The High-Frequency Impact of News on Long-Term Yields and Forward Rates: Is it Real?

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Abstract

This paper uses high-frequency intradaily data to estimate the effects of macroeconomic news announcements on yields and forward rates on nominal and index-linked bonds, and on inflation compensation. To our knowledge, it is the first study in the macro announcements literature to use intradaily real yield data, which allow us to parse the effects of news announcements on real rates and inflation compensation far more precisely than we can using daily data. Long-term nominal yields and forward rates are very sensitive to macroeconomic news announcements. We find that inflation compensation is sensitive to announcements about price indices and monetary policy. However, for news announcements about real economic activity, such as nonfarm payrolls, the vast majority of the sensitivity is concentrated in real rates. Accordingly, we conclude that most of the sizeable impact of news about real economic activity on the nominal term structure of interest rates represents changes in expected future real short-term interest rates and/or real risk premia rather than changes in expected future inflation and/or inflation risk premia. This sensitivity of real rates to macroeconomics news is hard to rationalize within the framework of existing macroeconomic models.

Keywords: intradaily data, news announcements, inflation compensation, real interest rates.
JEL codes: E43, E52, G14

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1. Introduction

It has long been recognized that the high-frequency reaction of asset prices to macroeconomic news announcements represents a rich source of information about the effects of economic fundamentals on financial markets. Economic theory—and much empirical evidence—indicates that macroeconomic news announcements lead to sudden jumps in the conditional means of asset prices. Studying the relationship between these jumps and the surprise components of the announcements may be the closest thing that we get in macroeconomics to a natural experiment. In this work, high-frequency data is especially valuable. In a short enough window around a news announcement, the data release should be the *only* information hitting the market. But macroeconomic news announcements explain only a modest share of the total variation in most asset prices, and so in longer windows the relationship between news announcements and asset prices will be clouded by the impact of other public or private information. For example, exchange rates are notoriously hard to relate to any macroeconomic fundamentals. Nonetheless, Andersen, Bollerslev, Diebold and Vega (2003) find that in short intradaily windows around macroeconomic news announcements, there is a systematic relationship between macroeconomic surprises and exchange rate changes. This relationship cannot be detected at lower frequencies, because macroeconomic announcements explain only a small share of the total variability of exchange rates.

The literature on the reaction of financial markets to macroeconomic news is vast, and we make no attempt to survey it. Many authors have studied the effects of news announcements on the term structure of interest rates, including Fleming and Remolona (1999), Gürkaynak, Sack and Swanson (2005a), and Goldberg and Klein (2005). A striking finding of these papers is that long-term nominal yields and forward rates are remarkably sensitive to incoming data. The

release of an employment report can sometimes cause ten-year yields and forward rates to jump over 10 basis points. Nominal yields and forward rates embody inflation expectations, expected future real interest rates, and term premia. Gürkaynak, Sack and Swanson (2005a) assume that news announcements do not affect long-term expectations of future real short-term interest rates or distant-horizon term premia. Hence, they interpret the sensitivity of far-horizon nominal forward rates to news announcements as investors revising their long-run inflation expectations in light of today's data, indicating that inflation expectations are very poorly anchored.

However, the sensitivity of nominal yields and forward rates to news surprises may owe to more than just inflation expectations: revisions to expected future real short-term interest rates, or to nominal term premia (in turn the sum of inflation risk premia and real term premia) are also candidates, and there are not strong reasons to rule them out *a priori*. Beechey (2007) used a three-factor affine term structure model to decompose the variation in nominal forward rates in the wake of news announcements into nominal term premia and expectations of future nominal short-term interest rates, and argued that most of the reaction at long horizons was in nominal term premia.

This paper employs a decomposition of the reaction of nominal yields to news into real and inflation components. This decomposition is implemented using a new dataset of intradaily quotes on Treasury Inflation Protected Securities (TIPS)—debt securities for which the coupon and principal payments are indexed to the Consumer Price Index (CPI)—in combination with intradaily data on nominal yields. We regress intradaily changes in nominal yields, real yields, and the spread between these two—inflation compensation—on the surprise component of macroeconomic news announcements. Several recent papers, among them Gürkaynak, Levin and Swanson (2006) and Beechey, Johannsen and Levin (2008), have employed daily-frequency

inflation compensation to estimate news announcement regressions for the United States and other countries, highlighting the greater sensitivity of U.S. forward rates of inflation compensation to various types of macroeconomic news announcements.

We group macroeconomic announcements into three broad types: news about prices, news about the real side of the economy (indicators of the labor market, spending, production and sentiment) and news about monetary policy. Armed with intradaily data, we find that different types of news have quite different effects on real rates and rates of inflation compensation. To summarize, price data mainly affect inflation compensation, real-side data have a large impact on real yields and forward rates—but little effect on forward rates of inflation compensation—and surprise tightenings of monetary policy push real rates up but inflation compensation down. We demonstrate the efficiency gains from running these regressions with intradaily data, rather than data at the daily frequency. That news buffets forward rates of inflation compensation is consistent with the conclusions of others that either long-run inflation expectations or inflation risk premia, or both, are sensitive to news—but the sensitivity appears to be confined to news about prices and monetary policy. Instead, our findings point to a great deal of sensitivity of the real component of long-run interest rates, a possibility that has largely been overlooked in the recent news-announcement literature. This suggests that the puzzling sensitivity of nominal forward rates lurks not just in the inflation component but, importantly, in uncertainty about the equilibrium real rate of interest. This in turn poses a substantial challenge to widely-used dynamic stochastic general equilibrium models, such as those of Smets and Wouters (2007) and Christiano, Eichenbaum and Evans (2005) which imply that the long-run expected value of the real short-term interest rate is constant.

The plan for the remainder of this paper is as follows. In Section 2, we introduce the data. Section 3 contains the main results, and Section 4 provides robustness checks and comparison with results in the existing literature. Section 5 gives discussion of the economic interpretation of our results. Section 6 offers some concluding thoughts.

2. The Data

This section briefly describes data sources and construction. We consider fourteen macroeconomic announcements, including the surprise element of FOMC decisions about the target Federal Funds rate. Table 1 lists the announcements, their frequency and release times. For all announcements other than the target funds rate, the surprise component of each announcement is measured as the real-time actual value less the median expectation from the survey conducted by Money Market Services (MMS) on the previous Friday. For the target Fed Funds rate, we measure the surprise component of the Fed's decision using intradaily changes in Federal Funds futures prices, following the methodology of Kuttner (2001). We sign the surprises such that positive surprises represent stronger-than-expected growth or higher-than-expected inflation: for the unemployment rate and initial jobless claims, which are both countercyclical indicators, we flip the sign of the surprise so that positive surprises reflect stronger-than-expected growth for these as well. The surprises are then standardized by their respective standard deviations. Letting $A_{j,t}$ denote the released value of an announcement of type j at time t, and $E_{j,t}$ denote the *ex-ante* expectation of this release, the surprise is defined as

$$s_{j,t} = \frac{A_{j,t} - E_{j,t}}{\sigma(A_{j,t} - E_{j,t})}$$

where $\sigma(.)$ denotes the standard deviation. This transformation has the effect of making the units comparable across different types of announcements. Table 1 also lists the standard deviation of the surprises for each announcement type.

We construct a high-frequency dataset consisting of five-minute quotes of yields-to-maturity on nominal Treasury securities and TIPS collected at the Federal Reserve Board. We choose securities with around five and ten years remaining time to maturity. The specific bonds used are listed in Table 2, and are generally the most recently issued "on-the-run" five- and ten-year nominal Treasury notes and TIPS.[1] The data are available from February 17, 2004 to June 13, 2008. From these, we can use the approximation of Shiller, Campbell and Schoenholtz (1983) to construct five-to-ten year forward nominal and real interest rates.[2] And, we can construct measures of five-year, ten-year, and five-to-ten-year forward inflation compensation, defined as the spreads between nominal and comparable-maturity real yields.[3] On-the-run nominal securities command a liquidity premium, and so trade at lower yields than their off-the-run counterparts. However, in the narrow windows around news announcements, the relative liquidity of on- and off-the-run bonds is unlikely to change. Likewise, a liquidity premium tends to push up TIPS yields relative to their nominal counterparts; but again, this liquidity premium should difference out under the plausible assumption that macroeconomic news does not affect the relative liquidity of index-linked and nominal securities.

