SMART^2 BETA TOTAL RETURN STRATEGIES

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Agenda

Introduction

Portable smart beta vs. portable alpha

Smart^2 Beta Total Return Strategies

Principles
Building blocks
Efficient risk hedging methodology + market timing
Diversification of portable smart beta building blocks
Historical excess performance evolution

Conclusions and outlook

Appendix

Introduction

- Smart beta, non cap-weighted indices increasingly popular in the last 15 years, given their observed long term outperformance potential with respect to their (“dumb”?) cap weighted counterparts
- Over 400 smart beta ETFs with close to $500 bn AuMs. Plenty of new smart beta indices (based on different drivers, geographies and methodologies) from different index providers
- Need for **smart approach to smart beta selection** = SMART^2 BETA
- Outperformance of smart beta vs. cap-weighted indices may provide an opportunity to enhance the performance of cash, or of an arbitrary market index, by exploiting **portable performance** techniques

Portable Smart Beta vs. Portable Alpha: Concept

Portable alpha strategy (first introduced by PIMCO, used since late 80's)

Portable smart beta strategy

Portable Smart Beta vs. Portable Alpha: Advantages

	Portable Smart Beta	Portable Alpha
Transparency	High (index composition immediately available)	Low (positions disclosed with delay)
Cost	Low (even negative on some net return indices, due to tax recovery on dividends)	High (management/performance fees)
Liquidity	High (many smart beta indices tracked by ETF's)	Low (potential problems with management of flows)
Funding needs	Low: possibility to apply a moderate degree of leverage	High

Smart^2 Beta Total Return Strategies: Principles

Smart^2 Beta Total Return Strategies are based on three key principles:

1. **Optimal selection** of portable smart beta building blocks, supported by theory
2. **Efficient risk hedging methodology**, based on the notion of **volatility targeting**, designed to maximize risk premium harvesting from each portable smart beta source, as a function of the underlying equity market environment.

   Market timing, aiming to minimize the risk of suffering large drawdowns from exposure to individual portable smart beta sources when the underlying risk factors are not remunerated
3. **Diversification** of portable smart beta building blocks on different geographies (USA, Europe, Japan, to begin with) and on the chosen smart beta methodologies within a **risk- weighted portfolio**

Since 2013 Smart^2 Beta Total Return Strategies have been successfully used at Ersel to gain exposure to alternative equity risk premium

1. Smart^2 Beta Total Return Strategies: Building Blocks

By using the stochastic portfolio theory framework, analytically show that a precise combination of smart beta strategies emerges as the optimal solution of the relative drift maximization problem at fixed tracking error risk budget.

***Stochastic portfolio theory optimization and the origin of rule-based investments*, G.O., Quantitative Finance, Vol. 15, N.8, 2015**

- Optimal solution based on the **linear combination of four smart beta «seeds»: equal weight, minimum variance, high dividend yield and inverse volatility**
- Theoretical Interest of the result: derivation of smart beta indices from «utility» maximization perspective

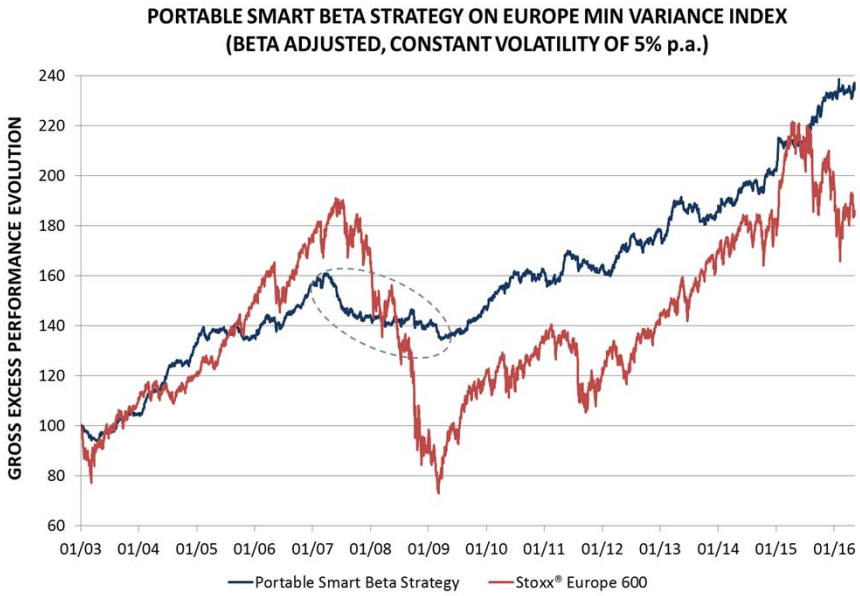
1.

