Macroeconomic Announcements and Risk Premia in the Treasury Bond Market

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Abstract

This paper studies the bond risk premia associated with important macroeconomic variables. The main question addressed in this paper is whether a risk premium is earned by risk-averse agents investing in Government bonds exposed to macroeconomic news. These news are obtained by focusing on macroeconomic announcements and using market consensus forecasts. Considering more than twenty-five years of data (1983-2008) and more than twenty announcements, several macroeconomic variables are priced in the bond market. In particular, procyclical variables carry a statistically significant negative price of risk. This result is confirmed by examining both cross-sectional regressions and expected returns of maximum-correlation portfolios mimicking the macroeconomic variables. Advantages of using high frequency data are also documented. Among the different announcements, the most important appear to be labor and business confidence announcements although one factor appears sufficient to explain the average returns on Government bonds. Time variation in the risk premia is also documented.

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1 Introduction

Risk adverse investors demand compensation for holding long term bonds over short horizons. Does this compensation depend on the exposure of bond returns to macroeconomic shocks? This paper investigates whether innovations to macroeconomic variables are priced factors in a linear factor model for Treasury bond returns. Economic intuition would suggest that this is the case. However, for both equity and bond returns, it has been challenging to obtain robust findings. I will use higher frequency data than the monthly or quarterly frequency used in the literature and I will focus on Government bond returns. These are assets for which we can obtain better estimates of expected return from realized return (see Elton 1999). Government bonds have indeed little asset-specific information and are significantly affected by important new information about macroeconomic fundamentals. Furthermore, scheduled economic announcements and consensus forecasts will be used to calculate macroeconomic news.

Particular attention has been paid in the recent literature to macroeconomic interpretations of asset pricing factors and tests of whether macroeconomic factors are priced in the security market. This seems to be an old question (see for example Chen et al., 1986), but as Cochrane (2005, p. 61) concludes in his review paper: "Though this review may seem extensive and exhausting, it is clear at the end that work has barely begun. The challenge is straightforward: we need to understand what macroeconomic risks underlie the 'factor risk premia', the average returns on special portfolios that finance research uses to crystallize the cross-section of assets". This search has been carried out in both the equity market and the fixed income market. For the equity market, papers such as Vassalou (2003) and Petkova (2006) showed that the Fama-French Factors could be replaced by innovations in macroeconomic variables. For the fixed income market this analysis has been recently carried out within sophisticated no-arbitrage models of the term structure.

Research started with Ang and Piazzesi (2001), develops no-arbitrage affine term structure models for Treasury yields which include macroeconomic information.[1] These term structure models allow the estimation of the market prices of risk associated with macroeconomics variables. These studies provide evidence of the importance of using macroeconomic factors to model the term structure of interest rates (some successes include better model fits and improved out-of-sample forecasts). However, they provide mixed results on the prices of risk attached to these factors. In Ang and Piazzesi (2001) the estimates differ "enormously" across two different specifications of the model. The market prices of risk coefficients are indeed negative and significant in the specification of the model that does not include lagged macro variables and positive and significant

[1] See, among others, Hördahl et al. (2006), Rudebusch and Wu (2003), Dai and Philippon (2005), Ang et al. (2007), Beckaert et al. (2005), Bikbov and Chernov (2006), Dewachter and Lyrio (2006) and Gallmeyer et al. (2005).

in the specification that includes lagged macro variables.[2] Moreover, Duffee (2006 and 2007) finds only weak links between macroeconomic variables and bond risk premia.

What are the possible reasons for such different results? One is that these models impose a lot of structure: not only do these models parameterize the price of risk, but they also parameterize the relation between state variables and interest rates and the dynamic of the state variables. Since these parameters are estimated all together, it is possible that a misspecification in a part of the model contaminates estimates of the risk premia. I only focus on the parameterization of the risk premia without examining the dynamic of the factors or the relation between factors and short term interest rates. Another advantage of my approach is that I do not need to make ad hoc hypotheses for the estimation such as assuming that the model perfectly fits some yields and that other yields have measurement errors (see Ang and Piazzesi 2001).

A contribution of this paper is to use data at high frequency in the context of studying bond risk premia. High-frequency data have already been used in the literature that investigates the impact of macro news on prices and returns. However, the novelty in this paper is to use these data not to quantify the reaction to announcement surprises but rather to quantify the risk premia associated with macroeconomic variables. An extensive literature (see among others Fleming and Remolona, 1997, and Balduzzi et al. 2001) provides evidence that macroeconomic surprises - measured as the difference between the headline figure and expectations taken from surveys conducted before the releases - have a significant impact on bond prices and returns using high-frequency data. I will follow this literature by using intra-day and daily data together with macroeconomic surprises to estimate the sensitivity of bond returns to macro news. As shown by Balduzzi et al. (2001), using a short window around the announcements it is possible to obtain a precise estimation of the sensitivity of bond returns to macro news. However, I will use all data to estimate the risk premium because every day there are revisions about macro variables although we can only observe these revisions during announcements.

Macroeconomic announcements are events whose timing is known in advance, and that convey new information to the market which affect securities prices. Announcements can also reduce uncertainty and cause investors who had different expectations to adjust their portfolios. Therefore, announcements are associated with higher volatility in the security prices. If this incremental risk is not totally diversifiable, risk-averse investors would require a reward (a risk premium). This premium is like a "jump" or announcement risk premium that only occurs during announcements. Jones et al. (1998) found significant excess Treasury bond holding returns on the release dates of Employment and Producer Price Index (PPI) data. Although I will re-examine this finding using a richer data set, I will focus on the economic risk premia that should be earned during

[2] In Bikbov and Chernov (2006) and Dai and Philippon (2005) the market price of risk associated to inflation and real activity have opposite sign.

all trading days. The risk premia will also be allowed to vary daily and jump during event days.

It is important to understand which macroeconomic surprises are priced. If some economic risks are priced, it is relevant to know what the reward for bearing those risks is. This can improve our understanding of expected returns and asset pricing considering the importance of returns on default-free bonds to price other financial assets. This study may also indicate hedging strategies for investors. For example, any source of risk that is not priced can be diversified away. Finally, when identifying economic state variables I can provide some guidance in the specification of the market price of risk in a macro-term structure model.

If factors were tradable, the risk premia could be obtained by calculating the average of the factors. However, for non-traded factors such as macroeconomic surprises, the risk premia can be estimated by running a cross-sectional regression of average returns on beta and testing whether there is a significant relation between exposure to macroeconomic announcements (betas) and expected returns. This is the two pass cross sectional (CS) regression method developed by Fama and MacBeth (1973). An alternative is to construct mimicking portfolios projecting the factors on the span of returns augmented with a constant. Mimicking portfolios are the maximum-correlation portfolios of Breeden et al. (1989). They estimated a portfolio that is maximally correlated with current consumption to test the Consumption Capital Asset Pricing Model.[3] Balduzzi and Robotti (2008a) compared the two formulations of the multifactor model with non-traded factors (the cross-sectional regression versus the maximum-correlation mimicking portfolios). Although the alphas are the same in the two formulations when Generalized Least Square is used, the maximum-correlation portfolios present several advantages such as the lack of dependence on a particular asset pricing model used. This is particularly important if one wants to estimate the risk premium assigned to non-traded factors (see Balduzzi and Robotti, 2008b).

Both the Fama-MacBeth and mimicking portfolio approaches will be presented although I will present as primary the first and more popular approach. I plan to estimate the time-series betas and the composition of the mimicking portfolios using only returns data around the announcements. This composition should be estimated with sufficient precision if high frequency data such as daily or intra-day data is used. Then, once betas are obtained it is possible to examine the relationship between excess returns and sensitivity to the news using all trading days. For the mimicking portfolios I will examine

[3] Lamont (2001) estimated what he called economic tracking portfolios. These are mimicking portfolios which track unexpected components of future macro variables. The author showed that these portfolios can be useful to forecast macroeconomic variables. Ferson et al. (2006) studied mimicking portfolios with time-varying weights in the presence of conditioning information. Using the same data as Lamont, they showed that using conditioning information they could improve the correlation significantly with the macroeconomic factors.

the average returns.

This study focuses on the Government bond market. The choice of this market is motivated by evidence from Andersen et al. (2007) that revealed the response to real-time US macroeconomic news is larger in the bond market than in the stock market. Indeed, the link between macroeconomic fundamentals and the bond market is clear: unexpected increases in real activity and inflation increases bond yields and hence decreases prices. Price movements in the fixed income market, especially in the Treasury market, are driven by public information. A cross section of 7 daily bond returns from 6 months maturity to 10 years is used. I also employ intra-day futures. These data include 30-year T-bonds, 10-year T-notes, 5-year T-notes and 2-year T-notes futures. In this way I can examine the advantages of having a shorter window to calculate the sensitivity to macroeconomic news (or similarly the composition of the unit beta and mimicking portfolios).

The main findings of this paper can be summarized as follows: Procyclical variables such as labor, prices, real activity, and business confidence are priced in the Treasury bond market. They have a negative price of risk such that a unit beta portfolio exposed to macroeconomic shocks is a hedge against the performance of the bond market. Bond returns however have a negative exposure to procyclical variables shocks. Therefore, their risk premia (the product of beta and the price of risk) are positive. This explains why long-term bond have higher returns than short-term bonds. This result is confirmed using the mimicking portfolios approach. This paper also documents that it is important to use high-frequency data to obtain precise estimates of exposure and price of risk.

Furthermore, it appears that the macroeconomic factors behave similarly and exhibit a very similar price of risk. I carry out a test inspired by Zhou (1994 and 1999) to examine whether a single factor is sufficient to explain expected bond returns. I find that one single factor is sufficient and it includes as main determinants the labor and business confidence factors. Finally, some evidence is presented that the economic risk premia are time-varying and their variations are associated with the term-spread and the presence of announcements.

2 Related literature

This paper primarily builds on two strands of literature. The first strand examines multi-factors asset pricing models which include economic variables. The research design of this paper is close to the equity literature but I will also refer to the recent term structure literature that uses macroeconomic factors. The second strand analyses the impact of macroeconomic announcements on returns and prices. This section presents a brief review of this literature.

2.1 Economic fundamentals and asset pricing

Some empirical studies have been conducted that relate state variables in a multifactor asset pricing model to macroeconomic factors. (For a more complete literature review, see Cochrane, 2005.) These studies typically focused on a equities' portfolios although some studies included bond portfolios. Chen et al. (1986) analyzed the following economic factors: the term and default spread, expected and unexpected inflation and industrial production. They concluded that industrial production, the default and term spread are priced factors whereas the evidence for inflation as a priced factor is weaker. Ferson and Harvey (1991) also found significant risk premia associated with similar economic variables and documented a time variation in risk premia which helped to explain predictable variations in asset returns. They also included three bonds portfolios in their analyses: Government, corporate, and Treasury bill portfolios. Campbell (1996) used similar base assets to estimate an equilibrium multifactor model which included revisions in the forecasts of future labor income growth (proxies for the return on human capital that is an important component of wealth) as priced factors. Fama and French (1993) identified five risk factors in the returns on stock and bonds: the market, size, value, term and default factors. They included the excess returns on two government and five corporate bond portfolios and they found that stock returns were linked to bond returns through shared variation in the two term-structure factors. More recently, Vassalou (2003) and Petkova (2006) showed that the Fama-French Factors are correlated and could be replaced respectively by innovations in GDP, shocks to dividend yield, and term spread, default spread and one-month T-bill yield.