[1] An on-the-run security is the most recently issued bond of a given maturity.

[2] The approximation is that if y_n denotes the yield on a bond with a maturity of n years and duration D_n, then the five-to-ten-year forward rate is approximately $(D_{10}y_{10} - D_5 y_5)/(D_{10} - D_5)$.

[3] All yields are expressed with semiannual compounding, and the calculation of the spread takes appropriate account of this. That is, if y_n^{nom} and y_n^{real} denote the nominal and real yield in percentage points, inflation compensation is constructed as $200(\frac{1+y_n^{nom}/200}{1+y_n^{real}/200} - 1)$.

To compare our results with those from daily data, we consider two alternative measures of nominal and real yields. The first consists of quotes on the same specific five- and ten-year nominal and TIPS securities recorded at 4pm each day from our intradaily dataset. The second consists of the five- and ten-year par nominal and TIPS yields from the smoothed fitted yield curves estimated late each afternoon by Federal Reserve staff using only off-the-run securities, as described by Gürkaynak, Sack and Wright (2007, 2008).

3. Regressions and Results

As a preliminary illustration of how macroeconomic news affects nominal and index-linked bond yields, Figure 1 plots the ten-year nominal and TIPS yields from 8:15am to 9:30am on the days of the two largest employment report surprises in our sample: April 2, 2004, when total payroll growth was 208,000 above survey expectations, and August 6, 2004, when payrolls came in 193,000 below expectations.

As expected in an efficient market, yields jumped up on the stronger-than-expected data and down on the weaker-than-expected data, with the reactions complete within ten minutes. Such rapid reaction of nominal interest rates is well documented in the news-announcement literature. But what has not been documented before is that TIPS yields move just as rapidly. The magnitude of the jump in TIPS yields on surprise days was similar to—but a bit smaller than—that in nominal yields. Having illustrated the point with these two large data surprises, we now turn to a more systematic analysis of the relationship between surprises and high-frequency yield changes.

3.1 Regressions of Changes in Yields and Forward Rates on Surprises

The regressions that we consider are of the form:

$$\Delta y_t(h) = \Sigma_{j=1}^{J} \beta_j(h) s_{j,t} + \varepsilon_t \qquad (1)$$

where $\Delta y_t(h)$ is the change in some yield or forward rate from 15 minutes before a news announcement until h minutes afterwards, and the variable $s_{j,t}$ is the standardized surprise component of an announcement of type j. The regression is run over all windows where there is at least one news announcement: the surprise is set to zero for news types for which there is not an announcement during that window. The device of regressing yield changes on surprise components of all different types of announcements jointly accommodates the possibility of multiple announcements coming out concurrently, as often happens (for example the unemployment report and payrolls releases always come out at the same time).[4]

3.2 Documenting the jump behavior of nominal and TIPS yields

We estimated equation (1) for nominal yields, TIPS yields, and inflation compensation of varying maturities and for window widths h ranging from 5 minutes to 60 minutes. Figures 2 and 3 plot the estimates of the coefficients $\beta_j(h)$ against h for some of the news announcements, for changes in ten-year nominal and TIPS yields respectively. These can be thought of as plotting the expected effect of a one standard deviation surprise on yields at different times after the news announcement.

It is evident from the figures that the impact of news announcements on nominal and TIPS yields is of the nature of a jump in the conditional mean, consistent with the example in Figure 1. This

[4] If no two different types of news announcements ever came out concurrently, the OLS estimation of (1) could be performed simply as separate regressions of yield changes on surprises by type

result is well known for nominal yields. Fleming and Remolona (1999), using very high-frequency data on nominal Treasury securities, find that the adjustment in the conditional mean is complete within a couple of minutes. Andersen, Bollerslev, Diebold and Vega (2007) and Ederington and Lee (1993) document similar jump behavior for other nominal interest rates. This is what one would expect in an efficient market, following the reasoning of French and Roll (1986).

The reaction of ten-year TIPS yields is as fast as the reaction of nominal yields, judging by our five-minutely data. For TIPS yields, one might have worried that the small size and comparatively lower liquidity of this market would result in a delayed reaction or some unwinding of initial jumps, but Figures 1 to 3 show that this is not the case. In this context, it is worth pointing out that although the TIPS market is much smaller than the market for nominal Treasury securities, it cannot be thought of as a small or illiquid market. According to the FR-2004 survey of primary dealers conducted by the Federal Reserve Bank of New York, primary dealer trading volumes in TIPS averaged about $8 billion per day over the period covered by our intradaily dataset.

3.3 Comparing the reaction of nominal and TIPS yields to news announcements

We now turn to studying the high-frequency reactions of nominal and TIPS yields of different maturities to all 14 news announcements. Table 3 gives coefficient estimates from estimating equation (1) with changes in the ten-year and five-year yield and the five-to-ten year forward rate as the respective dependent variables, setting the window size h to 15 minutes. This is a conservative choice of the window size, as it is safe to say that the jump in the conditional mean of nominal and TIPS yields is complete within 15 minutes of the data release.

In Table 3, we can see that nearly all of the announcements cause statistically significant increases in five- and ten-year nominal yields (columns 1 and 4). Moreover, and as documented by others, the sensitivity is still evident in the five-to-ten-year forward nominal rates (column 7). Different patterns emerge, however, for different types of news announcements when we decompose these effects on nominal rates into their real and inflation components.

Price News

Overall, it is inflation compensation rather than real rates that appear to be sensitive to news about prices. Core CPI announcements elicit statistically significant increases in inflation compensation at all maturities, including the far forward rate (columns 3, 6 and 9), but do not draw a systematic reaction in TIPS yields. Higher-than-expected core PPI announcements lead to significant increases in five- and ten-year TIPS yields and inflation compensation, but by the five-to-ten year horizon, the effect remains significant at the five-percent level only for inflation compensation. These results are at once heartening and puzzling; heartening in that one would expect inflation surprises to have the most bearing on investors' inflation forecasts and their perception of inflation risk, and yet puzzling in that the reactions are still evident for forward rates five to ten years ahead, well after most inflation shocks should have died out.

Real-Side News

Turning to news announcements concerning real economic activity, the decomposition of the response into real and inflation components is very different. Positive surprises to consumer confidence, durable goods orders, GDP, new home sales, initial claims, nonfarm payrolls, the NAPM index, retail sales and the unemployment rate all raise five- and ten-year TIPS yields and

the coefficients are statistically significant effects at the 1 percent significance level (columns 2 and 5 in Table 3). Some of these announcements also have statistically significant effects on inflation compensation, but the reactions are modest: news about real activity seems to affect TIPS yields considerably more than inflation compensation. For example, a nonfarm payrolls release that is one standard deviation above expectations is estimated to increase ten-year TIPS yields by 6 basis points, while ten-year inflation compensation rises only 1.4 basis points, with both coefficients precisely estimated.

Forward rates are analytically useful because they abstract from the effects of variation in short-term interest rates and the business cycle on longer-term yields and given a better view of investors' beliefs about the longer term. Specifically, distant-horizon real forward rates are comprised of long-run expectations of real short-term interest rates and real risk premia. Meanwhile, forward rates of inflation compensation are comprised of long-run inflation expectations and inflation risk premia. The results in Table 3 (columns 7, 8 and 9) indicate that the sensitivity of nominal forward rates to news about the real side of the economy is heavily concentrated in real forward rates. Of the 11 indicators of real economic activity that we consider, 6 have significant positive effects on five-to-ten-year forward TIPS yields at the 1 percent significance level, and 2 more are significant at the 5 percent level. None have a significant effect on five-to-ten year forward inflation compensation, even at the 5 percent level.

