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Long correlations and truncated Levy walks applied to the study Latin-American market indices

Sebastian Jaroszewicz[a], M. Cristina Mariani[b,*],
Marta Ferraro[a,b,c]

[a]*Departamento de Física, Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires,
Ciudad Universitaria Pab. I (1428), Buenos Aires, Argentina*
[b]*Department of Mathematical Sciences, New Mexico State University, Las Cruces,
New Mexico 88003-8001, USA*
[c]*CONICET*

Abstract

This work is devoted to the study of long correlations and other statistical properties of Latin-American market indices. We concluded that the behavior of the return is compatible with a slow convergence to a Gaussian distribution. We also detected long-range correlations in the absolute value of the return analyzing the effects of working with short data series. This fact has relevant consequences in the volatility dynamics.
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Keywords: Levy flight; Econophysics; Detrended fluctuation analysis; Stock market prices; Latin-American indices

*Corresponding author.

E-mail addresses: sebasj1@df.uba.ar (S. Jaroszewicz), mmariani@nmsu.edu (M.C. Mariani), marta@df.uba.ar (M. Ferraro).

1. Introduction

In recent years, there has been a growing literature in financial economics that analyzes the major Stock indices in developed countries [1–5].

One of the main problems is the analysis of the existence of long-term or short-term correlations in the behavior of financial markets.

The statistical properties of the temporal series got analyzing the evolution of the different markets have been of a great importance in the study of financial markets.

The empirical characterization of stochastic processes usually requires the study of temporal correlations and the determination of asymptotic probability density distributions (pdf). The first model that describes the evolution of option prices is the Brownian motion. This model assumes that the increment of the logarithm prices follows a diffusive process with Gaussian distribution [6]. However, the empirical study of temporal series of some of the most important indices shows that in short time intervals the associated pdf have larger kurtosis than a Gaussian distribution [5]. The first step in order to explain this behavior was done in 1963 by Mandelbrot [7]. He developed a model for the evolution of the cotton price by a stable stochastic non-Gaussian Levy process [8]. However, these distributions are not appropriate for working in long-range correlation scales. These problems can be avoided considering that the temporal evolution of financial markets is described by a truncated Levy flight (TLF) [9].

The detrended fluctuation analysis (DFA) method is an important technique that allows detecting the presence of long-range correlations in non-stationary temporal series. This method was developed by Peng, and has been applied to the study of the DNA, heart rate dynamics, solid state Physics, and economic series.

Most of the studies mentioned before have been done with indices of developed markets that have a great volume of transactions. This work is devoted to the study of the principal market indices in Latin America.

Our main interest is detecting long-range correlations in emerging markets economic indices. The presentation is described as follows: In the first section, we give a short introduction to the Levy distributions. In the second section, we present the indices that will be analyzed and we give a relation between them and the TLF. In the third section, we give a brief description of the fundamentals of the technique known as DFA and we applied this technique to the indices previously analyzed in order to determine the existence of long-range correlations. Finally, we conclude that our results are compatible with a power law, and also with a TLF distribution. We also detected the presence of long-range correlations in several emerging markets economic indices.

2. The truncated Levy flight

Levy [10] and Khintchine and Levy [11] solved the problem of the determination of the functional form that all the stable distributions must follow. They found that the most general representation is through the characteristic functions $\varphi(q)$, by the