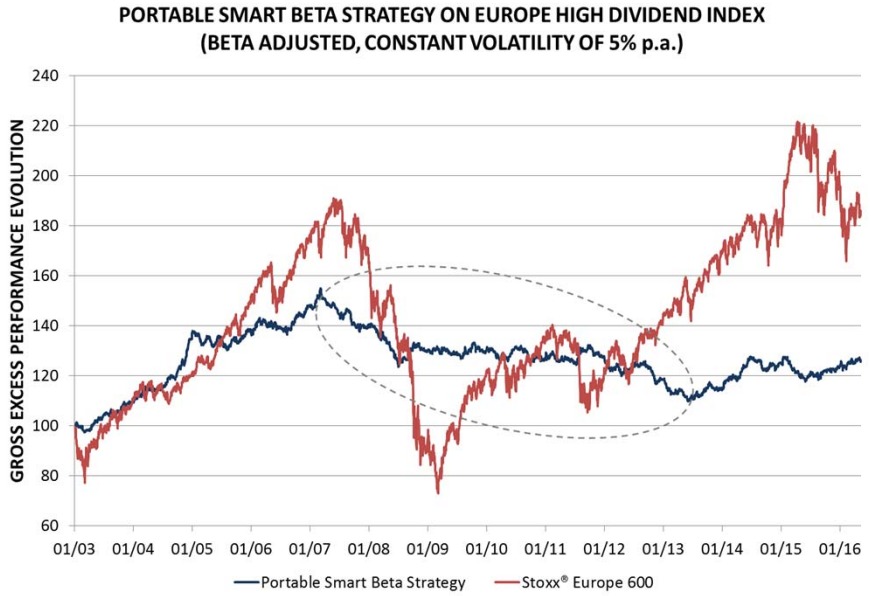
Investigate the possibility of building an investment strategy based on portable performance techniques applied to a STOXX index-based proxy of the optimal smart beta index selection we identified.

***STOXX® Index-Based Risk-Controlled Portable Smart Beta Strategies*, G.O., available at https://www.stoxx.com/stoxx-insights**

2.

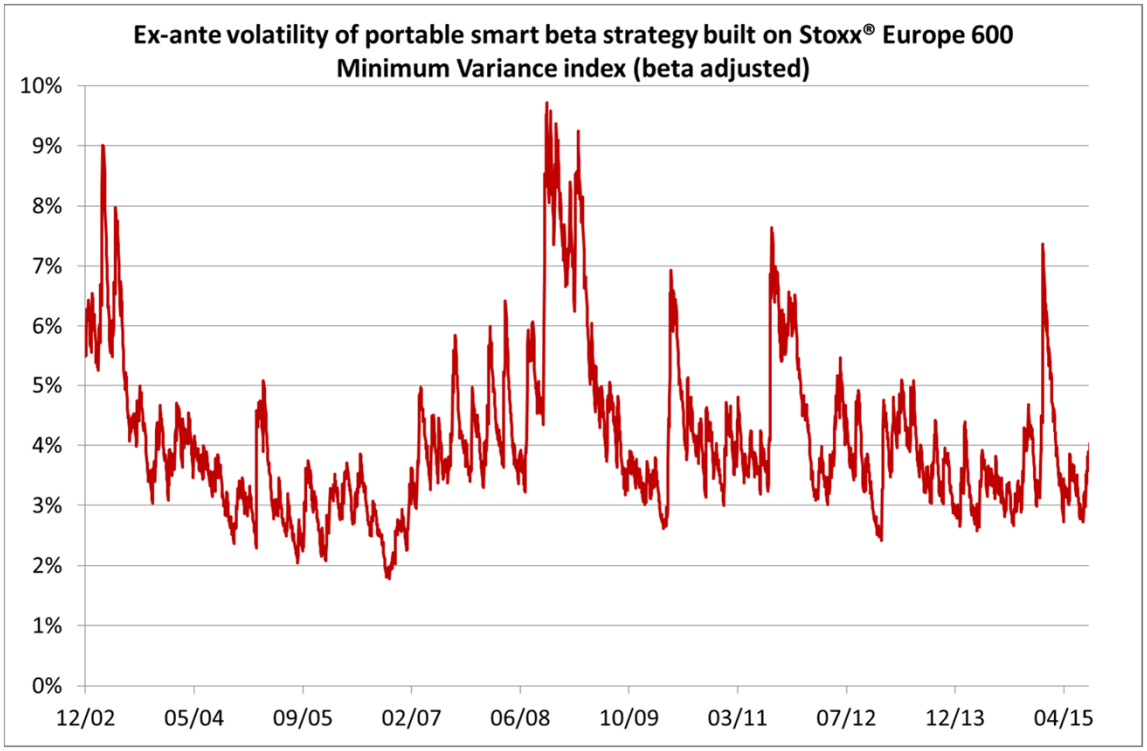
2. Portable smart beta strategies: why market timing?





