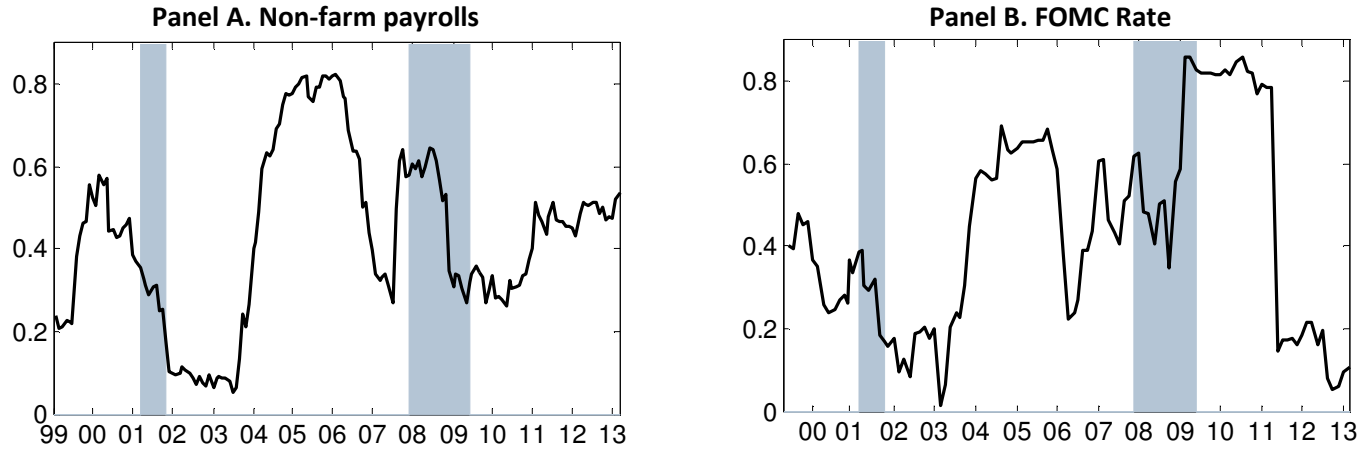



Figure shows results for bootstrapped regression $R_{total_k,t} = \alpha_k + \beta_k R_{k,t} + \varepsilon_t$, where $R_{total_k,t}$ is daily close to close return and $R_{k,t}$ is intraday return from 8.25 to 8.45 with no news announced in this window. The bootstrap results are given for the different 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 $\beta_k$ of the regression. Bold line indicates the average $R^2$. Dotted and dashed lines indicate 90% and 95% confidence band respectively.

