Asymmetries in the Reaction of Treasury Bond Futures Returns to Macroeconomic News

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Abstract

This paper analyzes a new comprehensive dataset of first-issued macroeconomic announcements to investigate how the Treasury bond futures market incorporates new information. While the impact of announcements increases with maturity, controlling for differences in duration shows that short maturities display a relatively stronger reaction. At the short-end of the yield curve, a one-standard deviation announcement shock leads to almost a one-standard deviation return shock. Responses to news announcements are significantly stronger when bad news for the bond market is announced during good economic times and when uncertainty among forecasters is high. *Daily* macroeconomic announcements explain a significant 70% of *monthly* directional changes of the bond futures market.

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Introduction

The link between (news about) fundamentals and asset prices plays a central role in financial economics in general and asset pricing in particular. Theoretical work conjectures that the reaction of asset prices to news is likely to be state-dependent.[1] This suggests that the way financial markets process information may depend on the context, but how to specify this context is an empirical question. This paper studies asymmetries in the response of the bond futures market to first-issued macroeconomic news announcements. More specifically, two types of asymmetries are examined empirically. First, whether different segments of the yield curve respond differently to macroeconomic news. Second, whether the reaction of the bond market varies over the economic cycle, with the content of the news and with uncertainty among market participants. In addition to studying asymmetries, this paper examines how far daily news about macroeconomic fundamentals goes in explaining longer-term directional changes of the bond market. This contrasts the recent emphasis in the literature on explaining very short intraday time windows around macroeconomic announcements (see for example Andersen, Bollerslev, Diebold and Vega, 2003; Balduzzi, Elton and Green, 2001; Ederington and Lee, 1995; Fleming and Remolona, 1999; and Hess, 2004).

Previous studies of the bond market have either focused on a limited number of announcements (Smirlock, 1986; Urich and Wachtel, 1984; and Beber and Brandt 2010), the response of volatilities and correlations (Crain and Lee, 1995; De Goeij and Marquering, 2006; Edering and Lee, 1996; and Jones, Lamont and Lumsdaine, 1998), or the high-frequency mechanism of price adjustments (Balduzzi, Elton and Green, 2001; Becker, Finnterty and Kopecky, 1996; Ederington and Lee, 1995; Faust, Rogers, Wang and Wright, 2005; Fleming and Remolona, 1997, 1999; Green, 2004; and Hess, 2004). This paper extends the existing literature in three key dimensions.

First, in addition to an analysis of the response of Treasury bond futures with different maturities, the responses of duration-neutral trading strategies that capture the slope and curvature of the yield curve are examined. The purpose is to investigate whether differences in duration fully explain the stronger response of longer-term bond futures observed in the current and previous studies. It also sheds light on the exposure of these common trading strategies to macroeconomic announcements and can hence be viewed in the context of risk management for trading purposes.

Second, several asymmetries related to the business cycle stage, news content, and investors' uncertainty are studied. More specifically, the effects of announcements during good and bad economic times, the response to good and bad news for bond returns, the announcement of good (bad) news in bad (good) times, announcements when uncertainty among market participants is high or low and the effect of exceptionally large surprises are examined. Theoretical work by Veronesi (1999)

[1] See for example the theoretical models of Blanchard (1981), Veronesi (1999) and Barberis, Shleifer and Vishny (1998).

shows that the impact of news may be different during good and bad times. In addition, the model predicts that the price sensitivity to news is at its maximum when uncertainty is high. With information on minimum and maximum forecasts for each variable at each announcement time, these predictions can be empirically tested in the bond futures market for the first time in the literature.
Third and finally, whether daily macroeconomic news is meaningful in explaining the direction of the bond market at a monthly frequency is examined. This contrasts much of the prior literature where the focus is on intra-daily microstructure dynamics of the trade process. Some prior studies focus on the high-frequency response of prices, bid-ask spreads and trading volume and analyze intraday (e.g. tick-by-tick, 10-second, 1-, 5-minute) data. If the effect of news disappears after minutes, it is questionable whether macroeconomic news announcements can explain longer-term movements of fixed income futures. This paper examines this issue explicitly for the first time.

In establishing these stylized facts, a previously unexplored source of macroeconomic expectations and initial unrevised (i.e., first issued) announcements from Bloomberg is used.[2] The main results from this paper can be summarized as follows. Macroeconomic announcements are both economically important and statistically significant in explaining Treasury bond futures returns of all maturities. Economically, macroeconomic news explains up to 27% of the return variation on announcement days. The two most important macroeconomic announcements are ISM manufacturing and nonfarm payrolls, which are also among the most timely released indicators on the health of the U.S. economy. A one-standard deviation shock in ISM manufacturing and nonfarm payrolls moves the returns on 2-, 5-, 10-, and 30-year instruments with as much as 11, 21, 29, and 42 basis points on announcement days. This is between 67% (30-year) and 90% (2-year) of the daily standard deviation of bond futures returns and suggests that large surprises in macroeconomic announcements lead to large moves in bond returns, on average. The impact of macroeconomic surprises is stronger for longer maturities, which is what one would expect given that volatility and duration increase with maturity (see also Balduzzi, Elton and Green, 2001). But when correcting for differences in duration, the short end of the maturity spectrum is substantially more responsive to macroeconomic news than the long end. In addition, the analysis of the impact of announcements on the duration-neutral term-spread and butterfly-spread strategies shows that macroeconomic news affects the slope, but not so much the curvature of the yield curve.

Considering potential asymmetries in the reaction of bond futures returns, this paper shows that there is a substantially stronger response to macroeconomic news when it concerns the announcement of bad news in good times. Furthermore, the reaction of the bond futures market is significantly stronger when the uncertainty among market participants is high. Other authors show differences in the

[2] A recent exception is the study of Li, Wang, Wu and He (2009), but the focal point of their analysis is on whether liquidity and information risks are priced in the (cash) Treasury bond market.

reaction of exchange rates to news during different economic regimes and for larger surprises (see Andersen, Bollerslev, Diebold and Vega (2003) and Ehrmann and Fratzscher, 2005b). This paper shows that the evidence for these effects is much weaker in the Treasury bond futures market.

Given the importance of macroeconomic news for the bond futures market in the short-run, an interesting question is whether fundamentals are able to explain longer-term movements. Daily macroeconomic surprises explain between 64% and 70% of monthly directional changes in the bond market. For all maturities, this is significant at the 1% level and shows that daily macroeconomic information is able to explain monthly movements in the bond market. This is in sharp contrast with the evidence for the foreign exchange market, see Almeida, Goodhart and Payne (1998).

The remainder of this paper is organized as follows. Section 1 describes the Treasury futures data and the macroeconomic announcements data and Section 2 outlines the econometric methodology. Section 3 discusses which economic announcements affect bond futures returns and investigates the sensitivity of two common duration-neutral bond trading strategies to macroeconomic announcements. Section 4 analyzes whether the response to news is asymmetric and dependent on the macroeconomic state, news content and uncertainty among market participants. Section 5 summarizes the results of multivariate models, evaluates the goodness-of-fit and examines whether daily announcement surprises can explain monthly directional changes in the bond market. Finally, Section 6 summarizes and concludes.

1. Data

1.1. Fixed income futures returns

All data is daily and the sample runs from 1/1/1996 – 12/31/2006. Closing prices are collected for 2-, 5-, 10- and 30-year Treasury bond futures (traded at the Chicago Board of Trade). Investors typically use futures, which are very liquid, to express a view on upcoming macroeconomic releases. The futures market has been shown to lead the cash market in terms of price discovery. The use of futures furthermore circumvents the problems associated with switches between on- and off-the-run bonds in the cash market. Nearest-to-expiry futures contracts are used to measure daily logarithmic price changes. In line with the market convention, contracts are rolled over to the next-month contract on the day that the open interest in this contract exceeds the open interest in the current-month contract.[3] As a robustness check, all analyses are re-run with contracts that roll over to the next contracts seven days before expiration. Inspection of the trading volume reveals that this timing convention captures

[3] Ederington and Lee (1995) follow the same convention in their dataset with T-bond, Eurodollar and Deutschemark futures.

the increasing volume in the new nearest-to-maturity contract for all instruments. Since the conclusions are very similar under this alternative roll schedule these results are not reported.

The studies surveyed in the Introduction typically document significant intraday responses to news in the minutes following news announcements. The daily frequency used in this study is thus likely to bias the results against finding a significant impact of macroeconomic news on Treasury bond futures returns. However, the statistical evidence documented in this paper is rather strong. The benefit of the daily data is that it is not affected by high-frequency noise such as the bid-ask bounce, staleness, price discreteness and clustering of quotes. Table 1 displays the summary statistics for the 2-, 5-, 10- and 30-year Treasury bond futures returns.

[Insert Table 1 about here]

Bond futures returns exhibit negative skewness, excess kurtosis and non-normality. For shorter-maturities (2- and 5-year) returns are modestly but significantly autocorrelated as the Ljung-Box statistics show. The autocorrelation in squared returns is significant at the 1%-level for all maturities. In modeling the impact of macroeconomic announcements, the econometric approach in Section 2 will carefully take these properties into account.

1.2. Macroeconomic announcements and expectations

The macroeconomic expectation and announcement data comes from Bloomberg. Most previous studies in the literature use data from Money Market Services International (MMS). There are, however, three main advantages of Bloomberg over MMS. First, there is a close link between the Bloomberg survey and financial markets. Bloomberg is widely adopted among international money managers and traders and most participants in the survey are active in financial markets. The surprise element in macroeconomic announcements is instantly available after announcement and it is straightforward for traders to adjust their dynamic trading strategies to this new information. Second, there are substantially more contributors to the Bloomberg survey, which makes the survey more reliable. Third and finally, MMS has recently stopped with their survey services and it is not clear whether Action Economics, its successor, uses the same survey panel and methodology (see Brenner, Pasquariello and Subrahmanyam, 2009). The Bloomberg survey runs on a consistent basis since 1996.

The Bloomberg survey is open to professional forecasters and is conducted by e-mailing the participants about 7 to 10 days prior to the release of an indicator. Once forecasters start to contribute to the survey, the median, or consensus, expectation is available in the system. The median gets up-dated when more forecasters start to contribute until the survey is closed, usually 3 days prior to the official release of the indicator. From the moment that an individual forecaster submits a forecast to

Bloomberg, the estimate, name, and institute she works for are visible to all Bloomberg users. This is likely to enforce reputational discipline and enhances the quality of the survey. The standard economic releases calendar lists the name of the indicator, the survey median and prior value for the indicator.

