BUSINESS CASE 4
Investment Replication

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01
Backtesting

Backtesting

01 - Train/cross-validate and forecast moving forward step-by-step.

02 - Use coefficients that we estimate in t to form a portfolio that will try to replicate our target in (t, t + Horizon], here Horizon = 1.

03 - Use Elastic Net regression.

04 - Keep for all models the same Lambda (halfway between MinMSE and 1SE away from Min MSe).

We use different approaches...

We backtest the model using different **Rolling Window** and different hyperparameters **alpha**.

Rolling Window:
104, 156, 208 260 weeks

Alpha:
0.05, 0.5, 0.95

First approach

TE: difference in returns between your replica portfolio and target portfolio.

TEV: standard deviation of the Tracking error reported typically on annualized basis.

TEV

	1	2	3
1	0.0291	0.0288	0.0288
2	0.0290	0.0285	0.0292
3	0.0284	0.0277	0.0279
4	0.0292	0.0285	0.0285

Rolling Window = 208 weeks
Alpha = 0.5

Mean Turnover and Mean Trading costs

MeanTurnover:

	1	2	3
1	3.0279	4.5352	5.1195
2	2.8523	3.7629	4.3617
3	2.5465	3.4713	4.0805
4	2.2089	3.1038	3.6994

The **turnover** is the sum of the absolute values of the difference in the weights between old and new portfolio, divided by 2.

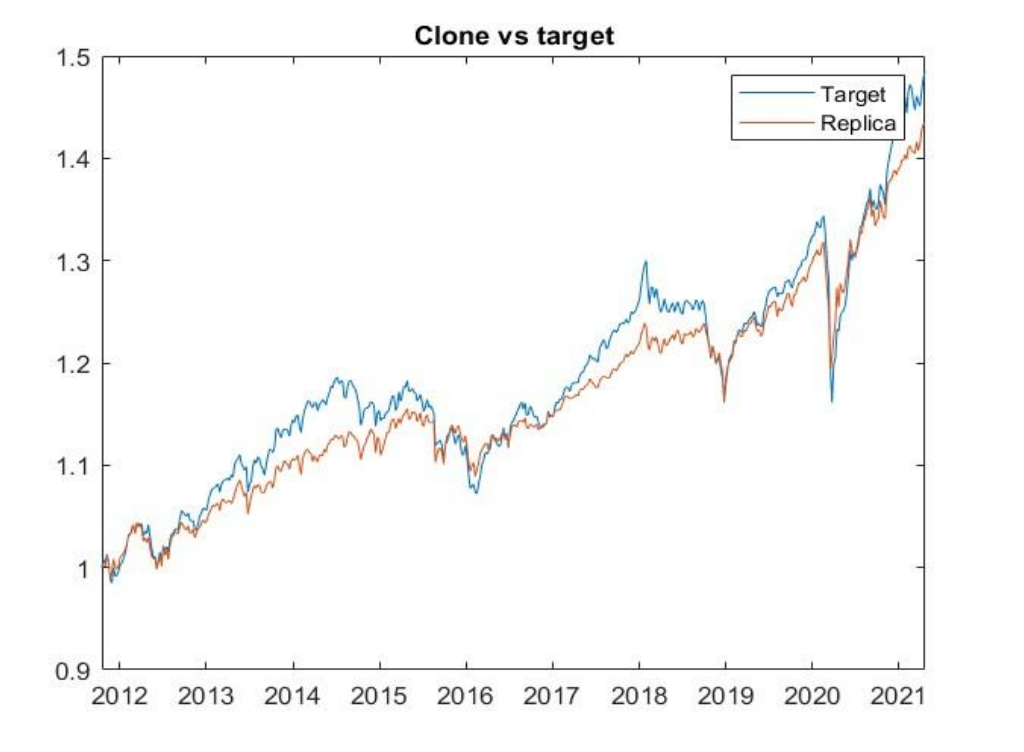
meanTradingCosts = meanTurnover*tradingCosts