**Figure 2. 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 3. Aggregated announcement importance**

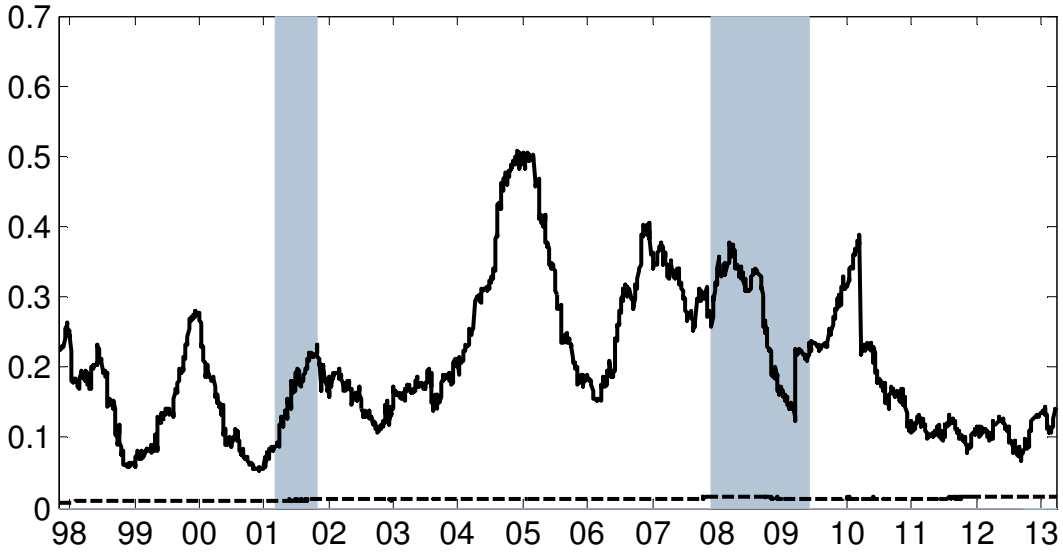



Figure demonstrates varying importance of the macroeconomic news. Bold line shows the variation of $R^2$ of the regression $R_{total_k,t} = \alpha_k + \beta_k R_{ann,t} + \varepsilon_t$ , where $R_{total_k,t}$ is daily return from close to close of the open outcry trading session on day $t$, $R_{ann,t}$ 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 4. News importance and VIX**

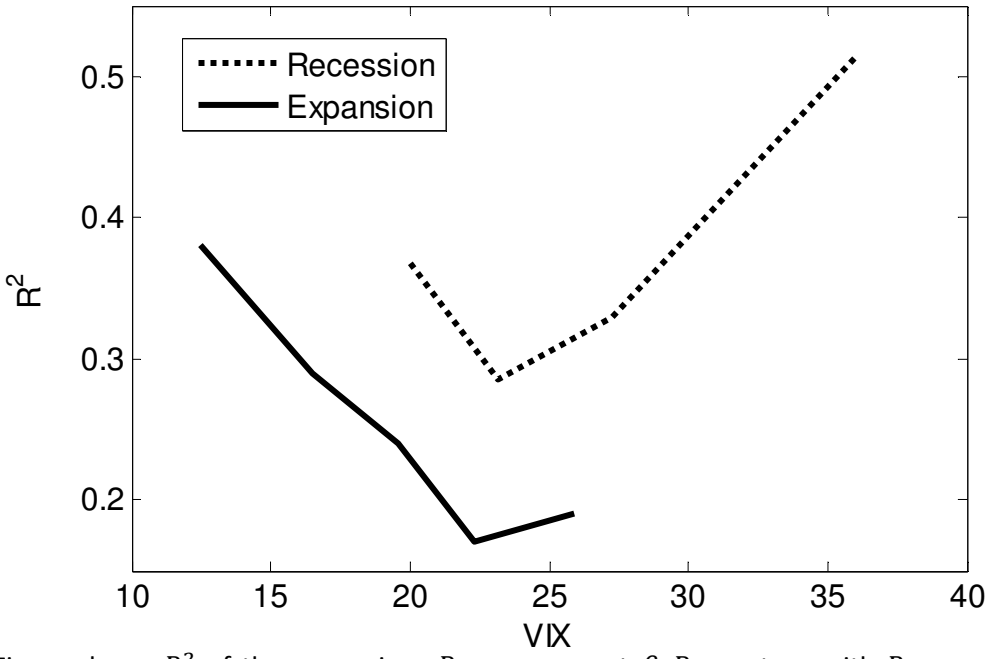



Figure shows $R^2$ of the regression $R_{total_k,t} = \alpha_k + \beta_k R_{ann,t} + \varepsilon_t$. with $R_{total_k,t}$ the total close to close daily return, $R_{ann,t}$ cumulative total return of the day around macroeconomic news. The sample is conditioned upon the NBER expansion-recession and then on the quantiles of the VIX. Vertical axis demonstrates the average level of VIX in each quantile. Solid line shows the $R^2$ for the expansion and dotted line shows the results for the recession period.