*Source STOXX; data between Dec 2002 and Apr 2016; own calculations

2. Portable smart beta strategies: why volatility targeting?



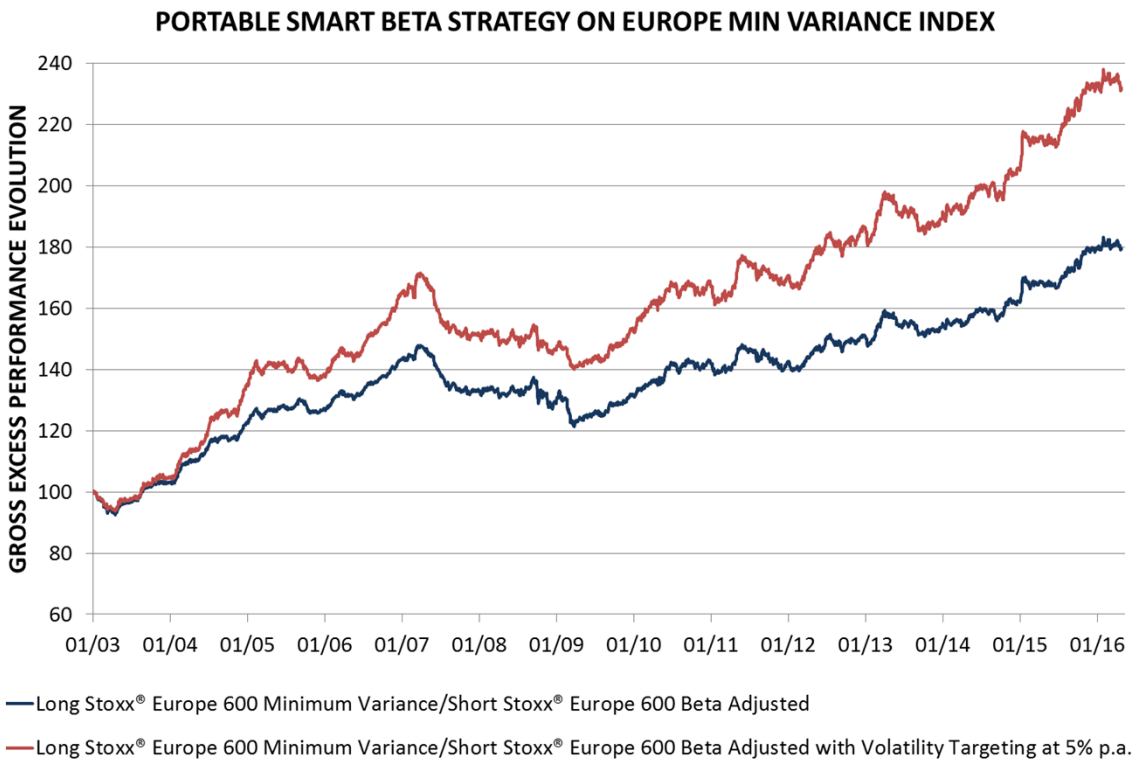
Source: STOXX, data between Dec 2002 and Aug 2015; own calculations

RELATIVE VOLATILITY behaviour subject to strong variations

IDEA: decrease (increase) active exposures in periods of high (low) relative volatility

VOLATILITY TARGETING (Giese, 2010) has been mathematically proved to improve efficiency of any strategy with positive long term expected Sharpe ratio

