High-Frequency Event Analysis in Eurex Interest Rate Futures

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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 may also have important effects on the interest rate markets but we do not consider them. 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

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Figure 1: Upper panel: effect of Change in Nonfarm Payrolls on March Eurex Bund contract. Lower panel: effect of a 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.

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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.

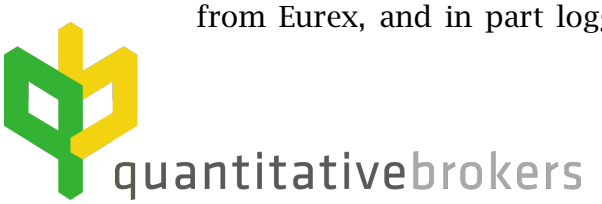
Cailloux (2007) considers 28 US and European economic data releases that are judged to have significant effects on the European bond market. Also using five-minute bars, and data from 1999 through 2007, he determines that fifteen indicators have particularly significant effects on the market, especially 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



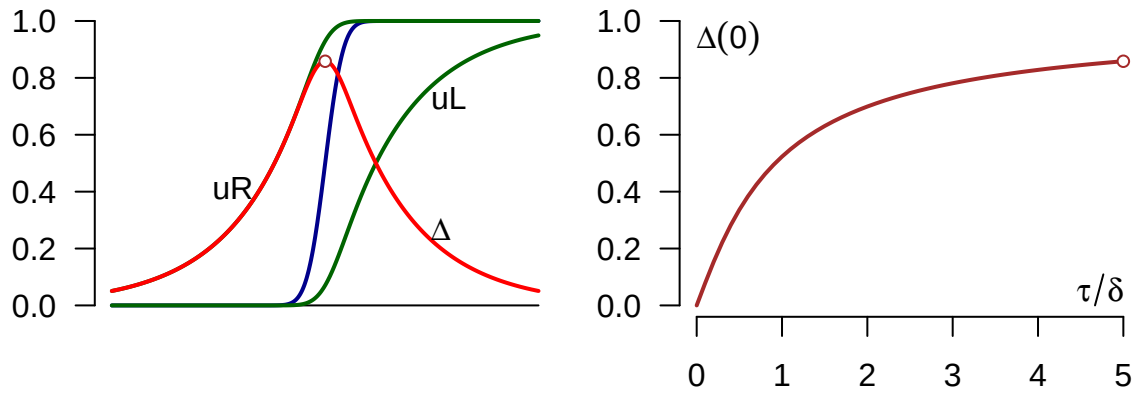


Figure 2: Left and right exponential averaging, applied to a smoothed step function. The ratio of the exponential smoothing time to the step smoothing time $\tau/\delta = 5$. The left panel shows the smoothed step function $u(t)$, the left and right averaged functions $\overline{u}_{\mathrm{L}}(t)$ and $\overline{u}_{\mathrm{R}}(t)$, 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 $\tau/\delta = 5$.

data feed. This data provides every trade and every quote update for Eurex interest rate products (Schatz, Bobl, Bund, and Buxl) from November 2010 through the present, except that we are missing the month of November 2011. 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 1561 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 "Employment Situation" cluster containing "Change in Nonfarm Payrolls" as well as about eight other employment statistics) we have about 363 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