tradingCosts=0.004

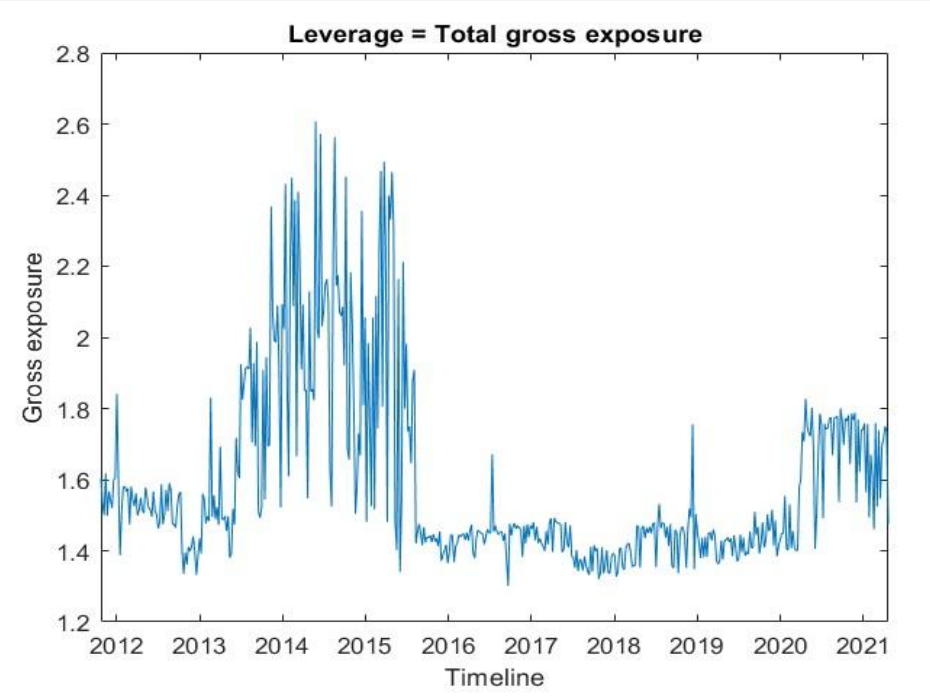
Trading Costs:

	1	2	3
1	0.0012	0.0018	0.0020
2	0.0011	0.0015	0.0017
3	0.0010	0.0014	0.0016
4	0.0009	0.0012	0.0015

First approach



First approach



Gross exposure is a measure that indicates total exposure to financial markets, thus providing an insight into the amount at risk that investors are taking on.

The higher the gross exposure, the bigger the potential loss (or gain).

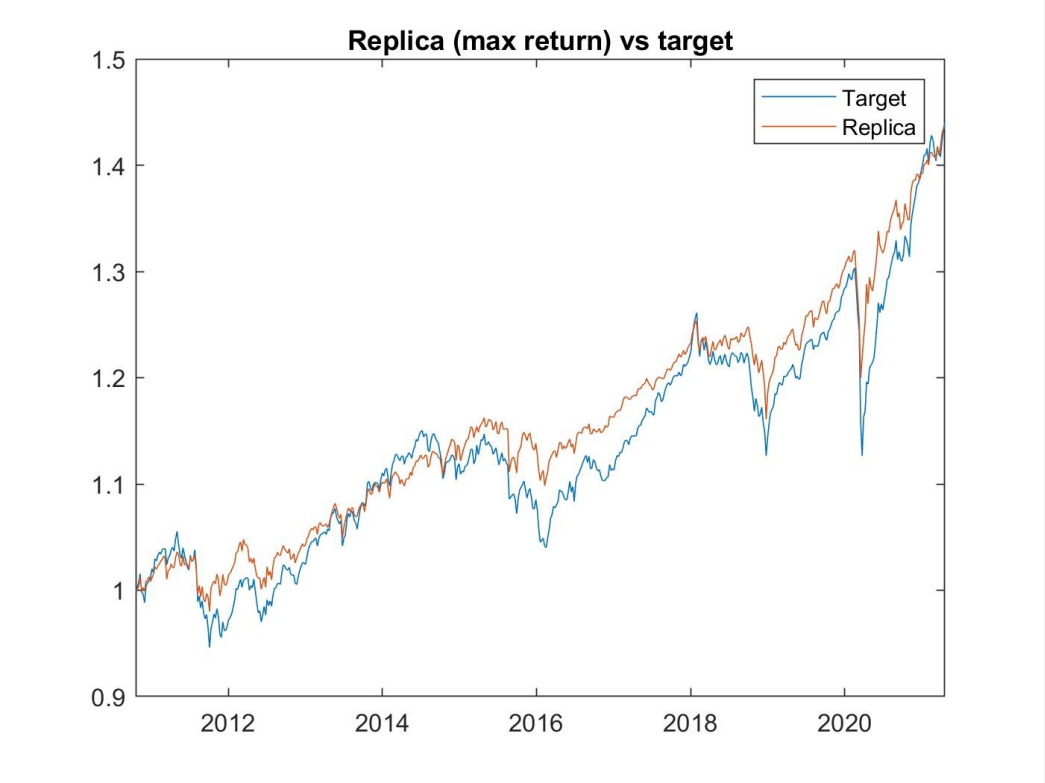
Second approach

We backtest the model using different alpha: for each iteration we choose the **alpha that corresponds to a maximum return**.

