High-Frequency Event Analysis in Eurex Interest Rate Futures

Robert Almgren

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Abstract

We investigate the effect of scheduled information releases and auctions on high-frequency trading of interest rate futures on the Eurex exchange, and compare with similar products on CME. Our study differs from earlier ones in two respects. First, we use very detailed tick data rather than five-minute bars, so we are able to look for sharp price changes on times scales of one or two seconds. Second, we use a very large universe of potential events, in particular including all US and European Treasury auctions as well as economic information releases. We find that, to a degree even greater than identified in previous work, both US and European rates markets respond almost exclusively to US events: European events and auctions have almost no discernible effect. Very short-term products—Eurodollars and two-year note futures—are affected only by the US "Change in Nonfarm Payrolls" release, whereas longer-term products are affected by a broad variety of US releases.

An *event* is a scheduled information release or action. Examples include the US Bureau of Labor Statistics (BLS) "Change in Nonfarm Payrolls" release on the first Friday of every month, or scheduled Treasury auctions. Unscheduled information events also have important effects on the interest rate markets but here we focus on what can be predicted for upcoming scheduled events. For high-frequency traders, events are important because they cause sudden large price moves, as well as substantial temporary increases in trade volume and volatility. Our focus in this article is the European interest rates futures trading on the Eurex exchange, although we will also compare with similar products on CME.

We have several goals:

- To identify the set of events that significantly move the rates markets,
- To characterize the magnitude of the price changes, and
- To characterize the precision in timing of the events.

Figure 1 shows two examples. In both, we show market behavior from 10 minutes before to 10 minutes after a scheduled event. The top panel shows the effect on the Eurex Bund futures contract of the U.S. Bureau of Labor Statistics "Change in

Figure 1: Upper panel: effect of Change in Nonfarm Payrolls on March Eurex Bund contract. Lower panel: effect of a US 30-year bond auction on the Bund. Gray region is bid-ask spread, blue and red show buy and sell posted volume to 10 levels in the order book, and green dots are trades.

Nonfarm Payrolls" (part of the "Employment Situation" cluster) at 7:30 AM CST on Friday, January 6, 2012. The lower panel shows the effect on the June Bund of the U.S. 30-year bond auction, scheduled at 12:00 PM CST on April 12, 2012. For the Nonfarm Payroll event, the sudden price change at 7:30 CST is followed by several rapid fluctuations, and the price returns to more or less its pre-event level. For the 30-year auction, we may tentatively identify a price motion a little less than two minutes following the scheduled time.

We want to systematically measure such effects from historical data, to characterize for each type of event and for each contract, the typical price change and time offset from the scheduled time. We are not trying to react to events in real time.

In previous literature, Andersson, Jul Overby, and Sebestyén (2009) have systematically studied the effect of macroeconomic data releases on the intraday Eurex futures, using 5-minute tick data from 1999 through 2005. Specifically, they considered 44 different types of macroeconomic information announcements from across the Euro area and the United Kingdom, as well as monetary policy decisions by the European Central Bank (ECB), and identified fifteen as significant, ten as very significant. They determined that "German bond markets tend to react more strongly to the surprise component in US macro releases compared with aggregated and national euro area and UK releases, and the strength of those reactions to US releases has increased over the period considered." They suggest a number of reasons for this dominance: in addition to the obvious size of the US economy, US data is often available earlier than its European counterparts. They also document that German unemployment data is systematically leaked before its official release.

Cailloux (2007) considers 28 US and European economic data releases that are judged to have significant effects on the European bond market. Also using five-minute bars, and data from 1999 through 2007, he determines that fifteen indicators have particularly significant effects on the market, especially when the content of the announcement is a surprise relative to the consensus expectation. Again, US events are the main drivers of rates markets in Europe as in the US. This is true even when the US number appears later than its European counterpart.

Asplund (2011) updates this study using data from January 2009 through mid-March 2010, looking at price changes from time of release to 10 minutes after, and using the fourteen indicators determined to be most significant by Andersson, Jul Overby, and Sebestyén (2009). He looks at the EURO STOXX 50 equity index futures contract as well as the Bund. The results are similar to the other studies: only a few European events are found to be significant.

Our data

We use two major data inputs, both of which are more extensive and more detailed than in previous work.

Market data We use a tick data set, in part obtained as historical data directly from Eurex, and in part logged by Quantitative Brokers from a real-time market data

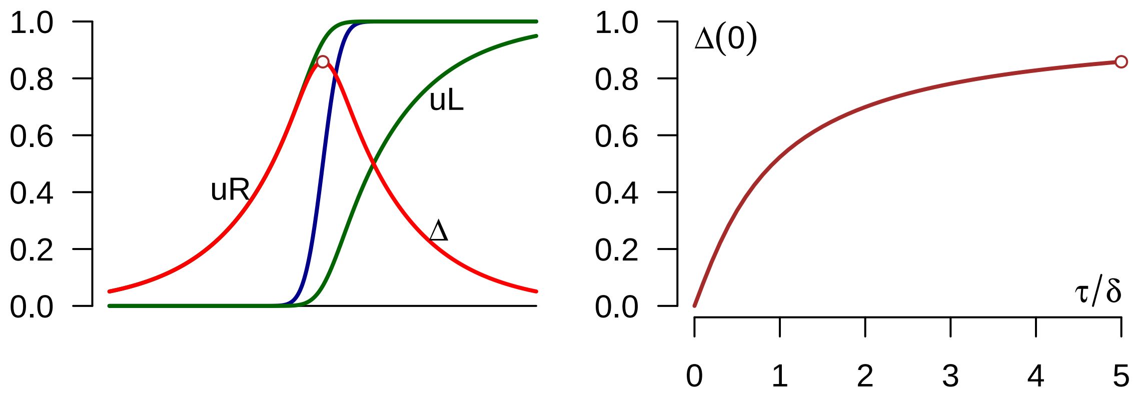

Figure 2: Left and right exponential averaging, applied to a smoothed step function. The ratio of the exponential smoothing time to the step smoothing time $\tau/\delta = 5$. The left panel shows the smoothed step function $u(t)$, the left and right averaged functions $\overline{u}_{\mathrm{L}}(t)$ and $\overline{u}_{\mathrm{R}}(t)$, and the difference $\Delta(t)$. The right panel shows $\Delta_{\max}$ as a function of τ/δ; the point is the common value $\Delta_{\max} \approx 0.8$ at $\tau/\delta = 5$.

