# Maximum Diversification Portfolio & Risk Factor Exposure

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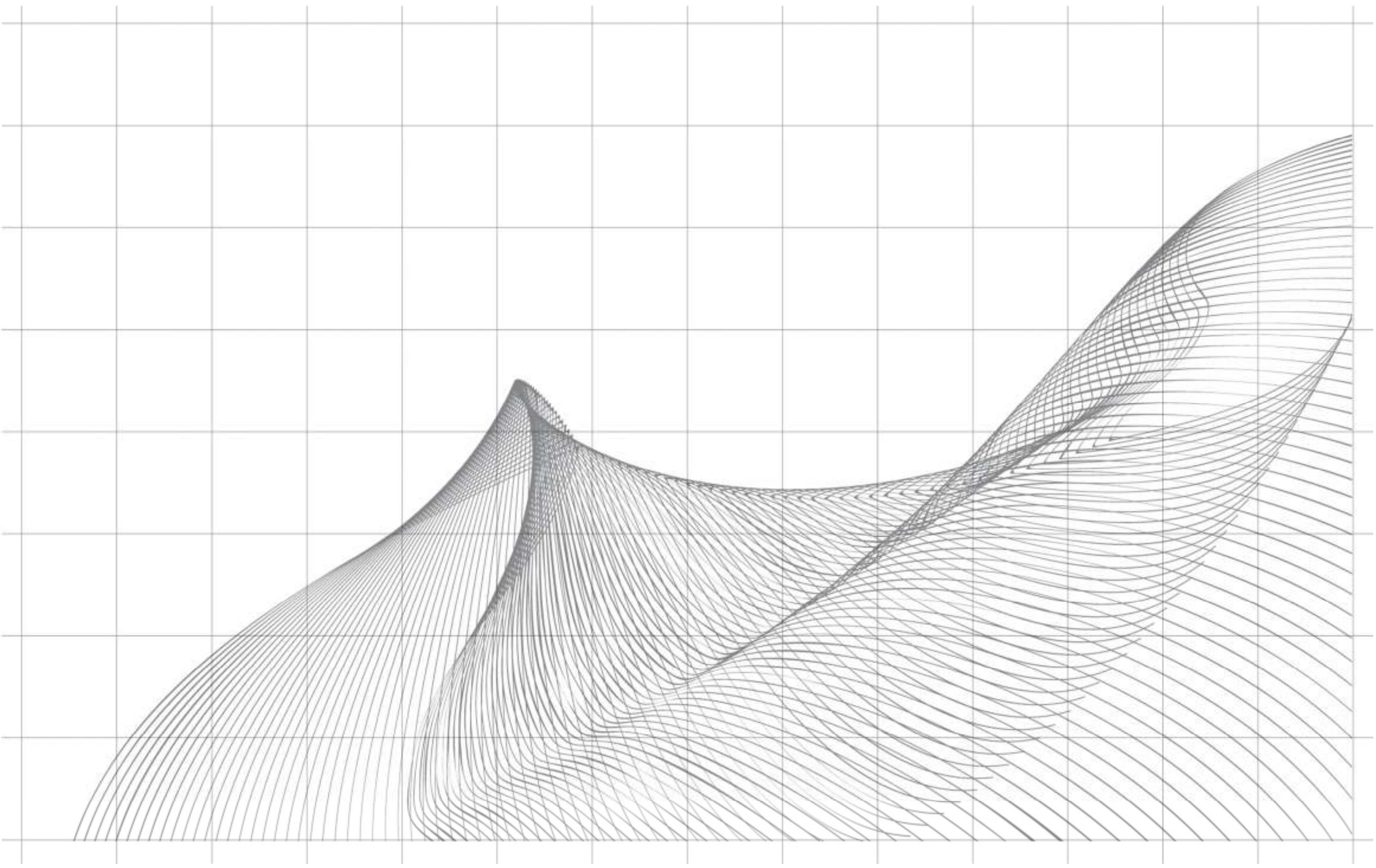

# Introduction

In this note we analyse the benefits of the Anti-Benchmark in the context of Risk Factor allocation.

