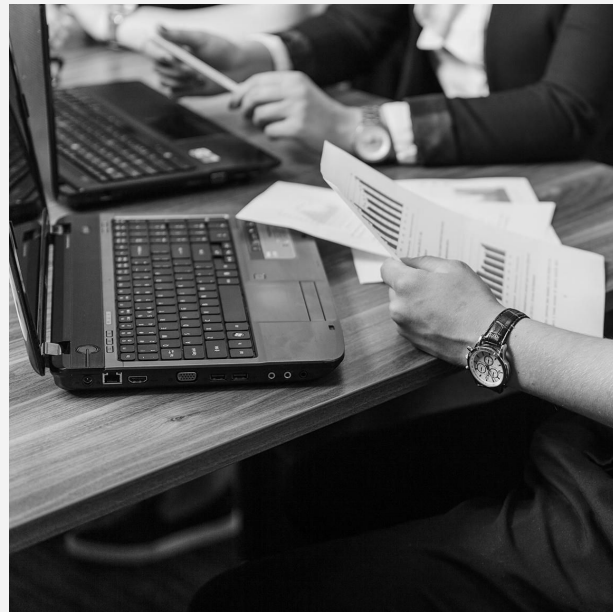


2025

McG-Coin PairGate Strategy (JPM-BAC)

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STRATEGY

Identify and exploit short-term mispricings between two historically related stocks using a hybrid of statistical and technical methods

Cointegration (Pairs Trading)

Run Engle–Granger / ADF to find a **stable long-run relationship** between two stocks.

Build the *spread* (hedge ratio) and track its deviation from the mean (Z-score).

McGinley Dynamic Filter

Adaptive moving average that adjusts to market speed.

Only trade when **both stocks' prices are within ± 1 % of their McGinley line**, signalling a sideways/non-trending regime.

Machine-Learning Gatekeeper

Logistic regression (or XGBoost) uses features such as current & lagged Z-score, spread volatility, and McGinley slopes.

Opens a trade only when predicted **success probability** > 60 %.

McGinley Dynamic Indicator

$$MD_t = MD_{t-1} + \frac{Price_t - MD_{t-1}}{N \times \left(\frac{Price_t}{MD_{t-1}} \right)^4}$$

- N is the smoothing factor (e.g., 10 for short-term, 14–20 for longer)
- We compute it per asset (KO and PEP).

```
def np_rolling_dynamic(price: pd.Series, W: int = 14) -> pd.Series:
    nd = np.zeros(len(price), dtype=float)
    p = price.values.astype(float)
    nd[0] = p[0]
    for i in range(1, len(p)):
        prev = nd[i-1]
        if prev == 0 or np.isclose(prev, 0.0):
            nd[i] = p[i]
        else:
            nd[i] = prev + (p[i] - prev) / (W + (p[i] / prev)+1)
    return nd.Series(nd, index=price.index, name='ND (price name) (00)')
```

```
nd_N = 10 # represents short term movement
nd = pd.DataFrame([(t, mcginy_dynamic(prices[t], N=nd_N) for t in tickers)]
nd.tail()
```

	JPM	BAC
Date		
2025-09-16	299.833309	49.515010
2025-09-17	300.852955	49.677342
2025-09-18	301.906325	49.879607
2025-09-19	302.995663	50.076471
2025-09-22	303.830979	50.236003

Engle-Granger Cointegration (ADF strategy)

[illegible]

Chosen regression: BAC_on_3PM
ADF p-value on residuals: 0.330764728815577

```
Date
2025-09-16    -5.374568
2025-09-17    -5.819728
2025-09-18    -4.512401
2025-09-19    -4.625603
2025-09-22    -4.683544
Name: spread, dtype: float64
```

