KagelsTrading

Method appendix: candlestick patterns in the DAX, S&P 500, EUR/USD and gold

Measurement protocol version 3.2 (rules frozen on 17 October 2026, version 3.2 of 20 October 2026). Kagels Trading GmbH, kagels-trading.com

What this document is for

Several candlestick articles on kagels-trading.com and kagels-trading.de quote numbers from our own measurement. This document shows how those numbers were made: which data, which rules, which calculations and which limits. The rules were fixed before the results were evaluated. Every later change gets a new version number.

The study is descriptive. It shows what happened after candlestick patterns in four markets on daily candles, with uncertainty intervals. It makes no statistical discovery claims (no p-values, no significance), and it proves neither a trading edge nor a cause. Null and negative results are published.

1. Question

What happens after a candlestick pattern, compared with trading days in the same market condition without that pattern? In addition, as a hypothetical test: how often does a target at the same distance as the risk (1:1) get hit before the stop?

2. Markets, sources, period

DAX: Yahoo Finance, index ^GDAXI, Xetra trading day. **S&P 500:** Yahoo Finance, index ^GSPC, NYSE trading day. **EUR/USD and gold (XAUUSD):** Dukascopy hourly bid candles, combined into daily candles from 5 pm to 5 pm New York time; each candle is dated to the end of its session.

Rejected sources: Yahoo EURUSD=X (97 candles with open or close outside high and low), Twelve Data (weekend candles appear suddenly from 2024 and 2025) and the gold future GC=F (roll jumps, flat candles).

Period: trading days from 2 January 2014 to 30 September 2026. **Development period:** signals up to 31 December 2021 whose result window ends before 2022. **Test period:** signals from 3 January 2022, evaluated once and not adjusted afterwards.

3. Calendar, gaps, data checks

Missing weekdays in the DAX and S&P 500 are, without exception, exchange holidays or special closures. For EUR/USD and gold, only single holidays are missing (25 and 26 December, 1 and 2 January, Good Friday, and once 24 December 2021); they count as non-trading days. A Dukascopy session is complete if it holds at least 18 hours with volume. Days with a missing value, with open = high = low = close, or with open or close outside the range are gaps. Gaps stay gaps; nothing is repaired.

Gold disclosure: In version 3.1 the minimum coverage was higher. Gold sessions with 18 to 21 hours, all of them shortened US holidays, therefore counted as gaps, and almost no gold cases remained in the test period. Version 3.2 lowered the threshold to 18 hours. The results for the DAX, S&P 500 and EUR/USD already existed at that point and did not change. **The gold evaluation was therefore adjusted after the case counts were known. It is descriptive and not an untouched external confirmation.**

Cross-check: 54 sessions from July to October 2026 were checked against Interactive Brokers. EUR/USD matches (median deviation at most 0.017 %). The gold open differs by about 0.1 % (roughly 0.07 ATR) because Interactive Brokers starts the session at 6 pm with the mid price. Gold patterns close to a body threshold therefore depend on the data source.

4. Building blocks

For candle i: range R = H − L, body B = |C − O|, upper wick OD = H − max(O,C), lower wick UD = min(O,C) − L; green: C > O, red: C < O. A pattern of k candles ends at the signal candle t; the reference candle is s = t − k.

ATR14 after Wilder (true range including the prior close), started with the simple mean of the first 14 values after the start of data or after a gap, valid from the 28th session. Size thresholds in the rules refer to A = ATR14(s); results are measured in ATR14(t).

Market condition at s: down if C(s) < C(s−10) and C(s) is below the 20-day average; up in the opposite case; otherwise sideways. **Volatility level:** A/C(s) in thirds, limits per market from the development period.

Lock: a case only counts if all sessions from the start of the trend window to ten days after the signal are free of gaps and the ATR is valid at s and t.

