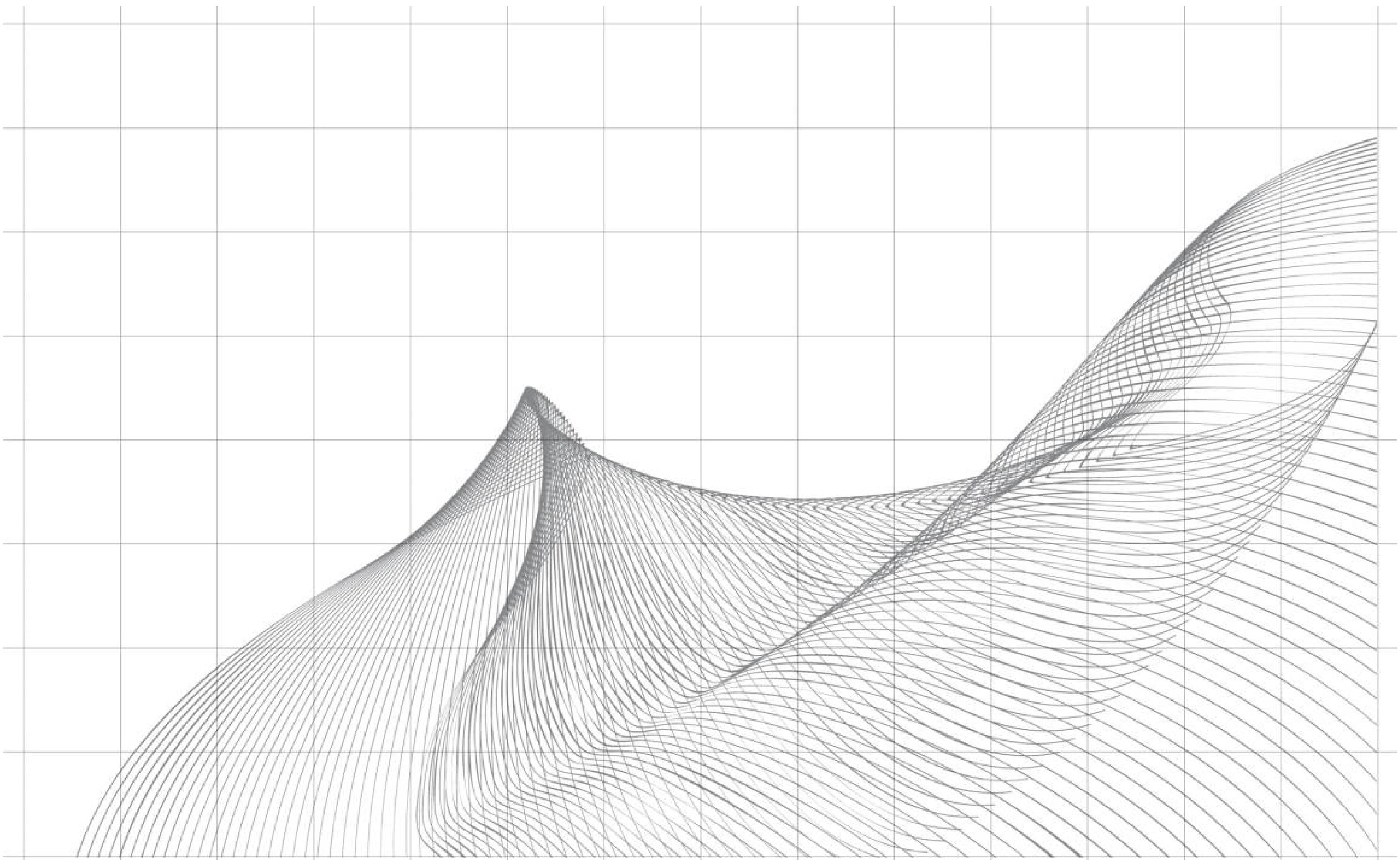
The Anti-Benchmark and stock-specific risk

July 2013



The Anti-Benchmark and stock-specific risk

1. Defining exposure to a risk factor

Intuitively speaking, just looking at a portfolio's weightings does not give a complete picture of the nature of this portfolio's exposures.