feed. This data provides every trade and every quote update for Eurex interest rate products (Schatz, Bobl, Bund, and Buxl). We have this data from November 2010 through the present, but the current study uses data from January 2011 through June 21, 2012. We do not use any form of time bar subsampling. Thus, for example, when we compute rolling exponential averages as described below, we use every single quote update, applying the procedure to the piecewise constant function of time defined by the bid-ask midpoint.

Event database From Bloomberg, we extract every "Economic Event" and every "Auction Event" for the United States and for all of Western Europe. We filter the auction data to exclude central bank purchases and sales, but including all bill, note, and bond sales by central treasuries. We have 1593 distinct events in the raw database; after filtering events that happen only a few times and after grouping events that consistently happen together (for example, the US BLS "Change in Nonfarm Payrolls" cluster includes about eight other employment statistics which are released at the same time) we have about 362 distinct events. Thus we have no preconceptions about which events are likely to be significant.

Exponential averaging

Our primary mathematical tool is exponential time averaging. Suppose that $u(t)$ is some function of time. The left and right moving averages of $u(t)$ with time scale

τ are

$$\overline{u}_{\mathrm{L}}(t) = \frac{\displaystyle\int_{-\infty}^{t} e^{-(t-s)/\tau}\, u(s)\, ds}{\displaystyle\int_{-\infty}^{t} e^{-(t-s)/\tau}\, ds} = \frac{1}{\tau}\int_{-\infty}^{t} e^{-(t-s)/\tau}\, u(s)\, ds$$

$$\overline{u}_{\mathrm{R}}(t) = \frac{\displaystyle\int_{t}^{\infty} e^{-(s-t)/\tau}\, u(s)\, ds}{\displaystyle\int_{t}^{\infty} e^{-(s-t)/\tau}\, ds} = \frac{1}{\tau}\int_{t}^{\infty} e^{-(s-t)/\tau}\, u(s)\, ds$$

Note that the left average $\overline{u}_{\mathrm{L}}(t)$ is purely backward-looking, while the right average $\overline{u}_{\mathrm{R}}(t)$ is purely forward-looking. Thus, in a real-time environment, only the left average can be evaluated. However, we are interested only in studying historical data, so we may equally well evaluate both $\overline{u}_{\mathrm{L}}(t)$ and $\overline{u}_{\mathrm{R}}(t)$.

To identify jumps we look for peaks of the magnitude of

$$\Delta(t) = \overline{u}_{\mathrm{R}}(t) - \overline{u}_{\mathrm{L}}(t)$$

Figure 2 shows an example. We take $u(t)$ to be a step function smoothed across a time scale δ[1] and we smooth with a time scale τ. In this case, $\tau = 5\delta$, so the step function appears to be reasonably sharp in comparison to the the smoothing. The right panel shows the maximum value of $\Delta(t)$ as a function of τ/δ. As $\tau \to 0$, $\Delta(t) \to 0$ as it must for any smooth function. Note that the sign of $\Delta(t)$ corresponds to the direction of the jump.

1 Single event analysis

To identify events, we apply the above exponential averaging procedure to the price history of the futures contract. As the price series $u(t)$, we take the bid-ask midpoint, ignoring the sizes of the quotes on either side. Thus $u(t)$ is piecewise constant, and its changes are always integer multiples of one-half the minimum tick

[1] We take $u(t)$ to be the cumulative normal function

$$u(t) = \Phi\left(\frac{t}{\delta}\right) \qquad \text{with} \qquad \Phi(t) = \frac{1}{\sqrt{2\pi}}\int_{-\infty}^{t} e^{-s^2/2} ds.$$

Then

$$\overline{u}_{\mathrm{L}}(t) = \Phi\left(\frac{t}{\delta}\right) - e^{\delta^2/2\tau^2} e^{-t/\tau}\Phi\left(\frac{t}{\delta} - \frac{\delta}{\tau}\right)$$

$$\overline{u}_{\mathrm{R}}(t) = \Phi\left(\frac{t}{\delta}\right) + e^{\delta^2/2\tau^2} e^{t/\tau}\left[1 - \Phi\left(\frac{t}{\delta} + \frac{\delta}{\tau}\right)\right]$$

and

$$\Delta(t) = e^{\delta^2/2\tau^2}\left\{e^{t/\tau}\left[1 - \Phi\left(\frac{t}{\delta} + \frac{\delta}{\tau}\right)\right] + e^{-t/\tau}\Phi\left(\frac{t}{\delta} - \frac{\delta}{\tau}\right)\right\}$$

so that

$$\Delta_{\max} = \Delta(0) = 2e^{\delta^2/2\tau^2}\left[1 - \Phi\left(\frac{\delta}{\tau}\right)\right].$$

