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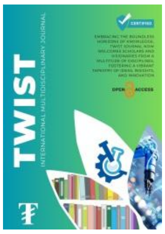

Primary Assessment of the Probability of some Phenomena Recognition in Building Physics with the Use of the Stock Markets Methodological Investigation

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Abstract
The subject of the paper is an assessment of the possibility of transferring stock markets technical analysis as the method of some phenomena detection in building physics, especially in case of microclimate research in some kind of closed large-volume rooms, where the huge number of people is staying the same time. Paper is based on Author's microclimate research in construction and environmental engineering (building physics) and researching the impact on the microclimate of heat emissions from humans in large-volume buildings. The research was based on an attempt to answer the question of whether there are universal dependencies between the specific areas of economy and engineering. The question was if some specific methods used in financial decisions, e.g. technical indicators using moving averages and other mechanisms, which have so far only been used in stock markets technical analysis, can be transposed to some phenomena research in area of building physics.

Keywords
Building Physics, Microclimate, Econophysics, Stock Markets, Technical Analysis

INTRODUCTION
Stock market trends have long been associated with animal metaphors: bulls and bears. This century has seen the addition of another species, black swan, to represent rare catastrophic events that engulf all financial markets. Not everyone loses when black swans land. American journalist Scott Patterson teases out the obscure world of traders and hedge funds who profit from doomsday scenarios such as the 2008 global financial crisis in Chaos Kings: How Wall Street Traders Make Billions In The New Age Of Crisis.

This paper reviews recent research adopting methods from statistical physics in theoretical or empirical work in economics and finance. The bulk of what has recently become known as 'econophysics' in broader circles draws its motivation from observed scaling laws in financial markets and the abundance of data available from the economy's financial sphere. Sec. 2 of this review presents the robust power laws encountered in financial economics and discusses potential explanations for scaling in finance derived from models of stochastic interactions of traders. Sec. 3 provides an overview over other applications of statistical physics methodology in finance and attempts to evaluate the impact they have had so far on financial economics. With the following section, the review turns to recent work on the emergence of wealth and income heterogeneity and the recent inception of new strands of research on this topic, both within econophysics and the neoclassical economics tradition. Sec. 5 re-views the new stylized facts that have been identified in cross-sectional data of firm characteristics and agent-based approaches to industrial organization and macroeconomic dynamics that have been motivated by these findings. We conclude with an assessment of the major methodological contributions of this new strand of research.

While the sheer ignorance of main-stream economics by practically all econophysists already stirred the bloodof many mainstream economists, the fact that they seemed to have easyaccess to the popular science press and as representatives of a `hard science'were often taken more seriously by the public than traditional economists,contributed to increased blood pressure among its opponents1. At the otherend of the spectrum, the adaptation of statistical physics methods has beenwelcomed by economists critical of some aspects of the standard paradigm.Econophysics, in fact, had a close proximity to attempts at allowing heterogeneous interacting agents in economic models. It is in this stronglyincreasing segment of academic economics where complexity theory andeconophysics have made the biggest impact.In the following I will review the econophysics contribution to various areasof economics/nance and compare it with the prevailing traditional economic approach.

REVIEW OF LITERATURE

The frequency distribution of wealth among the members of a society hasbeen the subject of intense empirical research since the days of VilfredoPareto (1897) who rst reported power-law behavior with an index of about1.5 for income and wealth of households in various countries. Empirical workinitiated by physicists has conrmed these time-honored findings (Levy andSolomon, 1997; Fujiwara et al., 2003; Castaldi and Milakovic, 2005). WhilePareto as well as most subsequent researchers have emphasized the powerlaw character of the largest incomes and fortunes, the recent literature hasalso highlighted the fact that a crossover occurs from exponential behaviorfor the bulk of observations and Pareto behavior for the outmost tail. It’s a strategy based on the principle that a crash is inevitable but the timing is unknowable. Not everyone thinks so. This is where mathematicians come in, looking for patterns that will lead to accurate forecasts on crashes. Using tools from other disciplines, some of them claim to have detected discernible patterns.