2. Volatility targeting: benefits



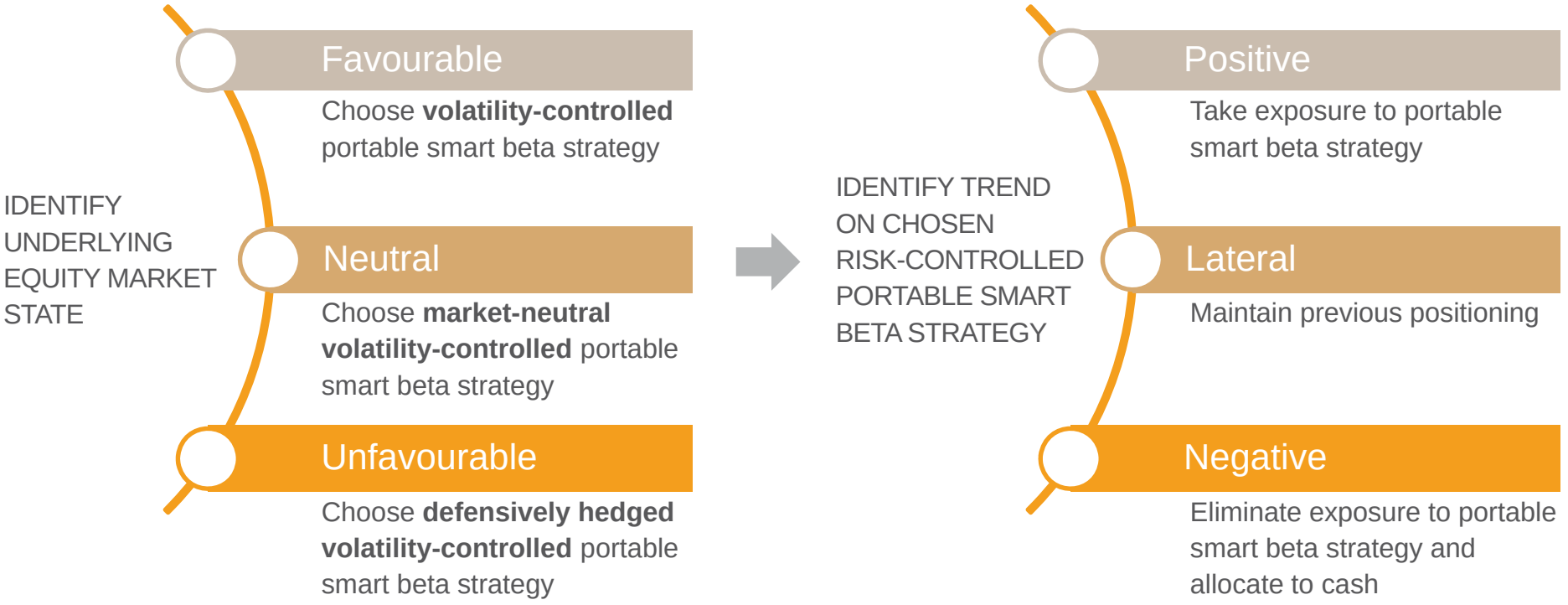
Ann Return	4,48%
Volatility	4,55%
Semi vol	2,71%
Skew	-0,13
Kurt	5,39
Sharpe Ratio	0,99
Sortino	1,65
Omega	1,18
Max Drawdown	-18,08%

Ann Return	6,57%
Volatility	5,30%
Semi vol	3,09%
Skew	-0,14
Kurt	4,59
Sharpe Ratio	1,24
Sortino	2,12
Omega	1,22
Max Drawdown	-18,30%

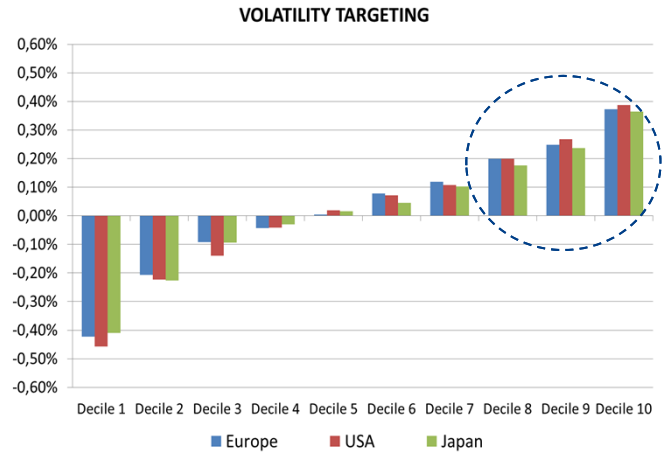
2. Volatility targeting-based market risk hedging techniques

