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Basis Convergence Arbitrage

Expert Advisor Documentation

PLATFORM	TYPE	TIMEFRAME	WEBSITE
MetaTrader 5 (MT5)	Statistical Arbitrage / Mean Reversion	M5 – M30 (e.g. EURUSD)	www.algobot.live

> ⚠ **Important Disclaimer** This document is for educational and informational purposes only. It does not constitute financial or investment advice. Trading forex, CFDs, and other leveraged instruments involves substantial risk of loss and is not suitable for all investors. Past backtest performance does not guarantee future results. Never trade with capital you cannot afford to lose.

Overview

Basis Convergence Arbitrage is a single-instrument statistical-arbitrage Expert Advisor. Classic arbitrage trades the spread between two related prices and collects the convergence when that spread snaps back to fair value. Because the engine feeds only one symbol on one timeframe, a cross-symbol spread is not available — so this EA arbitrages a *temporal* spread instead: the gap between the traded price and its own synthetic fair-value equilibrium.

The equilibrium anchor is an exponential moving average of the close. The **basis** — the tradable "spread" — is simply how far price has drifted from that anchor. Like an arbitrage spread, the basis wanders away from zero and is then pulled back. The EA standardises the basis into a stationary z-score so its entry threshold is volatility-invariant, then buys statistically cheap dislocations and sells statistically rich ones, betting on convergence back toward fair value.

Crucially, a dislocated spread is only tradable if it is actually expected to converge. Two robustness gates enforce that assumption — a **flat-regime gate** and a **turn confirmation** — which is what keeps a mean-reversion system from bleeding out in a strong trend. Everything self-scales: the z-score adapts to volatility, while the regime gate and hard stops adapt via ATR.

> **The core idea in one line.** Measure how far price has strayed from its own EMA equilibrium, convert that distance into a z-score, and only trade the extreme dislocations that are already curling back — in a market calm enough for reversion to be expected.

How It Works

1. The Fair Value Anchor and the Basis

A fair-value equilibrium is defined as an EMA of the close over `AnchorPeriod` bars. The basis is the raw deviation of price from that anchor:

```
FairValue = EMA(close, AnchorPeriod)     // the equilibrium anchor
Basis     = Close - FairValue            // the tradable "spread"
```

When the basis is positive, price sits above fair value (rich / at a premium); when negative, price is below fair value (cheap / at a discount).

2. Standardising the Basis into a z-score

Raw basis distance is not comparable across time — a 20-point gap means one thing in a quiet market and another in a volatile one. To make the entry threshold volatility-invariant, the basis is standardised over a rolling window of `BasisWindow` bars into a stationary z-score:

```
z = (Basis - mean(Basis, BasisWindow)) / std(Basis, BasisWindow)
```

The z-score expresses the current dislocation in standard deviations. A reading of `z = -2.0` means price is two standard deviations cheaper than its typical deviation from fair value. Both the C# and MQL5 implementations use a *population* standard deviation (dividing by `BasisWindow`) so the two engines match bit-for-bit.

3. Entry Logic

Signals are evaluated only on each freshly **closed** primary bar. A trade opens only when the statistical dislocation, the turn confirmation, and the regime gate all agree:

- **LONG** — `z ≤ -EntryZ` (price statistically cheap vs fair value) **AND** the basis is turning up (`BasisNow > BasisPrev`) **AND** the regime is flat. Buy the discount, betting on convergence upward.
- **SHORT** — `z ≥ +EntryZ` (price statistically rich vs fair value) **AND** the basis is turning down (`BasisNow < BasisPrev`) **AND** the regime is flat. Sell the premium, betting on convergence downward.

4. The Robustness Gates

These two gates are what separate a disciplined stat-arb system from a naive "buy the dip" rule:

- **Flat-regime gate.** The equilibrium itself must be roughly stationary. If the fair-value anchor is drifting hard — a structural break or strong trend — the basis will not revert; it just rides the trend. The EA measures the anchor's per-bar slope over `SlopeLookback` bars and only trades when `|slope| ≤ MaxSlopeAtr × ATR`. No convergence assumption, no trade.
- **Turn confirmation.** The EA does not grab a spread that is still widening. On the signal bar the basis must already be curling back toward zero (this bar's basis closer to zero than the previous bar's), so entries occur as convergence begins rather than mid-dislocation.
- **Spread filter.** New entries are skipped whenever the current broker spread exceeds `MaxSpreadPoints`, avoiding poor fills during thin or news-driven conditions.