## Tables

**Table 1.** Summary of the U.S. 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 | $\alpha$ | $\beta$ | $R^2$ | Obs. | Percentile | Rank |
|---|---|---|---|---|---|---|---|
| | ***Consumption*** | | | | | | |
| 1 | Existing Home Sales | -2.21 | 1.66 | 0.21** | 98 | 0.96 | 16 |
| 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 | 30 |
| 4 | Pending Home Sales | 1.62 | 1.20 | 0.12 | 95 | 0.86 | 19 |
| | ***FOMC*** | | | | | | |
| 5 | Beige Book | -4.18 | 1.04 | 0.05 | 104 | 0.65 | 32 |
| 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 | 24 |
| | ***Forward Looking*** | | | | | | |
| 8 | Dallas Manufacturing Activity | 9.64 | -1.50** | 0.09 | 51 | 0.66 | 31 |
| 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 | 17 |
| 11 | NAHB Index | 2.45 | 1.61 | 0.08 | 120 | 0.74 | 26 |
| 12 | Philadelphia Fed Survey | -3.43* | 1.31 | 0.18*** | 196 | 0.99 | 7 |
| 13 | CB Consumer Confidence | 4.68 | 0.95 | 0.12** | 194 | 0.96 | 15 |
| 14 | Chicago PMI | 10.86** | 1.17 | 0.18*** | 197 | 0.99 | 5 |
| 15 | ISM Manufacturing[a] | 0.33 | 0.94 | 0.19*** | 197 | 1.00 | 4 |
| 16 | ISM Prices Paid[a] | 1.34 | 0.85 | 0.15** | 153 | 0.97 | 4 |
| 17 | Building Permits[c] | 6.46 | 1.05 | 0.09 | 128 | 0.77 | 27 |
| 18 | Housing Starts[c] | 7.87** | 0.89 | 0.07 | 181 | 0.73 | 27 |
| 19 | Leading Indicators | 2.44 | 0.67 | 0.03 | 193 | 0.50 | 36 |
| 20 | Michigan Consumer Sentiment Preliminary | 1.83 | 1.44 | 0.16** | 166 | 0.97 | 11 |
| 21 | Michigan Consumer Sentiment Final | 5.05 | 0.85 | 0.07 | 166 | 0.84 | 20 |
| 22 | IBD/TIPP Economic Optimism | 0.37 | 2.08 | 0.11 | 79 | 0.76 | 25 |
| 23 | ISM Non-Manufacturing | -3.80* | 0.66 | 0.05 | 172 | 0.60 | 33 |
| | ***GDP*** | | | | | | |
| 24 | GDP Advance[d] | 5.96 | 1.27 | 0.36** | 64 | 0.99 | 10 |
| 25 | GDP Preliminary[e] | 8.25 | 2.16 | 0.36** | 65 | 0.99 | 8 |
| 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 | 10 |
| 28 | GDP Personal Consumption Preliminary[e] | 7.28 | 2.41 | 0.42** | 41 | 0.99 | 8 |
| 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 | 38 |
| 31 | Treasury Budget | -2.09 | 0.91 | 0.03 | 189 | 0.46 | 37 |

**Table 2.** Continued

| | Name | $\alpha$ | $\beta$ | $R^2$ | Obs. | Percentile | Rank |
|---|---|---|---|---|---|---|---|
| | ***Investment*** | | | | | | |
| 32 | Durable Goods Orders[n] | -2.77 | 1.14 | 0.15** | 185 | 0.96 | 14 |
| 33 | Durable Goods Orders ex transportation[n] | -3.26 | 1.03 | 0.14* | 136 | 0.91 | 14 |
| 34 | Construction Spending[a] | 2.83 | 0.60 | 0.06 | 116 | 0.65 | 4 |
| 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 | 35 |
| 39 | Trade Balance | 2.16 | 1.24 | 0.15** | 196 | 0.96 | 13 |
| | ***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 | 22 |
| 44 | CPI Core[h] | 5.07 | 0.85 | 0.09 | 195 | 0.84 | 22 |
| 45 | Cost Civilian Workers[d] | 10.08* | 1.05 | 0.37** | 64 | 0.99 | 10 |
| 46 | Unit Labor Costs[b] | 4.28 | 1.81 | 0.25** | 111 | 0.99 | 9 |
| 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 | 12 |
| 51 | Retail Sales Less Autos[k] | -2.60 | 0.87 | 0.14* | 191 | 0.95 | 12 |
| 52 | Capacity Utilization[m] | 3.23 | 1.21 | 0.07 | 194 | 0.85 | 18 |
| 53 | Industrial Production[m] | 2.81 | 1.22 | 0.07 | 196 | 0.86 | 18 |
| 54 | Personal Income | -0.87 | 1.00 | 0.07 | 197 | 0.71 | 28 |
| 55 | Nonfarm Productivity[b] | 4.50 | 1.77 | 0.24** | 124 | 0.99 | 9 |
| 56 | Initial Jobless Claims[i] | 1.00 | 1.24 | 0.16*** | 820 | 1.00 | 3 |
| 57 | Continuing Jobless Claims[i] | 0.60 | 1.34 | 0.19*** | 557 | 1.00 | 3 |