Let us consider a Japanese stock portfolio

Let us try to answer 2 questions about this portfolio.

Question 1: *How much is the portfolio exposed to oil price variations?*

In order to answer this question, you should not run to your office and count the barrels of oil in the portfolio! The scientific answer to this question is to compute the portfolio's correlation to the variations of the price of oil.

Question 2: *How much is the portfolio exposed to the variations in Toyota's stock price?*

The answer to this question is not simply that you hold 2.5% in Toyota shares in the portfolio! If these 2.5% are combined with the remaining 97.5% stocks that are not correlated to Toyota, your exposure to Toyota is lower than if you had only 1% of Toyota and the remaining 99% where highly correlated to Toyota.

The scientific answer to this question is thus to compute the degree to which the portfolio is correlated to the variations of Toyota's stock price!

A portfolio's true exposure to any given phenomena (or source of risk) is measured by the portfolio's correlation to this source of risk, whether this source of risk is the price of oil, inflation… or the price of Toyota!

Portfolio exposure to a risk factor = ρ (P, Risk factor)

As such, what matters is not the weight of a stock or a sector in the portfolio, but rather the portfolio's correlation to the risk factor it represents.

2. TOBAM's Most Diversified Portfolio – review

TOBAM's Diversification Ratio (the "DR") extracts the number of effective factor exposures contained in a portfolio.

$$DR(P) = \frac{\text{Combination of the risk}}{\text{Risk of the combination}}$$

$$= \frac{(\sigma_1 w_1 + \sigma_2 w_2 + \ldots + \sigma_n w_n)}{\sigma_P}$$

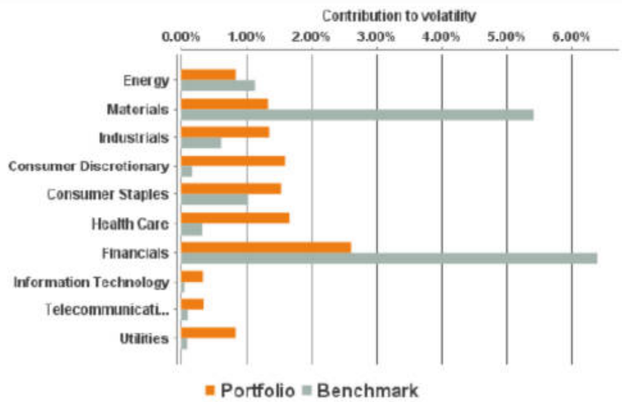
The weighted average of stock volatilities

Portfolio Volatility

A highly concentrated portfolio – not in number of positions, but in a particular sector a perhaps a certain style – will be characterized by a low DR. Conversely, a portfolio exposed to a broad distribution of diverse risk factors will have a relatively high DR, regardless of the physical number of positions:

	Anti-Benchmark Australia Equity	MSCI Daily TR Net Australia Local
Diversification Ratio	1.89	1.43

* Sources of Volatility (Ex ante)



Source: TOBAM, Factsheet as of 31st August 2011

As such, maximizing the DR is equivalent to maximizing the degree to which the portfolio is exposed to independent risk factors. Such a portfolio, the "Most Diversified Portfolio," is also the portfolio that minimizes idiosyncratic risk.

