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# Possible causes of long-range dependence in the Brazilian stock market

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## Abstract

While the presence of long-range dependence in the asset returns seems to be a stylized fact, the issue of arguing the possible causes of this phenomena is totally obscure. Trying to shed light in this problem, we investigate the possible sources of the long-range dependence phenomena in the Brazilian Stock Market. For this purpose, we employ a sample which comprises stocks traded in the Brazilian financial market (BOVESPA Index). The Hurst exponent here is considered as our measure of long-range dependence and it is evaluated by six different methods. We have found evidence of statistically significant rank correlation between specific variables of the Brazilian firms which subscribe stocks and the long-range dependence phenomena present in these stocks.

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## 1. Introduction

The presence of long-range dependence in asset returns has been intriguing academicians as well as financial market professionals for a long time. One of the

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first to consider the existence of long memory behavior in asset returns was Mandelbrot [1]. Since then, many others have supported Mandelbrot's results (for details see [2–7] and the references therein).

Actually, while the presence of long-range dependence in the asset returns seems to be a stylized fact, the issue of arguing the possible causes of this phenomena is totally obscure.<sup>1</sup> The question that usually arises is why we find evidence of long-range dependence for stocks of some firms and we do not find for stocks of other firms? This is an important question that to the best of our knowledge has not been addressed in the literature before. Therefore, due to the importance of the implications of the presence this phenomena in financial data,<sup>2</sup> this paper aims at shedding some light in this issue, so we investigate the possible causes of the long memory phenomena in the Brazilian Stock Market.

For this purpose, we employ some proxies for specific firm variables: capitalization measures (proxy for liquidity), dividends payments, return on equity (ROE) and financial leverage. The sample considered in this work comprises all stocks traded in the Brazilian financial market and the period of this research stems from January 1998 through November 2003. The data sampling employs daily closing prices for individual stocks. Additionally, the Hurst exponent is thought here as our measure of long-range dependence and to give some robustness to our results, we evaluate it by six different methods: R/S analysis, R/S analysis with shuffled data, R/S analysis with data aggregation, DFA, DFA with shuffled data and DFA with data aggregation. It is interesting to stress that we avoid here using the modification of the R/S method proposed by Lo [12] since this method has a strong preference for accepting the null hypothesis of no long-range dependence independently of whether long-range dependence is presented in the data or not (for details, see Refs. [13,14]). We present standard errors for Hurst exponents for each one these methods, which can be used to test for the null of  $H = 0.5$  (efficient market).

This paper is organized as follows. The methods used to evaluate the Hurst exponent are introduced in Section 2. The proxies for specific firm variables are presented in Section 3. In Section 4, the data used in this work is presented. In Section 5, the results are exposed. Finally, Section 6 presents some conclusions of this work.

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<sup>1</sup>Cajueiro and Tabak [8] present some evidence suggesting that liquidity and market restrictions play a role in explaining empirical results from testing for long-range dependence.

<sup>2</sup>The evidence of long-range memory in financial data causes several drawbacks in modern finance: (1) the optimal consumption and portfolio decisions may become extremely sensitive to the investment horizon [9]; (2) the methods used to price financial derivatives based on martingale models (the most common models, e.g. the Black–Scholes model [10]) are not useful anymore; (3) since the usual tests based on the Capital Asset Pricing Model and Arbitrage Pricing Theory [11] do not take into account long-range dependence, they cannot be applied to series that present such behavior. Moreover, if such long-range persistence is presented in the returns of the financial assets, the random walk hypothesis is not valid anymore and neither does the market efficiency hypothesis.

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