TOBAM*
CORE INVESTMENTS

DIVERSIFICATION DASHBOARD

December 2015

Diversification Ratios

TOBAM's Diversification Ratio (DR) measures to what extent a portfolio is diversified. The DR² (square of the diversification ratio) measures the number of effective degrees of freedom to which a portfolio is exposed.
As the table shows, the "broad market" indices leave diversification on the table. In addition to a snapshot of each market's DR2, the table shows the DR2 of a well-diversified portfolio, and the fraction of available diversification used by the index.

Universe	DR² Index diversification	DR² Maximum diversification	% diversification used by index
MSCI All Countries World	4.13	12.56	32.9%
MSCI World	3.74	11.29	33.1%
MSCI Emerging Markets	4.69	8.61	54.4%
MSCI Canada	3.63	7.92	45.8%
MSCI US Equity	2.54	5.62	45.2%
MSCI Pacific Ex-Japan	2.34	5.29	44.2%
MSCI Japan	2.16	4.06	53.2%
MSCI EMU	1.71	3.68	46.5%
MSCI UK Equity	2.16	3.51	61.4%
MSCI Australia	1.97	3.25	60.7%

Source: TOBAM, figures as of November 30, 2015

We present in this Dashboard a discussion on the recent decline in the Diversification Ratio (DR) both for the Anti-Benchmark® strategies and the benchmark indices, as well as the decrease of the DR²(AB) / DR²(B) ratio.

The recent decline in diversification potential in equity markets and the build-up of market concentrations

1. The recent evolution of equity market diversification

The diversification ratio (DR) measures the diversification of different portfolio strategies. The DR-squared (DR²) represents the number of risk dimensions in a portfolio. By taking the ratio of DR²s between the Anti-Benchmark® and the benchmark, we quantify the diversification advantage of the Anti-Benchmark® strategies vs that of the benchmark. The recent decline in DR² absolute levels and in the DR² ratios vs. the benchmark indices has been observed, to different extents, in most equity universes and Anti-Benchmark® strategies.

In Figures (1.i) and (1.ii) below we present this evolution for the World and the EM stock universes.

Figure 1.i: AB World vs MSCI World - DR² and ratio
December 2010 to October 2015

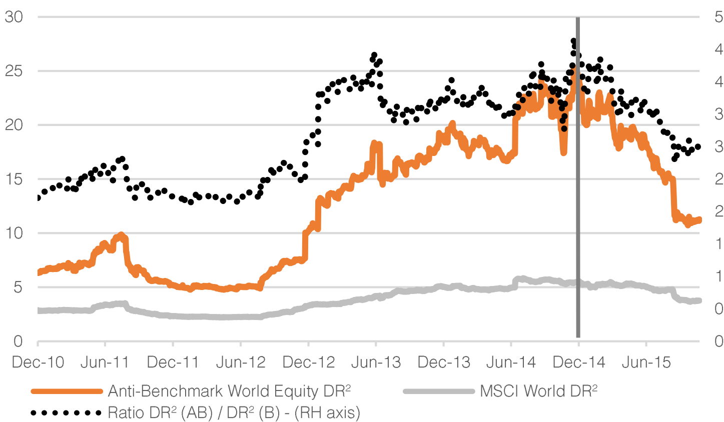
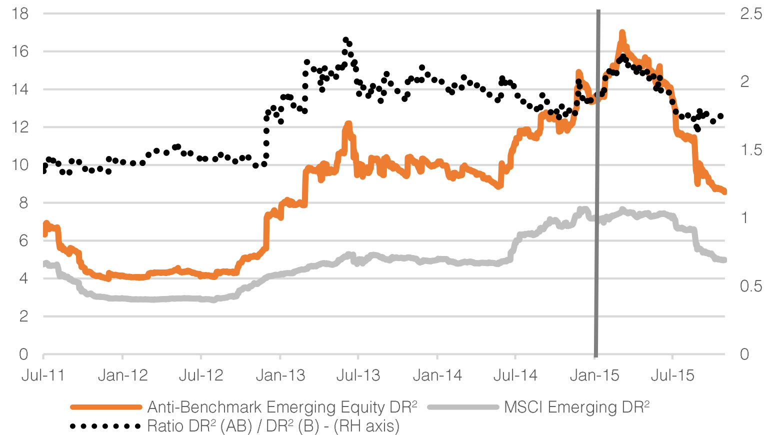


Figure 1.ii: AB EM vs MSCI EM - DR² and ratio
July 2011 to October 2015



Source: TOBAM

From the figures above, we observe a decline in DR² absolute levels beginning in the first quarter of the year, as well as a decrease of the DR² (AB)/ DR² (B) ratio. The decrease in diversification has been a steady process. In order to understand the build-up of market concentration, we will decompose the DR into its components and analyse their evolution.

