"REDEXE 4X4 GLOBAL MACRO"

Ex-ante Portfolio Optimization and Analysis

Portfolio Optimization on "Redexe 4x4 Global Macro" investment model.
Historical analysis of the Portfolio Candidate.

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Summary

1 OUR PARETO-LÉVY STABLE FRAMEWORK

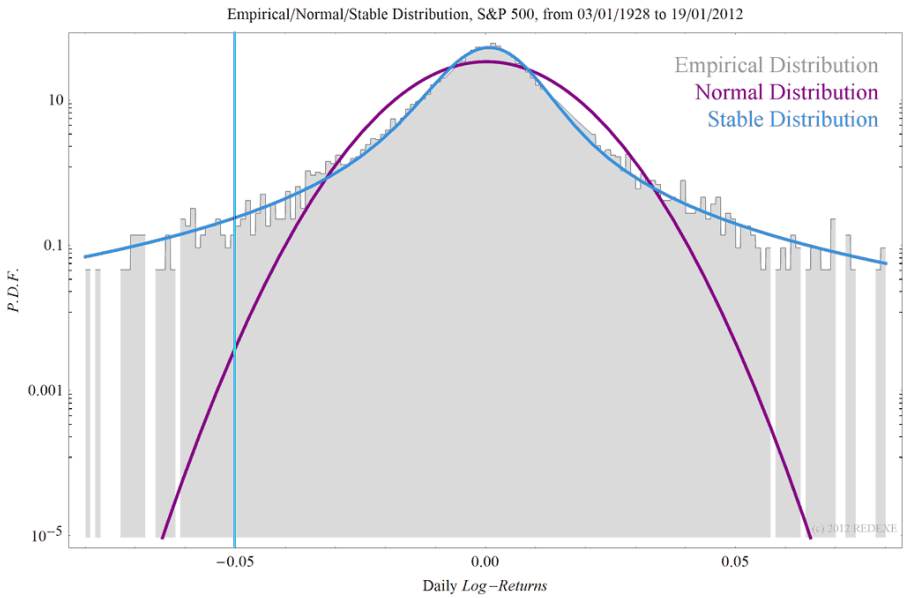
1.1 STABLE STATISTICS

Redexe[1] considers Pareto-Lévy Stable statistics[2] the best abstraction layer for log-returns distribution because:

- there is a strong theoretical basis, i.e. time scale invariance and generalized central limit theorem, and an empirical evidence over a very large number of shares and time frames;
- the most advanced market dynamics models, such as Spin Models that come from Econophysics, generate power-law distribution tails, as PL Stable statistics does.

Using P.L. Stable Statistics, in particular our custom risk measure *redES™* [3], we are able to take into account of fat tails and the so called "black swans", properly estimating the occurrence probability of bubbles and shocks, so achieving *rock-solid portfolio optimization*[4].

On the other hand, normal statistics and empirical distributions, still widely spread, fail exactly when they should help, i.e. during market crashes[5].



