How long is the memory of the US stock market?

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HIGHLIGHTS

- We apply DCCA and its correlation coefficient to study the efficient market hypothesis.
- We show that the correlation coefficient is significant till the 149th lag.
- It means that the US stock market has long memory for about seven months.
- It could be seen as a possible contradiction of the EMH.

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ABSTRACT

The Efficient Market Hypothesis (EMH), one of the most important hypothesis in financial economics, argues that return rates have no memory (correlation) which implies that agents cannot make abnormal profits in financial markets, due to the possibility of arbitrage operations. With return rates for the US stock market, we corroborate the fact that with a linear approach, return rates do not show evidence of correlation. However, linear approaches might not be complete or global, since return rates could suffer from nonlinearities. Using detrended cross-correlation analysis and its correlation coefficient, a methodology which analyzes long-range behavior between series, we show that the long-range correlation of return rates only ends in the 149th lag, which corresponds to about seven months. Does this result undermine the EMH?

1. Introduction

One of the most important hypotheses in financial economics is the Efficient Market Hypothesis (EMH). Accordingly, a financial market is considered efficient in its weak form if it is not possible to identify any deterministic pattern in its time series behavior. In other words, EMH means that through arbitrage, agents could not obtain systematic abnormal profits using past information [1]. Several studies analyze this hypothesis, checking for some windows of profit opportunities. In this paper, we do not carry out a thorough literature review, since our main objective is to use a different approach to EMH. For a more complete literature review on EMH see, for example, the work of Sewell [2].

One important conclusion of EMH, especially in its weak form, is that financial returns have no memory and are independent in time. This is an issue with many years of study, started at the turn of the 20th century by Bachelier [3] and corroborated by other studies, such as those of Kendall [4], Osborne [5], Granger and Morgenstein [6] or Fama [7]. In fact, this is the idea that originated the EMH. Several studies proved that, when linear autocorrelation exists between return rates, it quickly disappears. However, some authors argue that there may be long-range dependence in return rates. This

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