Do Price Channels Hold?

A Test of Trend-Channel Support and Resistance
in 28 Futures Markets at Daily and Intraday Horizons

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Abstract

Chart traders draw a trend line through two successive swing highs, add a parallel line through the swing low between them, and expect later prices to turn at either line. We test this claim mechanically on 28 liquid futures markets (equity indices, interest rates, currencies, energy, metals and agricultural commodities) using 36 years of daily data and eight and a half years of one-minute data. Channels are built from pivots of three sizes, and both lines of each channel are evaluated, which gives nearly five million decided line touches. Two statistics are measured. The *bounce rate* is the probability that price moves one average true range away from a touched line before it moves one range through it. *Precision* is the concentration of later swing extremes near the line. Each is compared with a construction-matched null, obtained by applying the same rules to volatility-normalised block-bootstrap price paths, and with copies of the real lines shifted by known amounts. On daily bars nothing is detectable: the pooled bounce rate is 50.0% against 49.9% in the null. On intraday bars there are statistically clear but small deviations. On five-minute bars, anchor lines bounce less often than the null and parallel lines more often. This split is explained by a drift of price relative to the channel that the bootstrap does not reproduce; it is not a property of the lines themselves. On one-minute bars the excess is concentrated in markets whose average range spans only one to three ticks, where the null is not well calibrated. The decisive comparison is with lines shifted a quarter to half a range away on the same price path. The real lines do no better at any horizon (differences of +0.19, -0.12 and -0.00 percentage points). Even the largest deviations are worth a small fraction of a tick per trade, well below transaction costs. As a mechanical rule, trend channels carry no economically useful information about where prices turn.

1 Introduction

Few tools of technical analysis are as widely taught as the trend channel. A trend line is drawn through two successive reaction highs (or lows), and a parallel *channel line* is drawn through the intervening reaction low (or high); prices are then expected to oscillate between the two lines until one of them is decisively broken [Murphy, 1999]. Traders fade touches of the lines, place stops just beyond them, and set targets at the opposite line. The practice rests on a testable empirical claim: *prices turn at channel lines more often than they would at arbitrary lines.*

Visual inspection of price charts appears to confirm this claim daily. Visual inspection, however, is a poor guide. Lines are often drawn after the fact; lines that failed are forgotten; and any price path with oscillations will occasionally turn near any line drawn through it. Whether channel lines carry information can only be decided by comparing touches of real lines with touches of lines that, by construction, carry none.

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This paper performs that comparison at scale. The contributions are threefold. First, we give a fully mechanical definition of the three-pivot channel (two highs and the low between them, or the mirror image), indexed by a single pivot-size parameter, and evaluate both lines of every channel. Second, we construct null models that are matched to the construction: the same rules are applied to bootstrap price paths that preserve the volatility, bar shapes and short-range dependence of each market but contain no line structure, and real lines are compared with copies of themselves shifted by known amounts. We show that the choice of null matters, and that two subtle artefacts (the geometry of shifted lines relative to the pivots, and the discreteness of the price grid at one-minute horizons) can produce spurious "effects" of either sign. Third, we test 28 markets at three bar sizes, with nearly five million decided touches in total. This gives power to detect differences in bounce rates of a small fraction of a percentage point.

The answer is negative. Real lines turn prices no more often than lines placed a fraction of a range away on the same price path. The statistically significant intraday deviations from the bootstrap null trace back to properties of the price path (drift relative to the channel and the coarseness of the price grid), not to the lines. Section 2 reviews related work, Section 3 describes the data, Section 4 the methodology, Section 5 the results, and Section 6 discusses why channels appear to work and what the tests do not cover.

2 Related literature

Academic evaluation of technical analysis began with simple, mechanically defined trading rules. Brock et al. [1992] found that moving-average and trading-range-break rules applied to the Dow Jones index generated returns inconsistent with several standard null models, using bootstrap simulations to obtain the distribution of rule returns under each null. Sullivan et al. [1999] showed that once data snooping across a large universe of rules is accounted for with White's Reality Check, much of this apparent predictability does not survive out of sample. Park and Irwin [2007] survey the subsequent literature and conclude that the profitability of technical rules is mixed and has declined over time.

Chart patterns are harder to test because they are defined visually. Lo et al. [2000] proposed smoothing prices with kernel regression and identifying patterns such as head-and-shoulders algorithmically, finding that several patterns carry some incremental information about the distribution of subsequent returns. Chang and Osler [1999] evaluated head-and-shoulders signals in currency markets. Closest to the present paper, Osler [2000] tested whether support and resistance levels published by foreign-exchange firms predicted intraday trend interruptions, comparing them with large numbers of arbitrarily chosen levels, and found that they did; Osler [2003] traced the effect to the clustering of stop-loss and take-profit orders at round numbers. Those results concern horizontal levels chosen by professional analysts. Sloped channel lines differ in that their position at any moment is not a price at which orders are likely to cluster, so the order-flow mechanism of Osler [2003] does not obviously carry over. We are not aware of a large-scale test of the three-pivot channel.

Methodologically we draw on the bootstrap approach of Brock et al. [1992], with the stationary block bootstrap of Politis and Romano [1994], on the arbitrary-level comparison of Osler [2000], and on false-discovery-rate control [Benjamini and Hochberg, 1995] for the many tests we run.

3 Data

Markets. We use 28 futures markets chosen for liquidity and sector coverage: US equity indices (ES, NQ, YM, RTY), European equity indices (DAX, Euro Stoxx 50), interest rates (5-, 10- and 30-year US Treasury futures, Euro-Bund), currencies (EUR, JPY, GBP, AUD, CAD, CHF against the US dollar), energy (crude oil, heating oil, gasoline, natural gas), metals (gold, silver,

copper) and agricultural commodities (corn, soybeans, wheat, live cattle, lean hogs). Table 6 in the appendix lists the markets and sample periods.

Daily data. Daily open, high, low and close prices are back-adjusted continuous futures series from Commodity Systems Inc. (CSI), from August 1990 (or the start of trading) to 30 October 2026, in total 244,976 bars. Back-adjustment is additive, so price differences, and therefore every quantity used below, are unaffected by contract rolls, while price levels may become negative for markets in persistent contango. All our statistics are invariant to additive shifts.