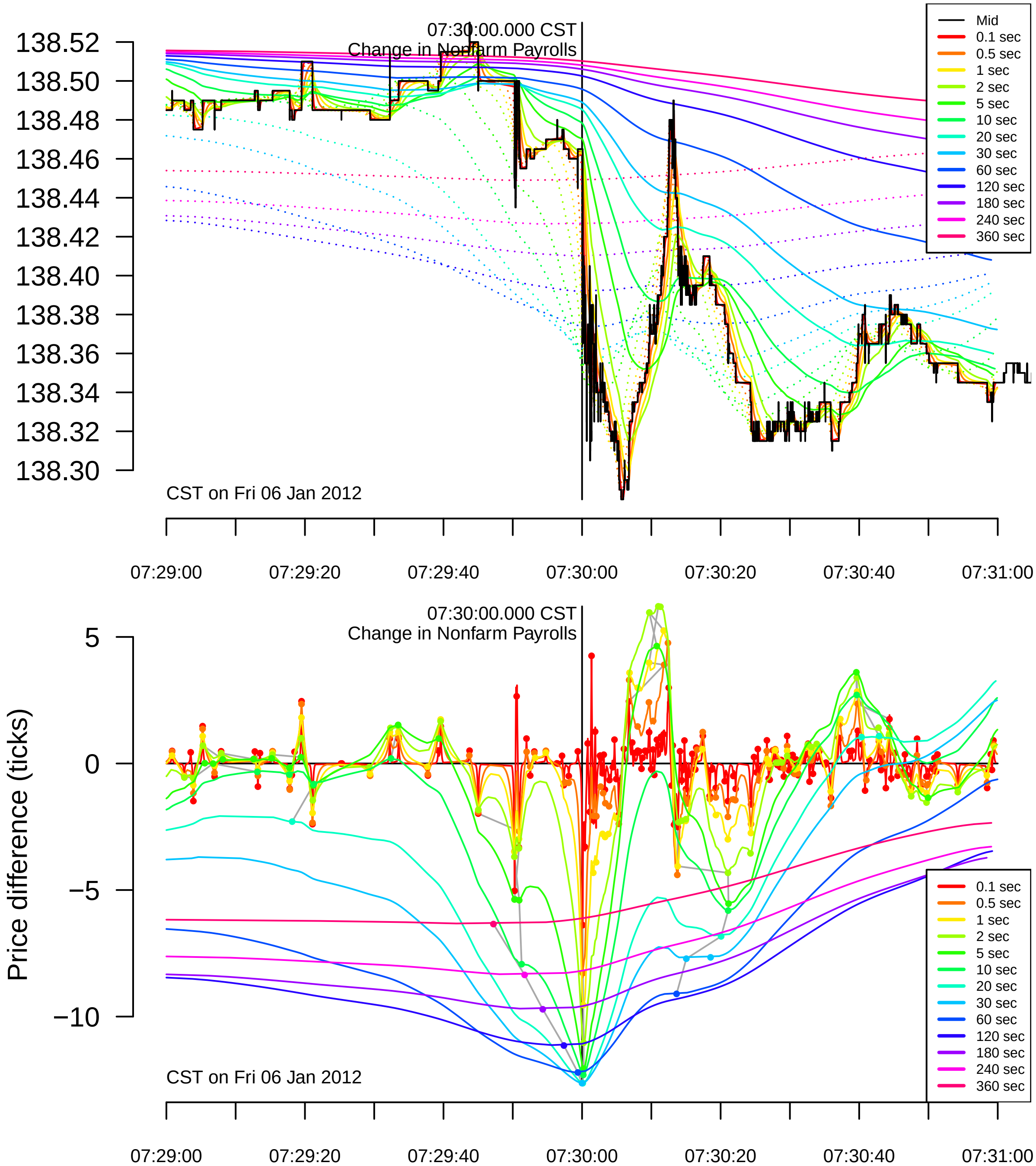

Figure 3: Upper panel is price history for the Eurex Bund March futures contract, trading around the Change in Nonfarm Payrolls event on January 6, 2012, with left exponential averages (solid lines) and right exponential averages (dotted lines) for a variety of averaging times τ; "mid" denotes the instantaneous bid-offer midpoint. Lower panel is right average minus left average, showing local extremal points.

size. The left and right averages $\overline{u}_{\mathrm{L}}(t)$ and $\overline{u}_{\mathrm{R}}(t)$ can be efficiently computed by an iterative procedure applied to the discrete quote updates.

Figures 3 and 4 show the results for the Nonfarm Payroll event. In Figure 3, the upper panel is essentially an expanded version of the upper panel of Figure 1, showing one minute before and after the event rather than ten minutes. In addition, we show the left and right exponential averages for a variety of averaging times τ varying from 0.1 sec to 6 minutes. The lower panel of Figure 3 shows the difference $\Delta(t)$. We measure price differences in "ticks," where one tick is the minimum allowable price increment for the traded asset. For the 10-year contract one tick is 1/2 of 1/32, or 1/2 of the discretization unit on the vertical scale of the upper panel. The lower panel clearly shows a negative spike of about 12 ticks at the event time, corresponding to the downward jump of about 6/32 visible in the upper panel.

To precisely identify the event, in Figure 4 we identify local extrema of the difference, and connect them together across the range of averaging times; these extrema are identified by dots in the lower panel of Figure 3. If the data shown in the lower panel of Figure 3 is imagined as a surface, whose horizontal axes are the clock time and the averaging period, and whose vertical axis is the price difference, then the upper panel of Figure 4 is a top-down view of this surface showing local extrema. The lower panel of Figure 4 is a side view, showing the maximum and minimum values of the price difference at each averaging time.

This procedure is clearly able to pick out the negative jump, and to identify its magnitude at approximately 10 negative ticks and its time as being almost exactly the event time. In addition, we are able to identify a number of lesser jumps, although these do not appear to have much significance in the price plot.

Figure 5 shows the analog of the lower panel of Figure 3, for the Bund contract trading around the 30-year bond auction on April 12, 2012. Again, we clearly identify a negative jump of more than 15 ticks, approximately 95 seconds after the scheduled event.

2 Multiple instances of one event type

We can now study the properties of each category of events. Because we do not want to do the full cross-sectional analysis shown in Figures 3, 4, and 5 for each event, we make two simplifying assumptions:

1. We look only at averaging period $\tau = 2\,\mathrm{sec}$. That is, we compute the left exponential average with parameter τ, the right exponential average with parameter τ, and we identify the event time and size as the location $t_{\max}$ and signed value $\Delta_{\max}$ of the largest absolute value of $\Delta = \overline{u}_{\mathrm{R}} - \overline{u}_{\mathrm{L}}$. We have also tested averaging period $\tau = 5\,\mathrm{sec}$ and the results are almost identical (though see Figure 7 for an example where they differ).