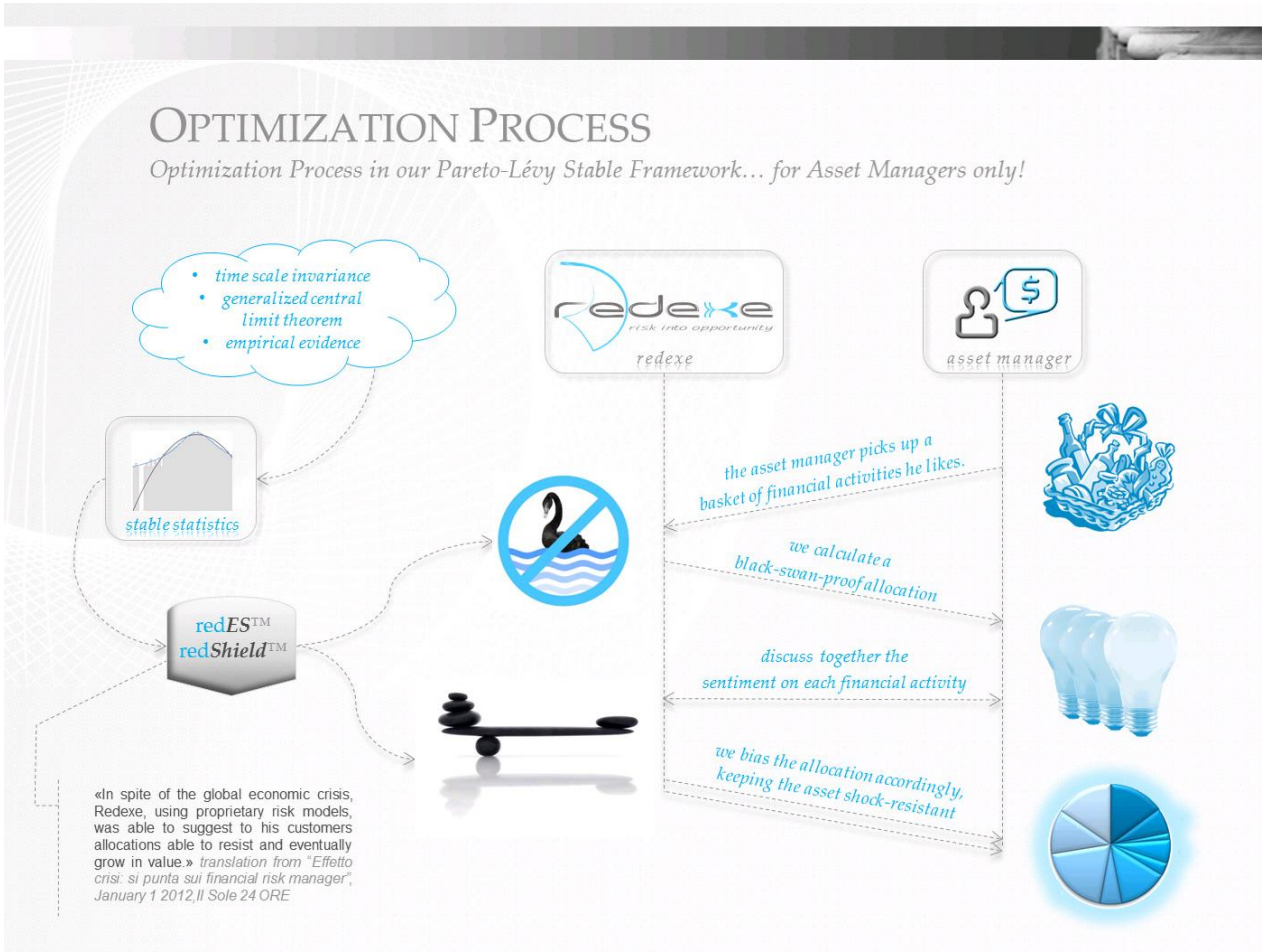
S&P 500 daily losses greater than 5%: historical data count 78 sessions (grey), normal statistics estimate 0.2 sessions (purple), stable statistics estimate 162 sessions (blue).

[1] Introduction to Redexe, see the **slides** *www.redexe.net/docs/redexe.pdf* and the **video** *youtu.be/F_4Npqkfd40* [Italian] Riccardo Donati, *Presentazione di Redexe*, Tol Expo 2012.
[2] See for example the **video** *youtu.be/SMpKmLQ5hm8* [Italian] Marco Corazza, *Introduzione Teorica*, Cà Foscari University 2011, taken from the **workshop** *www.redexe.net/riskmanagement/workshop2011*.
[3] See the **slides** *www.redexe.net/docs/redesfull.pdf* and the **video** *http://youtu.be/FGuIthVO89Y* [Italian] Riccardo Donati, *RedES, la "Vera" Misura di Rischio*, October 2011, Parma University.
[4] See the **paper** *www.redexe.net/docs/Risk24.jpg* *Effetto crisi: si punta sui financial risk manager*, January the 1st 2012, Il Sole 24 ORE and the **video** *youtu.be/vwqtAGqIYdw* [Italian] Riccardo Donati, *A prova di Crisi, nuove tecniche per la Gestione Patrimoniale*, September 2012, CUOA.
[5] See the **video** *youtu.be/sT9TXV1E8W8* [Italian] Riccardo Donati, *Fallimento della statistica Normale in finanza, Lévy contro Gauss stabilmente 2-0.*, Parma University 2010.

