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Abstract

This paper examines newly-available intraday data from the interdealer government bond market to investigate the effects of economic-news announcements on prices, volume, and bid-ask spreads. By using expectational data we are able to separate out the impact of concurrent announcements. The use of intraday price data together with data on market expectations allows us to obtain new and different results relative to previous studies. We find several economic announcements to have a significant impact on two, ten, and thirty-year bond prices. For announcements that have a significant impact on bond prices, the impact occurs within one minute after the announcement. The three-month T-Bill price, on the other hand, is not impacted by the major economic announcement releases. This suggests that at least two factors of uncertainty are needed to model bond prices. For the two, ten, and thirty-year bonds we find a strong association between announcements and volume. Macroeconomic announcements do not have as much of an effect on trading volume for the three-month Treasury bill, although changes in monetary policy lead to an average trading volume up to nine times higher than at non-announcement times. Immediately after most economic announcements, bid-ask spreads widen significantly, while they tighten in the next five to fifteen minutes.

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Introduction

It is a well-established paradigm in finance that asset prices are affected by the arrival of “news.” Unanticipated changes in underlying variables can affect the cash-flows provided by an asset as well as the discount factors used to value the cash-flows. In the case of U.S. government debt, the variables likely to be relevant for pricing are those that characterize the general macroeconomic environment. In fact, unlike stocks and corporate bonds, there is little, if any, asset-specific information concerning Treasury securities. Thus far, the lack of available data on the *intraday* behavior of prices in the secondary market for U.S. government debt has made it difficult to study the impact of macroeconomic news on interest rates. For example, the papers by Hardouvelis (1988) and Urich and Wachtel (1984) analyze the impact of macroeconomic news on the change in interest rates between the close on the day preceding the announcement and the close on the announcement day. Since several announcements may take place at different times during the day, it is hard to attribute price behavior to any one of them. The recent papers by Ederington and Lee (1993) and Harvey and Huang (1993), which do consider intraday data, focus on the effects of macroeconomic news on *futures prices*. Although there is evidence that the futures market may lead the way in reacting to news, it is interesting to study how the microstructure of the secondary Treasury market, as opposed to the futures market, affects its reaction to economic news.

This paper takes advantage of a newly-available data set to investigate the effects of macroeconomic news on the prices of bonds of different maturities.¹ Specifically, we consider the most-recently issued three-month bills, two-year notes, ten-year notes, and thirty-year bonds. These maturities were selected for two reasons. First, are highly liquid and by considering them we. Second, modern bond-pricing models describe interest rates as functions of one, two, or three factors. One factor is typically identified with the short-term rate (as in the traditional one-factor models of Cox, Ingersoll and Ross (1985) or Vasicek (1977)). The second factor has been identified with the long-term rate (Brennan and Schwartz (1979)), the spread between the short and the long-term rate (Elton, Gruber, and Mei (1995) and Schaefer and Schwartz (1984)), or a time-varying central tendency of the

¹ A recent paper by Fleming and Remolona (1996) analyzes the volatility effects of announcements using the same data set. Our study differs in that we use expectational data to measure surprises, which allows us to analyze the impact of announcements on prices. Also, we consider a longer data set, and a much richer set of announcements.

short-term rate, which in turn is proxied by a linear combination of two intermediate-maturity yields (Balduzzi, Das, and Foresi (1996)).

The study of bond price behavior in response to macroeconomic announcements has relevant implications for a variety of issues. From a policy standpoint, it is important to understand the direction and size of the market response to monetary and fiscal policy announcements. For example, several articles (Cornell (1983a,b), Grossman (1981), and Urich and Wachtel (1981), among others) have investigated the “anomalous” positive response of interest rates to money supply during the 1970s and the early 80s. From the investor’s standpoint, knowing which announcements impact prices and price volatility allows effort to be directed to forecasting relevant macroeconomic variables, and has relevant implications for the pricing of short-term interest rate options. Investor interest is documented, for example, by the *Atlas of Economic Indicators* put forward by Carnes and Slifer (1991), which summarizes the “street” wisdom concerning the relative impact of different economic announcements. From the perspective of a researcher in the field of asset pricing, the investigation of price responses to announcements may shed light on the appropriate processes driving the factors which affect interest rates (Brownian motion or jump),² as well as on the number of factors required to explain observed interest -rate behavior (one, two, or possibly three).

There are *four* aspects of this study that are different and new relative to the existing literature. First, we utilize expectations data to calculate *surprises* in the economic announcements. There is ample evidence that what moves asset prices is unanticipated information, given that anticipated news is already incorporated in asset prices.³ Second, we are able to utilize data from the *interdealer market* to analyze the effect on prices. This market provides a much better indication of actual market values than quotes from a single dealer, is very active, and has continuous prices, allowing us to measure minute-by-minute impacts. Third, since the inter-dealer market trades “around the clock,” in principle we are able to analyze the impact of announcements that occur at any point in time (this may not be

² Das and Foresi (1996) for example, models the innovations in the instantaneous riskless rate as the sum of a diffusion and a jump process.

³ The original study demonstrating this behavior for common equity is Elton, and Gruber (1972). This has been followed by close to five hundred other studies in the common equity area; see the I/B/E/S research bibliography by Brown (1996) and the associated overview for a history of these studies.

possible if we restrict ourselves to the futures market). Fourth, since we use expectational data, we are able to assess the different impact of announcements which occur *simultaneously*.

While we do not put forward an explicit model, we do outline a “view” of bond-market behavior that our data allows us to test. This view consists of the following elements. First, there is evidence that the short and the long end of the yield curve behave somewhat independently (Duffie (1996)). Moreover, there is evidence that the interest rate targeting activity of the Federal Reserve impacts the behavior of short-term rates (Balduzzi, Bertola, and Foresi (1996), Balduzzi, Bertola, Foresi, and Klapper (1996), Rudebusch (1995)). This also corresponds to the bond traders’ notion that the short end of the curve is “anchored” by monetary policy, while the long end is “speculative” and it reacts to economic announcements. Hence, we expect surprises in monetary policy to affect short-term bond prices, while other macroeconomic announcements may affect longer-maturity bond prices. Second, according to a traditional decomposition, nominal interest rates reflect factors affecting the real rate of interest and factors affecting expected inflation. Hence, we expect surprises in procyclical macroeconomic indicators to affect positively bond prices, while surprises in countercyclical indicators affect them negatively.⁴ Third, given the large amount of trading in the secondary market for Treasuries, we would expect prices to adjust quickly to news; similarly, as information is processed rapidly, bid-ask spreads should widen only temporarily in response to announcements.

The main findings of our analysis can be summarized as follows. First, we find several macroeconomic surprises to have a significant impact on the price of the two- and ten-year note and the thirty-year bond. The three-month bill price, on the other hand, is not significantly affected by any of the surprises that we consider. For the ten-year note we also find a strong association between news releases and trading volume; this effect is not nearly as strong for the three-month bill, although trading in this instrument is exceptionally high in response to changes in monetary policy. This evidence is consistent with the first the first element of our view on interest rates. Second, surprises in procyclical indicators (*e.g.* Nonfarm Payrolls) affect bond prices negatively, while surprises in countercyclical

⁴ In this respect, analyzing bond prices as opposed to stock prices is much easier. In fact, in the context of a present value model, bond prices are affected by discount rates only. On the other hand, stock prices are affected by variation in both expected cash flows and discount rates (Campbell and Mei (1993)). This means that announcements which affect in the same direction expected cash flows and discount rates may have an ambiguous

indicators (*e.g.* Initial Jobless Claims) affect bond prices positively. This evidence is consistent with the second element of our view. The ten-year note price adjusts to the important surprises within the first few minutes after the announcement, and the bid-ask spreads widens at the time of the announcement, but then reverts to its usual values immediately after. This evidence is consistent with the third element of our view.

The paper is organized as follows: Section 1 provides a review of the relevant literature. Section 2 describes the data set and the test methodology. Section 3 looks at the effects of different macroeconomic surprises. Section 4 concludes.

1. Literature Review

While there have been hundreds of studies on the effect of information on common stock prices,⁵ there have been relatively few in the fixed income area, and almost none using intraday bond prices. There are a large number of macroeconomic announcements that could impact bond prices. It is important from a policy standpoint, as well as from the point of view of an investor, to understand which announcements impact prices, and by how much.

Because of the lack of intraday bond data, we know of only one other study of the effect of macroeconomic announcements on bond prices at the intraday level: Fleming and Remolona (1996). Their main finding is that macroeconomic announcements induce higher volatility during the first few minutes after the announcement, and this volatility is accompanied by an increase in trading volume. While their study shares with ours the source of the intraday bond data, the focus and scope of their analysis is quite different. First, they examine monthly announcements using only one year of data: this paucity of observations makes their statistical inference somewhat unreliable, and constrains them to group together all announcements taking place at the same time during the day. Second, they consider a narrower set of economic announcements than we do. Third, their study only looks at bond-price

impact on prices. This is the case, for example, of the industrial production surprise examined in McQueen and Roley (1993), whose impact on stock prices changes in sign depending on the stage of the business cycle.