The dataset contains median expectations, minimum and maximum predictions for each survey date, the actual release, and the number of forecasters contributing to the survey. GDP announcements (advance, preliminary and final) are excluded from the dataset because the number of observations (28) is not enough to draw reliable inferences. Of the remaining series, some overlap (a clear example is the MoM and YoY release for the same variable). In these cases, the series with the highest number of contributing forecasters is taken. The extensive dataset of 27 series includes virtually all series considered in prior studies. Following Balduzzi, Elton and Green (2001), the standardized surprise for macroeconomic variable i at time t is defined as:

$$Surpr_{i,t} = \frac{A_{i,t} - E_{i,t}}{\hat{\sigma}_i},$$

where $A_{i,t}$ is the announced value for macroeconomic series i, $E_{i,t}$ is the median expected value for indicator and $\hat{\sigma}_i$ is the sample standard deviation of $A_{i,t} - E_{i,t}$. Since the units of measurement differ across announcements, this normalization allows for meaningful comparison of the parameter estimates across announcements. Note, however, that it does not affect the significance or the fit of the regressions described in Section 2 below. Following Ehrmann and Fratzscher (2005a and 2005b), the survey mean (rather than the median) is taken for the Fed funds target rate. Since the target rate moves in discrete steps only, the mean better reflects the variation in survey forecasts.

Figure 1 shows the time-series of the non-standardized macroeconomic surprises and Table 2 shows descriptive statistics. The 27 macroeconomic variables are grouped into the categories “real activity”, “employment”, “consumption”, “investment”, “prices”, “forward looking”, “FOMC”, “net exports”, and “government budget”.

[Insert Figure 1 about here]

[Insert Table 2 about here]

The number of participants compares favorably to the 40 money managers surveyed by MMS, especially since the data in this paper also include less studied, non-key announcements. The appendix shows that Bloomberg expectations are largely unbiased and efficient using standard regression-based techniques.

2. Methodology

Two primary regression types are used to study the link between macroeconomic news and futures returns. First, Treasury bond futures returns are regressed on a constant and on standardized announcement surprise i at announcement day τ :

$$\Delta\left(\ln P_\tau\right) = \alpha + \beta_i Surpr_{i,\tau} + \varepsilon_\tau , \qquad (1)$$

where P_τ is the daily Treasury bond futures index (either 2-, 5-, 10- or 30-year) as described in Section 1.1 on announcement day τ and $Surpr_{i,\tau}$ is the standardized surprise for macroeconomic variable i as described in Section 1.2. Note that the time subscript τ indicates announcement days, rather than trading days.

Second, Treasury bond futures returns are regressed on macroeconomic surprises in calendar time. Given the non-normality and heteroskedasticity of bond returns documented in Table 1, weighted least squares (WLS) is used. Estimation of the model proceeds in three steps.

First, for each macroeconomic surprise i, the mean return equation is estimated by ordinary least squares (OLS):

$$\Delta\left(\ln P_t\right) = \alpha + \sum_{k=1}^{K} \gamma_k \Delta\left(\ln P_{t-k}\right) + \delta_{Mon} D_{Mon,t} + \delta_{Wed} D_{Wed,t} + \delta_{Fri} D_{Fri,t} + \beta_i Surpr_{i,t} + \varepsilon_t , \qquad (2)$$

where P_t is the daily Treasury bond futures index (either 2-, 5-, 10- or 30-year) as described in Section 1.1, $D_{Mon,t}$, $D_{Wed,t}$ and $D_{Fri,t}$ are dummy variables to take day-of-the-week effects into account and $Surpr_{i,t}$ is the standardized surprise for macroeconomic variable i as described in Section 1.2. Observations are in calendar time.

Second, the squared error-term (ε_t) from equation (2) is modeled as:

$$\ln\left(\hat{\varepsilon}_t^2\right) = c + \sum_{l=1}^{L} \psi_l \ln\left(\hat{\varepsilon}_{t-l}^2\right) + \phi_{Mon} D_{Mon,t} + \phi_{Wed} D_{Wed,t} + \phi_{Wed} D_{Wed,t} + \lambda_i \left|Surpr_{i,t}\right| + \eta_t \qquad (3)$$

Third and finally, the fitted variance from equation (3), $\exp\left(\ln\left(\hat{\varepsilon}_t^2\right) - \hat{\eta}_t\right)$, is employed as instrument and equation (2) is re-estimated with WLS. The estimation procedure thus explicitly takes the heteroskedasticity and autocorrelation of the error term into account (see also Andersen, Bollerslev, Diebold and Vega, 2003).

In the empirical implementation, $K = L = 1$ which suffices to remove the serial correlation from the WLS residuals (using Ljung-Box Q-statistics). As a robustness check, equation (2) is estimated with OLS and heteroskedasticity and autocorrelation consistent (HAC) standard errors. These results lead to similar conclusions and are therefore not reported.

3. Which announcements matter?

3.1. Responses of 2-, 5-, 10-, and 30-year Treasury bond futures returns

This section and the next analyze the impact of individual announcements, whereas Section 5 focuses on the impact of all announcement surprises together in a multivariate setting. Tables 3 (all days) and 4 (announcement days) show the parameter estimates and adjusted R^2s for the regressions of the fixed income futures returns on the 27 types of macroeconomic surprises. Estimates of the intercept terms, lagged returns and dummy variables are omitted from the tables.

[Insert Table 3 about here]

[Insert Table 4 about here]

Tables 3 and 4 show that macroeconomic announcements are both economically important and statistically significant in explaining Treasury bond futures returns of all maturities. Economically, macroeconomic news explains up to 27% of the return variation on announcement days. The two most important macroeconomic announcements are ISM manufacturing and nonfarm payrolls. These indicators are among the most timely indicators of the U.S. economy and are available shortly after the end of the month. The release of ISM manufacturing is at least as important as nonfarm payrolls, especially for longer maturities. A one-standard deviation shock in ISM manufacturing and nonfarm payrolls moves the returns on 2-, 5-, 10-, and 30-year instruments with as much as 11, 21, 29, and 42 basis points on announcement days. This is between 67 (30-year) and 90% (2-year) of the daily standard deviation of bond futures returns and suggests that large surprises in macroeconomic announcements lead to large moves in bond returns, on average. The non-farm payrolls and ISM manufacturing releases are closely connected to the general state of the economy and their importance therefore does not come unexpectedly. Generally, 19 (20) announcements significantly affect the return of at least one of the instruments on all days (announcement days). This is more than what has been shown in any other study to date. Furthermore, there are at least 17 variables that significantly affect the return of a bond future of a particular maturity.

Looking in more detail at Tables 3 and 4, improving economic conditions, lower unemployment, higher inflation, and increases in the Fed funds target rate decrease Treasury bond futures returns. Furthermore, the signs of the coefficients are in general the same for the all-days and the announcement-days regressions and the signs are consistent across maturities. There are ten types of macroeconomic announcements that significantly affect all maturities for the all-days results (Table 3). These are Chicago purchasing managers, initial jobless claims, ISM manufacturing, nonfarm payrolls, ISM non-manufacturing, monthly budget statement, retails sales, Philadelphia Fed, durables, and wholesale inventories. In addition, nine variables affect at least on maturity significantly: consumer confidence, PPI, CPI, capacity utilization, leading indicators, new home sales, Fed funds target rate, personal consumption, and employment cost index. Looking at the various maturities, 17 announcements affect the return on the 2-year future significantly and 19 variables significantly move the 5-, 10- and 30-year instrument on announcement days.

Consistent with the findings of Balduzzi, Elton and Green (2001), who use a shorter time-period of high-frequency data, the size of the response seems to be higher for instruments with a longer maturity. This is in line with the fact that duration and volatility increase with maturity. Interestingly, and not addressed before, the impact of macroeconomic news diminishes as a fraction of the volatility for longer maturities. This suggests that, correcting for differences in duration, the short end of the yield curve is more affected by macroeconomic news than the long end. This issue is examined in the next paragraph.

By moving from all days (Table 3) to announcement days only (Table 4), the adjusted R^2 increases substantially. For all days, announcements occur infrequently (i.e. roughly once every 20 trading days for a monthly announcement) and hence have a low adjusted R^2. For announcement days only, the adjusted R^2 estimates increase to values as high as 27% for the effect of the nonfarm payrolls release on the 2-year future. For higher-frequency data as in Balduzzi, Elton and Green (2001) the typical R^2 is higher, of course, since the window to measure the response is much shorter around the actual announcement (the nonfarm payrolls R^2 is 68% for the 2-year, for example). The results in Tables 3 and 4 show that the response of Treasury bond futures returns to macroeconomic news is not confined to very short windows around the announcement time only, but is still significant at the daily frequency. This finding is consistent with the early evidence in Urich and Wachtel (1984), Smirlock (1986) and Hardouvelis (1988), but in sharp contrast with the findings of Almeida, Goodhart and Payne (1998) for the foreign exchange market, where the impact of economic news is only significant until approximately two hours after the release.

3.2. Asymmetric responses across the yield curve

The previous section shows that the responses of Treasury bond futures returns to macroeconomic surprises is stronger for longer maturities. This corroborates the findings of Balduzzi, Elton and Green (2001). It is also what should be expected given the higher duration of longer-term bonds. An interesting follow-on question that has not been answered before, however, is whether differences in duration fully explain the different responses along the maturity spectrum. In other words, is the stronger response of longer-term bonds proportional to the higher duration?

To examine this question, movements due to differences in duration should be separated from movements due to changes in the shape of the yield curve. To this end, two common duration-neutral Treasury bond future strategies are formed, which are responsive to changes in the shape of the yield curve, but not to parallel shifts. These strategies are (i) a term spread (or steepener) trade – a long position in a future with a short maturity and a short position in a future with a long maturity with offsetting durations; (ii) a butterfly spread trade – long positions in futures with a short and a long maturity and an offsetting short position in a future of intermediate maturity in such a way that the aggregate position is duration-neutral (note that the aggregate position can be broken up into two individually duration-neutral term-spread positions). The 2-year future is used as the short-maturity instrument, the 5-year future as the intermediate-maturity instrument and the 10-year future as the long-maturity instrument. The term spread position benefits when the short-end of the yield curve decreases more than the long-end. The butterfly spread position profits when the shape of the yield curve gets more 'concave', i.e. when long- and short yields decreases more than intermediate yields.

