Pairs trading strategy on bond futures

Hello everyone,

I am new here. Here is a simple pairs trading formula for calculating the spread between two assets (equation 1).

So, I have backtested a simple pairs trading strategy on the german bond market, especially on the pair Euro-bund/Bobl (Euro-bund = 10 year treasury note futures and Bobl = 5 year treasury note futures for the german bonds). I don't test the correlation between the two assets, but in general it is pretty high (over .90 or 90%).

So, here is the backtest I have done on the past five years (1/12/2009 – 17/10/2014). In the datas that I used, some gaps are there (no data between 28/2/2013 and 29/4/2013 excluded and between 30/8/2013 and 2/10/2013 excluded). The prices used are the close prise on the Euro-Bund and BOBL futures (EUREX) from 1 december 2009 to 17 october 2014.

Here is the formula to measure the discrepancies between the two assets:

$$Signal(t) = \frac{R_{A,i}}{\sigma_{A,20}} - \frac{R_{B,i}}{\sigma_{B,20}} \quad (1)$$

Where:

- $Signal(t)$ is the trading signal,
- $R_{A,i}$ is the return of the asset A for i period,
- $R_{B,i}$ is the return of the asset B for i period
- $\sigma_{A,20}$ is the standard deviation of the returns from the asset A for 20 periods,
- $\sigma_{B,20}$ is the standard deviation of the returns from the asset B for 20 periods.

Here are the trading rules:

- No stoploss because we assume that the capital and the margin call are not a limit,
- A position is opend each time the threshold of 1 is crossed upward for +1 and downward for -1, just one cross (for example is the signal passed from -0.9 to +1.1 a position is opened),
- The position(s) opened is closed once the mean (0) is crossed downward for a +1 cross and upward for a -1 cross
- The parameters are i = 1, A is the Bobl futures and B is the Euro-Bund futures,
- The trading period is the beginning of the month from the futures contrat ending the same month and the end is the last trading day of the month previous the futures contract ending the month after (for example for the setpember 2014 Bobl futures, the trading period would be the June 2nd 2014 to August 29 2014),
- In order to calculte the signal, 20 previous datas are taken from the same futures contrat of the trading period.

It is possible to backtest more periods from the equation 1, but if I chose the return of 1 period and the standard deviation from the last 20 periods the reason is 1 for the mispricing on a daily basis and the 20 for a averaged volatility of the return on the last trading month numbered in days.

The results are as follows:

- Sharpe ratio = 0,25
- first drawdown from 29/11/10 to 30/7/12 about 10,6%
- second drawdown from 24/6/13 to 9/6/14 about 3,3%
- 27 trades in total

- Winning rate of 74,07%

Here are the descriptive statistics:

Descriptive statistics

Mean	267,59
Error-type	71,4
Median	270
Mode	280
Standard deviation	371,02
Variance of the sample	137660,32
Kurtosis	4,51
Skewness	1,56
Range	1910
Minimum	-410
Maximum	1500
Sum	7225
Number of samples	27
level of confidance (95,0%)	146,77

Here is the PnL curve:

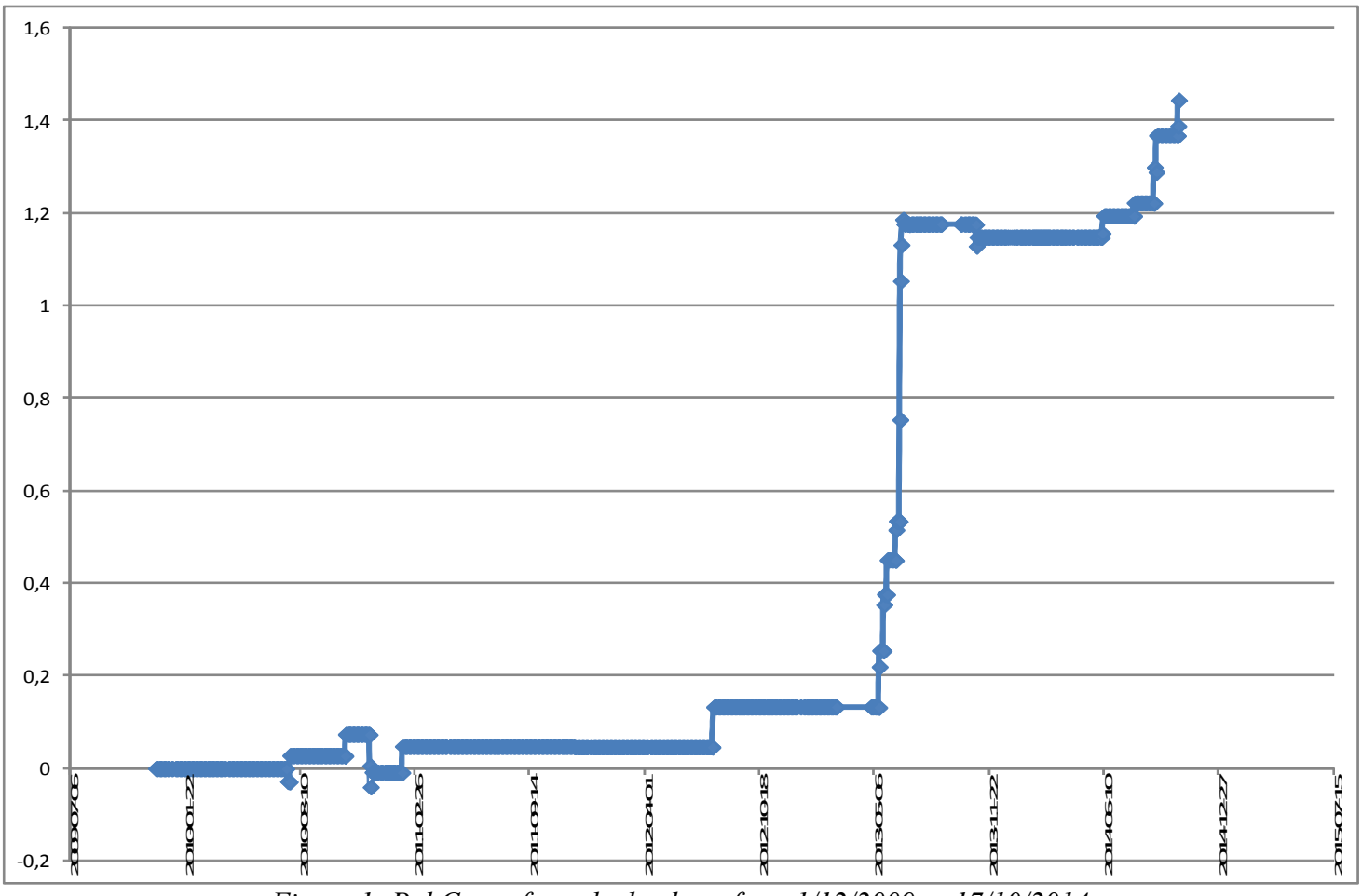

Figure 1: Pnl Curve from the backtest from 1/12/2009 to 17/10/2014

Here are the histograms of trade duration and profits and losses:

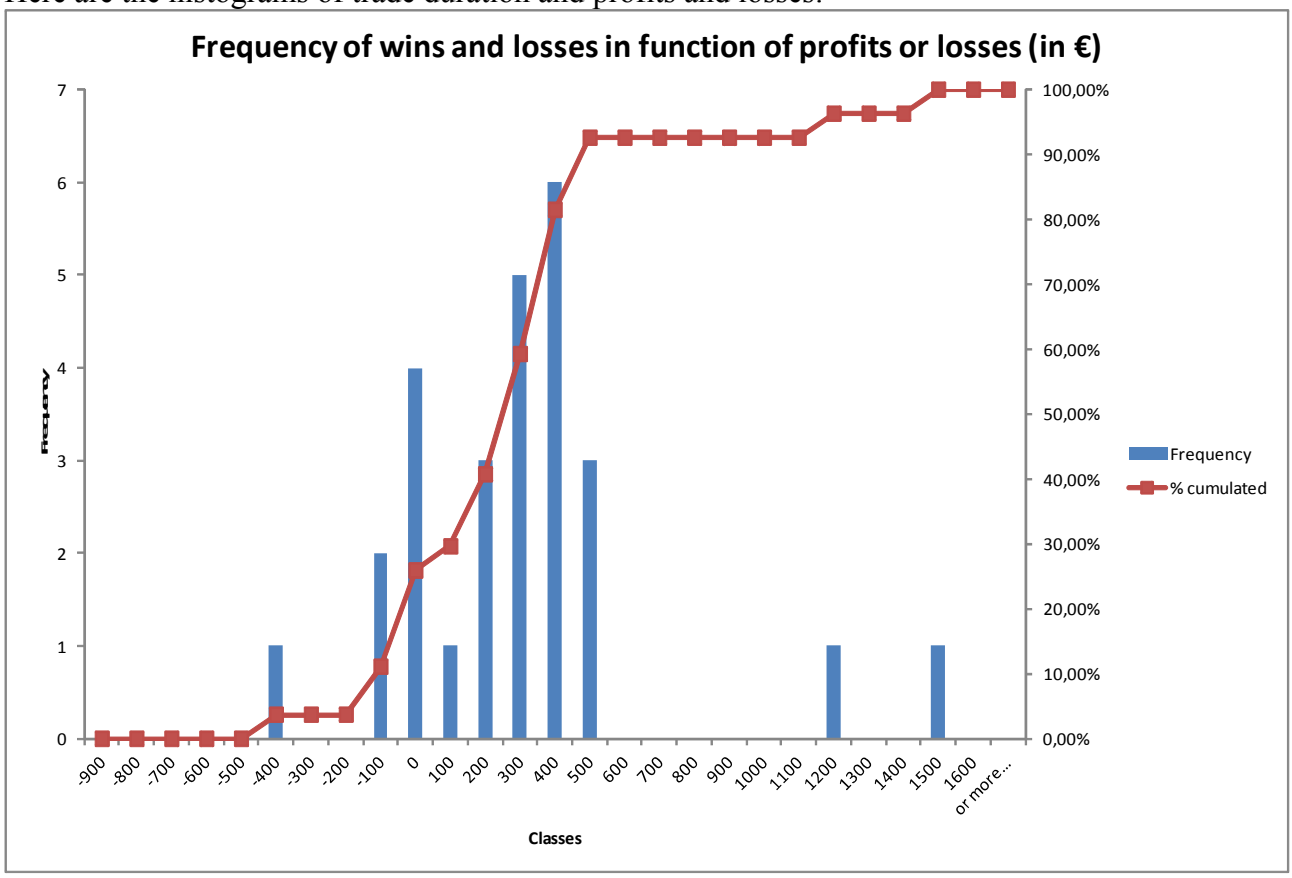

Figure 2: Histogram of profits or losses and the cumulated curve

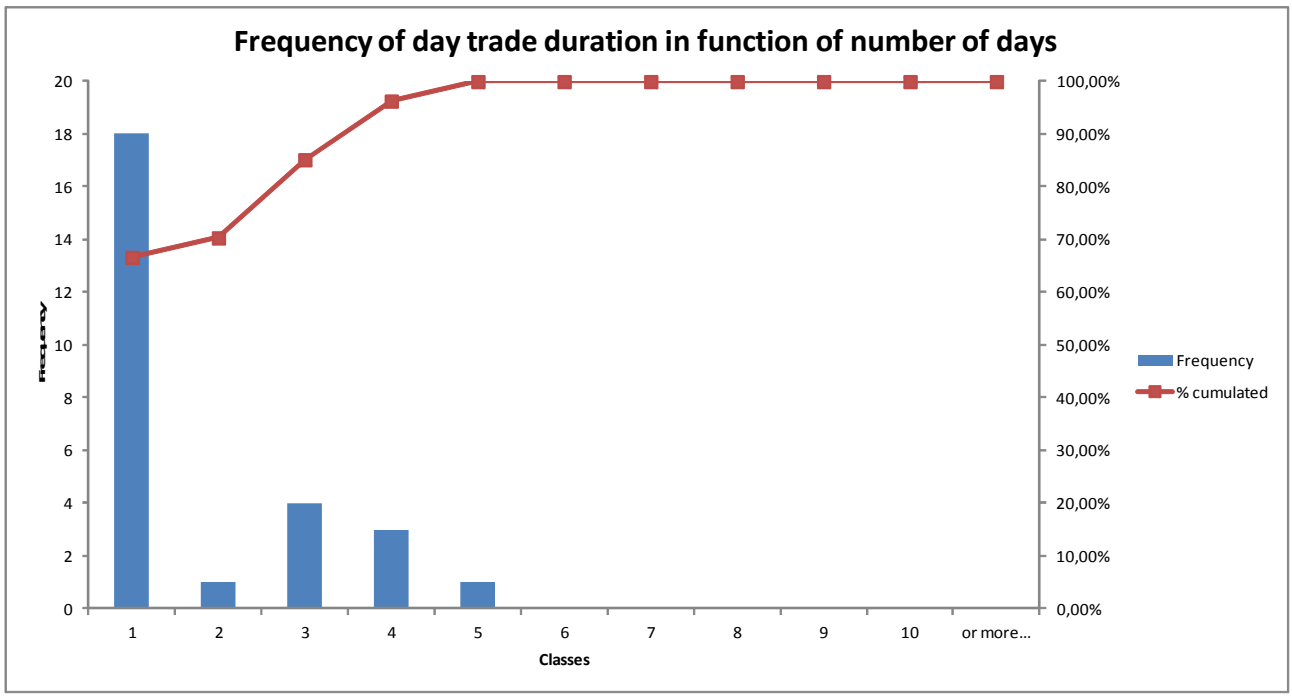

Figure 3: Histrogram of the trade duration and the cumulated curve

Here are the trades made during the backtest period:

Profits or losses	Open time	Close time	Trade duration
-140	16/07/2010 00:00	19/07/2010 00:00	3
280	22/07/2010	23/07/2010 00:00	1
230	27/10/2010 00:00	28/10/2010 00:00	1
-410	08/12/2010 00:00	13/12/2010 00:00	5
-3,12639E-11	13/01/2011	14/01/2011 00:00	1
280	03/02/2011 00:00	04/02/2011 00:00	1
-5	30/11/2011 00:00	30/11/2011 00:00	0
430	27/07/2012 00:00	30/07/2012 00:00	3
440	14/05/2013 00:00	15/05/2013 00:00	1
170	15/05/2013	16/05/2013 00:00	1
500	22/05/2013 00:00	23/05/2013 00:00	1
110	23/05/2013 00:00	24/05/2013 00:00	1
370	28/05/2013 00:00	29/05/2013 00:00	1
330	11/06/2013 00:00	12/06/2013 00:00	1
90	12/06/2013	13/06/2013 00:00	1
1100	18/06/2013 00:00	19/06/2013 00:00	1
1500	19/06/2013 00:00	20/06/2013 00:00	1
390	20/06/2013 00:00	21/06/2013 00:00	1
270	21/06/2013 00:00	24/06/2013 00:00	3
-50	25/06/2013 00:00	26/06/2013 00:00	1
-1,7053E-11	05/07/2013 00:00	08/07/2013 00:00	3
-140	31/10/2013 00:00	04/11/2013 00:00	4
230	05/06/2014 00:00	09/06/2014 00:00	4
140	31/07/2014	01/08/2014 00:00	1
390	04/09/2014 00:00	05/09/2014 00:00	1
340	05/09/2014	09/09/2014 00:00	4
380	15/10/2014 00:00	17/10/2014 00:00	2

Conclusion:

The results are very interesting and with parameters optimization because of the lack of datas (two gaps) and the data-mining or data snooping bias (which means the overoptimization of the parameters of the model based on transient noise in the historical data).

The histogram of profits and losses shows a positive skewness, so this pairs trading strategy seems profitable. Bootstrapping method or Monte Carlo simulations could confirm that, but with only 27 occurencies in a sample is borderline. Besides, the two gaps in the data put the trading results at stake, because big losses could happen.

More than 66% of the trades are closed after 1 day duration or 2 consecutive trading days. The winning rate is 74,07% and the losses are largely overwhelmed by profits. This short time exposure on the german bond futures market is interesting because it is possible to add some identical pairs trading strategies on the same futures account. In doing so, the profits could be larger and the losses as well.