

Preliminary Assessment of the Possibility of some Phenomena Detection in Building Physics with the Use of the Stock Markets Technical Analysis

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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.

I. INTRODUCTION

The article concerns the possibility of transferring some aspects of technical analysis used in economics in the case of investment processes and in trading to engineering applications. In particular, it is possible to use some methods and indicators in the microclimate research. It should be noted that in recent years the search for relationships between physical phenomena and their counterparts in economics has been developing. The article proposes the opposite point of view – trial of usage of some economic indicators in engineering research, including microclimate research. The literature so far has confirmed that physical phenomena are reflected in some market behavior. Hence, it can also be concluded that some methods used in technical analysis allow their application in engineering. The article is a proposal to use existing methods in the analysis of growth trends in engineering measurements.

This method helps in determining the direction of changes, in the context of appearing changes and random measurements as well as factors affecting the formation of a trend, e.g. temperature increase, in a rather random way. The classic statistical approach allows the determination of a regression curve that is devoid of root cause analysis. It is

not based on indicators which factors should be given special attention as significantly affecting the change in the trend of parameter values. The opposite is true of some indicators used in economics to forecast market behavior as part of technical analysis. Among others, the period of occurrence of a given phenomenon, the degree of its intensity through the volume involved and other factors that may indicate the intensification or weakening of the changes are analyzed. Transferring the above experiments to the field of engineering research, where similar phenomena often occur, can be very useful. This allows a faster assessment of the trend (like the announcements of the market news changes course trend). This is a new approach that has been proposed in this article. Here is presented some preliminary assumptions for transferring trading methods basing on technical analysis and indicators to building physics and its microclimate parameters changes analysis.

Research so far performed by the Author since 90s of the 20th century [1][2][3] concerns the impact of human heat emissions on the microclimate of closed rooms (in high-volume buildings where the microclimate is a significant factor influencing the microclimate of the room). At the same time, he has experience in carrying out forex transactions (he has tested numerous strategies that have finally resulted in numerous conclusions regarding the use of technical and fundamental analysis or volume analysis, which he considers as the most important factor in making effective decisions.

II. THE BACKGROUND OF ANALYSIS

One of the technical analysis indicators useful for the analysis of the conjunction between engineering and the trading is well-known MACD indicator. It is used in technical analysis of stock prices and it is created by Gerald Appel in the late 1970s [4]. It tests changes in the strength, direction, momentum, and duration of a trend. There is a huge amount of books considering MACD and other trading indicators basing on the moving averages.

Some behaviors of the market are clearly identified since Adam Smith described them in his book "An Inquiry into the Nature and Causes of the Wealth of Nations" [5] which was released in 1776 and another treatise was "The Theory of Moral Sentiments" (released in 1759) [6]. Those assumptions described there are used until these days [7].

One of the oscillators considering volume (except e.g. standard tick volume indicator or deep market real volume) is the Money Flow Index (MFI). It uses price and volume calculating buying and selling pressure. -It is indicator functioning as the volume-weighted RSI (another basic indicator) [8]. And also other often-used indicator using volumes is also e.g. On Balance Volume (OBV) indicator which also measures buying and selling pressure. Its nature is to be a cumulative indicator and it was developed by Joe Granville - and described in 1963 book "Granville's New Key to Stock Market Profits" [9]. Considering worth and usefulness of the technical and fundamental analysis it is necessary to say that in the engineering there is sometimes similar problem to check whether value of the meaning parameter is caused by important accidental impulses (by the analogy, like the important announcements of data influencing on market) or are only the "noise" – which is similar to "noise trading" and sentiments of individual investors [10, 11] where a huge group of trades is not obviously connected and parallel to the trend (of signal or adequately to price changes trend). In market analysis, there is still considered some kind of conflict (fundamental analysis versus technical analysis) between opinions [12] that technical or fundamental analysis is the most important thing to understand market trend changes and to predict it (and to know it is possible to determine trend).

There is some similarity also in a method in testing trends in parameters or price changes both in engineering and economy and nowadays because of the growth of computer technology the same methods are (and still will be in the future) used. Between them, there are neural networks [13] and plenty of typical or specialized software such as trading platforms, but also statistical analysis software [14], which is used both in engineering and in the economy (and also in other disciplines). It can be used for specialized analysis such as selecting macroeconomic influencers on stock markets using some algorithms [15].

Comparison and searching the connections between physical phenomena, kinematic variables of non-relativistic mechanics and in general context – theoretical physics and the economy are the very actual aspect of scientific research [16]. The econophysics is a very promising and quite new area of science. This considers the similarity of physical and economical phenomena like the price jerk equation (market) acquires the form that corresponds to the non-relativistic equation for the jerk in mechanics (following from Newton's second law of motion) [17]. Econophysics applies theories and methods from physics to solve problems in economics as it is represented by many books and papers e.g.: [18][19][20][21][22][23]. Those processes are transited from physics to the finance area [24] and they are the common part of the area of science.

III. COMPARISON OF SOME SIMILARITY BETWEEN PHENOMENA OBSERVED IN BUILDING PHYSICS RESEARCH AND IN THE STOCK MARKETS

Based on the numerous trading strategies tested so far (covering different transaction periods and their number), as well as hundreds of thousands of collected results of microclimate measurements through about 20 years of Author's research, the preliminary results of the studies presented below were collected. Those results consider similarities in microclimate measurement results and price exchange changes in the financial market like the Forex markets.

