



## **Deliverable D2.2**

### **MSCA-ITN Training for Big Data in Financial Research and Risk Management “BigDataFinance”**

**Grant Agreement: 675044**

*This is Deliverable D2.2 of the Work Package 2 (WP2) in “Training for Big Data in Financial Research and Risk Management” (BigDataFinance) Innovative Training Network Marie Skłodowska-Curie project 2015-2019.*

**Name of the deliverable:** “A report on an analysis of the behavioural differences between institutional and individual investors”

#### **Description**

A stock market is a complex system constituting of multiple stakeholders indirectly interacting with each other when they trade securities. Since by default there is no direct interaction between market participants, it is only possible to build network representation of this system, by inferring relationships between investors based on their actual trading behaviour. In order to make any conclusions about the state of such systems, one needs to have appropriate tools and methods in order to handle them. In this report, Kęstutis Baltakys present two recently accepted articles on the tools and methods to analyse and simplify complex networks and one recently published article that looks at the differences of different investor trading behaviour.

**Project title:** Complex Network Analysis in Stock Markets

**Date, place:** May 28<sup>th</sup>, 2018, Tampere, Finland

**Name, position:** Kęstutis Baltakys, Marie Skłodowska Curie Fellow, Tampere University of Technology



**Title:** Computational Analysis of the structural properties of Economic and Financial Networks

**Journal:** Journal Of Network Theory In Finance

**Authors:** Frank Emmert-Streib, Aliyu Musa, Kęstutis Baltakys, Juho Kanninen, Shailesh Tripathi, Olli Yli-Harja, Herbert Jodlbauer, Matthias Dehmer

**Abstract:** In recent years, methods from network science are gaining rapidly interest in economics and finance. A reason for this is that in a globalized world the interconnectedness among economic and financial entities are crucial to understand and networks provide a natural framework for representing and studying such systems. In this paper, we are surveying the use of networks and network-based methods for studying economy related questions. We start with a brief overview of graph theory and basic definitions. Then we discuss descriptive network measures and network complexity measures for quantifying structural properties of economic networks. Finally, we discuss different network and tree structures as relevant for applications.

Paper available at: <https://arxiv.org/abs/1710.04455>

**Title:** Multilayer Aggregation with Statistical Validation: Application to Investor Networks

**Journal:** Scientific Reports

**Authors:** Kęstutis Baltakys, Juho Kanninen, Frank Emmert-Streib

**Abstract:** Multilayer networks are attracting growing attention in many fields, including finance. In this paper, we develop a new tractable procedure for multilayer aggregation based on statistical validation, which we apply to investor networks. Moreover, we propose two other improvements to their analysis: transaction bootstrapping and investor categorization. The aggregation procedure can be used to integrate security-wise and time-wise information about investor trading networks, but it is not limited to finance. In fact, it can be used for different applications, such as gene, transportation, and social networks, were they inferred or observable. Additionally, in the investor network inference, we use transaction bootstrapping for better statistical validation. Investor categorization allows for constant size networks and having more observations for each node, which is important in the inference especially for less liquid securities. Furthermore, we observe that the window size used for averaging has a substantial effect on the number of inferred relationships. We apply this procedure by analyzing a unique data set of Finnish shareholders during the period 2004–2009. We find that households in the capital have high centrality in investor networks, which, under the theory of information channels in investor networks suggests that they are well-informed investors.

Paper available at: <https://doi.org/10.1038/s41598-018-26575-2>

**Title:** Facebook drives behavior of passive households in stock markets

**Journal:** Finance Research Letters

**Authors:** Milla Siikanen, Kęstutis Baltakys, Juho Kanninen, Ravi Vatrapu, Raghava Mukkamala, Abid Hussain

**Abstract:** Recent studies using data on social media and stock markets have mainly focused on predicting stock returns. Instead of predicting stock price movements, we examine the relation between Facebook data and investors' decision making in stock markets with a unique data on



investors' transactions on Nokia. We find that the decisions to buy versus sell are associated with Facebook data especially for passive households and also for nonprofit organizations. At the same time, it seems that more sophisticated investors---financial and insurance institutions---are behaving independently from Facebook activities.

Paper available at: <https://doi.org/10.1016/j.frl.2018.03.020>