5. Exit Logic and Safety Rails

The arbitrage closes when the spread converges. Once `|z| ≤ ExitZ`, the dislocation is effectively gone, so the position is flattened and the mean-reversion move is banked:

```
EXIT when  |z| ≤ ExitZ     // convergence realised → flatten
```

In addition, every order carries hard ATR-based safety rails attached at entry:

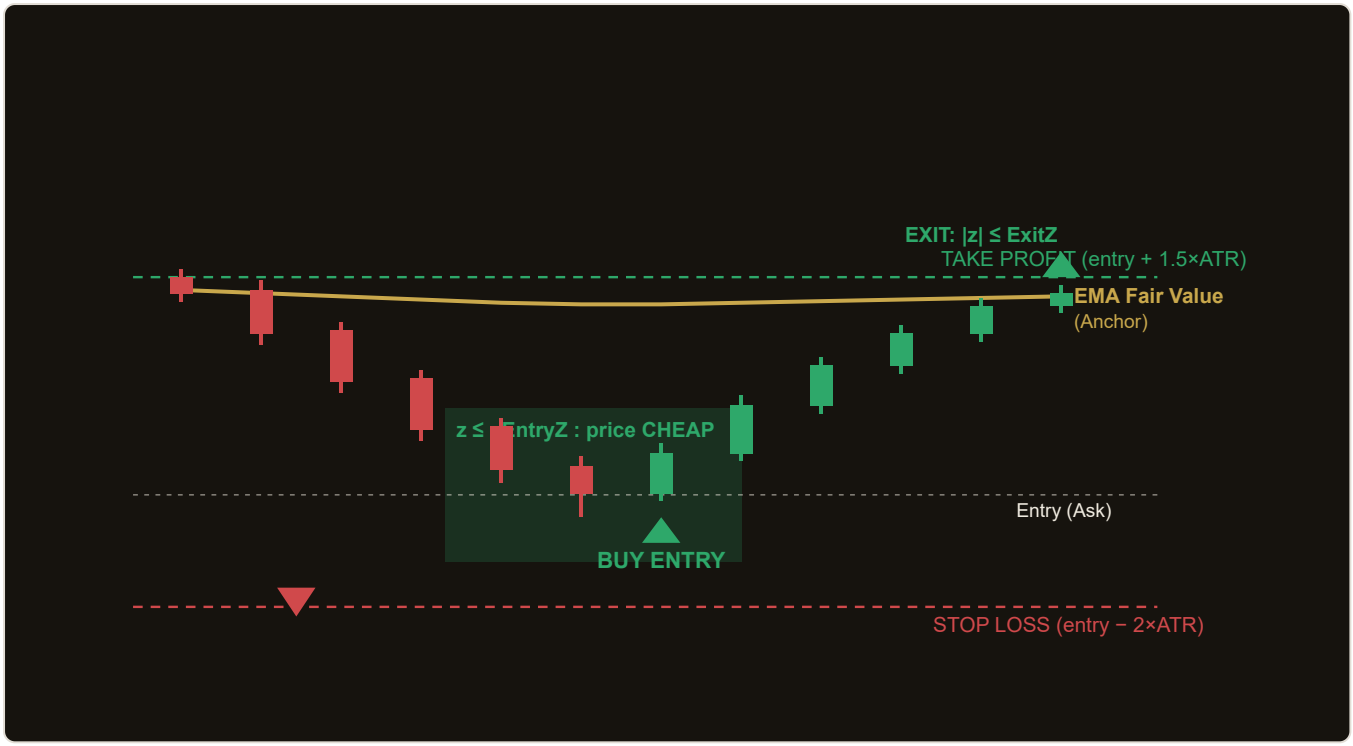
- **Stop loss** at `StopAtrMult × ATR` from entry — fires if the relationship broke and the basis keeps widening against the position.
- **Take profit** at `TpAtrMult × ATR` from entry — a hard target in case convergence overshoots fair value.

Only one position per `Magic` is held at a time, so the EA never stacks correlated exposure on the same dislocation.