2. We ignore any instance in which the maximum $\Delta_{\max}$ is smaller than 2 ticks. Such small maximum values are likely to be associated with random market motions rather than significant events.

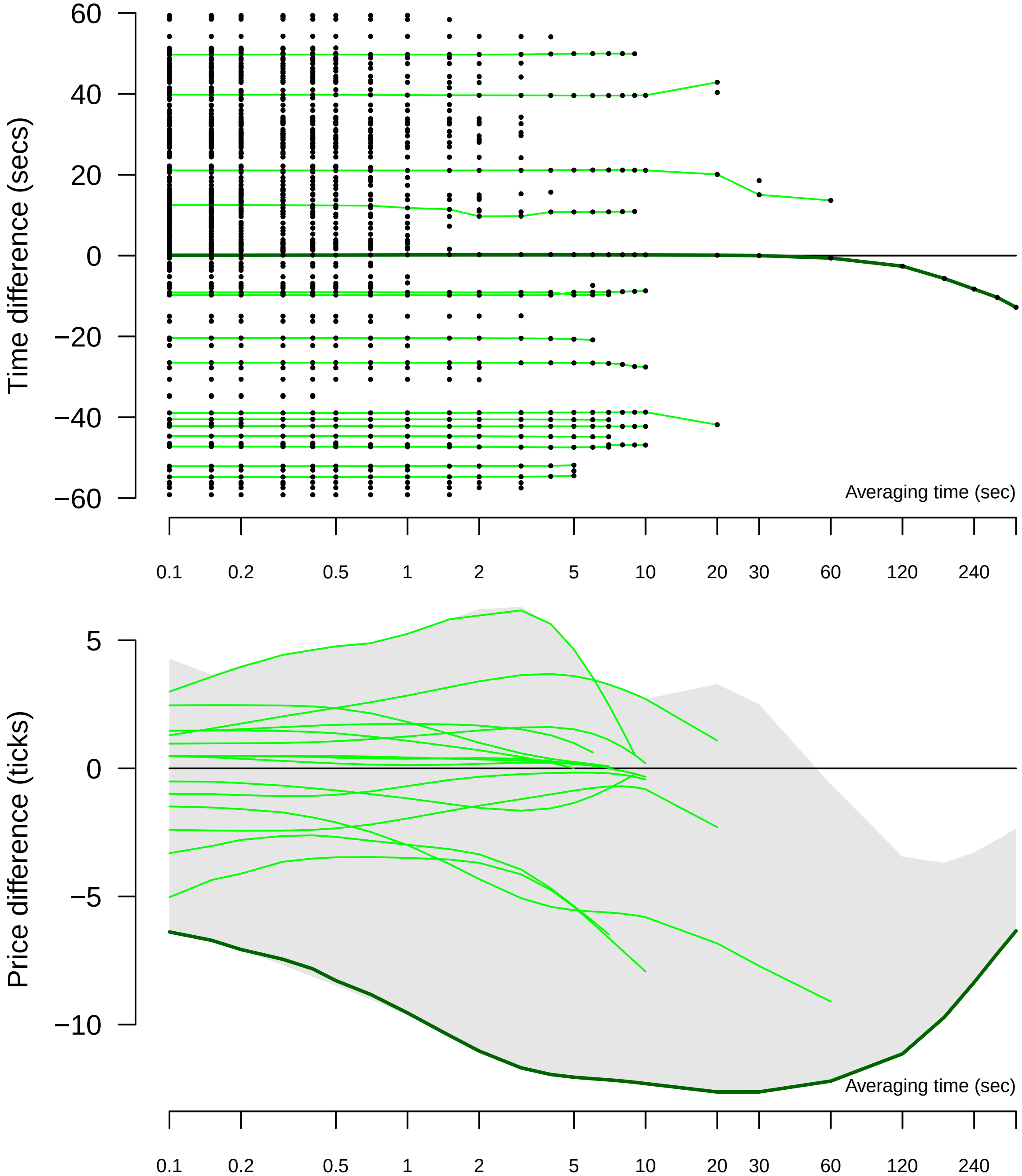

Figure 4: Upper panel shows the location of extremal points for the difference of moving averages shown in the lower panel of Figure 3, with connected paths identified; the heavy line is the primary event. Lower panel is the magnitude of price difference, with the primary event path in heavy line.