⁵ For a summary of the expectational literature, see Brown (1996).

volatility in response to an announcement and do not infer the direction of price changes nor separate the influence of concurrent announcements. Finally, their study considers only one instrument, the five-year note, and hence only one point in the yield curve.

Ederington and Lee (1993) perform a similar study using intraday Eurodollar and Treasury bond futures prices. They find the volatility of the two futures prices to be significantly higher during the first fifteen minutes after an announcement, for seven and six commonly-watched economic announcements, respectively. Like Fleming and Remolona (1996), Ederington and Lee (1993) do not use expectational data, and hence do not attempt to relate price reactions to economic surprises nor separate out the effects of concurrent announcements. Harvey and Huang (1993) consider the same two futures contracts and relate the higher volatility of prices to the release of six major economic announcements.⁶ Relative to both studies, the present paper differs in that we look at the *direct* impact of economic announcements on bond prices in the interdealer market, rather than on the volatility of futures prices. In addition, we analyze the impact on a much larger set of announcements. Especially, we include the announcement of changes in monetary policy, which other studies (Balduzzi, Bertola, Foresi, and Klapper (1996), and Cook and Hahn (1990)) have found to be significant. Moreover, we study announcements such as the money supply announcement, which takes place when the futures market is *closed*. Also, our use of expectational data allows us to *differentiate* between the effects of the various announcements. Finally, neither of the two studies mentioned above considers the effect of economic announcements on volume and bid-ask spreads.

In summary, this is the first study which i) considers a long sample of intraday observations in the secondary market for U.S. bonds, ii) looks separately at concurrent announcements, iii) relates the price changes to the size of the surprise, and iv) considers the effects of changes in monetary policy.

⁶ Harvey and Huang do examine the effect of surprises only for the industrial production announcement.

2 The Data

2.1 Bond Prices

We consider data from the secondary market for Treasury bonds for the June 1991-September 1995 period. The data is collected by the firm GovPX from four out of five inter-dealer brokers: Garban, Hilliard Farber, Liberty and RMJ. These brokers cover approximately 75% of the trades in the market.⁷

The interdealer market is much more active than the retail market for any single dealer, producing an almost continuous stream of price changes.⁸ Finally, the observed bid and ask quotes are “real,” in the sense that they represent prices at which dealers are committed to trade at least the stated amounts.⁹

In our analysis, we consider the price and trading volume information for the following instruments: the most-recently-issued (“on the run”) three-month bill, two-year bill, ten-year note, and thirty-year bond. These are two instruments for which trading is intense, and thus the market is liquid. They are also instruments frequently used in asset pricing tests. The availability of data for different maturities allows us to evaluate the impact of news announcements at several different points in the yield curve. This type of analysis would not be possible using data on interest-rate futures contracts only.

2.2 Survey and Announcement Data

The data on economic announcements and expectations are from Money Market Services (MMS), a San Francisco-based corporation which has conducted telephone surveys since late 1977.¹⁰ We consider the 27 economic news announcements shown in Table 1.

⁷ The data was provided to us in the form of “feed” files. We were able to produce time series of prices with the help of the software firm C-SCAPE.

⁸ In addition, bid-ask spreads are extremely small, allowing for a more accurate measurement of returns.

⁹ See Elton and Green (1996) for a more detailed description of the data set.

¹⁰ The MMS survey data has been extensively used in previous studies of announcements effects; see, for example, McQueen and Roley (1993), and Urich and Wachtel (1984).

As shown in Table 1, twelve of the announcements occur at 8:30, two at 9:15, eight at 10 o'clock, one at 2 PM, one at 3 PM, and three at 4:30 PM. Most of the announcements are made monthly, although M1, M2, M3 and initial jobless claims are announced weekly. Also shown in Table 1 is the number of times any announcement was made at a time that coincided with a second announcement. For example, non-farm payrolls and the civilian unemployment rate are always announced at the same time. Expectational data serves two purposes. First, there is ample evidence from other markets that it is the surprise in the announcement that the market reacts to. Thus, we use expectational data along with the announcement to measure the information content in any announcement. Expectational data also allows us to separate the effects of simultaneous announcements. For example, it may be that the non-farm payroll figure was different than expected, while at the same time the unemployment rate was exactly as expected (because of a contemporaneous change in the workforce and in the number of employed workers). Without using expectational data, it would appear that the market is reacting to both announcements. However, using expectational data it is clear that the new information concerns the non-farm payroll figure.

While we would expect macroeconomic announcements to be especially influential at the intermediate and long end of the yield curve, academics and market participants alike attach particular significance to the stance of monetary policy when assessing the outlook for short-term interest rates. In fact, the recent papers by Balduzzi, Bertola, and Foresi (1996), Balduzzi, Bertola, Foresi, and Klapper (1996), and Rudebusch (1995) show that interest rate targeting is especially influential on the overnight fed funds rate and on other money-market rates. Hence, we also examine the possible impact of changes in monetary policy, as they are summarized by changes in the fed funds rate target: the rate on which the open market operations of the trading desk of the Federal Reserve Bank of New York were based (or "indications of the fed funds rate expected to be consistent with the degree of reserve pressure specified by the Federal Open Market Committee"). Until 1994, these changes were mainly implemented in response to the employment announcement, within a few days after the announcement (Cook and Korn (1991)). The implementation of the change in policy was not explicitly announced, although the market was able to infer it from the desk's trades, which are implemented

during "Fed time:" from 11:30am and 12:00.¹¹ Hence, for the 1991-1993 period, we take the time of the announcement of a change in policy to be 11:30am. Beginning with 2/4/94, explicit announcements were made to the public, on the same day of the meeting of the Federal Open Market Committee (FOMC). This recent institutional feature allows us to identify for the 1994-1995 period both nonzero and *zero* target changes: zero target changes occur when, on the day of an FOMC meeting, the Board would announce that no change in monetary policy was decided. With two exceptions, all announcements were made within one or two minutes of 2:15pm. Summary statistics of target changes with dates and times are presented in Table 2.¹²

3. Economic News and Bond Prices

3.1 Methodology

The simplest way to measure surprises in the economic variables is to assume that expectations immediately before the announcement are the same as those held on the date expectations were surveyed.¹³ Let F_i and A_i denote the forecast value and announcement respectively for announcement i . We can measure the forecast error as:

$$E_i = A_i - F_i$$

The difficulty with using the forecast errors as surprises is that they do not account for the difference in units of measurements across economic variables. Thus we divide the forecast errors by their standard deviation across all observations. Thus our surprise measure is:

$$S_i = E_i / \sigma_i$$

¹¹ See Harvey and Huang (1994) for an analysis of the effect of open market operations on futures prices.

¹² Expectations on the next target change were based on the MMS surveys of expected average overnight fed funds rates for the following bank reserves' maintenance periods.

¹³ Actually, since expectations are martingales, the expectation on an economic variable at the time of the announcement should equal the expectation at the time of the survey, plus a mean-zero innovation.

Hence, when regressing bond returns on surprises, the regression coefficient is the change in return for a one standard-deviation change in the forecast error.

We had some additional concerns about our surprise variable. First, other news reach the market between the time of the survey and the time of the announcement, and these announcements could affect expectations. In other words, there is measurement error around our surprise variable, which is given by the expectation revision over the time interval between the survey and the announcement. The importance of this measurement error depends on the amount of expectations revision. We tested for this effect by regressing surprises on the price change between the time of the survey and five minutes before the announcement.¹⁴ With few exceptions, the R-squared of the regression is very low (less than 10%), hence we conclude that the expectations-revision does not substantially affect our measure of surprise.

A second concern regards the accuracy of the MMS survey data as opposed to other surveys. For this purpose we compared the MMS survey medians to the Bloomberg survey medians during the 1994-1995 period (the only period for which the Bloomberg survey data was available), for the Unemployment Rate, Nonfarm Payrolls, CPI, and PPI. The difference between the survey medians is always very small as a percentage of the average of the two individual surveys (at most 6%), hence we conclude that there is substantial consensus in the market on the expected value, and that the MMS survey data are an accurate representation of such consensus.

One last concern regards the fact that several series are then revised after the announcement. To the extent that the figure released at the time of the announcement is the best estimate of the actual figure, the market should try to anticipate it and then react to it. Hence, the possibility of a revision of the series should not introduce any additional measurement error.

To analyze the effect of economic news on bond prices, we ran the following linear regression at each announcement time:¹⁵

¹⁴ McQueen and Roley (1993) perform a similar test by regressing the announced value on the survey value and on the price change over the period between survey and announcement. They then use the residuals from this regression as the surprise variable. We do not follow their route since the R-squares that we obtain from similar regressions are always very low.