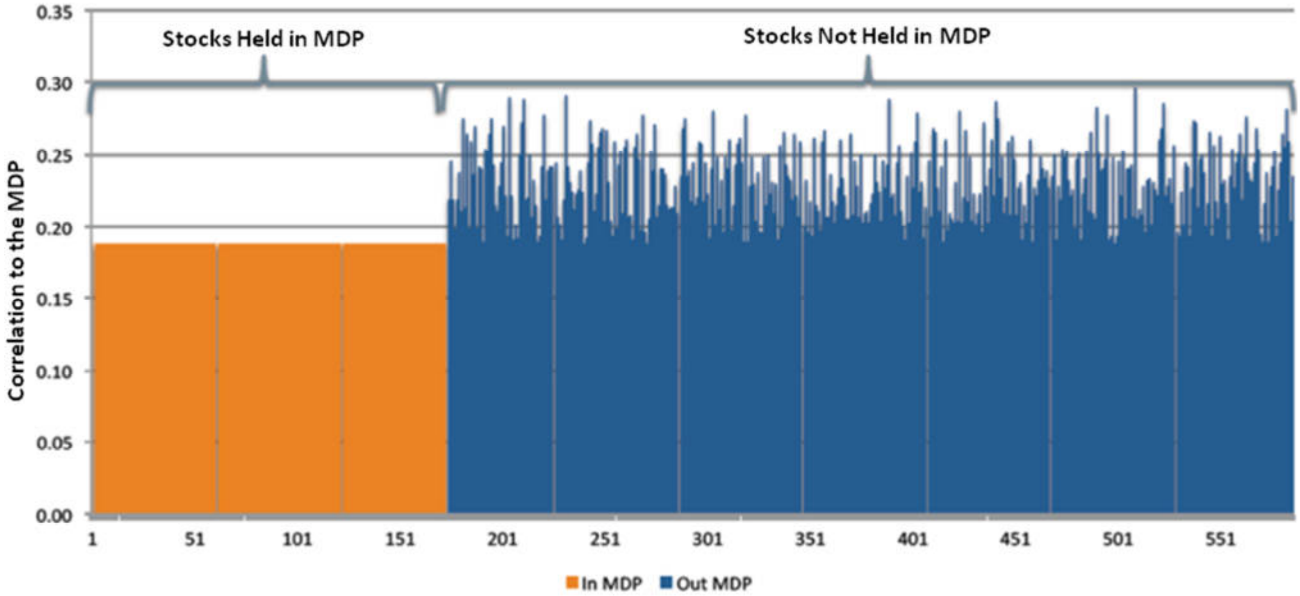
3. TOBAM's Most Diversified Portfolio and idiosyncratic risk

i. The "minimum idiosyncratic risk" portfolio is the portfolio that is the least exposed to any individual stock in the universe. As a reminder, exposure means correlation.

ii. TOBAM's research has proven that the Anti-Benchmark is the only portfolio that is less correlated to any of its holdings than to any stock it is not holding. This is, by the way, why it does not hold these other stocks.

> *"Any stock not held by the MDP is more correlated to the MDP than any of the stocks that belong to it. Moreover, all stocks belonging to the MDP have the same correlation to it."* [1]

The graph below illustrates the correlation of stocks, both within and outside of the portfolio, to the Anti-Benchmark portfolio:



Source: TOBAM, Factset.
The above chart is for illustrative purposes only.

"The TOBAM team…constructs a "maximum diversification" portfolio that has an equal and lowest-possible correlation with its constituent holdings, and for which all excluded assets would boost the correlations, if included."

-*"Beyond Cap Weight" by Rob Arnott, Research Affiliates Inc., Journal of Indexes , Jan 2010*

