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INTRODUCTION

1 Non-linear dependence between the security and the benchmark displays financial incoherence in linear risk measures.

A security with negative covariance and correlation regarding the market does not imply that there will be less risk than in the market because of the negative β .

2 A volatile contrarian security could be interpreted wrongly as a refuge value if solely assessing by the negative sign of its β .

Both relative volatility (RV) and β take arithmetic average of price oscillations which could be a mistake of undervaluation.

OBJECTIVES

1 Analyse linear market risk measures (RV & β) and propose a complementary non-linear and non-parametric risk measure.

Provide risk aversion approach thanks to its magnificent effect on important market movements and a collapse effect on returns considered as market noise.

2 Solution for non-elliptical probability distributions (fat tailed) that invalidate linear measures of association.

Automatic adjustment on high and low volatile market periods and a supply of most outstanding movements the manager should be concerned about.

ASSUMPTIONS

- Incomplete information.
- Market inefficiency.
- Discrete time and prices.
- Stochastic stationary process.

3 Let $a_t(a_1, \dots, a_n)$ and $m_t(m_1, \dots, m_n)$ standing $\{a_t, m_t \in \mathbb{R} : 0 < a_t, m_t \leq 1\}$ $\forall \infty > n \geq i > 0, \infty > t > 0$.

$$a_i = \cos\left(\ln\left(\frac{A_i}{A_{i-1}}\right)\right) \quad m_i = \cos\left(\ln\left(\frac{M_i}{M_{i-1}}\right)\right)$$

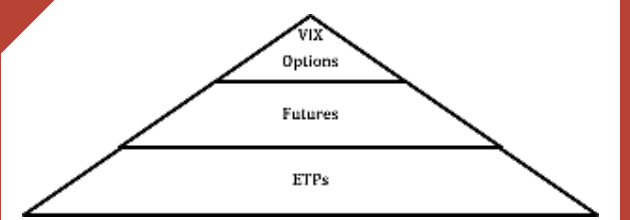
$$E(a_t), E(m_t) = 1$$

$$a_t = E(a_t) - o(a_t) = 1 + o(a_t)$$

$$m_t = E(m_t) - o(m_t) = 1 + o(m_t)$$

METHODOLOGY

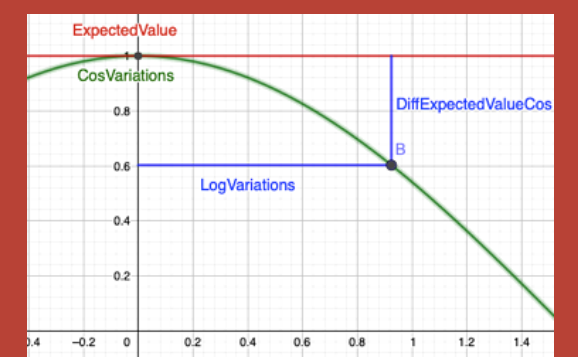
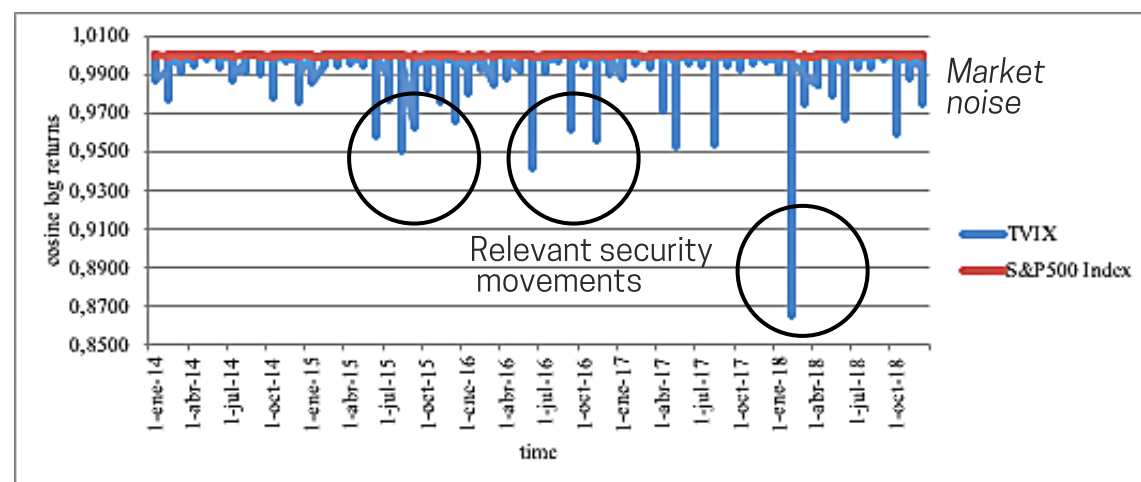
4 Study of ex post returns of six Exchange Traded Products (ETPs), VIX and SPX Index from 2014 until 2018.