Monetary Policy News

Monetary-policy surprises have no statistically significant effect on five- or ten-year nominal yields in Table 3. But this masks offsetting effects on real and inflation components. As can be seen in Table 3, a surprise tightening of policy leads to a rise in five-year real yields, a

smaller rise in ten-year real yields, and a decline in both five- and ten-year inflation compensation. All of these effects are statistically significant. Further ahead, at the five-to-ten – year horizon, the point estimate of the TIPS response becomes negative but is not significant, while the decline in inflation compensation becomes more pronounced. Given that the standard deviation of a funds rate surprise is 5.3 basis points (Table 1), the interpretation of our coefficient estimates is that a 25 basis point surprise tightening rotates the nominal yield curve, lowering five-to-ten year forward nominal rates by 12 basis points, of which 3 and 9 basis points are real and inflation compensation, respectively. A natural interpretation is that a surprise policy tightening leads investors to mark up their expectations for the real path of policy in the near-term, and perhaps also leads to some increase in real risk premia. However, the surprise tightening leads investors to revise down their inflation expectations, both in the short- and long-run, and reduce the compensation demanded for inflation risk, leaving inflation compensation lower at all horizons.

The reaction to monetary policy surprises is worth commenting upon a little more. It is central to the standard view of the transmission mechanism of monetary policy that tightening actions by the central bank should raise benchmark long-term interest rates, and hence raise the borrowing costs for households and businesses that are tied to those benchmark rates. Empirically, this relationship has been hard to detect. Some authors, including Cook and Hahn (1989) and Roley and Sellon (1995), have found little evidence of a relationship between Federal Reserve policy actions and longer-term nominal Treasury yields. Yet we find that unexpectedly tighter monetary policy raises *real* rates, which are presumably what matter for the spending decisions of agents, providing support for the standard view of the transmission mechanism of monetary policy. Because unexpectedly tighter policy also appears to lower inflation

expectations and/or inflation risk premia, the increase in real rates is obscured, leaving no statistically significant effect on long-term nominal interest rates in our sample.[5] It remains an open question why far-forward rates of inflation compensation respond to today's monetary policy surprises, a question we return to in the Discussion in Section 5.

4. Robustness checks

4.1 Comparison of intradaily and daily results

Gürkaynak, Sack and Swanson (2005a), and Gürkaynak, Levin and Swanson (2006) have performed similar analysis of the response of real yields and inflation compensation to macro announcement surprises, but have done so using daily-frequency data. However, as argued by Andersen, Bollerslev, Diebold and Vega (2003) and Gürkaynak, Sack and Swanson (2005b) and others, high-frequency intradaily data have the potential to give more precise estimates of announcement effects than can be obtained with daily data.

To measure the gains that can be obtained from high-frequency data on TIPS yields, we ran regression (1) using daily yield changes as the left-hand side variable in place of changes in narrow intradaily windows. Table 4 shows the results using the 4pm observation each day on the specific five- and ten-year nominal and TIPS bonds in our intradaily dataset. Not surprisingly, the standard errors are much larger, and several of the announcement effects are no longer statistically significant. Averaging across all the standard errors in Table 3 (the intradaily data), gives a standard error of 0.31. The corresponding average standard error in Table 4 (with the daily data) is 0.73—more than twice as big. The results with the intradaily and daily datasets are not inconsistent; it is simply that the latter are much less precise. For example, using the

[5] Our results differ from Kuttner (2001) who, using an earlier sample of daily data found that unexpected monetary policy tightenings raised long-term nominal yields.

intradaily data, the 95 percent confidence interval for the effect of a one standard deviation retail sales surprise on ten-year TIPS yields is from 0.4 to 2.0 basis points. The corresponding confidence interval using daily data is from 0.7 to 4.1 basis points. As a result of this loss of precision, the number of announcements that have a significant effect on ten-year TIPS yields at the 1 percent significance level drops from 10 using the intradaily data to 5 with the daily data.

A more formal test of the hypothesis that intradaily and daily data are estimating the same parameter, but that the intraday estimate is more precise is to apply Hausman specification tests to the two coefficient estimates. Given two estimators, one less efficient than the other, the null of the Hausman test is that both estimators are consistent for the same parameter. In our context, the null amounts to the hypothesis that the mean reaction to news surprises is the same in short windows as it is for whole days, implying that nominal and TIPS yields exhibit jump behavior in response to news announcements. The coefficient of the intradaily regression is assumed to be the more efficient estimator. We calculate the Hausman test statistic for each pair of coefficients, i.e., for a given maturity interest rate and a specific news variable, resulting in 126 test statistics.[6] Of these, only 14 reject the null hypothesis at the five-percent level and 7 at the one-percent level. The vast majority cannot reject the null that the estimators are consistent, leaving us confident that the intradaily regressions simply provide more efficient estimates of the reactions to news announcements than daily data.

Finally, a robustness check against the possibility that our results are driven by the particular securities in our intradaily dataset is to run the same regressions with daily data from smoothed yield curves fitted to off-the-run nominal and TIPS securities each day by Federal

[6] The general form of the Hausman specification test can be found in Hausman (1978). For our application, the test statistic has a χ^2 null distribution on one degree of freedom. In four cases the test statistic is not defined because the estimated variance in the denominator of the test statistic is negative.

Reserve Staff, as described in Gürkaynak, Sack and Wright (2007, 2008). These curves use late-afternoon quotes, and give yields on synthetic nominal and TIPS par securities with exactly five and ten years to maturity, from which forward rates can be constructed. Table 5 reports the results from estimating regression (1) using daily changes in these smoothed yields. The results are very similar to those in Table 4.

4.2 Structural Stability

The TIPS market has matured in liquidity and market functioning since its inception and we address how that may affect conclusions drawn from different sample periods. Gürkaynak, Sack and Swanson (2005a) and Gürkaynak, Levin and Swanson (2006) estimated regression (1) using daily changes in nine-to-ten year forward TIPS rates, constructed from daily prices of specific TIPS securities with nine and ten years to maturity, for samples starting in 1998.[7] In Gürkaynak, Sack and Swanson's sample ending in 2002, no types of announcement had a significant effect on TIPS forward rates (at the 5 percent level). For Gürkaynak, Levin and Swanson's sample extended to 2005, NAPM and nonfarm payrolls surprises enter with statistically significant effects on TIPS forward rates at the 1 percent level. Finally, using daily or intradaily data from early 2004 to mid-2008, we find that many real-side announcements have statistically significant effects on TIPS forward rates. This suggests that there may have been some evolution in the relationship between news announcements and interest rates as the TIPS market has matured.

Our data on smoothed TIPS yield curves permit us to calculate real yields and inflation compensation from early 1999.[8] Table 6 reports the results from estimating regression (1) using daily changes in these smoothed yields from the start of 1999 until February 16, 2004—the day

[7] Both employ the same approximation of Shiller, Campbell and Schoenholtz (1983) as we do.
[8] Nominal yield curve data go back much further but are of little use for the analysis considered here without the corresponding TIPS yields.

prior to the start of the sample considered in this paper. The results are quite different from our later sample (Tables 3 to 5). In the earlier period, real yields and forward rates were relatively less sensitive to news, while inflation compensation was more sensitive. Only 3 announcements have a significant effect on five-to-ten year forward real rates in Table 6: NAPM, nonfarm payrolls, and the FOMC announcement, whereas 6 announcements have a significant impact on five-to-ten year forward inflation compensation.

The typical sensitivity of nominal forward rates to news seems to be about the same in the two samples, but the sensitivity of real forward rates has increased, and arithmetically this means that the sensitivity of inflation compensation must have declined. Averaging across all 14 news announcements for the 1999 to 2004 sample period shown in Table 6, the average effect of a one standard deviation surprise on five-to-ten year nominal, real and inflation compensation forward rates were 1.19, 0.27 and 0.90 basis points, respectively.[9] In Table 5, for the 2004 to 2008 sample period, the corresponding numbers are 1.28, 1.00 and 0.27, respectively. The improved liquidity and functioning of the TIPS market in later years may have allowed TIPS yields to respond to incoming information more quickly than was the case in the early years of the TIPS program.

To investigate the possibility of structural breaks more formally, we considered tests of the null of parameter constancy in equation (1) that do not require the researcher to specify a potential break date *a priori*. We used the structural stability test statistic proposed by Nyblom (1989), and the sup-F statistic (the maximum value of the Chow statistic over all possible break dates).[10] For these tests, we used daily changes in yields from the smoothed yield curves from

[9] The results in Table 6 are qualitatively similar to those of Gürkaynak, Levin and Swanson (2006) over their 1998 to 2005 sample.