¹⁵ We also estimated regression models where the effects of positive and negative surprises are allowed to differ. The results are very similar to those of the simple regression model here, and hence are not reported. We

$$(P_{it} - P_{-5i}) / P_{-5i} = \alpha_{it} + \beta_{it} S_i + \sum_{k=1}^K \alpha_{ik} S_k + e_{it}$$

where

1. P_{it} is the price at time t after announcement i . Prices are measured as the average between the bid and ask quotes.
2. P_{-5i} is the price five minutes before the announcement.
3. β_{it} is the sensitivity of the price to the announcement.
4. α_{ik} is the sensitivity of the price to concurrent announcements.
5. t is the time the price is measured.

We perform a cross-sectional regression every minute after the announcement for the first five minutes, and then every five minutes for the next hour. The intensity of trading in these markets, especially around announcement times, ensures that some trades always occur between any two price observations. Table 3 shows the estimated betas for the regressions for the 3-month, 2-year, 10-year, and 30-year issues. Three numbers are reported. The top number under coefficient is the average sensitivity. For example, the estimate -.139 reported for the coefficient of the Consumer Price Index for the 10-year bond is the average of the seven betas obtained from running the cross-sectional regressions at 1, 2, 3, 4, 5, 10, and 15 minutes after the announcement. The number that we report under each average beta estimate is the number of times the beta is significant at the 5% level using a two-tailed t-test. Thus, the 2/7 for Consumer Price Index indicates that the beta estimate was significant in two out of seven cross-sectional regressions. The averaged R-squared for the seven regressions is also reported.

Table 4 summarizes the overall significance of our findings and compares them to the anecdotal evidence presented in the book by Carnes and Slifer (1991) and the statistical results of Ederington and Lee (1993) and Fleming and Remolona (1996). Carnes and Slifer (1991) is a widely used reference in money and banking textbooks, and provides a qualitative classification of the relevance of the different announcements in terms of “stars.” Four stars are assigned to the announcements the authors believe

did not attempt to estimate a model where the slope coefficients change according to the phase of the business cycle, as in McQueen and Roley (1993), since our sample only covers a period of economic expansion.

are most relevant, three stars to the less relevant, and so on. A single star denotes announcements that are not especially relevant. The table reports the stars assigned by Carnes and Slifer, where the single star is replaced by a dash, two stars are replaced by a single star, and so on. The significance of the findings of Ederington and Lee (1993) and Fleming and Remolona (1996), who look at the impact on price volatility, is also summarized by stars: one star for announcements significant at the two-percent level, two stars for announcements significant at the .5-percent level, and three stars for the announcements significant at the .01-percent level. Announcements that were studied, but found not significant are characterized with a dash. As to the present study, we assign three stars to announcements that have six or more significant coefficients in the percentage price change regressions, and no stars otherwise.

We now turn to a more detailed analysis of our results.

3.2 Which Macroeconomic Announcements Affect Prices?

Table 3 illustrates the response of the 3-month, 2-year, 10-year, and 30-year bonds to various economic surprises. The table shows the price response to the surprise in the fifteen minutes after the announcement. In a later section we will show that the impact of surprises on prices occurs within the first five minutes. In all cases where we find significant betas, the sign of the coefficients agree with the arguments put forth in existing literature about the specific direction a macroeconomic variable should have on prices. The table also reports the average R-squares for the various cross sectional regressions. It is comforting to notice that several R-squares are quite substantial (45.2% for the Nonfarm Payroll regression, for the two-year note, for example) indicating that macroeconomic surprises do capture a substantial portion of price variability at announcement times. Note that there is a clear difference between the impact on prices for the 3-month bill and the price impact for the 2, 10, and 30 year bonds. Before addressing this issue, we will discuss the effects of announcements at long and intermediate maturities.

Table 5 reports the average coefficients for regressions of 10-year price changes for up to one hour after the announcement.¹⁶ There are three announcements where we have different signs on the betas for different times after the announcement. These are Merchandise Trade Balance, Construction Spending, and Weekly M3 Medians. In none of these cases are any of the sensitivities significant. Furthermore, two of these announcements are announcements where there are no strong priors as to their effect on bond prices. The important announcements are Durable Goods Orders, Initial Jobless Claims, Non-farm Payrolls, Producer Price Index, Consumer Confidence, NAPM Index, and New Home Sales. These are shown in Table 4 with triple stars. Also shown in Table 4 are variables which other studies have found important. There are some substantial differences between our results and prior studies. First, consider Non-farm Payrolls and Civilian Unemployment. These are both 8:30 announcements, and they are announced together. Thus, without using expectational data, there is no way to separate their influence. Examining Table 4 shows that prior authors have found them equally important. However, examining Table 3 shows that the surprises in Civilian Unemployment do not affect price changes around announcements, whereas surprises in Nonfarm Payrolls highly affect price changes. What we have shown is that it is the Non-farm Payrolls figure that affects bond prices, while Civilian Unemployment is unimportant.¹⁷

Likewise, consider the National Association of Purchasing Managers (NAPM) Index and Construction Spending. Previous studies have not attempted to distinguish between the effects of the two ten o'clock announcements, and therefore find them equally important. Once again, examining Table 1 shows that 43 out of 50 times they are announced at the same time. Using expectational data, we are able to show that it is the NAPM Index and not Construction Spending that affects bond prices. In fact, not only are the sensitivities for Construction Spending insignificant; they vary in sign. Again, this shows the importance of using expectational data in comparing announcement effects. The last variable which we find significant and overlaps with other variables is Weekly Initial Claims. This announcement often occurs at the same time as other announcements. Of the remaining 8:30 announcements, Durable Goods Orders, and to a lesser extent the Producers Price Index, are generally announced by themselves. Like others, we find them significant. Finally, of the 10:30 announcements

¹⁶ The results for the two-year and thirty-year bonds are very similar.

¹⁷ This result confirms the findings of Cook and Korn (1991) for the 1985-1991 period.

we find New Home Sales to be significant. To sum up, the use of expectational data has allowed us to separate out simultaneous announcements and has resulted in a different set of announcements being important, relative to prior studies.

When we consider the sign, as well as the statistical significance of the various sensitivities reported in Tables 3, we obtain the following overall picture: the procyclical variables, such as CPI, Durable Goods Orders, and Nonfarm Payrolls almost always have a negative impact on bond returns, even when the effect is not significant. Vice versa, the countercyclical variables, such as Weekly Initial Claims and Civilian Unemployment have a positive impact on bond returns.

A further confirmation of this overall picture is provided by Figure 1 and Figure 2 which report the average percentage price change for the ten-year bond, in response to positive and negative surprises for the four significant 8:30 announcements and for the three significant 10:00 announcements. Again, prices respond positively, on average, to positive surprises in the countercyclical indicators (Initial Jobless Claims), while they react negatively to positive surprises in the procyclical indicators (all the other variables).

As mentioned above, the impact of the announcements on the three-month bill prices is quite different. Macroeconomic announcements have much less impact on the three-month rate. The only three announcements with many significant sensitivities over the first hour are Housing Starts, Initial Jobless Claims, and New Home Sales. However, Housing Starts and Initial Jobless Claims sometimes show a positive and sometimes a negative impact; this alternating sign at different time intervals is not economically plausible. Furthermore, New Home Sales show only 4 significant sensitivities out of a possible 16, so at most its effect is marginal. Finally, none of the announcements show significant price changes in the first 15 minutes (see Table 3) whereas for other announcements, all of the impact occurs within the first 5 minutes. This evidence suggests that macroeconomic announcements do not affect the prices of 3-month bills.

The lack of impact of macroeconomic announcements on the three-month bill price is consistent with the common wisdom among bond traders. However, it should be noted that most researchers estimating term structure models use a short-maturity rate as a proxy for the instantaneous riskless rate (*e.g.* Chan, Karolyi, Longstaff, and Sanders (1992)). In one-factor models, the dynamics of this short rate drive the entire yield curve. Hence, by focusing on one short-maturity rate these

models can only deliver little volatility in yields, and cannot capture the effect of macroeconomic variables on the different rates.

The strong effect of a number of macroeconomic announcements on the intermediate- and long-term bond prices, along with a very limited impact on the three-month rates is strong evidence of the need for a multi-factor term structure model. Macroeconomic announcements have a large impact on long rates and the spread, and little impact on short rates. The next issue is the speed of the impact

A. Speed of Impact

Consider Table 5 and examine the significant announcements. For any announcement, the surprise is a single number. Thus, if we examine any row in Table 3, the regressions differ only by the price change (the regressor is the same). If the price moves quickly to an equilibrium price, after the announcement we should see that the betas are the same along any row. If information takes a while to be incorporated into prices, then the pattern of betas should slowly increase as we move across any row. For Durable Goods, Weekly Initial Claims, Producers Price Index and Consumer Confidence, the price adjustment is in the first few minutes. For Non-farm Payrolls, New Home Sales, and the NAPM Index, the adjustment takes at most five minutes to be completed. Figure 1 and Figure 2 plot the price adjustment for the seven important announcements. The graphs show the price movement for the positive and negative surprises. As can be seen from the graphs, the price change after one minute (the first one measured) for most announcements is very close to the average price change over any interval. These are exceptionally fast price responses compared to other markets. This is strong evidence of the efficiency of the interdealer government bond market.