At this point, another French mathematician, Didier Sornette, enters the scene in the book. In 2003, he wove strands from chaos theory, fractal geometry, behavioural economics and earthquake science, among others, to explain why stock markets crash. One of the less-known aspects of financial market research is the interest it has triggered among those French mathematicians, whose curiositytakes them beyond the narrow bounds of their discipline. Benoit Mandelbrot, Taleb’s friend who was a pioneer in fractal geometry, believed that conventional finance was underpinned by an inappropriate strand of mathematics. He was drawn to finance not by the possibility of money, but the mountains of data that he could exploit.

According to critics, economic models are: too abstract and hard to relate to economic reality; reductionist and lacking the holistic perspective needed to integrate pieces of economic reality in a coherent whole; based on assumptions with no empirical support such as rationality, selfishness, or equilibrium. In this context, a variety of research programs practicing alternative approaches have claimed that their methods can provide a viable remedy. The question that naturally arises is: which of the offered alternatives is capable of dealing with the identified blind spots in mainstream methodology?

A more general insight about methodological challenges arising from complexity comes from Warren Weaver (1948) who provided a systematic decomposition of scientific questions by distinguishing between problems of simplicity, disorganized complexity, and organized complexity. He provided examples to illustrate that methods that proved successful in dealing with problems of simplicity were ineffective with problems of disorganized and organized complexity. While the introduction of statistical approaches made a significant advance in dealing with problems of disorganized complexity, problems of organized complexity in which variables interact in a nonrandom manner still remained difficult to deal with. He explained that it was physics that initially started dealing with simple problems, while biology was naturally devoted to problems of organized complexity, given that problems of living organisms “are seldom those in which one can rigidly maintain constant all but two variables” (Weaver, 1948, p. 2).

Even though the described phenomenological similarities would suggest corresponding methodological similarities, many approaches that have been successfully applied in ecology are still not common in mainstream economics. Agent-based models in combination with network approaches, for instance, are common tools that provide a framework for studying the structure of interactions between species in an ecosystem (Grimm et al., 2006; Janssen, Schoon, Ke, & Börner, 2006), but are still scarcely used in mainstream economics. Nevertheless, there are some good examples of the use of these models in finance, even though they are often applied by researchers from other disciplines (e.g. physicists, or epidemiologists) and have yet to gain acceptance from the mainstream.

As a res ult of these dispersed efforts, after the 2007–2009 financial crisis ecological insights have been more commonly used to understand the resilience of financial markets (Battiston et al., 2016; May, Levin, & Sugihara, 2008). Some examples of concepts from ecology and complex systems that are becoming increasingly frequent in the finance literature are tipping points (Scheffer et al., 2012), warning signs (Scheffer et al., 2009), relationships between the structural properties of system and its resilience (e.g. too central to fail concept, Thurner & Poledna, 2013), and the use of agent-based simulations as tools for designing financial regulations (Klimek, Poledna, Farmer, & Thurner, 2015; Poledna & Thurner, 2014).

Taken together, the work in this thesis shows that ecological approaches can illuminate important economic phenomena, including the effects of uncertainty, concentration, and inequality on the resilience of banking systems. More broadly, the thesis shows that there are systematic methods that can help in selecting analogical models well suited to the problems of interest. Unlike Marshal who could not afford to follow his own intuition, present -day researchers have the opportunity to take advantage of various methodological advances that put them in a better position to deal with complex problems. For instance, the development of conceptual foundations such as complex systems, analytical techniques such as network approaches and agent -based simulations, as well as various technological innovations such as widely accessible and increasingly powerful computational devices provides a strong foundation for the future research that does not need to compromise its way.

In our study, the inclusion of time dummies might also be important since our investigationperiod includes the occurrence of large financial crisis such as the Asian or the Russian crises. Tosum up, the inclusion of both effects allows to focus on the role of specific Xijtvariables, suchas financial integration and trade liberalization reforms,without failing to control for structuralfactors that determine the size of the cross-market correlations.Another global unobservable variable that could be captured by the time dummies is technology. Technological advances haveled to an increase of cross-border financial flows, which in turn can induce an overall increase incross-country stock market comovement. Once again, assuming that the effects of these omitted variables is identical across countries, the introductionof these time dummies significantly reducesthe scope of mispecification in the regression models. To sumup, the inclusion of both effectsallows to focus on the role of specificXijtvariables, such as financial integration and trade lib-eralization reforms, without failing to control for structural factors that determine the size of thecross-market correlations.