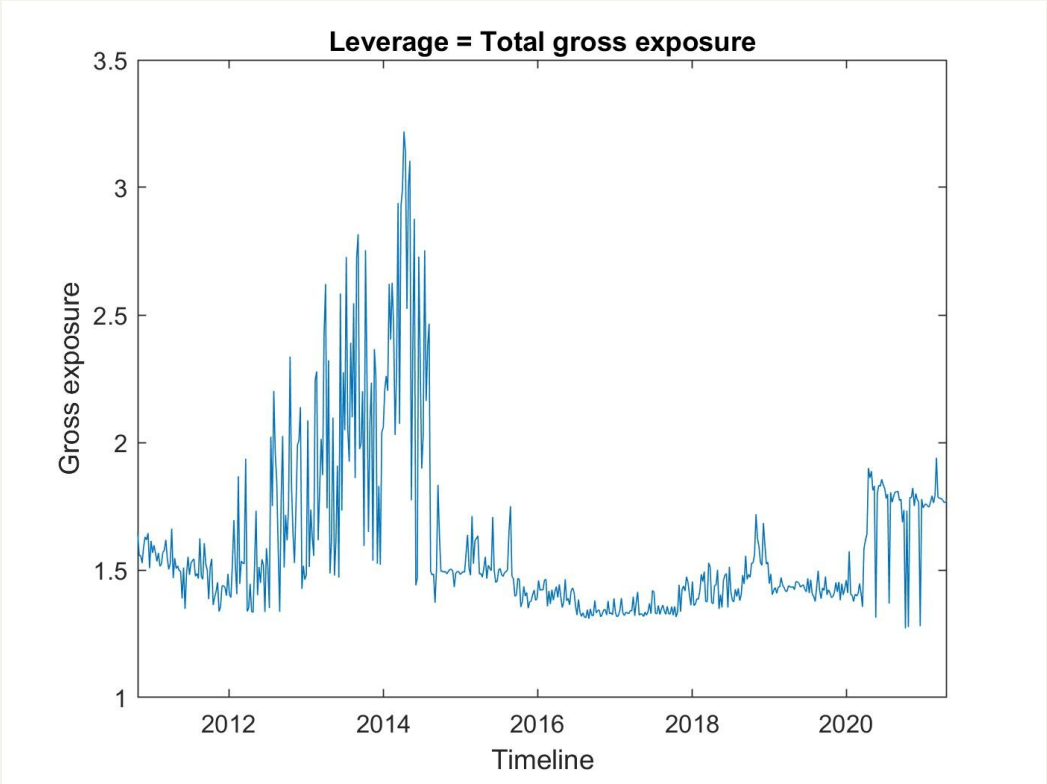
Alpha:
0.2 0.4 0.5 0.75 0.80 0.90

TEV	0.0291
Mean Turnover	4.0880
Trading Costs	0.0016

Second approach

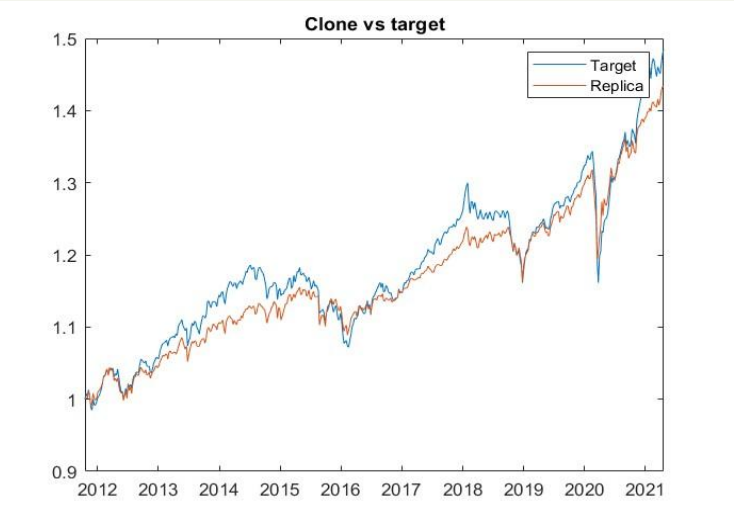


Second approach

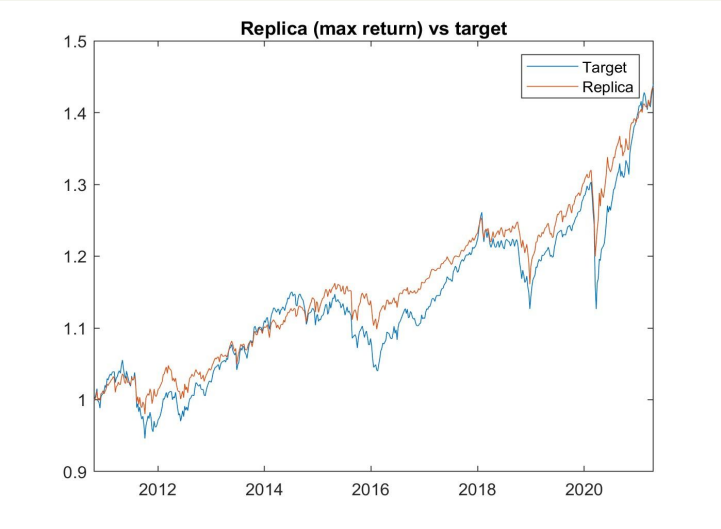


Comparison

First approach

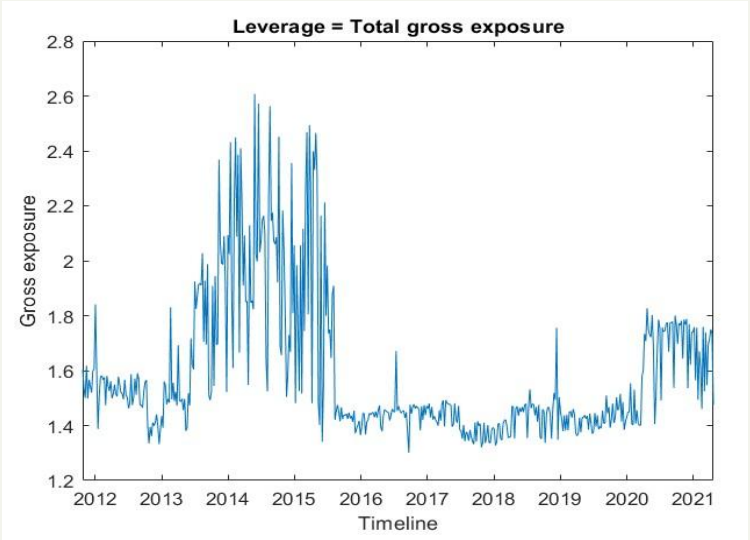


Second approach

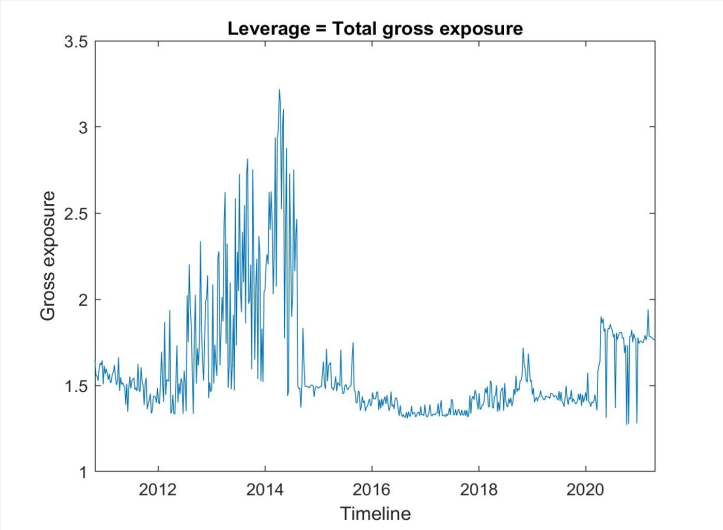


Comparison

First approach



Second approach



02

VaR analysis

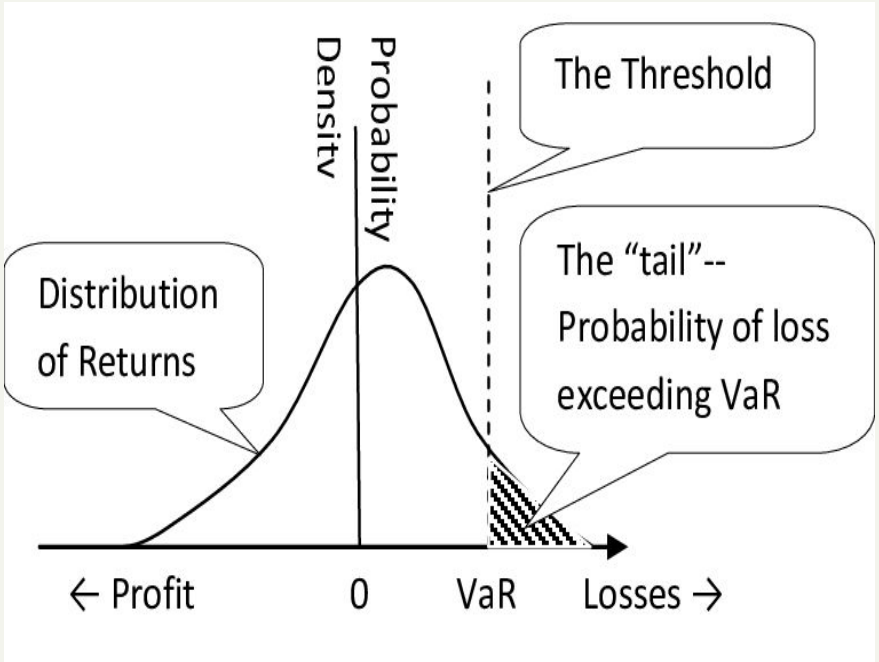
Parametric VaR, EWMA, Historical Simulation, comparison.

VaR: Value at Risk