Our aim is to illustrate that the Anti-Benchmark is evenly exposed to all the available sources of risk and also an appreciated diversifier relatively to the other Risk Factor Driven strategies.

# 1/ Even exposure to all available risk factors

TOBAM's "intelligent Beta" approach aims to go the distance in maximizing diversification from the outset. Other non-market capitalization approaches could be biased toward a single investment style and/or certain risk characteristics (low volatility stocks, value stocks, growth stocks…).

TOBAM's Anti-Benchmark approach is designed to capture the risk premium of an asset class evenly from all the independent risk factors available in the market at any given time, in other words, to explicitly avoid biases in terms of market cap, sector or style. The Anti-Benchmark does not identify risk factors; the even exposure to the sources of risk is an outcome of maximizing the Diversification Ratio (DR). The even exposure, being a result of maximizing diversification, is a unique property of the Anti-Benchmark.

For this reason, we apply as few constraints as possible, in order to avoid unwanted systematic exposures, and to ensure that the most diversified portfolio is free of style bias or other biases. Style analyses conducted by global consultants or independent risk analysis providers conclude that TOBAM's portfolios consistently display a "core" style profile.

- No factor bias in absolute terms $\Rightarrow$ Even exposure to all risk factors as a result of maximizing the DR

- The Anti-Benchmark maximizes the number of independent effective sources of risk: Anti-Benchmark ⇔ Max DR (P)

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

  ⇔ Max number of independent effective sources of risk

- In relative terms:
  - The cap-weighted benchmark builds concentrations or "bets," which are dynamic and do not result in wealth creation as they consist of adding to positions or "bets" that were successful in the past.
  - Other non-market capitalization approaches could be biased toward a single investment style and/or certain risk characteristics (low volatility stocks, value stocks, growth stocks…).

# 2/ Empirical illustrations (Fama French)

The above statement is completely sound even from a theoretical point of view, in the below we have shown some empirical illustrations.

## World Developed Region

Regression of the Anti-Benchmark excess returns vs. the MSCI World, the Value/Growth and Small/Large Factors (Dec 30, 1999 – Dec 31, 2013):

| 30/12/1999 - 31/12/2013 | AB World | | MSCI World | Small/Large | Value/Growth | Intercept |
|---|---|---|---|---|---|---|
| **AB World Annualized Excess Return** | **9.05%** | **=** | **2.78%** | **1.18%** | **0.21%** | **4.87%** |
| **Coefficients** | | | 0.61 | 0.23 | 0.07 | |
| Regression t-statistic | | | 121.44 | 18.11 | 7.87 | 3.55 |
| Level of significance | | | 100.0% | 100.0% | 100.0% | 100.0% |

- The Beta of 0.61 to the MSCI World Index and, the Fama-French factors' relative small contribution to the Anti-Benchmark excess return, indicates that the outperformance of the Anti-Benchmark is mostly explained by the intercept (the residual) and is therefore not only explained by common market factors or common investment styles.

## Emerging Markets Region

Regression of the Anti-Benchmark excess returns vs. the MSCI EM, the Value/Growth and Small/Large Factors (Dec 29, 2000- Dec 31, 2013, daily returns)

| 29/12/2000 - 31/12/2013 | AB EM | | MSCI EM | Small/Large | Value/Growth | Intercept |
|---|---|---|---|---|---|---|
| **AB EM Annualized Excess Return** | **16.01%** | **=** | **9.83%** | **1.63%** | **0.10%** | **4.45%** |
| **Coefficients** | | | 0.76 | 0.28 | -0.04 | |
| Regression t-statistic | | | 119.68 | 22.45 | -1.55 | 2.40 |
| Level of significance | | | 100.0% | 100.0% | 87.9% | 98.4% |

*Source: TOBAM.*

- Same as in developed markets, the intercept (what remains after the contribution of the common risk drivers) is the major contributor to the excess returns.