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τ are

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

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

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

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

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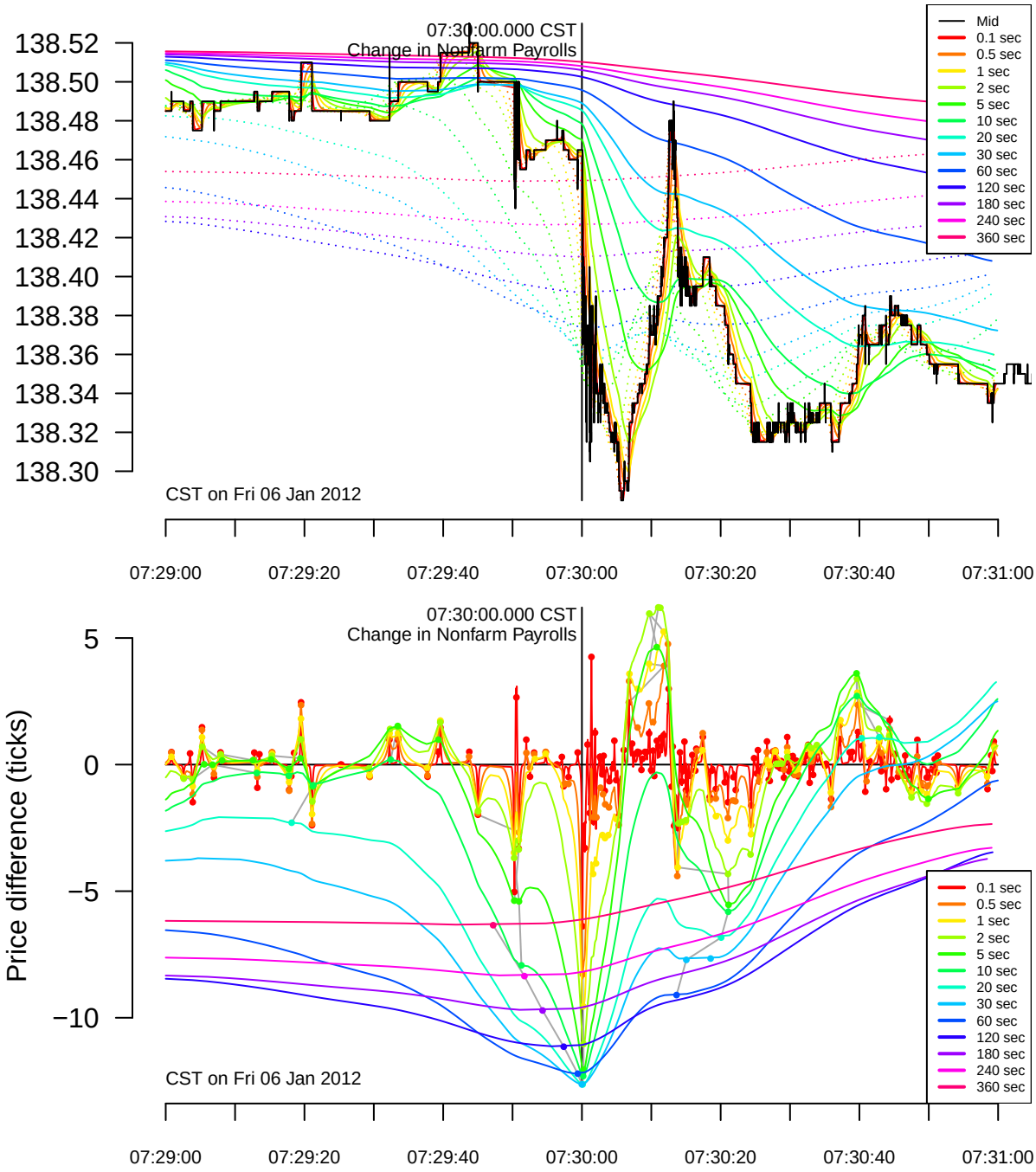


Figure 3: Upper panel is price history for the Eurex Bund March futures contract, trading around the Nonfarm Payroll event on January 6, 2012, with left exponential averages (solid lines) and right exponential averages (dotted lines) for a variety of averaging times τ; "mid" denotes the instantaneous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

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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.