[10] The null limiting distribution of this statistic was provided by Andrews (1993). We exclude break dates in the first and last 15% of the sample (see Andrews (1993)).

January 4, 1999 to June 13, 2008—the full sample for which these yields are available. We also applied the tests to the more recent period from February 17, 2004 to June 13, 2008—the sample period used in our intradaily regressions. The results are reported in Table 7.

In the longer sample, the null hypothesis of structural stability is rejected at the 1 percent level for nominal and TIPS yields, and inflation compensation, at all maturities with either test. There is, thus, decisive evidence of a structural break over the 1999 to 2008 sample. Over the more recent sample, there is little evidence for any structural instability; the hypothesis of parameter constancy can be rejected only for the change in five-year inflation. We leave further discussion of structural instability to future work, but note that the evidence of a structural break helps reconcile our findings with earlier work which highlighted the sensitivity of inflation compensation.

5. Discussion and Interpretation

Nominal yields and forward rates are very sensitive to macroeconomic news announcements, and as an accounting matter, such sensitivity must reside in some combination of expectations of future real short rates or inflation, or in real or inflation risk premia. Our finding that higher-than-expected inflation raises far-forward rates of inflation compensation could indicate that inflation expectations are poorly anchored, or that the premium required to hold inflation risk over the long run is sensitive to today's inflation developments. That tighter-than-expected monetary policy lowers far-forward inflation compensation adds to that picture. Were agents' perceptions of the Fed's implicit inflation target time varying, as in the model of Gürkaynak, Sack and Swanson (2005a), monetary policy surprises could prompt revisions to long-run inflation expectations. Alternatively, inflation expectations may be reasonably stable, but

inflation uncertainty and hence risk premia may be sensitive to unexpectedly higher inflation today or unexpectedly looser monetary policy.

However, most of the sensitivity of nominal forward rates to announcements other than prices and monetary policy appears to be in the real component, not in inflation compensation. Also, given the frequency of each of the announcements considered in this paper, we can compute the per-quarter standard deviation of real and nominal forward rates that are due to all 14 announcements collectively (including price and monetary policy announcements)—the standard deviation of real forward rates is about three times larger than that of forward rates of inflation compensation. In this sense the overall sensitivity of forward rates to news announcements is more on the real side than in inflation compensation. Evidently, expectations of short-term real interest rates far into the future and/or long-term real risk premia are substantially buffeted by incoming data.

Most theoretical models predict that real interest rates are stationary, and thus arbitrarily-distant-horizon expectations of real short-term interest rates ought to be constant. Equilibrium real interest rates and the factors that determine them in a Ramsey model framework (potential output growth, trend population growth, and preferences of agents in the economy) are notoriously difficult to observe accurately in real time, but the determinants of equilibrium real interest rates are potentially time varying.[11] As such, investors may take some signal from real-side data surprises, such as GDP and employment growth, to revise their estimates of long-run equilibrium real interest rates.[12]

One could envisage a standard new-Keynesian model, consisting of familiar aggregate demand and inflation relationships and closed by a monetary policy reaction function, but

[11] Some empirical evidence, such as that in Rose (1988), points to nonstationary real short-term interest rates.
[12] For example, Edge, Laubach and Williams (2007) describe a model in which agents learn about the trend rate of productivity by filtering incoming data.

modified to permit the rate of potential output growth and the central bank's inflation objective to both be time-varying, following random walks. In such an environment, when the public sees good news about real activity, it views some of that news as transitory but also places some odds on a permanent increase in the rate of potential output growth and thus the equilibrium real interest rate. Likewise, higher-than-expected inflation news may be viewed as a shock to the inflation equation, but also prompt a small upward revision to the public's perception of the inflation objective.[13] Finally, tighter-than-expected monetary policy can lead the public to mark down its estimate of the central bank's inflation objective, and mark up the near-term expected real interest rate required to achieve it.

However, it is hard to see how any such model could generate more than a tiny effect of one month's data on ten-year-ahead expected real short-term interest rates. Perhaps the effects could be amplified by assuming constant-gain learning on the part of agents, or by considering models in which there is a small permanent component of consumption growth and investors have preferences for the early resolution of uncertainty (as in the models of Bansal and Yaron (2004) and Bansal and Shaliastovich (2008)).

Beyond expectations of real short-term interest rates, the sensitivity of real forward rates to news announcements may also owe to time-variation in real risk premia. This paper finds that most of the sensitivity of nominal rates to real-side surprises is in real rates, while Beechey (2007) found that most of it was in term premia. If both results are correct, then most of the puzzling sensitivity to these news announcements must be in real term premia. Indeed, it does seem puzzling that news about variables such as retail sales, new homes sales, or consumer confidence reveal anything about long-run output growth or other determinants of equilibrium

[13] Beechey (2004) presents a model in which the public filters incoming inflation data into transitory and permanent components to try to infer the central bank's uncommunicated, and potentially time-varying, inflation target.

real rates. The reaction of far-forward real rates to such periodic announcements seems more suggestive of variation in real term premia, although for reasons that remain unclear. The information contained in real-side data releases may have little impact on investors' expectations of the long-run equilibrium real rate of interest but alter their perceptions of the quantity of risk and/or their degree of risk aversion.

We recognize that it is easy to argue why any one of the components of distant-horizon nominal forward rates should *not* react much to individual news announcements—but these forward rates do react to news, and the reaction has to be in one or more of the components. What we can conclude is that the sizeable impact of news about real activity on the nominal term structure of interest rates is concentrated in the real component. This suggests that long-run inflation expectations are better anchored than one would infer from studying the effects of news on distant-horizon nominal forward rates alone, and assuming that this reflected only variation in inflation expectations.

We have offered some thoughts about why long-term real rates may be so sensitive to news about real economic activity. More broadly, the extent of the sensitivity seems puzzling, being hard to reconcile with the theoretical behavior of real interest rates in existing macroeconomic models. We observe that long-term real forward rates routinely jump 10 basis points on a single employment report. Our finding is at odds with widely-used dynamic stochastic general equilibrium models, including those of Smets and Wouters (2007) and Christiano, Eichenbaum and Evans (2005). Such models imply that the long-run expected value of the real short-term interest rate is constant and that even near-term expectations of real short-term interest rates are very stable and so should react little to incoming data.

6. Conclusions

The high-frequency reaction of asset prices to macroeconomic news is a rich source of information about the effects of economic fundamentals on financial markets; reactions that are clouded with lower-frequency data come into sharper focus with intradaily data. With intradaily quotes on nominal government yields, we confirm the finding that long-term nominal yields and forward rates are remarkably sensitive to incoming data. But paired with a new dataset of intradaily quotes on real indexed government debt, we are able to parse the reactions more finely, and more precisely, than hitherto.

We find that news about prices, the real side of the economy, and monetary policy elicit distinctly different responses from real rates and rates of inflation compensation. Price data mainly affect inflation compensation, real-side data have a large impact on real yields and forward rates—but no measurable effect on forward rates of inflation compensation—and surprise tightenings of monetary policy push real rates up and inflation compensation down. Our results differ from earlier work that emphasized the sensitivity of inflation compensation in that much of the far-horizon reaction in our dataset is concentrated in real rates. The estimation efficiency gains from using narrower windows, and a dataset that spans the later and more mature years of TIPS, likely reconciles the findings.

That real forward rates—the sum of expectations of real short-term interest rates and real risk premia—are sensitive to a great number of important data releases suggests that explanations for nominal sensitivity that hinge upon unanchored long-run inflation expectations alone are insufficient. The pattern of reactions points to an explanation in which investors simultaneously update their assessment of long-run real interest rates and long-run inflation, and also the premia that they demand to hold risky assets. However, the sensitivity of real rates to

incoming economic data is hard to reconcile within the framework of existing dynamic stochastic general equilibrium models.

