

# Pair trading in the bond market

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KATANA LENS

# Our story and this talk

We started to work on a product called Katana Lens

to help asset managers to find trading opportunities.



# The bond market and relative value

- The bond market is a traditional market
  - that can be inefficient and illiquid
  - $\circ$  50% of the value is voice traded
  - \$700 billion traded daily, 3 times more than stocks
- Every company can issue multiple bonds with different characteristics (like maturity, rate, seniority)
  - $\circ$  Bonds move together

Therefore market anomalies can appear between bonds.

## Katana Lens

A tool that gives trading suggestions to asset managers based on relative value.

- It is not a pure auto trading
- There is trade-off between the number of alerts and profitability
- Alerting enough in advance



# Pair trading

Look for a **pair of bonds** that are **correlated** and/or **related to each other**.

Wait for an **anomaly** to appear, meaning that suddenly the difference between the two bonds increases.

## <u>Characteristics</u>:

- market neutral strategy
- statistical arbitrage
- convergence trading
- mean reversion

#### RENAUL 1 5/8 26/05/2026

FR0013334695 · France · BBB+

#### VW 2 1/2 31/07/2026

XS1944390597 · Germany · A-

#### z-spread of the 2 bonds:



### **KATANA LENS**

Detecting anomalies in relative value

2,000 bond universe

Algorithm analyses all possible combinations



Alerts of pairs that have a high probability of mispricing

→ **100** trade ideas



# **Problem statement**

How to perform:

- 1. Identifying relevant pairs of bonds
- 2. Detecting anomalies
- 3. When to open position
- 4. When to close position, after mean reversion happened

# The predictive / machine learning approach

Can we perform those 4 steps with machine learning?

- Definition of the target
- Features
- Prediction models
- Metrics
- Results and conclusions



# Target definition:

How much will it mean reverts in the next 30 days? Or what is the profitability (or PNL) of an alert?



## Features

- Correlation, cointegration, z-score, mean, pickup
- Bond features (issue date, maturity date, same issuer, same industry, etc)
- Daily market features
- Time series features (1<sup>st</sup> and 2<sup>nd</sup> order derivative)

Coupon	I	Maturity	L	Tier	I	Issuer	I	Cnt	I	Rate	L	Industry
2.375	Ľ	2024-05-20	L	Sr Pref	1	Credit Agricole S.A		FRA	I	A+	L	Financials
1.375	Ĺ	2022-09-08	ť	Sr Unsec	T	LLOYDS BANK PLC	Ľ	GBR	I	A+	Ľ	Financials

## Data overview

		Fea	atures:	Target:		
Target date	Bond 1	Bond 2	correlation	z-score		average 30-day reversion
2019-09-01	Renault 2022	VW 2023	0.8	3.2		-15

# Metrics

3 types of evaluation out of time:

- Prediction error, and distribution of the errors, for optimization
- Profit and Loss on the validation set and other common metrics (sharpe ratio)
- Fair comparison in term of number of alerts
  - i.e. compare the baseline model with a predictive model with the same number of alerts

# Models

- Regularized Logistic regression
- Random forest

Baseline threshold model:

- High correlation
- High z-score

# You shouldn't trade all the time

- Returns can be very different overtime
- Normalization
- Outliers



Mean and median of the target:



# There is not a lot of signal in the data

Very hard to learn and predict mean reversion

- Longer historical data
- More data like news

<u>Model logistic regression:</u> x axis: observed values of the target y axis: predicted values of the target





# Difficult to beat our baseline consistently

Average mean reversion of the alerts on validation out of time, for different models



# Conclusions

- Overfitting and the missing of signals is a big issue
- We were not successful in beating our baseline consistently
  - overtime
  - over different universes
- Learning all the steps end-to-end didn't work out

# What did workout then

We cut your algorithm into small pieces:

- Evaluate in an independent manner
- Can optimize each step independently
- Sure that you can test each contribution
- Make smaller iterations



# Cross-Validation with gap for time series



time

![](_page_19_Picture_3.jpeg)

Available open source in **scikit-lego**:

https://scikit-lego.readthedocs.io/en/latest/timegapsplit.html

# Questions?