

### **Diversification Dashboard as of October 2014:**

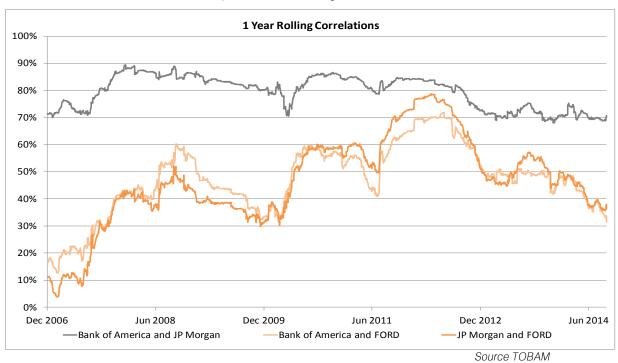
TOBAM's Diversification Ratio (DR)<sup>1</sup> measures to what extent a portfolio is diversified. The DR2 (square of the diversification ratio) measures the number of effective degrees of freedom to which a portfolio is exposed. As the table shows, the "broad market" indices leave diversification on the table. addition to a snapshot of each market's DR2, the table shows the DR<sup>2</sup> of a well-diversified portfolio, and the fraction of available diversification used by the index.

	DR <sup>2</sup> - Index diversification	DR <sup>2</sup> - Maximum diversification	% diversification used by index
MSCI All Countries	6.51	27.26	23.9%
MSCI World	5.61	22.69	24.7%
MSCI Emerging	7.02	12.52	56.1%
MSCI Canada	5.80	11.37	50.90%
MSCI US	3.54	10.89	32.5%
MSCI Pacific ex-Japan	3.31	9.70	34.2%
MSCI EMU	2.69	7.40	36.3%
MSCI UK	4.32	7.23	59.7%
MSCI Japan	2.19	5.16	42.3%
MSCI Australia	2.63	4.99	52.8%

As of September 30, 2014

## **Stability of the Pairwise Correlations Hierarchy**

Correlations data play an important role in several portfolio optimization, risk assessment and asset pricing techniques. While the historical levels of correlation are not static and change over time, their hierarchy– the fact that Bank of America and JP Morgan (JPM) are more correlated than Bank of America (BofA) and Ford – is remarkably stable, and this is the only information that is needed in order to assess that a portfolio combining BofA and Ford is more diversified than a portfolio combining BofA and JPM:



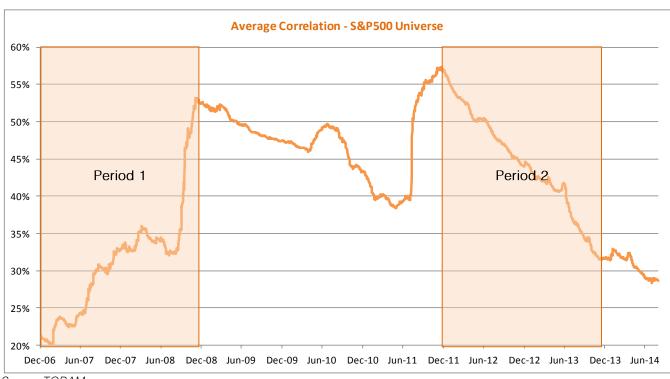
<sup>&</sup>lt;sup>1</sup> TOBAM's Diversification Ratio measures a portfolio's or index's diversification. It is supported by original research and is based on a mathematical definition of diversification. TOBAM's "Anti-Benchmark" Most Diversified Portfolio® maximizes this Diversification Ratio. Maximizing diversification within a universe of securities provides a result closer to the true market risk premium from that universe. "Maximum Diversification®" and "MaxDiv®" are registered trademarks of TOBAM.



In this note, we will investigate this property of stability in correlation hierarchy in two different environments in the US market:

- 1- When markets are experiencing an increase in average correlation levels.
- 2- When markets are experiencing a decrease in average correlation levels.
- I- US Market: Different Correlation Regimes

Figure 1: Average Correlation - S&P500 Universe



Source TOBAM.

As illustrated in the above chart, since Dec 2006, the US market experienced:

- Period 1 (Dec 2006 Dec 2008): Strong increase in average correlation levels.
- Period 2 (Dec 2011 Dec 2013): Strong decrease in average correlation levels.