Intraday data. One-minute trade bars come from Interactive Brokers, one file per contract, covering March 2018 to October 2026 for most markets. We build a continuous series by taking, for each date, the contract with the largest session volume, subject to contract expiries being non-decreasing over time. Because all intraday analysis is confined to single sessions (see below), no back-adjustment is needed. Three cleaning steps were necessary. (i) The raw files contain duplicate time stamps (in ES, for example, about 25,000 bars, with some sessions loaded two or three times); duplicates are removed. (ii) Minutes without trades are stored as flat bars with zero volume that carry the previous price forward; these placeholder bars are removed, so that a bar exists only where trading occurred. (iii) Sessions are restricted to the main trading hours: the 390-minute cash session for US equity-index futures, 09:00–17:30 CET for DAX and Euro Stoxx 50 and 08:00–17:15 CET for the Bund, and the regular trading hours as delivered for all other markets. Sessions with fewer than 30% of the median number of bars are discarded. Five-minute bars are aggregated from the one-minute bars within sessions. The intraday sample contains 22,869,830 one-minute bars.

4 Methodology

4.1 Pivots and channels

A bar i is a *pivot high of size* n if its high is strictly greater than the highs of the n preceding bars and at least as great as those of the n following bars; pivot lows are defined symmetrically. The asymmetric inequality ensures that a flat top produces a single pivot. A pivot of size n is known only at bar $i + n$.

A *T–B–T channel* is formed by two consecutive pivot highs T_1 at bar p_1 and T_2 at bar p_2, and the lowest pivot low B_1 strictly between them (channels without an intervening pivot low are skipped). The *anchor line* passes through T_1 and T_2,

$$L_A(t) = h_{p_1} + \frac{h_{p_2} - h_{p_1}}{p_2 - p_1}\,(t - p_1), \tag{1}$$

and the *parallel line* has the same slope and passes through B_1. The *B–T–B channel* is the mirror image, built from two consecutive pivot lows and the highest pivot high between them. Both lines of a channel are tested. In a T–B–T channel the anchor line is tested as resistance and the parallel line as support; in a B–T–B channel the anchor line is support and the parallel line resistance. Figure 1 shows an example.

The lines become active at $t_0 = p_2 + n + 1$, the first bar at which T_2 is known to be a pivot, and remain active for $p_2 - p_1$ bars, the time it took to form the channel, or until broken. Intraday, a channel must lie within one session (all three pivots and the start of the active window), and the active window and all outcome windows end at the session close. We use pivot sizes $n \in \{5, 10, 20\}$ at each bar size, giving $3 \times 2 \times 2 = 12$ line definitions per market and bar size.



Figure 1: A T–B–T channel in daily ES futures ($n = 10$; T_1 on 2014-04-04, B_1 on 2014-04-14, T_2 on 2014-07-03). The shaded area is the active window; the first touch of the parallel line in the window was a bounce.

4.2 Touches and outcomes

Let A_t be the 20-bar average true range known before bar t (intraday, the true range of the first bar of a session excludes the overnight gap). For a support line L, a *touch* occurs at bar t if

$$c_{t-1} > L(t-1) + \beta A_t \quad \text{and} \quad \ell_t \le L(t) + \beta A_t, \tag{2}$$

that is, price approaches the line from the inside of the channel and comes within βA_t of it; resistance lines are treated symmetrically. The outcome is a *bounce* if, within H bars, a close is first observed at least KA_t on the inside of the line, and a *break* if a close is first observed at least KA_t beyond it; otherwise the touch is undecided and excluded. A break ends the line; after a bounce, the next touch can occur from the following bar on. The *bounce rate* is the share of bounces among decided touches. The baseline parameters are $\beta = 0.25$, $K = 1$, $H = 20$.

The symmetric outcome has a direct economic reading. A trader who fades every touch with a stop KA_t beyond the line and a target KA_t inside it has expected gross profit $(2q-1)KA_t$ per decided trade, where q is the bounce rate. A difference Δq in bounce rate between two sets of lines is therefore worth $2\Delta q\, KA_t$ per trade.

4.3 Precision

A weaker claim is that prices turn *near* channel lines, whether or not they then move far. For each line we take the small swing extremes (pivots of size 2: lows for support lines, highs for resistance lines) inside the active window and compute their distance to the line in units of A_t. Among extremes within $\pm 2A_t$ of the line, the *precision* is the share within $\pm 0.25A_t$. Under a locally uniform density of extremes this share is 12.5%; an attracting line would raise it.

4.4 Null models

A statistic of real lines is only informative relative to the same statistic of lines that carry no information. We use three comparisons.

Synthetic null (primary). Bar shapes, that is open, high, low and close minus the previous close, are divided by A_t and resampled with the stationary block bootstrap [Politis and Romano, 1994] with mean block length 20 bars. The resampled shapes are rescaled with the original ATR path and cumulated into a price path; intraday paths start each session at the previous close and

are rounded to the market's tick grid. Pivots, channels, touches and outcomes are then computed by exactly the same code as for the real data. The synthetic paths have the volatility, volatility clustering, bar shapes and short-range dependence of the real market, but any structure tied to price levels formed more than a block earlier is destroyed. Each synthetic path also contains its own channels, so the null reproduces whatever bounce rate the channel construction produces mechanically. We use 200 paths per market for daily and five-minute bars and 100 for one-minute bars.

Placebo lines. Each real line is shifted vertically by $\pm U \cdot A_{t_0}$ with $U \sim \mathcal{U}(0.5, 2)$ and a random sign, and the statistics are recomputed on the real price path (200 or 100 draws). Intraday shifts are rounded to whole ticks. Unlike the synthetic null, placebo lines are not matched to the construction: a real anchor line passes through the most recent pivot, so at the start of its window price is always close to it on one side, which is not true of a shifted line. Section 5 shows that this geometric difference matters.

Offset curves. Every line is also shifted by fixed offsets $d \in \{-2, -1.75, \ldots, 2\}\, A_{t_0}$ (rounded to whole ticks intraday). If the real line ($d = 0$) were special, the bounce rate or precision would show a local peak at $d = 0$ relative to its neighbours. Smooth variation with d indicates that what matters is the position relative to recent prices, not the line. We summarise this with the *local excess*: the statistic at $d = 0$ minus the mean of the statistics at $d = \pm 0.25$ and $d = \pm 0.5$, weighted by the number of touches. Its standard error treats the five rates as independent binomial proportions. Because they share most of their price path, this is conservative. The comparison holds the price path, the time window and the slope fixed and moves only the level. It therefore isolates exactly what the channel claim is about: whether prices respond to *this* line rather than to a nearby one.

Price grid. At one-minute horizons the median ATR is only about three ticks, so βA_t is smaller than one tick. Real lines pass through traded prices, which lie on the tick grid. In a preliminary run in which the nulls ignored the grid, this alone produced large, spurious differences between real and null lines in both directions. All intraday null models therefore respect the grid. For markets with a coarse grid, rounding is not sufficient: the bootstrap does not reproduce the share of bars with zero or one tick of range, or the strength of the bid–ask bounce in successive closes [Roll, 1984]. In ZN one-minute bars, for example, 11% of real bars have no range against 18% of synthetic bars, and the first-order autocorrelation of close-to-close changes is -0.17 against -0.22. For ES, whose one-minute ATR spans about eight ticks, the same statistics agree closely. We therefore also report results restricted to markets whose median ATR spans at least five ticks at the bar size concerned.