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Table 1: U.S. Macroeconomic Announcements

Data Release	Source	Frequency	Release Time	Standard Deviation	Units
Capacity	Fed	Monthly	9:15	0.31	Percent
Confidence	Michigan	Monthly	10:00	4.84	Index
Core CPI	BLS	Monthly	8:30	0.09	Percent change mom
Durable Goods	Census	Monthly	8:30	3.15	Percent change mom
ECI	BLS	Monthly	8:30	0.24	Percent change mom
GDP (Advance)	BEA	Quarterly	8:30	0.81	Percent change qoq, ar
Claims	ETA	Weekly	8:30	18.5	Thousands
NAPM Index	NAPM	Monthly	10:00	2.09	Index
Nonfarm	BLS	Monthly	8:30	92.5	Thousands
New Homes	Census	Monthly	10:00	73.5	Thousands
Core PPI	BLS	Monthly	8:30	0.29	Percent change mom
Retail Sales	Census	Monthly	8:30	0.70	Percent change mom
Unemployment	BLS	Monthly	8:30	0.13	Percent
FOMC	Fed	8 per year	14:15	5.3	Basis points

Notes: Acronyms for the sources are as follows: BEA (Bureau of Economic Analysis), BLS (Bureau of Labor Statistics), Census (Bureau of the Census), ETA (Employment and Training Administration), Fed (Federal Reserve Board of Governors), Michigan (University of Michigan), NAPM (National Association of Purchasing Managers). Acronyms for the units are: mom (month-over-month), qoq (quarter-over-quarter), ar (annualized rate). Standard deviations pertain to the sample February 2004 to June 2008.

Table 2: TIPS bonds used

Date Range	TIPS Security Used
Five year TIPS	
February 17, 2004-July 16, 2004	January 15, 2009, 3⅞ percent
Until October 26, 2004	January 15, 2010 4¼ percent
Until April 25, 2006	April 15, 2010 ⅞ percent
Until April 24, 2007	April 15, 2011 2⅜ percent
Until April 22, 2008	April 15, 2012 2 percent
Since April 23 2008	April 30, 2013 ⅝ percent
Ten year TIPS	
February 17, 2004- July 8, 2004	January 15, 2014 2 percent
Until January 13, 2005	July 15, 2014 2 percent
Until July 14, 2005	January 15, 2015 1⅝ percent
Until January 12, 2006	July 15, 2015 1⅞ percent
Until July 13, 2006	January 15, 2016 2 percent
Until January 11, 2007	July 15, 2016 2½ percent
Until July 12, 2007	January 15, 2017 2⅜ percent
Until January 10, 2008	July 15, 2017 2⅝ percent
Since January 11, 2008	July 15, 2018 1⅝ percent

Notes: This table show the specific TIPS with remaining maturities of approximately five and ten years in our intraday dataset. The corresponding nominal securities are in all cases the most recently issued five- and ten-year notes. In most cases,the TIPS are also on-the-run securities, but the first two five-year TIPS are actually old ten-year TIPS with about five years left to maturity, because no five-year TIPS were issued by the Treasury between July 1997 and October 2004.

Table 3: Regressions of intraday yield changes on macroeconomic surprises

	Ten-year			Five-year			Five-to-ten-year forward		
	Nominal	TIPS	IC	Nominal	TIPS	IC	Nominal	TIPS	IC
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Capacity	0.60***	0.39*	0.20	0.64***	0.36*	0.28	0.54***	0.46	0.07
	(0.19)	(0.23)	(0.16)	(0.23)	(0.20)	(0.19)	(0.18)	(0.36)	(0.26)
Confidence	1.02***	0.95***	0.06	1.03***	1.15***	-0.13	1.00***	0.72***	0.27*
	(0.21)	(0.19)	(0.05)	(0.24)	(0.25)	(0.11)	(0.23)	(0.20)	(0.15)
Core CPI	2.21***	0.64	1.55***	2.55***	0.79	1.74***	1.77***	0.40	1.35***
	(0.34)	(0.41)	(0.31)	(0.45)	(0.51)	(0.39)	(0.26)	(0.40)	(0.39)
Durable	0.93***	0.83***	0.09	1.03**	1.00***	0.02	0.79***	0.70**	0.08
	(0.35)	(0.28)	(0.11)	(0.41)	(0.30)	(0.22)	(0.31)	(0.35)	(0.22)
ECI	0.11	0.15	-0.04	0.10	0.37	-0.27	0.11	-0.01	0.11
	(0.23)	(0.17)	(0.14)	(0.36)	(0.22)	(0.26)	(0.21)	(0.23)	(0.21)
GDP	1.40***	0.97***	0.42*	1.73**	1.30***	0.42	0.94***	0.62*	0.31
	(0.45)	(0.32)	(0.23)	(0.80)	(0.42)	(0.48)	(0.25)	(0.34)	(0.25)
Claims	0.52***	0.46***	0.05	0.67***	0.49***	0.17**	0.32***	0.45***	-0.13
	(0.09)	(0.09)	(0.06)	(0.12)	(0.11)	(0.07)	(0.09)	(0.10)	(0.08)
NAPM	1.84***	1.67***	0.15**	2.15***	1.89***	0.24**	1.43***	1.46***	-0.05
	(0.26)	(0.27)	(0.07)	(0.41)	(0.42)	(0.10)	(0.21)	(0.19)	(0.17)
Nonfarm	7.50***	5.98***	1.44***	10.34***	7.37***	2.87***	3.76***	4.54***	-0.83
	(0.71)	(0.55)	(0.25)	(1.02)	(0.80)	(0.70)	(0.56)	(0.65)	(0.53)
New Homes	0.66***	0.55***	0.10**	0.84***	0.63***	0.21**	0.43**	0.47***	-0.05
	(0.17)	(0.15)	(0.05)	(0.20)	(0.18)	(0.09)	(0.17)	(0.15)	(0.09)
Core PPI	1.25***	0.58***	0.66***	1.41***	0.66***	0.74***	1.06***	0.50*	0.55**
	(0.24)	(0.21)	(0.18)	(0.27)	(0.20)	(0.15)	(0.21)	(0.27)	(0.23)
Retail Sales	1.40***	1.20***	0.18	1.58***	1.42***	0.14	1.17**	0.95**	0.20
	(0.54)	(0.41)	(0.16)	(0.58)	(0.46)	(0.17)	(0.52)	(0.42)	(0.22)
Unemployment	2.52***	2.17***	0.32**	3.57***	2.35***	1.19	1.15**	2.08***	-0.95
	(0.54)	(0.42)	(0.16)	(0.73)	(0.77)	(0.79)	(0.45)	(0.78)	(0.68)
FOMC	-0.49	0.49**	-0.98***	0.92	1.62**	-0.72***	-2.32***	-0.64	-1.65***
	(0.33)	(0.23)	(0.21)	(0.58)	(0.69)	(0.18)	(0.52)	(0.36)	(0.37)

Notes: Estimates of the coefficients in equation (1) using data from the intraday database on five- and ten-year nominal and TIPS yields from 15 minutes before each announcement to 15 minutes after. White standard errors are shown in parentheses. *, ** and *** denote significance at the 10, 5 and 1 percent levels, respectively. Sample period: February 17, 2004 to June 13, 2008.