1.2 OPTIMIZATION PROCESS

The optimization process follows these steps.

- The Asset Manager selects a basket of financial activities representative of the Investment Universe, excluding the ones that, with high confidence, are supposed to perform poorly in the future.
- We calculate the weight of each item according to our Pareto-Lévy stable optimization framework, maximizing *redShield*™ [6], our target function that conveniently takes into account of fat-tails and shock probability. In this way, given the initial basket, the *Optimized Portfolio* will be the most shock-resistant asset allocation possible.
- In an interactive session, we discuss with the Asset Manager his sentiment on each financial activity, biasing the weights just to take into account of his ideas, keeping nevertheless *redShield*™ high enough.
- In this way, we obtain the Portfolio Candidate, including both the Asset Manager ideas and a strong resistance towards market shocks.



[6] *redShield*™ is the ratio between the weighted sum of *redES*™ and *redES*™ of the whole portfolio.

2 OPTIMIZATION

Following the previously mentioned steps, we hereafter summarize the optimization process results and then, in the next chapter, we will study the Portfolio Candidate.

financial activity	optimized	sentiment	candidate
Bloomberg/EFFAS Bond Indices U	9.17%	▼	6.83%
30-Year US Sector	4.79%	▲	7.42%
Bloomberg/EFFAS Bond Indices E	14.59%		13.89%
30y DE Sector	10.81%		10.30%
JPMorgan Emerging Markets Bond	1.47%		1.40%
Barclays US Inflation Linked B	0.38%		0.36%
EuroMTS IG Inflation Linked 17	11.72%	▼	5.45%
iBoxx $ Liquid Investment Grad	0.40%		0.38%
Barclays EuroAgg Corporate Tot	7.52%		7.17%
iBoxx $ Liquid High Yield Inde	0.73%		0.69%
Markit iBoxx EUR Liquid High Y	14.88%		14.17%
S&P 500 INDEX	0.70%	▲	4.48%
MSCI EMU	8.34%	▲	10.80%
MSCI JAPAN	1.30%	▲	3.14%
MSCI PACIFIC x JAPAN	0.37%		0.35%
MSCI Emerging Markets Europe M	0.20%		0.19%
MSCI EM LATIN AMERICA	1.12%		1.07%
MSCI EM ASIA	0.20%		0.19%
WTI	2.31%		2.20%
Copper	1.16%		0.15%
Gold	4.51%		4.29%
Corn	3.08%	▲	4.84%
REITS	0.25%		0.24%

Considering the Optimized Portfolio as a baseline, the Asset Manager introduced his sentiment, biasing the allocation. The resulting Candidate Portfolio has a redShield™ of 2.47, that is very close to the optimized redShield™ of 2.48, so keeping the portfolio capability to resist market shocks.

3 PORTFOLIO CANDIDATE ANALYSIS

3.1 DEFINITIONS

Let's consider the whole portfolio time series, hereafter called the **<NET NAV>**.