It is not trivial to calculate the duration of Treasury bond futures, as there is a range of deliverable notes or bonds and the cheapest-to-deliver instrument (and hence the duration) may change over time. Since data on the range of deliverable bonds and notes is not available historically, the empirical duration is calculated by regressing daily futures returns on changes in equally weighted zero-coupon yields of maturities: 3M, 6M, 12M, 24M, …, 120M, 180M, 240M and 360M.[4] A rolling window of 120 days is used. The definition of duration thus reflects the responsiveness of the futures contracts to shifts in the average of a wide array of zero-coupon yields.

To give an illustration, the empirical durations over the full-sample period are 1.871, 4.398 and 6.813 for the 2-, 5- and 10-year future, respectively. Based on these durations, the term-spread position would consist of a short position in the 10-year future of one lot and a long position of 3.64 lots in the

[4] To circumvent changes in a futures' duration because the cheapest-to-deliver changes, one could calculate the futures duration by weighting the durations of the deliverable bonds by the probabilities that they will be the cheapest-to-deliver instrument at maturity with the use of an interest rate model. However, information on the range of deliverable bonds is not available historically.

2-year future. The butterfly-spread position would consist of a long position of one lot in the 2-year future and the 10-year future and a short position of 1.97 lots in the 5-year future.[5] If the yield curve would shift in a parallel fashion, both strategies should be unaffected because of their duration neutrality. The extent to which the empirical hedging strategy achieves out-of-sample neutrality with respect to changes in the zero-coupon term structure is ultimately an empirical question. A regression of term- and butterfly spread returns on a constant and changes in the equally-weighted zero-coupon yields reveals that strategy returns are indeed duration neutral, as parameter estimates are not significantly different from zero. This shows that the empirical procedure is effective in estimating (and hedging) duration risks.

To see how the slope and curvature of the yield curve are affected by macroeconomic news, Table 5 shows the estimation results of equation (1) of the strategy returns on macroeconomic news surprises on announcement days.

[Insert Table 5 about here]

The curvature of the yield curve is significantly affected by nonfarm payrolls, PPI, new home sales and wholesale inventories announcements. Coefficients are relatively small, however, and PPI and wholesale inventories are significant at the 10% level only. In contrast, nine announcements have a significant impact on the slope of the yield curve. These are initial jobless claims, ISM manufacturing, nonfarm payrolls, the unemployment rate, PPI, retail sales, Philadelphia Fed, personal consumption and construction spending. Table 4 shows that the effect of macroeconomic announcements is larger for longer maturities. However, correcting for differences in duration, as Table 5 does, the short end of the yield curve is more affected by these announcements than the long end. This suggests that macroeconomic announcements affect the slope of the yield curve. Interestingly, the coefficient for all but PPI have the same sign as the original estimates from Table 4. Since most of the variables have negative coefficients, this implies that better than expected macroeconomic conditions tend to flatten the yield curve. This is consistent with a "Federal Reserve reaction function" interpretation: given that the Fed has a preference for low inflation, they raise the short-term interest rate to slow the economy down when economic figures come in better than expected. This flattens the yield curve. The results for the butterfly spread are much less pronounced, indicating that macroeconomic announcements leave the curvature of the yield curve largely unchanged. Prior literature shows that three factors are sufficient to describe yield curve dynamics. The evidence in this paper shows that only the first two factors, the level and slope of the yield curve, are significantly affected by macroeconomic

[5] Since futures only require a fraction of the futures price as margin, these strategies are cash efficient and do not assume significant additional cash positions or the assumption that prices are the same of all instruments.

announcements. This reinforces the importance of macroeconomic information, and surprises more specifically, in modeling the term-structure of interest rates.

In closing this paragraph, it is perhaps interesting to note that the results described here can also be interpreted in two other ways. First, the strategies can be seen as ways to express a duration-neutral view about upcoming macroeconomic releases. For example, a portfolio manager might want to set up a flattener term spread trade if he expects the nonfarm payrolls release (for example) to be substantially higher than consensus, without running duration risk. The second interpretation that the results can be given is in the context of risk management of these popular fixed income trading strategies. If a portfolio manager, for example, has put on a duration neutral butterfly spread, what will happen to this strategy if the new home sales release is one standard deviation stronger than expected by consensus?

4. Asymmetric responses

The previous section documents a strong link between macroeconomic surprises and Treasury bond futures returns. It furthermore shows that there is an asymmetric response to news across different points at the yield curve. Correcting for differences in duration, the short-end of the yield curve is more responsive that the long-end of the yield curve. Apart from asymmetry across the yield curve, several theoretical studies show that the response of asset prices to news may be asymmetric and dependent on economic conditions and news content. The intuition is as follows. If bad news arrives during good economic states, it depresses the present value of anticipated cash flows. It also increases state risk, which has an additional negative effect on the price of the asset. The arrival of bad news during good times increases the price of the asset, but also the state risk. Therefore, the response to news may be asymmetric. Blanchard (1981) and Veronesi (1999) develop models within a rational expectations equilibrium framework and show that asset prices react differently to news depending on the state-of-the-economy. Related to these theoretical predictions, Andersen, Bollerslev, Diebold and Vega (2003) document that the dispersion in forecasts is higher following bad news in the FX market. For fixed income, the issue of asymmetric responses to news has not received much attention in prior literature. Taking a behavioral perspective, the model of Barberis, Shleifer and Vishny (1998) predicts that bad news has a bigger impact on asset prices than good news. Empirically, Boyd, Hu and Jagannathan (2005) and McQueen and Roley (1993) show that the response to news indeed significantly depends on the state of the economy for equities. For exchange rates, Ehrmann and Fratzscher (2005b) document that the effect of news is stronger for negative news and large unexpected shocks.

The next two paragraphs examine two central predictions from the literature on asymmetries: the response to macroeconomic news during different states of the macroeconomy and news content (Section 4.1) and the impact of announcements when uncertainty among market participants is high (Section 4.2). Section 4.3 analyzes whether the response to macroeconomic news is stronger when surprises are bigger. Since conclusions are very similar for 2-, 5-, 10-, and 30-year Treasury bond futures, the results for the 10-year instrument are reported, since this instrument is representative for the results of all maturities.

4.1. Asymmetric responses across news content and the business cycle stage

Before testing whether the bond market exhibits an asymmetric reaction across news content and business cycle stage, the business cycle stage should be specified. It is important to use real-time information, i.e. the information available to market participants when making decisions, as Christoffersen, Ghysels and Swanson (2002), Croushore and Stark (2001), and Ehrmann and Fratzscher (2005b) show. The monthly real-time dataset for industrial production from the Federal Reserve Bank of Philadelphia is used. This dataset contains monthly industrial production figures that were available to a forecaster at each vintage date. Subsequent revisions of the data, which are largely unpredictable for forecasters (see Croushore and Stark, 2001) are included in the vintages when they become available. For each vintage, the log of industrial production is regressed on a constant and a time-trend. This is comparable to the approach of McQueen and Roley (1993) for equities, but the data in this paper is initial and unrevised, rather than final and revised. The sample period is rolling and includes the last 10 year. If the last known value for industrial production is above trend, the macroeconomic state is “good” and as “bad” otherwise. This procedure classifies the period 1996:1 – 2000:11 as good (above average trend growth) with the exception of 1999:10, the period 2000:12 – 2005:12 as bad and 2006:1 – 2006:12 as good again. The below-trend-growth period includes the recession of 2001, the only recession in the sample period. Note that the economic state is inferred ex-ante, i.e. with real-time data available prior to the announcement. This contrasts the traditional NBER recession dummies, which are determined ex-post. Since this paper uses macroeconomic surprises, which are by definition unpredictable, the sign of the surprise is independent of the state of the macroeconomy (i.e. the number of good (bad) news announcements is roughly the same during bad (good) times).

To allow variation in the response to news depending on the business cycle and news content, the models is extended as follows:

$$\Delta(\ln P_t) = \alpha + \sum_{k=1}^{K} \gamma_k \Delta(\ln P_{t-k}) + \delta_{Mon} D_{Mon,t} + \delta_{Wed} D_{Wed,t} + \delta_{Fri} D_{Fri,t} + \beta_i^{++} I_{news,t}^{+} I_{econ,t}^{+} Surpr_{i,t} + \beta_i^{+-} I_{news,t}^{+} I_{econ,t}^{-} Surpr_{i,t} + \beta_i^{-+} I_{news,t}^{-} I_{econ,t}^{+} Surpr_{i,t} + \beta_i^{--} I_{news,t}^{-} I_{econ,t}^{-} Surpr_{i,t} + \varepsilon_t , \quad (4)$$

where indicator function $I_{econ,t}$ measures the business cycle stage and $I_{news,t}$ the news content. More specifically, $I_{econ,t}^{+}$ takes a value of one when the growth of industrial production is above trend and a value of zero otherwise. Similarly, $I_{econ,t}^{-}$ takes a value of one of the economy shrinks (i.e. below-average growth in industrial production) and zero otherwise. The news content indicator function $I_{news,t}^{+}$ ($I_{news,t}^{-}$) takes a value of one for announcements that are expected to lead to positive (negative) returns for bond futures returns based on the evidence in Table 3 and zero otherwise. Good news should thus be interpreted in the context of the bond market. I.e., lower than expected nonfarm payrolls or ISM releases, for example, are good news for the bond market (since the coefficient is negative in Table 3). The coefficients $\beta_i^{\bullet\bullet}$ measure the impact of announcements for the combinations of news content (first indicator) and business cycle stage (second indicator). For example, β_i^{+-} measures the impact of good news during bad times. Note that the model reduces to the original specification if all β-coefficients are equal, i.e. $\beta_i^{++} = \beta_i^{+-} = \beta_i^{-+} = \beta_i^{--}$.

This generalization of the framework allows for straightforward testing of three asymmetry-hypotheses: $H_0 : \beta_i^{++} = \beta_i^{+-} = \beta_i^{-+} = \beta_i^{--}$ (equality across news content and business cycle stage), $H_0 : \beta_i^{++} + \beta_i^{-+} = \beta_i^{+-} + \beta_i^{--}$ (equality across business cycle stage), and $H_0 : \beta_i^{++} + \beta_i^{+-} = \beta_i^{-+} + \beta_i^{--}$ (equality across news content). Each hypothesis is conducted with a Wald F-test.