In the following sections we will analyse the stability of correlation hierarchy in each of the above periods.



#### II- Case1: Stability of pairwise correlation hierarchy when correlations are shifting up

#### Methodology:

One way to illustrate the stability of the hierarchy is to examine the change in the ranking of the pairwise correlations. In our study, the pairwise correlations are ranked according to their quintile position in the covariance matrices estimated at the start and end of each month over the periods mentioned in the previous section. We computed one year daily matrices using the S&P500 investment universe. One month separated quintiles are used as most of the Anti-Benchmark strategies are currently rebalanced on a monthly basis.

■ Final Quintile 1 (T+1) ■ Final Quintile 2 (T+1) ■ Final Quintile 3 (T+1) ■ Final Quintile 4 (T+1) ■ Final Quintile 5 (T+1) 95% 90% 85% 80% 75% 70% 65% 60% 55% 50% 45% 40% 35% 30% 25% 20% 15% 10% 5% 0% Start Quintile 1 (T+0) Start Quintile 2 (T+0) Start Quintile 3 (T+0) Start Quintile 4 (T+0) Start Quintile 5 (T+0) Low Correlation **High Correlation** 

Figure 2: Pairwise Correlation Rank - Dec 2006/Dec 2008

The stability of the first and fifth quintiles is of the most interest, as the Anti-Benchmark is most likely to select stocks from first quintile and least likely to select stocks from the fifth quintile.

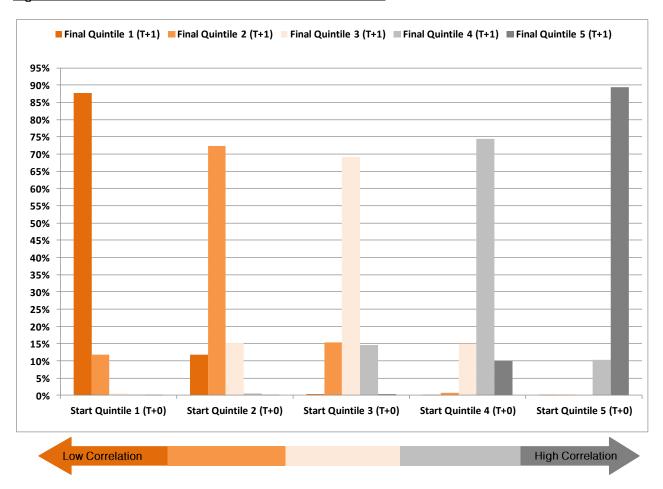
The above chart illustrates that:

- The most stable quintiles are the first and the fifth:
  - o Over 80% of the pairwise correlations starting in Quintile 1 end in Quintile 1.
  - Over 85% of the pairwise correlations starting in Quintile 5 end in Quintile 5.
- All quintiles are highly stable; at least 60% of the pairwise correlations remained in the same quintile.
- > Changes in rankings are between adjacent quintiles.
- ➤ While the global financial crisis of 2007/2008 had a major impact on the level of correlations, the hierarchy of the pairwise correlations remained stable over the period.



III- Case2: Stability of pairwise correlation hierarchy when correlations are shifting down

Figure 2: Pairwise Correlation Rank - Dec 20011/Dec 2013



The above chart illustrates that:

- > The most stable quintiles are the first and the fifth:
  - o Over 85% of the pairwise correlations starting in Quintile 1 end in Quintile 1.
  - Over 85% of the pairwise correlations starting in Quintile 5 end in Quintile 5.
- > All quintiles are highly stable; at least 69% of the pairwise correlations remained in the same quintile.
- Changes in rankings are between adjacent quintiles.
- Over the period, when markets correlations shifted down, the hierarchy of the pairwise correlations remained stable.

#### Conclusion

- Markets experience significant changes in the absolute level of correlations.
- Independently from the correlation environment (increasing or decreasing), the hierarchy of the pairwise correlations exhibited high stability even during extreme markets environment such as 2007-2008 for example.
- The stability of the correlation hierarchy can help understand the stability and robustness of the Anti-Benchmark portfolio.



# For more information

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