For the sake of interpretation of the results, it is interesting to look at the relationships betweenliberalization measures. As for the correlation between trade liberalization and trade intensity,one can expect some positive link between both concepts. Nevertheless, the correlation of tradeintensity with the Sachs and Warner measure indeed amounts to 0.01, reflecting a very loose rela-tionship between both variables. Several explanations arein order here. First, there is obviously adelay between liberalization and the increase in trade flowsbetween countries. Second, most tradeagreements seem to be implemented when the potential gains are the biggest. In other terms,there is less need to make explicit bilateral agreements when trade intensity is already high.The data also reveals that there is a moderate relationship between trade liberalization andfinancial liberalization in our sample. The correlation of trade liberalization with actual (resp.official) dates of financial liberalization amounts to 0.16 (resp. 0.13). This might reflect thatthe willingness to liberalize trade goes moderately hand inhand with the willingness to openthe capital account. This means that for a subset of countries, the economic policy in terms ofliberalization applied equally to the real and the financialside of the economy. Nevertheless, for aremaining number of countries, the political decisions were taken independently or at least involvesignificant delays. In this respect, the introduction of a time dimension in the sample is important here. Estimation results suggest that, in general, macroeconomic variables such as growth and theinflation differential are poorly related to stock return co-movements. This results in line withthe findings of Canova and De Nicolo (1997). They find that the European stock returns areexplained by US inflation and real variables rather than by domestic variables. Foreign variablescan indeed drive the correlations as they are good predictors of future domestic activity. In ouranalysis, since US variables are common to all countries, their effect will be captured through thetime dummies. In the full model, inflation differentials tendto be positively related to stock co-movements, which is rather counter-intuitive. Our measures of the exchange rates regimes do notprovide any significant explanatory power to the co-movement of stock prices. This might be duepartly to the fact that the classification regime variables are country-specific and not pair-specific. In contrast, the time dummies capturing the occurrence of the major crises tend to be highly related to correlation.

DISCUSSION

Bartram and Bodnar (2009)presented a detailed investigation of the global financial crisis 2008/2009and provided a timeline of events and policy actions for the crisisin equity markets.They stressed that at the beginning of Oct 2007 world equity markets measured at an all-time high USD market capitalization of more than $51 trillion as of this date, whereas by the end of Feb 2009, global equity market capitalization stood at just over $22 trillion, that is,it dropped offmore than 56%. However, as the Lehman collapse on Sept 15, 2008 has been a key event, theyconcludedthat for their purposes the crisis period being defined as the close of markets on Friday Sept 12, 2008 to the close of trading on Monday Oct 27, 2008 (Bartram & Bodnar 2009, p. 1248).Moreover, they proposed Jan 1, 2007 –Sept 12, 2008 as the pre-crisis period, and Oct 28, 2008 –Feb 27, 2009 as the post-crisis period. As a matter of fact, their choice of the post-crisis period seems to be rather controversial in the light of the major stock market indexes continuing their decline during this period,

The structure of NNs in applications is not presented in the Table 2. However, it is implied in the data model. since data model determines the number of input and output neurons. The number of hidden layers, and the numbers of neurons in hidden layers, is larger if the number of input data is larger too. The relation between NN learning functions and data models is clearer: most researchers use the sigmoid learning function. Important information for the data model can be the size of the training set in each application. The size of the training sets in applications is often over 100, and it depends on the predicted time period. Therefore, the set is larger in applications that try to predict 10, 20, 30, or more periods in advance. Some researchers emphasize that size of training set is critical because of the possible hidden correlations among the data.