> **Worked example — a LONG convergence**
>
> On EURUSD M15 the fair-value EMA sits flat (a calm range), so the flat-regime gate is open. Price sells off sharply and the basis reaches `z = −2.3`, below the `−EntryZ = −2.0` threshold — statistically cheap. On the next closed bar the basis ticks back toward zero (`BasisNow > BasisPrev`), confirming the turn. The EA buys at the ask with a stop 2×ATR below and a take-profit 1.5×ATR above. Price drifts back toward the anchor; once `|z|` falls to `0.4` or less, the position is closed and the convergence is banked.

Strategy in Action

The illustration below shows an example of how the strategy identifies a setup and triggers its entry and exit. This is a simplified, illustrative example for educational purposes — not real market data.



Illustrative example only. Actual market behaviour varies.

Parameters

Parameter	Default	Description
AnchorPeriod	`50`	EMA lookback for the fair-value equilibrium the basis is measured against. Range 20–150, step 5.
BasisWindow	`60`	Rolling window for the mean/std used to standardise the basis into a z-score. Range 20–150, step 5.
EntryZ	`2.0`	Enter when the standardised basis is at least this many standard deviations from its mean. Range 1.0–3.5, step 0.1.
ExitZ	`0.4`	Exit (convergence realised) once the basis pulls back inside this z-band. Range 0.0–1.5, step 0.1.
SlopeLookback	`20`	Number of bars used to measure the anchor's slope for the flat-regime gate. Range 5–60, step 5.
MaxSlopeAtr	`0.12`	Maximum anchor slope-per-bar (× ATR) allowed to call the regime "flat / reverting". Range 0.02–0.60, step 0.01.
AtrPeriod	`14`	ATR lookback used for both the regime gate and the hard stop / take-profit distances. Range 5–30, step 1.
StopAtrMult	`2.0`	Hard stop-loss distance as a multiple of ATR. Range 0.8–5.0, step 0.1.
TpAtrMult	`1.5`	Take-profit distance as a multiple of ATR. Range 0.5–4.0, step 0.1.
MaxSpreadPoints	`80`	Skip new entries when the current spread (in points) is wider than this. Range 5–300, step 5.
Lots	`0.10`	Fixed order volume in lots. Range 0.01–1.0, step 0.05.
Magic	`48213`	Magic number identifying this EA's positions. Range 0–9,999,999, step 1.

Recommended Settings

The strategy's natural home is a liquid, range-prone FX major such as **EURUSD on M5–M30**, but it runs on whatever symbol and timeframe are selected at attach time (it uses only the primary timeframe). Start with the defaults and tune from there.

SUGGESTED STARTING POINT

- **Symbol / Timeframe:** EURUSD, M15 (or M5–M30 on a comparable liquid major)

- **AnchorPeriod / BasisWindow:** 50 / 60 — the defaults balance responsiveness against a stable equilibrium
- **EntryZ / ExitZ:** 2.0 / 0.4 — trade only genuine dislocations and exit near fair value
- **MaxSlopeAtr:** 0.12 — keep this tight so trades only fire in calm, mean-reverting regimes
- **StopAtrMult / TpAtrMult:** 2.0 / 1.5 — wide safety stop, modest ATR target
- **Lots:** size to your account risk, not the 0.10 default

> **Tuning tips.** Raising `EntryZ` makes signals rarer but higher-conviction; lowering it trades more often with weaker edges. A larger `MaxSlopeAtr` loosens the flat-regime gate and lets more trades through in trending conditions — usually the wrong direction for a mean-reversion system, so widen it with care. Always backtest and forward-test any change on your own broker's data before going live.

> **Match the two engines.** The MQL5 EA is a 1:1 port of the C# strategy — the inputs map directly to `DescribeParameters()` and both use a population standard deviation for the z-score. If you re-tune parameters in one engine, mirror them in the other so backtest and live behaviour stay aligned.

How to Install on MetaTrader 5

1. Copy `BasisConvergenceArbitrage.ex5` to your MT5 `MQL5\Experts\` folder
2. Restart MetaTrader 5 and refresh the Navigator panel
3. Drag the EA onto a chart matching the recommended symbol and timeframe
4. Configure the input parameters and click **OK**
5. Enable **Algo Trading** in the MT5 toolbar

Risk Warning

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