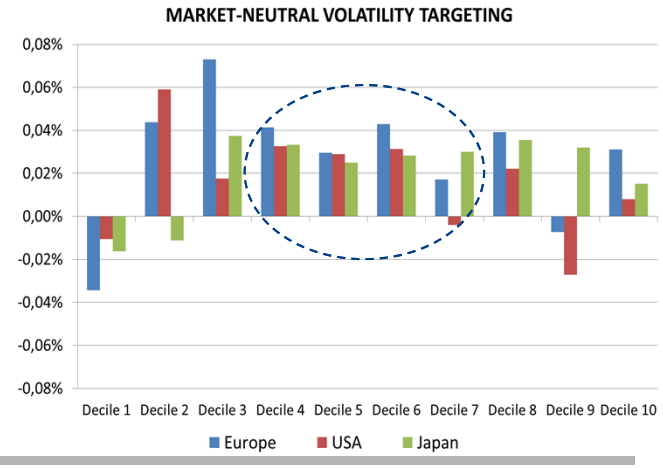
Market Risk Hedging Technique	Definition	Characteristics
Volatility targeting	Determine hedging instrument weight allowing to achieve a **constant target volatility** objective	Constant volatility Low degree of positive market directionality
Market-neutral volatility targeting	Determine hedging instrument weight allowing to achieve **beta neutrality**, with **constant target volatility** objective	Constant volatility No directional exposure
Defensive volatility targeting	Determine hedging instrument weight allowing to achieve **money neutrality**, with **constant target volatility** objective	Constant volatility Possible low degree of negative market directionality

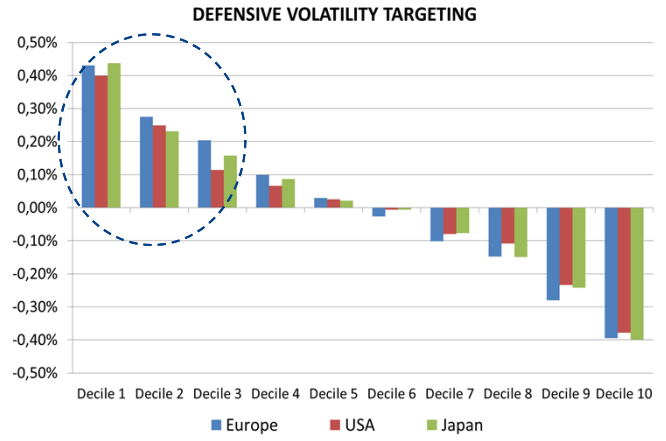
2. Efficient risk hedging methodology + market timing: process



