

Pairs Trading: performance of a relative value arbitrage strategy

by

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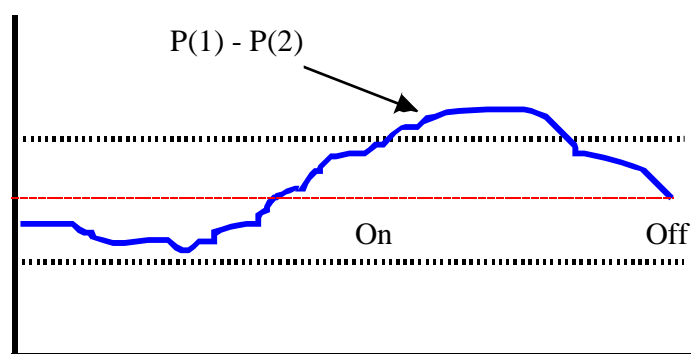
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Statistical “Arbitrage”

- Identify a pair of stocks that move in tandem
- When they diverge:
 - short the higher one
 - buy the lower one
- Unwind upon convergence
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Example



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Economic Rationale

- Tartaglia:
 - “Human beings don’t like to trade against human nature, which wants to buy stocks after they go up, not down...”
- Imperfect markets?
 - Over-reaction
 - Under-reaction

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Relative Pricing

- Approximate APT Models
 - Long-short “arbitrage in expectations”
 - Self-financing
 - Eliminate relative mispricing
 - Silent on absolute pricing
- Mechanisms
 - risk-matched portfolios
 - risk-matched securities

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Methodology

- Two stages:
 - 1. Pairs Formation
 - 2. Pairs Trading
- Committed Capital
 - full period
 - when-needed
 - no extra leverage

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Pairs Formation Period

- Match on stock cumulative return index
 - Minimize squared price error
 - Twelve months of daily prices
- Equivalent to matching on state-prices
 - Each day is a different state
 - Assumes stationarity
 - Assumes a year captures all states

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Pairs Formation Period

- Daily CRSP files
- Eliminate stocks that missed a day trading in a year
- Cumulative total return index for each stock
- Also restrict to same broad industry category: Utilities, Transports, Financials, Industrials

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Trading Period

- Six-month periods: 1962-1997
 - starting a new “trader” each month
 - closing all positions at end of each six month
- How many pairs to use?
 - 5, 20 and 20 after first 100, then all pairs under distance metric

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Trading Period

- Open at 2 sigma (historical sigma over past one year)
- Close upon convergence, or end of six-month period

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Excess Return

- Return on committed capital
 - Sum of payoffs over all pairs in period/# pairs
 - Allow \$1/per pair
- Return on employed capital
 - All \$1/pair used

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Results for Same Day Trading

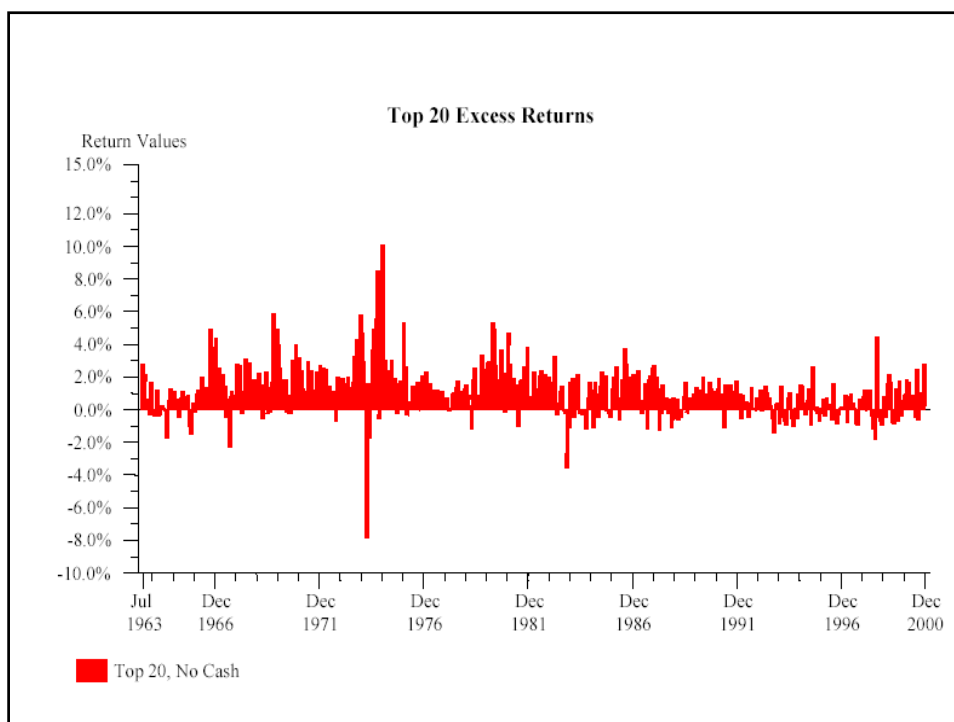
- Portfolio of 5 and 20 best pairs earn an average of 6% per six month period.
Average size of stocks in pairs: 3rd to 4th decile
- Utilities predominate