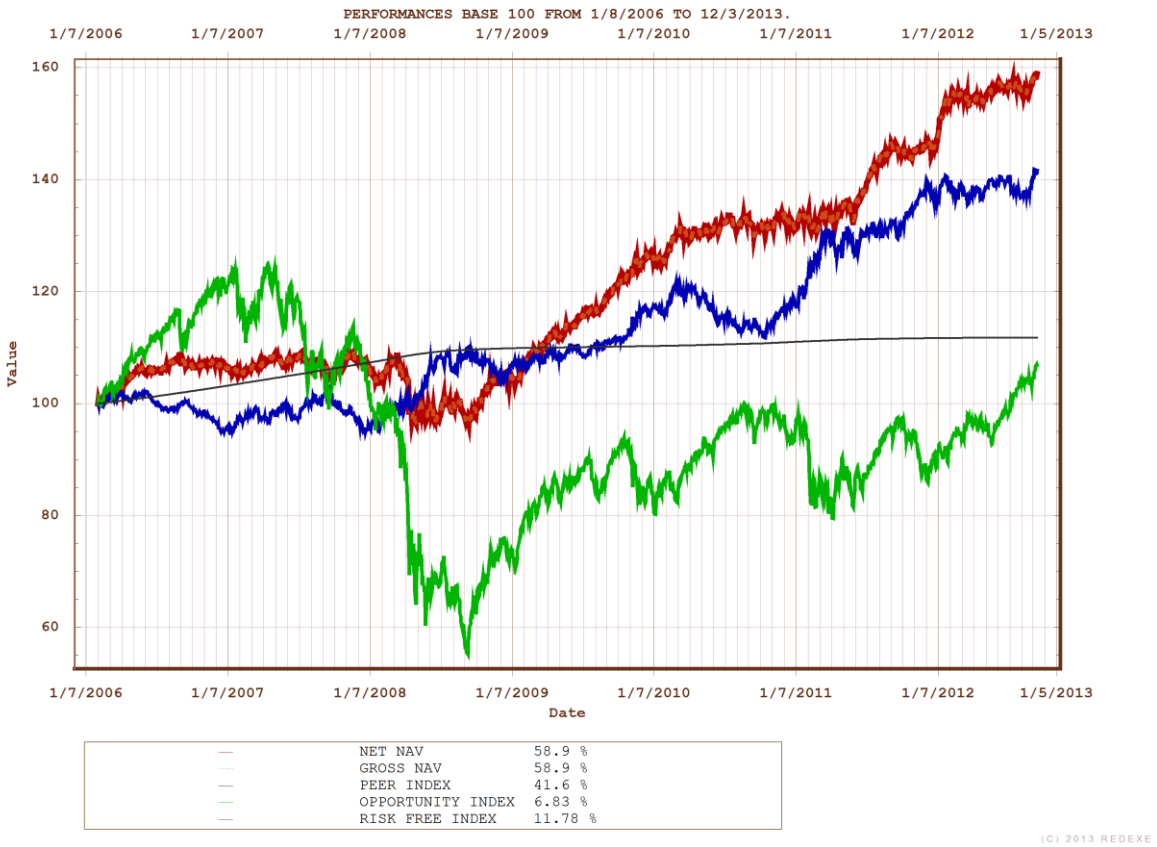
Since the investment style is "Global Macro" and aims to achieve absolute returns, we will compare such performance with a risk free investment in the Euro Zone, the Eonia Index, hereafter the **<RISK FREE INDEX>**.

In order to see if the management activity is able to take advantage of the opportunities given by the real economy growth in the World area, and if it is able to protect the investor against market shocks, we study the MSCI Word DM Local Currency Index, also, hereafter the **<OPPORTUNITY INDEX>**.

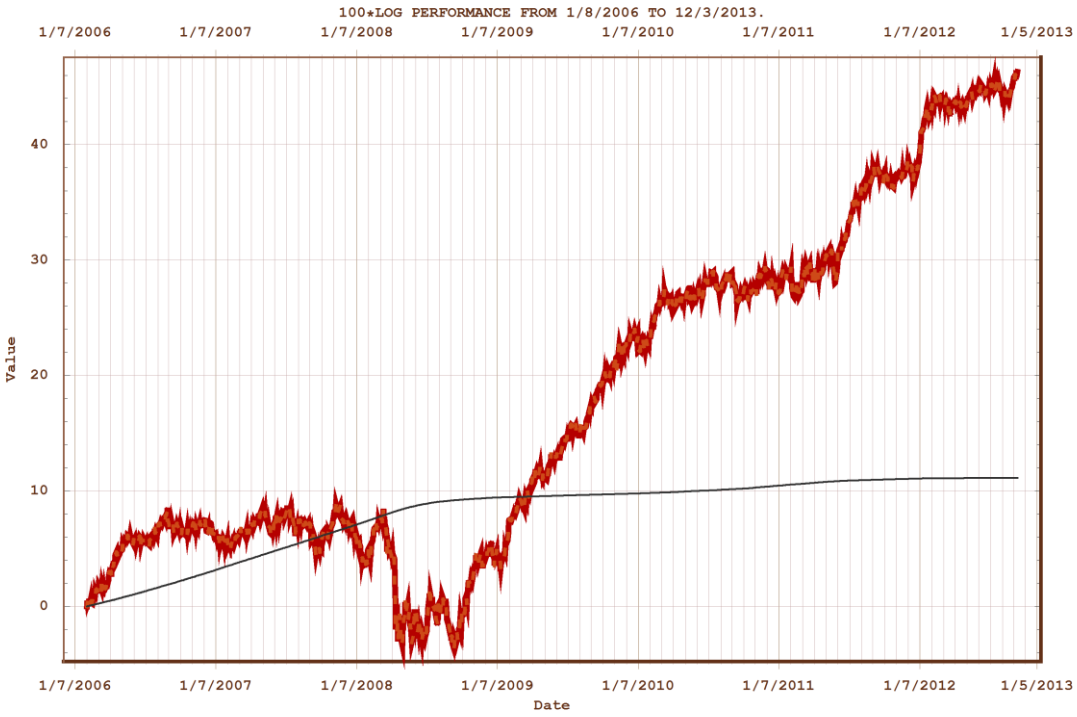
Finally, to compare the management activity with an investment with comparable volatility, we consider the Euro Bund Futures. We call it the **<PEER INDEX>**.