2. Comparison of risk hedging techniques: portable smart beta strategies based on minimum variance indices



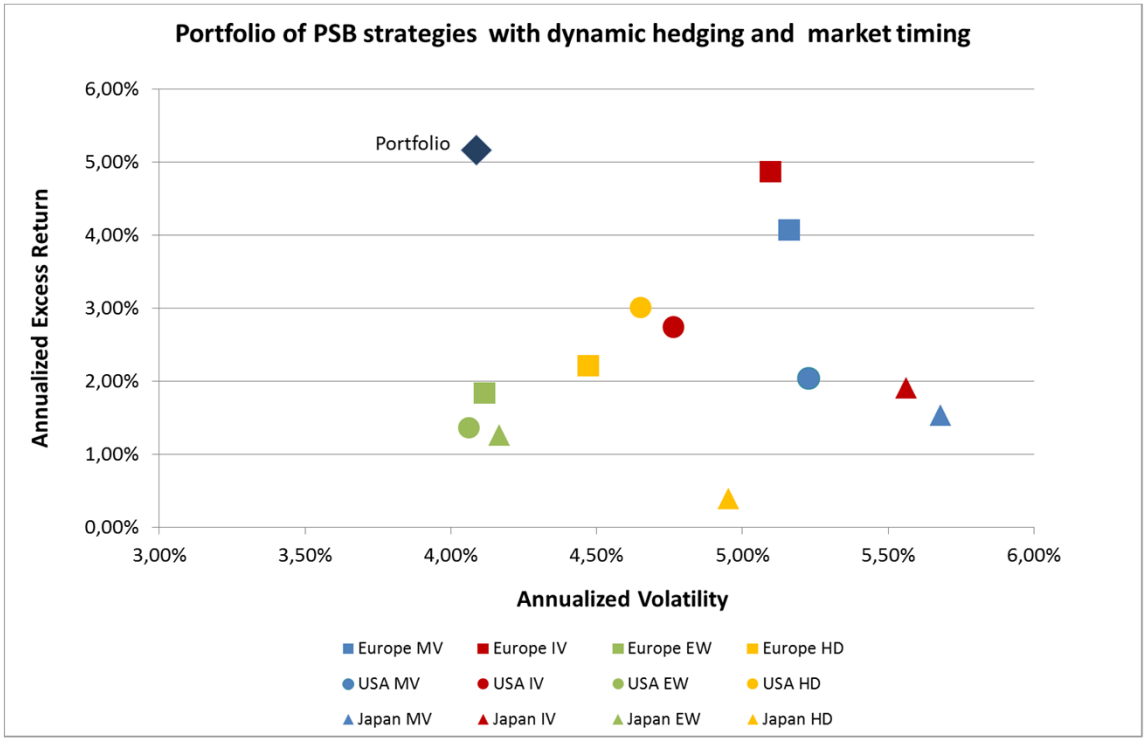




- Compute average daily returns of portable smart beta strategies for different deciles of underlying market performance **(optionality profile)**
- Volatility targeting optimal in best deciles of underlying market return
- Market neutral volatility-targeting optimal in intermediate deciles of underlying market return
- Defensive volatility targeting optimal in worst deciles of underlying market return

**Source STOXX; data between Dec 2002 and Mar 2016; own calculations*

3. Diversification of portable smart beta building blocks



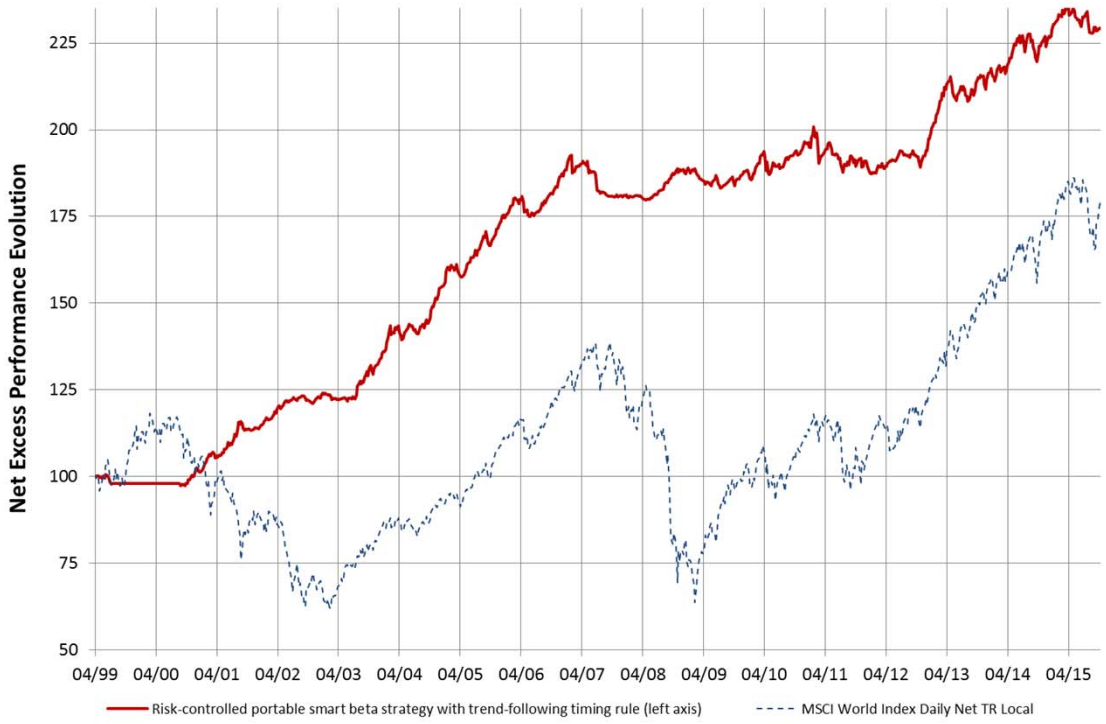
Aggregate individual portable smart beta strategies within risk weighted portfolio.