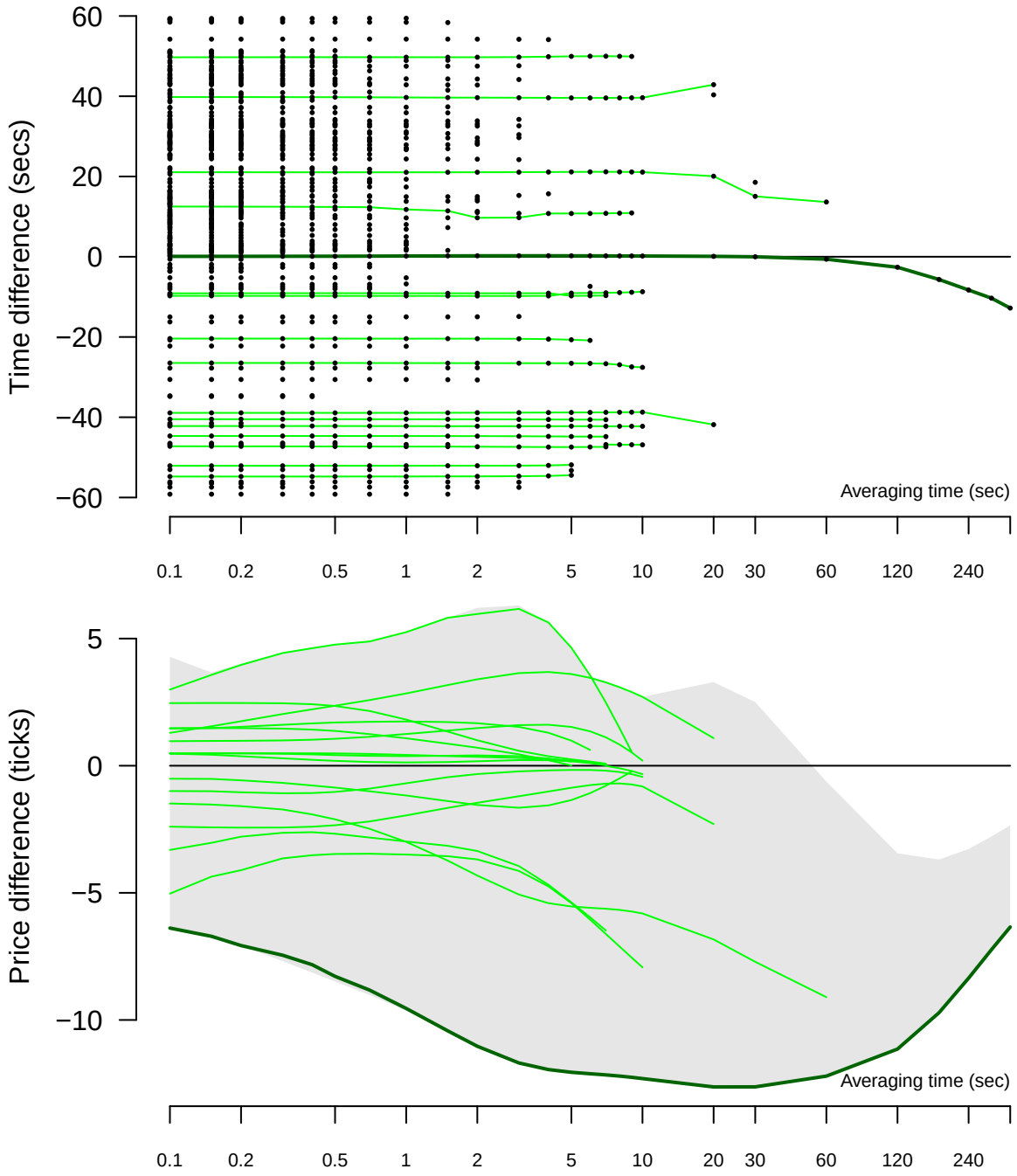


Figure 4: Upper panel shows the location of extremal points for the difference of moving averages shown in the lower panel of Figure 3, with connected paths identified; the heavy line is the primary event. Lower panel is the magnitude of price difference, with the primary event path in heavy line.