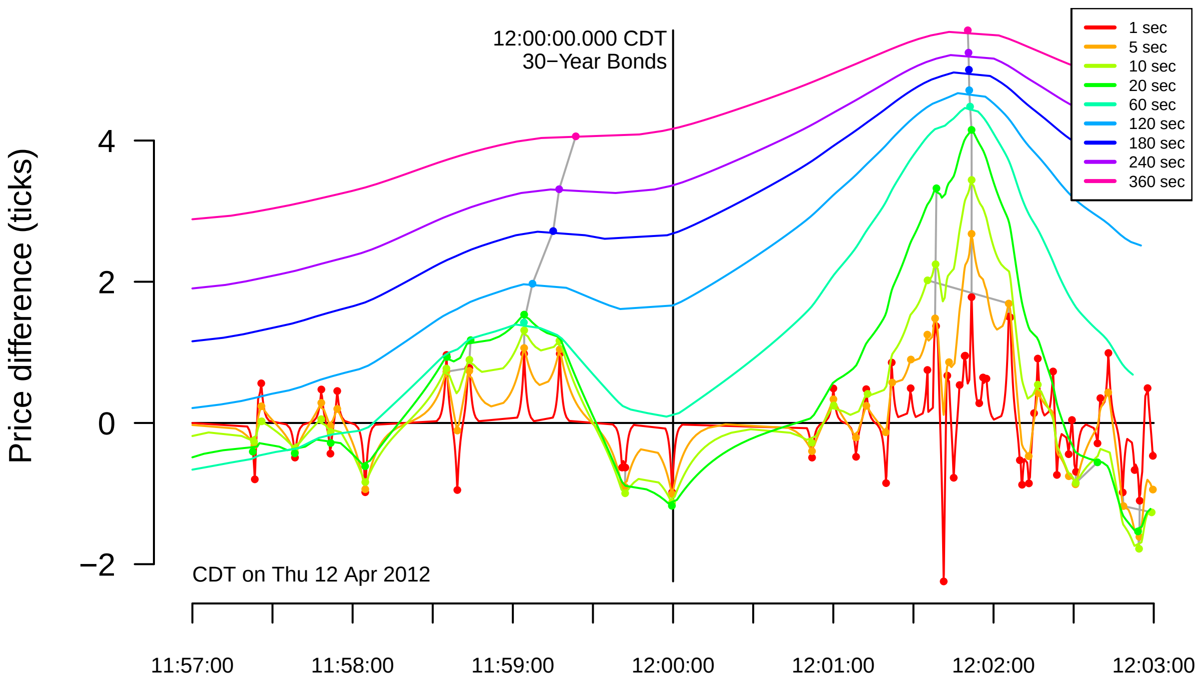

Figure 5: Bund, around the US 30-year bond auction on April 12, 2012. The positive price jump can be identified approximately two minutes after the scheduled event.

Figure 6 shows the results, for our two example events, for the 18 months from January 2011 through June 2012. Each of these events is monthly and so there are approximately 18 samples of each, although the April Change in Nonfarm Payrolls event fell on Good Friday, a Eurex holiday. For each instance of the given event, we identify the futures contract of the given type that has the highest traded volume, generally the front month contract.

The horizontal axis is time of the market reaction, measured in seconds relative to the nominal event time. The vertical dashed line is the median time offset; the two vertical dotted lines are first and third quartiles of the time distribution. Thus approximately one-quarter of the sample points fall between each pair of vertical dashed or dotted lines. We will use the difference between the first and third quartiles as a measure of dispersion.

The vertical axis is the signed magnitude of the price jump. We ignore instances for which the price jump is smaller than two ticks, as indicated by the gray bands on the picture. The horizontal dashed lines are the median of the absolute price change, so that half the points fall between these lines and half outside, whether above the top line or below the bottom line.

For the Change in Nonfarm Payrolls event (Figure 6 upper panel), the time offsets range from -2 to about 5 seconds. The median time change is 0.4 seconds, and 3/4 of the jumps occur sooner than 1.2 seconds after the scheduled events. The median price change is 21.5 ticks. All instances met the significance threshold, but there

