Sharenet
YOUR KEY TO INVESTING

Regression Trend Analyzer (RTA)

Finding JSE trading opportunities using linear regression and mean reversion

Version 1.1, August 2017

1.Introduction

The Regression Trend Analyzer (RTA) uses linear regressions to find JSE shares and indices that are trading two or more standard deviations above (shorting opportunity) or below (long opportunity) their linear means.

These are rare, above the norm events, and according to mean reversion theory, they offer high probabilities that the shares or indices in question will reverse their current trends.

The tool is useful for short term traders and investors wishing to acquire shares at extreme low prices as this offers a safety net against the prices going against you for extended periods.

There are two classes of trading opportunities identified by RTA:

1. Shares trading more than 2 standard deviations from their price trend regression
2. Relative pairs that are more than 2 standard deviations from each other (pairs trading)

RTA automatically identifies the best opportunities for you, but you are required to do visual inspections on the opportunities to confirm their validity as the presence of a 2-standard deviation event alone does not automatically imply a good trade.

RTA should be used as a blunt instrument as even the valid 2-standard deviation events you have confirmed with visual inspection are merely "in the kill zone" and you must apply further technical and/or fundamental analysis to perfect your entry timing.

2.User-configurations

RTA offers regression trend analysis over the following selectable periods depending if short-term, medium-term, or long-term (high probability) trends and opportunities are being sought:

- 250 days
- 500 days
- 750 days
- 1,000 days
- 1,250 days

In addition, shares from specific JSE sectors or groups of sectors can be targeted for opportunities. The following sectors are currently supported:

- J200 FTSE/JSE Top 40 Index
- J201 FTSE/JSE Mid Cap Index
- J202 FTSE/JSE Small Cap Index
- J203 FTSE/JSE All Share Index
- J210 FTSE/JSE Resource 10 Index
- J211 FTSE/JSE Industrial 25 Index
- J212 FTSE/JSE Financial 15 Index
- J253 FTSE/JSE SA Listed Property Index
- J835 FTSE/JSE Banks Index
- Shares which have CFD's available

Only about 190 of the most liquid JSE shares are analyzed by RTA, as regression analysis is not suitable to illiquid small or micro-cap shares.

3.Linear Regression Analysis refresher

Below is a broad definition of a Linear Regression, where in our case X would be Time and Y would be closing prices of the share we are analyzing:

The red line in the above picture is the *regression trend* and is merely the straight (linear) line going through all the closing prices that *minimizes* the sum of the squares of the distances between all the points and itself. In other words, it's the straight line that best captures the linear trend of all the data points. It is expected that a share price will fluctuate around its linear mean according to the law of mean reversion:

Mean reversion is the theory suggesting that prices and returns eventually move back towards the mean or average. This mean or average can be the historical average of the price or return, or another relevant average such as growth in the economy or the average return of an industry.
Investopia

With mean reversion, the further a data point moves from its linear mean, the higher the probability that it will be attracted back to its mean. The longer data points remain above the mean and the further away we are from the mean, the greater the forces that will attract it back to the mean.

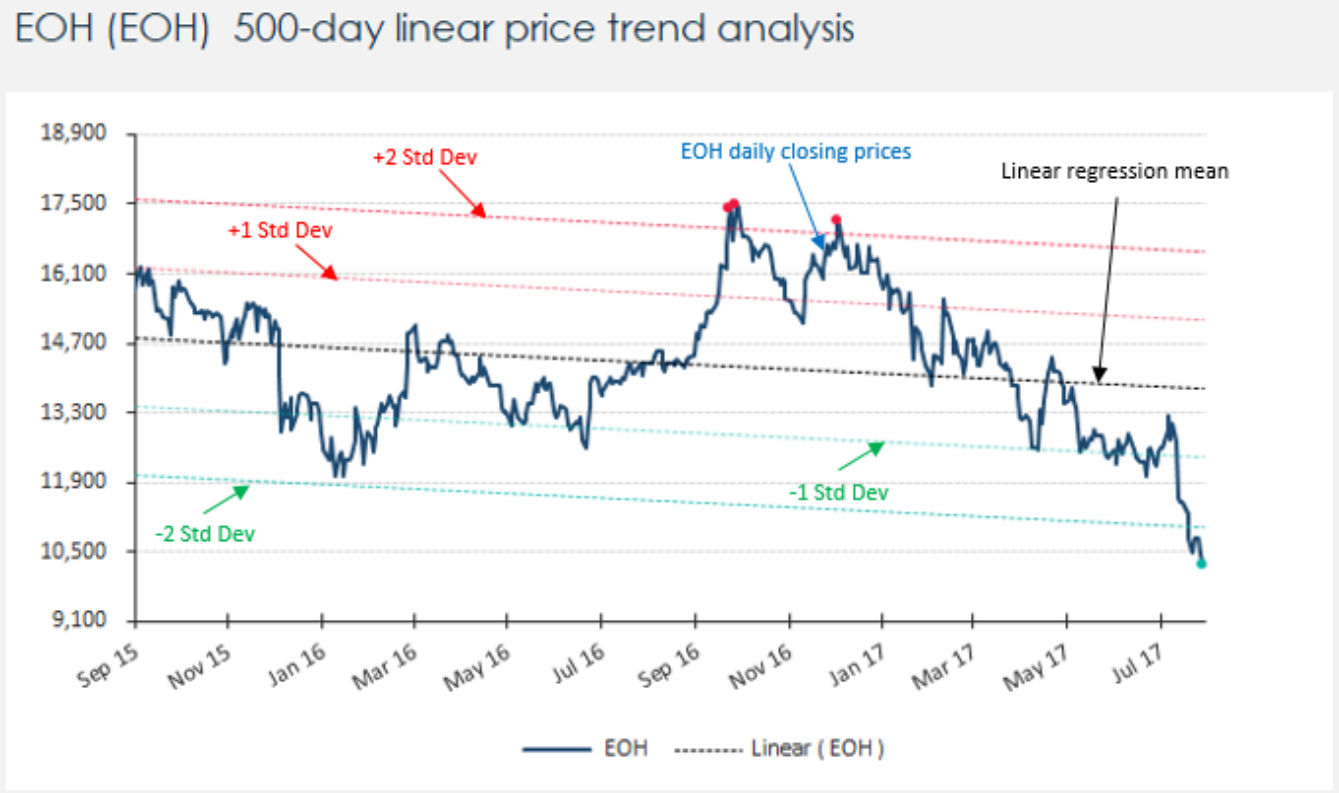
Now it is quite possible for the current trend to be broken and a new paradigm or trend or trajectory to be established that breaks the mean reversion theory, but in general in the stock market, trends reinforce themselves and mean reversion can work quite well when determining if shares are overbought or oversold.

In statistics, the standard deviation is a measure that is used to quantify the amount of variation or dispersion of a set of data values. A low standard deviation indicates that the data points tend to be close to the mean (also called the expected value) of the set, while a high standard deviation indicates that the data points are spread out over a wider range of values.

A +2 standard deviation (+2SD) says that the data point has wandered twice as far from its linear mean than is normally expected on a daily basis. This is a rare event where one would expect the mean reversion forces to be very high, thus raising the odds of a change in direction.

4.Price Trend Analysis example

Below is a sample Price Trend deviation from linear mean opportunity taken over a medium-term range of 500 trading sessions (not days, but trading sessions.) This is equivalent to about 100 weeks of 5 trading sessions each (Monday to Friday) and equivalent to roughly 2 calendar years.



The black dotted line is the linear mean that best describes the trend followed by the share EOH. The share fluctuates above and below this mean but when the share meanders more than 2 standard deviations above its mean, it corrects and reverses trend back down to the mean. It also appears that when the share meanders more than 2 standard deviations *below* the linear mean, that mean-reversion forces compel it to reverse direction and trend back *up* to the mean.

It would thus appear that incidents where EOH goes more than 2 standard deviations *above* its mean that this is a high probability *shorting* opportunity. Conversely, when EOH meanders more than two standard deviations *below* its linear mean, this is a high probability *long* opportunity.

NOTE: The red dots highlight areas on the charts when a share has risen above two standard deviations and fallen under it again. Conversely, green dots are placed on the chart when the share has fallen more than two standard deviations from the mean and rises above it again.

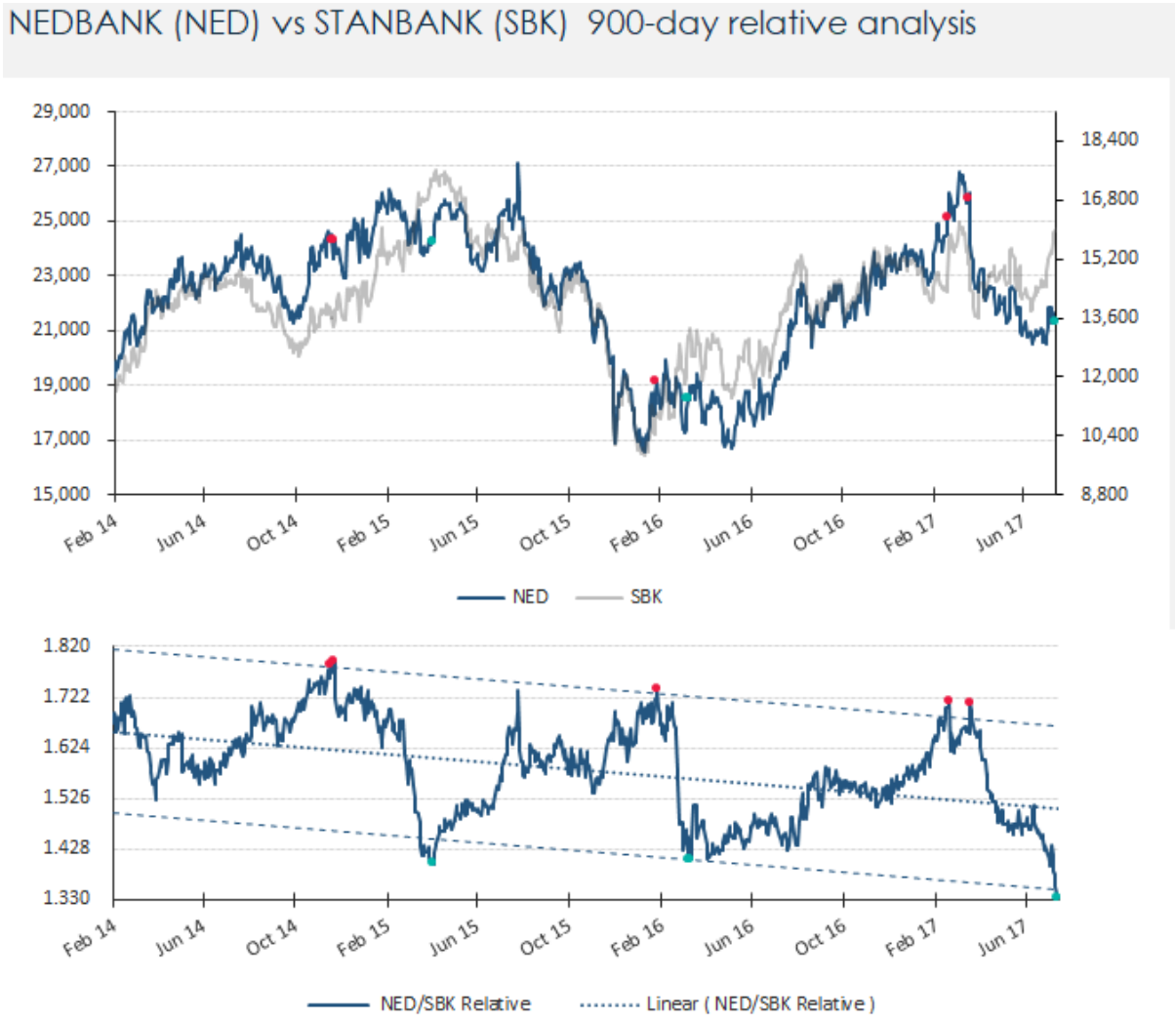
IMPORTANT: You need to see at least ONE prior instance of a share displaying mean reversion behavior around its +2 standard deviation limits before assuming that the current instance is likely to be repeated. The more instances of the share respecting the +2 standard deviation limits, the more powerful the signal.

