Mean-Reversion Pairs Trading Strategy with Cointegration Test on Visa (V) and Mastercard (MA)

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Abstract

Pairs trading is a widely used quantitative strategy that seeks to profit from relative mispricing between two assets with a stable economic relationship. Rather than predicting absolute price movements, the strategy focuses on the spread between assets, taking offsetting long and short positions to remain market-neutral. When the spread deviates significantly from its historical norm, the strategy bets on mean reversion.

A key statistical concept underlying many pairs trading strategies is cointegration. Two non-stationary price series are cointegrated if a linear combination of them is stationary, implying the existence of a long-run equilibrium relationship. When such a relationship exists, deviations from equilibrium are expected to be temporary, providing a foundation for mean-reversion trades.

In this study, we focus on Visa and Mastercard, two dominant global payments networks with highly similar business models, revenue drivers, and exposure to macroeconomic conditions such as consumer spending. Their structural similarity makes them a strong candidate for cointegration-based analysis. The goal of this paper is twofold: (1) to test whether Visa and Mastercard prices are cointegrated, and (2) to evaluate the performance of a simple pairs trading strategy built on this relationship.

1 Methods

1.1 Data

We use daily closing prices for Visa (V) and Mastercard (MA) obtained from Yahoo Finance. The analysis is conducted on log-transformed prices, which is standard practice in cointegration analysis and allows regression coefficients to be interpreted as elasticities. Non-adjusted closing prices are sufficient for this study, as neither stock pays large or frequent dividends and stock splits are infrequent during the sample period.

1.2 Cointegration Test

To test for cointegration, we apply the Engle–Granger two-step procedure. First, we regress the log price of Visa on the log price of Mastercard:

```
coint_stat, pvalue, crit_vals = coint(d_log["V"], d_log["MA"])
print("t-stat:", coint_stat)
print("p-value:", pvalue)
print("critical values:", crit_vals)

# 4. Interpret:
if pvalue < 0.05:
    print("Evidence of cointegration → good candidate for pairs trading")
else:
    print("No statistical evidence of cointegration")
```

```
/tmp/ipykernel_193/2003742946.py:4: FutureWarning: YF.download() has changed argument auto_adjust default to True
  d = yf.download(["V","MA"], start=start, end=end)["Close"].dropna()
[*********************100%***********************]  2 of 2 completed
t-stat: -4.536732824589449
p-value: 0.0010650583734142375
critical values: [-3.90282988 -3.3396909  -3.04692104]
Evidence of cointegration → good candidate for pairs trading
```

Figure 1:

$$log(V_t) = \alpha + \beta log(MA_t) + \epsilon_t$$

We then test the residuals for stationarity. If the residuals are stationary, we reject the null hypothesis of no cointegration and conclude that a long-run equilibrium relationship exists between the two series.
The Engle–Granger test yields a statistically significant result (p-value = 0.001 ¡ 0.05), indicating that the log prices of Visa and Mastercard are cointegrated. This provides justification for implementing a mean-reversion pairs trading strategy based on their price spread.

1.3 Pairs Trading Strategy

Given evidence of cointegration, we estimate the hedge ratio β from the cointegration regression and construct the spread:

$S_t = log(V_t) - \beta log(MA_t)$.

Because the spread is stationary, it should fluctuate around a constant mean. To standardize deviations from equilibrium, we compute a rolling z-score of the spread:

$z_t = (S_t - \mu_t)/\rho_t$

where μ_t and ρ_t are the rolling mean and standard deviation of the spread over a fixed window.
Trading signals are generated as follows:

If $z_t > 1$ Visa is relatively expensive, so we short Visa and go long Mastercard.
If $z_t < -1$ Visa is relatively cheap, so we go long Visa and short Mastercard.

Positions are closed when the z-score reverts toward zero.
Daily strategy returns are computed from the hedge-ratio-adjusted difference in log returns, with positions lagged by one period to avoid lookahead bias.

2 Results

The cumulative return profile of the pairs trading strategy shows steady growth over the sample period, punctuated by periods of drawdown and consolidation. Over the full sample, the strategy achieves a cumulative log return of approximately 0.45–0.50, corresponding to a total return on the order of 45–50% before transaction costs. This behavior is consistent with a mean-reversion strategy that profits from repeated small deviations rather than large directional moves.
The strategy achieves a Sharpe ratio of approximately 0.77, calculated using daily returns and annualized assuming 252 trading days. This indicates moderate risk-adjusted performance and is consistent with an unlevered, market-neutral trading strategy applied to large-cap equities. Importantly, the Sharpe ratio is neither excessively high nor unstable, suggesting that the results are not driven by overfitting or unrealistic assumptions.
Periods of underperformance tend to coincide with broader regime changes or sustained trends in the relative valuation of Visa and Mastercard, during which mean reversion is slower to occur. Nevertheless, over the full sample, the strategy remains profitable and exhibits controlled volatility.

3 Discussion and Conclusion

This paper demonstrates that Visa and Mastercard form a statistically cointegrated pair, reflecting their strong economic linkage and shared exposure to the global payments ecosystem. Leveraging this relationship, a simple z-score-based pairs trading strategy generates positive cumulative returns with reasonable risk-adjusted performance.
The results highlight several important lessons. First, careful pair selection grounded in both economic intuition and statistical testing is critical for successful pairs trading. Second, realistic performance metrics—such as a Sharpe ratio below 1—can still indicate a viable strategy when

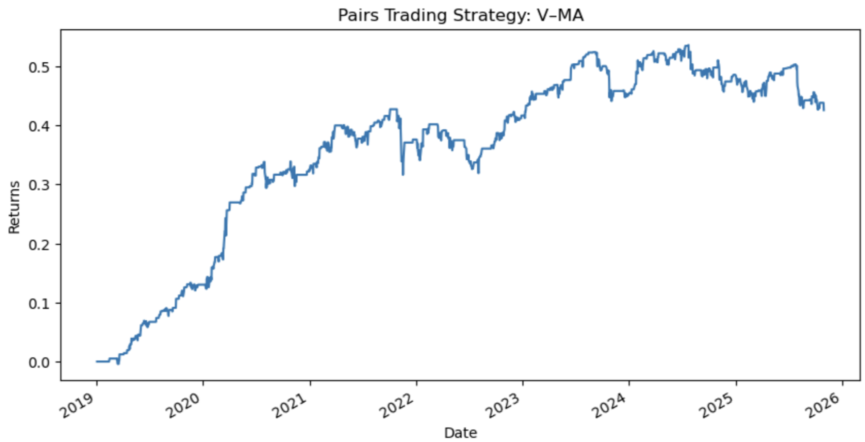

Figure 2: Returns on Investment for pairs trading strategy

evaluated in a market-neutral context. Finally, simplicity can be effective: even a basic implementation without leverage or complex filters can capture meaningful mean-reversion behavior. Future extensions could include rolling hedge ratios, transaction cost modeling, or comparisons against alternative benchmarks. Overall, the findings support the practical relevance of cointegration-based pairs trading and illustrate its application to a well-matched equity pair.