Available online at www.sciencedirect.com
ScienceDirect
Physica A 374 (2007) 315–324
PHYSICA A
www.elsevier.com/locate/physa

Nonextensive statistical features of the Polish stock market fluctuations

R. Rak[a], S. Drożdż[a,b], J. Kwapień[b,*]

[a]*Institute of Physics, University of Rzeszów, PL-35-959 Rzeszów, Poland*
[b]*Institute of Nuclear Physics, Polish Academy of Sciences, PL-31-342 Kraków, Poland*

Received 8 March 2006; received in revised form 7 July 2006
Available online 15 August 2006

Abstract

The statistics of return distributions on various time scales constitutes one of the most informative characteristics of the financial dynamics. Here, we present a systematic study of such characteristics for the Polish stock market index WIG20 over the period 04.01.1999–31.10.2005 for the time lags ranging from 1 min up to 1 h. This market is commonly classified as emerging. Still on the shortest time scales studied we find that the tails of the return distributions are consistent with the inverse cubic power law, as identified previously for majority of the mature markets. Within the time scales studied, a quick and considerable departure from this law towards a Gaussian can however be traced. Interestingly, all the forms of the distributions observed can be comprised by the single q-Gaussians which provide a satisfactory and at the same time compact representation of the distribution of return fluctuations over all magnitudes of their variation. The corresponding nonextensivity parameter q was found to systematically decrease when increasing the time scales. The temporal correlations quantified here in terms of multifractality provide further arguments in favor of nonextensivity.
© 2006 Elsevier B.V. All rights reserved.

Keywords: Financial markets; q-Gaussian distributions; Tsallis statistics

1. Introduction

Making the quantification of financial fluctuations is a real interdisciplinary challenge. The related well-identified stylized fact is the so-called inverse cubic power law [1] which applies to developed stock markets [2–5], to the commodity market [6], as well as to the most traded currency exchange rates [7]. The emerging stock markets are commonly considered to be governed by a somewhat different dynamics which often [8,9] results in exponential tails of the return distributions. Of course, both the above types of distributions are Lévy unstable and thus for the sufficiently long time lags they may converge towards a Gaussian. The distribution with an exponential tail might correspond to an intermediate stage between a distribution with the power law asymptotics and a very large time lag limit—a Gaussian [10]. Such a scenario corresponds for instance to the Heston model [11].

*Corresponding author.
E-mail address: jaroslaw.kwapien@ifj.edu.pl (J. Kwapień).

0378-4371/$ - see front matter © 2006 Elsevier B.V. All rights reserved.
doi:10.1016/j.physa.2006.07.035

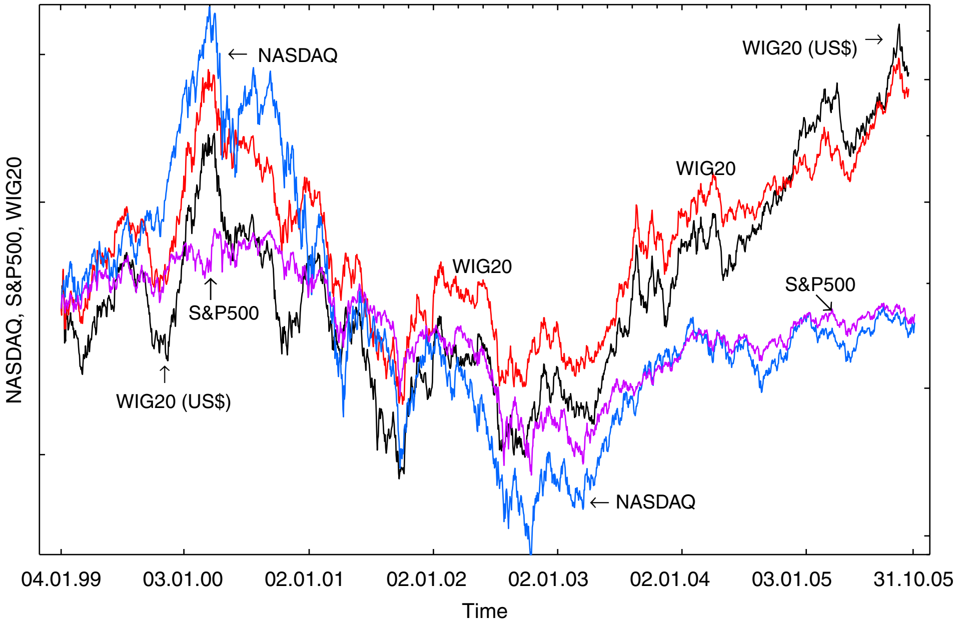

Fig. 1. NASDAQ, S&P500 and WIG20(Warsaw Stock Exchange) index from 04.01.1999 until 31.10.2005.

In order to elaborate more on this sort of issues, we systematically study the character of fluctuations of the Polish stock market as represented by the WIG20 index. This equity market started trading on 16 April 1991 and the presently most often quoted corresponding index is WIG20 (Warszawski Index Giełdowy—Warsaw Stock Market Index), introduced in 1994, comprising capitalization weighted prices of the 20 largest companies. The high quality electronic processing and recording of all the transactions started in the beginning of 1999. The analysis presented here thus covers the time period since 4 January 1999 until 31 October 2005.

The daily trading closing hour during this period was 4:00pm and since 17.11.2000 4:10pm. The opening hours have been changed two times. On 4.1.1999 until 30.7.1999 (Period1) it was 1pm, then until 16.11.2000 (Period2) it was 12am, and then 10am (Period3) with the closing at 4:10pm.

As it can be seen from Fig. 1 in the whole time period inspected here, even though representing an emerging market, the WIG20 has been following the overall world trend—more in terms of the phase than in the amplitude however. During the first 2 years of the period considered its behavior closely resembled the Nasdaq. Since 2003 it however by far overperforms the two world major indices: the Nasdaq and the S&P500. As natural, the original WIG20 is quoted in the Polish Zloty (PLN). Converting systematically the PLN into the US$—to make this comparison even more informative—results in an even larger gain as can be easily seen from Fig. 1. This is due to a parallel sizable PLN appreciation in the period considered.

2. Conventional log–log analysis

For the time series $W(t)$ representing the index value at time t we use the commonly accepted definition of returns as

$$R \equiv R(t, \Delta t) = \ln W(t + \Delta t) - \ln W(t). \quad (1)$$

As another standard procedure, we calculate the normalized returns $r \equiv r(t, \Delta t)$ defined as

$$r = \frac{R - \langle R \rangle_T}{v}, \quad (2)$$

Download English Version:

https://daneshyari.com/en/article/975754

Download Persian Version:

https://daneshyari.com/article/975754

Daneshyari.com