The concept of portfolio diversification was missing a dedicated research program so this is where TOBAM’s own research program is rooted. We started from what we saw as the core of the problem: How to measure “how much” an investment portfolio is diversified?

Our research led us to define a mathematical measure of diversification, the Diversification Ratio® (DR), which opened the door to a systematic approach for building well-diversified portfolios.

The Diversification Ratio® of a portfolio is defined as the ratio of the weighted average volatility of individual securities in that portfolio, divided by the volatility of the overall portfolio:

Formally, the Diversification Ratio® of a portfolio with weights $\omega = (\omega_1, ..., \omega_n)$ is:

$$DR(P) = \frac{\text{Combination of the risks}}{\text{Risk of the combination}} = \frac{\sigma_1 \omega_1 + \sigma_2 \omega_2 + ... + \sigma_n \omega_n}{\sigma_p}$$

Where $\sigma_i$ is the volatility of each asset, and $\sigma_p$ is the portfolio volatility.

The Diversification Ratio® embodies the very nature of the diversification of a portfolio: the risk of the combination of assets (the DR denominator) is lower than the combination of the risks of the assets (the DR numerator), provided the assets are not fully correlated.
Diversification Ratio®: How to read it

The Diversification Ratio® measures how much a given portfolio is diversified and as such, the ratio can be used to compare portfolios. The higher the Diversification Ratio®, the more diversified the portfolio. It’s important to emphasize that holding a large number of assets or investments does not necessarily increase a portfolio’s DR. Rather, for a portfolio to be characterized by a high DR it must be exposed to a diversified number of sources of risk. Holding 500 oil stocks is not diversifying a portfolio, but holding fewer stocks with low correlation provides better diversification.

Another way to understand the concept is to use the mathematics of the DR. Consider a portfolio that holds equal risk weights in two uncorrelated assets with equal volatility. Such a portfolio will have a DR of $\sqrt{2} : 1.41$. For a portfolio holding equal risk weights in three uncorrelated assets with equal volatility, the DR is $\sqrt{3}$, and so on.

In this example, the DR squared ($1.41^2$) measures the effective number of independent sources of risk of the portfolio: two.

The DR allows you to precisely measure the degree of diversification of a portfolio. Exhibit 1 displays the DR squared over time for the MSCI US, MSCI Europe (EMU) and MSCI World indices. We see that the U.S. and European equity indices are less diversified than the World index. As we increase the number of countries in the portfolio, we expand the opportunity sets in terms of diversification.

Similarly, in the late 1990s the emergence of the “new economy” added a diversifying source of investment opportunity in the form of technology and internet related companies (as suggested by the increase in the DR² over the period). In some cases, the diversifying characteristics of a new opportunity can disappear when its innovation is integrated into the rest of the equity market. Internet retail stocks, like Amazon for example, at one time behaved quite differently than other stocks but are likely to simply become part of the Consumer Discretionary sector over time.

EXHIBIT 1: DR – MSCI INDICES

![Graph showing DR for MSCI indices over time](source: TOBAM & MSCI)
Conclusion

A portfolio that maximizes the Diversification Ratio® has the appealing characteristic of also maximizing the effective number of independent sources of risk that it is exposed to. In that sense, a portfolio with a high DR is considered to be unbiased and built without using any views (i.e., market biases) regarding the future risk compensation of the constituent stocks. A truly diversified portfolio, in other words, does not reflect any speculative views from the marketplace.
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