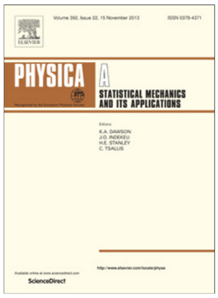
Accepted Manuscript



A statistical analysis of UK financial networks

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PII: S0378-4371(16)31052-4
DOI: http://dx.doi.org/10.1016/j.physa.2016.12.073
Reference: PHYSA 17875

To appear in: *Physica A*

Received date : 3 October 2016
Revised date : 21 November 2016

Please cite this article as: J. Chu, S. Nadarajah, A statistical analysis of UK financial networks, *Physica A* (2016), http://dx.doi.org/10.1016/j.physa.2016.12.073

A statistical analysis of UK financial networks

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Abstract: In recent years, with a growing interest in big or large datasets, there has been a rise in the application of large graphs and networks to financial big data. Much of this research has focused on the construction and analysis of the network structure of stock markets, based on the relationships between stock prices. Motivated by Boginski et al. Boginski et al. (2005), who studied the characteristics of a network structure of the US stock market, we construct network graphs of the UK stock market using same method. We fit four distributions to the degree density of the vertices from these graphs, the Pareto I, Fréchet, lognormal, and generalised Pareto distributions, and assess the goodness of fit. Our results show that the degree density of the complements of the market graphs, constructed using a negative threshold value close to zero, can be fitted well with the Fréchet and lognormal distributions.

Keywords: Degree density; Fréchet distribution; Lognormal distribution; Pareto distribution

1 Introduction

Large datasets have useful applications in many different areas, for example, science, engineering, and computer science, to name just a few. Such large data sets can often be represented in terms of large graphs, comprising vertices (or nodes) connected by edges. In the most simple case, we can consider an undirected graph, say $G(V, E)$, which is defined by the set of vertices V and edges $E \subset V \times V$ connecting pairs of vertices (Boginski et al. Boginski et al. (2005)).

The applications of large graphs or networks has been studied greatly, and also spans across a number of fields. For example, in chemistry, Chou Chou (1990)) applies large graphs to enzyme kinetics and protein folding mechanisms; in ecology, Bunn et al. Bunn et al. (2000)) apply large graphs to landscape and habitat connectivity; in engineering, Dobrjanskyj and Freudenstein Dobrjanskyj and Freudenstein (1967) apply large graphs to the structural analysis of mechanisms. In recent years, there has been a rise in the application of large graphs and networks to large datasets in the area of finance. More specifically, the structure of stock markets, see Kullman et al. Kullmann et al. (2002), Jung et al. WS et al. (2006), Ping and Binghong Ping and Binghong (2006), Zhuang et al. Zhuang et al. (2007), Tabak et al. Tabak et al. (2010), Zhang et al. Zhang et al. (2010) and Vizgunov et al. Vizgunov et al. (2014).

In particular, networks constructed based on the relationships between stock prices have been shown to follow a common distributional model. Kim et al. Kullmann et al. (2002) studied cross-correlations in stock price changes among S&P 500 companies by a weighted random graph. They found that the influence-strength distribution in absolute terms follows a power law. Huang et al. Huang et al. (2009) used a threshold model to construct China's stock correlation network and studied the structural properties. After conducting a statistical analysis on the network, they also