5. Pattern rules

Only tweezers have a tolerance: highs or lows count as equal if they are at most 0.05·A apart. All other comparisons are exact. Engulfing was also counted as a "whole candle" variant (high and low engulfed as well). Not measured: abandoned baby, morning and evening star with a gap, kicker, three methods, belt hold, hikkake. A day may belong to several patterns (for example hammer and bullish pin bar); subtypes are not added to their parent pattern.

Pattern	Candles	Direction	Rule (all conditions)	Difference from textbook
Doji	1	neutral	R(t) > 0, B(t) ≤ 0.1·R(t)	
Dragonfly Doji	1	neutral	Doji, OD(t) ≤ 0.1·R(t), UD(t) ≥ 0.6·R(t)	no trend condition, so measured as neutral
Gravestone Doji	1	neutral	Doji, UD(t) ≤ 0.1·R(t), OD(t) ≥ 0.6·R(t)	as above
Long-Legged Doji	1	neutral	Doji, OD(t) ≥ 0.3·R(t), UD(t) ≥ 0.3·R(t), R(t) ≥ A	minimum range is our own choice
Spinning Top	1	neutral	0.1·R(t) < B(t) ≤ 0.3·R(t), OD(t) ≥ 0.25·R(t), UD(t) ≥ 0.25·R(t)	
Hammer	1	long	trend down; B(t) > 0.1·R(t); UD(t) ≥ 2·B(t); OD(t) ≤ 0.1·R(t); any colour	body above 10 %, separate from the doji
Hanging Man	1	short	trend up; shape as hammer	
Inverted Hammer	1	long	trend down; B(t) > 0.1·R(t); OD(t) ≥ 2·B(t); UD(t) ≤ 0.1·R(t)	
Shooting Star	1	short	trend up; shape as inverted hammer	no gap to the prior candle
Bullish Marubozu	1	long	green, B(t) ≥ 0.9·R(t), R(t) ≥ A; any trend	minimum range is our own choice
Bearish Marubozu	1	short	red, otherwise as above	
Bullish Engulfing	2	long	trend down; t−1 red; t green; O(t) ≤ C(t−1); C(t) ≥ O(t−1); B(t) > B(t−1)	
Bearish Engulfing	2	short	trend up; t−1 green; t red; O(t) ≥ C(t−1); C(t) ≤ O(t−1); B(t) > B(t−1)	
Bullish Harami	2	long	trend down; t−1 red, B(t−1) ≥ 0.6·A; t green; O(t) ≥ C(t−1); C(t) ≤ O(t−1); 0.1·R(t) < B(t) ≤ 0.5·B(t−1)	body of t at most half as large