5.Relative Trend Analysis example

Relative Trend Analysis is where we compare the behavior of one share or index to another share or index. Usually we are comparing two instruments that normally track each other closely, like two banking shares or a mining company to the resources index for example. When they diverge from each other by more than two standard deviations we assume that mean reversion forces will bring them together again.

Relative Trend Analysis is useful for PAIRS TRADING. Pairs trading is a market-neutral trading strategy that matches a long position with a short position in a pair of highly correlated instruments such as two stocks, exchange-traded funds (ETFs), currencies, commodities, or options. Pairs traders wait for weakness in the correlation, and then go long on the under-performer while simultaneously going short on the over-performer, closing the positions as the relationship returns to its statistical norm.

The strategy's profit is derived from the difference in price change between the two instruments, rather than from the direction in which each moves. Therefore, a profit can be realized if the long position goes up more than the short, or the short position goes down more than the long (in a perfect situation, the long position will rise and the short position will fall, but this is not a requirement for making a profit). It is possible for pairs traders to profit during a variety of market conditions, including periods when the market goes up, down or sideways, and during periods of either low or high volatility. Below is an example of a trade opportunity found by RTA among two common shares traders like to pair up:

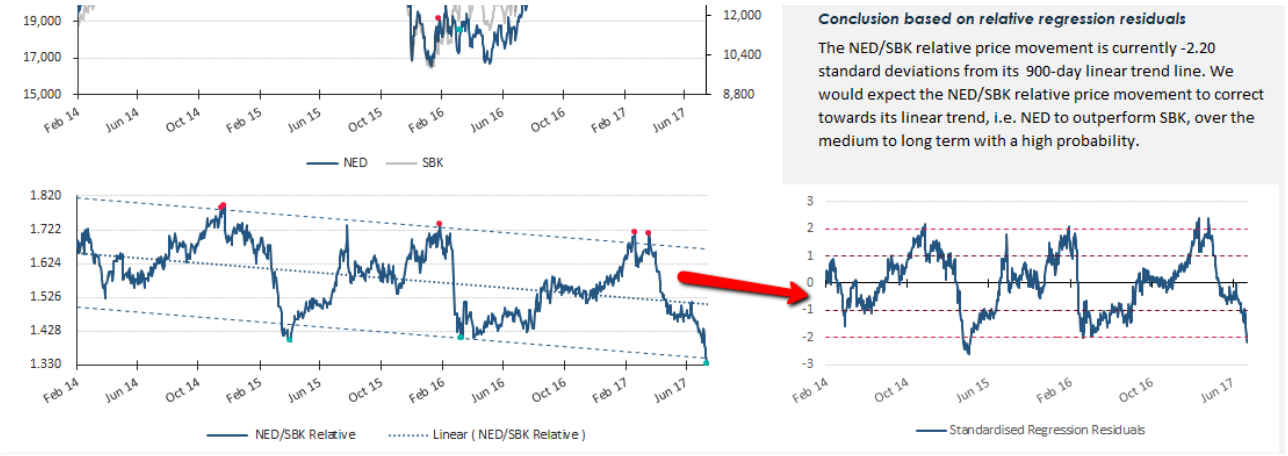


In the prior chart, we first compile the relative trend which is simply an arbitrary line consisting of the price of one share (NED) divided by the price of the other share (SBK). The actual value this division produces is arbitrary as we are merely interested in the trend of this line and its deviation around its mean.

When the line is rising it means NED is outperforming SBK and when the line is falling it means NED is underperforming SBK. Since one would expect these two shares to have a high degree of co-movement (correlation) we can assume that if the relative trend line rises or falls too far from its linear mean that we have high odds of a mean reversion.

You can see that NED/SBK Relative has been bounded quite nicely around the +/- two standard deviation extremes, providing for excellent pairs trading opportunities. Currently the chart is screaming that we must go long NED and short SBK.

With the relative trend analysis, RTA also draws the relative trends movement around its mean in a HORIZONTAL view with the mean pivoted around 0 as shown below under the conclusion section. This provides higher granularity for checking movement around the +/-1 and +/-2 deviation levels:



NOTE: The red dots highlight areas on the charts when the relative trend has risen above two standard deviations and fallen under it again. Conversely, green dots are placed on the chart when the relative trend has fallen more than two standard deviations from the mean and rises above it again.

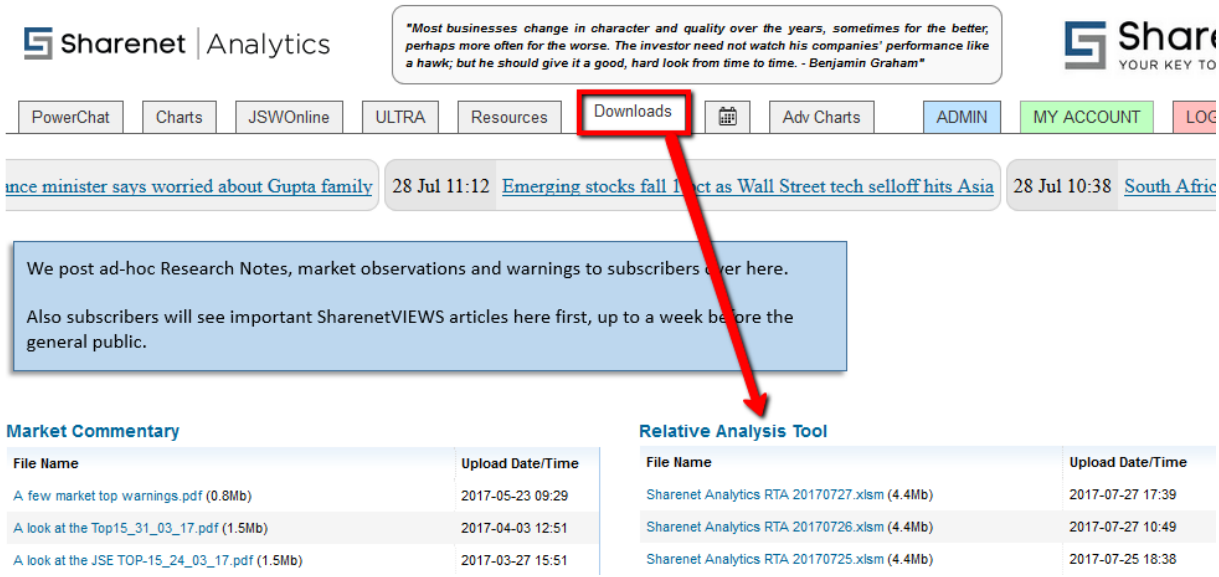
IMPORTANT: You need to see at least ONE prior instance of the relative trend displaying mean reversion behavior around its +2 standard deviation limits before assuming that the current instance is likely to be repeated. The more instances of the trend respecting the +2 standard deviation limits, the more powerful the signal.

CAUTION: Pairs trading requires more skill and is a bit more sophisticated than single share trading so you are advised to stick to Price Trend Analysis in RTA to find single share trade opportunities before attempting pairs trades.

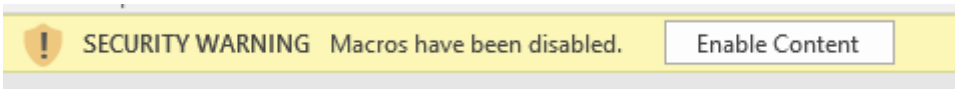
6.Downloading the RTA Data File

The RTA is published every trading day after the session close, normally around 17H30 but no later than 18H00. The data thus contains pre-finalized closing prices since the JSE only send finalized data after 21H00. Since RTA is a "kill zone" identification tool, any slight differences between pre-finalized closing prices and finalized closing prices will not make any real impact.

If you are a Sharenet Analytics (previously known as Powerstocks Research) client, you can download the file from the DOWNLOADS menu:

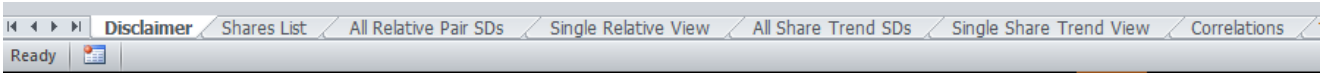


Once you have saved the file to your local PC, you can open it in Microsoft Excel. The RTA uses macros, so please enable content in Microsoft Excel when prompted.



Once enabled, the user will be presented with a disclaimer and copyright screen. You need to explicitly accept the terms of use to gain access to the RTA, otherwise it will automatically close.

You will see many sheets available through the tabs at the bottom:



1. Disclaimer – standard terms and conditions of use
2. Shares List – all the available shares, indices and indices constituents used by the sheet
3. All Relative Pairs SD's – standard deviations of all shares relative to all indices
4. Single Relative View – Chart of the relative pair you select from (3)
5. All Share Trend SD's – standard deviations of all shares from their linear means
6. Single Share Trend View – Chart of the single-share trend analysis you selected in (5)
7. Correlations – N x N correlation matrix for all share pairs to assist identifying pairs trades.

CAUTION: It is recommended you have a reasonably new (less than 3 years old) PC and at least Microsoft Excel 2010 onwards (preferably Excel 2016) in order to operate the RTA effectively. The file size is around 4.5Mb in size so at least 2Gb memory is recommended.

7.Shares List

This contains the universe of liquid shares available for analysis by RTA. The sheet also highlights the indices used with their respective constituents, as well as a list of shares covered that are tradeable on Sharenet's CFD platform.