Asymmetry across business cycle and news content jointly can be the result of the reaction of monetary authorities to good and bad news during the different stages of the business cycle. The Fed may, for example, pursue more aggressive monetary policy measures if unexpectedly stronger economic activity is announced during expansions than during recessions. But even the response to the same news may be different across different stages of the business cycle. As an illustration, consider the announcement of the nonfarm payrolls figure in March 2002 which was 66,000. The announcement in September 1997 was comparable with 80,000. But the former announcement was after 11 monthly negative announcements during the 2001 recession, whereas the latter followed eight previous announcements with an average of 233,000. The reaction of the bond market to the former may be statistically different from the response to the latter. The reaction of asset prices may also vary with the news content, irrespective of the business cycle stage. Previous empirical studies show that negative surprises have a stronger impact on stock prices and exchange rates than positive surprises (see for example Andersen, Bollerslev, Diebold and Vega, 2003; Boyd, Hu and Jagannathan, 2005; and Ehrmann and Fratzscher, 2005b).

Table 6 shows the parameter estimates for the news content and business cycle stage combinations and the three Wald-tests. Estimates of the lagged return and day-of-the-week dummies are omitted.

[Insert Table 6 about here]

The results in Table 6 reveal strong differences across economic states and news content combinations. Bad news for bond returns announced during good times elicits the most significant response (12 significant coefficients). The least significant reaction occurs when good news for bond returns is announcement in bad times (six significant coefficients). The differences in responsiveness across economic states and news content are strong enough to be statistically significant. Equality across of coefficients across news content and business cycle stage jointly is rejected for Chicago purchasing managers, ISM manufacturing, the trade balance, the monthly budget statement, Philadelphia Fed, personal income, personal consumption, construction spending and factory orders.

The last two columns in Table 6 test for equality of response coefficients across the business cycle stage or news content, respectively. Interestingly, differences across the business cycle stage or news content separately are not nearly as strong as differences across their combination. Table 6 shows that the response of the bond market to macroeconomic news is on average stronger during economic expansions ($\beta_i^{++} + \beta_i^{-+}$) than during contractions ($\beta_i^{+-} + \beta_i^{--}$). Differences, however, are rarely significant as the column "Business cycle stage" shows. The only exception is the monthly budget statement announcement, which is significant at the 5% level. The final column tests for equality across news content (i.e. whether the response of the bond market is different for good and bad news). Taken separately, the sign of the surprises (i.e. good or bad news) is also not very important. Response coefficients are statistically different for Chicago purchasing managers, ISM manufacturing, personal income, personal consumption and construction spending.

In conclusion, the results in Table 6 point at the importance of modeling the business cycle stage and news content jointly. The business cycle stage and news content individually are less informative than the combination of business cycle stage and news content. To assure that these results are not driven by the particular choice for the business cycle stage, three alternative specifications using real-time economic information are used. As a robustness check, the economic state is based on whether initial

ISM and the initial change in nonfarm payrolls are above their sample averages. In addition, the real-time Chicago Fed National Activity Index based on 85 economic indicators which was inspired by the work of Stock and Watson (1999) is employed.[6] The conclusions are very similar under these alternative definitions, and the results are therefore not reported.

4.2. Asymmetric responses for high and low uncertainty

Veronesi (1999) shows that the sensitivity of asset prices to news is at its maximum when uncertainty among investors is high. Previous literature has only indirectly been able to analyze this question empirically, as most surveys only report aggregate measures like the mean and median of the survey. Two interesting additional data items in the Bloomberg survey data are the minimum and maximum forecast for each macroeconomic series at every date.[7] Rather than relying on general measures of uncertainty (like implied volatilities, as in Fleming and Remolona, 1997) a survey-specific measure of uncertainty can be used:

$$\begin{aligned}\Delta(\ln P_t) = \alpha + \sum_{k=1}^{K}\gamma_k \Delta(\ln P_{t-k}) + \delta_{Mon} D_{Mon,t} + \delta_{Wed} D_{Wed,t} + \delta_{Fri} D_{Fri,t} \\ + \beta_i^{high} I_t^{high} Surpr_{i,t} + \beta_i^{low} I_t^{low} Surpr_{i,t} + \varepsilon_t\end{aligned}, \qquad (5)$$

where indicator function I_t^{high} (I_t^{low}) takes a value of one on announcement days if $\frac{E_i^{\max} - E_i^{\min}}{E_i^{median}}$ is above (below) the 66th (33th) percentile and zero otherwise.[8]

[Insert Table 7 about here]

Table 7 shows that the response to news is often significantly stronger when there is more uncertainty among forecasters. The unemployment rate, PPI ex food and energy, advance retail sales, Philadelphia Fed, durables ex transportation, the Fed funds target rate, personal income and factory orders have statistically different coefficients at the 10% level at least. In general, the results show that more uncertainty leads to a stronger response of the same sign as the unconditional sign from Table 3. Exceptions are Philadelphia Fed and personal income, where less uncertainty leads to stronger negative responses to positive surprises. The empirical results are strong compared to Fleming and Remolona (1997), who find significant results for only three variables out of a total of 25 series. Green

[6] The indicator is available from the website of the Chicago Fed: www.chicagofed.org/economic_research_and_data/cfnai_data_series.cfm

[7] An alternative would be to use information on the cross-sectional standard deviation or inter-quartile range. Unfortunately, these are not available.

[8] The conclusions are robust to changes in the cut-off values (the 75th versus the 25th and the 55th versus the 45th percentile).

(2004) finds only weak evidence for the role of dispersion in beliefs. His focus, however, is on the high frequency response of transaction prices to news using 4 year of tick-data for the 5-year note. In the context of exchange rates, the sample of Andersen, Bollerslev, Diebold and Vega (2003) does not lend itself for an analysis as presented here, because the period under investigation only contains good times. They find support, however, for the related hypothesis in the foreign exchange market that the arrival of bad news in good times leads to higher subsequent cross-sectional dispersion in forecasts.

4.3. Asymmetric responses for small and large surprises

The final analysis in this section concerns the different response as a result of small versus large surprises. If large surprises contain more than proportional new information, the response to large surprises may be disproportionately larger. Ehrmann and Fratzscher (2005b) document the existence of this effect in the US Dollar – Euro / DEM exchange rate. The implementation is comparable to the previous sections, but now the indicator function I_t^{high} takes a value of one if the absolute surprise is above the 75th or below the 25th percentile and zero otherwise. (I_t^{low}) takes a value of one if the absolute surprise is in one of the two middle quartiles of the empirical distribution and zero otherwise. The left panel of Table 8 shows the results.

[Insert Table 8 about here]

At the 10% level at least, the response to large surprises is significant for 13 macroeconomic announcements versus 7 for small surprises. Testing for statistically significant differences, however, only the monthly budget statement, leading indicators, personal income, and construction spending are significant. This shows that there is not much evidence that the bond market responds stronger to larger surprises. The evidence is indeed much less compelling than the evidence for differences across the business cycle and news content jointly and uncertainty among forecasters as documented in the previous sections.

As a robustness check to analyze whether the bond market reacts differently to large surprises, the equation is re-specified as:

$$\begin{aligned}\Delta(\ln P_t) = \alpha + \sum_{k=1}^{K} \gamma_k \Delta(\ln P_{t-k}) + \delta_{Mon} D_{Mon,t} + \delta_{Wed} D_{Wed,t} + \delta_{Fri} D_{Fri,t} \\ + \beta_i Surpr_{i,t} + \beta_i^{extr} I_t^{extr} Surpr_{i,t} + \varepsilon_t\end{aligned}, \qquad (6)$$

where I_t^{extr} is a dummy variable that takes a value of one if an announcement is extreme. Extreme is defined as either higher than the maximum or lower than the minimum of all forecasts in the survey. The other variables are identical to the variables in equation (2). This answers the question whether the response to news is disproportionately larger when the announcement is beyond what any forecaster in the survey expected. For some variables, there are only a handful of announcements that are lower than the minimum of higher than the maximum. Table 8 (right panel) therefore only reports estimation results for variables where there are at least 10 observations.

The right panel of Table 8 shows that there is a significant response to extreme news for the trade balance, capacity utilization and durables ex transportation announcements. The former two announcements are not significant in Table 3, which means that differentiating between normal and extreme observations makes a difference here. Several variables are not statistically significant anymore in comparison to Table 3. This is likely to be caused by the lack of estimation precision, since the number of observations is now split between the two variables. Experimenting with different definitions for large versus small surprises does not change the conclusions.

Summarizing the results from Table 8, the evidence for an asymmetric response to macroeconomic news conditional on the size of the surprise is not very strong. This contrasts the evidence for exchange rates reported by Ehrmann and Fratzscher (2005b), who show that large surprises are significant whereas small surprises are not.

5. Can daily news about fundamentals explain longer-term trends?

The results in Table 3 show that many announcements significantly affect the return of 2-, 5-, 10- and 30-year Treasury bond futures. The variation that each surprises explains is, however, relatively limited when all days in the sample are considered. Macroeconomic figures are only periodically released, typically once a month, and not all days in the sample contain announcements. It is therefore an open question whether all macroeconomic surprises combined can explain general movements in Treasury bond futures returns. Somewhat surprisingly, previous literature has not tried to answer how far daily fundamentals go towards explaining longer-term movements in the government bond futures market.

To answer this question, the following multivariate mean equation is estimated:[9]

[9] The model is estimated with OLS rather than WLS because the mean of the non-weighted residuals is non-zero under WLS. Under OLS, on the other hand, the mean of the residuals is zero by construction which makes fitted and actual cumulative values identical at the end of the sample. This allows for a better visual comparison in Figure 2. WLS results, however, lead to the same general conclusions.

$$\Delta(\ln P_t) = \alpha + \sum_{k=1}^{K} \gamma_k \Delta(\ln P_{t-k}) + \delta_{Mon} D_{Mon,t} + \delta_{Wed} D_{Wed,t} + \delta_{Fri} D_{Fri,t} + \sum_{i=1}^{I} \beta_i Surpr_{i,t} + \varepsilon_t, \quad (7)$$

where all variables are defined in Section 1. Based on the parameter estimates from the multivariate model and values for the explanatory variables, fitted continuously compounded returns are computed, $\Delta(\ln P_t) - \hat{\varepsilon}_t$. These returns are subsequently converted to cumulative futures prices, scaled to 100 on 12/31/1995.

Rather than providing the estimation results, which are very comparable to the univariate estimates reported in Table 3, fitted values and actual bond futures indexes are shown in Figure 2.

[Insert Figure 2 about here]

Macroeconomic surprises track the developments in the futures price indexes quite well, especially for the long-term bond futures. Up to the recession year 2001, the fit is close for all maturities. The sample includes the strong bond market performance over the period that begins in 1997 and ends in second half of 1998, the subsequent decline until the end of 1999, the rally to the end of 2000 when the economy slowed significantly and the decline to the end of 2001. However, the general up-market that runs from the end of 2001 to the beginning of 2003 and the downturn to the end of 2005 are not captured very well by the macroeconomic-surprises model. The upswing that starts in 2006 is captured again by the model. The R^2s of the daily models (not reported) are 12% (2y), 10% (5y), 9% (10y), and 8% (30y).