$$r_\alpha = r: P(R \leq r) = \alpha$$

Where r_α , is that loss value for which the probability of losses bigger than VaR itself is equal to α.

Despite various critiques concerning the inability of VaR to measure the magnitude of losses over α, it remains a key element in financial risk management.

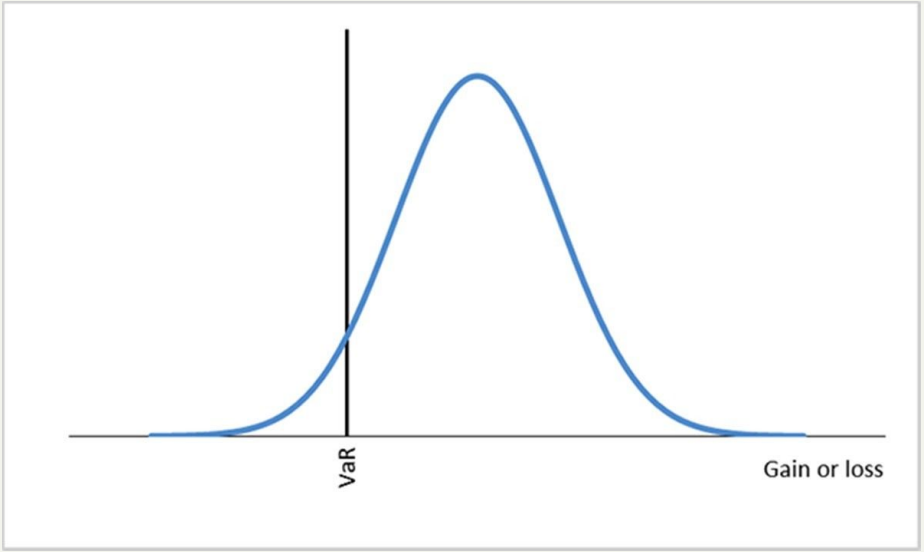


Parametric VaR

It works under two restrictive assumptions:

1. Normal distribution
2. Independence of returns

Hence it gives **all returns** the **same importance**, overlooking big shocks that should be carried over and should be given more power to impact the actual VaR.



EWMA: Exponentially Weighted Moving Average

It is a step forward from the parametric VaR, in the sense that it tries to **solve** the problem of **slow reaction to new information** and **equal importance of returns**.

Using a decay factor the EWMA formula is able to weight different information as it comes in, giving **more importance to recent returns** and less importance to data far in the past by slowly decaying their contribution to the VaR.
Through this, the measure limits the “echo effect”.