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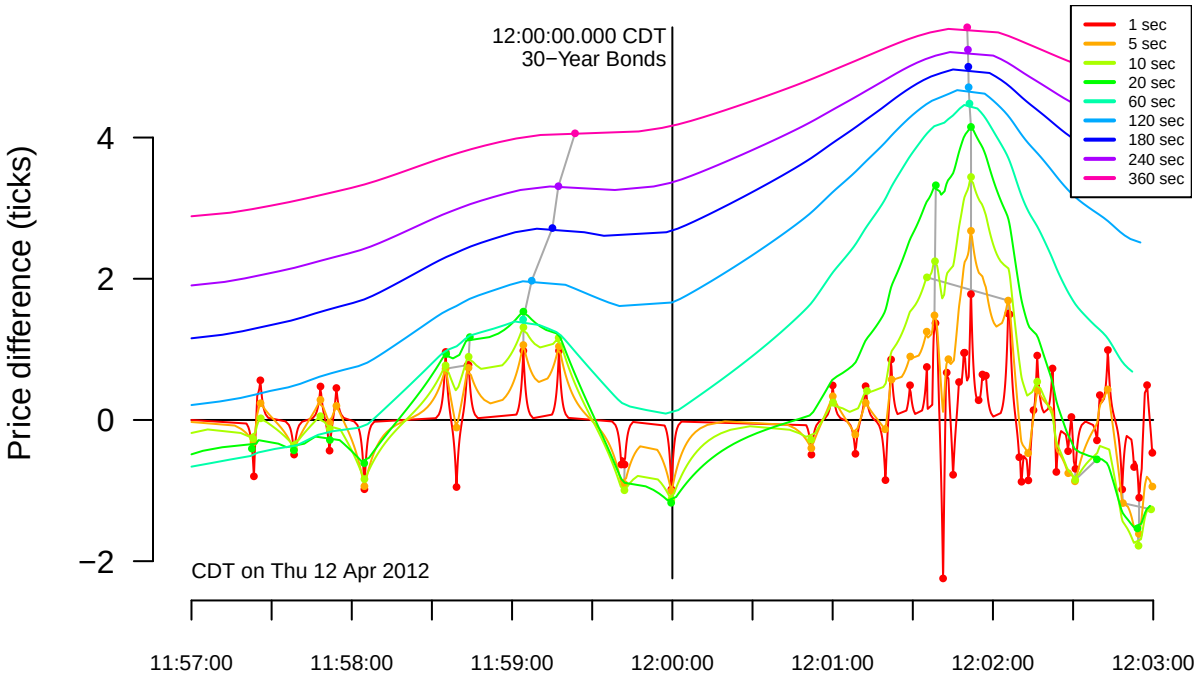


Figure 5: Bund trading around the 30-year bond auction on April 12, 2012. The positive event can be identified, approximately two minutes after the scheduled event.

Figure 6 shows the results, for our two example events, for the 16 months from January 2011 through April 2012. Each of these events is monthly and so there are 15 samples of each, since we are missing data for November 2011. For each instance of the given event, we identify the futures contract of the given type (10-year, for example) that has the highest traded volume, generally the front month contract.

In these pictures, the horizontal axis is time of the market reaction, measured relative to the nominal event time. For the Nonfarm Payrolls event, the time offsets range from -1.3 to about 8 seconds. For the 30-year bond auction event, the times range from about 93 seconds to 104 seconds after the event. 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 vertical axis is the signed magnitude of the estimated price change. As described above, we ignore price changes that are smaller than two ticks in absolute value, as indicated by the gray bands on the picture. For these events, all instances have significant price changes.

The dashed lines indicate median values of the data. The vertical dashed lines are the median of the time change, while the horizontal dashed lines are the median value of the unsigned magnitude of the price change. Thus half the points, eight

