Is Pair Trading dead?

A look at how the 2013-2015 bull market in US equities has killed pair trading and how you need to re-work your pair strategies!

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1. Abstract

Pair trading has long been known as a relatively safer investment strategy, given that the overall portfolio is market neutral (as equal dollar value or beta adjusted dollar value is invested in both the long and short side of the investment leg) and also sector neutral (as both stocks belong to the same sector / sub-sector category). The only risk which Pair trading carries is the single stock risk, as unforeseen news/events in one of the stocks can cause substantial divergence in the pairs.

In this paper, we look at pair trading model in the US markets and identify how the model has performed historically as well as the reason behind its sloppy performance in the bull market phases like the 2014, 2015 bull market cycles in the S&P Index.

2. The Pair trading back-test

We outline the methodology that we adopted to carry out the back-test of Pairs trading in the US equity market.

2.1 The Pairs Identification

We picked the 500 stocks in S&P 500 as on 1st Jan'2015 and divided them into sectors and further into sub-sectors. Firstly a total of 10 major sectors were identified in the S&P Index. These sectors were:

Consumer Discretionary	**Industrials**
ConsumerStaples	**IT**
Energy	**Materials**
Financials	**Telecom**
Healthcare	**Utilities**

Table 1: 10 Major sectors in the US market for Pair Trading

Further we narrowed down the sectors into sub-sector category. A total of 74 subsectors were identified belonging to these 10 major sectors. A total of 4282 pairs were made belonging to these 74 sub-sectors. A total of 443 stocks out of S&P 500 could be categorized into various plausible sub-sectors. The table below outlines the total sub-sectors, number of stocks and pairs belonging to each sub-sector.

Sectors	Sub Sectors	Total Stocks	Total Pairs
Consumer Discretionary	Advertising, Apparel Retail, Apparel, Accessories & Luxury Goods, Auto Parts & Equipment, Broadcasting & Cable TV, Consumer Electronics, Department Stores, General Merchandise Stores, Home Improvement Retail, Homebuilding, Hotels, Resorts & Cruise Lines, Household Appliances, Leisure Products, Publishing, Restaurants, Specialty Stores	68	334
Consumer Staples	Distillers & Vintners, Food Retail, Household Products, Hypermarkets & Super Centers, Packaged Foods & Meats, Personal Products, Soft Drinks, Tobacco	34	186
Energy	Integrated Oil & Gas, Oil & Gas Drilling, Oil & Gas Equipment & Services, Oil & Gas Exploration & Production, Oil & Gas Refining & Marketing & Transportation	39	380
Financials	Banks, Consumer Finance, Diversified Financial Services, Insurance Brokers, Life & Health Insurance, Multi-line Insurance, Multi-Sector Holdings, Property & Casualty Insurance, REITs	80	1124
Healthcare	Biotechnology, Health Care Distributors & Services, Health Care Equipment & Services, Health Care Facilities, Health Care Supplies, Managed Health Care, Pharmaceuticals	49	482
Industrials	Aerospace & Defense, Air Freight & Logistics, Airlines, Building Products, Construction & Farm Machinery & Heavy Trucks, Data Processing Services, Diversified Commercial Services, Industrial Conglomerates, Industrial Machinery, Railroads	55	608

IT	Application Software, Computer Hardware, Computer Storage & Peripherals, Internet Software & Services, IT Consulting & Services, Networking Equipment, Semiconductor Equipment, Semiconductors, Systems Software, Telecommunications Equipment	58	516
Materials	Diversified Chemicals, Diversified Metals & Mining, Fertilizers & Agricultural Chemicals, Industrial Gases, Metal & Glass Containers, Paper Packaging, Specialty Chemicals, Steel	25	66
Telecom	Integrated Telecommunications Services	5	20
Utilities	Electric Utilities, Gas Utilities, Multi-Utilities & Unregulated Power	30	566

Table 2: Breakdown of the pair strategy into sectors, sub-sectors and number of stocks and pairs

2.2 Rules for back-testing the Pairs

The following set of factors and rules were developed for back-testing the pairs. The back-testing was done for the period of Apr'2010 to 31st Dec'2014 (56 Months). We took a slippage and transaction cost of 0.75% (75 BP) per trade round-trip.

Pair Trading Factor Construction	
Pair Ratio	Stocks prices for both stocks in the pairs converted to their log ratios: Pair Ratio = Ln(Stock1/Stock2)
Z-Scoring	The 20 days Z-Score of the Pair Ratio was obtained as: Z-Score = (Pair Ratio - Average Ratio)/(StDev Ratio)
Variance Ratio Test	A 60 days Variance Ratio Test was done on the Pair Ratio to check its convergence
Beta	Beta of the 2 stocks were obtained by regressing the Short sided stocks (Y-Axis) against the Long sided stock (X-axis)

Rules for going long & unwinding the Pair	
Rules for Trade Entry	Z-Score < -2 AND VRT < 0.8 AND 0.8 < Beta < 1.2
Rules for Trade Exit	Z-Score > 0 OR PairRatio < 5*StDev of the PairRatio from time of entry (Stop Loss)

3. The results

After the pairs trading back-test was completed we compiled the results of the back-test. We also leveraged the portfolio 3 times (3x leverage) – so as to target a daily volatility of less than 50 BP (0.5%). The results were quite promising in pockets and disappointing in the recent past.