## 3/ Diversifying benefits of the Anti-Benchmark compared to the risk factor driven strategies

### Methodology

The purpose of this part is to analyze the benefits of the Anti-Benchmark in the context of risk factor decomposition. The study concludes that the Anti-Benchmark is an appreciated diversifier relatively to Risk Factor Driven strategies.

We analyze the relative risk/return characteristics of the AB and of a variety of MSCI Indices over a five years period (over a market cycle), split into two regions: Developed Markets and Emerging Markets.

In addition to the regional benchmark, the factors considered in the study are:

1. Growth
2. Value
3. Small capitalizations
4. Large capitalizations

This review illustrates the diversification benefits of the Anti-Benchmark which generally:

- provides a combination of return improvement and volatility reduction
- has the lowest pair-wise correlation among all portfolios
- has the highest pair-wise tracking error among all portfolios

In fact this analysis shows that the AB does what it says on the tin, achieving maximum diversification. The Most Diversified Portfolio (MDP) is by definition the non-diversifiable portfolio.

This means that:

- The MDP is a diversifier to other strategies
- The MDP as a result of maximizing diversification provides an even exposure to all risk factors available

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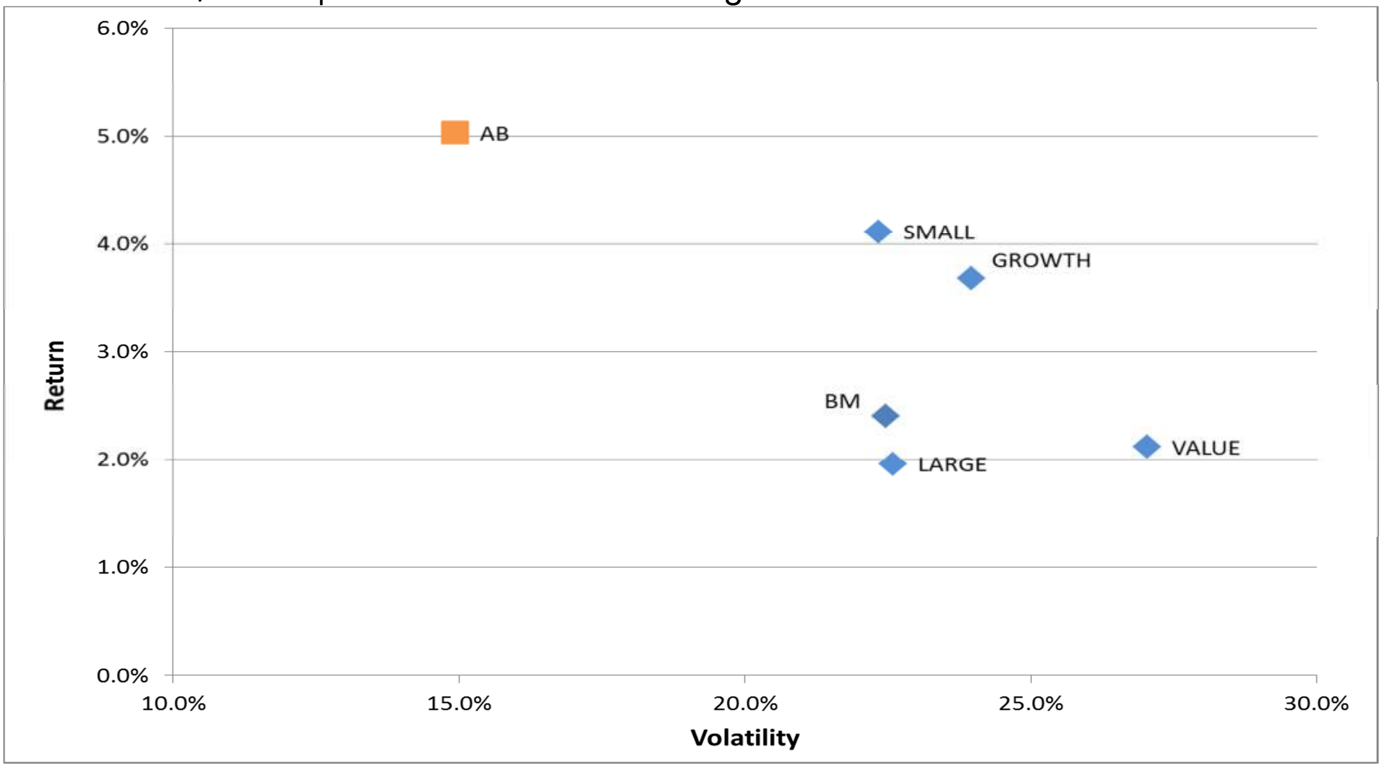
## AB World versus single factors

