Stock market volatility: an approach based on Tsallis entropy.

S. Bentes\textsuperscript{1}, R. Menezes\textsuperscript{2} and D. Mendes\textsuperscript{2}

\textsuperscript{1}Department of Finance, ISCAL, Lisbon, Portugal.
\textsuperscript{2}Department of Quantitative Methods, IBS-ISCTE, Lisbon, Portugal.

One of the major issues actually studied in finance that had always intrigued, both scholars and practitioners, and to which there weren’t yet discovered a unified theory, is the reasons why price moves over time and the underlying volatility inherent to those movements, which actually seems to affect markets as a whole. Since there are several well known traditional techniques in literature to measure stock market volatility, a central point in this debate that constitutes the actual scope of this paper, is to put together this common approach in which we discuss popular techniques like the variance and/or standard deviation, from which depart all the Autoregressive Conditionally Heteroscedastic Models - ARCH type models, and an innovative methodology called the Econophysics approach which applies concepts of physics to explain economic/financial phenomena. This new branch of knowledge has some defendants (e.g. [1]), and emerged when some regularities between such areas were found in a consistent way.

In our particular study, we use the concept of Tsallis entropy, $S_T$ to capture the nature of volatility. To shed some light in this discussion we shall clarify that the concept of entropy was originally introduced in 1865 by Clausius in the context of thermodynamics and, since then, several formulations have been constructed. Although the debate generated over its meaning, it is generally understood as measure of disorder, uncertainty, ignorance, dispersion or even lack of information. More precisely, what we want to know in our study is if Tsallis entropy is able to detect volatility in stock market indexes and to compare its values with the ones obtained from the variance and/or standard deviation analysis. Also, we shall refer that one of the advantages of this new methodology when compared with the traditional one is its ability to capture nonlinear dynamics, which does not happen with the common variance and/or standard deviation of the traditional approach. This is especially relevant as it has been widely recognized by several authors ([2], inter alia) that economic and financial relationships are typically nonlinear. For our purpose, we shall basically focus on the behaviour of stock market indexes and considered the FTSE 100 (UK), SP 500 (USA), CAC 40 (France), MIB 30 (Italy), Nikkei 225 (Japan), IBEX 35 (Spain) and PSI 20 (Portugal) for a comparative analysis between the approaches mentioned above.