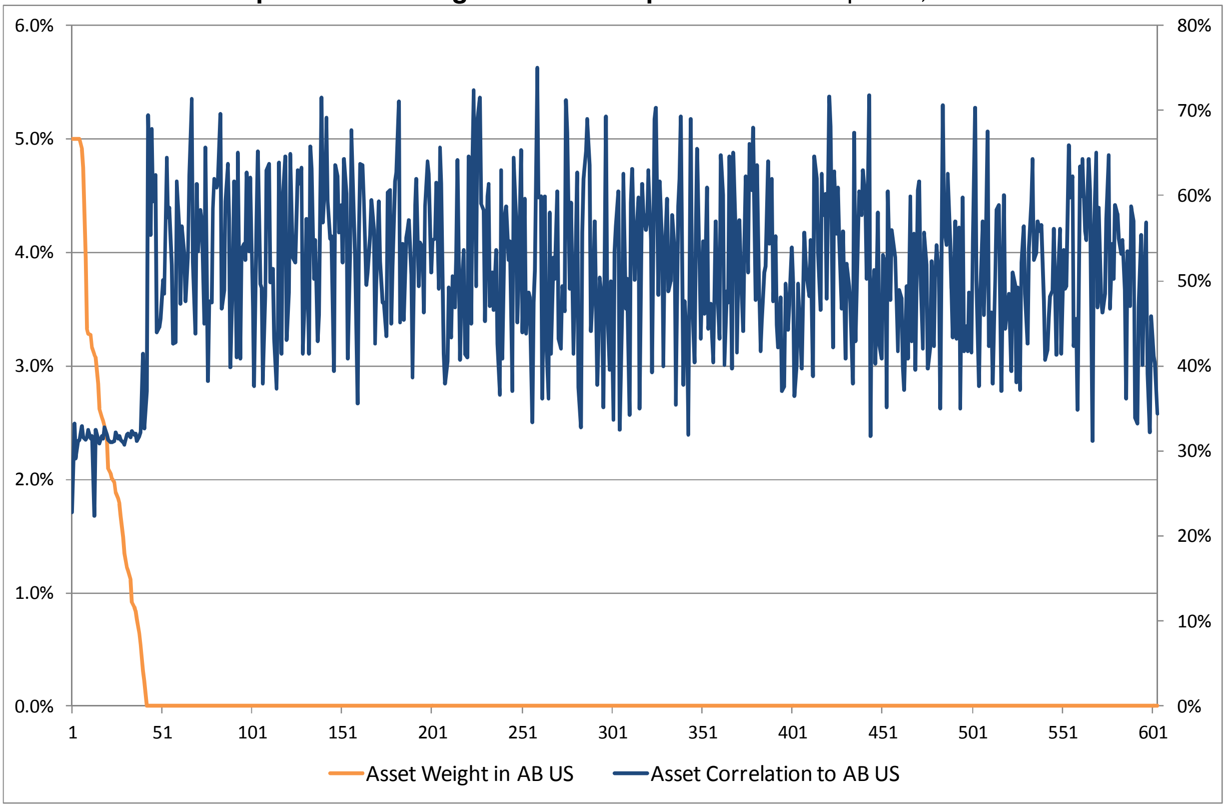
[1] Choueifaty, Yves; Froidure, Tristan; Reynier, Julien; « Properties of the Most Diversified Portfolio », *Journal of Investment Strategies, Vol. 2 No. 2, Spring 2013, pages 5-6.*

4. Illustrations

The Anti-Benchmark portfolio is less correlated to the stocks it *holds* than to the stocks it *does not hold.*

As an illustration, the following graph charts the correlation of each stock in the investment universe with the Anti-Benchmark US portfolio (based on 30/04/2013 portfolio):

Correlations of each portfolio holding to the AB US portfolio As of April 30, 2013



Source: TOBAM. The above chart is for illustrative purposes only, and represents a version of the AB US portfolio with no turnover.

Note: two stocks (A and B) included in the MDP are less correlated to the MDP that the other stocks within the portfolio: for the above implementation, TOBAM capped the weight of any stock to 5% (Stock A: CenturyLink) and capped the stock-specific contribution to volatility to 5% (Stock B: Facebook). Due to these constraints, the weighting of these stocks in the AB is lower than it would be in an unconstrained model. Consequently, the correlations of these stocks to the AB portfolio are lower.

Impact on Sector Allocation

The property further illustrates that all assets in the universe considered are effectively represented in the MDP, even if the portfolio does not physically hold them. For example, an MDP portfolio constructed using S&P 500 stocks may hold approximately 50 stocks. That does not mean, however, that this portfolio is not diversified, as the 450 stocks it does not hold are more correlated to the MDP compared with the 50 stocks it actually holds. This is consistent with the notion that the MDP is the undiversifiable portfolio.

At the sector level: regardless of a stock's sector label, the AB aims to select the least correlated stocks from a bottom-up perspective. This means that the AB portfolio will also favor the most diversifying sectors.