4.5 Inference

For each market, bar size and line definition (a *cell*) we compute $z = (s - \bar{s}_0)/\mathrm{sd}(s_0)$, where s is the real statistic and s_0 its null distribution, and the one-sided empirical p-value. Cells with fewer than 20 decided touches are excluded. Across markets, z-scores are combined with Stouffer's method, $Z = \sum_m z_m/\sqrt{M}$ [Stouffer et al., 1949], which treats markets as independent. Correlated markets (for example the four US equity indices) make this optimistic, so the combined Z overstates significance rather than understates it. As a check we also average z within each of the nine sectors before combining. Because we evaluate close to a thousand cells per statistic, we control the false discovery rate with the procedure of Benjamini and Hochberg [1995] applied to two-sided normal p-values of the cell z-scores.

Table 1: Bounce test, pooled over markets. Bounce rates are touch-weighted; Z are Stouffer combinations of the per-market z-scores against the synthetic (block-bootstrap, primary) and placebo (shifted-line) nulls. R/S: line tested as resistance/support. Last column: number of markets whose synthetic-null z exceeds +1.96 / falls below −1.96.

Bars	Line (role)	N	Mkts	touches	real bounce %	synth. %	placebo %	Z_{synth}	Z_{plac}	$\lvert z_{\text{synth}}\rvert>1.96$ (mkts +/−)
Daily	T–B–T anchor (R)	5	28	7,728	46.3	47.4	49.2	-1.94	-5.94	0/1
Daily	T–B–T anchor (R)	10	28	4,396	48.4	49.2	49.5	-1.38	-2.03	0/1
Daily	T–B–T anchor (R)	20	28	2,439	49.9	50.7	50.1	-1.10	-0.59	0/1
Daily	T–B–T parallel (S)	5	28	7,080	51.7	50.7	52.0	+1.52	-0.87	1/0
Daily	T–B–T parallel (S)	10	28	4,093	52.7	52.0	52.4	+0.75	+0.09	0/0
Daily	T–B–T parallel (S)	20	28	2,294	55.6	53.8	54.5	+1.66	+0.93	0/0
Daily	B–T–B anchor (S)	5	28	7,807	48.0	48.6	50.7	-1.19	-5.54	0/2
Daily	B–T–B anchor (S)	10	28	4,452	50.5	50.7	51.3	-0.54	-1.41	1/0
Daily	B–T–B anchor (S)	20	28	2,518	52.7	52.2	52.1	-0.03	+0.34	0/1
Daily	B–T–B parallel (R)	5	28	7,107	49.2	48.9	50.6	+0.44	-2.80	1/0
Daily	B–T–B parallel (R)	10	28	4,302	51.4	50.3	51.0	+1.39	+0.37	0/0
Daily	B–T–B parallel (R)	20	28	2,471	53.0	51.6	51.1	+1.08	+1.67	1/0
5-minute	T–B–T anchor (R)	5	28	82,712	46.4	47.9	48.5	-8.91	-13.05	0/15
5-minute	T–B–T anchor (R)	10	28	25,910	47.4	48.9	48.8	-4.66	-4.77	0/6
5-minute	T–B–T anchor (R)	20	23	2,501	48.6	51.4	49.7	-2.91	-1.47	0/2
5-minute	T–B–T parallel (S)	5	28	58,907	51.6	49.3	53.9	+11.77	-13.01	17/0
5-minute	T–B–T parallel (S)	10	28	16,038	55.1	51.2	55.8	+11.24	-2.26	15/0
5-minute	T–B–T parallel (S)	20	22	1,352	59.3	54.9	59.8	+4.71	-0.63	2/0
5-minute	B–T–B anchor (S)	5	28	81,578	46.3	48.0	48.2	-8.92	-11.34	0/9
5-minute	B–T–B anchor (S)	10	28	25,108	47.0	49.2	48.9	-6.29	-6.60	0/7
5-minute	B–T–B anchor (S)	20	23	2,332	51.4	52.0	50.5	-0.72	+0.79	0/2
5-minute	B–T–B parallel (R)	5	28	57,410	51.2	48.9	53.5	+12.44	-11.97	20/0
5-minute	B–T–B parallel (R)	10	28	15,312	54.1	50.4	55.2	+10.02	-3.29	14/0
5-minute	B–T–B parallel (R)	20	20	1,174	54.2	54.1	57.0	+0.99	-1.90	1/1
1-minute	T–B–T anchor (R)	5	28	702,090	50.1	49.8	51.0	+5.32	-15.85	7/2
1-minute	T–B–T anchor (R)	10	28	387,829	52.2	51.4	52.5	+9.11	-5.83	13/0
1-minute	T–B–T anchor (R)	20	28	189,388	53.5	52.7	53.8	+6.93	-2.80	8/0
1-minute	T–B–T parallel (S)	5	28	527,318	52.4	51.0	53.6	+21.20	-19.58	23/0
1-minute	T–B–T parallel (S)	10	28	291,223	54.1	52.5	54.6	+17.37	-6.82	22/0
1-minute	T–B–T parallel (S)	20	28	136,909	55.6	54.1	55.9	+11.63	-2.59	13/1
1-minute	B–T–B anchor (S)	5	28	698,340	49.7	49.7	50.6	-0.40	-16.22	6/8
1-minute	B–T–B anchor (S)	10	28	388,082	51.9	51.5	52.2	+5.32	-4.72	10/1
1-minute	B–T–B anchor (S)	20	28	187,377	53.4	52.9	53.7	+3.91	-2.75	9/4
1-minute	B–T–B parallel (R)	5	28	521,133	52.6	50.9	53.5	+23.32	-15.08	27/0
1-minute	B–T–B parallel (R)	10	28	285,591	54.2	52.3	54.6	+20.92	-3.69	24/0
1-minute	B–T–B parallel (R)	20	28	133,504	55.6	53.9	55.8	+13.17	-1.65	18/0

Exploratory sample. The construction and the parameters β, K, H and n were chosen during an exploratory analysis of the ES contract (daily and one-minute bars) before the other markets were examined. ES is retained in the panel; the remaining 27 markets serve as an out-of-sample replication. Parameter sensitivity is reported in Section 5.5.

5 Results

5.1 Bounce rates

Table 1 reports the bounce test for each line definition, pooled over markets.