Pattern	Candles	Direction	Rule (all conditions)	Difference from textbook
Bearish Harami	2	short	trend up; t–1 green, B(t–1) ≥ 0.6·A; t red; O(t) ≤ C(t–1); C(t) ≥ O(t–1); 0.1·R(t) < B(t) ≤ 0.5·B(t–1)	
Bullish Harami Cross	2	long	trend down; t–1 red, B(t–1) ≥ 0.6·A; B(t) ≤ 0.1·R(t); min(O,C)(t) ≥ C(t–1); max(O,C)(t) ≤ O(t–1)	counted separately from the harami
Bearish Harami Cross	2	short	trend up; t–1 green, B(t–1) ≥ 0.6·A; B(t) ≤ 0.1·R(t); min(O,C)(t) ≥ O(t–1); max(O,C)(t) ≤ C(t–1)	
Piercing Line	2	long	trend down; t–1 red, B(t–1) ≥ 0.6·A; t green; O(t) ≤ C(t–1); (O(t–1)+C(t–1))/2 < C(t) < O(t–1)	open below the prior close instead of below the prior low
Dark Cloud Cover	2	short	trend up; t–1 green, B(t–1) ≥ 0.6·A; t red; O(t) ≥ C(t–1); O(t–1) < C(t) < (O(t–1)+C(t–1))/2	as above, mirrored
Morning Star	3	long	trend down; t–2 red, B(t–2) ≥ 0.6·A; B(t–1) ≤ 0.3·R(t–1); max(O,C)(t–1) ≤ C(t–2) + 0.1·A; t green; C(t) > (O(t–2)+C(t–2))/2	no gap required
Evening Star	3	short	trend up; t–2 green, B(t–2) ≥ 0.6·A; B(t–1) ≤ 0.3·R(t–1); min(O,C)(t–1) ≥ C(t–2) − 0.1·A; t red; C(t) < (O(t–2)+C(t–2))/2	as above
Three White Soldiers	3	long	trend down or sideways; t–2, t–1, t green; C(t–2) < C(t–1) < C(t); O(t–1) between O(t–2) and C(t–2); O(t) between O(t–1) and C(t–1); for all three OD ≤ 0.3·R and B ≥ 0.5·A	
Three Black Crows	3	short	trend up or sideways; t–2, t–1, t red; C(t–2) > C(t–1) > C(t); O(t–1) between C(t–2) and O(t–2); O(t) between C(t–1) and O(t–1); for all three UD ≤ 0.3·R and B ≥ 0.5·A	
Tweezer Bottom	2	long	trend down; t–1 red; t green; L(t) and L(t–1) equal (tolerance)	
Tweezer Top	2	short	trend up; t–1 green; t red; H(t) and H(t–1) equal (tolerance)	
Inside Bar	2	neutral	H(t) < H(t–1) and L(t) > L(t–1); any trend	
Bullish Pin Bar	1	long	UD(t) ≥ (2/3)·R(t); min(O,C)(t) ≥ L(t) + (2/3)·R(t); L(t) < min L(t–5 … t–1); any trend	
Bearish Pin Bar	1	short	OD(t) ≥ (2/3)·R(t); max(O,C)(t) ≤ H(t) − (2/3)·R(t); H(t) > max H(t–5 … t–1); any trend	

6. Measures

Entry E = open of the day after the signal. **Directional patterns:** M5 = direction · (C(t+5) − E) / ATR14(t), reported as the mean; plus median, share of positive cases, and best and worst move over ten days. **Neutral patterns** (doji family, spinning top, inside bar): N5 = range from the highest high to the lowest low of the next five days, in ATR14(t). No breakout direction is measured.

1:1 test (hypothetical, directional patterns only): stop 0.1·A beyond the pattern extreme, target at the same distance on the other side, observed for ten days. If a day opens beyond stop or target, the case ends at the open. If a day touches both, the case is unresolved. Without an event it ends at the close of day ten. All five outcomes are reported.

7. Comparison group

Separately for each pattern, market and period. Comparison days meet every condition of a pattern case except the pattern itself. They are grouped into cells of calendar year, market condition and volatility level. If a cell has fewer than 30 comparison days, the three volatility levels of the same year are merged; if that is still not enough, the case counts without comparison. The reported difference is the mean over all comparable cases of (measure of the case minus mean measure of its cell). It describes an association, not an effect.

8. Uncertainty

Block bootstrap per market with blocks of 20 trading days, 5,000 repetitions, seed 20261017, 95 % percentile interval; checked with 10 and 40 days as well. Each repetition recomputes cells, assignment and difference

from scratch. A result is only shown from 30 comparable cases per market and period; below that, only the case count. This limit is an editorial choice, not proof of reliability.

There is no total across the four markets. With about 25 patterns and four markets, some striking values are to be expected by chance.

9. What the numbers do not show

The results apply only to daily candles of these four markets in the period named. They include no costs. The DAX and S&P 500 are indices and cannot be traded directly; EUR/USD and gold are bid prices. The measurement is not a trading system and says nothing about other timeframes, other markets or future developments.

Every result row, including those with fewer than 30 cases, is listed at kagels-trading.com/data/candlestick-pattern-study-results.csv.