LIMITATIONS

Some of the NN limitations mentioned in the analyzed articles are: (1) NNs require very large number of previous cases [4, 12]; (2) "the best" network architecture (topology) is still unknown; (3) for more complicated networks, reliability of results may decrease; (4) statistical relevance of the results is needed; and (5) a more careful data design is needed [6].

The first limitation is connected to the availability of data, and some researchers have already proven that it is possible to collect large data sets for the effective stock market predictions, e.g. Schoeneburg used the input data of 2000 and 3000 sets [7]. The limitation still exists for the problems that do not have much previous data, e.g. new founded companies. The second limitation still does not have a visible solution in the near future. Although the efforts of the researchers are focused on performing numerous tests of various topologies and different data models, the results are still very dependent on particular cases. The third limitation, concerning to the reliability of results, requires further experiments with various network architectures to be overcome. The problem with evaluating NN reliability is connected with the next limitation, the need for more complex statistical relevance of the results. Finally, the variety of data models shows that data design is not systematically analyzed. Almost every author uses a different data model, sometimes without following any particular acknowledged modeling approach for the specific problem.

REFERENCES

1. Adkins L.C. 2013. Using Gretl for Principles of Econometrics,4th Ed., Version 1.041.Bartram S.M., Bodnar G. (2009). No place to hide: The global crisis in equity markets in 2008/2009. Journal of International Money and Finance. 28(8), 1246-1292.
2. Alexander, S., "Price Movements in Speculative Markets: Trends or Random Walks," Industrial Management Review, vol. 2, No. 2 (May 1961), pp. 7–26.
3. Brunnermeier M.K. (2009). Deciphering the liquidity and credit crunch 2007-2008. Journal of Economic Perspectives. 23(1), 77-100.
4. Bry G., Boschan C. (1971). Cyclical Analysis of Time Series: Selected Procedures and Computer Programs, NBER: New York.
5. Calomiris C.W. (2009). The subprime turmoil: What's old, what's new, and what's next. Journal of Structured Finance. 15(1), 6-52.
6. Chottiner, Sherman, " An Investigation of Stock Market Interactions via Computer Simulation of an Idealized Behavior Model," unpublished Ph.D. dissertation, New York University Graduate School of Business, 1968.
7. Clarkson, Geoffrey G.P., Portfolio Selection: A Simulation of Trust Investment, Prentice-Hall, Inc., Englewood Cliffs , New Jersey , 1962.
8. Cootner, Paul H., "Stock Prices: Random vs. Systematic Changes," Industrial Management Review, vol. 3 (Spring, 1962).
9. Fama, Eugene F., "Random Walks in Stock Market Prices", Financial Analysts Journal, vol. 21, No. 5 (SeptemberOctober 1965), p. 57.
10. Harding D., Pagan A. (2002). Dissecting the cycle: a methodological investigation. Journal of Monetary Economics. 49, 365-381.
11. Lee J.-S., Kuo C.-T., YenP.-H. (2011). Market states and initial returns: Evidence from Taiwanese IPOs. Emerging Markets Finance & Trade,47(2),6-20.
12. Levy, Robert A., "Random Walks: Reality of Myth," Financial Analysts Journal, vol. 23, No. 6 (November 1967).
13. Lunde A., TimmermannA.(2000). Duration dependence in stock prices: An analysis of bull and bear markets. University of California, San Diego.
14. Maheu J.M., McCurdy T.H. (2000). Identifying bull and bear markets in stockreturns. Journal of Business & Economic Statistics. 18(1), 100-112.
15. Mishkin F.S. (2011). Over the cliff: From the subprime to the global financial crisis. Journal of Economic Perspectives. 25(1), 49-70.
16. Pagan A.R., Sossounov, K.A. (2003). A simple framework for analysing bull and bear markets. Journal of Applied Econometrics.18(1),23-46.
17. Pisani-Ferry J., Sapir A. (2010). Banking crisis management in the EU: An early assessment. Economic Policy. 62, 341-373.
18. Reinhart, C.M., & Rogoff, K.S.(2008). Is the 2007 US sub-prime financial crisis so different? An international historical comparison. American Economic Review, 98(2), 339-344.