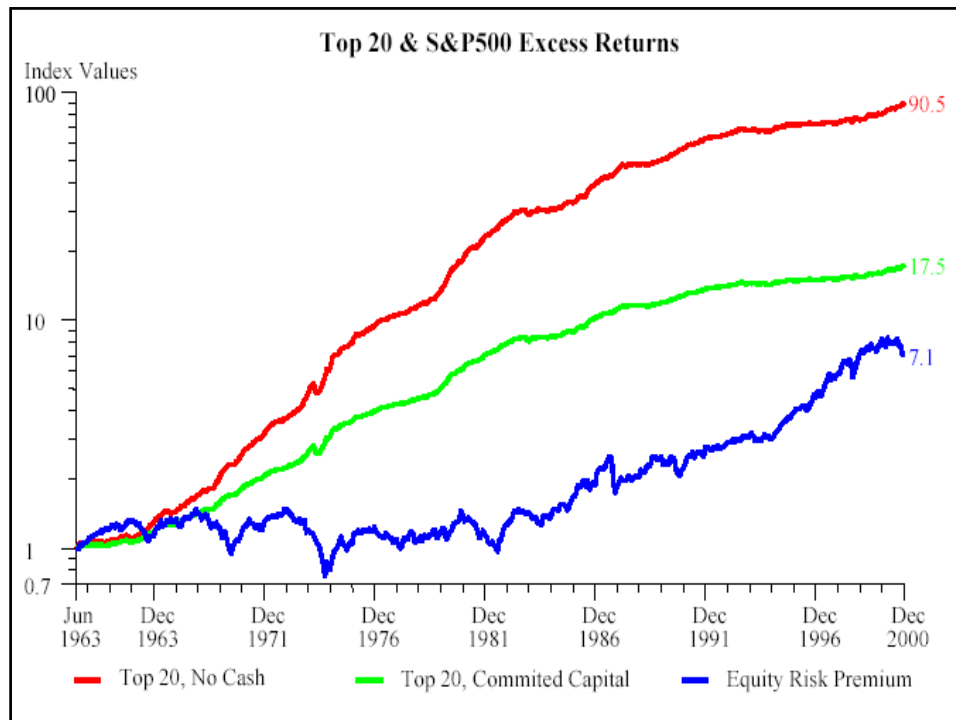
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Trading Performance

	Top 5	Top 20	20- 100	All
6-month Mean	5.98%	6.01%	4.51%	4.10%
Utilities	81%	82%	33%	9%
Transportation	1%	1%	2%	3%
Financial	4%	4%	16%	12%
Industrial	13%	13%	48%	76%

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Systematic Risk Exposure

	Top 5	top 20	20 a 100	All	ERP
Intercept	0.0056	0.0061	0.0056	0.0044	0.0070
U.S. EquityPrem.	0.0102	0.0080	-0.0067	-0.0167	
Small - Big	0.0404	0.0511	0.0465	0.0688	0.2117
High B/M - Low B/M	0.0791	0.0210	0.0180	0.0689	-0.5847

Ibbotson Risk Exposures

	Top 5	top 20	20 a 100	All	ERP
Intercept	0.0059	0.0064	0.0057	0.0047	0.0035
U.S. Equity Prem.	-.0296	-.0259	-0.0206	-0.0408	
Small Stock Prem.	0.0477	0.0494	0.0349	0.0496	0.1771
Bond Default Prem.	0.1288	0.1266	0.1344	0.1680	0.7103
Bond Horizon rem.	0.0815	0.0743	0.0440	0.0429	0.6805

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Transactions Costs

- Conservative round-trip cost estimate
 - Same Day vs. Wait 1 Day = 200 basis points
 - 2.4 round-trip per pair/6 months
 - 83 bp/round-trip and an effective spread of 42 bp
- Net 6 month excess return: 168 to 88 BP

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Improvements

- We may be opening pairs too soon
- We may not be picking pairs wisely
- Other sensible rules
 - don't open a pair on the last day of the period

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Summary of findings

- There exists relative price reversion
- Marginally profitable
 - Consistent with hedge fund business
- Not simply mean reversion

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