Table 4: Regressions of daily yield changes on macroeconomic surprises
Measure 1: End-of-day data on securities from the intraday database

	Ten-year			Five-year			Five-to-ten-year forward		
	Nominal	TIPS	IC	Nominal	TIPS	IC	Nominal	TIPS	IC
Capacity	0.46	0.26	0.20	0.63	0.53	0.09	0.39	-0.26	0.64**
	(0.55)	(0.46)	(0.38)	(0.67)	(0.55)	(0.55)	(0.44)	(0.42)	(0.31)
Confidence	0.83	0.33	0.49	0.30	0.78	-0.48	1.48	-0.27	1.73
	(0.81)	(0.78)	(0.51)	(0.93)	(0.99)	(0.60)	(1.06)	(0.88)	(1.39)
Core CPI	1.57**	-0.48	2.04***	1.96**	-1.01	2.96***	1.31*	0.15	1.15***
	(0.78)	(0.58)	(0.45)	(0.90)	(0.71)	(0.55)	(0.75)	(0.55)	(0.41)
Durable	1.22	1.33*	-0.13	1.73*	2.37***	-0.67	0.56	0.67	-0.12
	(0.83)	(0.71)	(0.41)	(1.00)	(0.89)	(0.60)	(0.68)	(0.69)	(0.43)
ECI	0.07	2.51**	-2.45**	-0.18	2.66*	-2.86***	0.30	2.51*	-2.21**
	(1.88)	(1.26)	(0.98)	(2.08)	(1.41)	(0.93)	(1.72)	(1.39)	(1.08)
GDP	2.21	2.26***	-0.07	2.51	2.57***	-0.10	1.28	1.95**	-0.69
	(1.44)	(0.85)	(1.00)	(1.76)	(0.99)	(1.11)	(1.27)	(0.87)	(0.85)
Claims	1.21***	0.89**	0.31*	1.24***	0.90**	0.33	1.23***	0.91**	0.31
	(0.41)	(0.36)	(0.17)	(0.45)	(0.40)	(0.22)	(0.41)	(0.36)	(0.24)
NAPM	2.16***	2.45***	-0.32	2.47***	2.90***	-0.46	1.75***	2.00***	-0.27
	(0.63)	(0.51)	(0.38)	(0.77)	(0.75)	(0.47)	(0.65)	(0.51)	(0.40)
Nonfarm	8.19***	6.27***	1.83***	10.06***	7.78***	2.18***	5.77***	4.72***	0.97**
	(1.11)	(0.94)	(0.40)	(1.24)	(1.07)	(0.51)	(1.01)	(0.93)	(0.38)
New Homes	0.82*	0.50	0.32	1.04*	0.78*	0.24	0.53	0.54	-0.02
	(0.48)	(0.39)	(0.28)	(0.54)	(0.46)	(0.36)	(0.46)	(0.50)	(0.37)
Core PPI	1.76***	0.57	1.18***	1.87**	0.48	1.37***	1.68***	0.76**	0.91**
	(0.66)	(0.37)	(0.45)	(0.76)	(0.47)	(0.45)	(0.58)	(0.36)	(0.44)
Retail Sales	2.20**	2.42***	-0.24	2.64**	2.51***	0.10	1.66	2.25**	-0.61
	(1.05)	(0.86)	(0.43)	(1.20)	(0.93)	(0.59)	(1.08)	(0.94)	(0.41)
Unemployment	3.99***	2.96***	0.99*	5.10***	3.90***	1.14	2.51***	2.05***	0.43
	(0.71)	(0.78)	(0.56)	(0.77)	(0.87)	(0.71)	(0.77)	(0.78)	(0.40)
FOMC	0.14	0.41	-0.27	1.58	2.20**	-0.64	-2.37***	-1.10*	-1.24
	(0.91)	(0.56)	(0.82)	(1.24)	(0.87)	(0.54)	(0.79)	(0.66)	(0.90)

Notes: Estimates of the coefficients in equation (1) using data from the intraday database on five- and ten-year nominal and TIPS yields from 4pm on the day before each announcement to 4pm on the announcement day. White standard errors are shown in parentheses. *, ** and *** denote significance at the 10, 5 and 1 percent levels, respectively. Sample period: February 17, 2004 to June 13, 2008.

Table 5: Regression of daily yield changes on macroeconomic surprises
Measure 2: End-of-day data from smoothed, off-the-run yield curves

	Ten-year			Five-year			Five-to-ten-year forward		
	Nominal	TIPS	IC	Nominal	TIPS	IC	Nominal	TIPS	IC
Capacity	0.40	0.24	0.15	0.60	0.45	0.14	0.16	-0.01	0.17
	(0.53)	(0.44)	(0.37)	(0.66)	(0.52)	(0.58)	(0.47)	(0.41)	(0.23)
Confidence	0.10	0.03	0.07	0.42	0.25	0.17	-0.30	-0.22	-0.07
	(0.78)	(0.74)	(0.40)	(0.82)	(0.85)	(0.44)	(0.83)	(0.72)	(0.45)
Core CPI	1.68**	-0.48	2.15***	2.06**	-1.00	3.05***	1.29	0.12	1.16***
	(0.83)	(0.60)	(0.46)	(1.02)	(0.69)	(0.73)	(0.74)	(0.58)	(0.36)
Durable	1.27	1.37*	-0.12	1.87*	2.51***	-0.66	0.55	0.13	0.42
	(0.85)	(0.71)	(0.42)	(1.02)	(0.86)	(0.52)	(0.72)	(0.62)	(0.37)
ECI	0.86	1.73	-0.88	0.81	1.41	-0.61	1.03	2.14	-1.13
	(1.78)	(1.57)	(0.70)	(2.01)	(1.87)	(0.94)	(1.69)	(1.33)	(0.79)
GDP	1.99	2.11**	-0.15	1.94	2.63**	-0.71	2.09*	1.55	0.51
	(1.41)	(1.05)	(0.84)	(1.66)	(1.10)	(1.23)	(1.27)	(1.10)	(0.87)
Claims	1.36***	1.00***	0.34**	1.56***	1.11***	0.43**	1.15***	0.91***	0.22
	(0.38)	(0.34)	(0.17)	(0.44)	(0.39)	(0.21)	(0.38)	(0.33)	(0.19)
NAPM	1.73***	2.01***	-0.30	2.07***	2.53***	-0.49	1.34**	1.48***	-0.15
	(0.59)	(0.51)	(0.41)	(0.74)	(0.73)	(0.48)	(0.57)	(0.47)	(0.39)
Nonfarm	8.05***	5.89***	2.08***	9.77***	7.44***	2.24***	6.21***	4.30***	1.83***
	(1.08)	(0.88)	(0.45)	(1.25)	(1.15)	(0.49)	(1.02)	(0.76)	(0.53)
New Homes	1.04**	0.53	0.50*	1.12**	0.80*	0.30	0.96*	0.22	0.73***
	(0.50)	(0.37)	(0.29)	(0.53)	(0.43)	(0.35)	(0.51)	(0.38)	(0.25)
CorePPI	1.76***	0.58*	1.16**	1.86**	0.36	1.49**	1.67***	0.84***	0.81**
	(0.62)	(0.31)	(0.47)	(0.78)	(0.38)	(0.63)	(0.52)	(0.30)	(0.40)
Retail Sales	2.01**	2.28***	-0.29	2.63**	2.46***	0.14	1.28	2.12**	-0.86*
	(1.01)	(0.85)	(0.36)	(1.07)	(0.91)	(0.47)	(1.08)	(0.89)	(0.46)
Unemployment	3.95***	2.77***	1.13**	4.94***	4.07***	0.82	2.81***	1.36**	1.41***
	(0.73)	(0.71)	(0.52)	(0.75)	(0.89)	(0.71)	(0.84)	(0.64)	(0.49)
FOMC	-0.59	0.35	-0.94	0.74	1.56**	-0.83	-2.27***	-0.98	-1.26***
	(0.99)	(0.59)	(0.60)	(1.50)	(0.62)	(1.13)	(0.61)	(0.66)	(0.36)

Notes: Estimates of the coefficients in equation (1) using daily changes in yields from the smoothed nominal and TIPS yield curves estimated late each afternoon by Federal Reserve Staff, and described in Gürkaynak, Sack and Wright (2007, 2008). White standard errors are shown in parentheses. *, ** and *** denote significance at the 10, 5 and 1 percent levels, respectively. Sample period: February 17, 2004 to June 13, 2008.