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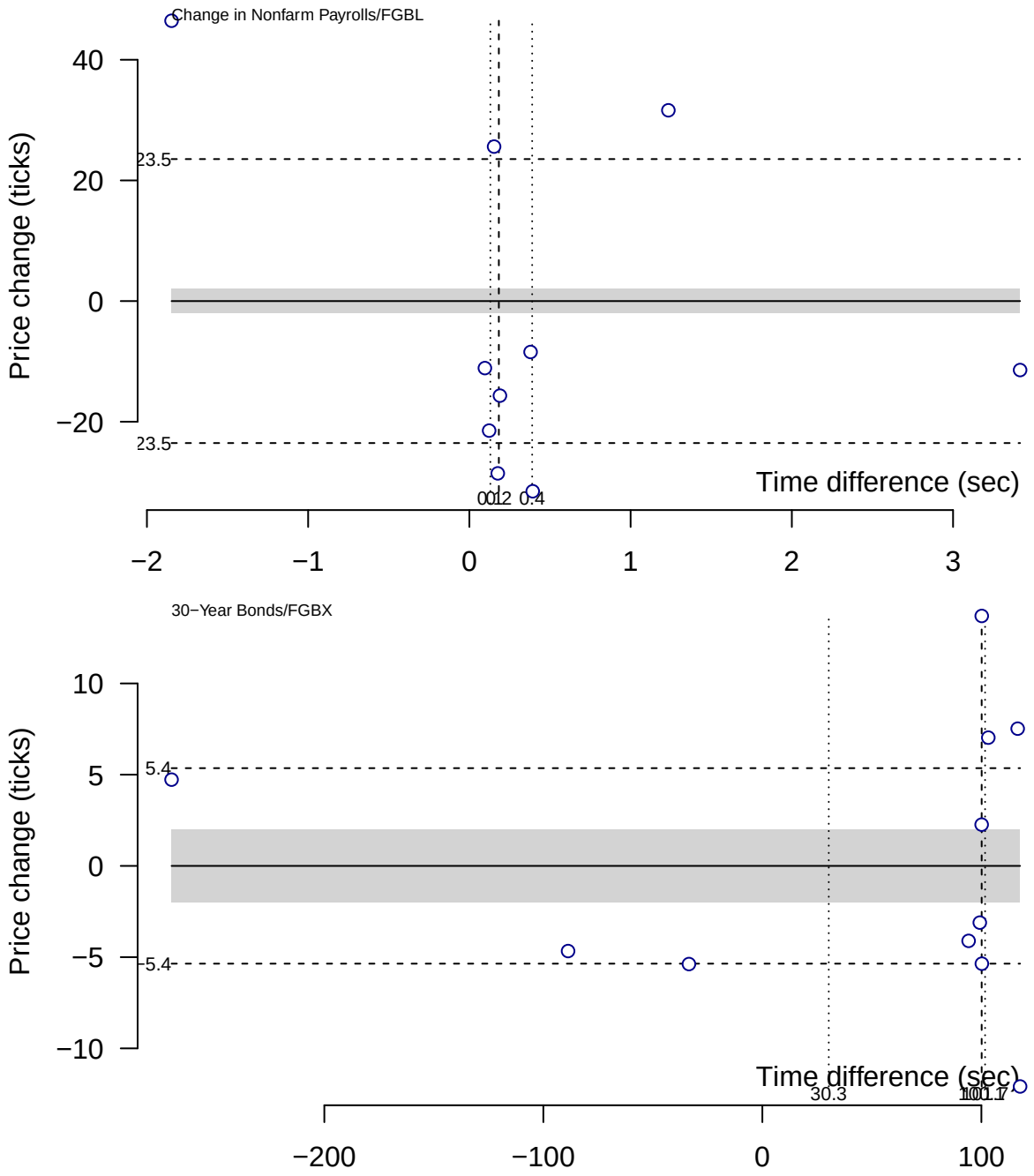


Figure 6: Time relative to event time and magnitude of market reaction to event, for the 16 months from January 2011 through April 2012 (15 events). Dashed lines are median and dotted lines are quartiles as described in the text. Upper panel: Nonfarm Payrolls event, for the Bund. Lower panel: 30-year bond auction, for the Bund. The gray band is the 2-tick threshhold for signficance: for these events all instances are significant.

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in this case, are to the left of the vertical dashed line and half are to the right; half are between the two horizontal dashed lines and half are outside, either above or below.

The vertical dotted lines show first and third quartiles of the time distribution; we will use the difference between these as a measure of dispersion. Thus in this example with 16 points, 4 points fall within each horizontal segment.

In the upper panel of Figure 6 the dot to the left of zero, corresponding to July 8, 2011, indicates an instance for which the price changed happened nearly two seconds before the information release. Figure 7 shows a detail of the Non-farm Payrolls event on July 8, 2011, for the CME 10-year Treasury futures contract. There is a jump about 1.5 seconds before the event, and thus it is likely that the information leaked a bit early.

In the lower panel of Figure 6, the dots to the left of zero most probably represent misidentifications of the jump. It is already surprising that we are able to pinpoint the time of a US 30-year Treasury auction by looking at a European rates future, and we should not be too disappointed that some of them do not work perfectly.

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: Eurodollars, 2-, 5-, 10-, and 30-year Treasury futures contract, and the Ultra Treasury futures contract. Table 1 shows the results for our two example events.

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 16-month period from January 2011 through April 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.