An interesting observation from Figure 2 is that although the explanatory power is relatively low, the model seems to fit longer-term directional changes. To test this observation formally, monthly directional changes are analyzed. Each month is classified as up or down depending on whether the return was positive or negative that month. Similarly, the model in equation (7) is used to determine whether the fitted part of the model is up or down for a particular month. Note that the monthly fitted series is derived from daily macroeconomic surprises. This procedure mitigates the issues with directly regressing monthly futures returns on macroeconomic data. The link between actual and fitted monthly directional changes is analyzed by calculating the percentage of correctly predicted directional moves. The Henriksson and Merton (1981) non-parametric market timing test is used examine statistical significance. The test statistic is asymptotically standard normally distributed under the null and is given by:

$$HM = \frac{n_1 - \frac{nN_1}{N}}{\sqrt{\frac{nN_1(N-n)N_1}{N^2(N-1)}}}, \tag{8}$$

where n_1 is the number of correctly fitted down-markets, n is the number of fitted down-markets, N_1 is the actual number of down-markets and N is the total number of periods.

Table 9 shows the accuracy of the models in explaining monthly directional changes.

[Insert Table 9 about here]

The models explain between 64% and 70% of monthly directional changes and are significant at the 1% level for all maturities. In general, the daily macroeconomic models are better at explaining up-markets than down-markets, as differences in correctly explained directions differ as much as 11% (for the 30-year future). The table shows that models estimated with daily macroeconomic surprise data are able to explain general longer-term trends in the government bond futures market, even though the explanatory power for daily changes is relatively low. This highlights the importance of macroeconomic information for the Treasury bond futures market.

6. Summary and conclusions

This paper uses an extensive set of macroeconomic expectations and announcements to analyze how Treasury bond futures returns are affected by macroeconomic surprises (i.e. differences between announced values and median survey expectations). The data come from Bloomberg, which is the standard source for financial market practitioners, but has not been used much in the academic literature. The most important conclusions from this paper are as follows.

First, macroeconomic news matters for bond futures returns. Reponses are economically large and statistically significant for many variables. The most market-moving releases are the nonfarm payrolls and ISM manufacturing announcements. The impact of news increases with time to maturity of the instruments. However, using popular duration-neutral bond futures trading strategies, there is a significant asymmetry in how different maturities react to news. Most announcements affect the short end of the yield curve more than the long end. Consistent with the 'reaction function of the Fed' interpretation, good news for the economy flattens the yield curve, on average. The impact on the curvature of the yield curve is much weaker.

Second, there is strong empirical support for asymmetries in the response of the bond market to news depending on the business cycle stage and news content and on whether uncertainty among investors is high. First, the bond market's reaction to news is strongest when bad news for bond returns is announced during good times. Second, the response to news is significantly stronger when there is much uncertainty among forecasters in the survey. These results show the importance of taking the content of news and the state of the business cycle jointly into account when modeling government bond futures returns.

Third, macroeconomic surprises explain the general movements of the bond market well. Information extracted from daily fundamentals explains around 70% of monthly directional changes in bond futures, which is significant at the 1% level for all maturities.

Taken together, the evidence in this paper points at an important role for asymmetries in the response of government bond futures to news. In addition, macroeconomic fundamentals exert a significant impact on the bond market beyond the high-frequency domain.

Appendix A. Unbiasedness and efficiency of the expectations data

Aggarwal, Mohanty and Song (1995), and more recently Ehrmann and Fratzscher (2005a) test the unbiasedness and efficiency of MMS survey data. Since this is the first paper to use survey data from Bloomberg, similar tests are conducted. First, the unbiasedness of the data is tested with the regression:

$$A_{i,t} = \alpha + \beta E_{i,t} + \varepsilon_{i,t}\ , \qquad (8)$$

where variable definitions are the same as in the main text. Unbiasedness corresponds to the joint hypothesis $H_0 : \alpha = 0\, and\, \beta = 1$, which is tested by a Wald test. Table 10 shows parameter estimates, the R^2 of the regression, the F-value of the Wald test and the associated p-value for each variable.

[Insert Table 10 about here]

At the 5%-level of significance, the unemployment rate, advance retail sales, CPI ex food and energy, industrial production, leading indicators and personal consumption do not pass the test for unbiasedness. For advance retail sales, this is caused by a single observation where the median expectation is much higher than the subsequent (also high) realization. Advance retail sales passes the test once this observation is removed. The same holds for industrial production and personal consumption when two observations where expectations were clearly different from realizations are removed. The results of the unbiasedness test are, at least, as good as the results for MMS reported in Ehrmann and Fratzscher (2005a), where 4 out of 7 series do not pass the test at the 5%-level. Interestingly, among these series are also CPI, industrial production and retail sales. In general, there is no evidence that the Bloomberg expectations data are biased.

If the expectations from the survey are efficient, there should be no information in past announcements that predicts subsequent surprises. This can be examined by the regression:

$$A_{i,t} - E_{i,t} = \alpha + \sum_{k=1}^{K} \beta_k A_{i,t-k} + \varepsilon_{i,t}\ , \qquad (9)$$

where the efficiency hypothesis implies $H_0 : \beta_1 = \beta_2 = ... = \beta_K = 0$, which is tested by a Wald test. The test is implemented with $k = 6$. Table 11 reports the results.

[Insert Table 11 about here]

Table 11 shows that null hypothesis is rejected for initial jobless claims, ISM non-manufacturing, PPI ex food & energy, advance retail sales, and factory orders at the 5%-level of significance. Overall, the results in Table 10 and 11 indicate that the Bloomberg survey data are of good quality, as they are largely unbiased and efficient.

Expectations might be more accurate when there are more forecasters contributing to the survey. In addition the results in Table 10 and 11, this prediction is tested by regressing absolute differences between announced values and median expectations on the number of forecasters in the survey for each variable. Additionally, the link between the number of forecasters and accuracy in terms of Mean Absolute Errors and standardized Root Mean Squared Errors is examined. It turns out that median forecasts are not more accurate when there are more contributing forecasters. Nor are median forecasts more accurate for variables with more contributing forecasters. This alleviates potential concerns about the quality of the data at the start of the sample when less forecasters are contributing. Full results are available upon request.

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Table 1
Summary statistics Treasury bond futures returns

	2-year		5-year		10-year		30-year	
Mean	0.0002		0.0011		0.0014		0.0030	
St. Dev.	0.122		0.268		0.406		0.628	
Skewness	-0.977		-0.788		-0.683		-0.490	
Kurtosis	10.749		7.738		6.420		5.021	
Jarque-Bera	7347.661	***	2862.844	***	1555.804	***	579.358	***
LB Q(5)	13.617	**	12.605	**	8.804		3.604	
LB $Q^2(5)$	32.710	***	51.737	***	45.706	***	52.868	***

The table shows the mean, standard deviation, skewness, kurtosis, Jarque-Bera test for non-normality, and Ljung-Box Q-statistic for serial correlation in returns (LB Q) and squared returns (LB Q^2) up to the fifth lag. Returns are continuously compounded for 2-, 5-, 10-, and 30-year Treasury bond futures and are expressed in percentage terms. The sample period is 1/1/1996 – 12/29/2006.
** significant at the 5% level.
*** significant at the 1% level.

Table 2

Summary Statistics Macroeconomic Expectations

	First obs	Last obs	# of obs	# of forec.
Real activity				
Advance retail sales	06/13/2001	12/13/2006	67	67
Industrial production	11/15/1996	12/15/2006	121	61
Capacity utilization	01/17/1997	12/15/2006	120	54
Personal income	10/31/1996	12/22/2006	122	53
Employment				
Change in nonfarm payrolls	01/10/1997	12/08/2006	120	52
Initial jobless claims	06/04/1998	12/28/2006	448	30
Unemployment rate	12/06/1996	12/08/2006	121	60
Average weekly hours	10/02/1998	12/08/2006	94	29
Consumption				
Personal consumption	02/03/1997	12/22/2006	120	54
New home sales	10/30/1996	12/27/2006	123	52
Investment				
Durables ex transportation	12/28/2001	12/22/2006	61	20
Construction spending (MoM)	08/01/2003	12/01/2006	41	46
Factory orders	11/01/1996	12/05/2006	122	54
Wholesale inventories	11/08/1996	12/11/2006	122	27
Prices				
PPI ex food & energy (MoM)	12/11/1996	12/19/2006	121	58
CPI ex food and energy (MoM)	01/14/1997	12/15/2006	119	59
Employment cost index	01/28/1997	10/31/2006	40	54
Forward-looking				
Consumer confidence	02/25/1997	12/28/2006	119	52
ISM manufacturing	11/01/1996	12/01/2006	122	55
ISM non-manufacturing	01/06/1999	12/05/2006	95	42
Chicago purchasing managers	11/27/1996	12/28/2006	119	45
Housing starts	03/17/1998	12/19/2006	106	57
Leading indicators	12/30/1996	12/21/2006	119	45
Philadelphia fed	12/19/1996	12/21/2006	120	42
FOMC				
Fed Funds target rate	12/22/1998	12/12/2006	64	79
Net exports				
Trade balance	12/19/1996	12/12/2006	121	55
Government budget				
Monthly budget statement	11/22/1996	12/12/2006	122	31

The table shows the variable name, dates of the first and last observation in the sample (MM/DD/YYYY), number of observations and the median number of forecasters.