Daily bars. Real lines bounce in 50.0% of 56,687 decided touches, against 49.9% for lines constructed on synthetic paths ($Z = +0.05$). No single line definition differs significantly from the null after combining markets ($|Z| < 2$ in all twelve rows). Of the 336 market-level cells, 3 survive false-discovery-rate control, all with *fewer* bounces than the null. The rates depend on the line: anchor lines bounce less than 50% of the time and parallel lines more. The synthetic null reproduces this pattern, so it is a property of the construction and not evidence about the lines.

Five-minute bars. The pooled rate (48.9% against 48.8%) hides a systematic split. Every anchor-line definition bounces *less* often than its synthetic counterpart (Z between -0.7 and -8.9), and every parallel-line definition bounces *more* often (Z between $+1.0$ and $+12.4$). Of the 241 cells (out of 984, all bar sizes) that survive false-discovery-rate control, 52 upward and 28 downward are five-minute cells. The split has a simple explanation. In a T–B–T channel, fewer bounces at the upper (anchor) line and more at the lower (parallel) line both mean that price drifts *upward relative to the channel* after it becomes active. In a B–T–B channel, both mean that price drifts downward. Table 2 measures this drift directly: the change in price relative to the channel over the first $H = 20$ bars, in ATR units. On five-minute bars the real drift is about 0.2–0.5 ATR larger in magnitude than on synthetic paths, in the direction that produces the observed split, and in 22–26 of 28 markets for every pivot size. The deviation from the null is therefore a property of how real five-minute prices move after a pivot is confirmed, which the block bootstrap does not fully reproduce. It is not a property of the lines. On daily bars the drift difference is much smaller and less consistent across markets, and the split has the same sign but is not significant (Table 3).

One-minute bars. Real lines bounce in 52.1% of 4,448,784 decided touches against 51.2% in the null ($Z = +11.48$), and 149 one-minute cells survive false-discovery-rate control upward. With this many touches, a difference of 0.07 percentage points is detectable. The excess is concentrated in markets with a coarse price grid. Across markets, the correlation between the mean z-score and the logarithm of the ATR in ticks is -0.50 (Figure 3). The largest z-scores are in the Treasury futures, whose one-minute ATR spans little more than one tick, so that "one ATR" is the next tick move. As shown in Section 4.4, the null is miscalibrated at this resolution. Restricted to the nine markets with an ATR of at least five ticks, the touch-weighted excess falls from $+0.90$ to $+0.45$ percentage points, and the anchor lines no longer differ from the null (Table 3). The parallel lines retain an excess of similar size to the five-minute case. Their drift difference, however, is small on one-minute bars (Table 2), so that explanation does not carry over directly. The offset curves below show that this excess is shared equally by lines a quarter of a range away.

Placebo lines. Against shifted placebo lines, real lines bounce *less* often at every bar size (50.0% vs. 51.0%, 48.9% vs. 50.8%, 52.1% vs. 52.8%). This is a geometric artefact of the placebo, not a sign of anti-persistence at the lines. The offset curves in Figure 2 show why: bounce rates vary monotonically and slightly convexly with the offset. A line shifted away from the recent swing behaves systematically differently from the real line, and averaging over random shifts in both directions raises the rate. We therefore treat the placebo as secondary and use the deterministic offsets as the line-specific test.

5.2 Precision

Table 4 reports the precision test. On daily bars, 13.3% of swing extremes within two ranges of a line lie within a quarter range of it, the same as in the synthetic null (13.3%, $Z = -0.21$), and no cell survives false-discovery-rate control. Both values exceed the uniform benchmark of 12.5% because swing extremes cluster near recent prices, and recent prices are near the line. The construction reproduces this.

Intraday, real lines show slightly higher precision than the null: 14.0% against 13.8% on five-minute and 14.0% against 13.7% on one-minute bars. The difference is largest for anchor lines with small pivots. It is again tied to the price grid (correlation with log ATR in ticks -0.70 at one minute). Restricted to markets with an ATR of at least five ticks, the one-minute anchor excess falls to $Z \approx 1.4$ and the parallel excess disappears (Table 3). A line through two traded highs passes, near its anchor points, through prices that were actually traded. In a coarse-grid market this is where later swing extremes can coincide with a recent extreme to within a fraction

Table 2: Channel-relative drift: mean of $(c_{t_0+H} - c_{t_0} - bH)/\mathrm{ATR}_{t_0}$ over all channels ($H = 20$, truncated at the session end), averaged over markets. Positive: price rises relative to the channel. Synthetic: mean over bootstrap paths (number in parentheses).

Bars	Pattern	N	real	synthetic	difference	real>synth.
Daily (50)	T–B–T	5	+0.125	+0.144	-0.018	16/28
	B–T–B	5	+0.029	+0.019	+0.009	15/28
	T–B–T	10	+0.145	+0.172	-0.027	10/28
	B–T–B	10	+0.009	-0.007	+0.017	13/28
	T–B–T	20	+0.241	+0.087	+0.154	20/28
	B–T–B	20	+0.002	+0.029	-0.027	13/28
5-minute (20)	T–B–T	5	+0.468	+0.257	+0.212	22/28
	B–T–B	5	-0.491	-0.270	-0.221	2/28
	T–B–T	10	+0.654	+0.462	+0.192	23/28
	B–T–B	10	-0.670	-0.452	-0.218	2/28
	T–B–T	20	+0.679	+0.213	+0.467	24/28
	B–T–B	20	-0.550	-0.197	-0.352	4/28
1-minute (10)	T–B–T	5	+0.337	+0.352	-0.015	11/28
	B–T–B	5	-0.376	-0.366	-0.010	12/28
	T–B–T	10	+0.371	+0.443	-0.071	0/28
	B–T–B	10	-0.425	-0.443	+0.017	16/28
	T–B–T	20	+0.369	+0.355	+0.014	19/28
	B–T–B	20	-0.411	-0.351	-0.060	6/28

of a tick, which is the horizontal "double top" pattern rather than a property of the sloped line. In absolute terms the excess is a few tenths of a percentage point on a base of 14%.

5.3 Offset curves

Figure 2 shows the bounce rate and precision of lines shifted by fixed multiples of the ATR. The bounce curves are smooth and monotone through $d = 0$ at every bar size. A support line moved upward (into recent prices) bounces more often and one moved downward less often, with no visible discontinuity at the real line. The local excess at $d = 0$ is +0.19 percentage points (standard error 0.23) on daily, -0.12 (0.09) on five-minute and -0.00 (0.03) on one-minute bars. With nearly 4.5 million one-minute touches, a real line is thus no more likely to turn price than a line a quarter or half range away on the same path, to within a few hundredths of a percentage point. In particular, the intraday excess over the synthetic null is shared equally by the neighbouring lines. This includes the parallel lines in the nine markets with an ATR of at least five ticks, whose local excess is -0.11 (0.07) percentage points.