B. Size of Response

The seven macroeconomic announcements that significantly affect bond prices have differing impacts in terms of the magnitude of price changes. Per unit of standard deviation of surprise, the most important is Non-farm Payrolls. This is the announcement that traders we interviewed said they most closely followed. To get some idea of the importance of this announcement, note that the average

absolute value of the daily price change for the 10-year note is .31 and the average absolute price change for five minutes at nonannouncement times is about .03. Thus, a one standard deviation surprise in nonfarm payrolls leads to a price change greater than the normal daily absolute value of price change and 15 times the normal five minute absolute price change. Next in importance is the Producers Price Index. For the Producer Price Index a one standard deviation surprise leads to a price change of about 60% of the normal daily absolute value of price change and 6 times the normal five minute absolute value of price change. The Durable Goods Orders, NAPM Index, Consumer Confidence, and New Home Sales are of roughly equal importance, with Weekly Initial Claims being the least important. These announcements have price changes from 20 to 30 percent of the normal daily absolute price change and two to four times the average absolute five minute price change. The 40th and 60th deciles of daily price change differ from the mean by more than the magnitude of the effect of a one standard deviation surprise for these four announcements. Thus, capturing the effects of surprises on prices for these announcements would be difficult using daily price data.

C. The Effect of Monetary Policy

We also analyzed the effect of the announcements of changes in the Fed funds target rates shown in Table 2. Given the limited number of observations where we were able to precisely determine the release time (the last 9), none of the beta coefficients is significant. However, some insight into the effects of changes in the fed funds rate target are summarized in Figure 3, which shows the price response to positive and negative surprises in the target change for the 3-month bill and the 10-year note. The figure shows that T-bill prices respond negatively to positive unexpected changes in the target and positively to negative unexpected changes. Ten-year bond prices, on the other hand, tend to be positively affected by both positive and negative target surprises. This evidence further confirms the different behavior at the short and long ends of the yield curve.

4 Economic News and Bond Trading

4.1 Effect of Announcements on Volume

In this section we examine the impact of different macroeconomic announcements on trading volume in the interdealer market. Table 6 presents the ratio between the average trading volume over different intervals preceding and following announcement times and the average volume over the same interval on days when no announcement took place. Ratios are reported for the ten-year note and the three-month bill.¹⁸

For the ten year note, we find consistent patterns of volume for each of the announcements which have a significant impact on prices. In the five minutes before the announcement, volume is either not different from or significantly less than trading volume on nonannouncement days. Within the first five minutes after the announcement, trading volume grows to about 1½ times the average volume for that time period on nonannouncement days. The volume ratio continues to grow in the following ten minutes, up to twice the size of the nonannouncement average, but then declines after another 15 minutes, while still remaining above normal.¹⁹ For the three-month bill, we find that volume is substantially higher around announcements. However, the pattern is erratic, suggesting that the increased volume is not related to the specific announcement but rather a general increase in trading, possibly as a consequence of the implementation of hedging strategies. One announcement that does significantly affect trading volume in both instruments is changes in the Fed funds target rate. Announcements of changes in the Fed funds target rate will be in all subsequent tables because the effect seems to be unusually high. For the ten-year note, average trading volume is 1½ times the average on nonannouncement days. For the three-month bill, volume increases are much larger, reaching 8 to 9 times the normal volume for the 2:15 policy change announcements.

¹⁸ We also ran regressions of volume against the absolute size of economic surprises, in the same way as we did with bond returns. We found little evidence of a statistically reliable relation between volume and surprises, even for the announcements that significantly affect bond prices. This is consistent with the notion that traders wait until the key announcements are made to adjust their portfolios.

We also found that several of the announcements that exhibit significant increases in volume at some point after their release time are also announcements for which the forecast error does not appear to affect prices (these results are not reported in the table). This does not seem unreasonable when we consider the number of times non-significant announcements overlap with announcements that do move prices. Even the observed trading volume after the 9:15 announcements may be effected by important announcements released 45 minutes earlier.

4.2 Effect on Bid-Ask Spread

In this section we examine the impact of different macroeconomic announcements on the bid-ask spread.²⁰ Table 7 presents the ratio between the average bid-ask spread at different times before and after the announcement and the average bid-ask spread at the same times during non-announcement days for the ten-year note and for the three-month bill, respectively.

For most of the 8:30 and 9:15 announcements, for both the ten-year note and the three-month bill, we find a significant widening of the spread exactly at the time when the announcement is made. The spread then reverts to its normal values after five to ten minutes.

There are several theories that predict this response. First there is an asymmetric information argument that predicts a widening of the spread because of the fear that traders may have better information (Glosten and Milgrom (198?)). Since there should be no leakage of information before the announcements are made, and since the information relevant for the bond market is very widespread, information differentials arise because of the different ability to process information, rather than the difference in the signals themselves. A second argument is that the presence of a bid ask spread is an “option to trade” offered by the market maker to traders (Copeland and Galai (198?) and Ho and Stoll (198?)); the price of the option is the bid-ask spread itself. As volatility increases because of the announcement, the value of the option increases, and this should be reflected into a widening of the spread.

¹⁹ This pattern is strongest for the 8:30 announcements, which is reasonable since relative to announcements later in the day there is less potential for there to be other information affecting trading.

²⁰ Once again, we find no relation between the size of the bid-ask spread and the surprise component of the announcement.

4.3 Price Volatility

We also examine price volatility around announcements. We measure this by the mean absolute value of the price changes on announcement days over the mean absolute value of price changes during the same time interval on nonannouncement days. For almost all announcements, volatility is significantly higher after announcements. The evidence is strongest for the announcements that we find to significantly impact prices. The notable exception again is Fed funds target rate changes. In Table 8, we present volatility ratios for the important announcements. The magnitude of the volatility increases for Fed funds target changes is among the highest of all the announcements we study, and the ratio of mean absolute deviations is much higher for the three-month bill than for the ten-year note. This is further evidence of the overall importance of monetary policy for bond prices, and of its special influence at the short end of the yield curve.

5 Conclusions

This paper examines the effect of macroeconomic announcements on the price, volatility and bid-ask spread of Treasury securities. To analyze price effects, we use intraday data of bid and ask quotes from the interdealer government bond market. This database provides a continuous posting of bids and asks, and the trading is sufficiently intense that in most cases there are multiple trades every minute. This allows us to measure impact on price at very short intervals. Many announcements are made concurrently. By using a database on forecasts, we are able to measure the surprise component of any announcement. This allows us to separate out the impact of concurrent announcements. While previous researchers have grouped simultaneous announcements together, we find that in several cases of important announcement pairs only one of the two announcements has a significant impact on prices. Because of our ability to separate out the impact of concurrent announcements, and because we analyze a larger data set, the announcements that we find important differ from what other researchers have found.

We find that macroeconomic announcements are incorporated in bond prices within one minute of the announcement for most significant announcements. This implies that the interdealer government bond market is highly efficient. We also find a strong impact of announcements on ten-year rates and almost none on three-month rates. In contrast, changes in Fed policy seem to impact mainly the three-month rate. This strongly suggests that at least two factors are needed in equilibrium bond pricing models.

We also consider the effect of announcements on transaction volume, bid-ask spreads, and price volatility. The announcements whose surprise component significantly affects prices also have a significant impact on volume, bid-ask spread, and price volatility. Interestingly, we find that several announcements whose surprise component does not affect bond prices trigger a significant increase in trading volume, the size of the bid-ask spread, and price volatility.

Table 1.
Contemporaneous Announcement Releases

The table contains the number of times each announcement is released concurrently with other announcements. The sample covers 6/17/91 to 9/29/95.

8:30 Announcements

		1	2	3	4	5	6	7	8	9	10	11	12
Civilian Unemployment	1	51	0	0	0	7	1	0	51	0	0	0	0
Consumer Price Index	2	0	51	0	5	0	11	5	0	0	18	5	4
Durable Goods Orders	3	0	0	51	0	0	14	0	0	0	0	0	0
Housing Starts	4	0	5	0	51	0	8	0	0	0	0	1	1
Index of Leading Indicators	5	7	0	0	0	50	4	0	7	0	0	0	0
Initial Jobless Claims (weekly)	6	1	11	14	8	4	219	19	1	18	19	22	22
Merchandise Trade Balances	7	0	5	0	0	0	19	39	0	0	0	39	38
Nonfarm Payrolls	8	51	0	0	0	7	1	0	51	0	0	0	0
Producer Price Index	9	0	0	0	0	0	18	0	0	51	14	0	0
Retail Sales	10	0	18	0	0	0	19	0	0	14	51	0	0
U.S. Imports	11	0	5	0	1	0	22	39	0	0	0	51	51
U.S. Exports	12	0	4	0	1	0	22	38	0	0	0	51	51

9:15 Announcements

		13	14
Capacity Utilization	13	51	51
Industrial Production	14	51	51

10:00 Announcements

		15	16	17	18	19	20	21	22
Business Inventories	15	51	0	0	0	0	0	0	0
Construction Spending	16	0	50	1	0	43	1	5	5
Consumer Confidence	17	0	1	50	0	1	10	0	0
Factory Orders	18	0	0	0	50	3	0	2	2
NAPM Index	19	0	43	1	3	51	1	5	5
New Home Sales	20	0	1	10	0	1	51	7	7
Personal Consumption	21	0	5	0	2	5	7	50	50
Personal Income	22	0	5	0	2	5	7	50	50

2:00 Announcements

Treasury Budget	23	51
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3:00 Announcements

Consumer Credit	24	51
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4:30 Announcements

		25	26	27
M1 Medians (weekly)	25	223	223	223
M2 Medians (weekly)	26	223	223	223
M3 Medians (weekly)	27	223	223	223

Table 2.
Changes in the Federal Funds Target Rate

Changes in the Fed Funds Target Rate are reported for the time period 6/17/91 to 9/29/95. After 2/4/94, the Federal Reserve usually announced policy changes at Board meetings. After this date, meeting dates were included when the Fed did not act.