Available Instruments

Instrument Co	Instrument Name
J200	FTSE/JSE Top 40 Index
J201	FTSE/JSE Mid Cap Index
J202	FTSE/JSE Small Cap Index
J203	FTSE/JSE All Share Index
J210	FTSE/JSE Resource 10 Index
J211	FTSE/JSE Industrial 25 Index
J212	FTSE/JSE Financial 15 Index
J253	FTSE/JSE SA Listed Property Index
J835	FTSE/JSE Banks Index
ACG	Anchor Group Limited
ACL	ArcelorMittal South Africa Ltd
ACT	Afrocentric Investment Corp
ADH	Advtech
ADR	Adcorp Holdings Limited
AEG	Aveng Limited
AEL	Allied Electronics Corporation Limited
AFE	AECI

Index Constituents

Index Name	Index Code	Constituent
FTSE/JSE Top 40 Index	J200	AGL
FTSE/JSE Top 40 Index	J200	ANG
FTSE/JSE Top 40 Index	J200	APN
FTSE/JSE Top 40 Index	J200	BGA
FTSE/JSE Top 40 Index	J200	BID
FTSE/JSE Top 40 Index	J200	BIL
FTSE/JSE Top 40 Index	J200	BTI
FTSE/JSE Top 40 Index	J200	BVT
FTSE/JSE Top 40 Index	J200	CFR
FTSE/JSE Top 40 Index	J200	DSY
FTSE/JSE Top 40 Index	J200	FFA
FTSE/JSE Top 40 Index	J200	FFB
FTSE/JSE Top 40 Index	J200	FSR
FTSE/JSE Top 40 Index	J200	GFI
FTSE/JSE Top 40 Index	J200	GRT
FTSE/JSE Top 40 Index	J200	IMP
FTSE/JSE Top 40 Index	J200	INL

Tradeable CFDs

Instrument Co	Instrument Name
ADH	Advtech
ACG	Anchor Group Limited
ACL	ArcelorMittal South Africa Ltd
ADR	Adcorp Holdings Limited
AEG	Aveng Limited
AEL	Allied Electronics Corporation Limited
AFE	AECI
AFH	Alexander Forbes Equity Holdings Proprietary
AFX	African Oxygen
AGL	Anglo American
AIP	Adcock Ingram Holdings
AMS	Anglo American Platinum
ANG	Anglogold Ashanti
APK	Astrapak Limited
APN	Aspen Pharmacare Holdings
ARI	African Rainbow Minerals Ltd
ARL	Astral Foods Ltd

The filters here do not impact the sheet at all, it is simply for reference purposes. One use that comes to mind is to identify constituents of a certain index.

8.All Share Trend SD's

This contains the deviation of each shares' current closing price from its linear mean derived over the period programmed into the area highlighted with a 250-day (1) trading session in the example below:

Grouped Shares

Select Period (days) 250D (1)

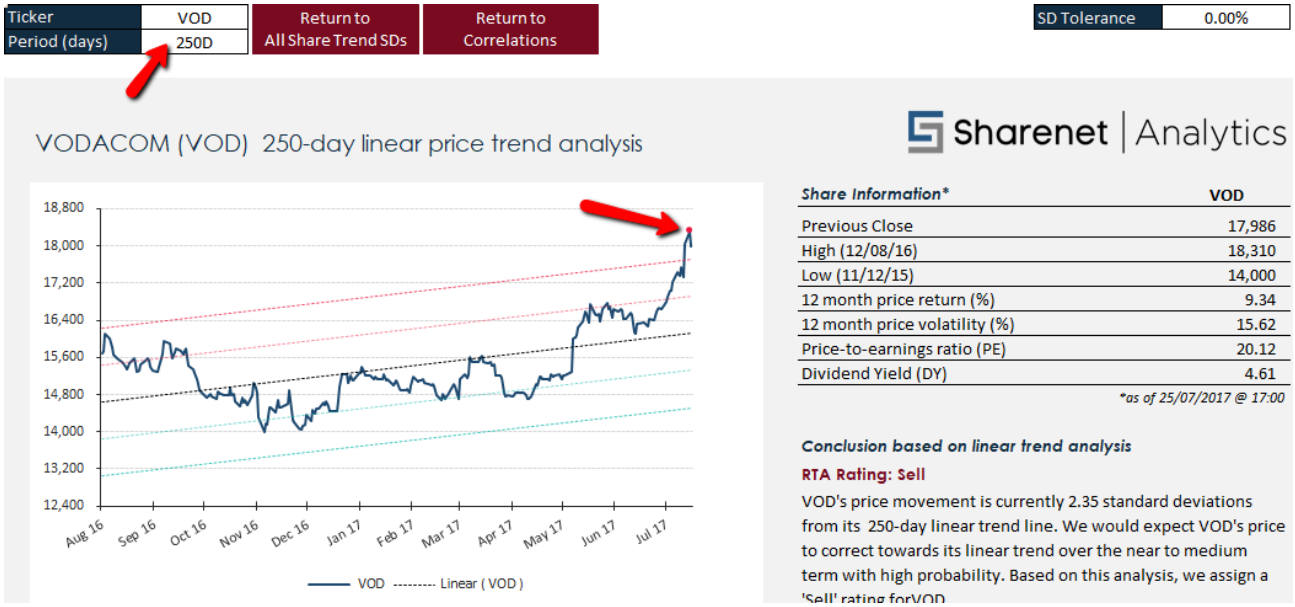
(2) ☐ Tradeable CFDs only

<2 SD	<1 SD	<0 SD	>0 SD	>1 SD	>2 SD
(3)	NED (-1.04)	NTC (-0.01)	RCL (0.02)	LBH (1.02)	VOD (2.35)
	COH (-1.06)	LHC (-0.01)	TFG (0.03)	CLS (1.05)	(4)
	ACL (-1.10)	RMH (-0.02)	BGA (0.06)	J211 (1.05)	
	FBR (-1.11)	TON (-0.05)	IMP (0.07)	CML (1.13)	
	EOH (-1.22)	SOL (-0.07)	WHL (0.07)	MRP (1.14)	
	J202 (-1.34)	ARI (-0.08)	SHP (0.09)	J203 (1.28)	
	IPF (-1.44)	MNP (-0.09)	GLN (0.10)	NPN (1.30)	
	ZED (-1.44)	MND (-0.09)	ANG (0.12)	RES (1.34)	
	KAP (-1.45)	SPP (-0.16)	AGL (0.12)	FFB (1.34)	
	REB (-1.49)	INP (-0.20)	REI (0.13)	J200 (1.51)	
	TKG (-1.56)	EXX (-0.21)	JSE (0.13)	SBK (1.67)	
	APF (-1.78)	DTC (-0.22)	BTI (0.13)		
	DLT (-1.83)	OCE (-0.22)	HAR (0.16)		
		SAC (-0.24)	TSH (0.16)		
		HYP (-0.29)	EMI (0.17)		
		AVI (-0.34)	PIK (0.18)		
		NHM (-0.34)	OML (0.19)		

You will predominantly be concerned with the right-hand side of this sheet, as depicted above. This is the area where you can see how many standard deviations away each share is from their 250-day linear regression. If you would like to restrict the analysis to shares that have CFD's, then tick item (2)

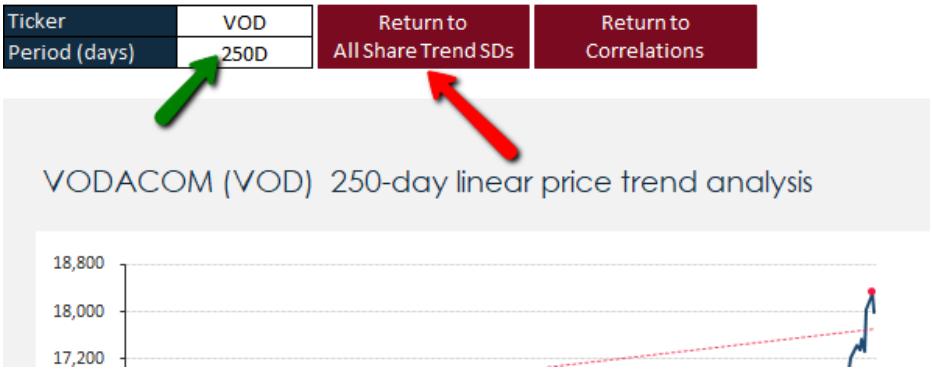
You are mostly concerned with the columns tagged (3) and (4) since these are the shares that are at statistical extremes most likely to cause a trend direction change. In the above example, there are no shares trading less than 2 standard deviations from their liner mean and there is one share (VOD) trading more than 2 standard deviations from its mean. VOD is a likely candidate for a short, but we must first conduct a visual inspection.

By taking your mouse and double clicking on VOD, you will automatically be taken to the chart in the "Single Share Trend View" sheet:



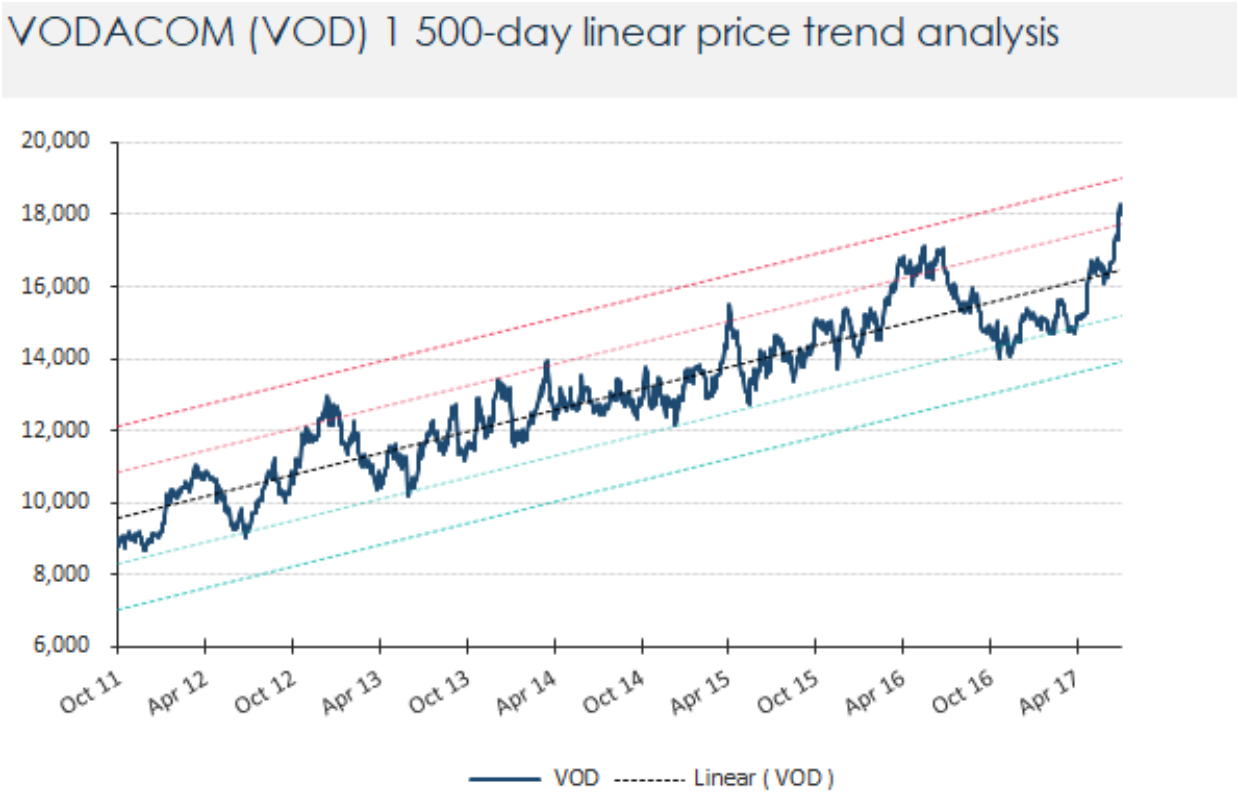
Sure enough, the visual inspection confirms VOD is a likely shorting candidate, or if you hold long positions, you may want to think about taking profit. Note that the chart period is set to 250d to match the period you had on the sheet before you came to the chart.