3.2 PERFORMANCE

We plot the log percentage[7] of the relevant time series



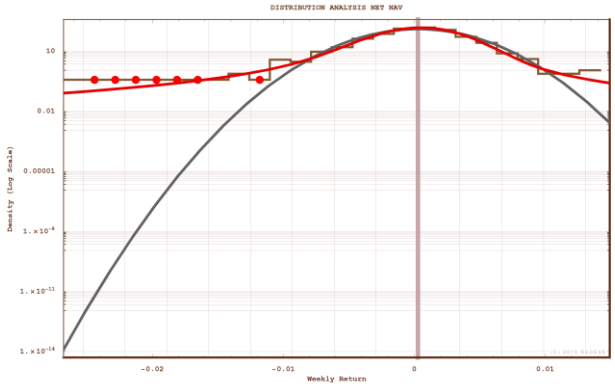
[7] The log percentage, "per centum", variation is defined as 100*(Log(P(t)-Log(P(t-1)). It is close to the per cent % price variation, in the limit of a small price change..



3.3 LOG-RETURNS DESCRIPTIVE STATISTICS

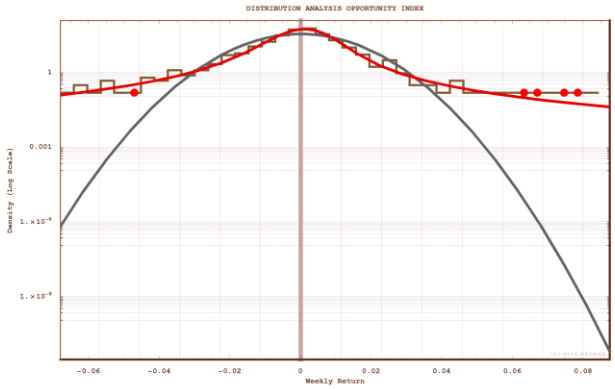
Let's study the descriptive statistics of log returns. In the following charts, we plot the empirical distribution, in brown, the best Normal fitting curve, in grey, and the best P.L. Stable fitting, in Red. *As you can see, P.L. Stable fitting is really close to the empirical distribution, while Normal fitting is far from empirical distribution, especially moving towards "extreme" values.*

3.3.1 <NET NAV>



N.Samples	1725	+-	0
Delta T	1.4	+-	69.14×10
Mean Y %	7.3895	+-	2.1238
Std Y % [Wiener]	5.0884	+-	86.63×10
Stability Alpha	1.7874	+-	0
Stability Beta	-341.48×10^{-3}	+-	0
Stability C	1.9102×10^{-3}	+-	0
Stability Mu	232.2×10^{-6}	+-	0
Std Y % [Lévy]	7.0836	+-	120.6×10
Risk Free Y %	1.6976	+-	0
Sharpe [Wiener]	1.1186	+-	417.81×1
Sharpe [Lévy]	803.54×10^{-3}	+-	300.13×1
Skew	-571.83×10^{-3}	+-	58.977×1
Kurt	7.7065	+-	117.95×1

