Global Macro Market Diversification and CTA Performance

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Abstract
Trend-following, a main component of CTA strategies, relies in large part on market diversification to deliver attractive risk-adjusted returns. In this paper we define a quantitative measure of diversification in the global macro space and show evidence that it has explanatory power for CTA performance.

Keywords
Trend Following; Diversification

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1. Introduction

Diversification is a key component in the success of trend-following strategies. In the GCM Research Note on Market Diversification, we demonstrated the effect of diversification through trading a number of markets on generic trend-following strategies (a good proxy for aggregate CTA performance), finding that while it is important for a CTA to diversify, the incremental benefits quickly diminished after adding the first 40 to 60 most liquid markets to a portfolio.

In this research paper, we will expand on market diversification, this time focusing on shorter time periods compared to the 20 year aggregate we had used before. Intuitively, when the level of correlation is low, CTAs should benefit from diversification with the potential for strong performance. On the other hand, CTA experience in risk-on/risk-off environments (e.g., 2012/2013) suggests that when global macro markets are all moving in sync, CTA performance can suffer. We define a *Market Diversification Index* (MDI) to measure how much diversification is available. This index relates to risk-adjusted performance of generic trend-following strategies in an idealistic market environment, and thus generally has good explanatory power on contemporaneous CTA performance.

It is important to note that diversification is only one of the determinants of CTA returns. Indeed 2008 is an example of exceptionally strong trends driving strong performance despite low market diversification.

2. Definition of Market Diversification Index

Starting with a set of n markets and a time period of interest, one can measure the return correlation matrix C over this time period (we suggest using weekly returns to address the issue of non-synchronized closing times of global markets). Then one can perform the eigen-decomposition[1]: $C = VDV'$ where $D = diag(\lambda_1, ..., \lambda_n)$ give the eigenvalues which measure the variances of the eigenvectors as portfolios which are collected in V, each of which can be thought of as a risk factor. In economics theory, the *Inverse Herfindahl Index*[2], a function of a set of numbers which denote sizes of a collection of entities, measures the effective number of independent entities. If we apply this to the set of eigenvalues of C, we measure the effective number of independent risk factors. Therefore, we define our MDI to be:

$$MDI = \frac{\left(\sum_i \lambda_i\right)^2}{\sum_i \lambda_i^2}$$

In our experience, measuring the MDI over a period of three months strikes a good balance between controlling estimation error and responding adequately to changing market conditions.

2.1 Theoretical Connections with Trend-Following Performance

For a directional trading strategy, if *ex ante* we expect it to perform the same across all markets, then for markets that are perfectly correlated with each other, the strategy does not gain any advantage from diversification by trading these correlated markets. If all markets are uncorrelated, then the strategy's expected performance should scale with the square root of the number of markets. Between these extreme cases, where all correlation data are collected in a matrix C, our MDI serves as a measure of aggregate diversification such that it should relate to expected portfolio performance.

Trend-following, being a directional strategy for which there are generic versions (such as the SG Trend Indicator[3]) that are simply defined as a linear filter of historical price returns, lends itself well to analytical analysis. Indeed, under idealistic assumptions, where the correlation structure is stable over a period of time and the expected Sharpe ratio of a generic strategy is stable and the same across all markets, then the expected Sharpe ratio of the whole portfolio can be shown to be proportional to $\sqrt{MDI}$. Thus we can think of MDI as measuring the number of independent, or diversifying, markets in this context.

[1] See for example Hervé Abdi's exposition: https://www.utdallas.edu/~herve/Abdi-EVD2007-pretty.pdf.

[2] For more see https://fraser.stlouisfed.org/files/docs/publications/FRB/pages/1990-1994/33101_1990-1994.pdf

[3] For more details on the SG Trend Indicator see https://cib.societegenerale.com/fileadmin/indices_feeds/SG_Trend_Indicator_Methodology_Summary.pdf

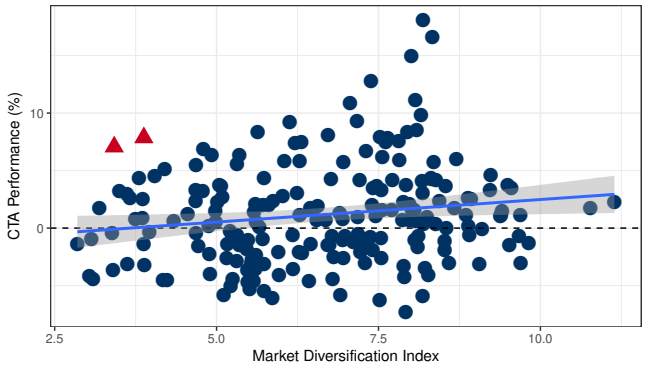

Figure 1. Since the creation of the SG CTA Index in 2000, CTA performance tends to be higher when the MDI takes larger values. The two outliers shown in triangles correspond to late 2008.