Risk weighted portfolio similar to equally weighted portfolio, since all portable smart beta building blocks target the same volatility (5% p.a.).

Combined solution shows significant improvement in efficiency.

**Source STOXX; data between Apr 1999 and Mar 2016; own calculations*

3. Smart^2 Beta Total Return Strategy: historical excess performance evolution



	Combined Portfolio Statistics
	Net Results
Data sample	Apr 99-Mar 16
Annualized return	5,17%
Annualized volatility	4,09%
Annualized semivolatility	2,44%
Skewness	-0,57
Kurtosis	6,60
Sharpe ratio	1,26
Sortino ratio	2,12
Omega ratio	1,63
Calmar ratio	0,76
Maximum drawdown	-6,80%
Ulcer index	2,75

**Source STOXX; data between Apr 1999 and Mar 2016; own calculations*

Conclusions and outlook

Portable smart beta strategies represent a cheap and transparent performance enhancement opportunity

The smart beta portfolio maximizing relative long term drift w.r.t cap-weighted benchmark is composed by a limited number of elementary smart beta “seeds”

Ersel proposes Smart^2 Beta Total Return strategies, based on an optimal and geographically diversified selection of portable smart beta building blocks, subject to efficient risk hedging/market timing algorithms, combined in a risk-weighted portfolio

Ersel will launch in Q3 2016 a new systematic total return UCITS fund, Leadersel Alternative Beta (target annualized volatility of 4%, annualized return objective EONIA+2%), implementing the Smart^2 Beta Total Return approach on selections of STOXX indices covering global developed equity markets

Appendix

Long term outperformance of smart beta indices: conventional explanations

Smart beta index vs. BM (beta adj., constant TE risk of 5% p.a.)	Time Window	Intercept	Market Factor	Size Factor	Value Factor	Momentum Factor	Coeff. of Determination
Stoxx® Europe 600 Minimum Variance	2002 - 2004	1,31%**	0,13	0,27**	-0,58**	0,11*	20,85%
	2004 - 2007	0,22%	0,11	0,29*	0,45	0,07	19,92%
	2007- 2010	0,31%	0,03	0,18**	-0,03	0,01	8,78%
	2010 - 2013	0,11%	0,04	0,08	-0,26*	0,21**	31,21%
	2013 - 2015	0,37%	0,09	0,06	-0,45**	0,28**	46,44%
	2002- 2015	0,49%***	0,08***	0,19***	-0,22**	0,07***	11,68%
Stoxx® Europe Low Risk Weighted 300	2002 - 2004	1,23%**	0,23**	0,54***	-0,35	0,00	26,80%
	2004 - 2007	0,45%	-0,02	0,51***	0,70**	0,05	20,97%
	2007- 2010	0,62%**	0,01	0,26***	0,17	-0,06	26,20%
	2010 - 2013	0,43%**	0,08**	0,24*	-0,26**	0,22***	40,01%
	2013 - 2015	0,36%	0,14**	0,24	-0,72***	0,02	49,83%
	2002- 2015	0,78%***	0,08***	0,30***	-0,15*	-0,02	11,28%
Stoxx® Europe 600 Equal Weight	2002 - 2004	-0,25%	0,31***	0,59***	0,23	-0,17***	58,53%
	2004 - 2007	-0,10%	0,15**	0,71***	0,54***	0,13	66,48%
	2007- 2010	0,40%**	0,04*	0,41***	0,25**	-0,01	59,85%
	2010 - 2013	-0,08%	0,12***	0,69***	0,10*	0,08*	64,84%
	2013 - 2015	0,06%	0,19***	0,75***	-0,21	0,02	58,02%
	2002- 2015	0,29%**	0,12***	0,53***	0,06	-0,04	46,20%
Stoxx® Europe Select Dividend 30	2002 - 2004	0,64%*	0,12*	0,23*	0,05	0,01	13,91%
	2004 - 2007	0,24%	-0,14	0,12	0,52**	-0,05	10,70%
	2007- 2010	-0,31%	-0,13***	0,09	0,14	-0,11**	32,66%
	2010 - 2013	-0,14%	-0,08*	-0,16	0,07	-0,01	8,40%
	2013 - 2015	-0,03%	-0,04	0,19	-0,27	-0,08	7,11%
	2002- 2015	0,19%*	-0,08***	0,07*	0,11*	-0,06*	5,79%