3.3.2 <OPPORTUNITY INDEX>



N.Samples	1725	+-	0
Delta T	1.4	+-	69.14×10
Mean Y %	2.735	+-	7.3582
Std Y % [Wiener]	18.425	+-	313.69×1
Stability Alpha	1.5004	+-	0
Stability Beta	-228.21×10^{-3}	+-	0
Stability C	5.2803×10^{-3}	+-	0
Stability Mu	-261.5×10^{-6}	+-	0
Std Y % [Lévy]	46.52	+-	792.×10⁻¹
Risk Free Y %	1.6976	+-	0
Sharpe [Wiener]	56.308×10^{-3}	+-	399.36×1
Sharpe [Lévy]	22.302×10^{-3}	+-	158.17×1
Skew	-221.01×10^{-3}	+-	58.977×1
Kurt	10.809	+-	117.95×1

3.4 ACHIEVED VS. ATTENDED PERFORMANCE

Our technique allows for an intuitive yet precise comparison between the achieved performance and the attended one.

We start building a simplified investment model, based on P.L. Stable Statistics, able to estimate the probability of having a certain performance at a given time.

The parameters used for this simulation are

- Target Risk Premium 5% yy
- Target Volatility[8] 6% yy
- Stability Exponent (Alpha) 1.7

Then we plot the probability field in a performance vs. time plane, using relevant colours.

Finally, we lay in upon the coloured plane the achieved performance <NET NAV> minus the <RISK FREE INDEX> to study the "Risk Premium".

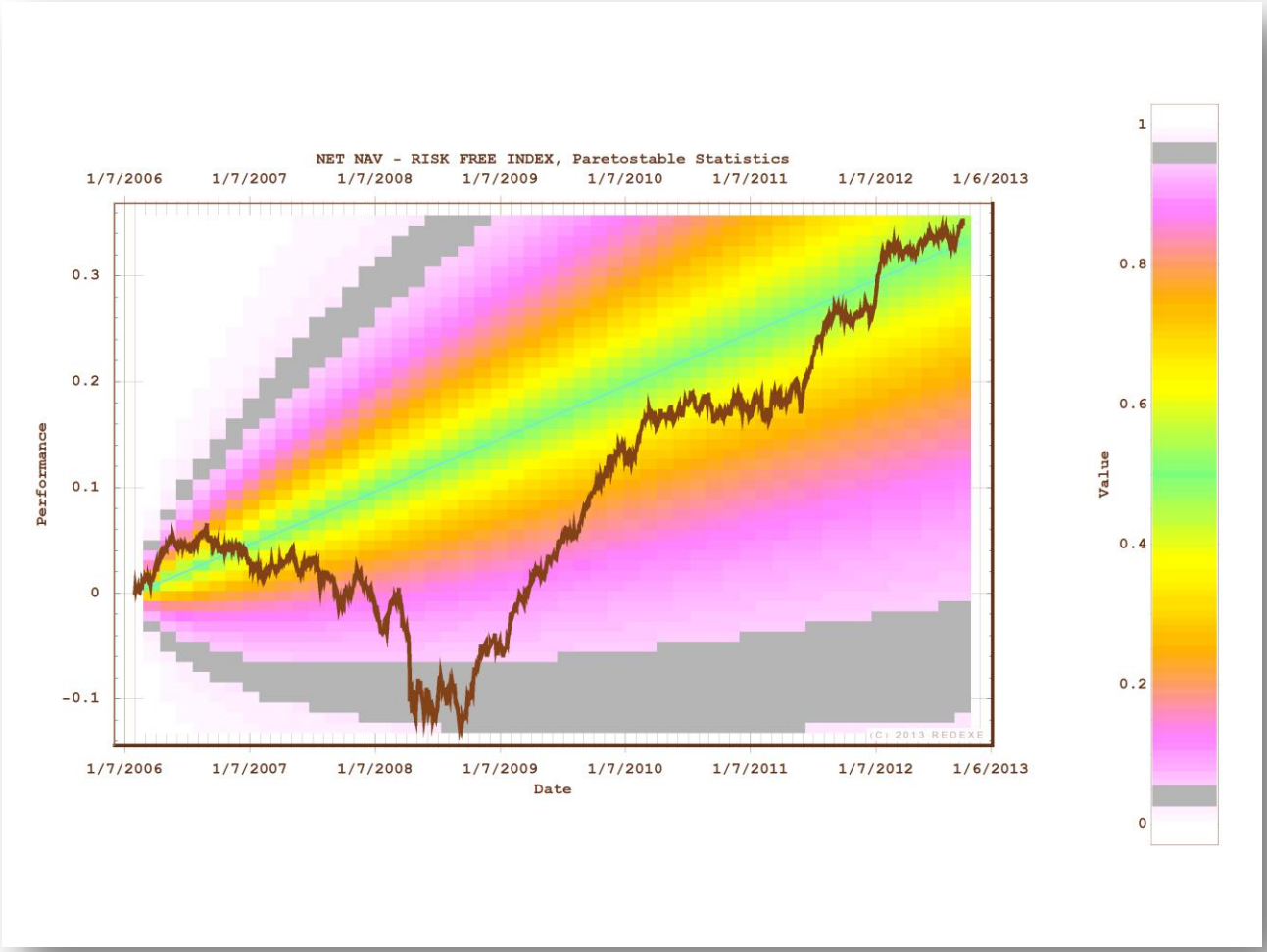
The green area indicates that the performance is on target, yellow and orange areas raise an alert, the purple zone suggests reviewing the investment process and the grey stripes (centile 2.5-5.0) suggest to stop and review the investment model.