Date	Release Time	New Target Rate	Basis Point Change
8/6/91	11:30	5.50	-25
9/13/91	11:30	5.25	-25
10/31/91	11:30	5.00	-25
11/6/91	11:30	4.75	-25
12/6/91	11:30	4.50	-25
12/20/91	11:30	4.00	-50
4/9/92	11:30	3.75	-25
7/2/92	11:30	3.25	-50
9/4/92	11:30	3.00	-25
2/4/94	11:00	3.25	25
3/22/94	2:15	3.50	25
4/18/94	2:15	3.75	25
5/17/94	2:15	4.25	50
7/6/94	2:15	4.25	0
8/16/94	1:29	4.75	50
9/27/94	2:15	4.75	0
11/15/94	2:15	5.50	75
12/20/94	2:15	5.50	0
2/1/95	2:15	6.00	50
3/28/95	2:15	6.00	0
5/23/95	2:15	6.00	0
7/6/95	2:15	5.75	-25
8/22/95	2:15	5.75	0
9/26/95	2:15	5.75	0

Table 3.
The Affect of Announcement Surprises at Different Points on the Yield Curve.

For each announcement type i , we run the following regressions:

$$(P_{ti} - P_{-5i}) / P_{-5i} = \alpha_{ti} + \beta_{ti} S_i + \sum_{k=1}^K \alpha_{tk} S_k + e_{ti},$$

where P_{ti} is the price of the instrument t minutes before or after announcement i , S_i is the standardized surpris for announcement type i , and k denotes other announcements occurring at the same time as announcement i . The table reports the average coefficient β_{ti} for regressions 1, 2, 3, 4, 5, 10 and 15 minutes after th announcement. Reported below the averages is the number coefficients included in the average which ar significant at the 5% level, along with the total number of coefficients included in the average. The averag value of R^2 for the regressions is also reported.

	3 Month		2 Year		10 Year		30 Year	
	Coeff.	R ²	Coeff.	R ²	Coeff.	R ²	Coeff.	R ²
8:30 Announcements								
1 Civilian Unemployment	0.006 0/6	0.035	0.021 0/7	0.452	0.037 0/7	0.408	-0.044 0/7	0.357
2 Consumer Price Index	0.000 0/7	0.056	-0.032 1/7	0.198	-0.139 2/7	0.290	-0.233 1/6	0.356
3 Durable Goods Orders	0.010 0/7	0.058	-0.048 6/7	0.367	-0.121 7/7	0.326	-0.166 7/7	0.337
4 Housing Starts	0.006 1/7	0.052	-0.023 6/7	0.320	-0.058 1/7	0.139	-0.082 2/7	0.194
5 Index of Leading Indicators	-0.003 0/7	0.011	-0.005 0/7	0.515	-0.015 0/7	0.402	-0.021 0/7	0.017
6 Initial Jobless Claims (weekly)	-0.001 1/7	0.015	0.020 7/7	0.084	0.056 7/7	0.063	0.049 3/7	0.040
7 Merchandise Trade Balances	0.000 0/6	0.190	0.003 0/7	0.350	-0.001 0/7	0.334	0.157 0/7	0.336
8 Nonfarm Payrolls	0.005 0/6	0.035	-0.132 7/7	0.452	-0.336 7/7	0.408	-0.453 5/7	0.357
9 Producer Price Index	-0.001 1/6	0.078	-0.041 7/7	0.302	-0.196 7/7	0.322	-0.289 6/7	0.293
10 Retail Sales	0.008 0/7	0.028	-0.031 0/7	0.220	-0.098 0/7	0.281	-0.105 0/6	0.209
11 U.S. Imports	0.000 0/7	0.118	-0.002 0/7	0.175	0.003 0/7	0.243	-0.005 0/7	0.151
12 U.S. Exports	0.000 0/7	0.117	-0.006 0/7	0.175	-0.030 0/7	0.110	-0.021 0/7	0.151
9:15 Announcements								
13 Capacity Utilization	0.000 0/7	0.006	-0.012 0/7	0.221	-0.033 0/7	0.165	-0.024 0/7	0.129
14 Industrial Production	0.001 0/7	0.006	-0.013 0/7	0.220	-0.047 0/7	0.164	-0.051 0/7	0.130

Table 3 (continued).
The Affect of Announcement Surprises at Different Points on the Yield Curve.

3 Month		2 Year		10 Year		30 Year	
Coeff.	R ²	Coeff.	R ²	Coeff.	R ²	Coeff.	R ²

10:00 Announcements

15 Business Inventories	0.001 0/7	0.002	0.004 0/7	0.009	0.007 0/7	0.004	0.003 0/7	0.011
16 Construction Spending	-0.003 0/7	0.052	-0.001 0/7	0.354	-0.010 0/7	0.221	-0.023 0/7	0.140
17 Consumer Confidence	0.005 0/7	0.028	-0.028 7/7	0.352	-0.111 7/7	0.364	-0.142 7/7	0.354
18 Factory Orders	-0.001 0/7	0.025	-0.004 0/7	0.022	-0.017 0/7	0.019	-0.017 0/7	0.006
19 NAPM Index	0.011 0/7	0.027	-0.031 6/7	0.356	-0.082 5/7	0.237	-0.138 5/7	0.140
20 New Home Sales	-0.001 4/7	0.142	-0.026 7/7	0.221	-0.076 6/7	0.219	-0.101 5/7	0.212
21 Personal Consumption	-0.003 0/7	0.035	-0.004 0/7	0.051	-0.015 0/7	0.068	0.012 0/7	0.026
22 Personal Income	-0.006 0/7	0.035	-0.008 0/7	0.051	-0.025 0/7	0.068	0.006 0/7	0.026

2:00 Announcements

23 Treasury Budget	0.000 2/7	0.089	0.000 0/7	0.005	0.003 0/7	0.002	0.009 0/7	0.019
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3:00 Announcements

24 Consumer Credit	0.000 0/7	0.005	-0.003 0/7	0.018	-0.011 0/7	0.036	-0.001 0/7	0.010
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4:30 Announcements

25 M1 Medians (weekly)	0.000 0/7	0.009	0.000 0/7	0.196	0.002 0/7	0.055	-0.001 0/7	0.062
26 M2 Medians (weekly)	0.009 0/7	0.009	-0.010 0/7	0.195	-0.020 0/7	0.055	-0.018 0/7	0.062
27 M3 Medians (weekly)	-0.008 0/7	0.009	-0.003 0/7	0.195	0.002 0/7	0.055	0.001 0/7	0.062

Table 4.
The Impact of Economic Announcements on Treasury Prices

Practitioners' perceived importance is taken from The Atlas of Economic Indicators (1991), where “*”, “**”, and “***” signify announcements deemed as “sometimes,” “usually,” and “crucially” important. A “-” is shown for other announcements that are considered to be routine. We also report the sign of the effects. Ederington and Lee (EL) examine the effect of announcements on the volatility of T-Bond Futures prices. Fleming and Remolona (FR) do a similar procedure using the active 5 year T-Note. In both cases, “*”, “**”, and “***”, reflect significance at the .02, .005, and .0001 levels, and a “-” means the announcement was considered but not found to be significant. Using the price five minutes before the announcement as our reference point, we regress the percentage price change at several times shortly before and after the announcement on the standardized surprise. The sample period covers 6/17/91 to 9/29/95. For our results, “***” denotes an announcement where six or more of the regressions yielded significant coefficients at the .05 level. We also report the sign of the significant betas.