Table 6: Regression of daily yield changes on macroeconomic surprises
Sample Period: January 4, 1999-February 16, 2004

	Ten-year			Five-year			Five-to-ten-year forward		
	Nominal	TIPS	IC	Nominal	TIPS	IC	Nominal	TIPS	IC
Capacity	2.00**	0.26	1.70**	2.34***	0.35	1.94***	1.58*	0.14	1.41
	(0.80)	(0.38)	(0.74)	(0.81)	(0.49)	(0.75)	(0.95)	(0.41)	(0.87)
Confidence	1.37*	0.24	1.10**	1.61*	0.58	1.01**	1.10	-0.15	1.23**
	(0.82)	(0.59)	(0.45)	(0.87)	(0.64)	(0.47)	(0.82)	(0.57)	(0.50)
Core CPI	1.00	-0.58	1.56**	1.07	-0.90*	1.95***	0.95	-0.19	1.12*
	(0.72)	(0.43)	(0.66)	(0.83)	(0.50)	(0.76)	(0.70)	(0.46)	(0.67)
Durable	0.51	0.21	0.30	0.57	0.13	0.43	0.47	0.31	0.15
	(1.06)	(0.37)	(0.74)	(1.25)	(0.39)	(0.95)	(0.92)	(0.38)	(0.66)
ECI	2.16**	0.55	1.57	2.69**	0.90*	1.75	1.47	0.16	1.28
	(1.09)	(0.45)	(1.13)	(1.34)	(0.47)	(1.34)	(0.95)	(0.53)	(1.03)
GDP	2.84**	1.37**	1.44	3.02**	2.05**	0.93	2.75**	0.59	2.12**
	(1.27)	(0.56)	(0.97)	(1.39)	(0.80)	(1.07)	(1.33)	(0.43)	(1.04)
Claims	1.28***	0.66***	0.60**	1.59***	1.01***	0.56*	0.92**	0.26	0.64**
	(0.40)	(0.20)	(0.28)	(0.47)	(0.25)	(0.33)	(0.39)	(0.20)	(0.30)
NAPM	4.52***	2.15***	2.31***	4.93***	2.07***	2.81***	4.16***	2.30***	1.79***
	(0.82)	(0.43)	(0.59)	(0.90)	(0.54)	(0.56)	(0.85)	(0.46)	(0.69)
Nonfarm	2.08***	1.30***	0.76	2.95***	1.63***	1.28***	0.99	0.95***	0.03
	(0.73)	(0.38)	(0.51)	(0.78)	(0.50)	(0.49)	(0.77)	(0.30)	(0.66)
New Homes	0.69	-0.68	1.34*	0.37	-0.29	0.64	1.12	-1.15	2.24***
	(1.01)	(0.73)	(0.69)	(1.11)	(0.75)	(0.77)	(1.05)	(0.81)	(0.79)
CorePPI	-0.18	-0.39	0.21	-0.66	-0.60	-0.05	0.47	-0.15	0.62
	(0.52)	(0.45)	(0.49)	(0.61)	(0.61)	(0.67)	(0.56)	(0.42)	(0.54)
Retail Sales	1.80***	0.75***	1.02***	2.12***	1.17***	0.93**	1.45**	0.27	1.15**
	(0.55)	(0.27)	(0.38)	(0.58)	(0.36)	(0.39)	(0.58)	(0.28)	(0.49)
Unemployment	-0.48	-0.51	0.03	-0.13	-0.47	0.34	-1.03	-0.59	-0.42
	(0.93)	(0.50)	(0.54)	(0.98)	(0.60)	(0.48)	(0.98)	(0.47)	(0.72)
FOMC	0.44	1.08**	-0.64**	0.60	1.13	-0.53	0.27	1.05**	-0.78*
	(0.54)	(0.49)	(0.31)	(0.80)	(0.66)	(0.50)	(0.81)	(0.53)	(0.44)

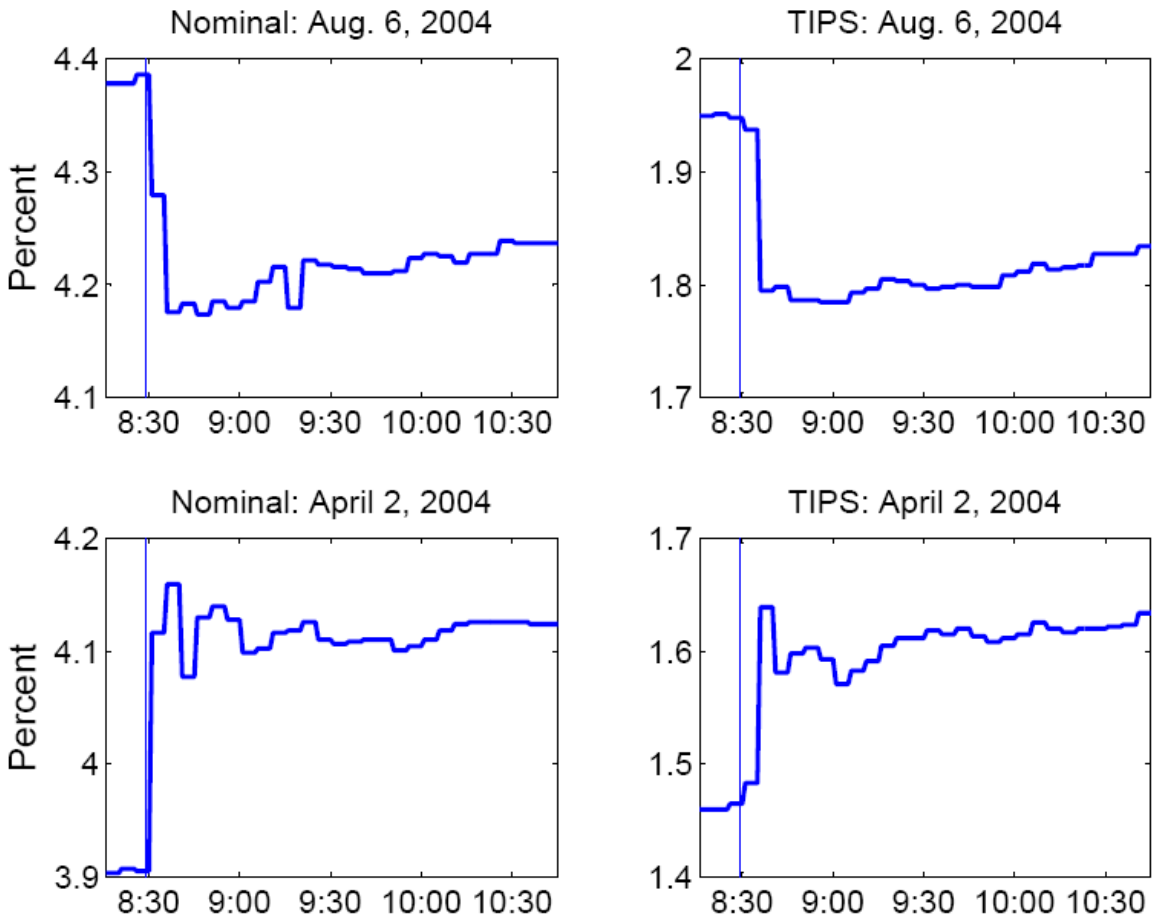
Notes: As in Table 5, except the sample period is January 4, 1999 to February 16, 2004.

Table 7: Structural Stability Tests

	Ten-year			Five-year			Five-to-ten-year forward		
	Nominal	TIPS	IC	Nominal	TIPS	IC	Nominal	TIPS	IC
				January 1, 1999-June 13, 2008					
Nyblom	5.15***	5.96***	5.18***	5.50***	6.95***	5.02***	4.11***	4.41***	4.30***
Sup F	65.60***	76.80***	75.18***	70.06***	87.73***	64.53***	49.62***	51.38***	58.33***
	7/10/03	*7/10/03*	*5/24/01*	*7/10/03*	*7/29/03*	*5/17/01*	*7/11/03*	*7/10/03*	*5/14/01*
				February 17, 2004-June 13, 2008					
Nyblom	2.36	1.94	2.94	2.75	2.24	3.29*	1.65	1.61	2.33
Sup F	23.69	20.15	28.33	22.69	20.72	49.41***	23.62	18.74	23.94
						10/11/07			