We look at the period 31/12/2007 – 31/10/2013 using daily data. The indices used are:

- Growth: MSCI Daily TR Net Growth World
- Value : MSCI Daily TR Net Value World
- Small : MSCI Daily TR Net Small Cap World (proxy)
- Large : MSCI World Large Cap Net Total Return (proxy)
- Benchmark: MSCI World TR Net

Chart 1: Risk/Return profile of AB World and single factors




Source: Bloomberg, TOBAM

Table 1: pair-wise correlation and average tracking error, world region

| Correlation | AB | BM | SMALL | LARGE | VALUE | GROWTH | Average | Avg Tracking Error |
|---|---|---|---|---|---|---|---|---|
| AB | | 92% | 91% | 92% | 85% | 87% | 89% | 12.3% |
| BM | 92% | | 98% | 99% | 90% | 91% | 94% | 7.9% |
| SMALL | 91% | 98% | | 95% | 85% | 87% | 91% | 9.6% |
| LARGE | 92% | 99% | 95% | | 91% | 92% | 94% | 8.2% |
| VALUE | 85% | 90% | 85% | 91% | | 96% | 89% | 12.5% |
| GROWTH | 87% | 91% | 87% | 92% | 96% | | 91% | 10.4% |

Source: TOBAM

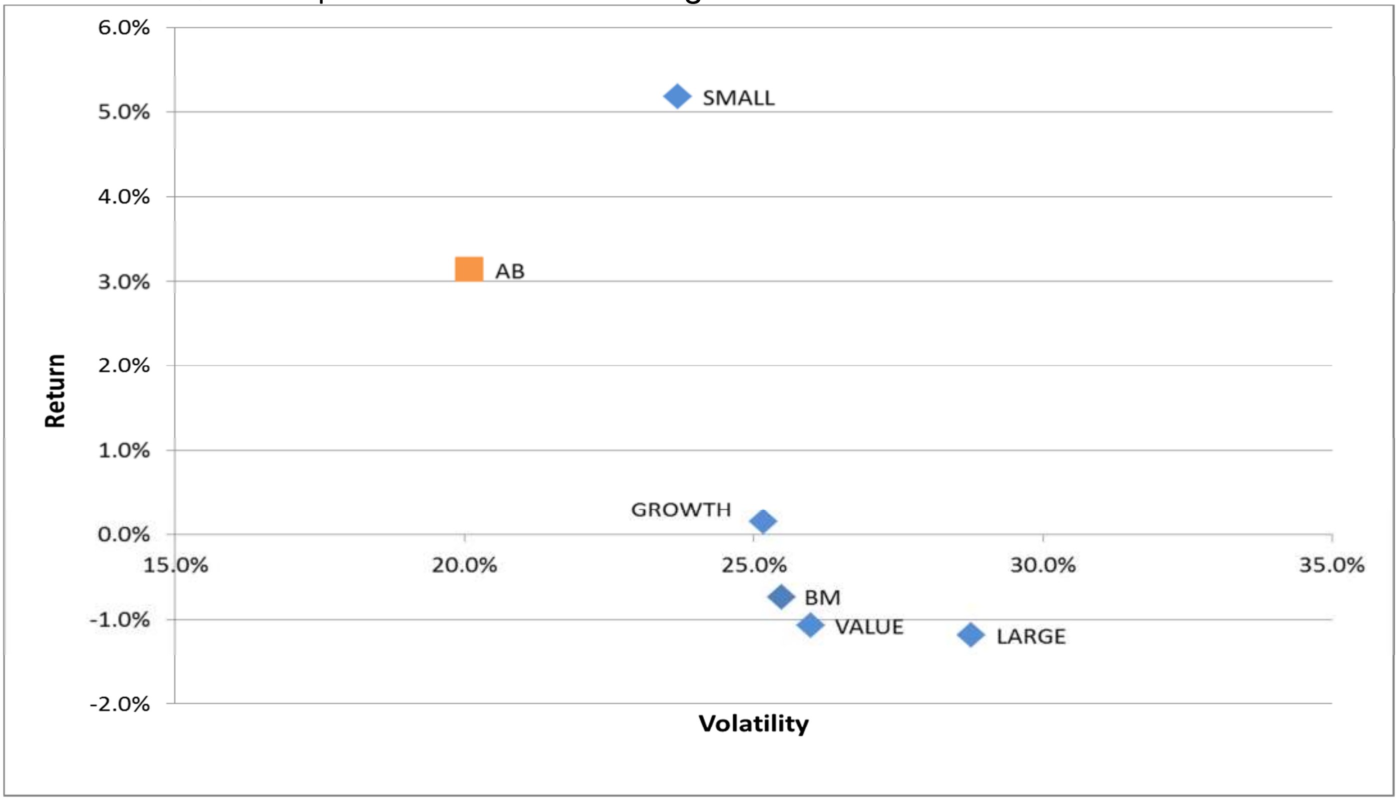
Chart 1 and table 1 show the efficiency of the Anti-Benchmark, which diversifying properties also stands out as having the lowest average correlation and second highest average tracking error to other strategies in the World Developed region.

## AB EM versus single factors

We look at the period 31/12/2007 – 31/10/2013 using daily data. The indices used are:

- Growth: MSCI Daily TR Net Growth EM