	Practitioners'		EL	FR	Our Study				Coeff. Sign
	Perc. Imp.	Exp. Sign			3 Mo.	2 Yr.	10 Yr.	30 Yr.	
8:30 Announcements									
1 Civilian Unemployment	***	> 0	***	**	-	-	-	-	
2 Consumer Price Index	**	< 0	***	**	-	-	-	-	
3 Durable Goods Orders	*	< 0	***	-	-	***	***	***	< 0
4 Housing Starts	**	< 0	-	-	-	***	-	-	
5 Index of Leading Indicators	**	< 0	-	-	-	-	-	-	
6 Initial Jobless Claims (weekly)					-	***	***	***	> 0
7 Merchandise Trade Balances	*	< 0	-	-	-	-	-	-	
8 Nonfarm Payrolls	***	< 0	***	**	-	***	***	***	< 0
9 Producer Price Index	**	< 0	*	**	-	***	***	***	< 0
10 Retail Sales	**	< 0	-	-	-	-	-	-	
11 U.S. Imports					-	-	-	-	
12 U.S. Exports					-	-	-	-	
9:15 Announcements									
13 Capacity Utilization	**	< 0	***	**	-	-	-	-	
14 Industrial Production	**	< 0	***	**	-	-	-	-	
10:00 Announcements									
15 Business Inventories	-	?	-	-	-	-	-	-	
16 Construction Spending	*	?	***	**	-	-	-	-	
17 Consumer Confidence				**	-	***	***	***	< 0
18 Factory Orders	-	< 0	-	-	-	-	-	-	
19 NAPM Index	*	< 0	***	**	-	***	***	***	< 0
20 New Home Sales	*	< 0	-	**	-	***	***	***	< 0
21 Personal Consumption	**	< 0			-	-	-	-	
22 Personal Income	**	< 0	-	-	-	-	-	-	
2:00 Announcements									
23 Treasury Budget			**	-	-	-	-	-	
3:00 Announcements									
24 Consumer Credit			-		-	-	-	-	
4:30 Announcements									
25 M1 Medians (weekly)					-	-	-	-	
26 M2 Medians (weekly)					-	-	-	-	
27 M3 Medians (weekly)					-	-	-	-	

Table 5.
Results of Regressions of Percentage Price Changes on Standardized Announcement Surprises
10 Year Note

For each announcement type i , we run the following regressions:

$$(P_{ti} - P_{-5i}) / P_{-5i} = \alpha_{ti} + \beta_{ti} S_i + \sum_{k=1}^K \alpha_{tk} S_k + e_{ti},$$

where P_{ti} is the price of the instrument t minutes before or after announcement i , S_i is the standardized surprise for announcement type i , and k denotes other announcements occurring at the same time as announcement i . The table reports averages of the coefficients β_{ti} over a range of values of t . Reported below the averages is the number of coefficients included in the average which are significant at the 5% level, along with the total number of coefficients included in the average.

	Average -4 to -1	Average 1 to 4	Average 5,10,15	Average 20,25,30	Average 35,40,45	Average 50,55,60
8:30 Announcements						
1 Civilian Unemployment	0.002 0/3	0.037 0/4	0.037 0/3	0.062 0/3	0.066 0/3	0.055 0/3
2 Consumer Price Index	-0.001 0/4	-0.135 1/4	-0.144 1/3	-0.138 0/3	-0.133 1/3	-0.120 0/3
3 Durable Goods Orders	-0.003 0/4	-0.124 4/4	-0.115 3/3	-0.116 3/3	-0.109 3/3	-0.100 3/3
4 Housing Starts	0.007 0/4	-0.047 1/4	-0.072 0/3	-0.074 0/3	-0.062 0/3	-0.064 1/3
5 Index of Leading Indicators	-0.004 0/4	-0.015 0/4	-0.016 0/3	-0.034 0/3	-0.023 0/3	-0.047 0/3
6 Initial Jobless Claims (weekly)	-0.001 0/4	0.057 4/4	0.055 3/3	0.060 3/3	0.050 3/3	0.055 3/3
7 Merchandise Trade Balances	0.000 0/4	-0.004 0/4	0.003 0/3	0.000 0/3	-0.004 0/3	-0.018 0/3
8 Nonfarm Payrolls	-0.001 0/3	-0.309 4/4	-0.373 3/3	-0.435 3/3	-0.432 3/3	-0.449 3/3
9 Producer Price Index	-0.005 1/4	-0.203 4/4	-0.186 3/3	-0.185 3/3	-0.185 3/3	-0.197 3/3
10 Retail Sales	0.002 0/4	-0.088 0/4	-0.112 0/3	-0.112 0/3	-0.125 0/3	-0.128 0/3
11 U.S. Imports	0.007 0/4	0.001 0/4	0.005 0/3	0.012 0/3	0.021 0/3	0.028 0/3
12 U.S. Exports	0.000 0/4	-0.034 0/4	-0.024 0/3	-0.044 0/3	-0.028 0/3	-0.031 0/3
9:15 Announcements						
13 Capacity Utilization	0.001 0/4	-0.024 0/4	-0.044 0/3	-0.059 0/3	-0.075 0/3	-0.077 0/3
14 Industrial Production	0.001 0/4	-0.048 0/4	-0.045 0/3	-0.048 0/3	-0.056 0/3	-0.036 0/3

Table 5 (continued).
Results of Regressions of Percentage Price Changes on Standardized Announcement Surprises
10 Year Note

	Average -4 to -1	Average 1 to 4	Average 5,10,15	Average 20,25,30	Average 35,40,45	Average 50,55,60
10:00 Announcements						
15 Business Inventories	0.001 0/4	0.004 0/4	0.011 0/3	0.011 0/3	0.033 0/3	0.035 0/3
16 Construction Spending	-0.001 0/4	-0.009 0/4	-0.011 0/3	0.009 0/3	0.016 0/3	0.019 0/3
17 Consumer Confidence	-0.012 2/4	-0.109 4/4	-0.112 3/3	-0.103 3/3	-0.117 3/3	-0.114 3/3
18 Factory Orders	-0.002 0/4	-0.014 0/4	-0.021 0/3	-0.038 0/3	-0.046 0/3	-0.051 0/3
19 NAPM Index	-0.004 0/4	-0.069 3/4	-0.100 2/3	-0.141 1/3	-0.144 2/3	-0.158 2/3
20 New Home Sales	-0.001 0/4	-0.070 3/4	-0.084 3/3	-0.090 3/3	-0.088 3/3	-0.095 3/3
21 Personal Consumption	0.000 0/4	-0.007 0/4	-0.025 0/3	-0.017 0/3	-0.027 0/3	-0.001 0/3
22 Personal Income	0.001 0/4	-0.007 0/4	-0.050 0/3	-0.047 0/3	-0.058 0/3	-0.034 0/3
2:00 Announcements						
23 Treasury Budget	-0.001 0/4	0.003 0/4	0.003 0/3	0.002 0/3	0.010 0/3	0.001 0/3
3:00 Announcements						
24 Consumer Credit	-0.004 0/4	-0.011 0/4	-0.010 0/3	-0.021 0/3	-0.012 0/3	-0.020 0/3
4:30 Announcements						
25 M1 Medians (weekly)	0.000 0/4	0.003 0/4	0.001 0/3	0.000 0/3	0.001 0/3	0.002 0/3
26 M2 Medians (weekly)	-0.001 0/4	-0.019 0/4	-0.022 0/3	-0.023 0/3	-0.033 0/3	-0.026 0/3
27 M3 Medians (weekly)	-0.001 0/4	0.002 0/4	0.002 0/3	0.000 0/3	-0.002 0/3	-0.012 0/3

Table 6.
Mean Trading Volumes on Announcement and Nonannouncement Days

Mean Trading Volume is calculated around announcements and compared to the mean trading volume at the same time of day on nonannouncement days. Announcements that are usually released alone are considered in isolation. Announcements that are frequently released at the same time are grouped together. The table reports the ratio of mean volume on announcement days over the mean volume on nonannouncement days. Reported below the ratio is the t-statistic for a test that the two means are equal.