To quickly return to the All Share Trend sheet click on the button highlighted with the red arrow in the below example:



To include longer-term analysis on the chart, merely program in the number of days you want to view in the box highlighted by the green arrow and the chart will automatically update itself with the new regression trend analysis.

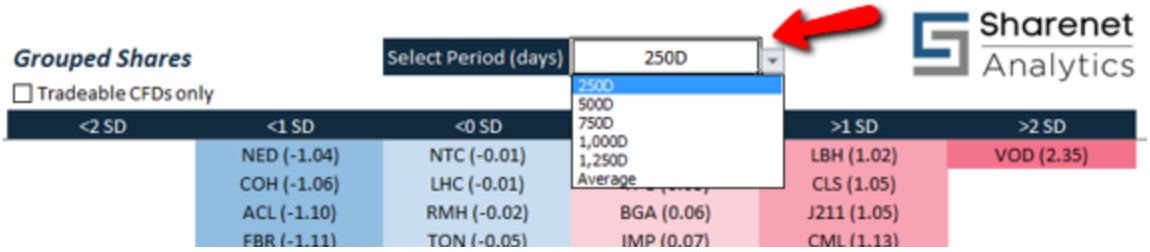
At this point you can play around with the period cell highlighted by the green arrow to check how well the VOD relationship with its standard deviations hold. Obviously, the more times VOD started correcting shortly after rising above 2 standard deviations the stronger the odds that this is a good trade. In the below example, we changed the 250 to 1,500 days (the maximum):



The regression trend and the +/- 1 and 2 standard deviations lines have adjusted accordingly. We can see that over the long term, VOD is only 1.4 standard deviations from its mean. More importantly though, it is clear that visitations of VOD above the 1 standard deviation long term mean has almost always led to a pullback. So, we can confirm that this is probably a high probability shorting opportunity or we should take profits from any long positions we hold in VOD shares.

NOTE: The above example highlights that just because a share is trading 2 standard deviations above her 250 day (short term) linear mean does not imply the share is overbought in the long term. Also, a share does not have to be above 2 standard deviations to be overbought. In the VOD example, the share rarely reaches higher than 1.5 standard deviations above her linear mean in the long-term view and therefore even at 1.5 standard deviations the implication is that VOD is heavily overbought.

We can return to the Trend SD's sheet to look for more longer-term trading opportunities. In general, we have found that the longer the term used to identify a trading opportunity that repeatedly behaves in a consistent fashion with its standard deviations, the better the odds of the assumptions we are making for our trade coming true.



<2 SD	<1 SD	<0 SD		>1 SD	>2 SD
	NED (-1.04)	NTC (-0.01)		LBH (1.02)	VOD (2.35)
	COH (-1.06)	LHC (-0.01)		CLS (1.05)	
	ACL (-1.10)	RMH (-0.02)	BGA (0.06)	J211 (1.05)	
	FBR (-1.11)	TON (-0.05)	IMP (0.07)	CML (1.13)	

You can select longer time horizons in the selector shown above and the table will dynamically update in real time to reflect your new trading opportunities, as shown with our long-term selection below:

<2 SD	<1 SD	<0 SD	>0 SD	>1 SD	>2 SD
WHL (-2.09)	MMI (-1.03)	MSM (-0.02)	IPF (0.12)	RLO (1.21)	
FBR (-2.21)	J201 (-1.03)	NPK (-0.05)	ACL (0.17)	BIL (1.22)	
LHC (-2.37)	COH (-1.17)	REB (-0.08)	TBS (0.17)	CLS (1.28)	
	SPG (-1.18)	MNP (-0.09)	CFR (0.17)	EXX (1.50)	

Here we see three long opportunities have revealed themselves namely WHL, FBR and LHC. The lower down the list the more oversold/overbought the share, so in this instance, LHC is the most oversold at -2.37 standard deviations from her 1,250-day linear mean.

All Shares — Latest Close: 25/7/2017

Ticker	250D	500D	750D	1,000D	1,250D	Average
Indices	Number of standard deviations from regression line					
Size Segments						
J200	1.51	1.73	1.53	0.61	-0.12	1.05
J201	-0.52	-1.25	-0.92	-1.06	-1.03	-0.96
J202	-1.34	-1.33	-0.99	-1.15	-0.97	-1.16
J203	1.28	1.03	1.08	0.33	-0.21	0.70
Sectors						
J210	0.77	0.12	0.88	0.75	0.86	0.68
J211	1.05	1.79	0.77	0.09	-0.23	0.70
J212	0.75	0.84	0.48	-0.41	-0.62	0.21
J253	0.84	0.55	0.01	-0.47	-0.45	0.10
Constituents by Sector						
FTSE/JSE Top 40 Index (J200)						
AGL	0.12	-0.32	0.88	0.96	1.71	0.67
ANG	0.12	-1.07	-1.34	-1.01	-0.53	-0.77
APN	0.52	-0.39	0.12	-0.75	-0.92	-0.28
BGA	0.06	-0.09	0.26	-0.45	-0.63	-0.17
BID	0.63					0.63
BIL	0.90	0.60	1.21	0.99	1.22	0.98
BTI	0.13	0.32	-0.31	-0.29	-0.45	-0.12
BVT	0.33					0.33
CFR	-0.44	1.16	1.22	1.61	0.17	0.75
DSY	0.48	1.61	0.77	-0.04	-0.20	0.52
FFA	0.28	0.43	1.21	0.69	0.75	0.67
FFB	1.34	1.72	-0.15	-0.35	-0.37	0.44
FSR	0.44	0.38	0.70	-0.21	-0.37	0.19

The left-hand side of the All-Trend SD's provides a more two-dimensional way to scan for opportunities, since it shows the deviations from mean across all the time horizons for each share and JSE indices.

Here we merely look for red (overbought) or blue (oversold) colored cells to identify opportunities. We see that the J200 TOP40 is overbought across the 250, 500 and 750-day horizons.

We also see CFR offering 750 and 1,000-day overbought warnings.

NOTE: Just double-click on any of the highlighted cells indicating an opportunity and the trend chart will automatically open the share with the selected time horizon.

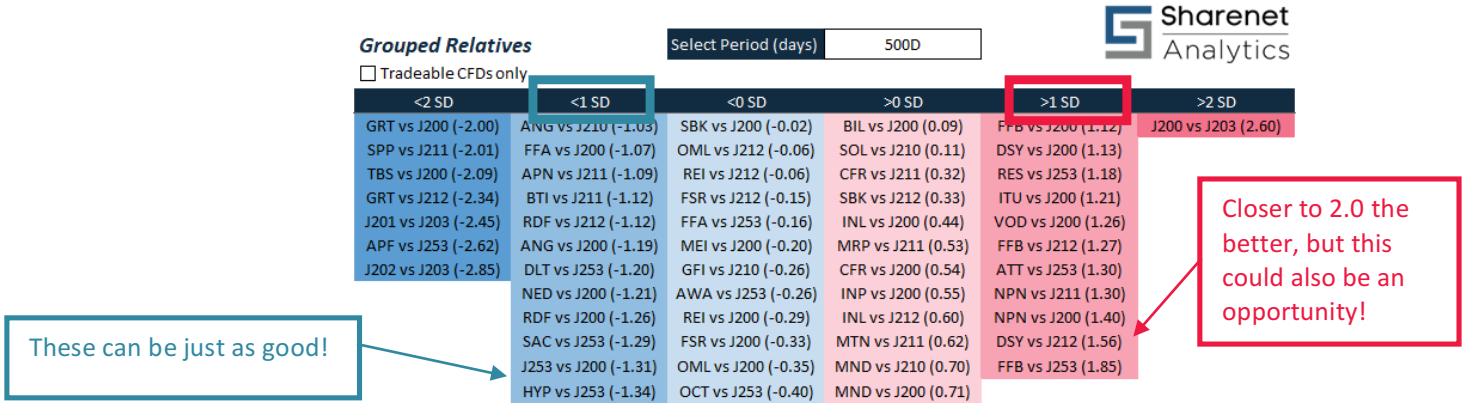
You can also use the left side of the Trend SD's sheet to remove or target entire sectors of the JSE from the opportunities shown on the right-hand side of the sheet. Just tick/untick the selector boxes as shown below, where we have elected to remove all the shares belonging to the TOP40 from our analysis:

Ticker	250D	500D	750D	1,000D	1,250D	Average
Indices	Number of standard deviations from regression line					
Size Segments						
J200	1.51	1.73	1.53	0.61	-0.12	1.05
J201	-0.52	-1.25	-0.92	-1.06	-1.03	-0.96
J202	-1.34	-1.33	-0.99	-1.15	-0.97	-1.16
J203	1.28	1.03	1.08	0.33	-0.21	0.70
Sectors						
J210	0.77	0.12	0.88	0.75	0.86	0.68
J211	1.05	1.79	0.77	0.09	-0.23	0.70
J212	0.75	0.84	0.48	-0.41	-0.62	0.21
J253	0.84	0.55	0.01	-0.47	-0.45	0.10
Constituents by Sector						
FTSE/JSE Top 40 Index (J200)						
AGL	0.12	-0.32	0.88	0.96	1.71	0.67
ANG	0.12	-1.07	-1.34	-1.01	-0.53	-0.77
APN	0.52	-0.39	0.12	-0.75	-0.92	-0.28

Some shares that appear in the J200 TOP40 index also are a part of other indices. They are shown in bold text with "*" next to their names such as AGL, ANG, GFI, IMP and MND in the J210 index below:

FTSE/JSE Resource 10 Index (J210)						
AGL*	0.12	-0.32	0.88	0.96	1.71	0.67
ANG*	0.12	-1.07	-1.34	-1.01	-0.53	-0.77
BIL*	0.90	0.60	1.21	0.99	1.22	0.98
GFI*	0.86	-0.35	-0.48	-0.64	0.21	-0.08
GLN	0.10	0.02	1.32			0.48
IMP*	0.07	-1.35	-0.13	0.35	0.43	-0.13
MND*	-0.09	1.18	0.12	0.02	-0.10	0.22

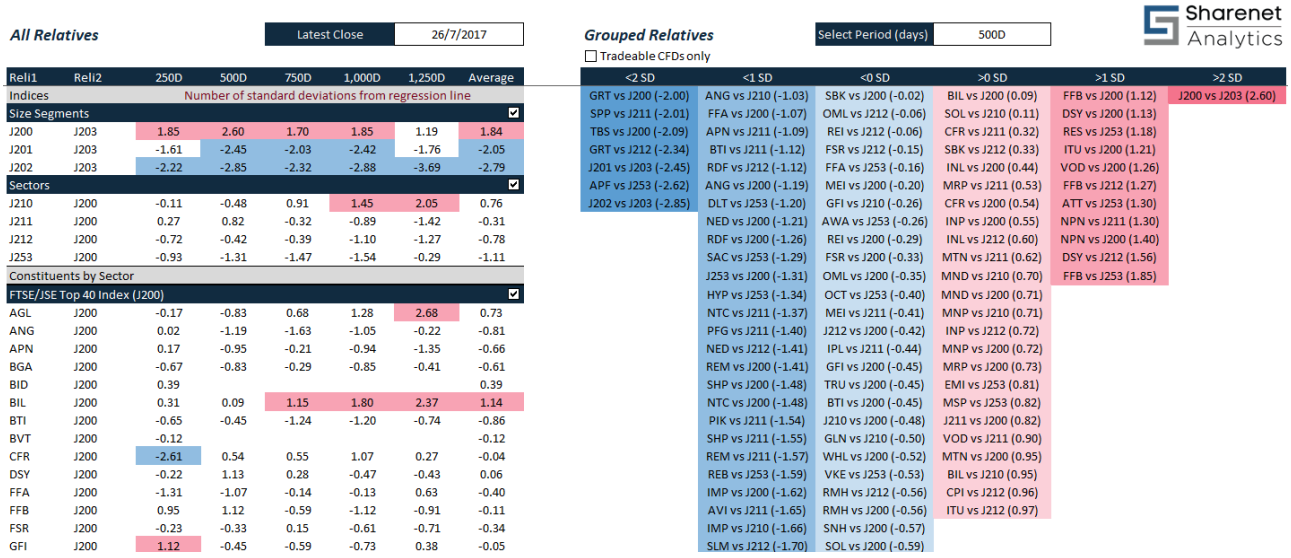
On a final note, don't be despondent if you don't find opportunities in the 2 SD columns. A great trick is to go fishing at the bottom of the 1 SD columns for opportunities. An opportunity doesn't have to be an exact number of more than 2 standard deviations, very often deviations of 1.5 or more can be just as valuable for identifying overbought/oversold conditions (as we saw with our VOD example.)



9.Relative Pair SD's

The two sheets shown below work in tandem to identify pair-wise standard deviations between any JSE share in the RTA universe and any JSE Index. This is used to identify trading opportunities where one share has moved too far away from a related index it belongs to or is supposed to be tracking.

The All Relative Pairs SDs sheet contains all the data we need to identify trades. It consists of a LEFT SIDE and a RIGHT SIDE as shown below. The right-hand side is used to highlight all extreme standard deviations for a specific selected period (500D in this example) whereas the left-hand side is used to identify extreme movements across multiple time frames:



All Relatives

Latest Close: 26/7/2017

Reli1	Reli2	250D	500D	750D	1,000D	1,250D	Average
Indices		Number of standard deviations from regression line					
Size Segments							
J200	J203	1.85	2.60	1.70	1.85	1.19	1.84
J201	J203	-1.61	-2.45	-2.03	-2.42	-1.76	-2.05
J202	J203	-2.22	-2.85	-2.32	-2.88	-3.69	-2.79
Sectors							
J210	J200	-0.11	-0.48	0.91	1.45	2.05	0.76
J211	J200	0.27	0.82	-0.32	-0.89	-1.42	-0.31
J212	J200	-0.72	-0.42	-0.39	-1.10	-1.27	-0.78
J253	J200	-0.93	-1.31	-1.47	-1.54	-0.29	-1.11
Constituents by Sector							
FTSE/JSE Top 40 Index (J200)							
AGL	J200	-0.17	-0.83	0.68	1.28	2.68	0.73
ANG	J200	0.02	-1.19	-1.63	-1.05	-0.22	-0.81
APN	J200	0.17	-0.95	-0.21	-0.94	-1.35	-0.66
BGA	J200	-0.67	-0.83	-0.29	-0.85	-0.41	-0.61
BID	J200	0.39					0.39
BIL	J200	0.31	0.09	1.15	1.80	2.37	1.14
BTI	J200	-0.65	-0.45	-1.24	-1.20	-0.74	-0.86
BVT	J200	-0.12					-0.12
CFR	J200	-2.61	0.54	0.55	1.07	0.27	-0.04
DSY	J200	-0.22	1.13	0.28	-0.47	-0.43	0.06
FFA	J200	-1.31	-1.07	-0.14	-0.13	0.63	-0.40
FFB	J200	0.95	1.12	-0.59	-1.12	-0.91	-0.11
FSR	J200	-0.23	-0.33	0.15	-0.61	-0.71	-0.34
GFI	J200	1.12	-0.45	-0.59	-0.73	0.38	-0.05

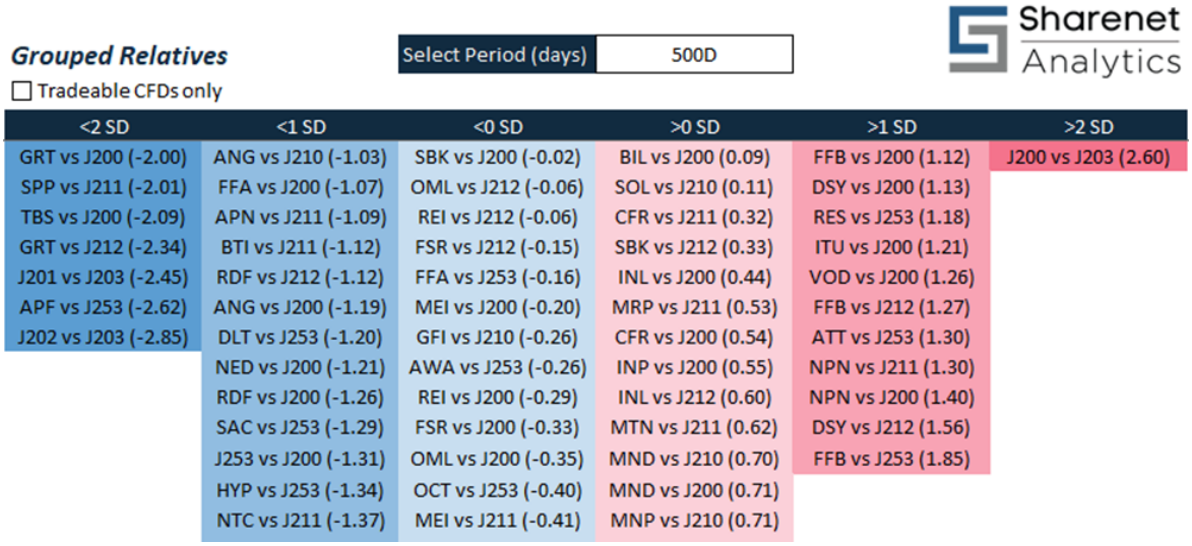
Grouped Relatives

Select Period (days): 500D

☐ Tradeable CFDs only

<2 SD	<1 SD	<0 SD	>0 SD	>1 SD	>2 SD
GRT vs J200 (-2.00)	ANG vs J210 (-1.03)	SBK vs J200 (-0.02)	BIL vs J200 (0.09)	FFB vs J200 (1.12)	J200 vs J203 (2.60)
SPP vs J211 (-2.01)	FFA vs J200 (-1.07)	OML vs J212 (-0.06)	SOL vs J210 (0.11)	DSY vs J200 (1.13)	
TBS vs J200 (-2.09)	APN vs J211 (-1.09)	REI vs J212 (-0.06)	CFR vs J211 (0.32)	RES vs J253 (1.18)	
GRT vs J212 (-2.34)	BTI vs J211 (-1.12)	FSR vs J212 (-0.15)	SBK vs J212 (0.33)	ITU vs J200 (1.21)	
J201 vs J203 (-2.45)	RDF vs J212 (-1.12)	FFA vs J253 (-0.16)	INL vs J200 (0.44)	VOD vs J200 (1.26)	
APF vs J253 (-2.62)	ANG vs J200 (-1.19)	MEI vs J200 (-0.20)	MRP vs J211 (0.53)	FFB vs J212 (1.27)	
J202 vs J203 (-2.85)	DLT vs J253 (-1.20)	GFI vs J210 (-0.26)	CFR vs J200 (0.54)	ATT vs J253 (1.30)	
	NED vs J200 (-1.21)	AWA vs J253 (-0.26)	INP vs J200 (0.55)	NPN vs J211 (1.30)	
	RDF vs J200 (-1.26)	REI vs J200 (-0.29)	INL vs J212 (0.60)	NPN vs J200 (1.40)	
	SAC vs J253 (-1.29)	FSR vs J200 (-0.33)	MTN vs J211 (0.62)	DSY vs J212 (1.56)	
	J253 vs J200 (-1.31)	OML vs J200 (-0.35)	MND vs J210 (0.70)	FFB vs J253 (1.85)	
	HYP vs J253 (-1.34)	OCT vs J253 (-0.40)	MND vs J200 (0.71)		
	NTC vs J211 (-1.37)	MEI vs J211 (-0.41)	MNP vs J210 (0.71)		
	PFG vs J211 (-1.40)	J212 vs J200 (-0.42)	INP vs J212 (0.72)		
	NED vs J212 (-1.41)	IPL vs J211 (-0.44)	MNP vs J200 (0.72)		
	REM vs J200 (-1.41)	GFI vs J200 (-0.45)	MRP vs J200 (0.73)		
	SHP vs J200 (-1.48)	TRU vs J200 (-0.45)	EMI vs J253 (0.81)		
	NTC vs J200 (-1.48)	BTI vs J200 (-0.45)	MSP vs J253 (0.82)		
	PIK vs J211 (-1.54)	J210 vs J200 (-0.48)	J211 vs J200 (0.82)		
	SHP vs J211 (-1.55)	GLN vs J210 (-0.50)	VOD vs J211 (0.90)		
	REM vs J211 (-1.57)	WHL vs J200 (-0.52)	MTN vs J200 (0.95)		
	REB vs J253 (-1.59)	VKE vs J253 (-0.53)	BIL vs J210 (0.95)		
	IMP vs J200 (-1.62)	RMH vs J212 (-0.56)	CPI vs J212 (0.96)		
	AVI vs J211 (-1.65)	RMH vs J200 (-0.56)	ITU vs J212 (0.97)		
	IMP vs J210 (-1.66)	SNH vs J200 (-0.57)			
	SLM vs J212 (-1.70)	SOL vs J200 (-0.59)			