2. Understanding the drivers of the Diversification Ratio

From the properties of the Diversification Ratio (DR), we know that for any portfolio the DR is **inversely related** to 1) the volatility-weighted average correlation of the assets in the portfolio and to 2) its concentration ratio. That matches the intuition: less correlated assets and less concentrated portfolios must result in a more diversified portfolio, and vice versa.

Mathematically, the DR² decomposition is given by the following formula:

$$DR^2 = \frac{1}{\rho(\boldsymbol{w})\big(1 - CR(\boldsymbol{w})\big) + CR(\boldsymbol{w})}$$

where $\rho(\boldsymbol{w})$ – Rho- denotes the volatility-weighted average correlation of the assets in the portfolio,

$$\rho(\boldsymbol{w}) = \frac{\sum_{i \neq j}\big(w_i\sigma_i w_j\sigma_j\big)\rho_{ij}}{\sum_{i \neq j}\big(w_i\sigma_i w_j\sigma_j\big)}$$

and $CR(\boldsymbol{w})$ denotes the volatility-weighted concentration ratio of the portfolio (not taking into account any correlation effect):

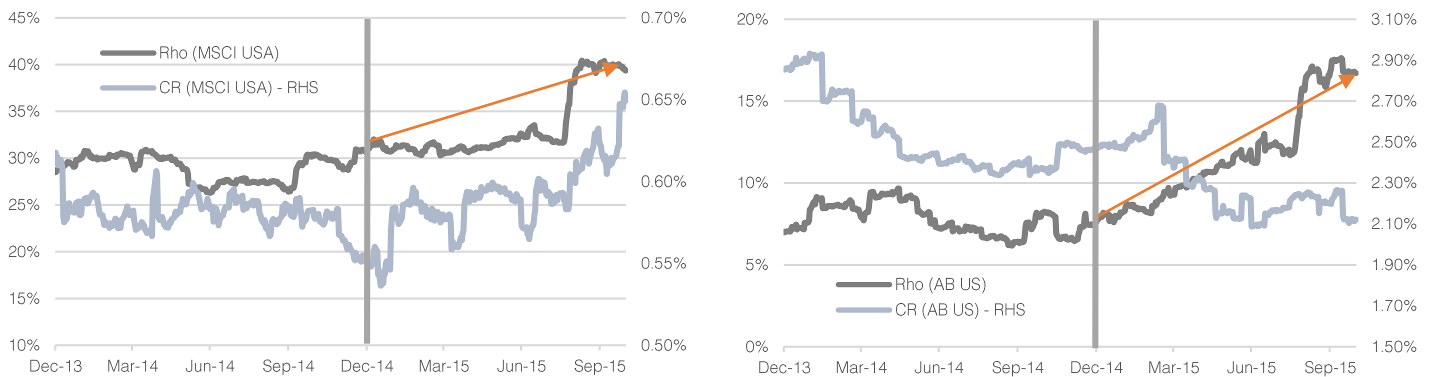
$$CR(\boldsymbol{w}) = \frac{\sum_i (w_i\sigma_i)^2}{(\sum_i w_i\sigma_i)^2}$$

From the formula we see that the DR of a portfolio will increase when the denominator becomes smaller – we need either the Rho or the CR (or both) to decrease. Conversely, a decrease in the DR of a portfolio, as witnessed recently, must be related to an increase in Rho or in the CR or both. What is key is that this decomposition separates the effect of increasing correlations (captured by Rho) from that of a pure risk concentration (as reflected by the CR).

3. The impact of time-varying stock correlations and risk concentrations

Now that we have established how to analyse a move in Diversification Ratios, we put that to use by looking at the evolution of the Anti-Benchmark® strategies, in relation to that of the benchmark indices. In this section, we focus on the US equities universe.

Figure 2: US Equities – Decomposition of the Diversification Ratio into ρ and CR
December 2013 to October 2015



Source: TOBAM

In Figure 2 above we present the dynamics of the volatility-weighted average correlation Rho, and the volatility-weighted concentration ratio (CR), for the MSCI USA and for the Anti-Benchmark® US.