These studies however tend to explain returns with other current returns such as the term and default spread (which are themselves driven by economic forces) and not with contemporaneous economic variables. When the latter are included in the analysis (see for example Chan et al. 1998) and when real data are used (see Christoffersen et al., 2002) macroeconomic factors perform poorly. Despite the fact that for bond returns (especially Treasury) public information is very important to explain price variation, there is only scant evidence of economic risk premia. Indeed, the main asset pricing models in the bond area are continuous time models which consider the short-term interest rate as a fundamental building block.[4]

More recently, however, a growing strand of literature has focused on the links between macro variables and the yield curve. Ang and Piazzesi (2003) wrote one of the first papers that incorporated macro variables as factors in a term structure model. More specifically, they estimated a VAR that included three latent variables and two macro factors extracted as the first principal components from three measures of inflation and

[4] One work that is more similar to the equity studies, is Elton et al (1995) who in the context of the fixed income market presented an APT model and showed the importance of using unanticipated changes in economic variables to explain the cross-section of expected bond returns.

from four real activity variables. Cross-equation restrictions implied by no-arbitrage were imposed in this estimation. The authors used a discrete time affine term structure model which, under a Gaussian hypothesis, reduces to a VAR with cross-equation restrictions. They showed that macroeconomic variables have an important explanatory role for yields and, that the inclusion of such variables in a term structure model can improve the forecasting performance. However, Ang and Piazzesi did not provide a clear macroeconomic interpretation for the unobservable factors that accounted for most of the movement at the long end of the curve.

Other papers have tried to put more structure in the relationship between interest rates and the macroeconomy. In this way it is possible to create feedback from the interest rates to the macroeconomy that was absent in the Ang and Piazzesi paper. In Hördahl et al. (2006) a small structural model of the macro economy was combined with an arbitrage-free model of bond yields. Using German data Hördahl et al. showed that macroeconomic factors affect the term-structure in different ways. While monetary policy shocks have an impact on yields at short maturities, inflation and output shocks mostly affect yields at medium-term maturities. Changes in the perceived inflation target tend to have a stronger influence on longer-term yields.

Rudebusch and Wu (2003) developed a macro-finance model and examined the joint movement of the term structure and macroeconomic variables. The macro model is a New Keynesian forward looking model and the finance model is a discrete time affine term structure model. They showed that the "level" factor is closely associated with the central bank's long-run inflation target and that the "slope" factor captures the central bank's responses to cyclical variations in inflation and output gaps. Next, they incorporated such relationships in a term structure model which estimated with data on both yields and macroeconomic variables. Dewachter Lyrio (2006) provided a similar interpretation for the level although they showed that the slope appears to be related to business cycle conditions, and the "curvature" to the monetary stance of the central bank.

As previously mentioned in the introduction, the findings on the market prices of risk associated with macroeconomic variables are inconclusive. This is perhaps due to over-parameterization and potential misspecification which contaminates the estimates of the market prices of risk.[5] I will use high-frequency data and I will focus on macroeconomic announcements. Therefore, I extract macroeconomic news in a different way.

[5] This problem is also recognized by Ang, Dong and Piazzesi (2007). They suggest using a Bayesian approach to handle this problem. As noted by Bikbov and Chernov (2006) "risk premia are hard to estimate in practice despite their theoretical identification. Typically, one encounters multiple local optima that have similar likelihood values, but imply dramatically different estimates of the risk premia. Additionally, a rich specification of market prices of risk might be a reason for concern, because they could be compensating for the misspecification of the factors dynamics instead of measuring the compensation for risk."

Macroeconomic news are calculated in this study as the difference between the headline figures of macroeconomic announcements and the expected values based on survey data.

Another way to extract macro news is from innovations obtained from a time series model of the relevant economic variables. This approach is used for example by Campbell (1996) and more recently by Petkova (2006).[6] They use a vector autoregressive (VAR) approach to obtain the surprise components of economic variables. However, one assumption of this approach is that all relevant information available to investors is used in the VAR system. By contrast, observations of this information is not necessary when surveys are used which avoids a potential cause of misspecification. Another advantage of using news from macroeconomic announcements is that it is possible to analyze many more news and use a higher frequency of data. Indeed, whereas the number of variables that can be included in a VAR system is limited, it is possible to analyze more than twenty different news in this study. I use daily data instead of monthly or annual frequency of data used in the previous literature. Daily returns should reflect the impact of macroeconomic shocks more clearly whereas monthly stock returns incorporate a lot of information that can fade or at least make it difficult to identify the impact of macroeconomic developments. Finally, another advantage of using macroeconomic announcements stem from the use of real time data to construct news rather than revised data which deliver news which could be available only ex-post. Christoffersen et al. (2002) present evidence that the use of real time data can change the significance of the rewards to macroeconomic risk changes.

2.2 Macroeconomic announcements

The literature on macroeconomic announcements has tended to focus on the impact of unexpected announcements on prices and returns. Evidence provided shows that macroeconomic surprises have an impact on asset returns (for Treasury returns see inter alia Balduzzi et al. 2001). This finding however does not answer the question of whether these surprises can be viewed as systematic risks and whether investors are compensated for holding securities which are more exposed to these risks. Jones et al. (1998) found significant excess Treasury bond holding returns on the release dates of Employment and Producer Price Index (PPI) data.[7] They did not however test whether these risks were priced in accordance with their exposure. Moreover, their focus was on an announcement risk premia rather than an economic rick premia that should be earned every day and not only during announcement days.

[6] Evans and Marshall (2007) and Diebold et al. (2006) also use a VAR framework to investigate the link between macroeconomic shocks and the term structure of interest rates.

[7] Li and Engle (1998) considered only three announcements and did not find a statistically significant risk premium on the release dates in the Treasury futures market.

An extensive literature has documented the impact of macroeconomic announcements on security returns for the U.S. and other main industrialized countries. The strand of literature which focuses on the U.S. markets can be classified in at least three different ways.[8]

A first classification is based on which moments of the returns the researchers focused their attention. Many studies estimate by OLS the following type of regression:

$$\Delta y_t = \alpha + \beta surprise_t + \varepsilon_t \tag{1}$$

where the dependent variable is the change in the asset price or return around the macroeconomic announcement and the independent variable is the macroeconomic surprise calculated as the difference between the actual headline figures and the expectation which is generally obtained by a survey. Balduzzi et al. (2001) also controlled for contemporaneous releases which are added on the right-hand side of the regression. Another approach is to use dummy variables for the surprises however, this does not allow for the separation of the impact of contemporaneous macroeconomic releases. Studies that have examined the first moment have found an immediate impact of macroeconomic news on asset prices. The impact of the macroeconomic surprises on returns volatility has also been investigated extensively. A GARCH specification was used in the literature to model the conditional variance of the errors in (1). The impact of the macroeconomic releases on the volatility was gauged using dummy variables for the macroeconomic announcements which were entered as exogenous variables into the conditional variance equation. This type of analysis has been performed for example by Jones et al. (1998) and De Goeij and Marquering (2006) for the bond market and Flannery and Protopapadakis (2002) for the stock market. Volatility appeared to be significantly affected by the main macroeconomic announcements. Finally, few studies also considered the impact of the macroeconomic announcements on the correlation between stocks and bonds. For instance Brenner et al. (2006) found that conditional excess return co-movement between stock and bond markets decreased on announcement days.

A second classification of the literature is based on the market or asset class studied. Different market and asset classes such as stock, bond and currency markets are usually considered in isolation. Few studies however have considered a broader perspective such as Anderson et al. (2005) and Kim et al (2004). They examined the response of stock, bond and foreign exchange markets to several US macroeconomic news using intra-day and daily data respectively. Brenner et al. (2006) also used daily data to examine the impact of the main US macroeconomic news on stock, Treasury, and corporate bond markets. They found that the bond market reacted the strongest to news followed by foreign exchange and equity markets. Focusing on the fixed income markets, Fleming and

[8] Fleming and Remolona (1997) and Andersen et al. (2005), provide a more detailed review of this literature.

Remolona (1999a) and Balduzzi et al. (2001) studied the links between macroeconomic news and Treasury bills and bond price changes. The latter study used intra-day data and found that 17 macroeconomic news had a significant impact on the price of at least one of the instruments examined (3-month T-bill, 2-year and 10-year note, and 30-year bond). The new information captured by the surprise component of the macroeconomic announcements was incorporated very quickly into prices (one minute or less). Ramchander et al. (2005) studied the impact of macroeconomic news on term and quality spread. Similar to Barnhill et al. (2000) they used cointegration techniques to investigate these links. They estimated different specifications of a Vector Error Correction Model which included Federal funds rate, Treasury rate for different levels of maturity, the prime interest rate and the Moody's Baa corporate bond rate. Finally, Ramchander et al. (2003) and Xu and Fung (2005) used monthly data to show that Mortgage rates and mortgage-backed security indices are also influenced by macroeconomic news. As expected, the significant impact of macroeconomic announcements on asset prices was not limited to the Treasury market but rather also expanded to the other fixed income asset classes.

The last method that has been used to classify the literature is based on the frequency of data. While previous works have generally used low frequency data, more recent studies use intra-day data (see *inter alia* papers quoted above). High frequency data such as tick-by-tick data allow researchers to better pinpoint the reaction of the price to the arrival of the news because a short window around the announcement is applied. Researchers have found that by using intra-day data, more types of announcements impact asset prices and the explained variance is larger.

Another related question addressed in the literature is whether the response of the asset price to the macro surprises depends on the state of the business cycle. Veronesi (1999) showed theoretically that both investors' uncertainty over some important factors affecting the economy and investors' willingness to hedge, make stock prices overreact to bad news in good times and underreact to good news in bad times. McQueen and Roley (1993) showed that allowing for business cycle variation in the response of stock prices to news makes this response more evident. Boyd and Jagannathan (2004) found that the reaction to unemployment news was similar across different states of the business cycle for the bond market, whereas the stock market reaction to an unexpected increase in unemployment was positive during economic expansions and negative during economic contractions.

3 Data

Three different data sets are used in the current study. The first consists of the macroeconomic announcements data. The last two consist of Government bond data from the spot and futures markets.

4 Macroeconomic announcements data

Macroeconomic announcements are publicized events which happen on pre-scheduled dates. I focus on the headline figures for which market expectations are available. The sources of the date, time, announcement values and forecasted values are Money Market Services (MMS) and Bloomberg. MMS data have been used extensively in the literature. Data were collected from the beginning of the 1980s via weekly telephone surveys. The MMS data that I obtained were used by Balduzzi et al. 2001 and they are available only until September 1995. Bloomberg provides data from the beginning of January 1997 to the end of September 2006. The forecasts are obtained from the median expectation of surveys prepared by Bloomberg News. The survey responses are collected until one business day before the economic release. Major Wall Street firms participate in the survey. The number of participants depends on the announcements. Participation rate has increased during the most recent period. To fill in the gap between the MMS data and Bloomberg data I hand-collected consensus forecasts and actual releases from Factiva.[9] For the monetary policy expectations I followed Kuttner (2001) by estimating these expectations using data from the futures market for Federal funds and updating the data set of Gürkaynak et al. (2006).

The final data set includes data from the 25 macroeconomic announcements listed in Table 1. As common in the literature (see Balduzzi et al. 2001) standardized surprises are calculated as the difference between announced and forecasted value (the survey median), divided by its standard deviation. The starting dates vary from the beginning of the 1980s to January 1997. The total number of announcements is more than 6000 (Table 2). These are generally released monthly except for initial jobless claims (released weekly) and a few other indicators released less often (Employment Cost Index, FOMC interest rate decision, Nonfarm Productivity). The economic indicators considered in this study tend to be released during the second half of the week. Often the day of the announcement coincides with other announcements. This always happens for few announcements that are released at the same time. These are Non-farm Payrolls and

[9] Whenever available I used the MMS forecast. For instance, the "week ahead" section of the business week provided MMS forecasts. Some missing values in the MMS or Bloomberg data have also been filled using Factiva.