The precision curves at intraday horizons form a broad hump, about one ATR wide on each side, centred near $d = 0$. The local precision excess is +0.10 (standard error 0.04) and +0.16 (0.01) percentage points on five- and one-minute bars. A local excess defined by neighbours at ± 0.25 and ± 0.5 ATR is positive on any concave hump, so this does not show concentration at the exact line. The hump reflects the clustering of swing extremes near recent prices, which the synthetic null largely reproduces (13.7% against 14.0% at one minute). On daily bars there is no hump, and the local excess is -0.09 (0.11).

5.4 Individual markets

Figure 3 and Table 7 in the appendix show results by market. On daily bars no market stands out. The mean z-score is between -1 and $+0.6$ in all 28 markets, as expected under the null. On five-minute bars the anchor/parallel split appears in almost every market, consistent with a common drift mechanism rather than market-specific line effects. On one-minute bars the excess

Table 3: Robustness of the cross-market synthetic-null Z. Each entry is the mean, over the six line definitions of that kind ($N \in \{5, 10, 20\}$, T–B–T and B–T–B), of the Stouffer Z. "All": 28 markets. "ATR≥5 ticks": markets whose median ATR spans at least 5 ticks at that bar length (number in parentheses). "Sector": per-market z averaged within each of the nine sectors first, then combined over sectors.

		Bounce		Precision	
Bars	Markets	anchor	parallel	anchor	parallel
Daily	All	-1.03	+1.14	-0.47	+0.06
	Sector	-0.48	+0.43	-0.14	-0.02
5-minute	All	-5.40	+8.53	+2.24	-0.22
	ATR≥5 ticks (23)	-4.81	+7.15	+1.95	-0.47
	Sector	-2.76	+3.87	+1.09	-0.18
1-minute	All	+5.03	+17.94	+7.56	+4.82
	ATR≥5 ticks (9)	-0.40	+7.16	+1.40	-0.66
	Sector	+2.50	+8.45	+3.67	+2.31

over the null is ordered by grid coarseness. It is near zero in ES and NQ, whose one-minute ranges span 8 and 35 ticks, and largest in the Treasury, currency and agricultural futures, whose ranges span one to three ticks. ES, the exploratory market, is unremarkable at every bar size: the replication on the other 27 markets does not reveal effects that the exploration missed.

Averaging z-scores within sectors before combining (Table 3) roughly halves the combined statistics but changes none of the patterns, so correlation between markets does not drive the conclusions.

5.5 Sensitivity

Table 5 varies the touch band β, the target and stop distance K and the horizon H one at a time, for daily and five-minute bars (50 null paths per market). The bounce rate itself moves strongly with the parameters: a tighter target or a wider band makes bounces more likely, for real and null lines alike. The difference from the null stays within 1.6 percentage points in either direction. The difference from the placebo is negative in every variant. No variant reveals an effect that the baseline hides. The largest five-minute difference, +1.4 percentage points for $K = 0.5$, is consistent with the drift mechanism: with a target half a range away, a small directional drift relative to the channel moves more touches across the target.

5.6 Economic significance

Fading every touch with a symmetric target and stop of KA_t earns, gross of costs, $2\Delta q\, K$ ATR per trade more than the same rule applied to null lines, where Δq is the excess bounce rate. Using the pooled differences from the synthetic null, this is +0.002 ATR on daily, +0.002 ATR on five-minute and +0.018 ATR on one-minute bars. With median ATRs of 7.7 and 2.9 ticks, the two intraday figures are +0.01 and +0.05 ticks per trade. A round trip costs at least one tick in spread plus commissions, more than an order of magnitude more. The largest single cell, the five-minute T–B–T parallel line with $n = 20$ (59.3% against 54.9%), would earn about 0.09 ATR, or roughly 0.7 ticks, per trade gross. That is still below the cost of a round trip, and a line placed at a random offset on the same path earns the same (placebo 59.8%). Against lines shifted a fraction of a range on the same path, the real-line advantage is indistinguishable from zero at every horizon (Section 5.3).

Table 4: Precision test, pooled over markets: share of small swing extremes within ±0.25 ATR of the line among those within ±2 ATR (uniform density: 12.5%). Columns as in Table 1.