The right-hand side is shown below. As with the Share Trend SD's its used to identify extreme variations in the relative relationship between JSE shares and their associated JSE indices. It also compares Indices to Indices such as the extreme variance observed between J202: Small-cap and J203: All-Share below:



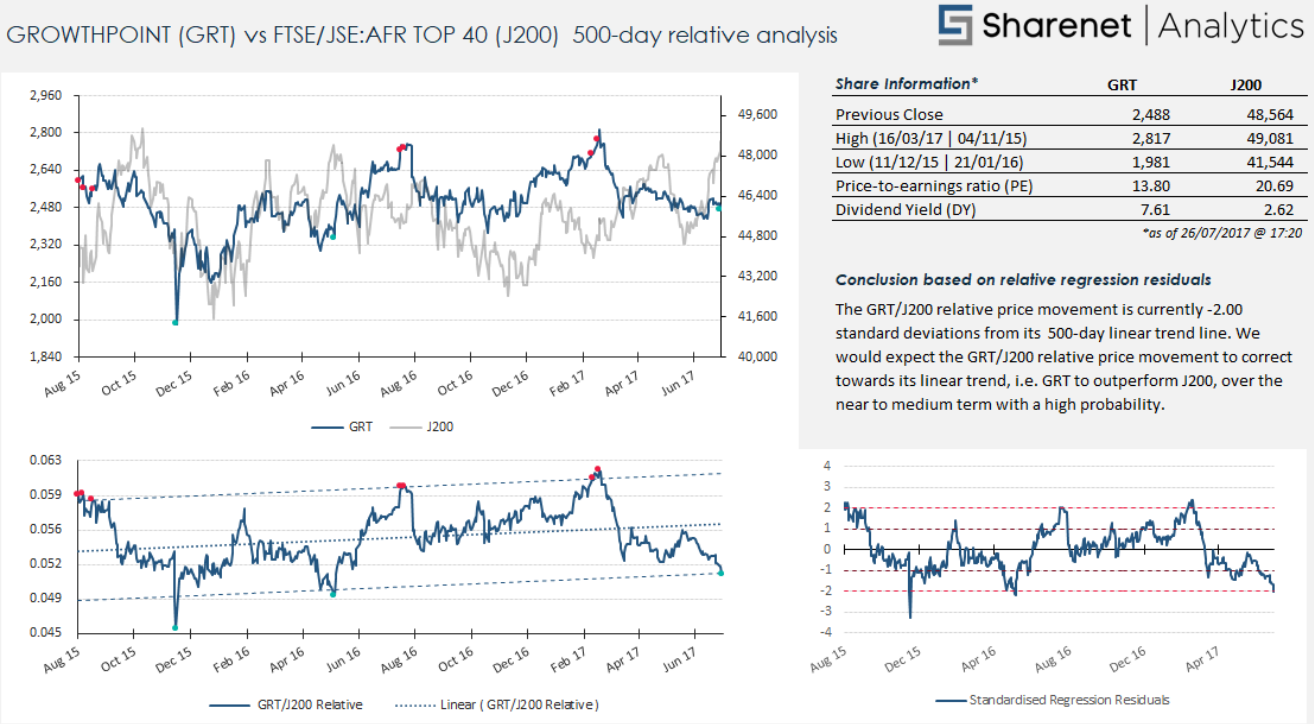
Grouped Relatives

Select Period (days): 500D

☐ Tradeable CFDs only

<2 SD	<1 SD	<0 SD	>0 SD	>1 SD	>2 SD
GRT vs J200 (-2.00)	ANG vs J210 (-1.03)	SBK vs J200 (-0.02)	BIL vs J200 (0.09)	FFB vs J200 (1.12)	J200 vs J203 (2.60)
SPP vs J211 (-2.01)	FFA vs J200 (-1.07)	OML vs J212 (-0.06)	SOL vs J210 (0.11)	DSY vs J200 (1.13)	
TBS vs J200 (-2.09)	APN vs J211 (-1.09)	REI vs J212 (-0.06)	CFR vs J211 (0.32)	RES vs J253 (1.18)	
GRT vs J212 (-2.34)	BTI vs J211 (-1.12)	FSR vs J212 (-0.15)	SBK vs J212 (0.33)	ITU vs J200 (1.21)	
J201 vs J203 (-2.45)	RDF vs J212 (-1.12)	FFA vs J253 (-0.16)	INL vs J200 (0.44)	VOD vs J200 (1.26)	
APF vs J253 (-2.62)	ANG vs J200 (-1.19)	MEI vs J200 (-0.20)	MRP vs J211 (0.53)	FFB vs J212 (1.27)	
J202 vs J203 (-2.85)	DLT vs J253 (-1.20)	GFI vs J210 (-0.26)	CFR vs J200 (0.54)	ATT vs J253 (1.30)	
	NED vs J200 (-1.21)	AWA vs J253 (-0.26)	INP vs J200 (0.55)	NPN vs J211 (1.30)	
	RDF vs J200 (-1.26)	REI vs J200 (-0.29)	INL vs J212 (0.60)	NPN vs J200 (1.40)	
	SAC vs J253 (-1.29)	FSR vs J200 (-0.33)	MTN vs J211 (0.62)	DSY vs J212 (1.56)	
	J253 vs J200 (-1.31)	OML vs J200 (-0.35)	MND vs J210 (0.70)	FFB vs J253 (1.85)	
	HYP vs J253 (-1.34)	OCT vs J253 (-0.40)	MND vs J200 (0.71)		
	NTC vs J211 (-1.37)	MEI vs J211 (-0.41)	MNP vs J210 (0.71)		

As in the previous section you can move your mouse to any pair that interests you and double-click on it to be taken to the chart to visually inspect the relative relationship. We clicked on GRT vs J200 (-2.00) to reveal the following chart:



This shows us that the relative relationship between GROWTHPOINT and the JSE TOP40, defined by the price of GRT divided by the price of J200, is trading 2 standard deviations below the 500 days linear mean. As we see from the chart, prior occasions this occurred have led to GRT outperforming the J200. One could use this to initiate a long trade on GRT or even a pairs trade which would go long GRT and short the TOP40 (you could short the Top40 with a SAFEX TOP-40 Futures contract for example).

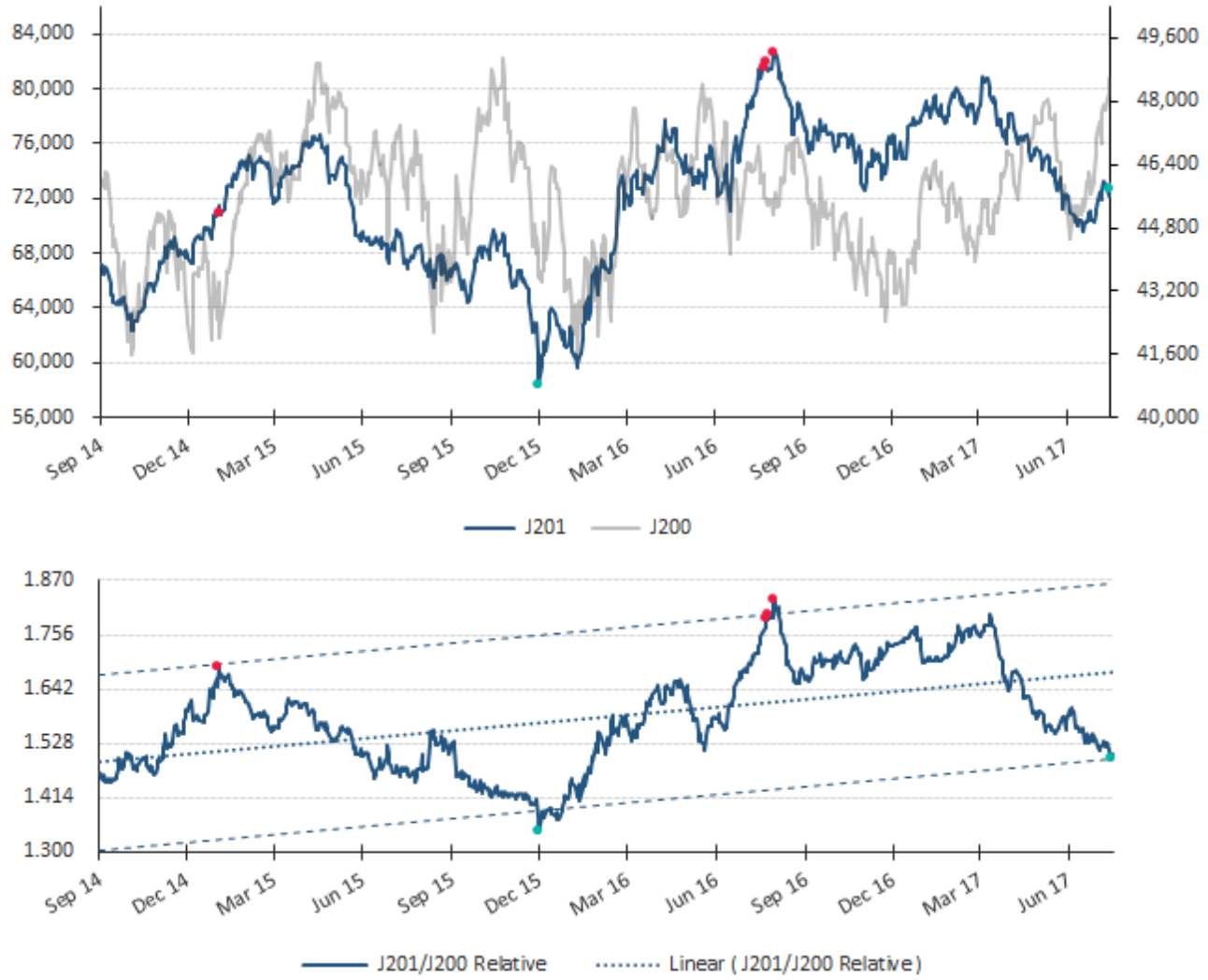
This opportunity shown above has all five hallmarks for a high probability trade, namely

1. The +/- 2 standard deviation (SD) levels have worked at least twice before
2. The period the relationship has been bounded by the +/- 2 SD's is 500 days or more
3. The relative line moves in clearly defined cycles from the -2 SD to the +2 SD
4. The second instrument (J200) makes a logical comparator to the first (GRT)
5. The second instrument is easily tradeable (you can trade J200 with a SAFEX future)

NOTE: If the first instrument is a JSE share (i.e. a company listed on the JSE) then RTA will only show relative relationships to JSE Indices that it is a constituent of. So GRT will only ever show relationships to the J200 (Top-40) and the J253 (Listed property index) since it is a constituent of both these indices.