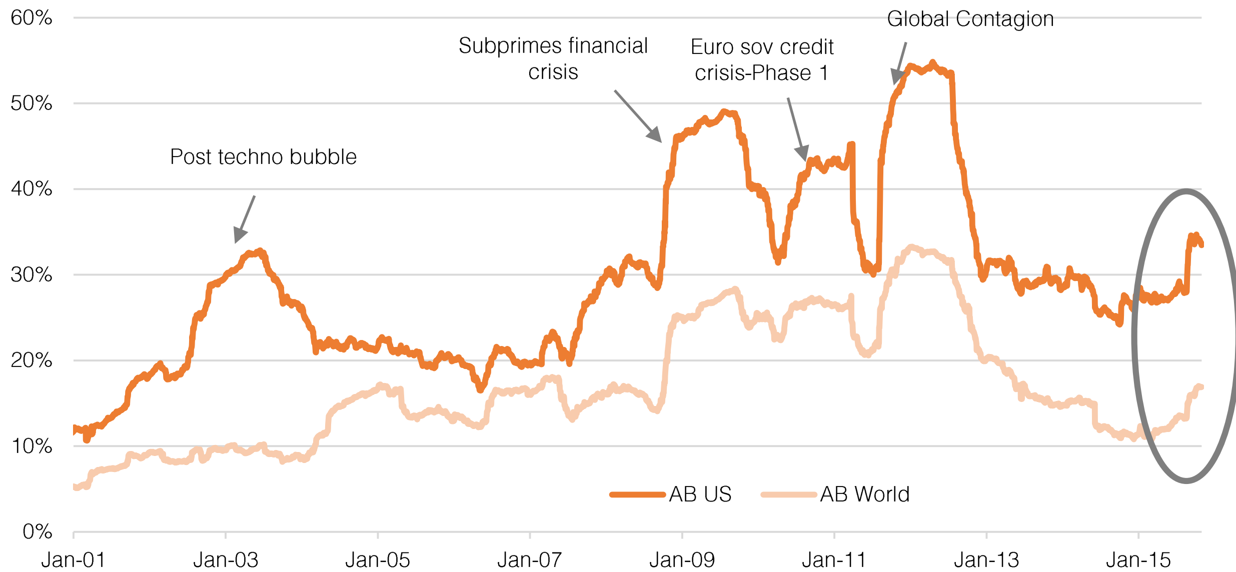
In both cases we observe a very significant increase in the (volatility-weighted) correlations, Rho. For the MSCI USA, we have gone from just above 30% at the beginning of 2015 to about 40% currently. In the case of the Anti-Benchmark®, the move has been from about 8% at the beginning of 2015, to the current 16.5%. This implies that a generalised increase in stock correlations has contributed to the decrease of diversification ratios of both the Anti-Benchmark® strategy and the Benchmark. The fact that the Rho increase has been more important in the case of the AB than in the case of the Benchmark being in line with the decrease of the DR^2 (AB) / DR^2 (B) ratio.

The CR of the MSCI US has strongly increased contributing even more to the decrease of its Diversification Ratio, coherent, by the way, with its outperformance versus the Anti-Benchmark. In contrast, the concentration ratio of the Anti-Benchmark® has actually decreased partially mitigating the effect of the Rho increase in the Diversification Ratio. We stress again that the CR does not take into account correlations. **Stated otherwise, the Anti-Benchmark® has decreased its risk weighted concentration, in a context of strongly rising correlations.**

In order to have a long-term view of the rise in equity correlation, we plot in Figures 3 below, the long-term evolution of the average pairwise correlation of the stocks in the Anti-Benchmark® US and World.

We observe a recent period of a sustained increase in the average pairwise correlation of the stocks in the AB strategies, coming from a relatively low base level. We also remark that the spikes in correlation coincide with negative market moves and their aftermath (2003, 2008, 2010, 2011 and finally, August 2015). In our view, this supports the view that equities correlations increase in periods of market stress but also in periods of slow build-up of risk and market concentration.

Figure 3: AB US & AB World – Average pairwise correlation
January 2001 – October 2015



Source: TOBAM

4. Conclusions

In our view, the market has concentrated as macroeconomic risks mount with the unfolding of the EM crisis and the divergences in Central Bank policies. One indication of the process of market concentration is the recent strong performance of low volatility momentum strategies, which has taken the valuation of these stocks to lofty levels.

We have discussed the decline in the DR of Anti-Benchmark® strategies, both in absolute terms and in relative terms vs. the benchmark. The main conclusion is that the decline in DR is related to an overall increase in the stocks correlations over the last year –as measured by either "Rho" or the average pairwise correlation. In the US, the increase in correlations has been so strong as to outweigh the decrease in concentration ratios of the Anti-Benchmark® strategies.

The divergence in central bank policies could continue, with the Fed just beginning to hike rates (as widely expected) and the ECB and the Bank of Japan facing pressure for an even more accommodative stance. However, given the inflation picture in the US (not a pressing issue at all), the fact that the Fed has begun a tightening cycle suggests, a positive view on the state of the US economy, and as such, an indication of a better risk outlook. The healthy response of the fixed income markets to the rate hike (10-year US Treasury yield actually fell by 6bp to 2.24%) indicates a very well-choreographed move by the Fed. A progressive normalization of the risk outlook for markets could help normalise the diversification potential conditions.

For more information

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