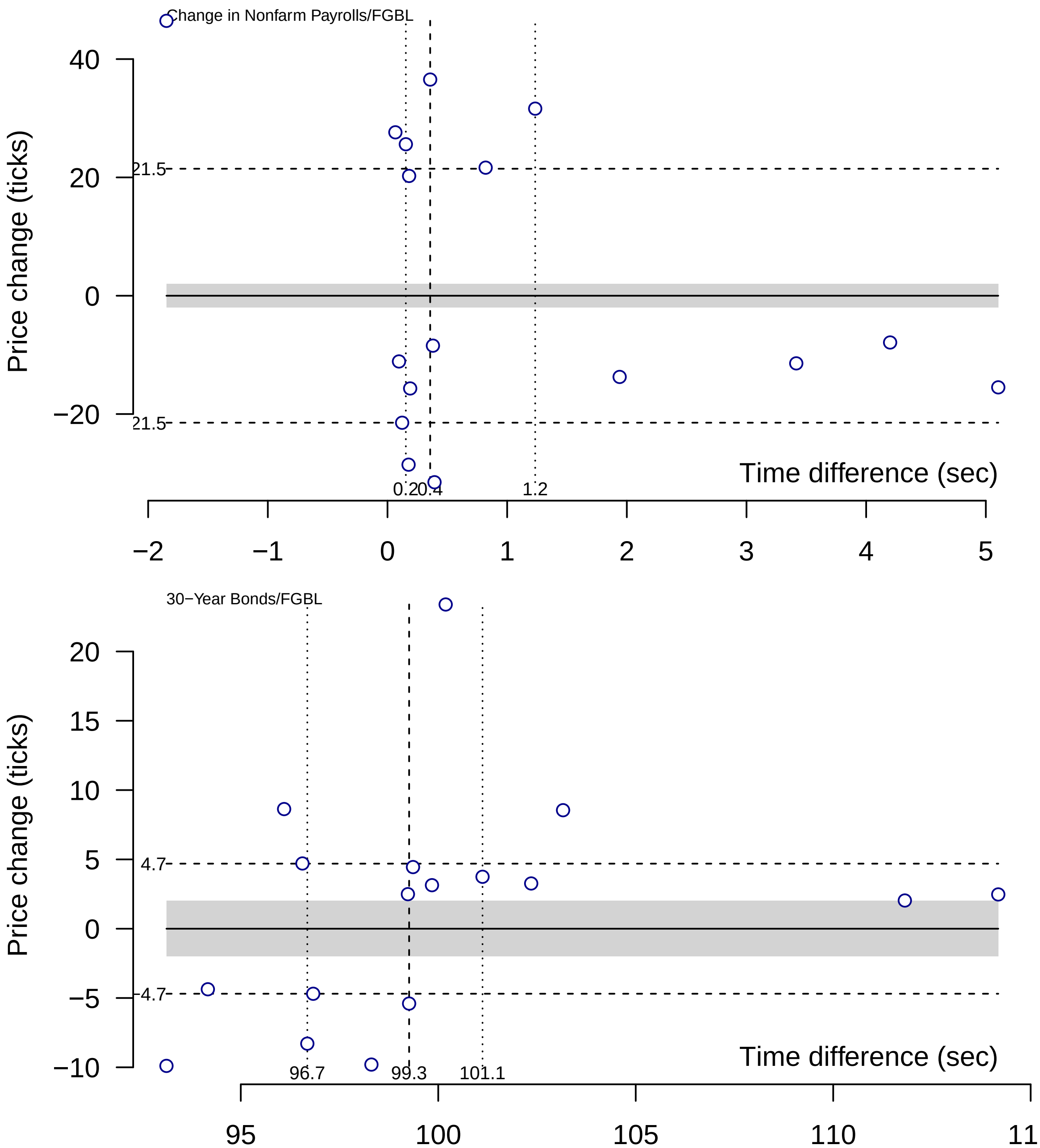

Figure 6: Relative time and magnitude of Bund market reaction to event, for 18 months from January 2011 through June 2012. Dashed lines are median and dotted lines are quartiles as described in the text; the gray band is the 2-tick signficance threshhold. Upper panel: Nonfarm Payrolls event—the instance in the top left is illustrated in Figure 7. Lower panel: US 30-year bond auction.

	Change in Nonfarm Payrolls				US 30-year bond auction			
	n	med $\|\Delta p\|$	med Δt	range Δt	n	med $\|\Delta p\|$	med Δt	range Δt
Eurodollar	11	5.8	0.6	0.5	0			
2-year	12	5.6	0.4	0.8	1	2.0	96.5	0
5-year	18	21.7	0.4	0.3	17	5.5	99.4	4.1
10-year	18	19.3	0.4	0.4	17	6.0	98.4	3.1
30-year	18	14.9	0.5	2.8	18	7.2	98.1	3.1
Ultra	18	18.2	0.6	1.5	18	11.0	97.8	3.2
Schatz	16	4.7	0.7	2.3	5	2.1	103.2	115.9
Bobl	17	9.5	0.4	2.0	9	4.0	98.3	2.7
Bund	17	21.5	0.4	1.1	17	4.7	99.3	4.4
Buxl	17	16.0	1.9	4.6	17	5.4	99.3	10.9

Table 1: Summary statistics for 6 CME and 4 Eurex interest rate products, for two different event categories, for the 18 monthly events from January 2011 through April 2012. "n" is the number of events that meet the 2-tick signficance threshhold, "med $|\Delta p|$" denotes median absolute price change in ticks (minimum price increment), "med Δt" is median value of time offset in seconds relative to scheduled event time, and "range Δt" is the interquartile range of time offsets.

are only 17 because Good Friday, April 6, 2012, was a Eurex holiday.

The instance in the top left, corresponding to July 8, 2011, indicates a price change nearly two seconds before the information release. Figure 7 shows a detail of the Change in Nonfarm Payrolls event on that date, for the CME 10-year Treasury futures contract for which the effect is more clearly seen than for the Bund. There is a jump about 1.5 seconds before the event, and thus it is likely that the information leaked a bit early.

For the US 30-year bond auction event (Figure 6 lower panel), the median time offset is 99.3 seconds and the first and third quartile times are 96.7 and 101.1 seconds after the event, more than a minute and a half. As noted above, this is because the time of the event is the last time at which bids are accepted, and this delay is the time for the Treasury to determine the outcome and announce the results. The median price change is 4.7 ticks. The June 2012 instance barely did not meet the significance threshold and is not shown.

3 The universe of events

Finally, we may summarize all the instances for a single event type by reporting the median magnitude of price change (we assume that price changes have mean zero), and the median and inter-quartile distance of time offsets. We use medians and quartiles rather than means and standard deviations for robustness.

We do this for each event type, and for each separate contract type. Table 1 shows the results for our two example events.