When you have concluded your visual analysis, you can return to the list of trade opportunities by clicking on the button shown below. You can also modify the Period field (500D) to explore the strength of the relative relationship over other time spans.

You don't have to be looking for trading opportunities on specific shares to get useful information from the relative analysis. You can also compare sectors to identify broad swathes of shares that are likely to outperform. The below is an example of the J201 Mid-Cap sector compared to the J200 Large Caps:



Quite clearly this implies mid-caps are likely to outperform large caps, since the entire mid-cap sector has been underperforming the TOP40 to the point that it is now a statistically extreme divergence.

This would imply, especially since the J200 is looking quite extended in the above picture, that safety could be found by picking a handful of mid-cap shares (the top 41-100th largest shares on the JSE). The constituents for this and other indices can be found in the Shares List sheet.

It could also imply your portfolio needs to be underweight large caps and overweight small-caps. A more aggressive strategy could imply longs on a basket of mid-caps coupled with a short on the JSE SAFEX Top40 future.

Alternatively, if your portfolio was loaded with large caps that have done very well for you in the recent J200 run-up that you may be inclined to take some profits and redeploy these funds into some oversold mid-caps.

The left-hand side of the Relative Pairs SD's sheet provides a more two-dimensional way to scan for opportunities, since it shows the relative deviations from mean across all the time horizons for each possible share/Indices pair.

Here we merely look for red or blue colored cells to identify opportunities. We see that the J200 TOP40 is overstretched across the 250, 500, 750 and 1,000-day horizons relative to the J203 (All Share)

We also see BIL offering 750, 1,250 and 1,500-day overstretched versus the TOP40 warnings.

Now think about this – if J200 is overstretched versus the small, midcap, and All Share then it means breadth is weak and the large caps have been propping up the JSE and are due a pullback. Now BIL, which is itself a large-cap, is overstretched against the J200 large caps itself! So, it is REALLY overreaching. Its "double likely" that BIL is going to pull back.

All Relatives

Latest Close	27/7/2017

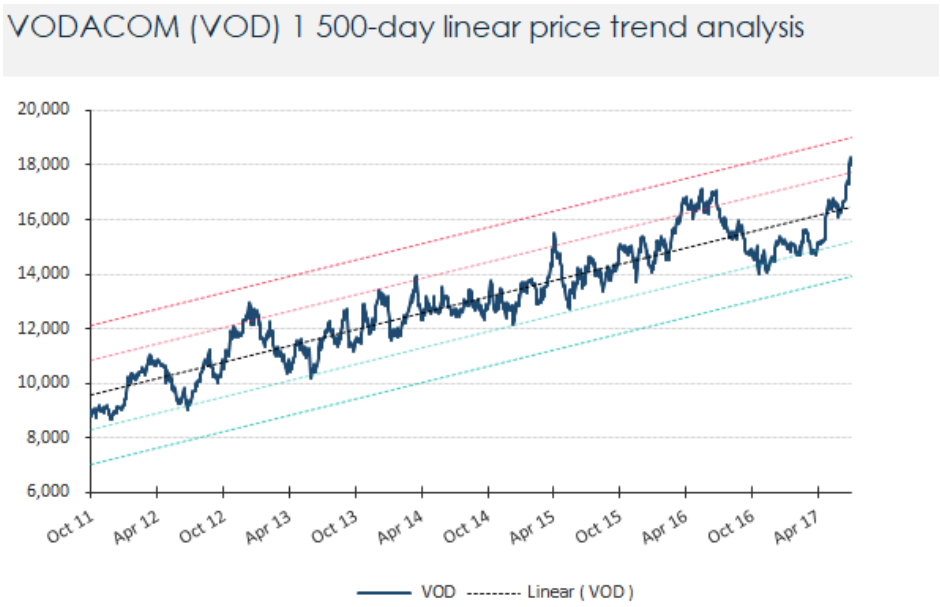
Reli1	Reli2	250D	500D	750D	1,000D	1,250D	Average
Indices		Number of standard deviations from regression line					
Size Segments							☑
J200	J203	1.67	2.48	1.60	1.74	1.09	1.71
J201	J203	-1.36	-2.30	-1.88	-2.25	-1.61	-1.88
J202	J203	-2.14	-2.82	-2.29	-2.87	-3.66	-2.75
Sectors							☑
J210	J200	0.13	-0.37	0.97	1.51	2.14	0.88
J211	J200	0.08	0.68	-0.43	-1.01	-1.58	-0.45
J212	J200	-0.69	-0.41	-0.37	-1.08	-1.26	-0.76
J253	J200	-1.08	-1.45	-1.57	-1.62	-0.34	-1.21
Constituents by Sector							
FTSE/JSE Top 40 Index (J200)							☑
AGL	J200	0.09	-0.65	0.80	1.39	2.88	0.90
ANG	J200	0.12	-1.14	-1.58	-1.00	-0.19	-0.76
APN	J200	0.09	-0.98	-0.23	-0.96	-1.36	-0.69
BGA	J200	-0.62	-0.81	-0.27	-0.83	-0.39	-0.58
BID	J200	0.37					0.37
BIL	J200	0.43	0.17	1.20	1.85	2.46	1.22
BTI	J200	-0.73	-0.51	-1.29	-1.26	-0.81	-0.92
BVT	J200	-0.27					-0.27

NOTE: Just double-click on any of the highlighted cells indicating a relative trade opportunity and the trend chart will automatically open the share with the selected time horizon.

IMPORTANT: The Relative Pair SD's sheet does not identify share-on-share pairs trading opportunities. It only identifies share-on-indices and indices-on-indices opportunities. To identify share pairs trading, you need to use the CORRELATIONS sheet described in Section-11.

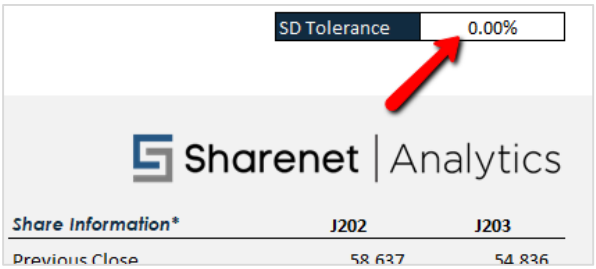
10.Modifying SD Tolerances

Standard Deviation analysis is not a perfect science. Who is to say that EXACTLY 2 standard deviations is the important level to be looking at to determine stretched statistical relationships? Why not 1.95? Why not 2.05? In fact, as we showed with the VOD example in Section-8, the share behaved very consistently around the +/- 1.5 standard deviations levels providing a superb trading strategy:



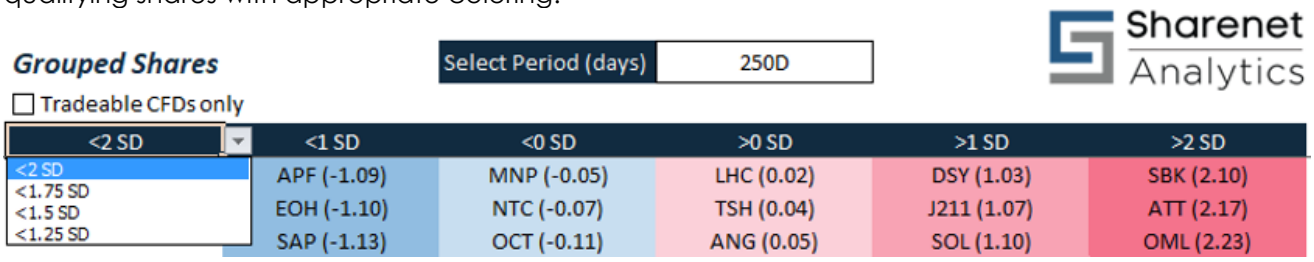
There is an SD Tolerance field available in all charting sheets so that you can highlight on the chart SD levels lower than 2 standard deviations.

If you enter 50% then highlights will appear on the +/- 1.5 standard deviation levels. If you enter 100% then highlights will appear at the +/- 1 standard deviation levels. If you enter x% then highlights will appear at the +/- (2-x%) SD levels



We used x=50% and the chart displayed markers at the +/- (2-0.5) = +/-1.5 SD levels as shown below:

You can also modify the lower or upper bound standard deviation in the grouped shares views as depicted below. When you modify this the opportunity list will be amended according with qualifying shares with appropriate coloring:



11.Share-on-Share pairs trading

During the 1980s, a group of quants working for Morgan Stanley struck gold with a strategy called the *pairs trade*. Institutional investors and proprietary trading desks at major investment banks have been using the technique ever since, and many have made a tidy profit with the strategy.

It is rarely in the best interest of investment bankers and mutual fund managers to share profitable trading strategies with the public, so the pairs trade remained a secret of the pros (and a few deft individuals) until the advent of the internet. Online trading opened the lid on real-time financial information and gave the novice access to all types of investment strategies. It didn't take long for the pairs trade to attract individual investors and small-time traders looking to hedge their risk exposure to the movements of the broader market.

The goal is to match two trading vehicles that are highly correlated, trading one long and the other short when the pair's price ratio diverges "x" number of standard deviations - "x" is optimized using historical data. If the pair reverts to its mean trend, a profit is made on one or both positions. Pairs trading has the potential to achieve profits through simple and relatively low-risk positions. The pairs trade is market-neutral, meaning the direction of the overall market does not affect its win or loss.

The strategy's profit is derived from the difference in price change between the two instruments, rather than from the direction in which each moves. Therefore, a profit can be realized if the long position goes up more than the short, or the short position goes down more than the long (in a perfect situation, the long position will rise and the short position will fall, but this is not a requirement for making a profit). It is possible for pairs traders to profit during a variety of market conditions, including periods when the market goes up, down or sideways, and during periods of either low or high volatility.

The broad market is full of ups and downs that force out weak players and confound even the smartest prognosticators. Fortunately, using market-neutral strategies like the pairs trade, investors and traders can find profits in all market conditions. The beauty of the pairs trade is its simplicity. The long/short relationship of two correlated securities acts as a ballast for a portfolio caught in the choppy waters of the overall market.

In June of 1998, Yale School of Management released a paper written by Even G. Gatev, William Goetzmann, and K. Geert Rouwenhorst who attempted to prove that pairs trading is profitable. Using data from 1967 to 1997, the trio found that over a six-month trading period, the pairs trade averaged a 12% return. To distinguish profitable results from plain luck, their test included conservative estimates of transaction costs and randomly selected pairs. You can find the full 34-page document here.