Unemployment rate, GDP and GDP Deflator.[10]

4.1 Government bond Data

The primary data set contains seven daily Government bond returns for the following maturities: 6-month, 1-year, 2-year, 3-year, 5-year, 7-year and 10-year.[11] I follow the same approach as in Jones et al. (1999) to calculate returns using daily constant maturity interest rate series from FRED St. Luis database. The excess returns are calculated from the yields using a hypothetical par bond with the stated maturity over a 3-month spot rate also obtained from FRED.

Table 3 provides summary statistics for the total sample and for the sample divided in two: one sample only includes announcements days and another sample only includes only non-announcement days. The data are from January 3, 1983 to March 31, 2006. In both cases, during announcement days the mean and the standard deviation are significantly higher than during non-announcement days (with the exception of the 6-month rate mean), although the evidence is stronger for the latter. Higher moments like skewness and kurtosis are also different and a non-parametric test (the Kolmogorov-Smirnov test) rejects the null hypothesis that the two samples come from the same distribution. Figure 1 shows the empirical probability density obtained using a Kernel-smoothing method for 5-year excess returns. The distribution for the non-announcement days is concentrated around the mean whereas the announcement days distribution is more dispersed.

To show the advantages of using high-frequency data I will compound the daily returns in monthly returns. I will also use bond futures data to compare the analysis using daily returns with the analysis using intra-day returns. Indeed, the results of Balduzzi et al. (2001) suggest that most of the action happens within a short window around the announcement. Perhaps using daily data it is not sufficient to obtain a precise estimate of the sensitivity to macroeconomic shocks. To test this, 30-year T-bonds, 10-year T-notes, 5-year T-notes and 2-year T-notes futures were collected. Daily data were provided by Datastream and intra-day data were bought from TickData with a sample starting on March 1993. The underlying source of uncertainty is the same in the future and spot bond market but microstructure differences can affect the results. Using futures data instead of spots data present pros and cons. One advantage is that information processing in the open outcry system of the CBOT market should be more efficient than the inter-dealer cash market.[12] As shown by Mizrach and Neely (2007) the futures

[10] CPI and PPI are released together with a measure that excludes food and energy (core measure). The non-core measures were selected because they include a longer time-series.

[11] A 30-year rate is also available but it has been discontinued between February 2002 and February 2006.

[12] Starting in 1999 the secondary Treasury market experienced a change to electronic trading. The two main trading platforms (eSpeed and BroketTec) have captured almost the entire market for the on-

market contributes substantially to price discovery often dominating the cash market for long maturities. This can be explained by the high liquidity and low transaction cost of the long maturity contracts. Moreover, Kamara (1988) and Hess and Kamara (2005) documented that the spot T-bill term premia include a default premia component due to the risk that the counterpart may default. This is absent in the futures markets because they have a clearing association that serves as the guarantor of every contract and they employ mechanisms that virtually eliminate default risk. However, a disadvantage of using futures data stems from the effects of contract expiration. US T-bond and T-note futures have a quarterly delivery cycle March, June, September, and December. In order to create a continuous series, price information is usually obtained from the nearest-to-maturity futures which are generally the most traded contracts. The switch to the next maturity contract is chosen either as the first day of the expiration month (Li and Engle, 1998) or five days before the delivery date (Andersen et al., 2007) or when the trading volume of the second nearby contract exceeds the nearby contract (Ederington and Lee, 1993 and 1995). In this paper I will adopt this latter approach. Another issue with using futures is the optionality features embedded in futures contracts. The underlying is indeed not a bond but a basket of bonds. The seller can choose which bond to deliver (quality option) and when to deliver during the delivery month (timing option). The quality option can have substantial value (see, for example, Kane and Marcus, 1986).

Intra-day futures returns are calculated using the price at the end and at the beginning of a 30-minute interval around the announcement (similar to Balduzzi et al. 2001). I consider five minutes before the announcement and twenty-five minutes after the announcement. For the daily futures the settlement prices are used.

5 Empirical analysis

This section first presents the results of the two pass cross sectional regression method developed by Fama and MacBeth (1973). The goal is to examine whether different sensitivities (betas) to macroeconomic announcements are associated with different expected returns. Betas are estimated in the first pass with a time series regression and then betas are used as independent variables in a cross sectional regression. More precisely, according to multi-betas linear asset pricing models such as the Intertemporal Capital Asset Pricing Model (ICAPM) of Merton (1973) or the Asset Pricing Model (APT) of Ross (1976), there is a linear relationship between expected return and betas. I assume therefore that the model for the unconditional expected excess returns on asset or portfolio i,

the-run Treasuries. Therefore GovPX (a database which consolidated voice-brokered interdealer quotes and trades), which has been used extensively in the literature, does not provide a reliable indicator of transactions during the most recent years. For a study see Mizrach and Neely (2006).

$E(r_i)$ is:

$$E(r_i) = \sum_K \lambda_{S^K} \beta_{i,S^K} \ , \forall i, \tag{2}$$

where λ_{S^K} is the price of risk for innovations in the macroeconomic state variable K. The betas are the slope coefficients from a regression of the excess return on asset i on the standardized innovations to the state variable K, S_t^K, calculated as the difference between the actual value of the macroeconomic variable and the median forecast divided by the standard deviation of this difference:

$$r_{i,t} = \alpha_i + \sum_K \beta_{i,S^K} S_t^K + \varepsilon_{i,t}, \ \forall i, \tag{3}$$

An assumption in my analysis is that the announcement betas β_{i,S^K} are not time-varying. These betas are estimated using announcement days but I assume that they do not change during non-announcement days. During non-announcement days there are revisions about macro variables although they can not be observed. The sensitivity to these shocks can be estimated only when I observe the shocks (during announcement days) but I assume that this sensitivity does not change during non-announcement days. Under this assumption, I can use all trading days to estimate the risk premium parameters. In the main analysis I will also consider one factor model, using a different macroeconomic surprise each time.

As a robustness check I will estimate the composition of the mimicking portfolios that track the main macroeconomic surprises by performing a regression of standardized surprises on bond excess returns:

$$S_t^K = a_i + \sum_i w_{i,S^K} r_{i,t} + \varepsilon_{i,t}, \ \forall K \tag{4}$$

Once I have the composition of the mimicking portfolios (the vector of slope coefficients $\hat{\mathbf{w}}_{S^K}$) I can calculate portfolio returns as $r_{p^K,t} = \hat{\mathbf{w}}_{S^K} \mathbf{r}_t'$, that track the K macroeconomic news.

The betas and the composition of the mimicking portfolios are estimated using only announcement data whereas the lambdas and the returns of the mimicking portfolios are calculated using all trading days. This is because market participants are constantly revising their expectations about macroeconomic variables whether or not there is an official Government announcement on a particular day. In this paper the interest is on economic risk premia that should be present daily.

5.1 Time-series analysis

Following the specification used by Balduzzi et al. (2001), for any economic announcement a regression is estimated using only the announcement days controlling for surprises in variables announced simultaneously. As in Balduzzi et al. (2001), I include a concurrent announcement in the regression if it occurs at least 10% of the times the announcement under analysis is released. Table 4 shows the betas obtained in the time series regression of bond indices returns on macroeconomic news (the standardized surprises). As found in the literature, the majority of the macroeconomic surprises significantly affect bond indices excess returns. An unexpected increase in a procyclical variable such as a real economy indicator or inflationary variable has a negative impact on excess total returns. Only seven betas are never significant. They are Business Inventories, Existing Home Sales, Housing Starts, Factory Order, GDP Deflator, Non-farm Productivity and Wholesale Inventories. For the announcements with significant betas, the slope coefficients are increasing with the maturity of the bond. An interesting effect is that of the monetary policy announcements (FOMC) which significantly enter in the regression only for the short-term returns. This is consistent with recent works such as Gürkaynak et al. (2006) who show that the long term of the yield curve is affected by the changes in financial expectations of future policy actions and less by unexpected changes in the federal fund rate target.

Since there are many announcements with similar information content and that also have a similar impact on bond returns, it seems natural to aggregate some announcements. One issue is how to aggregate announcements which happen on the same day and have a different impact on returns. For the sake of simplicity, I took the sum of the standardized and demeaned surprises. Table 5 shows the different components of the aggregate announcements. Table 6 shows the time-series results for the aggregate announcements and for some announcements that did not fit in any of the groups. Only for three announcements (Inventories, Housing Starts, and Non-farm Productivity) the returns are not significantly affected by the news. The results confirm that shocks to procyclical variables impact negatively bond returns and that betas increase with maturity.

5.2 Cross-sectional analysis

Following Fama and MacBeth (1973) a regression is performed of bond excess returns on the betas estimated above for each t. I also include an intercept in equation (2) to test whether it is significantly different from zero. Since I have only 7 observations in the cross section, I consider one factor model at a time similar to Ferson and Harvey (1991). Table 7 presents the results of this CS regression: the estimated coefficients together with

Fama-MacBeth t-statistics adjusted with the Shanken (1992) correction that takes into account the errors-in-variables problem.

The risk premia associated with labor, prices, aggregate demand, real activity, business confidence and home sales news are negative and statistically significant. The risk premia for budget, for which the betas were positive in Table 6, is instead positive and statistically significant. The lambdas are divided by the time-series standard deviation to allow comparison. The magnitudes are very similar with the largest value for the Labor factor (-0.041). The intercepts are not significant for labor, prices, aggregate demand, and real activity. Therefore, procyclical variables that had a negative beta exhibit a negative lambda so the product of beta with lambda is positive. Long-term bonds that had a higher exposure (beta) to news are rewarded with a positive risk premium. The lambdas have a portfolio interpretation as a portfolio with a beta equal to one. These unit beta portfolios are hedge portfolios (since the sign is negative) that hedge against the bond market performance.[13]

The cross-sectional adjusted R-squared coefficients (average of each R-squared obtained in the cross sectional regressions) suggest good explanatory power. However, given the small variability in bond portfolios and the strong factor structure, it is important to provide a p-value associated with that (see Lewellen et al. 2006). Therefore, a simulation analysis was performed following Jagannathan and Wang (2007). I bootstrapped the factors and conducted 2000 time series regressions with the simulated series. Since these new factors are composed of surprises picked up at random they should not be able to explain the cross section of bond excess returns. The probability of obtaining an adjusted R-squared greater than what I obtained in the real analysis can be rather large. In other words it is easy to obtain a high R-squared coefficient. Only for Prices, Business Confidence, Home Sales, and Consumer Confidence the probability of getting such a high value using random factors is very small. Using this bootstrapping approach p-values were calculated for the adjusted t-statistics.[14] The p-values indicate the probability of obtaining a bootstrapped t-statistics greater (lower) than the sample t-statistics when the sample t-statistics is positive (negative). For the intercept t-statistics the simulation suggests that it is not difficult to obtain the sample t-statistics. Concerning the lambdas, the probability of getting a t-statistic of the magnitude obtained in the regression during the bootstrapping simulation is below 1% for significant t-statistics. The only exception is Budget for which the p-value is almost 10%. These results also suggest that Consumer Confidence is significantly priced with a negative risk premium.

[13] I also tried to perform a GLS style regression and the results are similar.

[14] I tried also to estimate the standard errors by GMM which is robust to the distributional assumption. The same moment conditions and weighting matrix as in Balduzzi and Robotti (2008a) were used. The results are comparable.

6 Frequency comparison

One of the advantages of my approach is that it allows the use of high frequency data to estimate betas. This should provide more precise estimates of betas which will likely improve the estimation of lambdas. To support this argument, the daily results are compared to those obtained using monthly return data. To use the same length for the returns data and surprises, the announcements are not aggregated and the weekly Initial Jobless Claims announcements are excluded. Table 8 presents the time-series results. Compared to Table 4 the significance is lower. Now, there are almost double (from seven to thirteen) the non-significant announcements. The t-statistics are also much lower. This lower precision in the estimates will potentially affect the cross-sectional regression results. Indeed, Table 9 shows that using monthly data it is not possible to obtain significant priced lambdas whereas using daily data I obtained significant results.