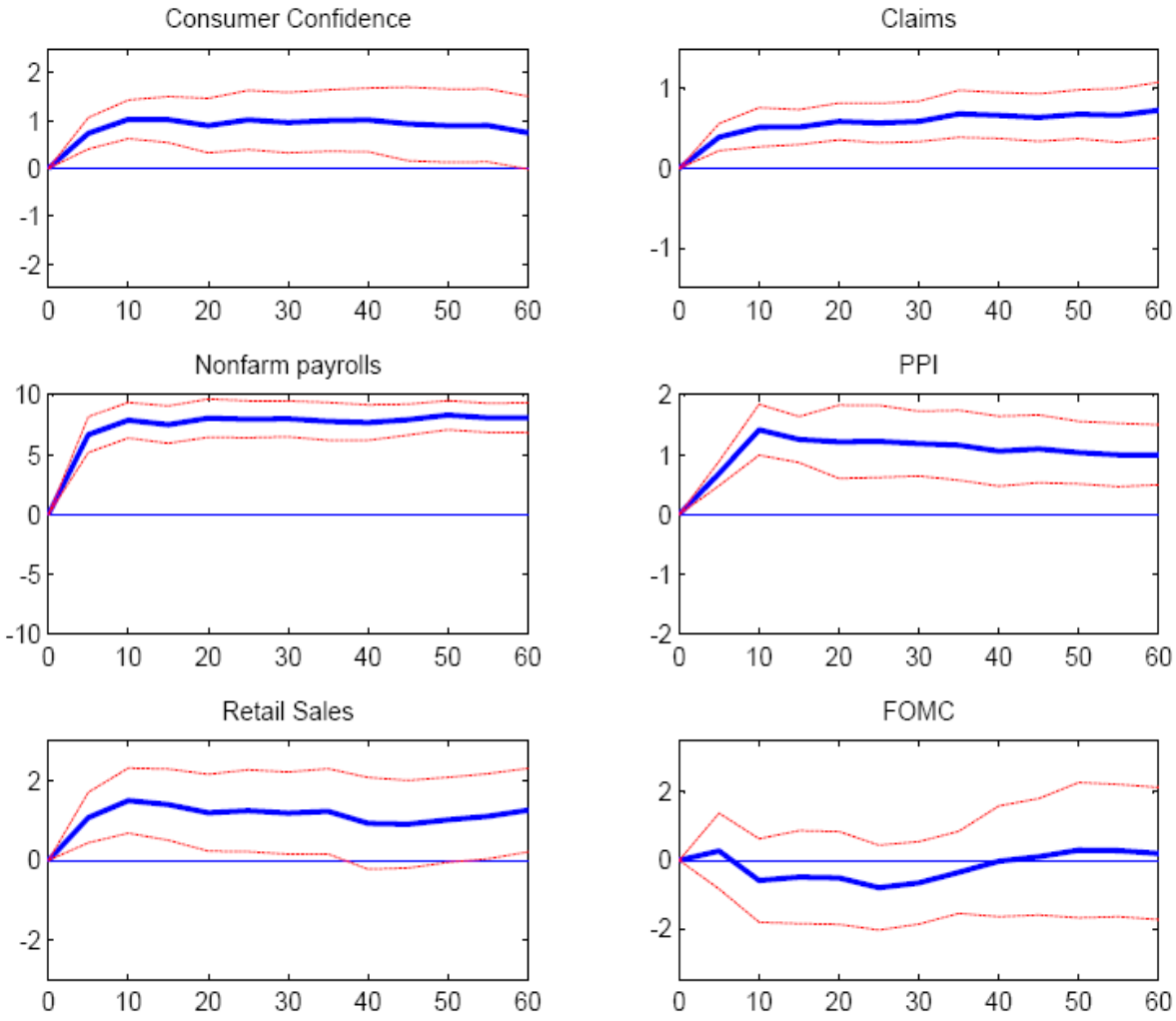
Notes: Results of tests of parameter constancy (Nyblom and sup-F) in estimating equation (1) using daily changes in yields from the smoothed nominal and TIPS yield curves estimated late each afternoon by Federal Reserve Staff. Results are shown for two sample periods. *, ** and *** denote significance at the 10, 5 and 1 percent levels, respectively. In cases where the Sup F test is significant, the date of the putative break which gives the maximum value of the Chow Test is given in italics in month/day/year format. This can be thought of as a crude estimate of the break date.

Fig. 1: Intraday plots of ten-year nominal and TIPS yields around two employment reports



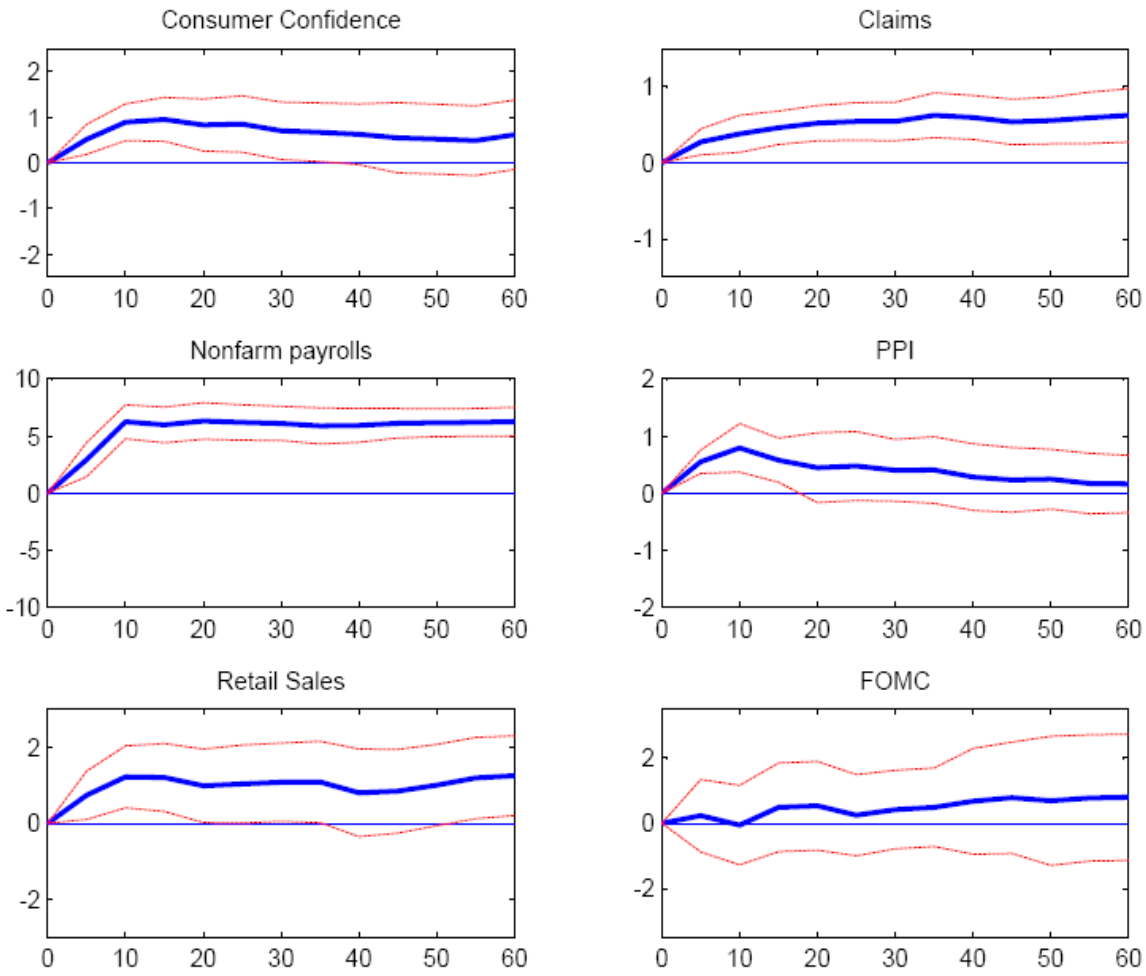
Notes: These two employment reports were the largest absolute surprises among employment reports in the sample. The August 6, 2004 report was much weaker than expected. The April 2, 2004 report came in well above expectations.

Fig. 2: Estimated Effects of Selected News Surprises on Nominal Ten-Year Yields



Notes: This plots the estimated coefficients $\beta_j(h)$ in equation (1) against h, for some of the news announcements, where the dependent variable is the intraday change in ten-year nominal yields. The window used in the regression is from 15 minutes before the announcement time until h minutes afterwards.

Fig. 3: Estimated Effects of Selected News Surprises on Ten-Year TIPS Yields



Notes: As in Figure 2, but with intraday changes in ten-year TIPS yields as the dependent variable instead.