Z-score of spread & McGinley regime filter

- Z-score over rolling window (default 60).
- Regime filter: only allow trades when both KO and PEP are within $\pm 1\%$ of their McKinley line (to avoid strong trends).
- Signals:
 - If $z > +2 \Rightarrow$ short KO / long PEP (weighted by hedge ratio from regression used),
 - If $z < -2 \Rightarrow$ long KO / short PEP.
- Exits: when $|z| \leq 0.5$ or max holding days reached.

```
lookback = 60
z = (spread - spread.rolling(lookback).mean()) / spread.rolling(lookback).std()
z = z.dropna().rename('z')

# regime filter: both within 1% of MD
md_dist = [prices / md - 1.0].abs()
regime_uk = [md_dist["JPM"] <= 0.01] & [md_dist["BAC"] <= 0.01]
regime_uk = md_dist.rolling(window=25, min_periods=1).filter(regime_uk)
```

```
# hedge ratio from chosen regression - essentially slope
beta = model_used.params[1]
beta
4) ✓ 0.0a
np.float64(0.15045359859693058)
```

```
4) ✓ 0.0% Python
np.float64(0.15045359859693058)
```

ML Gatekeeper (defaulted Logistic Regression)

[illegible]

This strategy combines **cointegration analysis** with a **McGinley Dynamic filter** to spot when the JPM-BAC price spread strays from its long-term equilibrium but the market isn't trending. A **Z-score of the spread** flags potential entries, and a lightweight **machine-learning gate** approves only those trades with a high probability of mean reversion.

Together these layers turn **raw price data** into a **disciplined, high-conviction pairs-trading signal**.

ANALYSIS

Performance Metrics

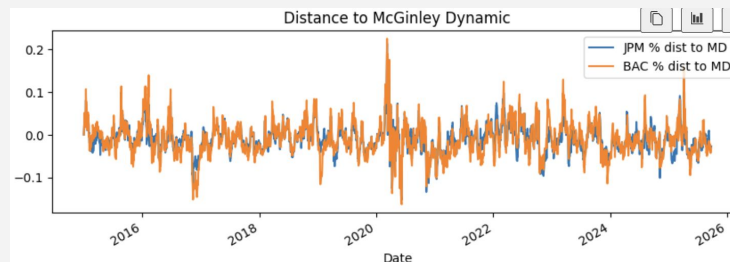
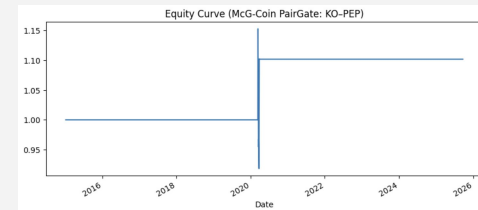
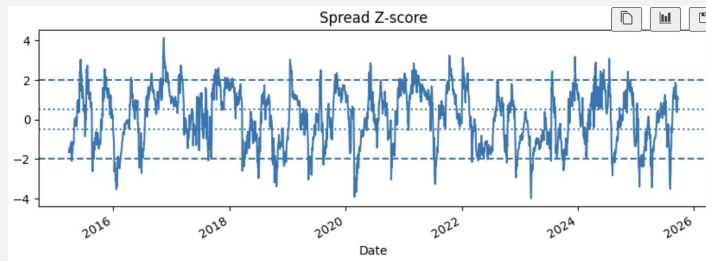
Equity final: 1.102 – Portfolio grew about 10 % over the test period.

Annualized return: 1.22 % – Roughly a slow, bond-like yearly return.

Sharpe ratio: 0.15 – Only slightly positive risk-adjusted performance.

Max drawdown: -20.36 % – At one point the strategy fell over 20 % from its peak.

Trades taken: 1 – Only a single round-trip trade triggered.



Key Insights:

The strategy **worked mechanically**: waiting for a statistically significant spread move and filtering with the McGinley line. However, **opportunity was scarce** and the lone trade came with **meaningful interim drawdown**.

Future work: **widen Z-score thresholds** or test other sector pairs to increase trade frequency and risk-adjusted returns.