It therefore appears that it is better to have high frequency data for estimating betas and lambdas. Is this is also true for intra-day versus daily data? To answer this question, I compare the results using daily and intra-day futures data. Table 10 shows the time-series results for the two different frequencies. Using intra-day data improves the precision. The t-statistics are higher and the R-squared coefficients are also higher. However, the coefficients for the significant betas are very similar. It is not surprising then that in the cross section the results are similar (Table 11). Daily returns were always used to calculate lambdas because I wanted to capture the risk premium for all the periods not only during a short window around the announcement.

In conclusion, to estimate the risk premium attached to macroeconomic variables it appears important to use daily data instead of monthly data which was done in past studies. Moreover, daily data seems to provide sufficient precision to estimate the betas without contaminating the estimation of the risk premia.[15]

7 Robustness checks

Balduzzi and Robotti (2008a) suggest that estimating mimicking portfolios should be considered in addition to (or even instead of) the two-pass regression. As a robustness check, a regression of the standardized surprises was performed on the excess returns as described in (4). In this way the (squared) correlation between news and returns is maximized. First, I tested whether the mimicking portfolios "track" the surprises by doing a jointly test on the portfolio weights (the slope coefficients) estimated in the regression. An F-test is therefore performed to examine whether the slope coefficients as

[15] An advantage of daily data is that intra-day data can present potential overshooting effects in the very short run. Moreover, microstructure frictions are more serious for higher frequency data.

a group are significantly different from zero. The F-test suggests that with the exception of Inventories, Budget and Consumer Confidence for which the null hypothesis is not rejected, the mimicking portfolios track the main macroeconomic news. Table 12 therefore only presents the results for tracked surprises. It also shows the mean excess returns for the tracking portfolios. It is confirmed that the risk premia for procyclical variables are negative and significant. The Sharpe ratios are very similar across different announcements.

Next, I also include other factors in addition to the macroeconomic factors. Following Chen et al. (1986) and Fama and French (1996) I include as additional factor the term spread (the difference between 10-year and the 3-month rate). Since this factor is also affected by the macro surprises, I first regress the term spread on the surprises and then I consider the residual plus the intercept as an additional regression in the time-series regression. Table 13 confirms that the macroeconomic shocks are priced in the cross-section of bond returns. I also control for portfolio characteristics as suggested by Jagannathan and Wang (1998). In the case of bond returns the main portfolio characteristic is the maturity. Therefore, I include the maturity as additional regressor in the cross-section. Table 13 shows that this does not change the main result.

One concern in the previous analyses is that betas can be time-varying. The period under analysis is after the monetary experiment of 1979-1982 and it is characterized by a relative homogenous monetary policy and relationship between interest rates and macroeconomic variables (see for example Clarida et al. 2000). However, between 1983 and 2008 there were few changes in the business cycle and one might wonder whether the announcement betas vary with the business cycle. Table 14 presents the results of a time-series regression that includes a dummy variable for recession and shows that for the main announcements there are not dramatic changes. The dummy variable depends on the value of the Chicago Fed National Activity Index (CFNAI) index. The CFNAI is a weighted average of 85 existing monthly indicators of national economic activity. It is constructed by the Federal Reserve Bank of Chicago to have an average value of zero and a standard deviation of one. A recession is defined when the 3-month moving average of this index is less than -0.7 which historically is an indication of recession (see Evans et al. 2002).

8 One factor model test

It appears that the different procyclical variables considered so far (labor, prices, aggregate demand, real activity, business confidence, and home sales) behave similarly and they exhibit a negative and similar price of risk. Is it possible that only one factor is in play to explain expected returns? Let's assume that there are M observable economic factors f and that the returns are generated by the factors,

$$r_{it} = \alpha_i + \beta_{i1} f_{1t} + \cdots + \beta_{iM} f_{Mt} + \varepsilon_{it}, \qquad i = 1, \ldots, N$$

or in matrix form

$$\mathbf{r}_t = \alpha + \beta \mathbf{f}_t + \varepsilon_t \tag{5}$$

We posit that there is one latent factor y that is a linear combination of the economic factors

$$y_t = c_1 f_{1t} + \cdots + c_M f_{Mt}$$
$$y_t = \mathbf{c}^{\intercal} \mathbf{f}_t$$

then (5) can be rewritten as

$$\mathbf{r}_t = \alpha + \mathbf{a}\mathbf{c}^{\intercal} \mathbf{f}_t + \varepsilon_t$$

Therefore, the restriction is that

$$\mathrm{H}_0 : \beta = \mathbf{a}\mathbf{c}^{\intercal}$$

where $\mathbf{a}$ is a nx1 vector and $\mathbf{c}$ is a mx1 vector.

As shown by Zhou (1994 and 1999) this is equivalent to a rank restriction on β (rank equals to 1). The author shows how to estimate the parameters by generalized method of moments (GMM) and test whether one factor is sufficient to explain the returns.

The moment conditions are

$$E \begin{bmatrix} \mathbf{r}_t - \alpha - \mathbf{a}\mathbf{c}^{\intercal} \mathbf{f}_t \\ (\mathbf{r}_t - \alpha - \mathbf{a}\mathbf{c}^{\intercal} \mathbf{f}) \otimes \mathbf{f}_t \end{bmatrix} = 0$$

for a total of (N+NxM) moment conditions and (N+N+M) parameters to estimate. Zhou (1994 and 1999) provides the analytical solution of this GMM problem and a test of the overidentified restrictions. The analytical solution is obtained by using not the optimal weighting matrix, but one with a structure form of this type

$$W \equiv W_1 \otimes W_2, \quad W_1 : N \times N, \quad W_2 : L \times L$$

where L is the number of instrumental variables.

The estimates of $\mathbf{a}$ and $\mathbf{c}$ are not unique since I can multiply $\mathbf{a}$ by a scalar and divide $\mathbf{c}$ by the same scalar and obtain the same matrix β. However, they are unique under a normalization that $\breve{\mathbf{a}} = [1, \mathbf{a}_2]$ and then the estimator will be unique. There is then one parameter less to estimate.

Table 15 presents the test statistics of the rank restriction based on GMM. This statistic is asymptotically χ^2 distributed with degree of freedom equal to $NL - q$ where q is the number of parameters to estimate. The results suggest that one factor is sufficient to explain bond returns (the null hypothesis can not be rejected). This result is a bit surprising considering the stylized fact that we need three factors to explain bond returns (see Litterman and Scheinkman 1996 Knez et al. 1994) although the first factor is considered the most important one. Indeed, a principal component analysis applied to the bond returns data shows that the first factor explains more than 86% of the return variance. The Table also reports the estimates of the vector **c**, the loading of the economic factors on the latent factor. As suggested by Zhou (1999) the latent factor can be interpreted as an economic index that drives the returns and the coefficients as weights or the contributions of the individual economic variables to the index. I focus on the announcements that were significant in the cross sectional regression and I consider two periods: From the beginning of 1985 when labor announcement data are available and from the beginning of 1990 when all the surprises under analysis are available. The coefficients are all significant and labor and business confidence have the largest weights.

9 Time-varying risk premia

Does the bond market systematically price new information about macroeconomic fundamentals released during the scheduled announcements? If so, we should expect a change in the risk premium during the announcements. The risk premium is therefore allowed to vary daily during event days and its variation is related to the arrival of macroeconomic news.[16]

Table 16 reports the results of a regression of the returns on the unit beta portfolios (the time-series of lambdas) on predetermined variables. The high-frequency limits the choices of predetermined variables. I use the term spread (defined as difference between the 10-year and 1-year rate) the curvature (equal to the difference between the 3-year rate minus the difference between the 7-year rate and twice the 1-year rate divided by 3) and an announcement dummy. All of these variables are lagged one day except the dummy variable which is deterministic. The term spread appears to be the best predictor of the economic risk premia. The risk premia of prices, real activity, business confidence and housing starts vary significantly if there is a scheduled announcement. The curvature is only significant for the Nonfarm Productivity risk premium. The term spread is usually positively associated with a change in the investors' risk aversion. Therefore, if the risk aversion increases, lambdas of procyclical variables such as labor become more negative (the unit beta portfolio is more valuable for hedging).

[16] Ample evidence is also provided in the literature of time-varying risk premium in the bond market (see among others Fama 1984, Keim and Stambaugh 1986, Fama and Bliss 1987, and Cochrane and Piazzesi, 2005).

10 Conclusion

In summary, using high frequency data and macroeconomic news obtained from announcements and surveys, I provide evidence of significant economic risk premia in the Government bond market. In particular, procyclical variables carry a statistically significant negative price of risk. Long-term bonds that are more exposed than short-term bonds to macroeconomic shocks are rewarded with a positive risk premium. This is documented both with a two pass cross-sectional regression and calculating mimicking portfolios. I also show that there are advantages of using high-frequency data such as daily or intra-day data in comparison with monthly data.

The risk premia associated with macroeconomic variables appear to be very similar. A test was carried out to examine whether one factor model was sufficient to explain the expected returns. The null hypothesis can not be rejected. The loadings on a single latent factor show that the most important announcements are labor and business confidence. Finally, I examine whether the return of the unit beta portfolios are time varying. Important predictors of risk premia changes are the term spread and the presence of an announcement.

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Table 1
U.S. Macroeconomic Announcements

Announcements name	Announcements abbreviation	Units	Source
Advance retail sales	RetS	(%)	Bureau of the Census
Business Inventories	Buinv	(%)	Bureau of the Census
Change in Nonfarm Payrolls	nfarm	(thousands)	Bureau of Labor Statistics
Chicago Purchasing Manager	Chic	(number)	Institute for Supply Management
Consumer Confidence	CConf	(number)	Conference Board
Consumer Price Index	CCPI	(%)	Bureau of Labor Statistics
Durable Goods Orders	Durab	(%)	Bureau of the Census
Employment Cost Index	ECI	(%)	Bureau of Labor Statistics
Existing Home Sales	EHS	*(millions)*	Bureau of the Census
Factory Orders	FacO	(%)	Bureau of the Census
Federal Open Market Committee rate decision	FOMC	(%)	Federal Reserve Board
Gross Domestic Product	GDP	(%)	Bureau of Economic Analyis
GDP Price Deflator	GDPDefla	(%)	Bureau of Economic Analyis
Housing starts	Hst	*thousands*	Bureau of the Census
Industrial Production	IP	(%)	Federal Reserve Board
Initial Jobless Claims	ijob	(thousands)	Bureau of Labor Statistics
Leading Indicators	Lind	(%)	Conference Board
Monthly Treasury Budget Statement	Budge	($ Billions)	Department of the Treasury
NAPM (after 1/02 ISM Manufacturing)	NAPM	(number)	Institute for Supply Management
New Home Sales	NewH	(thousands)	Bureau of the Census
Nonfarm Productivity	NFpro	(%)	Bureau of Labor Statistics
Philadelphia Fed	Phil	(number)	Federal Reserve Bank of Philadelphia
Producer Price Index	PPIC	(%)	Bureau of Labor Statistics
Unemployment Rate	Unemp	(%)	Bureau of Labor Statistics
Wholesale Inventories	Winv	(%)	Bureau of the Census

Note: The Institute for Supply Management was called National Association of Purchasing Management before 2002

Table 2
Macroeconomic Announcements: Release dates frequency and distribution in the week days (January 1983 - March 2008)