Bars	Line (role)	N	Mkts	swings	real near %	synth. %	placebo %	Z_{synth}	Z_{plac}	$\lvert z_{\text{synth}}\rvert>1.96$ (mkts +/−)
Daily	T–B–T anchor (R)	5	28	14,447	14.1	14.1	13.3	+0.13	+2.90	1/0
Daily	T–B–T anchor (R)	10	28	10,290	12.5	13.1	13.0	-1.36	-1.28	0/2
Daily	T–B–T anchor (R)	20	28	7,048	12.4	12.7	12.8	-0.65	-0.72	0/0
Daily	T–B–T parallel (S)	5	28	12,911	13.7	13.6	13.1	+0.25	+1.98	1/0
Daily	T–B–T parallel (S)	10	28	9,033	13.6	13.1	12.6	+1.54	+3.11	2/0
Daily	T–B–T parallel (S)	20	28	6,327	11.7	12.8	12.8	-2.21	-2.13	0/0
Daily	B–T–B anchor (S)	5	28	14,507	13.5	13.9	13.5	-1.36	-0.02	1/0
Daily	B–T–B anchor (S)	10	28	10,271	13.4	13.1	12.9	+0.59	+1.65	2/1
Daily	B–T–B anchor (S)	20	28	6,904	12.8	12.7	12.7	-0.20	+0.32	0/1
Daily	B–T–B parallel (R)	5	28	13,637	13.3	13.7	13.4	-1.37	-0.14	0/1
Daily	B–T–B parallel (R)	10	28	9,696	13.3	13.1	13.0	+0.47	+1.31	1/0
Daily	B–T–B parallel (R)	20	28	6,575	13.5	12.8	12.5	+1.67	+2.58	2/0
5-minute	T–B–T anchor (R)	5	28	155,317	14.8	14.3	13.3	+5.49	+16.34	4/0
5-minute	T–B–T anchor (R)	10	28	55,120	13.6	13.3	13.2	+1.57	+2.27	1/0
5-minute	T–B–T anchor (R)	20	23	5,747	12.7	12.9	13.2	-0.51	-0.92	1/0
5-minute	T–B–T parallel (S)	5	28	124,660	13.6	13.6	13.2	+0.22	+3.98	1/0
5-minute	T–B–T parallel (S)	10	28	38,639	13.1	13.2	12.8	-0.33	+1.99	1/1
5-minute	T–B–T parallel (S)	20	23	3,632	12.7	13.0	12.8	-0.58	-0.17	0/1
5-minute	B–T–B anchor (S)	5	28	150,821	14.7	14.2	13.4	+4.60	+14.33	2/0
5-minute	B–T–B anchor (S)	10	28	53,466	13.4	13.3	13.3	+0.94	+0.99	0/0
5-minute	B–T–B anchor (S)	20	23	5,446	13.3	12.9	13.0	+1.37	+1.30	2/0
5-minute	B–T–B parallel (R)	5	28	124,063	13.7	13.6	13.2	+0.70	+4.44	0/0
5-minute	B–T–B parallel (R)	10	28	38,727	13.0	13.2	13.0	-1.35	-0.11	0/0
5-minute	B–T–B parallel (R)	20	23	3,310	12.8	13.0	12.6	+0.04	+0.84	0/0
1-minute	T–B–T anchor (R)	5	28	1,111,962	14.7	14.3	13.7	+12.14	+32.52	15/0
1-minute	T–B–T anchor (R)	10	28	750,778	13.8	13.4	13.3	+7.75	+10.65	10/0
1-minute	T–B–T anchor (R)	20	28	423,114	13.2	13.0	13.0	+3.27	+2.71	3/1
1-minute	T–B–T parallel (S)	5	28	937,321	14.2	13.9	13.6	+8.30	+14.96	10/0
1-minute	T–B–T parallel (S)	10	28	595,454	13.4	13.3	13.3	+3.04	+2.88	6/0
1-minute	T–B–T parallel (S)	20	28	313,817	13.1	13.0	13.0	+1.65	+0.67	2/0
1-minute	B–T–B anchor (S)	5	28	1,090,496	14.7	14.3	13.7	+10.82	+28.48	13/0
1-minute	B–T–B anchor (S)	10	28	731,383	13.8	13.5	13.4	+7.89	+9.85	9/0
1-minute	B–T–B anchor (S)	20	28	407,108	13.2	13.0	13.1	+3.47	+2.80	5/2
1-minute	B–T–B parallel (R)	5	28	938,625	14.2	13.9	13.6	+8.26	+16.06	10/0
1-minute	B–T–B parallel (R)	10	28	595,947	13.5	13.3	13.3	+4.40	+4.52	7/2
1-minute	B–T–B parallel (R)	20	28	312,256	13.2	13.0	13.0	+3.30	+2.12	5/1

6 Discussion

Why channels appear to work. The bounce rates of channel lines are not low. Parallel lines in particular bounce in 51–59% of decided touches, depending on the pivot size and bar length. A trader who watches charts sees many clean bounces. The comparisons in this paper show that lines with no special status produce the same rates: lines on bootstrap paths, and lines shifted away from the real position on the real path. Three effects create the impression of efficacy. First, base rates: a line drawn through recent swing points sits in the range where price has been oscillating, and oscillating prices turn near any line in that range. Second, geometry: which line a touch tests, and from which side, is determined by the recent path, so bounce rates differ systematically between anchor and parallel lines and between lines placed above and below recent prices. These differences are real but belong to the construction. Third, selective attention: a line that is broken is redrawn or forgotten, while a line that holds is remembered.

The choice of null matters. Three of our comparisons could each have produced a publishable-looking "effect". A placebo of randomly shifted lines makes real lines look *worse* than chance, because shifted lines sit at systematically different positions relative to recent prices. A synthetic null that ignores the tick grid makes one-minute lines look far better than chance, with Z-scores near 20. A bootstrap that reproduces volatility and bar shapes but not the drift after pivots

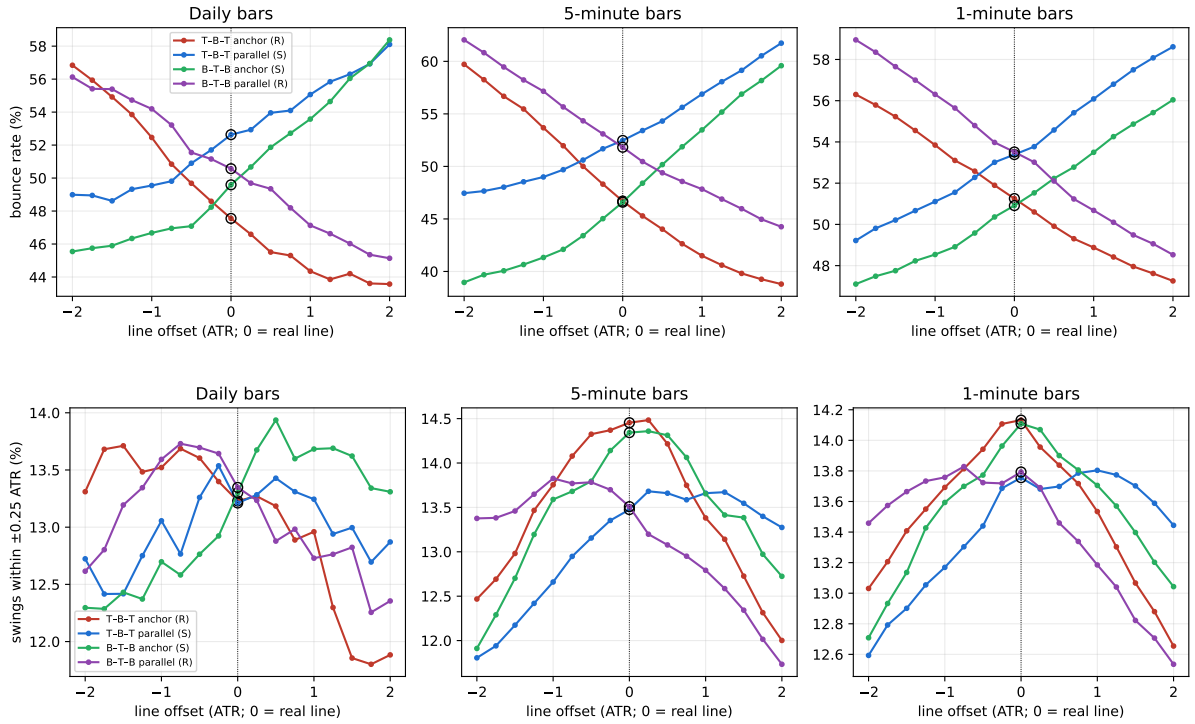


Figure 2: Offset curves: bounce rate (top) and precision (bottom) of lines shifted by $d \cdot A_{t_0}$, pooled over markets and pivot sizes. The real lines are at $d = 0$ (circled). A line that attracted prices would produce a local peak at $d = 0$.

makes five-minute parallel lines look better and anchor lines worse. Only the deterministic offset comparison holds everything fixed except the level of the line, and it shows no effect. We recommend that tests of support and resistance report such offset curves alongside any null distribution.