Table 3
Effects of Announcement Surprises: All Days

	2-year future			5-year future			10-year future			30-year future		
	β_i		$\overline{R}^2$	β_i		$\overline{R}^2$	β_i		$\overline{R}^2$	β_i		$\overline{R}^2$
Real activity												
Advance retail sales	-0.05	***	0.012	-0.11	***	0.011	-0.14	**	0.004	-0.18	**	0.003
Industrial production	-0.02		0.007	-0.04		0.005	-0.04		0.003	-0.04		0.001
Capacity utilization	-0.02	**	0.007	-0.05	*	0.005	-0.06		0.003	-0.07		0.002
Personal income	-0.03	*	0.009	-0.03		0.004	-0.07		0.002	-0.11		0.001
Employment												
Change in nonfarm payrolls	-0.09	***	0.012	-0.15	*	0.007	-0.25	**	0.004	-0.34	**	0.003
Initial jobless claims	0.02	***	0.010	0.05	**	0.005	0.07	**	0.005	0.09	**	0.003
Unemployment rate	0.02		0.007	0.00		0.005	0.01		0.002	-0.02		0.001
Average weekly hours	-0.03		0.008	-0.05		0.004	-0.08		0.002	-0.12		0.001
Consumption												
Personal consumption	-0.03		0.007	-0.09		0.006	-0.12	***	0.005	-0.12	**	0.004
New home sales	-0.02	*	0.009	-0.02		0.003	-0.06		0.003	-0.09		0.002
Investment												
Durables ex transportation	-0.04	**	0.009	-0.07	***	0.006	-0.10	**	0.004	-0.12	*	0.002
Construction spending (MoM)	-0.08		0.007	-0.05		0.003	-0.04		0.002	-0.02		0.001
Factory orders	0.00		0.007	0.00		0.003	-0.03		0.003	-0.06		0.001
Wholesale inventories	-0.01	*	0.009	-0.06	***	0.006	-0.08	**	0.004	-0.12	**	0.003
Prices												
PPI ex food & energy (MoM)	-0.02		0.008	-0.04		0.004	-0.04		0.003	-0.09	**	0.002
CPI ex food and energy (MoM)	-0.03	***	0.011	-0.05		0.004	-0.09		0.003	-0.16	**	0.003
Employment cost index	-0.04		0.008	-0.12	*	0.005	-0.19	***	0.008	-0.30	***	0.006
Forward-looking												
Consumer confidence	-0.04	**	0.009	-0.08	**	0.005	-0.11	***	0.005	-0.12		0.002
ISM manufacturing	-0.08	**	0.008	-0.17	***	0.008	-0.19	**	0.003	-0.30	**	0.002

ISM non-manufacturing	-0.03	**	0.010	-0.09	**	0.006	-0.14	***	0.005	-0.24	***	0.005
Chicago purchasing managers	-0.04	***	0.018	-0.11	***	0.010	-0.17	***	0.018	-0.25	***	0.011
Housing starts	0.02		0.008	0.03		0.004	0.07		0.003	0.09		0.002
Leading indicators	0.02		0.008	0.01		0.004	-0.02		0.002	-0.09	***	0.004
Philadelphia fed	-0.04	***	0.011	-0.10	***	0.021	-0.12	***	0.008	-0.16	***	0.005
FOMC												
Fed Funds target rate	-0.10	*	0.009	-0.07		0.004	-0.04	***	0.033	-0.10	***	0.011
Net exports												
Trade balance	0.00		0.008	-0.01		0.005	-0.02		0.003	-0.04		0.001
Government budget												
Monthly budget statement	0.02	***	0.008	0.03	***	0.006	0.05	**	0.004	0.08	*	0.002

The table reports the response of 2-, 5-, 10-, and 30-year Treasury bond futures returns to macroeconomic surprises for all days in the sample days over the period 1996 – 2006 as well as the adjusted R-squared from the regression. The response equation is estimated by two-stage least squares as described in the text.
* significant at the 10% level.
** significant at the 5% level.
*** significant at the 1% level.

Table 4
Effects of Announcement Surprises: Announcement Days

	2-year future			5-year future			10-year future			30-year future		
	β_i		$\overline{R}^2$	β_i		$\overline{R}^2$	β_i		$\overline{R}^2$	β_i		$\overline{R}^2$
Real activity												
Advance retail sales	-0.05	***	0.148	-0.10	***	0.083	-0.13	***	0.060	-0.15	***	0.033
Industrial production	-0.02	**	0.024	-0.04	**	0.014	-0.05	*	0.011	-0.07	*	0.008
Capacity utilization	-0.03	***	0.059	-0.06	***	0.047	-0.09	***	0.044	-0.12	**	0.037
Personal income	-0.01		-0.006	-0.01		-0.008	-0.02		-0.006	-0.03		-0.006
Employment												
Change in nonfarm payrolls	-0.09	***	0.272	-0.20	***	0.234	-0.27	***	0.207	-0.35	***	0.161
Initial jobless claims	0.03	***	0.052	0.06	***	0.043	0.08	***	0.037	0.10	***	0.023
Unemployment rate	0.03	**	0.020	0.04		0.004	0.05		-0.002	0.04		-0.006
Average weekly hours	-0.03		0.011	-0.05		0.002	-0.05		-0.003	-0.09		0.001
Consumption												
Personal consumption	-0.04	**	0.040	-0.06	**	0.028	-0.07	**	0.021	-0.10	***	0.017
New home sales	-0.01	*	0.008	-0.04	*	0.011	-0.07	**	0.022	-0.11	**	0.029
Investment												
Durables ex transportation	-0.04	**	0.062	-0.08	**	0.058	-0.10	**	0.052	-0.15	*	0.047
Construction spending (MoM)	-0.06		0.033	-0.07		0.003	-0.07		-0.009	-0.07		-0.010
Factory orders	-0.01		-0.005	-0.01		-0.006	-0.03		-0.003	-0.04		-0.004
Wholesale inventories	-0.01		0.010	-0.04	**	0.019	-0.07	*	0.021	-0.11	*	0.022
Prices												
PPI ex food & energy (MoM)	-0.01		-0.002	-0.03	*	0.004	-0.06	**	0.012	-0.11	***	0.029
CPI ex food and energy (MoM)	-0.03	***	0.048	-0.07	***	0.055	-0.10	***	0.049	-0.17	***	0.056
Employment cost index	-0.05	**	0.105	-0.11	**	0.144	-0.17	***	0.118	-0.25	***	0.101
Forward-looking												
Consumer confidence	-0.03	**	0.054	-0.06	**	0.057	-0.10	**	0.061	-0.13	**	0.036
ISM manufacturing	-0.11	***	0.183	-0.21	***	0.182	-0.29	***	0.202	-0.42	***	0.267

ISM non-manufacturing	-0.04	***	0.084	-0.10	***	0.108	-0.15	***	0.108	-0.24	***	0.128
Chicago purchasing managers	-0.05	***	0.190	-0.11	***	0.175	-0.16	***	0.155	-0.24	***	0.121
Housing starts	0.01		-0.001	0.03		0.001	0.04		0.003	0.07		0.005
Leading indicators	0.00		-0.008	-0.01		-0.007	-0.02		-0.005	-0.07	*	0.008
Philadelphia fed	-0.04	***	0.138	-0.09	***	0.123	-0.12	***	0.104	-0.15	***	0.061
FOMC												
Fed Funds target rate	-0.02		0.010	-0.04	*	0.007	-0.05	***	0.005	-0.10	***	0.018
Net exports												
Trade balance	0.00		-0.008	-0.02		-0.003	-0.03		0.000	-0.05		0.001
Government budget												
Monthly budget statement	0.01	***	0.011	0.03	**	0.005	0.04	**	0.005	0.06	*	0.002

The table reports the response of 2-, 5-, 10-, and 30-year Treasury bond futures returns to macroeconomic surprises on announcement days during the period 1996 – 2006 as well as the adjusted R-squared from the regression. The response equation is estimated by OLS with heteroskedasticy and autocorrelation consistent standard errors.
* significant at the 10% level.
** significant at the 5% level.
*** significant at the 1% level.

Table 5
Effects of Announcement Surprises on Duration Neutral Trading Strategies

	Term spread			Butterfly spread		
	β_i		$\bar{R}^2$	β_i		$\bar{R}^2$
Real activity						
Advance retail sales	-0.03	***	0.017	0.01		0.000
Industrial production	-0.03		0.010	0.00		-0.007
Capacity utilization	-0.02		0.003	0.00		-0.008
Personal income	-0.01		-0.008	-0.01		-0.006
Employment						
Change in nonfarm payrolls	-0.08	***	0.126	0.02	**	0.025
Initial jobless claims	0.01	*	0.003	0.00		-0.002
Unemployment rate	0.05	**	0.045	-0.01		0.011
Average weekly hours	-0.05		0.024	0.01		0.012
Consumption						
Personal consumption	-0.04	*	0.019	0.00		-0.008
New home sales	0.00		-0.007	-0.01	**	0.020
Investment						
Durables ex transportation	-0.02		0.004	0.01		-0.005
Construction spending (MoM)	-0.14	**	0.066	0.01		-0.022
Factory orders	0.01		-0.004	-0.01		0.010
Wholesale inventories	0.02		-0.002	0.01	*	0.011
Prices						
PPI ex food & energy (MoM)	0.02	*	0.017	-0.01	*	0.004
CPI ex food and energy (MoM)	0.00		-0.008	0.00		-0.008
Employment cost index	-0.03		0.001	0.02		-0.001
Forward-looking						
Consumer confidence	0.01		-0.006	0.00		-0.008
ISM manufacturing	-0.11	***	0.066	0.01		-0.006
ISM non-manufacturing	0.02		-0.001	0.01		-0.001
Chicago purchasing managers	-0.02		0.005	0.00		-0.007
Housing starts	-0.01		-0.005	0.00		-0.006
Leading indicators	0.02		0.004	-0.01		-0.006
Philadelphia fed	-0.03	*	0.021	0.01		0.008
FOMC						
Fed Funds target rate	-0.02		-0.008	0.00		-0.014
Net exports						
Trade balance	0.02		0.004	-0.01		-0.004
Government budget						
Monthly budget statement	0.00		-0.007	0.00		-0.008

The table reports the response of two common bond trading strategies to macroeconomic surprises on announcement days during the period 1996 – 2006 as well as the adjusted R-squared from the regression. The response equation is estimated by OLS with heteroskedasticy and autocorrelation consistent standard errors.
* significant at the 10% level.
** significant at the 5% level.
*** significant at the 1% level.