Announcements	Starting Date	Release Frequency	Release Time	Day Mon	Tue	Wed	Thu	Fri	Number
Advance Retail Sales	Jan-83	Monthly	8:30 AM	4	77	49	94	77	301
Business Inventories	Apr-88	Monthly	10/8:30:00 AM	43	24	58	43	72	240
Change in Nonfarm Payrolls	Jan-85	Monthly	8:30 AM	10	0	1	6	260	277
Chicago Purchasing Manager	Jan-97	Monthly	10:00 AM	17	18	22	23	55	135
Consumer Confidence	Jul-91	Monthly	10:00 AM	0	144	2	3	1	150
Consumer Price Index	Jan-83	Monthly	8:30 AM	1	79	91	48	84	303
Durable Goods Orders	Jan-83	Monthly	8:30 AM	0	72	106	70	53	301
Employment Cost Index	Jan-97	Monthly	8:30 AM	0	9	2	25	9	45
Existing Home Sales	Jan-97	Quarterly	10:00 AM	40	37	19	20	19	135
Factory Orders	Mar-88	Monthly	10:00 AM	9	38	64	77	50	238
Federal Open Market Committee	Feb-94	8 per year	2:15 PM	1	75	37	5	1	119
GDP (advance, preliminary and final)	Apr-93	Monthly	8:30 AM	0	10	38	63	66	177
GDP Price Deflator (advance, preliminary and final)	Apr-93	Monthly	8:30 AM	0	10	38	63	66	177
Housing Starts	Jan-83	Monthly	8:30 AM	4	111	98	54	34	301
Industrial Production	Jan-83	Monthly	9:15 AM	28	66	60	33	116	303
Initial Jobless Claims	Jul-91	Weekly	8:30 AM	0	1	29	832	3	865
Leading Indicators	Jan-83	Monthly	8:30/10:00 AM	31	81	67	77	47	303
Monthly Treasury Budget Statement	Apr-88	Monthly	2:00 PM	49	40	42	45	61	237
NAPM (after 1/02 ISM Manufacturing)	Jan-90	Monthly	10:00 AM	83	40	31	34	30	218
New Home Sales	Mar-88	Monthly	10:00 AM	37	55	64	47	36	239
Nonfarm Productivity	Jan-97	8 per year	8:30 AM	0	30	19	36	3	88
Philadelphia Fed	Jan-97	Monthly	12:00 PM	0	0	0	135	0	135
Producer Price Index	Jan-83	Monthly	8:30 AM	3	40	21	60	179	303
Unemployment Rate	Jan-83	Monthly	8:30 AM	5	0	2	8	287	302
Wholesale Inventories	Jan-97	Monthly	10:00 AM	13	32	32	31	27	135
Total				378	1089	992	1932	1636	6027

Note: In 01/97, the business inventory announcement was moved from 10:00 am to 8:30 am whereas the leading indicator announcement was moved from 8:30 am to 10:00 am. Whenever GDP is released on the same day as durable goods orders, the durable goods orders announcement is moved to 10:00 am. On 07/96 the durable goods orders announcements was released at 9:00 am. 17 September 2001 is not included. The FOMC rate decision includes three intermeeting moves (15-Oct-98, 3-Jan-01 and 18-Apr-01).

Table 3
Summary statistics of bond indices excess return daily returns (all trading days between 3 January 1983 - 31 March 2008)

	TRSY (6M)	TRSY (1Y)	TRSY (2Y)	TRSY (3Y)	TRSY (5Y)	TRSY (7Y)	TRSY (10Y)
All sample (6307)							
Mean (annual)	5.91	6.53	7.44	8.31	9.71	10.57	11.61
SD (annual)	0.50	1.00	2.15	3.20	5.00	6.43	7.93
Sharpe ratio	11.89	6.55	3.46	2.60	1.94	1.64	1.46
autocorrelation (1 lag)	0.12	0.10	0.08	0.07	0.07	0.06	0.06
Kurtosis	19.06	15.89	11.29	9.37	8.39	8.19	8.14
Skewness	1.39	0.94	0.46	0.27	0.20	0.15	0.14
Only announcement days (3600)							
Mean (annual)	5.81	6.75	8.09	9.46	11.86	12.73	14.15
SD (annual)	0.52	1.10	2.43	3.62	5.66	7.21	8.84
Sharpe ratio	11.14	6.14	3.34	2.61	2.10	1.77	1.60
autocorrelation (1 lag)	0.12	0.09	0.05	0.05	0.04	0.03	0.03
Kurtosis	23.19	16.72	10.84	8.77	7.78	7.77	7.79
Skewness	1.75	1.25	0.60	0.36	0.27	0.21	0.20
Non-announcement days (2707)							
Mean (annual)	6.04	6.23	6.58	6.78	6.84	7.70	8.23
SD (annual)	0.46	0.84	1.71	2.54	3.95	5.21	6.51
Sharpe ratio	13.07	7.44	3.84	2.67	1.73	1.48	1.27
autocorrelation (1 lag)	0.05	0.04	0.02	0.03	0.03	0.01	0.01
Kurtosis	9.43	7.61	7.03	6.81	6.41	6.26	6.34
Skewness	0.68	-0.11	-0.25	-0.26	-0.22	-0.17	-0.18
Test mean difference announcement vs non-announcement							
P-value (one-tailed)	0.83	0.13	0.06	0.04	0.01	0.05	0.05
F test on variance difference announcement vs non-announcement							
P-value (two-tailed)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Kolmogorov-Smirnov test to compare distribution of announcement vs non-announcement							
P-value (two-tailed)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: The daily risk free rate is the 3-Month rate. The test for the mean difference allows for unequal variance in the two samples.

Table 4

Slope coefficients from OLS regression of daily excess returns on standardized macro surprises (only announcement days).

	TRSY (6M)		TRSY (1Y)		TRSY (2Y)		TRSY (3Y)		TRSY (5Y)		TRSY (7Y)		TRSY (10Y)		Mean Adj. R2
	Coeff.	tstat	Coeff.	tstat	Coeff.	tstat	Coeff.	tstat	Coeff.	tstat	Coeff.	tstat	Coeff.	tstat	
RetS	-0.01	**-4.87**	-0.02	**-4.84**	-0.05	**-6.29**	-0.07	**-5.99**	-0.11	**-5.48**	-0.13	**-5.04**	-0.16	**-5.16**	0.11
Buinv	0.00	0.19	0.00	0.97	0.01	1.66	0.01	1.40	0.02	1.23	0.02	1.20	0.02	0.97	0.06
nfarm	-0.02	**-10.84**	-0.05	**-11.91**	-0.12	**-11.65**	-0.17	**-10.98**	-0.24	**-10.17**	-0.28	**-9.27**	-0.33	**-8.42**	0.32
Chic	0.00	**-3.60**	-0.01	**-4.69**	-0.05	**-5.22**	-0.08	**-5.53**	-0.11	**-4.97**	-0.15	**-5.30**	-0.17	**-4.88**	0.20
CConf	0.00	**-2.38**	-0.01	**-2.46**	-0.03	**-2.58**	-0.04	**-2.51**	-0.07	**-2.75**	-0.09	**-2.97**	-0.11	**-2.83**	0.14
Durab	0.00	-1.87	-0.01	**-2.98**	-0.03	**-3.09**	-0.05	**-3.00**	-0.07	**-3.21**	-0.07	**-2.83**	-0.09	**-2.92**	0.05
EHS	0.00	-1.23	0.00	-1.75	-0.01	-1.46	-0.01	-1.49	-0.02	-1.25	-0.01	-0.70	-0.01	-0.56	0.10
Hst	0.00	-0.75	0.00	-1.08	0.00	-0.48	-0.01	-0.69	0.00	-0.26	0.00	-0.11	0.00	-0.15	0.00
IP	-0.01	**-3.28**	-0.02	**-3.87**	-0.03	**-3.47**	-0.05	**-3.77**	-0.06	**-3.42**	-0.08	**-3.28**	-0.09	**-3.32**	0.04
ijob	0.00	**4.32**	0.01	**4.42**	0.02	**5.79**	0.03	**5.36**	0.05	**5.49**	0.07	**5.35**	0.08	**5.19**	0.05
Lind	-0.01	-1.86	-0.01	-1.63	-0.02	-1.76	-0.03	**-2.19**	-0.04	-1.67	-0.04	-1.17	-0.05	-1.44	0.08
NAPM	-0.01	**-5.39**	-0.02	**-7.31**	-0.05	**-6.92**	-0.07	**-7.01**	-0.11	**-7.08**	-0.13	**-7.15**	-0.16	**-7.18**	0.18
NewH	0.00	**-2.53**	-0.01	**-2.51**	-0.02	**-2.64**	-0.03	**-2.89**	-0.05	**-3.23**	-0.06	**-2.91**	-0.09	**-3.27**	0.07
Phil	-0.01	**-3.01**	-0.02	**-3.64**	-0.05	**-4.82**	-0.08	**-4.90**	-0.12	**-4.67**	-0.14	**-4.36**	-0.16	**-4.17**	0.16
PPI	0.00	**-2.21**	-0.01	**-2.09**	-0.01	-1.36	-0.01	-1.19	-0.02	-1.26	-0.02	-1.10	-0.04	-1.55	0.03
Unemp	0.01	**4.78**	0.02	**4.68**	0.04	**4.45**	0.06	**3.67**	0.07	**3.07**	0.08	**2.57**	0.08	**2.22**	0.29
CPI	-0.01	**-3.19**	-0.02	**-3.89**	-0.03	**-3.14**	-0.05	**-3.32**	-0.07	**-3.08**	-0.07	**-2.66**	-0.08	**-2.51**	0.05
ECI	-0.01	**-2.86**	-0.02	**-3.69**	-0.06	**-3.21**	-0.09	**-3.27**	-0.13	**-3.21**	-0.15	**-3.16**	-0.19	**-3.07**	0.13
FacO	0.00	0.72	0.00	0.60	0.00	0.21	0.00	-0.21	0.00	0.14	0.00	-0.24	-0.01	-0.51	0.18
GDP	0.00	**-2.79**	-0.01	-1.78	-0.02	-1.75	-0.02	-1.21	-0.03	-1.13	-0.03	-0.87	-0.04	-0.99	0.06
Defla	0.00	-0.83	0.00	-0.49	0.00	0.17	0.00	0.18	0.00	0.13	-0.01	-0.31	-0.01	-0.21	0.06
Budge	0.00	1.47	0.00	**2.01**	0.01	**2.82**	0.02	**2.69**	0.03	**2.69**	0.03	**2.63**	0.03	**2.50**	0.02
Nfpro	0.00	0.89	0.00	0.42	0.00	0.41	0.01	0.53	-0.01	-0.31	0.02	0.69	0.02	0.40	0.03
Winv	0.00	-0.09	0.00	-0.64	-0.01	-1.34	-0.02	-1.31	-0.03	-1.41	-0.04	-1.34	-0.06	-1.40	0.08
FOMC	-0.02	**-5.26**	-0.03	**-4.66**	-0.04	**-2.50**	-0.05	-1.95	-0.05	-1.09	-0.03	-0.44	0.00	0.01	0.08
Mean Adj. R2	0.11		0.12		0.11		0.11		0.10		0.09		0.08		

Note: Tstats are computed using White consistent standard errors. In bold |tstat|>1.96. Each coefficient corresponds to a different regression. I present the average adjusted R-squared across the two dimensions (assets and announcements). I control for announcements occurring at the same time.

Table 5
Group announcements by type

Announcements type:
Labor
Change in Nonfarm Payrolls
Initial Jobless Claims (opposite sign)
Prices
Consumer Price Index
Employment Cost Index
GDP Price Deflator
Producer Price Index
Aggregated demand
Advance retail sales
Durable Goods Orders
Factory Orders
Real activity
Gross Domestic Product
Industrial Production
Business confidence
Chicago Purchasing Manager
Leading Indicators
NAPM (after 1/02 ISM Manufacturing)
Philadelphia Fed
Home sales
Existing Home Sales
New Home Sales
Inventories
Business Inventories
Wholesale Inventories

Note: The sign of the surprises of Initial Jobless Claims was switched to be similar to the surprises of Change in Nonfarm Payrolls.