Horizontal versus sloped lines. Osler [2000, 2003] found that horizontal support and resistance levels in currency markets do interrupt trends, and traced the effect to orders clustering at round numbers. Our results are compatible with that work. A sloped line passes through a different price on every bar, so no standing order can be placed "at the line", and there is no order-flow mechanism to make it hold. The small precision excess we find in coarse-grid markets is consistent with the horizontal effect: near its anchor points, a sloped line coincides with a recently traded extreme.

Limitations. The tests are mechanical. A discretionary trader selects channels by criteria we do not model (the quality of the touches, the trend context, confluence with other levels), and we cannot rule out that such selection adds information. We can only say that the unselected population of channels contains none, which puts the burden of proof on the selection. Intraday channels are confined to a single session, so channels formed over several days and tested on intraday data are not covered. The intraday sample covers 2018–2026 only. The parameters were chosen on ES before the other markets were examined. ES behaves like the others, but the parameter choice is not independent of it. We test futures only, and the 28 markets are correlated, although sector-level aggregation does not change the conclusions. Finally, the block bootstrap is an imperfect null at intraday horizons: it misses the post-pivot drift on five-minute bars and the discreteness of coarse-grid markets on one-minute bars. Rather than adjust the null until it fits, we have reported these failures and relied on the offset comparison, which needs no model of the price process.

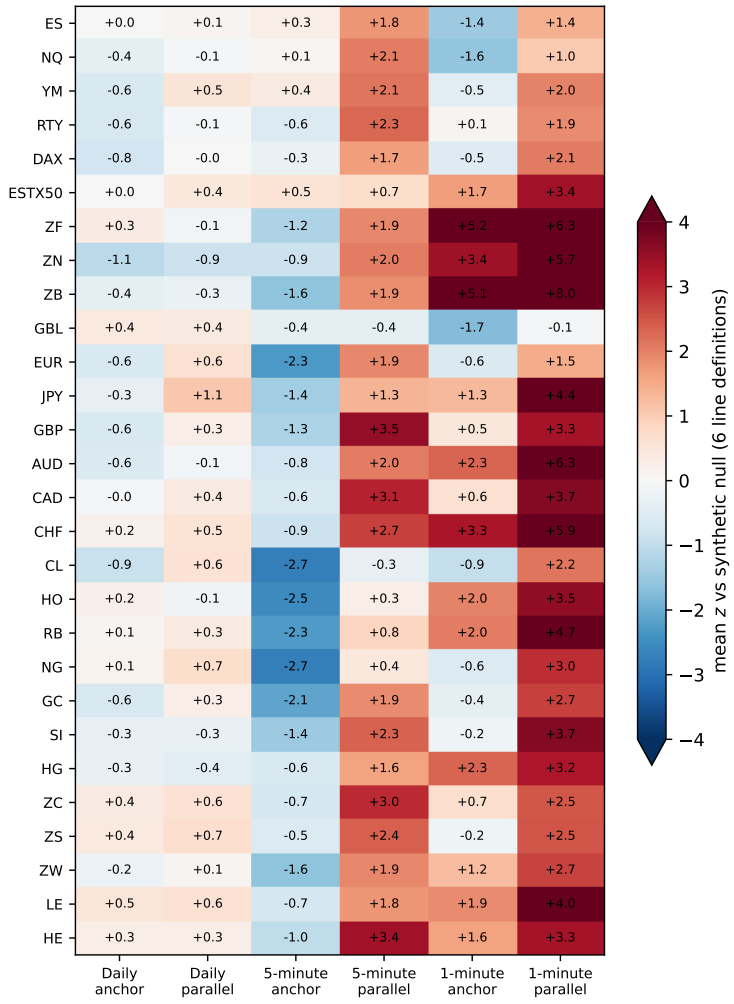


Figure 3: Mean z-score of the bounce rate against the synthetic null, per market, bar size and line type, averaged over the six line definitions of each type ($n \in \{5, 10, 20\}$, T–B–T and B–T–B). Positive values: real lines bounce more often than the null. The colour scale saturates at ± 4. Markets are grouped by sector.

7 Conclusion

We test the three-pivot trend channel, two highs and the low between them or the mirror image, on 28 futures markets at daily, five-minute and one-minute horizons, with nearly five million decided touches. Real channel lines do not turn prices more often than lines constructed in the same way on bootstrap price paths at daily horizons. They do not turn prices more often than lines shifted a fraction of a range away on the same path at any horizon. Swing extremes do not concentrate at the lines beyond what the clustering of extremes near recent prices implies. The statistically significant intraday deviations from the bootstrap null are explained by a drift of price relative to the channel after a pivot is confirmed and by the discreteness of the price grid, and are worth a small fraction of a tick per trade. As a mechanical rule, trend channels describe where prices have been. They carry no information about where prices will turn.

Table 5: Sensitivity of the bounce test to the event parameters (all markets and line definitions pooled). Δ: real minus null bounce rate in percentage points; $\bar{z}$: mean per-cell z-score against the synthetic null. Baseline: band 0.25, $K = 1$, $H = 20$.

	Daily				5-minute			
Variant	bounce %	Δ_{syn}	$\bar{z}_{\text{syn}}$	Δ_{plac}	bounce %	Δ_{syn}	$\bar{z}_{\text{syn}}$	Δ_{plac}
baseline	50.0	+0.1	+0.01	-0.9	48.9	+0.1	+0.31	-1.9
$K = 0.5$	57.5	+0.2	+0.01	-0.7	59.2	+1.4	+1.16	-0.8
$K = 2$	42.8	-0.8	-0.18	-2.0	39.4	-1.6	-0.61	-3.2
band = 0.1	44.3	-0.0	-0.03	-1.1	42.3	-0.3	+0.04	-2.3
band = 0.5	59.9	+0.2	+0.03	-0.6	60.7	+0.8	+0.80	-1.0
$H = 10$	50.5	+0.1	-0.00	-0.9	49.9	+0.2	+0.40	-1.8
$H = 40$	49.9	+0.1	-0.00	-1.0	48.8	+0.1	+0.32	-1.9

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A Data and per-market results

Table 6: Data. Daily: CSI back-adjusted continuous futures. Intraday: IB 1-minute trade bars, continuous by volume roll. ATR in ticks is the median 20-bar ATR of 1-minute bars.