The table below outlines the average annualized returns of the Pair trading strategy and its co-relation with the S&P volatility:

Year	Annual Returns (3x leveraged)	S&P Daily Volatility
2010	7.05%	1.20%
2011	26.20%	1.47%
2012	16.37%	0.80%
2013	5.93%	0.70%
2014	9.78%	0.72%
Average Return	**13.07%**	
StDev	**8.39%**	
Sharpe Ratio	**1.56**	

Table 3: Average annualized returns of the pair strategy

There is a correlation of 0.61 between the returns of the Pair Trading and daily volatility of S&P index. This indicates that during periods of high daily volatility the pair trading strategy performs the best and during stable and low volatility times the pair strategy does not yield good returns. The return graph on the daily basis on the pair trading strategy is presented below:

As quite evident from Fig 1, the bull market of 2013 and 2014 has been quite a deterrent to the pair trading strategy. The strategy which was making a consistent 26% and 16% return on 2011 and 2012 has made sub 10% return in the period of 2013 and 2014.

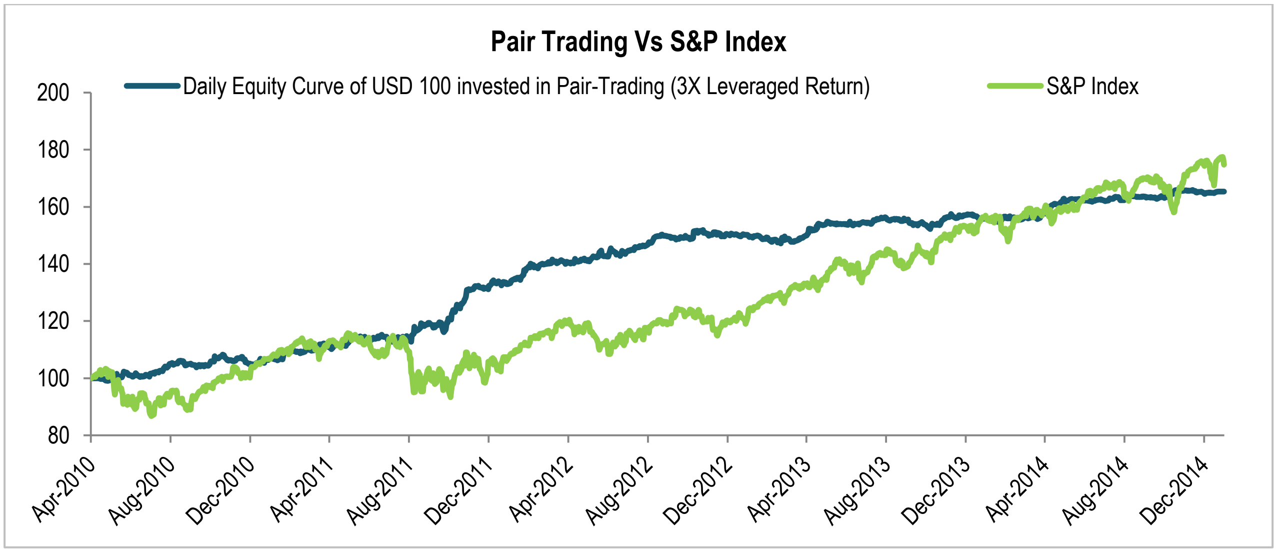

Fig 1: A comparison of the returns of S&P Index and Pair Trading strategy

Table below shows the most outperforming sectors and their average trade returns.

Sectors	Avg. Trade Return (%)	Rank
Consumer Discretionary	3.33%	1
Consumer Staples	1.14%	7
Energy	0.11%	9
Financials	2.58%	4
Healthcare	2.59%	3
Industrials	2.78%	2
IT	1.56%	5
Materials	-0.04%	10
Telecom	1.43%	6
Utilities	0.34%	8

Table 4: Sector wise performance of the pair trading strategy

The top sectors which has consistent performance in pair trading has been, Consumer discretionary, Industrials, Healthcare and Financials. Apart from Healthcare we expect the other 3 sectors to be quite volatile and hence their pairs performing better than the overall portfolio.

4. Conclusion

The study has been done to show that pair trading in US markets over the last 2 years has been saturating mainly due to low volatility in the S&P Index. Whereas the years 2011-2012 has been quite phenomenal for pair trading the subsequent years has been an absolute deterrent. However there are pockets and further filters which can be applied on top of this strategy to further improve the returns and deal with volatile times. For example larger concentration in financials, industrials, IT and such volatile sectors can help improve the returns (although the volatility will also increase!). On top of that further convergence filters like the Ornstein Uhlenbeck time decay rates, co-integration, and correlation studies can be done to improve the returns a notch above what the current returns are.

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The team at Samssara works on mathematical models and statistical tools that identify repetitive patterns in equity, commodity currency and treasury markets globally. We offer solutions to ride the volatility of the markets and generate consistent returns with systematic approach.

Samssara was founded in 2010 by a highly professional and experienced team of alumni of IIT Bombay.

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