- Value : MSCI Daily TR Net Value EM
- Small : MSCI Daily TR Net Small Cap EM (proxy)
- Large : MSCI EM Large Cap Net Total Return (proxy)
- Benchmark: MSCI EM TR Net

Chart 2: Risk/Return profile of AB EM and single factors




Source: Bloomberg, TOBAM

Table 2: pair-wise correlation and average tracking error, EM region

| Correlation | AB | BM | SMALL | LARGE | VALUE | GROWTH | Average | Avg Tracking Error |
|---|---|---|---|---|---|---|---|---|
| AB | | 91% | 92% | 87% | 91% | 91% | 90% | 11.5% |
| BM | 91% | | 97% | 98% | 100% | 100% | 97% | 5.4% |
| SMALL | 92% | 97% | | 93% | 97% | 97% | 95% | 7.8% |
| LARGE | 87% | 98% | 93% | | 98% | 98% | 95% | 9.0% |
| VALUE | 91% | 100% | 97% | 98% | | 99% | 97% | 6.1% |
| GROWTH | 91% | 100% | 97% | 98% | 99% | | 97% | 6.0% |

Source: TOBAM

Chart 2 and table 2 show the efficiency of the Anti-Benchmark, which diversifying properties also stands out as having the lowest average correlation and highest average tracking error to other strategies in the Emerging Markets region

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# 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. The company manages over $5.6 billion via its Anti-Benchmark strategies for institutional clients worldwide. Its team includes twenty four financial professionals.

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