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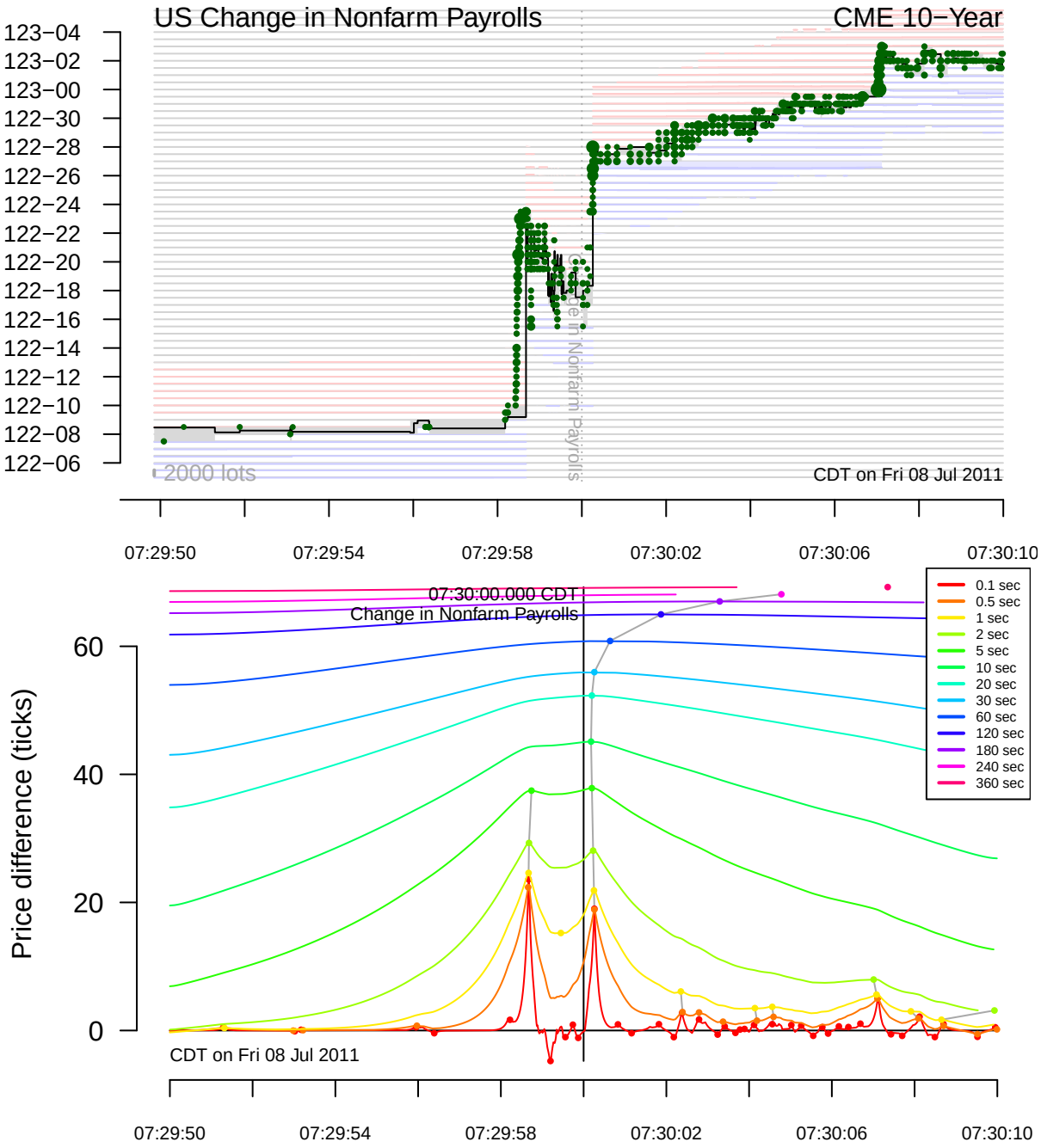


Figure 7: Detail of the Nonfarm Payrolls event on July 8, 2011. As suggested by Figure 6, there is indeed sharp price motion, followed by heavy trade activity, about 1.3 seconds before the scheduled announcement. With averaging period 2 seconds or less, the earlier jump is identified, with 5 seconds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