For example, the following table shows the AB US portfolio's average correlations with each industry sector, as of April 30, 2013:

Sector Correlations with AB US Portfolio

Sectors	***AB Correlation to Sector****	***AB Weight*****
Energy	76.11%	0.25%
Materials	80.14%	3.78%
Industrials	81.21%	8.60%
Consumer Discretionary	85.23%	18.46%
Consumer Staples	73.89%	16.02%
Health Care	76.60%	13.81%
Financials	79.31%	8.31%
Information Technology	74.60%	8.27%
Telecommunication Services	57.52%	8.86%
Utilities	60.68%	13.63%

** average one-year correlation of daily returns*

*** portfolio weight as of 30.04.2013*

As indicated, the portfolio holds only 0.25% in Energy stocks, and its fourth largest sector holding is in the Utilities sector. At first glance, one might be tempted to conclude that the portfolio has a virtually no exposure to the Energy sector, and a rather high exposure to the Utilities sector. This conclusion would be correct if all sectors were uncorrelated. This is clearly not the case; it is possible, for example, for a portfolio to invest in a given sector (A) that is highly correlated to another sector (B), and as such achieve a significant exposure to sector B, without actually holding any stock belonging to it.

The table illustrates this phenomenon: the Anti-Benchmark is actually more correlated to the Energy sector – in which its allocation is close to 0 – compared to the Utility sector – to which it has a sizeable allocation. The resulting sector allocation consistently favors the *most diversified* sectors that also have the *most diversifying* potential compared to other sectors.

Impact on Performance

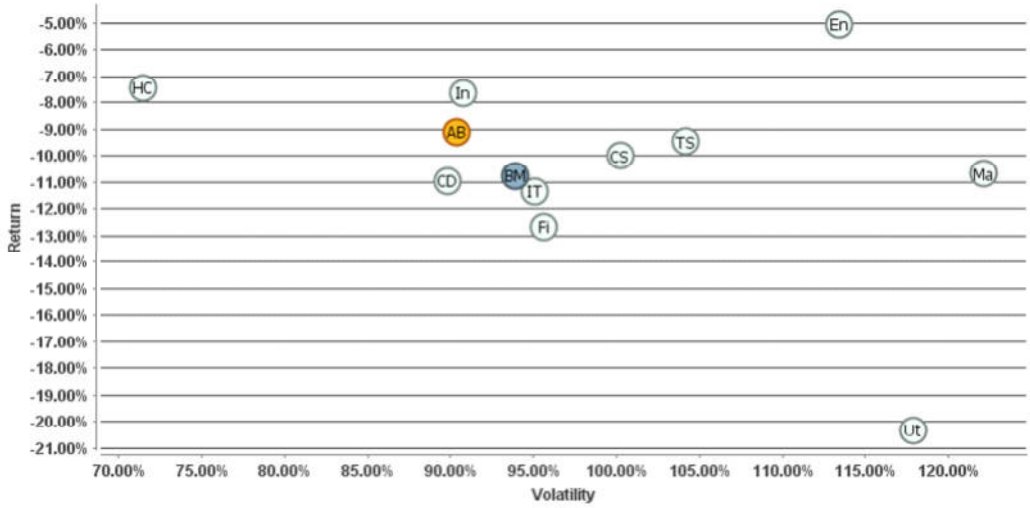
The consequence of the above property is that Anti-Benchmark portfolios are particularly protected against an idiosyncratic sharp price drop.

For example, we consider the Japan stock market decline over the eight days following the Fukushima event in March 2011. This decline was led by the Utilities sector, whose volatility rose to 120% and whose performance sank by -20%, due to its constituent Electric Power companies. At the time, the AB Japan portfolio held 4.54% of Tepco vs. 1.28% in the index.

The graph below plots the risk and return of the benchmark, its constituent sectors and the Anti-Benchmark portfolio over the eight days following the Fukushima event. We note in particular that:

- Although the Utilities sector was hit hardest, the overall effect of Utilities sector performance is not homogenous: Gas companies such as Tokyo Gas benefited the portfolio (+0.47% for the period).
- The Energy Sector resisted quite well overall because it mainly includes Oil companies (energy alternative to Electric Power, within the Utilities sector)
- The Health Care sector was one of the least volatile.