Table 6
Asymmetric Responses: Good (Bad) News in Bad (Good) Times

	β_i^{++}		β_i^{+-}		β_i^{-+}		β_i^{--}		News content & business cycle stage		Business cycle stage	News content	
Real activity													
Advance retail sales	-0.22		0.02		-0.30		-0.16	***	0.47		0.76	0.33	
Industrial production	-0.08		-0.06		-0.03		-0.03		0.08		0.01	0.15	
Capacity utilization	-0.14	*	-0.11		0.02		-0.04		0.73		0.01	1.43	
Personal income	0.00		0.39		-0.19	**	-0.33	**	2.33	*	0.42	5.51	**
Employment													
Change in nonfarm payrolls	-0.16	***	-0.20		-0.17		-0.60		0.39		0.76	0.58	
Initial jobless claims	0.06		0.05		0.06	*	0.13	**	0.63		0.45	0.48	
Unemployment rate	0.18	*	-0.41		0.10		-0.04		0.66		1.40	0.21	
Average weekly hours	-0.10		-0.11		0.10		-0.15		0.07		0.19	0.06	
Consumption													
Personal consumption	0.16	***	0.05		-0.19	***	-0.40	*	8.89	***	1.88	11.60	***
New home sales	-0.20	*	-0.03		-0.08		0.01		0.79		1.14	0.47	
Investment													
Durables ex transportation	-0.08		-0.10		-0.18	***	-0.14		0.47		0.02	0.35	
Construction spending (MoM)	0.06		0.32	**	-0.13	**	-1.02		4.54	***	0.87	5.11	**
Factory orders	0.05	**	-0.03		-0.15	***	-0.03		3.97	***	0.03	0.88	
Wholesale inventories	-0.12		-0.09		-0.10	*	-0.01		0.47		0.32	0.23	
Prices													
PPI ex food & energy (MoM)	-0.09		-0.05		-0.01		-0.14		0.24		0.07	0.00	
CPI ex food and energy (MoM)	-0.20		-0.09		-0.13		0.02		0.72		1.05	0.57	
Employment cost index	-0.30		-0.11		0.10		-0.08	*	0.15		0.00	0.40	
Forward-looking													

Consumer confidence	-0.16		-0.13		-0.11	*	-0.03		0.22		0.23		0.42	
ISM manufacturing	-0.05		0.50	**	-0.40	***	-0.79	***	10.20	***	0.26		25.70	***
ISM non-manufacturing	-0.24		-0.16		-0.11	**	-0.06		0.33		0.31		0.95	
Chicago purchasing managers	-0.22	***	-0.40	***	-0.03		-0.09		2.90	**	1.86		8.06	***
Housing starts	0.06		0.08		-0.15		0.00		0.46		0.22		0.60	
Leading indicators	0.05		0.00		-0.01		0.02		0.05		0.02		0.05	
Philadelphia fed	-0.18	***	-0.03		0.05		-0.29	***	15.70	***	1.49		0.05	
FOMC														
Fed Funds target rate	-0.03	***	-0.04	***	-0.10	**	-0.15		1.60		0.13		1.29	
Net exports														
Trade balance	0.05	*	-0.08	***	0.01		-0.03		4.52	***	1.68		0.00	
Government budget														
Monthly budget statement	0.04		0.06	***	0.48	***	-0.09		3.89	***	4.31	**	1.23	

The table reports the response of 10-year Treasury bond futures returns to macroeconomic surprises for all days in the sample when good news is announced in good times (β_i^{++}), good news in bad times (β_i^{+-}), bad news in good times (β_i^{-+}) and bad news in bad times (β_i^{--}). Whether the announcement can be considered good or bad news is based on the evidence in table 3 and the business cycle stage is determined by real-time industrial production relative to trend growth. The column "news content & business cycle stage" shows the Wald F-statistic for the hypothesis $H_0 : \beta_i^{++} = \beta_i^{+-} = \beta_i^{-+} = \beta_i^{--}$. Similarly, the column "business cycle stage" shows the Wald F-statistic for the hypothesis: $H_0 : \beta_i^{++} + \beta_i^{-+} = \beta_i^{+-} + \beta_i^{--}$ and "news content" for: $H_0 : \beta_i^{++} + \beta_i^{+-} = \beta_i^{-+} + \beta_i^{--}$.

* significant at the 10% level.
** significant at the 5% level.
*** significant at the 1% level.

Table 7
Asymmetric Responses: Uncertainty

	High vs. Low Uncertainty					
	β_i^{high}		β_i^{low}		F-stat	
Real activity						
Advance retail sales	-0.16	***	0.20	*	8.58	***
Industrial production	-0.02		-0.11		0.25	
Capacity utilization	-0.03		-0.09		0.28	
Personal income	0.11		-0.29	***	5.37	**
Employment						
Change in nonfarm payrolls	-0.37		-0.10		0.78	
Initial jobless claims	0.08	**	0.11		0.10	
Unemployment rate	0.23	***	-0.24	*	7.50	***
Average weekly hours	-0.18		-0.05		0.12	
Consumption						
Personal consumption	0.02		-0.04	*	0.31	
New home sales	-0.05	*	-0.07		0.23	
Investment						
Durables ex transportation	-0.19	***	0.03		7.57	***
Construction spending (MoM)	0.15		0.01		0.40	
Factory orders	-0.12		0.09		2.89	*
Wholesale inventories	-0.15		0.00		0.50	
Prices						
PPI ex food & energy (MoM)	-0.06	***	0.12	**	8.26	***
CPI ex food and energy (MoM)	-0.04		-0.17		0.22	
Employment cost index	-0.08	***	-0.10	**	0.24	
Forward-looking						
Consumer confidence	-0.05		-0.14		0.54	
ISM manufacturing	-0.23	**	-0.24		0.00	
ISM non-manufacturing	-0.23	*	-0.06		1.35	
Chicago purchasing managers	-0.08		-0.09		0.00	
Housing starts	0.05		-0.01		0.48	
Leading indicators	-0.01		0.02		0.03	
Philadelphia fed	0.11		-0.15	***	5.47	**
FOMC						
Fed Funds target rate	-0.37	***	-0.07	**	4.46	**
Net exports						
Trade balance	-0.03		-0.09	**	0.93	
Government budget						
Monthly budget statement	0.17		0.05		0.14	

The table reports the response of 10-year Treasury bond futures returns to macroeconomic surprises for all days in the sample conditioned on high (β_i^{high}) and low (β_i^{low}) uncertainty. The F-stat is the value for the Wald test: $H_0 : \beta_i^{high} = \beta_i^{low}$.
* significant at the 10% level.
** significant at the 5% level.
*** significant at the 1% level.

Table 8
Asymmetric responses: large versus small surprises and extreme announcements

	Large vs. small surprises			Extreme announcements	
	β_i^{large}	β_i^{small}	F-stat	β_i	β_i^{extr}
Real activity					
Advance retail sales	-0.14 **	0.00	0.10	-0.24	0.09
Industrial production	-0.04	0.00	0.04	-	-
Capacity utilization	-0.06	-0.03	0.08	-0.03	-0.12 **
Personal income	-0.01	-0.50 **	3.84 *	-	-
Employment					
Change in nonfarm payrolls	-0.30 **	-0.12	0.43	-0.12	-0.33
Initial jobless claims	0.07 **	0.13	0.49	0.08	-0.01
Unemployment rate	0.03	0.06	0.03	0.03	-0.04
Average weekly hours	-0.06	-0.14	0.03	-0.06	-0.07
Consumption					
Personal consumption	-0.12 ***	-0.15	0.02	-	-
New home sales	-0.07	0.05	0.39	-0.11	0.07
Investment					
Durables ex transportation	-0.10	-0.18 ***	0.81	-0.25 ***	0.17 **
Construction spending (MoM)	0.04	-0.19 *	3.96 **	-	-
Factory orders	-0.05	0.03	0.19	-0.03	-0.03
Wholesale inventories	-0.09 ***	0.05	1.22	-0.07 **	-0.01
Prices					
PPI ex food & energy (MoM)	-0.02	-0.13	0.23	-0.07	0.04
CPI ex food and energy (MoM)	-0.12 *	-0.31	0.05	-	-
Employment cost index	-0.19 **	-0.12	0.07	-	-
Forward-looking					
Consumer confidence	-0.10 **	-0.25 *	1.08	-0.11 *	0.01
ISM manufacturing	-0.15	-0.27	0.22	-0.14	-0.23
ISM non-manufacturing	-0.16 ***	-0.13	0.03	-0.12	-0.03
Chicago purchasing managers	-0.17 ***	-0.06	0.78	-0.16 **	-0.01
Housing starts	0.03	0.25	1.00	0.11	-0.08
Leading indicators	-0.05 **	0.22 ***	10.60 ***	-	-
Philadelphia fed	-0.12 ***	-0.19 ***	1.10	-0.06 **	-0.09
FOMC					
Fed Funds target rate	-0.04 ***	-0.27	0.31	-	-
Net exports					
Trade balance	-0.03	0.08	1.21	-0.17 ***	0.17 ***
Government budget					
Monthly budget statement	0.05	0.94 **	3.54 *	0.05	0.01

The left panel in the table reports the response of 10-year Treasury bond futures returns to macroeconomic surprises conditioned on large (β_i^{large}) and small (β_i^{small}) surprises. The F-stat is the value for the Wald test: $H_0 : \beta_i^{large} = \beta_i^{small}$. The left panel reports the response of 10-year Treasury bond futures returns to macroeconomic announcements (β_i) and announcements that are either higher than the maximum or lower than the minimum of all forecasts in the survey (β_i^{extr}). Estimates are for all days in the sample.

* significant at the 10% level.
** significant at the 5% level.
*** significant at the 1% level.

Table 9
Accuracy for Monthly Directional Changes

	2-year		5-year		10-year		30-year	
Up-market HIT	0.70		0.73		0.71		0.69	
Down-market HIT	0.62		0.66		0.67		0.58	
HIT	0.66		0.70		0.69		0.64	
HM	3.65	***	4.51	***	4.32	***	3.07	***

The table shows the percentage of correctly fitted up-market months ("Up-market HIT"), down-market months ("Down-market HIT"), all months ("HIT") and the non-parametric Henriksson and Merton (1981) market timing test (HM).
*** significant at the 1% level.