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 $R^2$estimate. 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

**Panel A.** All Days

| $\alpha$ | $\beta$ | $R^2$ | Obs. |
|---|---|---|---|
| 1.51*** | 1.02 | 0.20 | 4223 |

**Panel B.** Announcement Days

| $\alpha$ | $\beta$ | $R^2$ | Obs. |
|---|---|---|---|
| 1.21* | 1.02 | 0.24 | 3211 |

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. Panel A gives the estimation results for the all days in our sample where announcement return on non-announcement day is set to zero. In Panel B days without announcements are excluded.

**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 | 0.38 | 12.51 | 0.27 | 63.94 | 0.11 | 0.12 | 0.32 | -0.47 | 0.22 | -1.79 |
| 2 | 0.28 | 16.48 | 0.22 | 79.47 | 0.33 | 0.44 | 0.31 | -0.15 | 0.31 | -0.61 |
| 3 | 0.26 | 19.61 | 0.25 | 90.77 | 0.25 | 1.57 | 0.26 | -0.01 | 0.29 | -0.20 |
| 4 | 0.18 | 22.37 | 0.21 | 101.64 | 0.25 | 3.56 | 0.25 | 0.12 | 0.24 | 0.11 |
| 5 | 0.22 | 25.88 | 0.24 | 112.65 | 0.32 | 5.13 | 0.21 | 0.33 | 0.20 | 0.56 |

**Panel B.**

| | $R^2$ | $VIX_{t-1}$ | $MOVE_{t-1}$ | Obs. | | $R^2$ | $VIX_{t-1}$ | $MOVE_{t-1}$ | Obs. |
|---|---|---|---|---|---|---|---|---|---|
| Easing | 0.24 | 24.57 | 106.30 | 2275 | Expansion | 0.23 | 20.72 | 93.31 | 2768 |
| Hiking | 0.25 | 16.74 | 82.07 | 936 | Recession | 0.30 | 32.08 | 136.25 | 443 |

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. On the left we split into decreasing (Easing) and increasing (Hiking) target rate periods. On the right NBER business cycle split is estimated. All estimations are based on sample October 1996 – March 2013, except for sentiment indices where the data is available until end of 2010.

**Table 5.** Comparing the methodology

| | | (1) | | (2) | | (3) | | |
|---|---|---|---|---|---|---|---|---|
| | | $\beta$ | $R^2$ | $\beta$ | $R^2$ | $\beta$ | $R^2$ | 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 5.** Continued

| | | (1) | | (2) | | (3) | | |
|---|---|---|---|---|---|---|---|---|
| | | $\beta$ | $R^2$ | $\beta$ | $R^2$ | $\beta$ | $R^2$ | 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 of daily close to close return on the intraday return around a macroeconomic announcement (1), 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 6.** Aggregate News Importance

**Panel A.** Surprises

| $\alpha$ | $\beta$ | $R^2$ | Obs. |
|---|---|---|---|
| 1.49** | 1.01 | 0.08 | 3161 |

**Panel B.** Returns

| $\alpha$ | $\beta$ | $R^2$ | Obs. |
|---|---|---|---|
| 1.39** | 1.02 | 0.24 | 3161 |

Table gives the regression statistics of daily close to close announcement day return on the aggregated announcement time return (Panel B) and weighed surprises (Panel A). Announcement time includes windows starting 5 minutes before and ending 15 minutes after each announcement. *, ** and *** indicate statistical significance at 10%, 5% and 1% levels, respectively, using HAC errors. For coefficient $\alpha$ the difference from 0 is tested; and for coefficient $\beta$ significance from 1 is tested.