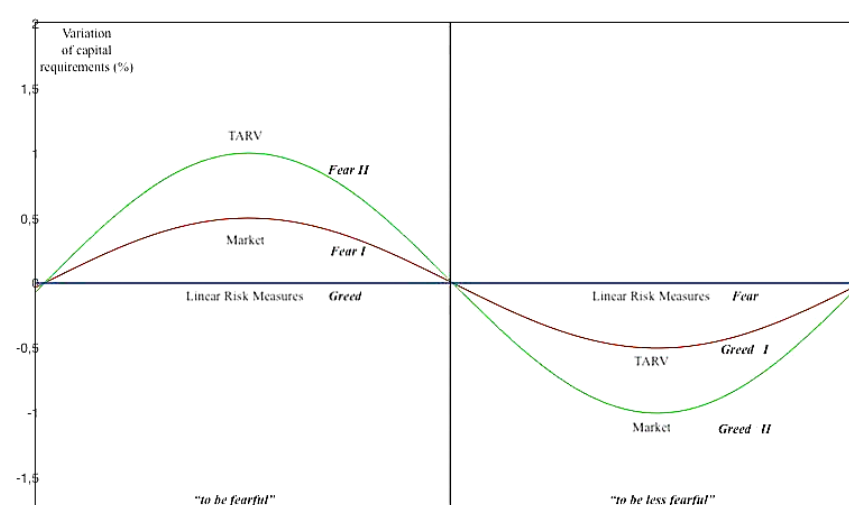
RESULTS

$$RV_t = \frac{\sigma_{a_t}}{\sigma_{m_t}} = \frac{\sqrt{(a_t - E(a_t))^2}}{\sqrt{(m_t - E(m_t))^2}} = \frac{a_t - E(a_t)}{m_t - E(m_t)} = \frac{0 + o(a_t) - 0}{0 + o(m_t) - 0} = \frac{o(a_t)}{o(m_t)}$$

$$TARV_t = \frac{\sigma_{a_t}}{\sigma_{m_t}} = \frac{\sqrt{(a_t - E(a_t))^2}}{\sqrt{(m_t - E(m_t))^2}} = \frac{a_t - E(a_t)}{m_t - E(m_t)} = \frac{1 + o(a_t) - 1}{1 + o(m_t) - 1} = \frac{o(a_t)}{o(m_t)}$$



5



CONCLUSIONS

6 The effect of the cosine as positive for high volatile returns and as negative for low volatile returns leads to increase the number of outliers and decrease the number of insiders.

TARV accomplishes the Coherent Risk Metrics except for the translation invariance assumption.

TARV will remove the market noise and stress the significant movements.

6 The positivity of TARV increases its application on conventional as non-conventional securities.

RV	Risk neutral approach						
2014-2018	VIX	UVXY	VIXY	PHDG	VXX	TVIX	SVXY
S&P500	9.8364	9.2064	4.8197	0.6962	4.7980	9.3738	4.7760
VIX	1	0.9360	0.4900	0.0708	0.4878	0.9530	0.4855

TARV	Risk aversion approach						
2014-2018	VIX	UVXY	VIXY	PHDG	VXX	TVIX	SVXY
S&P500	127.4047	90.5537	25.7512	0.7751	25.5161	98.1280	26.8898
VIX	1	0.7108	0.2021	0.0061	0.2003	0.7702	0.2111