		10-Year Note						
		-30 to -5	-5 to 0	0 to 5	5 to 15	15 to 30	30 to 45	45 to 60
		8:30 Announcements						
3	Durable Goods Orders	1.064	0.689	1.554	1.718	1.425	1.211	1.124
		0.499	-2.474	4.064	6.248	4.267	2.164	1.204
6	Initial Jobless Claims (weekly)	1.139	0.760	1.472	1.745	1.509	1.409	1.290
		1.861	-3.476	6.026	10.275	8.012	6.827	4.776
9	Producer Price Index	1.563	0.893	2.049	2.539	2.076	1.770	1.634
		4.246	-0.828	7.292	12.354	9.816	7.439	5.669
1	Civilian Unemployment	1.461	0.734	1.622	2.361	2.392	2.144	1.783
8	Nonfarm Payrolls	3.433	-2.055	4.482	11.546	13.276	11.251	7.342
		10:00 Announcements						
17	Consumer Confidence	1.067	1.424	1.809	1.772	1.706	1.398	1.241
		0.659	2.773	5.460	6.514	5.886	3.677	2.281
20	New Home Sales	1.200	1.174	1.937	1.929	1.539	1.345	1.397
		1.920	1.141	6.526	7.691	4.521	3.134	3.744
16	Construction Spending	1.068	1.162	1.724	1.845	1.533	1.341	1.346
19	NAPM Index	0.882	1.378	6.422	8.886	5.803	4.079	4.248
		11:30 Announcements						
	Fed Target Changes	0.796	0.778	1.662	1.854	1.428	1.464	1.395
		-0.965	-0.718	1.966	3.083	1.544	1.794	1.422
		2:15 Announcements						
		1.421	0.901	2.063	2.597	3.146	2.687	2.252
		1.858	-0.314	3.305	6.173	8.346	6.453	3.900
		3-Month Bill						
		11:30 Announcements						
	Fed Target Changes	1.066	1.857	2.333	9.084	3.364	2.112	1.521
		0.107	1.001	1.181	8.675	3.861	1.755	0.899
		2:15 Announcements						
		1.184	0.571	4.358	8.341	8.440	6.070	6.494
		0.408	-0.555	3.575	8.423	10.647	7.058	8.071

Table 7
Mean Bid-Ask Spreads on Announcement and Nonannouncement Days

Mean Percentage bid-ask spread is calculated around announcements and compared to the mean bid-ask spread volume at the same time of day on nonannouncement days. Announcements that are usually released alone are considered in isolation. Announcements that are frequently released at the same time are grouped together. The table reports the ratio of mean bid-ask spread on announcement days over the mean bid-ask spread on nonannouncement days. Reported below the ratio is the t-statistic for a test that the two means are equal.

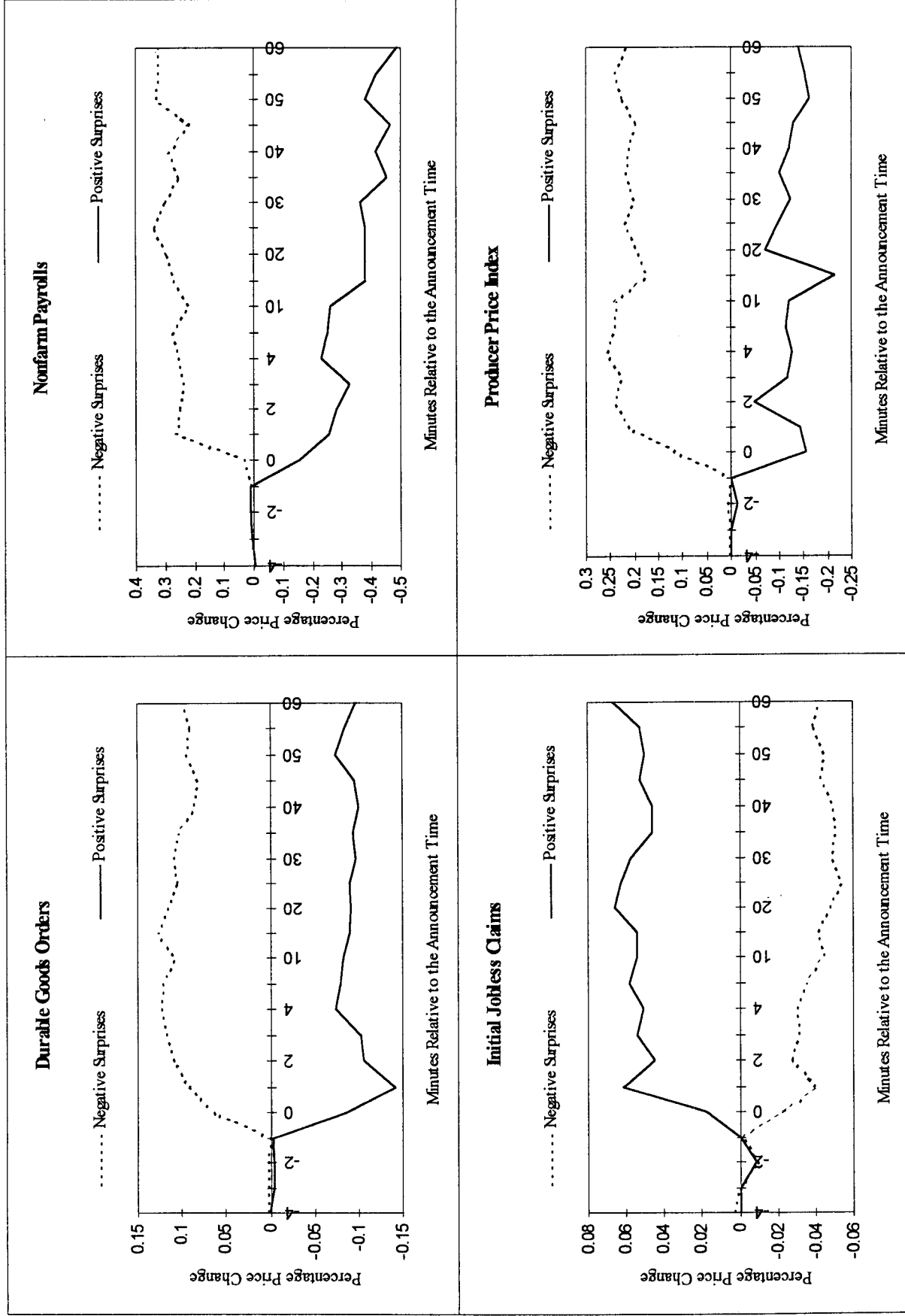
		10-Year Note							
		-30	-5	0	5	15	30	45	60
		8:30 Announcements							
3	Durable Goods Orders	0.998	0.885	2.107	1.006	0.842	0.888	1.002	1.082
		-0.026	-1.302	7.576	0.049	-1.477	-1.064	0.017	0.740
6	Initial Jobless Claims (weekly)	0.917	1.016	1.831	0.987	0.971	0.886	0.979	1.057
		-1.376	0.302	8.575	-0.195	-0.277	-1.952	-0.382	0.454
9	Producer Price Index	0.945	0.981	2.037	1.328	0.856	1.066	1.082	0.935
		-0.535	-0.203	6.900	2.687	-1.289	0.577	0.801	-0.598
1	Civilian Unemployment	0.841	1.272	5.394	1.933	1.039	1.276	1.524	1.210
8	Nonfarm Payrolls	-1.620	2.524	12.517	6.965	0.359	2.427	4.458	1.885
		10:00 Announcements							
17	Consumer Confidence	0.936	0.902	1.391	0.977	1.180	1.016	1.212	0.903
		-0.601	-1.036	3.282	-0.239	1.804	0.171	2.290	-1.026
20	New Home Sales	0.746	1.054	1.500	1.374	1.015	1.064	1.156	0.892
		-2.302	0.575	4.168	3.712	0.162	0.731	1.701	-1.122
16	Construction Spending	0.799	0.986	1.543	1.195	1.001	1.046	1.096	0.860
19	NAPM Index	-2.547	-0.194	5.381	2.456	0.011	0.681	1.343	-1.933
		11:30 Announcements							
	Fed Target Changes	1.001	1.237	0.711	1.381	1.180	0.968	1.202	1.260
		0.005	1.052	-1.480	1.760	0.919	-0.148	1.038	1.321
		2:15 Announcements							
		1.072	0.859	0.832	1.509	1.203	0.934	0.687	0.508
		0.393	-0.674	-0.911	2.776	1.064	-0.332	-1.549	-2.632
		3-Month Bill							
		11:30 Announcements							
	Fed Target Changes	1.401	1.696	2.742	5.361	1.285	1.523	1.943	1.540
		0.817	2.707	6.438	8.587	0.193	0.350	2.697	1.839
		2:15 Announcements							
		4.024	1.274	1.089	4.536	1.891	2.127	1.024	0.957
		4.608	0.406	0.085	8.015	0.923	3.010	0.017	-0.035

Table 8.
Mean Price Deviations on Announcement and Nonannouncement Days

Mean Price Deviation is calculated around announcements and compared to the mean price deviation at the same time of day on nonannouncement days. Price deviation is defined as the absolute value of the percentage price change. Announcements that are usually released alone are considered in isolation. Announcements that are frequently released at the same time are grouped together. The table reports the ratio of price deviation on announcement days over the price deviation on nonannouncement days. Reported below the ratio is the t-statistic for a test that the two means are equal.