Table 6

Slope coefficients from OLS regression of daily excess returns on standardized aggregate macro surprises (only announcement days).

	TRSY (6M)		TRSY (1Y)		TRSY (2Y)		TRSY (3Y)		TRSY (5Y)		TRSY (7Y)		TRSY (10Y)		Mean Adj. R2
	Coeff.	tstat	Coeff.	tstat	Coeff.	tstat	Coeff.	tstat	Coeff.	tstat	Coeff.	tstat	Coeff.	tstat	
Labor	-0.01	**-8.74**	-0.02	**-8.79**	-0.05	**-10.01**	-0.07	**-9.52**	-0.10	**-9.36**	-0.12	**-8.98**	-0.14	**-8.50**	0.11
Prices	0.00	**-3.98**	-0.01	**-4.04**	-0.02	**-2.90**	-0.02	**-3.10**	-0.04	**-3.01**	-0.04	**-2.98**	-0.06	**-3.09**	0.05
Agg. Demand	-0.01	**-4.49**	-0.01	**-5.01**	-0.03	**-5.38**	-0.04	**-5.29**	-0.06	**-5.04**	-0.07	**-4.73**	-0.09	**-4.88**	0.06
Real Activity	-0.01	**-4.20**	-0.01	**-4.40**	-0.03	**-4.10**	-0.04	**-3.98**	-0.06	**-3.68**	-0.07	**-3.38**	-0.08	**-3.47**	0.05
Business Conf.	-0.01	**-5.95**	-0.01	**-7.62**	-0.04	**-8.70**	-0.06	**-9.17**	-0.09	**-8.46**	-0.11	**-8.10**	-0.14	**-8.09**	0.14
Home Sales	0.00	**-2.66**	-0.01	**-3.06**	-0.02	**-3.08**	-0.03	**-3.27**	-0.04	**-3.45**	-0.05	**-2.92**	-0.06	**-3.24**	0.10
Inventories	0.00	-0.14	0.00	0.23	0.00	0.44	0.00	0.22	0.00	-0.13	0.00	-0.15	-0.01	-0.43	0.04
Budget	0.00	1.47	0.00	**2.01**	0.01	**2.81**	0.02	**2.69**	0.03	**2.68**	0.03	**2.63**	0.03	**2.50**	0.02
Cons. Confidence	0.00	**-2.29**	-0.01	**-2.44**	-0.03	**-2.64**	-0.04	**-2.61**	-0.07	**-2.83**	-0.09	**-3.03**	-0.11	**-2.91**	0.14
Hous. Starts	0.00	-0.72	0.00	-1.03	0.00	-0.44	-0.01	-0.64	0.00	-0.21	0.00	-0.05	0.00	-0.09	-0.01
NonFarm Prod.	0.00	0.91	0.00	0.43	0.00	0.42	0.01	0.55	-0.01	-0.30	0.02	0.73	0.02	0.43	0.03
FOMC	-0.02	**-5.38**	-0.03	**-4.73**	-0.04	**-2.51**	-0.05	-1.94	-0.05	-1.08	-0.03	-0.44	0.00	0.02	0.07
Mean Adj. R2	0.09		0.08		0.07		0.07		0.06		0.06		0.05		

Note: Tstats are computed using White consistent standard errors. In bold |tstat|>1.96. Each coefficient corresponds to a different regression. I present the average adjusted R-squared across the two dimensions (assets and announcements). I control for announcements occurring at the same time.

Table 7
Results from CSR of bond excess returns on announcement betas (all trading days).

	alpha			Surprise λ			R-squared	
	Coeff.	tstat adj.	p-value	Coeff.	tstat adj.	p-value		p-value
Labor	0.001	1.381	0.863	-0.041	**-3.072**	0.000	0.676	0.208
Prices	0.001	1.755	0.843	-0.038	**-2.892**	0.005	0.683	0.026
Agg. Demand	0.001	1.600	0.891	-0.039	**-3.021**	0.000	0.674	0.122
Real Activity	0.001	0.661	0.921	-0.039	**-2.999**	0.000	0.669	0.208
Business Conf.	0.002	**2.830**	0.826	-0.039	**-3.043**	0.000	0.677	0.095
Home Sales	0.002	**2.804**	0.813	-0.038	**-2.625**	0.000	0.685	0.080
Inventories	0.006	**2.834**	0.429	-0.038	-1.797	0.378	0.592	0.547
Budget	0.001	**2.171**	0.850	0.039	**2.529**	0.101	0.670	0.228
Cons. Confidence	0.003	**3.537**	0.407	-0.033	-1.841	0.002	0.723	0.003
Hous. Starts	0.011	1.834	0.639	0.036	1.389	0.482	0.404	0.780
NonFarm Prod.	0.004	**3.429**	0.324	0.037	1.850	0.233	0.485	0.615
FOMC	0.010	**2.247**	0.763	0.025	1.490	0.444	0.023	0.914

Note: The lambdas are divided by their standard deviation. Tstats are computed using Fama Mac-Beth methodology and are adjusted with Shanken (1992) correction. In bold |tstat|>1.96. The R-squared coefficients are adjusted R-squared and they are the averages of each R-squared obtained in the cross sectional regressions. The p-values are obtained performing a bootstrapping of the factors in the time-series regression. The p-values indicate the probability of obtaining a bootstrapped t-statistics greater (lower) than the sample t-statistics when the sample t-statistics is positive (negative). For the R-squared coefficients the p-values indicate the probability of obtaining a bootstrapped adjusted R-squared greater than the sample adjusted R-squared.

Table 8

Slope coefficients from OLS regression of monthly excess returns on standardized macro surprises.

	TRSY (6M)		TRSY (1Y)		TRSY (2Y)		TRSY (3Y)		TRSY (5Y)		TRSY (7Y)		TRSY (10Y)		Mean Adj. R2
	Coeff.	tstat	Coeff.	tstat	Coeff.	tstat	Coeff.	tstat	Coeff.	tstat	Coeff.	tstat	Coeff.	tstat	
RetS	-0.02	-1.54	-0.04	-1.92	-0.10	**-2.50**	-0.13	**-2.39**	-0.21	**-2.52**	-0.28	**-2.66**	-0.33	**-2.61**	0.01
Buinv	0.00	0.62	0.01	0.92	0.05	1.38	0.08	1.54	0.13	1.64	0.19	1.87	0.27	**2.04**	0.02
nfarm	-0.02	**-2.17**	-0.05	**-3.39**	-0.12	**-3.66**	-0.18	**-3.38**	-0.25	**-3.03**	-0.30	**-2.68**	-0.31	**-2.15**	0.05
Chic	-0.01	-1.34	-0.04	**-2.10**	-0.14	**-3.54**	-0.22	**-3.78**	-0.35	**-3.73**	-0.42	**-3.70**	-0.46	**-3.32**	0.04
CConf	-0.02	-1.92	-0.07	**-3.66**	-0.19	**-4.35**	-0.26	**-4.08**	-0.38	**-3.55**	-0.45	**-3.26**	-0.53	**-2.95**	0.07
Durab	0.00	-0.14	0.00	-0.16	-0.03	-0.83	-0.05	-0.84	-0.08	-0.92	-0.10	-0.92	-0.16	-1.23	0.00
EHS	-0.01	-1.41	-0.03	**-2.01**	-0.12	**-2.96**	-0.18	**-2.92**	-0.25	**-2.28**	-0.34	**-2.41**	-0.42	**-2.30**	0.13
Hst	-0.02	-1.88	-0.03	-1.63	-0.08	-1.73	-0.12	-1.80	-0.19	-1.80	-0.22	-1.67	-0.27	-1.68	0.01
IP	-0.03	**-2.53**	-0.05	**-2.63**	-0.11	**-2.66**	-0.17	**-2.74**	-0.25	**-2.61**	-0.32	**-2.77**	-0.39	**-2.84**	0.03
Lind	-0.03	-1.55	-0.05	-1.68	-0.09	-1.63	-0.13	-1.53	-0.20	-1.60	-0.29	-1.75	-0.29	-1.49	0.01
NAPM	-0.01	-1.35	-0.02	-1.27	-0.04	-0.88	-0.06	-1.05	-0.12	-1.31	-0.14	-1.18	-0.17	-1.22	0.01
NewH	-0.01	-1.84	-0.03	**-2.23**	-0.08	**-2.69**	-0.11	**-2.25**	-0.17	**-2.22**	-0.20	**-1.97**	-0.23	-1.78	0.01
Phil	-0.03	-1.89	-0.06	**-2.07**	-0.11	**-2.21**	-0.15	**-2.25**	-0.20	-1.94	-0.22	-1.73	-0.21	-1.30	0.05
PPI	-0.01	-1.32	-0.02	-1.41	-0.03	-1.03	-0.05	-1.02	-0.09	-1.13	-0.12	-1.17	-0.14	-1.11	0.01
Unemp	0.02	**2.08**	0.04	1.95	0.07	1.61	0.10	1.51	0.14	1.40	0.15	1.17	0.17	1.06	0.03
CPI	0.01	0.47	0.00	-0.23	-0.03	-0.62	-0.05	-0.74	-0.09	-0.93	-0.12	-0.95	-0.13	-0.85	0.00
ECI	-0.01	-0.38	-0.02	-0.45	-0.05	-0.74	-0.12	-1.04	-0.20	-1.12	-0.28	-1.29	-0.29	-1.06	-0.02
FacO	0.00	0.30	0.01	0.58	0.03	0.65	0.04	0.73	0.05	0.65	0.05	0.45	0.04	0.32	-0.01
GDP	0.00	-0.28	0.00	0.23	-0.01	-0.15	-0.02	-0.32	-0.03	-0.34	-0.02	-0.17	-0.06	-0.36	0.01
Defla	-0.01	-1.93	-0.01	-1.13	-0.03	-1.12	-0.04	-1.04	-0.06	-1.12	-0.08	-1.07	-0.10	-1.11	0.01
Budge	-0.01	-1.00	-0.01	-0.73	-0.01	-0.36	-0.01	-0.21	0.00	0.00	-0.01	-0.08	-0.02	-0.17	0.02
Nfpro	0.01	0.59	0.02	0.81	0.08	1.24	0.12	1.28	0.19	1.31	0.27	1.52	0.36	1.74	0.01
Winv	-0.01	-0.79	-0.02	-1.35	-0.05	-1.07	-0.06	-0.90	-0.08	-0.66	-0.07	-0.50	-0.08	-0.44	-0.02
FOMC	-0.06	**-3.13**	-0.11	**-3.18**	-0.12	-1.92	-0.13	-1.33	-0.08	-0.54	-0.04	-0.22	0.07	0.32	0.04
Mean Adj. R2	0.02		0.02		0.02		0.02		0.02		0.02		0.02		

Note: Tstats are computed using White consistent standard errors. In bold |tstat|>1.96. Each coefficient corresponds to a different regression. I present the average adjusted R-squared across the two dimensions (assets and announcements). I control for announcements occurring at the same time. I did not include the initial jobless claims announcement because it is released weekly.