3. MDI vs. Historical CTA Performance

We sampled returns for the 100 most actively traded and liquid markets and calculated MDI for quarterly time periods on a monthly basis. For the same contemporaneous periods, we calculated CTA index performance, which starts in 2000. We present the data in a scatter plot with an estimated trend line (Figure 1), which shows stronger CTA performance when the MDI is high and vice versa. Note that there is a fair amount of dispersion around the fitted trend line, which shows the limitations of our idealized assumptions. Indeed our MDI does not measure the strength of trends as it varies across markets and/or over time, which is also a driver of trend-following performance.

3.1 Is There A Regime Shift?

In Figure 2 we collect and plot the MDI over a longer time history (from 1995) and across two trading universes: 100 most liquid markets and 55 most liquid markets. The two MDI series are very close together, confirming the results of our previous research note that trading additional markets beyond 50 or so does not automatically bring diversification benefits. As a further illustration, in Figure 3 we show the heat map presentation of correlation matrices taken from two representative periods of low and high MDI values. Overall, the MDI was lower in the second half of the chart than in the first half, especially after 2008, where many quarters dropped below 4. The local peak in 2014 coincided with a strong year for CTAs. After 2014, MDI tended to be close to pre-crisis levels, but still has not reached levels previously observed before 2000. These results may indicate that there was a regime shift in the global macro markets, such that the available market diversification is now lower. These market environments can be more difficult for CTAs.

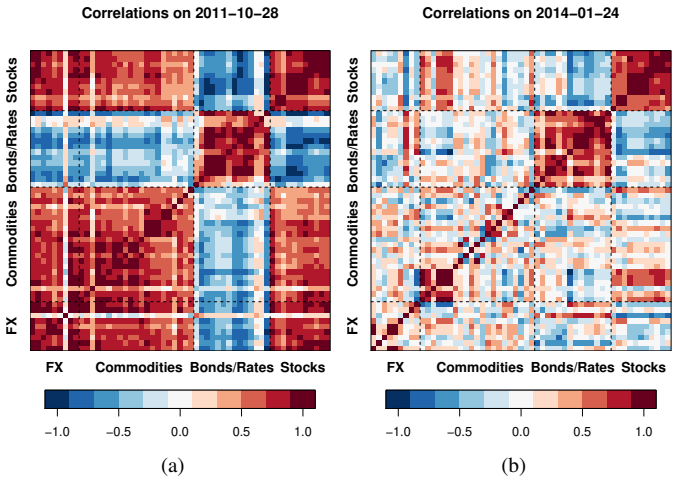

Figure 3. These heatmaps represent correlation matrices corresponding to low (a) and high (b) MDI levels.

4. Conclusion

Our Market Diversification Index is a quantitative measure that calculates the effective number of independent global macro markets. It can be used as a barometer for the performance potential of directional trading strategies such as trend-following. While it is not perfect and does not measure the strength of trends, empirical data shows a positive correlation between the MDI index and CTA performance.

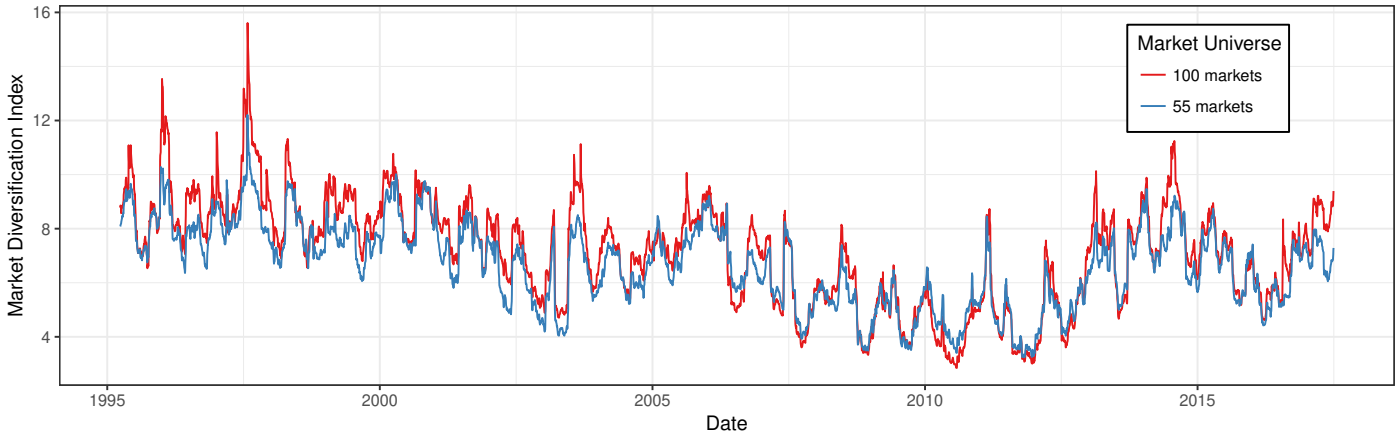

Figure 2. History of Market Diversification Index (MDI). The MDI has been relatively low since the financial crisis in 2008, with the exception of 2014-2015. Note that the index varies little between 55 and 100 markets.

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