Table 10
Unbiasedness of Bloomberg Expectations Data

	α	β	R^2	F-stat	p-value
Real activity					
Advance retail sales	-0.03	1.32	0.70	4.76	0.01
Industrial production	-0.06	1.20	0.71	4.30	0.02
Capacity utilization	-0.02	1.00	0.99	0.01	0.99
Personal income	0.04	0.99	0.80	1.91	0.15
Employment					
Change in nonfarm payrolls	-28.20	1.05	0.61	2.78	0.07
Initial jobless claims	10.70	0.97	0.87	1.50	0.23
Unemployment rate	0.18	0.96	0.96	5.35	0.01
Average weekly hours	0.88	0.97	0.87	2.49	0.09
Consumption					
Personal consumption	-0.07	1.18	0.85	7.68	0.00
New home sales	15.10	1.00	0.93	2.10	0.13
Investment					
Durables ex transportation	-0.36	0.98	0.16	1.68	0.20
Construction spending (MoM)	-0.02	0.82	0.14	0.61	0.55
Factory orders	0.03	1.04	0.93	1.56	0.22
Wholesale inventories	0.06	1.05	0.28	1.41	0.25
Prices					
PPI ex food & energy (MoM)	-0.08	1.54	0.18	1.88	0.16
CPI ex food and energy (MoM)	0.09	0.50	0.06	3.87	0.02
Employment cost index	0.52	0.40	0.03	1.63	0.21
Forward-looking					
Consumer confidence	-0.10	1.00	0.94	0.48	0.62
ISM manufacturing	0.27	1.00	0.84	0.01	0.99
ISM non-manufacturing	7.19	0.88	0.63	2.73	0.07
Chicago purchasing managers	2.22	0.97	0.66	0.80	0.45
Housing starts	114.00	0.94	0.75	2.11	0.13
Leading indicators	-0.01	1.23	0.87	13.40	0.00
Philadelphia fed	0.09	0.93	0.61	0.71	0.49
FOMC					
Fed Funds target rate	0.00	1.00	1.00	0.18	0.83
Net exports					
Trade balance	-0.23	1.00	0.98	0.42	0.66
Government budget					
Monthly budget statement	2.73	1.01	0.93	1.89	0.16

Unbiasedness of the forecasts is tested with the regression: $A_{i,t} = \alpha + \beta E_{i,t} + \varepsilon_{i,t}$, where $A_{i,t}$ ($E_{i,t}$) is the announced (median expected) value for macroeconomic series i at time t. The table shows parameter estimates for α and β, the R-squared of the regression and the F-value and associated p-value for the Wald-test: $H_0 : \alpha = 0 \; and \; \beta = 1$.

Table 11

Efficiency of Bloomberg Expectations Data

	R^2	F-stat	p-value
Real activity			
Advance retail sales	0.28	3.43	0.01
Industrial production	0.03	0.52	0.80
Capacity utilization	0.05	0.91	0.49
Personal income	0.03	0.47	0.83
Employment			
Change in nonfarm payrolls	0.05	1.01	0.42
Initial jobless claims	0.03	2.52	0.02
Unemployment rate	0.07	1.41	0.22
Average weekly hours	0.09	1.34	0.25
Consumption			
Personal consumption	0.07	1.24	0.29
New home sales	0.03	0.50	0.81
Investment			
Durables ex transportation	0.18	1.74	0.13
Construction spending (MoM)	0.04	0.21	0.97
Factory orders	0.13	2.67	0.02
Wholesale inventories	0.10	2.03	0.07
Prices			
PPI ex food & energy (MoM)	0.17	3.65	0.00
CPI ex food and energy (MoM)	0.02	0.39	0.88
Employment cost index	0.07	0.32	0.92
Forward-looking			
Consumer confidence	0.03	0.53	0.79
ISM manufacturing	0.05	0.98	0.44
ISM non-manufacturing	0.14	2.26	0.05
Chicago purchasing managers	0.07	1.43	0.21
Housing starts	0.08	1.31	0.26
Leading indicators	0.08	1.44	0.21
Philadelphia fed	0.05	1.01	0.43
FOMC			
Fed Funds target rate	0.03	0.25	0.96
Net exports			
Monthly budget statement	0.05	1.00	0.43
Government budget			
Trade balance	0.09	1.83	0.10

Efficiency of the forecasts is tested with the regression: $A_{i,t} - E_{i,t} = \alpha + \sum_{k=1}^{K} \beta_k A_{i,t-k} + \varepsilon_{i,t}$, where $A_{i,t}$ ($E_{i,t}$) is the announced (median expected) value for macroeconomic series *i* at time *t*. The table reports the R-squared of the regression and the F-value and associated p-value for the Wald-test: $H_0 : \beta_1 = \beta_2 = ... = \beta_K = 0$. The test is implemented with 6 lags.

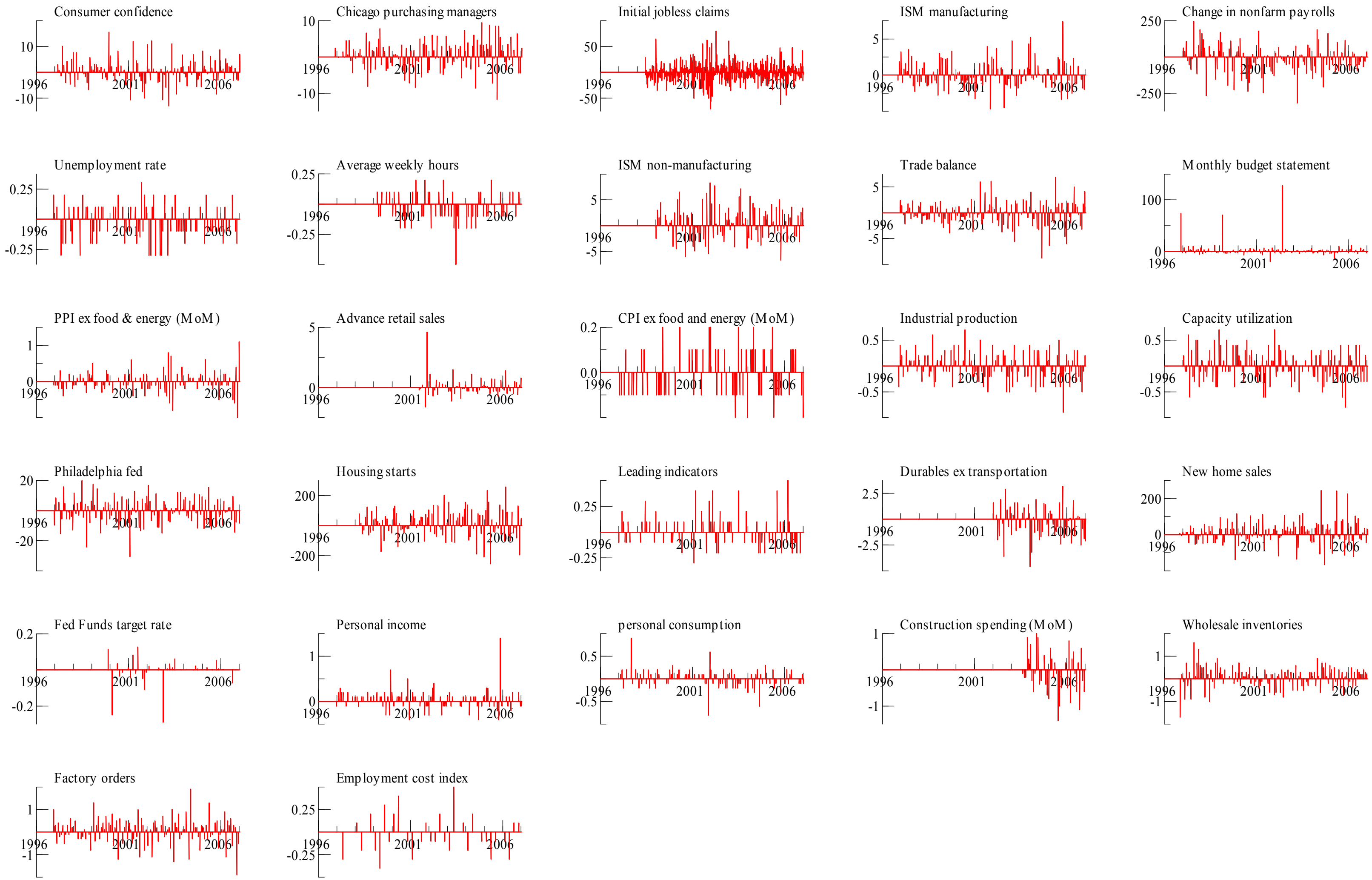

Figure 1. Macroeconomic announcement surprises. The chart shows (non-standardized) macroeconomic announcement surprises over the period 1996 – 2006.

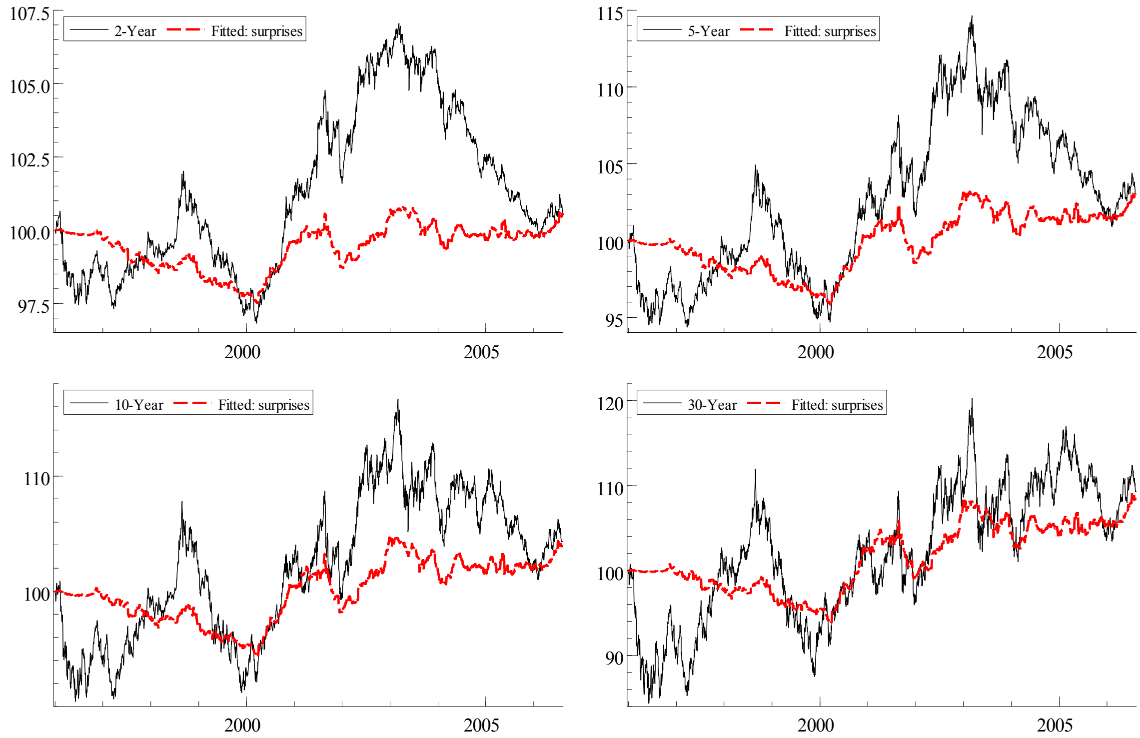

Figure 2. Multivariate model fit. The panels show the cumulative futures returns (solid dark line) and the fitted values (lighter, dashed line) based on announcement surprises for 2-, 5-, 10-, and 30-year futures.