Using this chart, the Asset Manager is able to check out the performance and to evaluate the magnitude of the shift with the target, if any. He will actually be able to plan an action in both under and over-performance scenarios, maybe retuning the model.

This chart may be also used as a real "agreement" between the Asset Manager and the Investors[9], as it allows an easy-to-understand comparison of the achieved performance versus the ex-ante declared one.

[8] In a Pareto-Lévy Stable framework, the volatility may be defined as the fitting scale parameter by the square root of two. In this way, when the stability exponent Alpha is exactly 2, i.e., in the normal case, the so defined volatility leads to the classical definition, see for example the **slidecast** *www.slideshare.net/redexe/stable-distributions-003*

[9] See for example the **video** *youtu.be/FzBCjXQ7fVE* [Italian] Riccardo Donati, *Un patto con l'Investitore ed una guida per l'Asset Manager: il campo di probabilità stabile*, University of Parma, 2010.



From Date	1/8/2006
To Date	12/3/2013
Days	2415.
Stable Alpha	1.7
Stable Beta	0
Target Log Perf.	330.822×10^{-3}
Achieved Log Perf.	351.759×10^{-3}
Target Log Perf. Y	$50. \times 10^{-3}$
Achieved Log Perf. Y	53.1644×10^{-3}
Target Log Vola Y	$60. \times 10^{-3}$
Target Log Vola	182.336×10^{-3}
Achieved Quantile	545.998×10^{-3}