Table 9

Results from CSR of bond excess returns on announcement betas using monthly and daily returns data.

	alpha		Surprise λ		alpha		Surprise λ	
Using monthly returns data					*Using daily returns data*			
	Coeff.	tstat adj.	Coeff.	tstat adj	Coeff.	tstat adj.	Coeff.	tstat adj
RetS	0.148	**7.609**	-0.125	-1.666	0.001	1.249	-0.039	**-3.049**
Buinv	0.149	**6.092**	0.130	1.462	0.002	2.479	0.039	**2.432**
nfarm	0.111	**4.477**	-0.153	-1.812	0.000	0.619	-0.041	**-3.100**
Chic	0.109	**4.388**	-0.135	-1.359	0.002	2.636	-0.037	-1.954
CConf	0.101	**3.500**	-0.121	-1.295	0.003	3.537	-0.033	-1.841
Durab	0.181	**4.575**	-0.133	-1.112	0.001	1.490	-0.039	**-3.039**
EHS	0.114	**4.416**	-0.134	-1.338	0.001	0.849	-0.037	-1.785
Hst	0.134	**5.190**	-0.134	-1.479	0.011	1.834	0.036	1.389
IP	0.142	**6.581**	-0.135	-1.764	0.001	0.709	-0.039	**-3.019**
Lind	0.139	**6.552**	-0.127	-1.656	0.001	1.095	-0.039	**-2.980**
NAPM	0.129	**3.795**	-0.142	-1.049	0.002	2.918	-0.038	**-2.562**
NewH	0.114	**4.030**	-0.107	-1.158	0.002	3.584	-0.038	**-2.639**
Phil	0.067	1.072	-0.137	-0.967	0.002	2.203	-0.037	-1.957
PPI	0.155	**4.498**	-0.123	-0.957	0.002	2.705	-0.038	**-2.766**
Unemp	0.110	**2.821**	0.138	1.354	0.000	-0.404	0.039	**3.084**
CPI	0.177	**4.169**	-0.130	-0.925	0.001	1.091	-0.039	**-3.029**
ECI	0.173	**4.208**	0.031	0.202	0.002	**2.023**	-0.037	-1.953
FacO	0.112	1.750	0.157	0.448	0.004	**3.985**	-0.037	**-2.302**
GDP	0.208	**2.148**	-0.063	-0.609	0.000	0.460	-0.031	-1.832
Defla	0.097	1.944	-0.105	-0.586	0.008	**2.488**	-0.015	-0.903
Budge	0.166	0.804	-0.143	-0.277	0.001	**2.171**	0.039	**2.529**
Nfpro	0.102	**2.209**	0.225	1.187	0.004	**3.429**	0.037	1.850
Winv	0.101	**2.466**	-0.149	-0.481	0.003	**3.450**	-0.037	-1.921
FOMC	0.240	1.452	0.088	0.776	0.010	**2.247**	0.025	1.490

Note: The lambdas are divided by their standard deviation. Tstats are computed using Fama Mac-Beth methodology and are adjusted with Shanken (1992) correction. In bold |tstat|>1.96. The R-squared coefficients are adjusted R-squared.

Table 10

Slope coefficients from OLS regression of daily and intra-day futures returns on standardized macro surprises (only announcement days and future return data from Mar. 93 to Mar. 08)

	2-year		5-year		10-year		30-year		Mean Adj. R2
	Coeff.	tstat	Coeff.	tstat	Coeff.	tstat	Coeff.	tstat	
Daily returns									
Labor	-0.03	**-6.96**	-0.06	**-6.68**	-0.09	**-6.42**	-0.12	**-5.91**	0.08
Prices	-0.01	-1.89	-0.01	-1.32	-0.02	-1.19	-0.05	-1.92	0.05
Agg. Demand	-0.02	**-3.63**	-0.05	**-3.95**	-0.08	**-3.90**	-0.11	**-3.79**	0.06
Real Activity	-0.02	**-3.78**	-0.05	**-3.07**	-0.06	**-2.99**	-0.09	**-2.82**	0.06
Business Conf.	-0.04	**-9.63**	-0.09	**-9.59**	-0.12	**-9.42**	-0.18	**-9.03**	0.16
Home Sales	-0.02	**-4.04**	-0.04	**-4.27**	-0.06	**-4.19**	-0.09	**-3.74**	0.08
Inventories	-0.01	-0.96	-0.02	-1.12	-0.03	-1.17	-0.04	-1.17	0.02
Budget	0.01	1.57	0.01	1.14	0.01	1.06	0.02	0.99	0.04
Cons. Confidence	-0.02	-1.91	-0.04	**-2.15**	-0.06	**-2.15**	-0.07	-1.62	0.08
Hous. Starts	-0.01	-1.06	-0.02	-0.70	-0.02	-0.42	0.00	-0.01	0.04
NonFarm Prod.	0.00	-0.22	-0.02	-0.96	-0.01	-0.47	-0.01	-0.31	-0.03
FOMC	-0.03	-1.61	-0.04	-0.72	-0.01	-0.09	0.05	0.63	-0.01
Mean Adj. R2	0.06		0.05		0.05		0.05		
Intra-day returns (30-minute window)									
Labor	-0.04	**-8.13**	-0.07	**-8.01**	-0.10	**-8.23**	-0.12	**-7.74**	0.14
Prices	-0.01	**-3.97**	-0.04	**-3.92**	-0.05	**-4.09**	-0.09	**-4.19**	0.17
Agg. Demand	-0.02	**-7.04**	-0.05	**-7.11**	-0.07	**-6.37**	-0.10	**-5.83**	0.16
Real Activity	-0.02	**-7.53**	-0.04	**-6.44**	-0.06	**-6.20**	-0.08	**-5.46**	0.15
Business Conf.	-0.03	**-10.84**	-0.08	**-11.14**	-0.10	**-10.62**	-0.14	**-10.55**	0.21
Home Sales	-0.01	**-4.76**	-0.03	**-4.83**	-0.04	**-4.56**	-0.06	**-4.43**	0.14
Inventories	0.00	0.12	0.00	0.25	0.00	0.41	0.01	0.57	0.07
Budget	0.00	1.81	0.00	1.46	0.01	1.33	0.01	1.75	0.00
Cons. Confidence	-0.03	**-5.12**	-0.07	**-4.97**	-0.09	**-4.96**	-0.12	**-4.74**	0.29
Hous. Starts	-0.02	**-3.31**	-0.04	**-3.30**	-0.04	**-3.01**	-0.06	**-3.04**	0.12
NonFarm Prod.	0.00	0.31	0.00	-0.37	0.01	0.52	0.01	0.67	-0.01
FOMC	-0.02	**-2.15**	-0.02	-1.74	-0.01	-0.68	0.02	0.99	0.00
Mean Adj. R2	0.12		0.12		0.12		0.11		

Note: Tstats are computed using White consistent standard errors. In bold |tstat|>1.96. The intra-day future returns are calculated as percentage return using the prices 25 minutes after the announcements and 5 minutes before the announcements. Each coefficient corresponds to a different regression. I present the average adjusted R-squared across the two dimensions (assets and announcements). I control for announcements occurring at the same time.

Table 11
Results from CSR of bond excess returns on announcement betas using daily and intra-day returns data.

	alpha		Surprise λ		alpha		Surprise λ	
Using daily returns					*Intra-day returns for betas and daily returns for λs*			
	Coeff.	tstat Adj.	Coeff.	tstat Adj.	Coeff.	tstat Adj.	Coeff.	tstat Adj.
Labor	-0.003	-1.278	-0.033	**-2.003**	-0.003	-1.277	-0.032	**-1.973**
Prices	0.002	1.085	-0.034	**-1.966**	0.000	0.133	-0.033	**-2.016**
Agg. Demand	-0.001	-0.606	-0.033	**-2.022**	-0.002	-0.948	-0.033	**-1.987**
Real Activity	-0.003	-1.205	-0.033	-1.955	-0.002	-1.066	-0.033	-1.956
Business Conf.	-0.001	-0.695	-0.033	**-2.028**	-0.002	-0.855	-0.033	**-2.009**
Home Sales	-0.002	-0.928	-0.033	**-1.989**	-0.002	-0.802	-0.033	-1.951
Inventories	-0.001	-0.461	-0.033	-1.904	0.003	0.645	0.034	0.962
Budget	-0.005	-1.168	0.034	1.582	0.001	0.279	0.034	1.161
Cons. Confidence	-0.001	-0.551	-0.033	-1.794	-0.002	-1.052	-0.033	**-1.990**
Hous. Starts	0.012	1.785	0.035	1.807	-0.002	-0.758	-0.033	-1.910
NonFarm Prod.	0.009	**2.467**	-0.012	-0.649	0.006	1.374	0.037	1.615
FOMC	0.010	**1.990**	0.035	**2.034**	0.010	**2.049**	0.035	**2.068**

Note: The lambdas are divided by their standard deviation. Tstats are computed using Fama Mac-Beth methodology and are adjusted with Shanken (1992) correction. In bold |tstat|>1.96. The R-squared coefficients are adjusted R-squared.

Table 12
Mimicking portfolio results using daily data from Jan. 1983 to Mar. 2008

	F-test p-value	Rbar	mean	mean/Sdev	T-stat	95% Bootstrapped CI	
Labor	0.00	0.11	-0.02	-0.07	-5.42	-0.026	-0.013
Prices	0.02	0.01	-0.01	-0.07	-5.68	-0.011	-0.006
Agg. Demand	0.00	0.05	-0.01	-0.07	-5.42	-0.020	-0.009
Real Activity	0.00	0.04	-0.01	-0.07	-5.50	-0.018	-0.008
Business Conf.	0.00	0.12	-0.02	-0.05	-4.20	-0.027	-0.009
Home Sales	0.01	0.03	-0.01	-0.05	-3.83	-0.019	-0.006
NonFarm Prod.	0.00	0.15	0.02	0.04	2.03	0.000	0.030
FOMC	0.00	0.42	-0.04	-0.08	-5.02	-0.053	-0.023

Note: The F-test is a jointly test on the slope coefficients of the regression of standardized surprises on seven excess bond returns. The mean is the average return of the mimicking portfolio.

Table 13

Results from CSR of bond excess returns on announcement betas and on the term spread beta (upper panel) and maturity beta (lower panel)

	alpha		Surprise λ		Term Spread		R-squared
	Coeff.	tstat adj.	Coeff.	tstat adj	Coeff.	tstat adj	
Labor	0.001	**3.213**	-0.092	**-2.368**	-0.057	-0.686	0.707
Prices	0.001	1.433	-0.396	**-2.886**	0.030	0.975	0.684
Agg. Demand	0.001	**3.441**	-0.166	**-3.147**	-0.038	-0.287	0.741
Real Activity	0.001	0.681	-0.226	**-2.979**	0.007	0.280	0.677
Business Conf.	0.002	**4.438**	-0.121	-1.948	0.008	0.144	0.749
Home Sales	0.002	**5.775**	-0.215	**-2.755**	-0.004	-0.112	0.725
Inventories	0.001	**2.081**	0.285	1.258	-0.060	**-2.141**	0.729
Budget	0.002	**5.122**	0.514	**2.206**	0.013	1.023	0.771
Cons. Confidence	0.002	**6.095**	-0.107	-1.611	0.015	0.583	0.794
Hous. Starts	0.005	1.498	**-2.067**	-1.592	-0.062	-1.133	0.492
NonFarm Prod.	0.001	0.432	-0.661	-1.669	-0.109	-0.942	0.678
FOMC	0.004	**2.604**	0.074	1.416	0.237	1.491	0.762

	alpha		Surprise λ		Maturity		R-squared
	Coeff.	tstat adj.	Coeff.	tstat adj	Coeff.	tstat adj	
Labor	0.001	**3.046**	-2.249	**-2.513**	0.000	0.753	0.777
Prices	0.001	1.425	-7.748	**-2.452**	-0.001	-0.862	0.764
Agg. Demand	0.001	**2.894**	-3.696	**-2.650**	0.000	0.263	0.769
Real Activity	0.001	1.830	-4.452	**-2.650**	0.000	0.512	0.766
Business Conf.	0.002	**4.029**	-2.438	**-2.632**	0.000	0.196	0.770
Home Sales	0.002	**3.996**	-4.412	**-2.088**	0.000	0.260	0.777
Inventories	0.001	**3.393**	9.851	1.835	0.002	**2.906**	0.719
Budget	0.002	**3.751**	7.771	**2.090**	0.001	1.135	0.778
Cons. Confidence	0.003	**3.590**	-2.291	-1.293	0.000	-0.219	0.800
Hous. Starts	0.002	**3.351**	-7.462	-1.874	0.002	**3.234**	0.682
NonFarm Prod.	0.003	**3.121**	-0.206	-0.247	0.002	**1.990**	0.705
FOMC	0.001	0.635	-0.940	-1.210	0.001	1.849	0.798

Note: Tstats are computed using Fama Mac-Beth methodology and are adjusted with Shanken (1992) correction. In bold |tstat|>1.96. The R-squared coefficients are adjusted R-squared and they are the averages of each R-squared obtained in the cross sectional regressions. All trading days were used.