		Daily		Intraday			
Market	Sector	from	bars	from	sessions	bars/session	ATR (ticks)
ES	Equity index	1990-08-01	9,116	2018-03-01	2,181	390	7.9
NQ	Equity index	1996-04-10	7,652	2018-03-01	2,180	390	35.3
YM	Equity index	1997-10-06	7,305	2018-03-01	2,181	390	14.6
RTY	Equity index	2001-10-23	6,256	2018-03-07	2,176	390	12.7
DAX	Equity index	1990-11-23	9,078	2018-03-08	2,174	510	12.8
ESTX50	Equity index	1998-06-22	7,208	2018-03-01	2,097	510	3.9
ZF	Interest rate	1990-08-01	9,118	2018-03-01	1,920	447	1.2
ZN	Interest rate	1990-08-01	9,119	2018-03-01	2,088	449	1.3
ZB	Interest rate	1990-08-01	9,118	2018-03-01	2,058	442	1.1
GBL	Interest rate	1990-11-23	9,098	2018-06-01	2,112	555	2.3
EUR	Currency	1999-01-04	6,997	2018-03-01	2,206	447	2.9
JPY	Currency	1990-08-01	9,126	2018-03-08	2,201	442	1.9
GBP	Currency	1990-08-01	9,126	2018-03-08	2,202	435	1.8
AUD	Currency	1990-08-01	9,110	2018-03-08	2,201	439	2.2
CAD	Currency	1990-08-01	9,126	2018-03-01	2,205	440	1.9
CHF	Currency	1990-08-01	9,125	2018-03-12	2,200	410	2.7
CL	Energy	1990-08-01	9,100	2018-06-01	2,119	450	5.9
HO	Energy	1990-08-01	9,097	2018-06-01	2,119	430	16.8
RB	Energy	1990-08-01	9,092	2018-06-01	2,119	426	16.3
NG	Energy	1990-08-01	9,091	2018-06-01	1,635	446	3.4
GC	Metal	1990-08-01	9,104	2018-04-02	1,593	450	6.9
SI	Metal	1990-08-01	9,103	2018-05-01	1,346	443	2.9
HG	Metal	1990-08-01	9,102	2018-05-01	1,080	431	2.7
ZC	Agricultural	1990-08-01	9,120	2018-05-01	2,090	290	1.5
ZS	Agricultural	1990-08-01	9,102	2018-05-01	1,904	290	2.5
ZW	Agricultural	1990-08-01	9,122	2018-05-01	1,927	289	2.0
LE	Agricultural	1990-08-01	9,133	2018-04-02	2,152	274	3.2
HE	Agricultural	1990-08-01	9,132	2018-04-02	2,157	273	3.0

Table 7: Per-market bounce test, pooled over the 12 line definitions: touch-weighted bounce rate of the real lines minus that of the synthetic null (percentage points) and the mean z-score against the synthetic and placebo nulls.

	Daily			5-minute			1-minute		
Market	Δ pp	$\bar{z}_{\text{syn}}$	$\bar{z}_{\text{plac}}$	Δ pp	$\bar{z}_{\text{syn}}$	$\bar{z}_{\text{plac}}$	Δ pp	$\bar{z}_{\text{syn}}$	$\bar{z}_{\text{plac}}$
ES	+0.5	+0.06	-0.40	+1.4	+1.01	-1.30	-0.0	-0.01	-3.72
NQ	-1.1	-0.23	-0.33	+1.5	+1.07	-1.28	-0.1	-0.27	-4.20
YM	-0.3	-0.05	-0.06	+1.8	+1.24	-1.17	+0.3	+0.76	-3.53
RTY	-1.3	-0.37	-0.83	+1.5	+0.87	-1.03	+0.4	+0.99	-3.21
DAX	-1.2	-0.39	-0.78	+0.6	+0.71	-1.34	+0.3	+0.77	-3.28
ESTX50	+1.0	+0.21	+0.08	+1.1	+0.62	-1.37	+0.8	+2.52	-1.50
ZF	+0.8	+0.10	-0.24	+0.2	+0.34	-1.02	+2.4	+5.77	+0.68
ZN	-3.3	-0.97	-1.37	+0.8	+0.59	-0.67	+1.6	+4.56	-0.03
ZB	-1.2	-0.31	-0.30	-0.3	+0.14	-1.34	+2.7	+6.55	-0.22
GBL	+1.2	+0.38	-0.04	-0.3	-0.36	-1.37	-0.3	-0.89	-2.56
EUR	-0.1	+0.00	-0.40	-1.1	-0.18	-1.43	+0.2	+0.46	-2.32
JPY	+1.3	+0.38	+0.08	-0.6	-0.03	-1.43	+1.1	+2.84	-0.75
GBP	-0.4	-0.17	-0.47	+0.6	+0.91	-0.87	+0.7	+1.90	-1.54
AUD	-0.8	-0.34	-0.54	+0.3	+0.63	-0.61	+1.8	+4.34	+0.23
CAD	+0.8	+0.16	-0.27	+0.7	+1.24	-0.81	+0.8	+2.14	-0.79
CHF	+1.2	+0.36	+0.19	+0.5	+0.95	-1.02	+2.1	+4.59	-0.08
CL	-0.5	-0.15	-0.70	-2.6	-1.53	-1.90	+0.2	+0.60	-2.78
HO	-0.3	+0.04	-0.18	-1.9	-1.15	-2.02	+1.2	+2.76	-2.05
RB	+1.2	+0.24	-0.14	-1.6	-0.71	-1.67	+1.4	+3.35	-1.51
NG	+1.5	+0.41	+0.57	-2.8	-1.15	-1.47	+0.5	+1.21	-1.54
GC	-0.7	-0.19	-0.45	-1.3	-0.11	-1.48	+0.5	+1.18	-2.37
SI	-1.5	-0.31	-0.49	-0.4	+0.28	-0.86	+0.9	+1.76	-0.98
HG	-1.4	-0.35	-0.64	+0.0	+0.28	-0.49	+1.9	+2.77	-0.22
ZC	+2.1	+0.46	-0.10	+1.4	+1.14	-0.36	+0.6	+1.58	-0.77
ZS	+2.2	+0.53	+0.35	+1.5	+0.92	-0.93	+0.6	+1.18	-1.72
ZW	-0.2	-0.06	-0.09	-0.7	+0.16	-1.19	+1.2	+1.97	-0.46
LE	+1.8	+0.55	+0.47	+0.6	+0.54	-0.72	+1.7	+2.95	-0.53
HE	+1.1	+0.27	+0.12	+1.4	+1.17	-0.90	+1.4	+2.46	-1.29