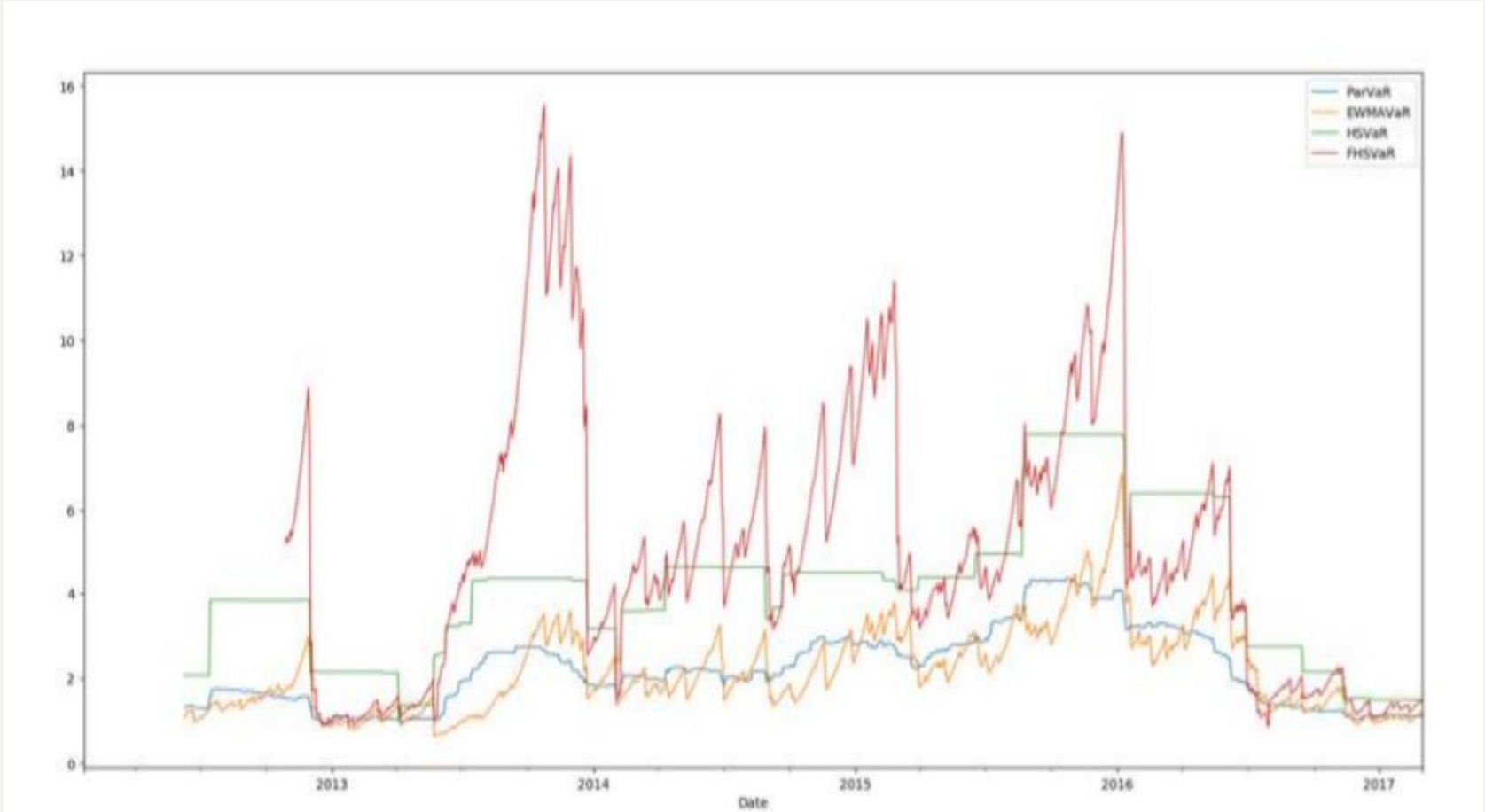
Results and comparison

Depending on the current market and economic situations you should be able to use properly all techniques and interpret them rightly. There is no universal answer, but you should rather look at it as at **indicators** that allow you to quantify the information available.

VaR for 1 million $ initial investment and uniformly assigned weights: 22070
Parametric EMWA: 18760
Historical: 21489

Use separate VaRs to better understand your data

MXWO	3994
MXWD	4053
LEGATRUU	1216
HFRXGL	1090
RX1	1398
TY1	1283
GC1	4039
CO1	9273
ES1	3877
VG1	4945
NQ1	4428
LLL1	4125
TP1	5144
DU1	257
TU2	288


ParVaR
EWMAVaR
HSVaR
FHSVaR
16
14
12
10
8
6
4
2
0
2013
2014
2015
2016
2017
Date

THANK YOU!

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