3.5 RISK BUDGETING

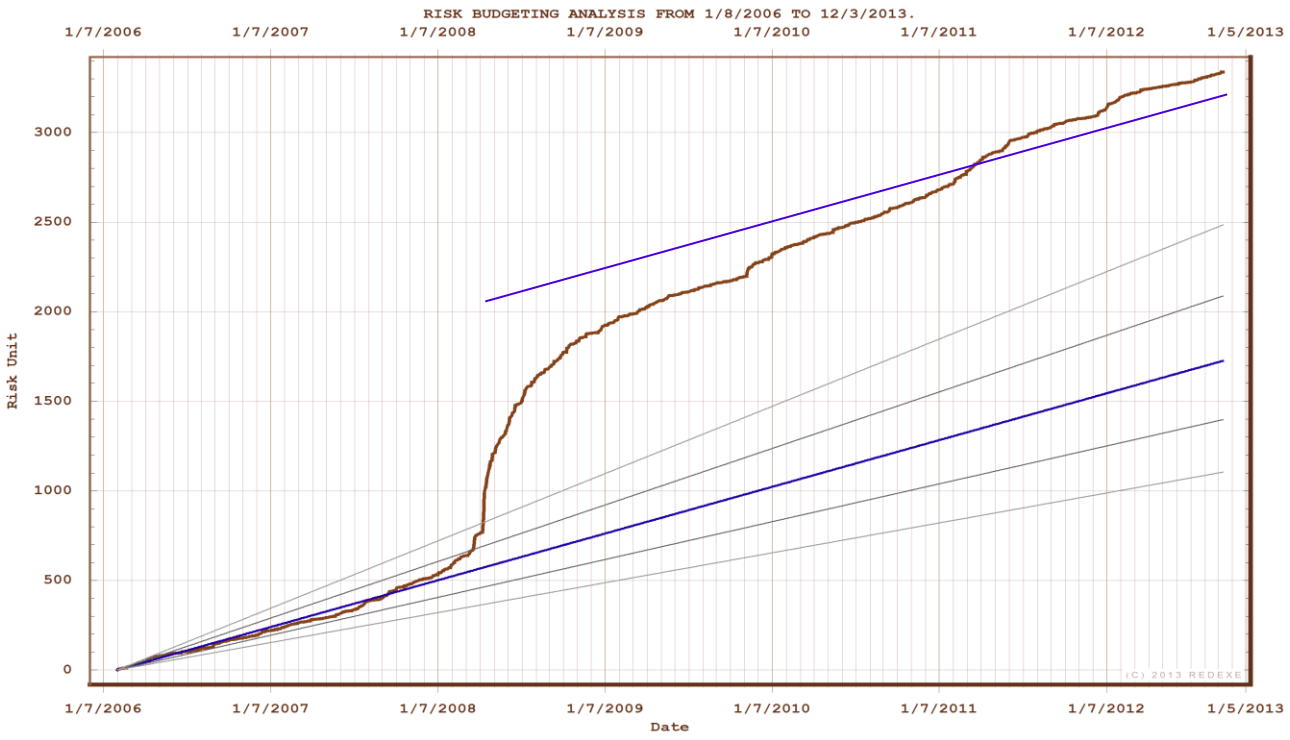
Our proprietary model is shown through an intuitive graphical representation. The Asset Manager has a risk budget that grows of one risk unit per-session, in blue. When he decides to invest in risky assets, he uses a part of the accumulated risk budget, according to the effective risk assumed, in brown.

We help the Asset Manager to plan risk usage, calculating the historical risk consumption vs. the budgeted one. In this way, the Asset Manager is not forced to enter into mathematical details and is free to focus on risk planning, according to his investment ideas.

Moreover, this method protects not only against an excessive risk usage, but also against risk waste, commonly seen in VAR-centric risk frameworks.

The target volatility is set to 6% yy, and stability exponent Alpha to 1.7.

The grey lines represent a 10% and 20% shift from target volatility.



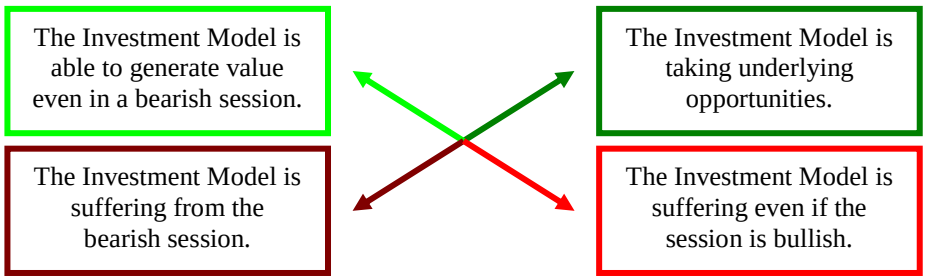
From Date	1/8/2006
To Date	12/3/2013
Delta T	1.4
Target Lévy Std %Y	6.
Stability Exponent	1.7
Risk Budget	1725
Risk Expense	3338.02
Measured Standard Std %Y	5.08839
Measured Wiener Std %Y	5.09175
Measured Lévy Std %Y	8.31874

3.6 STYLE ANALYSIS

Style drifts are under control with our monitoring tool.

We draw the <OPPORTUNITY INDEX> against the <GROSS NAV> in a scatter plot. Time flow is represented through coloured arrows, starting from red and fading to blue. In this way, we can study the response of the Investment Model to the opportunities or to the difficulties arising from the underlying assets.

Every arrow represents one market session. The direction of each arrow tells us that



For example, a trend following, long only management style, will draw anti-clockwise loops in the chart, due to the hysteresis of the response.

Style drifts are promptly pointed out, allowing the Asset Manager to correct or improve his investment strategy.