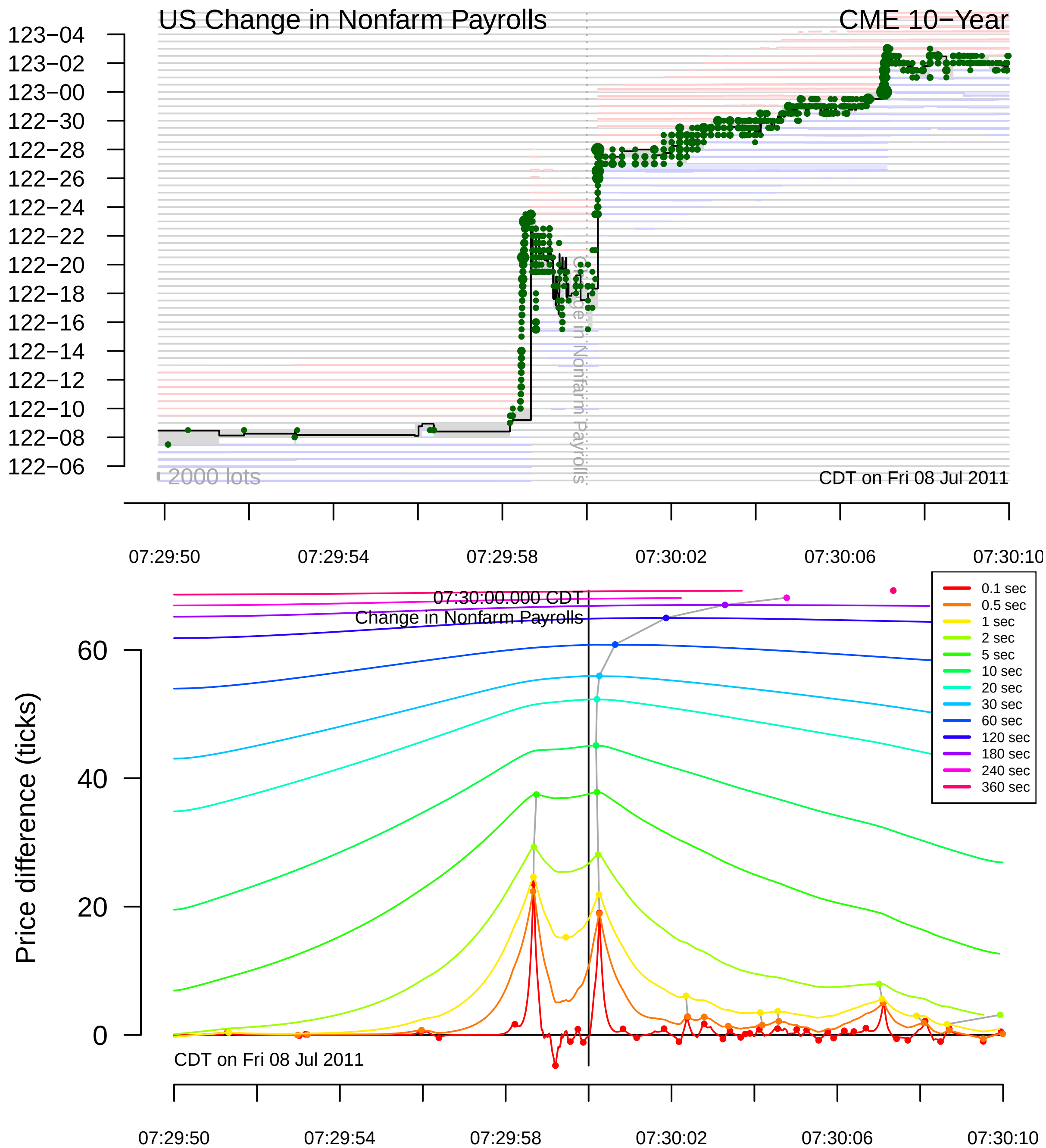

Figure 7: Detail of the Nonfarm Payrolls event on July 8, 2011. As suggested by Figure 6, there is indeed sharp price motion, followed by heavy trade activity, about 1.3 seconds before the scheduled announcement. With averaging period 2 seconds or less, the earlier jump is identified, with 5 seconds or greater, the jump immediately following the announcement is selected.

3.1 Significant Events

Finally, we may look across the entire universe of events for to identify events that are "significant" for each individual contract. Our universe of events is all "Economic Events" or "Auctions" identified by Bloomberg, for the US and for all of Western Europe. We include debt sales by central treasuries but exclude asset sales by central banks (e.g. US Fed). For the 18-month period from January 2011 through June 2012, this set includes 586 distinct events, and 7033 occurrences.

A "significant" event is defined as an event type for which

- For at least half of the occurences, we are able to identify a price jump whose magnitude is at least two ticks, and
- For durations of 10 years and longer (Tables 4 and 5), among the occurences for which the magnitude is at least two ticks, the median magnitude of the price jump is at least four ticks. For the short- and medium-term contracts (Tables 2 and 3), we use a threshhold of two ticks.

Tables 2 through 5 show the results.

In these tables, the column n_e shows the number of times this event has occured in the 18-month period. For example, for a monthly event, $n_e = 18$. n shows the number of instances for which a price jump of at least two ticks was observed (thus in these tables, always $n \geq n_e/2$).

US Contracts For the US contracts, no European events are significant. The most important events, for all contracts, are the employment numbers, with price jumps consistently in the 20-tick range for the medium-term contracts (Tables 3 and 4), in the 15–20 tick range for the long-term contracts (Table 5), and about 5–6 ticks for the short-term contracts (Table 2).

The time offsets are close to zero for most economic information announcements. They are consistently about 90–100 seconds for US Treasury auctions. The FOMC Rate Decision event has a wide variability in time. A seeming outlier is the "Chicago Purchasing Manager" event, for which the price jump occurs three minutes before the scheduled time; in fact, that organization releases the results to its subscribers exactly three minutes before the scheduled public release. Where an events has high time variability, other than FOMC events or auctions, it is likely that our method is picking up spurious jumps.

Eurex Contracts For European contracts, only one European event is identified as significant: the German "ZEW Survey" employment report for the Bund. The European markets are primarily driven by US news. Otherwise the profile is broadly similar to the US contracts.

Contract	Event name and region		n_e	n	med $\lvert\Delta p\rvert$	med Δt	range Δt
GE	Change in Nonfarm Payrolls	US	18	11	5.8	0.6	0.5
ZT	Change in Nonfarm Payrolls	US	18	12	5.6	0.4	0.8
FGBS	Change in Nonfarm Payrolls	US	17	16	4.7	0.7	2.3

Table 2: Significant events for short-term contracts: US Eurodollar (GE), US 2-year contract (ZT), and Eurex 2-year Schatz (FGBS). Significance threshhold is 2 ticks.

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Contract	Event name and region		n_e	n	med $\lvert\Delta p\rvert$	med Δt	range Δt
ZF	Change in Nonfarm Payrolls	US	18	18	21.7	0.4	0.3
	10-Year Notes	US	18	13	7.3	97.5	2.9
	Leading Indicators	US	18	11	6.0	0.8	0.4
	Philadelphia Fed.	US	18	14	5.9	0.6	0.3
	7-Year Notes	US	17	14	5.6	96.8	3.2
	30-Year Bonds	US	18	17	5.5	99.4	4.1
	5-Year Notes	US	17	15	5.3	96.0	6.0
	Construction & Manufacturing	US	18	15	5.1	0.7	0.5
	GDP	US	6	6	4.8	0.7	12.1
	ADP Employment Change	US	18	15	4.8	0.1	4.3
	PPI	US	18	14	4.7	0.3	0.5
	Consumer Confidence	US	17	12	4.7	0.2	0.3
	Chicago Purchasing Manager	US	17	12	4.5	-179.8	0.6
	FOMC Rate Decision	US	12	11	4.5	115.5	178.4
	Goods	US	17	12	4.3	0.8	0.9
	CPI	US	18	12	4.1	0.3	6.9
	Trade Balance	US	18	9	4.0	0.3	91.5
FGBM	Change in Nonfarm Payrolls	US	17	17	9.5	0.4	2.0
	ADP Employment Change	US	18	9	4.6	-0.0	0.1
	30-Year Bonds	US	18	9	4.0	98.3	2.7
	GDP	US	6	5	3.6	0.7	16.8
	Philadelphia Fed.	US	18	11	3.1	0.5	0.1
	Productivity and Costs	US	12	8	3.1	152.7	207.0
	PPI	US	18	10	3.1	0.4	0.8
	Leading Indicators	US	18	11	3.0	0.5	0.1