Traditional and alternative risk factor exposures help to explain relative performance

Significant positive size factor exposures, particularly in the equal weight index vs. BM (no surprise)

Exposure to value and momentum factors not persistent and sometimes counterintuitive

Source: STOXX, for style index data http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html, own calculations

Long term outperformance of smart beta indices: mathematical derivation

- Stochastic portfolio theory (Fernholz, 1987): descriptive theory of financial markets
- Accounts for impact of compounding and rebalancing, often neglected in literature
- Equation describing relative performance of generic portfolio vs. cap-weighted benchmark:

$$\Delta \log\left(\frac{P(t)}{BM(t)}\right) = \sum_{i=1}^{n} w_i(t)\Delta \log(w_{BM,i}(t)) + \sum_{i=1}^{n} \delta_i(t)\left(w_i(t) - w_{BM,i}(t)\right)\Delta t + \frac{1}{2}\left[\sum_{i=1}^{n} w_i(t)\Sigma_{ii}(t) - \sum_{i,j=1}^{n} w_i(t)\Sigma_{ij}(t)w_j(t)\right]\Delta t$$

Stochastic noise, depending on random market weight changes

Drift component, depending on differential dividend rate of return and on «excess growth rate»

Excess growth rate and long term outperformance of smart beta indices

Stochastic noise bounded if portfolio weights independent of market-cap weights

$$\sum_{i=1}^{n} w_i(t)\Delta\log(w_{\mathrm{BM},i}(t)) = \Delta\log\left[\prod_{i=1}^{n} w_{\mathrm{BM},i}(t)^{w_i(t)}\right]$$

Remains bounded if market is diverse and coherent (i.e. no market weight declines to zero too rapidly)

EXCESS GROWTH RATE

Difference between portfolio-weighted average of asset variances and portfolio variance.

Always positive for a long-only portfolio

$$\gamma_{\pi}^{\star}(t) = \left[\sum_{i=1}^{n} w_i(t)\Sigma_{ii}(t) - \sum_{i,j=1}^{n} w_i(t)\Sigma_{ij}(t)w_j(t)\right]$$

Similar to diversification ratio in maximum diversification approach of Choueifaty and Coignard (2008)

CONSEQUENCE

Any weighting scheme independent of market-cap weights should out perform the cap-weighted benchmark in the long term.

Correlation among timed portable smart beta building blocks

	Europe MV	Europe IV	Europe EW	Europe HD	USA MV	USA IV	USA EW	USA HD	Japan MV	Japan IV	Japan EW	Japan HD
Europe MV	100%	69%	40%	39%	28%	25%	21%	21%	17%	18%	14%	15%
Europe IV	69%	100%	65%	45%	32%	27%	30%	22%	15%	17%	18%	16%
Europe EW	40%	65%	100%	42%	23%	12%	38%	16%	11%	8%	19%	12%
Europe HD	39%	45%	42%	100%	17%	13%	20%	15%	7%	8%	9%	10%
USA MV	28%	32%	23%	17%	100%	73%	51%	53%	3%	2%	4%	3%
USA IV	25%	27%	12%	13%	73%	100%	37%	65%	4%	5%	5%	5%
USA EW	21%	30%	38%	20%	51%	37%	100%	45%	2%	1%	6%	8%
USA HD	21%	22%	16%	15%	53%	65%	45%	100%	5%	6%	7%	9%
Japan MV	17%	15%	11%	7%	3%	4%	2%	5%	100%	74%	58%	57%
Japan IV	18%	17%	8%	8%	2%	5%	1%	6%	74%	100%	56%	48%
Japan EW	14%	18%	19%	9%	4%	5%	6%	7%	58%	56%	100%	53%
Japan HD	15%	16%	12%	10%	3%	5%	8%	9%	57%	48%	53%	100%

- Strong correlation among smart beta indices belonging to same geography
- Lower correlation among smart beta indices belonging to different geographies (country diversification makes sense).

**Source STOXX; data between Apr 1999 and Mar 2016; own calculations*