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	Employment Situation				30-year bond auction			
	n	med $\lvert\Delta p\rvert$	med Δt	range Δt	n	med $\lvert\Delta p\rvert$	med Δt	range Δt
Eurodollar	10	6.6	0.6	0.4	0			
2-year	11	5.7	0.4	1.3	1	2.0	96.5	0
5-year	16	22.6	0.4	0.5	15	5.6	99.4	3.4
10-year	16	20.3	0.4	0.6	15	6.7	98.4	2.8
30-year	16	13.8	0.5	3.3	16	7.2	98.1	3.3
Ultra	16	15.6	0.6	1.8	16	11.0	97.8	3.5

Table 1: Summary statistics for 5 different CME interest rate products, for two different event categories, for the 16 monthly events from January 2011 through April 2012. "n" is the number of events that meet the 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. For the Eurodollar, there was no detectable price change in response to the 30-year bond auction.

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 16-month period. For example, for a monthly event, $n_e = 16$. 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 very close to zero for all 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.

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	Employment Situation US	16	10	6.6	0.6	0.4
ZT	Employment Situation US	16	11	5.7	0.4	1.3
FGBS	Employment Situation US	15	13	5.7	1.1	1.8

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.

References

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Asplund, R. (2011). The fundamentals that drive the Eurex European equity index and interest rate futures markets. Technical report, Optima Investment Research, Inc.

Cailloux, J. (2007). What moves the European bond market? Market responses to surprises in main economic indicators. Technical report, The Royal Bank of Scotland.

Contract	Event name and region		n_e	n	med $\lvert\Delta p\rvert$	med Δt	range Δt
ZF	Employment Situation	US	16	16	22.6	0.4	0.5
	10-Year Notes	US	16	12	7.5	97.5	3.2
	Leading Indicators	US	16	9	6.8	0.8	0.4
	Philadelphia Fed.	US	16	12	6.4	0.7	0.3
	5-Year Notes	US	16	14	6.0	94.7	5.1
	30-Year Bonds	US	16	15	5.6	99.4	3.4
	7-Year Notes	US	15	14	5.6	96.8	3.2
	Chicago Purchasing Manager	US	15	10	5.1	-179.8	0.7
	PPI	US	16	13	5.1	0.2	0.5
	ADP Employment Change	US	16	14	5.1	0.2	5.9
	Construction & Manufacturing	US	16	14	4.8	0.7	0.6
	Consumer Confidence	US	16	11	4.7	0.2	0.3
	Goods	US	16	11	4.4	0.8	1.0
	FOMC Rate Decision	US	11	10	4.3	71.5	179.2
	GDP	US	15	13	4.3	0.8	3.0
	CPI	US	16	11	4.2	0.2	3.4
	Jobless Claims	US	68	49	4.0	0.3	3.2
	Trade Balance	US	16	9	4.0	0.3	91.5
FGBM	Employment Situation	US	15	14	10.2	0.3	1.8
	30-Year Bonds	US	16	8	3.6	98.8	2.8
	Philadelphia Fed.	US	16	9	3.0	0.5	0.1
	Leading Indicators	US	16	8	3.0	0.5	0.1
	GDP	US	15	9	2.9	0.7	3.1
	PPI	US	16	9	2.9	0.3	0.9

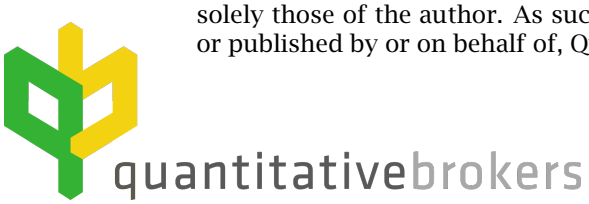
Table 3: Significant events for 5-year contracts: US (ZF) and Eurex Bobl (FGBM). Significance threshhold is 4 ticks for ZF, 2 ticks for FGBM.

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Hypothetical performance results are prepared with the benefit of hindsight. Hypothetical trading does not involve financial risk, and no hypothetical trading record can completely account for the impact of financial risk in actual trading. The ability to withstand losses or to adhere to a particular trading program in spite of trading losses are material points which can also adversely affect actual trading results. Numerous other factors related to the markets in general or to the implementation of any specific trading program cannot be fully accounted for in the preparation of hypothetical performance results and can adversely affect actual trading results.