Table 3: Significant events for 5-year contracts: US (ZF) and Eurex Bobl (FGBM). Significance threshhold is 4 ticks for ZF, 2 ticks for FGBM.

Disclaimer

Contract	Event name and region		n_e	n	med $\lvert\Delta p\rvert$	med Δt	range Δt
ZN	Change in Nonfarm Payrolls	US	18	18	19.3	0.4	0.4
	7-Year Notes	US	17	13	6.5	97.0	2.8
	Leading Indicators	US	18	10	6.3	0.8	0.4
	Philadelphia Fed.	US	18	13	6.1	0.6	0.4
	30-Year Bonds	US	18	17	6.0	98.4	3.1
	Construction & Manufacturing	US	18	13	5.8	0.9	2.0
	ADP Employment Change	US	18	14	5.0	0.0	0.3
	5-Year Notes	US	17	14	4.9	94.7	4.9
	GDP	US	6	6	4.9	0.9	0.6
	10-Year Notes	US	18	15	4.7	97.5	2.1
	FOMC Rate Decision	US	12	11	4.6	124.3	154.4
	Goods	US	17	12	4.4	0.7	0.7
	PPI	US	18	15	4.4	0.2	0.3
	Retail Sales	US	18	13	4.2	0.5	0.4
	Consumer Confidence	US	17	11	4.2	0.1	0.2
FGBL	Change in Nonfarm Payrolls	US	17	17	21.5	0.4	1.1
	GDP	US	6	6	5.9	0.7	0.4
	Consumer Confidence	US	17	14	5.5	0.0	0.0
	Construction & Manufacturing	US	17	15	5.2	0.6	1.3
	Leading Indicators	US	18	16	5.0	0.5	0.2
	Philadelphia Fed.	US	18	17	4.9	0.5	0.1
	ADP Employment Change	US	18	17	4.9	0.0	0.1
	30-Year Bonds	US	18	17	4.7	99.3	4.4
	Trade Balance	US	18	12	4.6	98.3	267.8
	Productivity and Costs	US	12	10	4.3	148.3	212.4
	Goods	US	17	17	4.3	0.8	4.3
	PPI	US	18	17	4.1	0.7	101.5
	ZEW Survey	GE	18	16	4.1	0.5	8.2
	Retail Sales	US	18	14	4.1	0.5	2.3
	GDP rev 1	US	6	6	4.0	1.1	1.2

Table 4: Significant events for 10-year contracts: US (ZN) and Eurex Bund (FGBL). Significance threshhold is 4 ticks.

Contract	Event name and region		n_e	n	med $\lvert\Delta p\rvert$	med Δt	range Δt
ZB	Change in Nonfarm Payrolls	US	18	18	14.9	0.5	2.8
	30-Year Bonds	US	18	18	7.1	98.1	3.1
	Construction & Manufacturing	US	18	13	6.1	0.6	0.3
	7-Year Notes	US	17	12	5.2	96.9	2.8
	10-Year Notes	US	18	15	4.8	97.7	2.8
	ADP Employment Change	US	18	13	4.7	0.0	0.2
	Leading Indicators	US	18	11	4.6	0.7	0.3
	GDP	US	6	6	4.4	0.7	0.3
	Philadelphia Fed.	US	18	14	4.2	0.7	0.8
UB	Change in Nonfarm Payrolls	US	18	18	18.2	0.6	1.5
	30-Year Bonds	US	18	18	11.0	97.8	3.2
	GDP	US	6	5	7.3	2.1	86.5
	10-Year Notes	US	18	17	5.5	97.6	3.8
	7-Year Notes	US	17	15	5.5	96.7	4.3
	5-Year Notes	US	17	14	5.5	94.7	5.5
	FOMC Rate Decision	US	12	12	4.9	9.2	204.4
	GDP rev 1	US	6	6	4.7	1.0	0.9
	Leading Indicators	US	18	16	4.6	0.7	2.9
	ADP Employment Change	US	18	18	4.5	1.7	11.6
	Philadelphia Fed.	US	18	18	4.5	0.9	5.3
	Productivity and Costs	US	12	11	4.5	10.4	124.8
	Employment Cost Index	US	6	5	4.4	2.1	39.4
	Construction & Manufacturing	US	18	17	4.3	0.9	1.7
	Goods	US	17	16	4.3	1.8	8.2
	Chicago Purchasing Manager	US	17	14	4.3	-179.8	0.7
	Consumer Confidence	US	17	13	4.2	0.2	0.3
FGBX	Change in Nonfarm Payrolls	US	17	17	16.0	1.9	4.6
	FOMC Rate Decision	US	12	8	5.9	132.1	146.6
	30-Year Bonds	US	18	17	5.4	99.3	10.9
	Construction & Manufacturing	US	17	15	5.1	0.6	84.4
	ADP Employment Change	US	18	12	4.2	0.1	16.3
	Minutes of FOMC Meeting	US	11	8	4.2	-62.7	200.5
	Trade Balance	US	18	10	4.2	84.9	192.5

Table 5: Significant events for long-term contracts: US 30-year contract (ZB), US Ultra (UB), and Eurex Buxl (FGBX). Significance threshhold is 4 ticks.