Table 14

Slope coefficients from OLS regression of daily excess returns on standardized aggregate macro surprises (only announcement days) interacting with a recession dummy

		TRSY (6M)		TRSY (1Y)		TRSY (2Y)		TRSY (3Y)		TRSY (5Y)		TRSY (7Y)		TRSY (10Y)	
		Coeff.	tstat	Coeff.	tstat	Coeff.	tstat	Coeff.	tstat	Coeff.	tstat	Coeff.	tstat	Coeff.	tstat
Labor	Recession	-0.01	**-4.43**	-0.02	**-4.30**	-0.05	**-5.21**	-0.07	**-4.84**	-0.10	**-4.05**	-0.12	**-4.30**	-0.14	**-3.78**
	Expansion	-0.01	**-3.32**	-0.02	**-4.93**	-0.05	**-5.84**	-0.08	**-5.75**	-0.12	**-5.82**	-0.15	**-5.63**	-0.18	**-5.34**
Prices	Recession	0.00	-0.51	-0.01	-0.83	-0.02	-0.95	-0.02	-0.98	-0.04	-1.39	-0.04	-1.52	-0.06	-1.75
	Expansion	0.00	-1.91	-0.02	**-3.30**	-0.04	**-3.11**	-0.07	**-3.36**	-0.10	**-3.57**	-0.13	**-3.28**	-0.15	**-3.15**
Agg. Demand	Recession	-0.01	**-2.12**	-0.01	-1.03	-0.03	-1.75	-0.04	-1.71	-0.06	-1.08	-0.07	-1.38	-0.09	-1.23
	Expansion	0.00	**-2.06**	-0.01	**-2.47**	-0.02	-1.54	-0.04	**-2.15**	-0.05	-1.74	-0.05	-1.28	-0.07	-1.45
Real Activity	Recession	-0.01	-0.25	-0.01	-0.25	-0.03	-0.15	-0.04	-0.03	-0.06	0.19	-0.07	0.33	-0.08	0.70
	Expansion	0.01	0.86	0.01	0.25	0.01	0.22	0.00	-0.21	0.01	-0.10	-0.02	-0.47	-0.05	-0.75
Business Conf.	Recession	-0.01	**-4.01**	-0.01	**-3.50**	-0.04	**-3.70**	-0.06	**-4.11**	-0.09	**-3.35**	-0.11	**-3.51**	-0.14	**-3.97**
	Expansion	-0.01	**-3.20**	-0.02	**-3.57**	-0.04	**-4.16**	-0.06	**-3.67**	-0.08	**-3.40**	-0.10	**-3.10**	-0.12	**-3.17**
Home Sales	Recession	0.00	-1.04	-0.01	-1.84	-0.02	-1.78	-0.03	-1.80	-0.04	-1.68	-0.05	-1.26	-0.06	-1.43
	Expansion	0.00	-0.77	-0.01	-0.95	-0.02	-1.09	-0.04	-1.41	-0.08	-1.84	-0.10	-1.56	-0.13	-1.83
Inventories	Recession	0.00	-0.65	0.00	-0.41	0.00	0.04	0.00	0.28	0.00	0.21	0.00	0.11	-0.01	0.28
	Expansion	0.00	-0.82	0.00	-0.40	0.00	-0.09	-0.01	-0.59	-0.01	-0.17	-0.03	-0.43	-0.06	-1.01
Budget	Recession	0.00	-0.96	0.00	-1.13	0.01	0.19	0.02	-0.15	0.03	-0.24	0.03	-0.32	0.03	-0.37
	Expansion	0.00	0.05	-0.01	-1.04	-0.04	-1.73	-0.07	-1.79	-0.12	**-2.21**	-0.16	**-2.51**	-0.15	**-2.06**
Cons. Confidence	Recession	0.00	**-2.85**	-0.01	**-4.24**	-0.03	**-4.48**	-0.04	**-4.27**	-0.07	**-3.52**	-0.09	**-4.83**	-0.11	**-3.95**
	Expansion	0.00	-1.49	0.00	-1.80	-0.01	-1.64	-0.01	-1.59	-0.01	-0.91	-0.02	-0.85	-0.03	-1.09

Note: Tstats are computed using White consistent standard errors. In bold |tstat|>1.96. Each coefficient corresponds to a different regression. I control for announcements occurring at the same time. A recession is defined when the 3-month moving average of the Chicago Fed National Activity Index (CFNAI) is less than -0.7.

Table 15

Test of one factor model

From 01/1985 to 03/2008	Test	pvalue	*From 01/1990 to 03/2008*	Test	pvalue
	44.122	0.382		36.541	0.709
	Coeff	Tstat		Coeff	Tstat
Labor	-0.008	-8.845		-0.006	-7.615
Prices	-0.003	-2.925		-0.002	-2.363
Agg. Demand	-0.004	-4.670		-0.004	-4.730
Real Activity	-0.005	-4.441		-0.004	-4.020
Business Conf.	-0.008	-8.618		-0.007	-8.346
Home Sales	-0.003	-3.491		-0.003	-3.842
Budget	0.002	2.440		0.001	2.193

Note: The table reports the test statistics of one factor model based on the generalized method of moments (GMM) and the asymptotic p-values. It also reports the coefficients of vector *c* (the linear combination of the macroeconomic factors) and the associated t-statistics.

Table 16

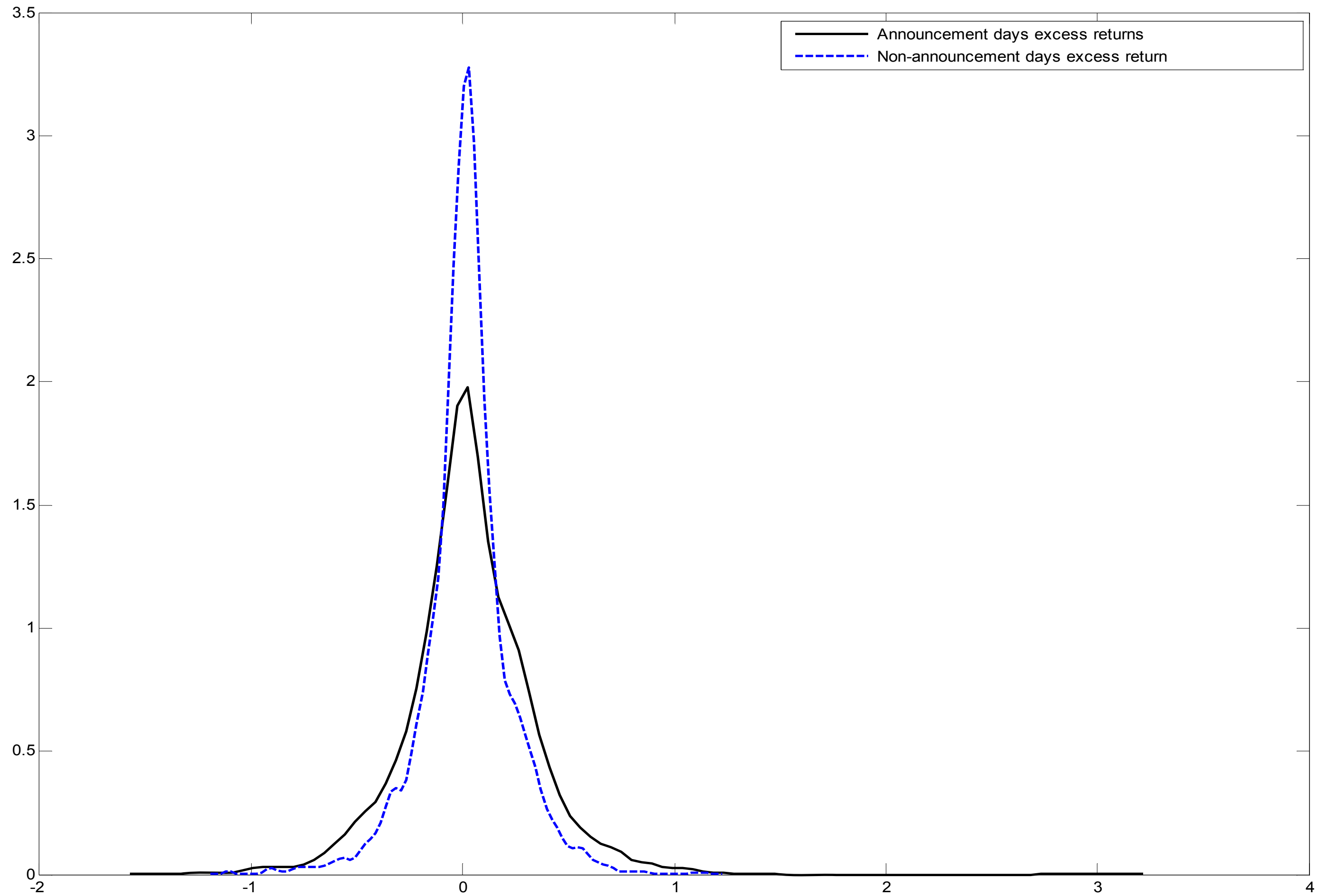
Results from regression daily unit beta portfolio excess returns on predetermined variables and announcements dummy (from January 1983 when possible)

	alpha		Term Spread		Curvature		Dummy		Rbar (%)
	Coeff.	tstat	Coeff.	tstat	Coeff.	tstat	Coeff.	tstat	
Labor	0.21	1.31	-0.09	**-2.14**	-0.03	-1.81	0.06	0.47	0.07
Prices	0.47	1.22	-0.20	-1.75	-0.05	-1.31	-1.08	**-2.88**	0.18
Agg. Demand	0.12	0.61	-0.10	-1.62	-0.02	-1.13	0.07	0.38	0.01
Real Activity	0.27	1.06	-0.13	-1.72	-0.04	-1.31	-0.76	**-2.43**	0.12
Business Conf.	0.17	1.25	-0.07	-1.83	-0.02	-1.44	-0.32	**-2.55**	0.12
Home Sales	0.39	1.14	-0.17	**-1.97**	-0.06	-1.58	-0.07	-0.21	0.01
Inventories	2.27	1.32	-0.93	**-2.14**	-0.33	-1.71	-0.89	-0.50	0.03
Budget	-0.80	-1.20	0.35	**2.07**	0.13	1.72	-0.87	-1.27	0.05
Cons. Conf.	0.71	1.81	-0.25	**-2.43**	-0.10	-1.91	-0.15	-0.46	0.09
Hous. Starts	-1.88	-0.87	1.11	1.71	0.24	1.08	8.33	**2.27**	0.13
NonFarm Prod.	-2.27	**-2.18**	0.76	**2.78**	0.34	**2.33**	0.18	0.19	0.15
FOMC	-0.47	-1.59	0.18	**2.35**	0.06	1.64	-0.06	-0.18	0.05

Note: Tstats are computed using Newey-West consistent standard errors. In bold |tstat|>1.96. The term spread is the difference between the 10-year and 1-year rate. The curvature is equal to the difference between the 3-year rate minus the difference between the 7-year rate and twice the 1-year rate divided by 3.

Figure 1

Probability density estimate for announcement and non-announcement days 5-year bond excess returns



Note: a kernel-smoothing method was used.