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Contract	Event name and region		n_e	n	med $\lvert\Delta p\rvert$	med Δt	range Δt
ZN	Employment Situation	US	16	16	20.3	0.4	0.6
	30-Year Bonds	US	16	15	6.7	98.4	2.8
	7-Year Notes	US	15	13	6.5	97.0	2.8
	Leading Indicators	US	16	8	6.2	0.9	0.4
	ADP Employment Change	US	16	12	5.6	0.1	0.5
	10-Year Notes	US	16	14	5.5	97.4	2.5
	Construction & Manufacturing	US	16	12	5.4	0.9	2.4
	5-Year Notes	US	16	13	5.1	93.4	3.9
	Philadelphia Fed.	US	16	11	5.0	0.8	0.4
	PPI	US	16	14	4.4	0.2	0.2
	Consumer Confidence	US	16	10	4.4	0.1	0.2
	Goods	US	16	12	4.4	0.7	0.7
	Retail Sales	US	20	13	4.4	0.5	0.3
	FOMC Rate Decision	US	11	10	4.3	102.7	181.3
	ISM Non-Manf. Composite	US	16	12	4.0	0.6	5.6
FGBL	Employment Situation	US	15	14	20.9	0.3	0.9
	Construction & Manufacturing	US	16	13	5.2	0.5	0.1
	Consumer Confidence	US	16	10	5.2	0.0	0.1
	Philadelphia Fed.	US	16	13	4.9	0.6	0.1
	Richmond Fed Manufact. Index	US	16	9	4.9	-0.0	173.9
	ADP Employment Change	US	16	13	4.9	0.0	2.7
	Leading Indicators	US	16	12	4.7	0.6	0.4
	30-Year Bonds	US	16	15	4.4	99.4	4.2
	ZEW Survey	GE	16	13	4.4	0.5	6.9
	GDP	US	15	12	4.3	0.7	0.6
	Trade Balance	US	16	11	4.3	76.2	269.7
	PPI	US	16	14	4.3	0.8	87.5
	Retail Sales	US	20	14	4.1	0.5	2.1
	Chicago Purchasing Manager	US	15	11	4.1	-179.9	0.5

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	Employment Situation	US	16	16	13.8	0.5	3.3
	30-Year Bonds	US	16	16	7.2	98.1	3.3
	Construction & Manufacturing	US	16	11	6.1	0.6	0.2
	10-Year Notes	US	16	14	5.4	97.7	3.3
	7-Year Notes	US	15	12	5.2	96.9	2.8
	ADP Employment Change	US	16	11	4.7	0.1	0.3
	Consumer Confidence	US	16	10	4.1	0.1	0.3
	Productivity and Costs	US	10	5	4.0	0.5	139.8
UB	Employment Situation	US	16	16	15.6	0.6	1.8
	30-Year Bonds	US	16	16	11.0	97.8	3.5
	7-Year Notes	US	15	14	5.6	96.6	4.1
	10-Year Notes	US	16	15	5.5	97.5	3.5
	5-Year Notes	US	16	13	5.5	93.5	5.4
	Goods	US	16	15	5.2	1.4	6.4
	GDP	US	15	13	5.1	1.1	5.2
	FOMC Rate Decision	US	11	11	4.8	-9.4	180.3
	Productivity and Costs	US	10	9	4.7	10.4	103.1
	ADP Employment Change	US	16	16	4.5	2.6	11.9
	Consumer Confidence	US	16	12	4.3	0.3	0.3
	Current Account Balance	US	5	5	4.3	1.3	25.0
	Philadelphia Fed.	US	16	16	4.2	1.0	18.4
	Leading Indicators	US	16	14	4.1	0.8	7.8
FGBX	Employment Situation	US	15	14	17.6	1.9	5.6
	30-Year Bonds	US	16	14	5.0	99.7	25.5
	Construction & Manufacturing	US	16	13	4.7	0.6	29.5
	ADP Employment Change	US	16	9	4.4	0.1	10.1
	5-Year Notes	US	16	8	4.3	85.7	144.8
	Minutes of FOMC Meeting	US	10	6	4.2	-61.7	248.0

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.