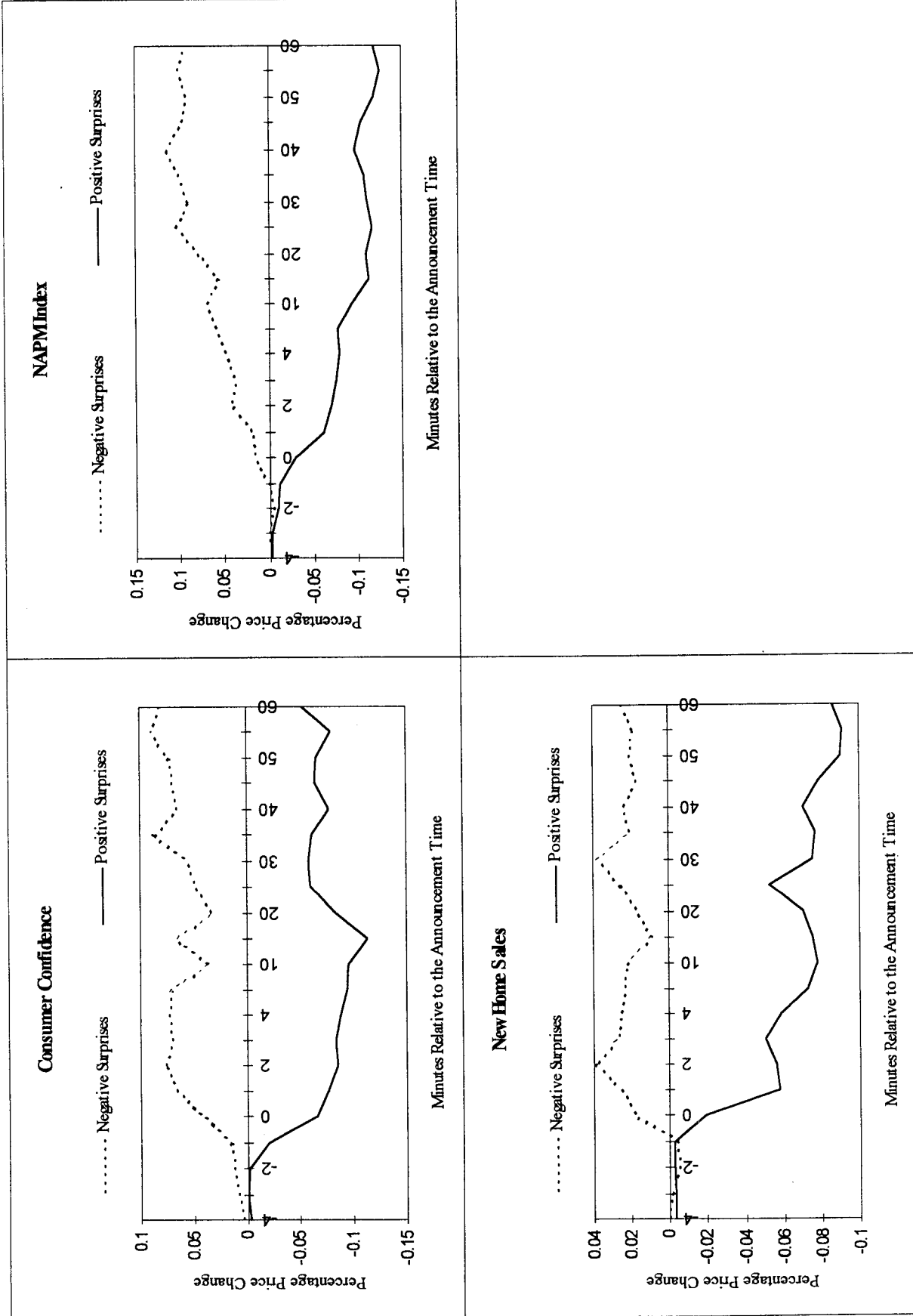
	10-Year Note						
	No					No	
	Ann.	Obs.	Ratio of	T-Stat	Ann.	Ave	
	Obs.	Deviation	T-Stat	Ave	Ave		
8:30 Announcements							
3 Durable Goods Orders	331	45	3.6159	10.6605	0.0337	0.1220	
6 Initial Jobless Claims (weekly)	331	190	2.7010	8.1111	0.0337	0.0911	
9 Producer Price Index	331	44	6.0134	14.9301	0.0337	0.2028	
1 Civilian Unemployment -	331	33	10.2084	17.0681	0.0337	0.3444	
8 Nonfarm Payrolls							
10:00 Announcements							
17 Consumer Confidence	334	49	3.0381	9.7531	0.0250	0.0760	
20 New Home Sales	334	45	3.5144	8.7213	0.0250	0.0880	
16 Construction Spending -	334	52	3.2276	9.1655	0.0250	0.0808	
19 NAPM Index							
11:30 Announcements							
Fed Target Changes	322	10	3.6957	7.1809	0.0172	0.0635	
2:15 Announcements							
	318	12	3.9905	5.7806	0.0200	0.0797	
3-Month Bill							
11:30 Announcements							
Fed Target Changes	310	10	26.2508	11.2996	0.0002	0.0062	
2:15 Announcements							
	306	11	2.4233	0.5389	0.0025	0.006	

Figure 1.
Price Response in the Active 10 Year T-Note to Economic Announcements



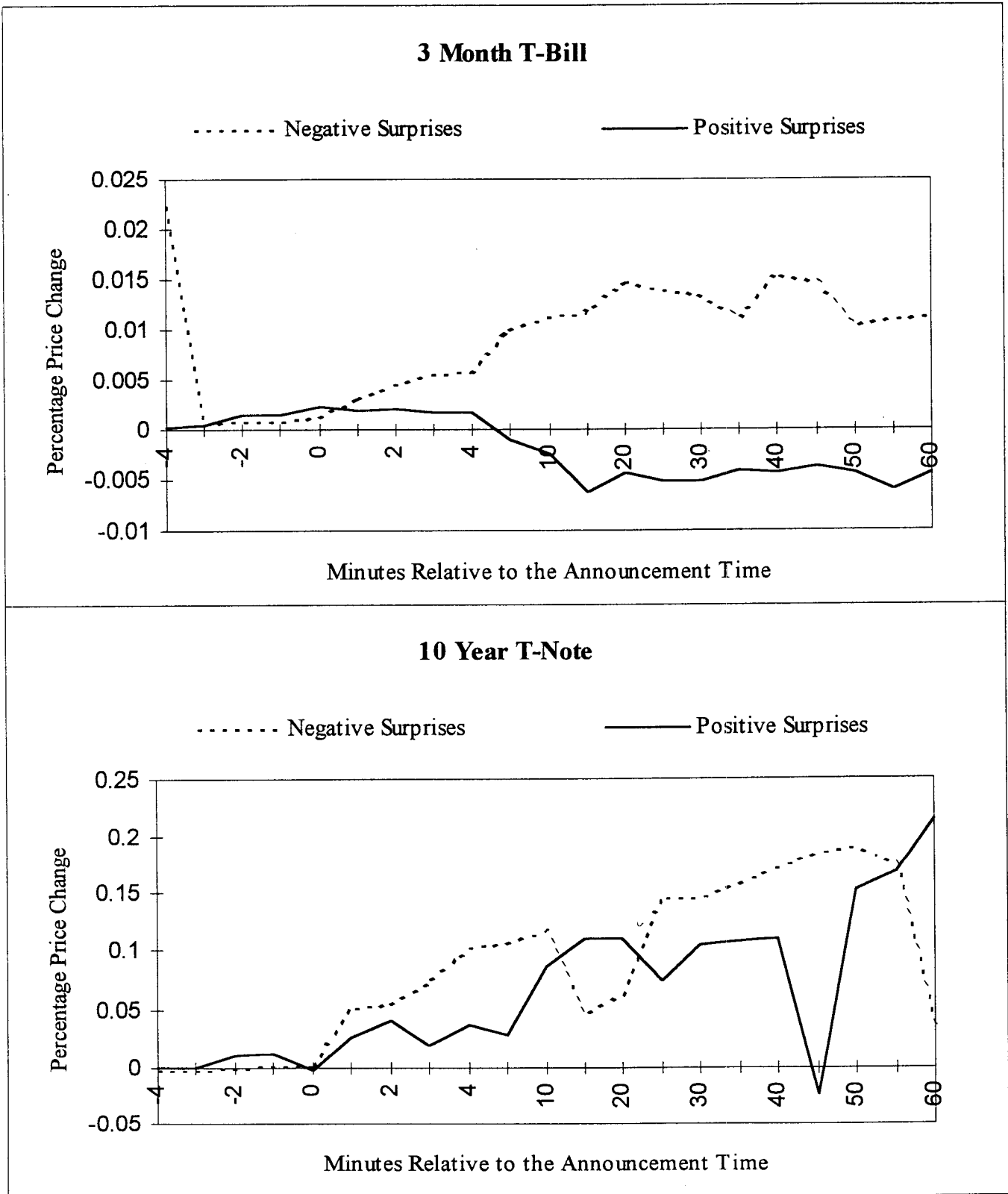
The charts depict the average percentage price change relative to five minutes before the announcement. Observations are grouped by the sign of the surprise. The sample covers 6/17/91 to 9/29/95.

Figure 2.
Price Response in the Active 10 Year T-Note to Economic Announcements



The charts depict the average percentage price change relative to five minutes before the announcement. Observations are grouped by the sign of the surprise. The sample covers 6/17/91 to 9/29/95.

Figure 3.
Price Response to Surprises in the Federal Funds Target Rate



The charts depict the average percentage price change relative to five minutes before the announcement. Observations are grouped by the sign of the surprise. The sample covers 6/17/91 to 9/29/95.