AB Japan: Risk/Return by sector
March 10-18, 2011



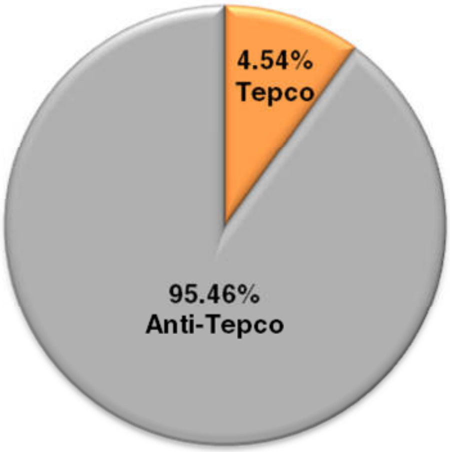
AB	Anti-Benchmark	BM	Benchmark
CS	Consumer Staples	HC	Health Care
UT	Utilities	FI	Financials
IT	Information Technology	CD	Consumer Discretionary
IN	Industrials	MA	Materials
EN	Energy	TS	Telecom Services

Source: TOBAM, Bloomberg

Although the AB Japan held a significant allocation to Utilities compared to the index (21.31% vs. 5.15% for the index, including a large holding in Tepco (4.54% at the beginning of March), which declined a cool 56% over these eight days, the portfolio nonetheless outperformed the index mainly thanks to its strong stock selection in Financials (+1.39% relative to the index), significant exposure to Health Care, and stock selection in Consumer Discretionary.

As a result, the AB Japan portfolio registered strong outperformance for the year 2011:

		Year 2011
Performance		
TOBAM Anti-Benchmark Japan		-9.31%
MSCI Japan TR		-18.13%
	Δ	*+9.42%*
Volatility		
TOBAM Anti-Benchmark Japan		18.13%
MSCI Japan TR		23.49%
	Δ	*-5.36%*
	% of volatility reduction	*-23%*



Source: TOBAM

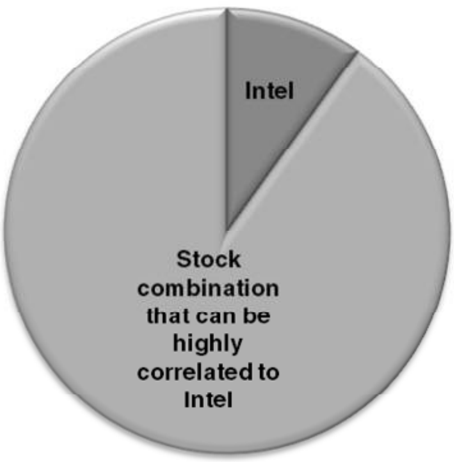
The Anti-Benchmark is the portfolio that is the most immune to its own mistakes:

The Anti-Benchmark's overall risk composition – the fact that each of its holdings is the most decorrelated from the rest of the fund – protected the fund's performance throughout the year.

We can therefore think of the Anti-Benchmark as the combination of a risk source and its "anti-risk source."

The Anti-Benchmark and stock-specific risk:

Benchmark



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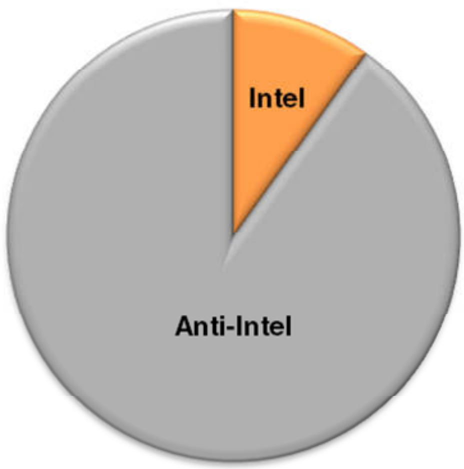
Anti-Benchmark



Source: TOBAM. The above chart is for illustrative purposes only.

TOBAM*
Core investments

For more information

TOBAM is an asset management company offering innovative investment capabilities whose aim is to maximize diversification. TOBAM's flagship Anti-Benchmark® strategies, supported by original research and a mathematical definition of diversification, provide clients with diversified core equity exposure, both globally and in domestic markets. FTSE also publishes the FTSE TOBAM Maximum Diversification Index Series based on the Anti-Benchmark equity portfolio construction methodology. The company manages over $4.3 billion via its Anti-Benchmark strategies for institutional clients worldwide. Its team includes eighteen financial professionals.

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