On the JSE there are a set of *some* favorite combinations used for pairs trading:

1. SBK/ NED/ FSR
2. MTN and VOD
3. AGL and BIL
4. NPN and J200
5. NPK and MND
6. KIO/AGL/EXX/GLN

Another favorite technique in pairs trading is to looks at shares and their parent holding company. For example, PWK and PIK, REI and BTI, PSG and CPI etc.

Apart from these "usual suspects", which you must manually inspect each day yourself, the best way to seek out share-on-share pairs trade opportunities is to use the CORRELATIONS sheet.

	K	U	V	W	X	Y	Z	AA	AB
1	250	ACG	ACL	ACT	ADH	ADR	AEG	AEL	AFE
11	ACG	1.00							
12	ACL	0.31	1.00						
13	ACT	(0.57)	0.44	1.00					
14	ADH	(0.66)	0.09	0.57	1.00				
15	ADR	0.43	0.46	(0.17)	(0.01)	1.00			
16	AEG	0.40	0.80	0.36	(0.04)	0.41	1.00		
17	AEL	(0.95)	(0.18)	0.66	0.65	(0.33)	(0.25)	1.00	
18	AFE	(0.53)	(0.27)	0.11	0.69	0.08	(0.44)	0.52	1.00
19	AFH	(0.09)	0.20	0.32	(0.17)	0.07	0.40	0.24	(0.33)
20	AFT	(0.71)	0.30	0.83	0.74	(0.24)	0.13	0.73	0.34
21	AFX	0.36	(0.17)	(0.55)	(0.09)	0.48	(0.20)	(0.38)	0.30
22	AGL	(0.28)	0.66	0.80	0.41	0.10	0.56	0.40	(0.03)
23	AIP	(0.88)	(0.39)	0.37	0.71	(0.23)	(0.51)	0.87	0.78
24	AMS	0.53	(0.13)	(0.67)	(0.51)	0.44	(0.25)	(0.55)	(0.02)
25	ANG	0.76	0.00	(0.74)	(0.65)	0.43	(0.08)	(0.78)	(0.31)
26	APF	0.04	0.70	0.40	0.39	0.20	0.42	0.04	0.09

This is a N x N correlation matrix that shows the statistical correlation among each share and every other share in the RTA database. Pairs with high correlations have a high matching co-movement meaning they move together very closely and are highlighted in red cells. Large positive numbers mean a high positive correlation meaning they generally move in the same direction.

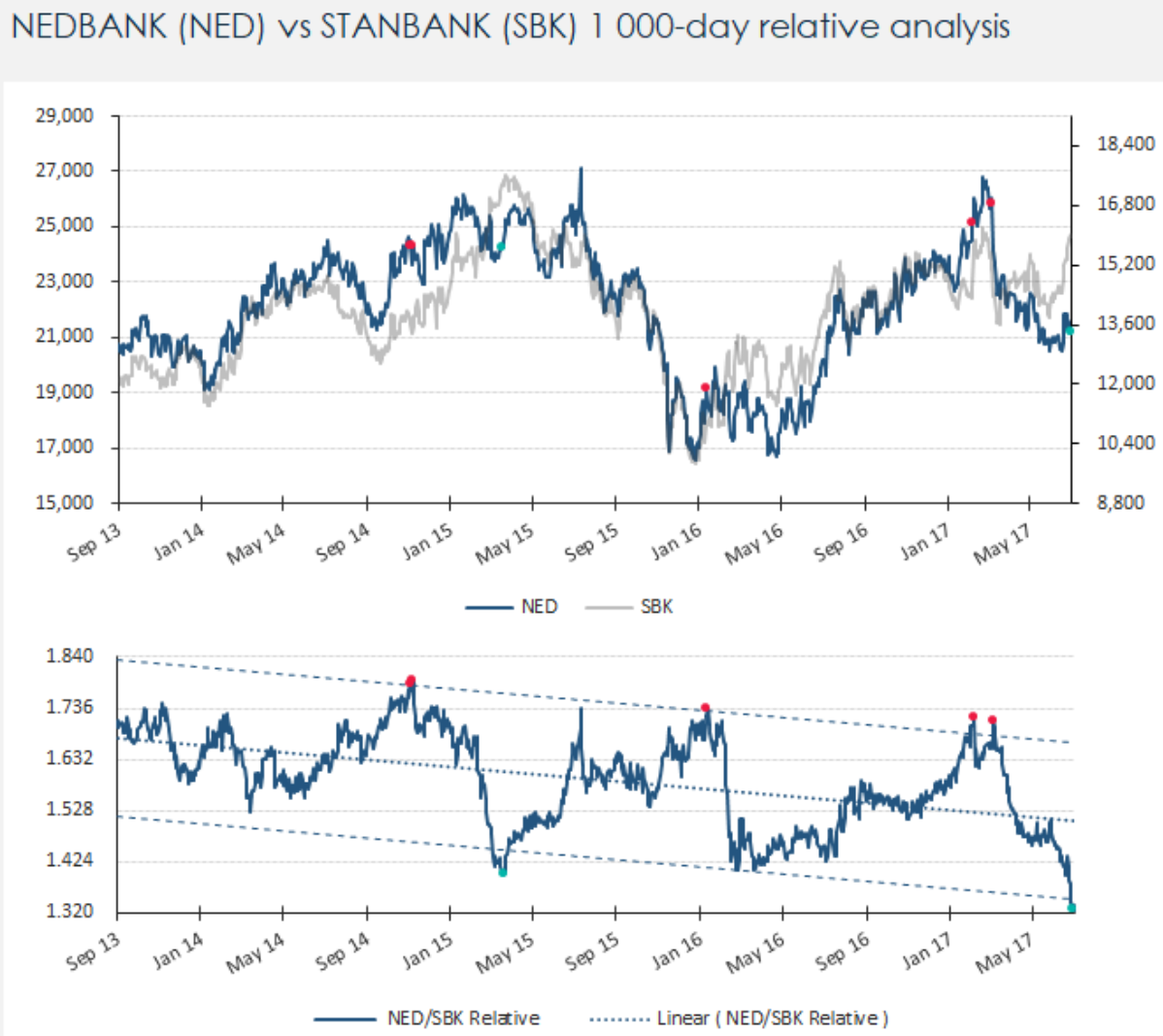
Large negative numbers (shown with numbers enclosed in brackets) have a close INVERSE correlation meaning they virtually move in opposite directions.

Theoretically any pairs identified by red cells, regardless if they are positive or negative numbers are closely correlated and are candidates for pairs trading.

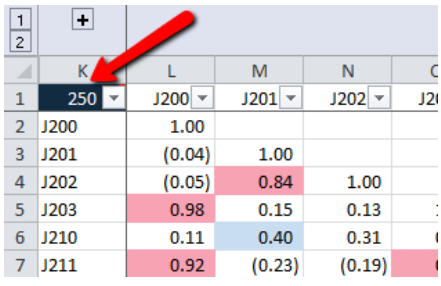
AEG paired with ACL, AFT paired with ACT, AGL paired with ACT, AIP paired with ACG or AEL are examples taken from the above example.

These correlations can get very high. Over 1,000 trading sessions, as at 28 Jul 2017 these were some of the most correlated large caps: BTI and ACL (-0.9), EXX and AEG (+0.9), KIO and AEG (+0.95), KIO and ARI (+0.96)

Here is a sample of an old classic favorite pairs setup, for LONG NEDBANK and SHORT STANBANK:



It's important when viewing the correlations that you set the right time horizon. The sheet is defaulted to 250 trading sessions if you want to examine short-term horizons, but for medium term relationships you need to set this to at least 500-750 trading sessions to ensure the relationships are more persistent. As you change the time horizon cell, the correlations matrix will automatically recalculate and update itself.



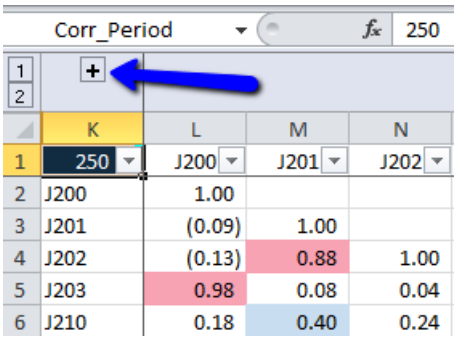
	K	L	M	N
1	250	J200	J201	J202
2	J200	1.00		
3	J201	(0.04)	1.00	
4	J202	(0.05)	0.84	1.00
5	J203	0.98	0.15	0.13
6	J210	0.11	0.40	0.31
7	J211	0.92	(0.23)	(0.19)

Click on the RETURN TO CORRELATIONS button in the Relative View Chart to return to the correlation matrix to seek another opportunity.

NOTE: Just double-click on any of the highlighted cells in the CORRELATIONS sheet and the Relative View chart will automatically open the pair with the selected time horizon.

IMPORTANT: Don't select pairs willy-nilly just because they have a high correlation. There must be some underlying reason you would expect the pairs to be correlated or else you may just be trading on a spurious random chance that a pair is correlated, and thus your odds of this correlation persisting will be low. A share should naturally correlate to the index it is a constituent of, the J200 or other shares in the index it belongs to.

You can look at the top-5 correlated shares for every share in the matrix by pressing the expansion button "+" highlighted below:



This will expand the sheet as shown below, where we see that over the selected 250 session period, J203, J211, NPN, MNP and MND are the shares most correlated to the J200 TOP40:

A	B	C	D	E	F	G	H	I
Top 5 Correlated	1	2	3	4	5		12m Return	12m Volatility
J200	J203 (0.98)	J211 (0.93)	NPN (0.85)	MNP (0.74)	MND (0.74)		8.73%	13.24%
J201	MMI (0.91)	J202 (0.88)	PFG (0.85)	PIK (0.84)	DRD (0.83)		-9.07%	12.31%
J202	J201 (0.88)	PFG (0.85)	ZED (0.85)	MSM (0.83)	MMI (0.83)		-2.33%	7.69%

In columns H and I, we show the 12 months return of each share together with its 12 month volatility.

Again, you can double click on any of the shares to bring up charts of the selected pair.

Some final points on pairs trading:

1. When executing pairs trades, you must make the trades equally weighted exposures. So, if you go long R10,000 on Nedbank, you must couple it with a R10,000 short.

2. Be extra cautious on the shares you short, since you may be liable for the dividends should they pay dividends whilst you are holding them short.

3. Pairs trades can be very efficient from a funding interest perspective. Although you pay interest on the exposure "loaned" to you for a long trade executed with a CFD, this is offset with the interest you earn on the exposure shorted.

4. The interest you get for your short position is always less than the interest you pay on your long position, so the effect is a small differential. The funding interest on a pairs trade is still a fraction of the interest on a single long trade.

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