Measurements in engineering are characterized often by a far-reaching randomness of the decomposition oscillating around a certain average value. Under the conditions considered as stable, measurements performed under established conditions relate to a measurement whose value (for a given parameter, e.g. air temperature) changes within the limits of a measurement error (statistical errors) and accidental errors.

For additional factors that determine the change in temperature (a specific accepted factor, e.g. an additional heat stream affecting temperature gain) – this leads to often quite a linear increase in temperature.

In terms of random parameter changes, the time of impact of the factor on the change of parameter (e.g. microclimate parameter) is important. Therefore, in this situation, these factors affect the value of e.g. microclimate parameter as an air temperature – with the often random significant impact on the factor value and its varying.

In terms of microclimate change, individual events randomly affect the measurement results. These include e.g. opening of external doors or windows of the room (influx of cold, fresh air from the outside). Sudden shutdown of the heating equipment (stopping the operation of the kettle and thus subsequently heaters) as a result of the lack of an inflow of electrical current and the stop of the kettle and heating system operation.

In the case of investment markets, an equivalent is a sudden event (e.g. announcement of an incompatible to the consensus decision of the Fed, ECB or other market-relevant institutions and bodies). This resulted, for example, a sudden change in the exchange rate and subsequent volatility resulting from an unforeseen event. In this situation, there is some similarity between processes affecting e.g. the change in air temperature and on the graph covering the course changes. - the randomness of events - in both cases, these factors can be unpredictable. In the case of investment markets, however, there is often a pre-event reaction, which is not observed in the event of an incident involving central heating installations (power accidentally voltage failure is an unannounced event). However, in the case of forex financial markets, we are seeing a similar situation – in the case of a one-off market for significant money (by some market participant like smart money being large speculators), we are seeing a similar phenomenon of market disturbances. At the same time, after a change in the rate caused by a one-off

purchase or sale, we observe the lack of impact of the above factor, but only the effects of the change in the course (market reaction in the form of a return to the previous value or, for example, on the contrary – maintain a new trend, knock out stop losses and change the situation after buying or selling (e.g. changing the direction of change to the opposite).

Therefore, the closest case to the case in question is the option of announcing new information that may affect the process in a similar dimension as a sudden change in microclimate factors. Another situation is the process of gradual changes that are initiated by a specific trend. Cyclical changes that occur in investment markets include buying and selling. These are situations where, as a result of the long-term supply advantage, there is a gradual drop in the instrument rate (buying at an increasingly lower price, thanks to sales offers at a sufficiently low price), which is then manifested by the sell-out of the market. This is a situation where the money supply is falling at a relatively low price offered by the market. Hence, the trend of gradual market purchases is changing from low prices to higher prices to the market overbought level, which again, for the variety, is manifested by the gradual disappearance of demand for currency at the price offered by the market (which becomes increasingly, reaching a certain range that accepts the market at a given time). In this situation, there is a gradual return to the previous phase and fluctuations (volatility) - upward and downward trend. There is no obvious and fixed and unequivocal level of market overbought and oversold levels, as there may be a sudden speculative capital engaged at any time, which will change the market image, causing, for example, a market buy-out and a sell-out. extension of the period of sell-out and out of the scope determined by economic indicators such as RSI (over 70% and less than 30%) or Stochastic Oscillator (over 80% and less than 20%). At the same time, it should be noted that the price oscillates (as illustrated e.g. by Elliot's wave theory). They change in repeated increases and decreases cycles, which during consolidation can even have rather repetitive amplitudes and frequency of change. A similar situation may occur in engineering, in case of air temperature measurements. For example - alternating times of day and sunlight as an additional heat source (day and night time), use (staying people indoors or lacking it, which is associated with emissions of heat from humans or lack thereof) and a cyclical change in the use of the room (lack of equipment operation as the source of heat or change in human heat emission). Oscillations can be less disturbed in financial markets through sudden events like the supply of capital carrying out one or more transactions (by Smart Money as the large speculative investors). Alternatively, this is reminiscent of changes in the use of the room, the volatility of the weather and changes in sunlight intensity (a change of significant factor constituting an additional heat source), etc.. Similarly, economic events and news (e.g. announcement of the unexpected by the market change in interest rates) can affect the market intensively for some range of time. These are events of significant similarity.

Thus, it can be pointed out that there is a significant similarity between the factors of changes in the e.g. Forex market (as the selected part of the financial markets) and the analysis of changes in air temperature (a selected aspect

concerning measurements in engineering). The factors that influence the obtained values (exchange rates and analogously air temperatures) are either accidental (sudden, unforeseen events) or cyclical (temperature oscillations around a certain temperature value and cyclical changes between the level of oversold and overbought, clearly visible on the charts, e.g. M5 or M15 during the consolidation period). So, there is the question if the analysis can be made in the same way as in the case of financial markets. In the case of analyses carried out on financial markets, moving averages, oscillators and numerous indicators are used, which are to provide an indication of possible future changes based on historical data. Some of the indicators are of a pre-emptive nature - such as Momentum or Stochastic Oscillator. In the case of delayed indicators, MACD (based on moving averages) can be indicated. The use of moving averages from different range of time is typical for some of the numerous (going into hundreds) used indicators, of which the most popular are relatively few (RSI, Stochastic Oscillator, Accumulation-Distribution, Momentum, Awesome Oscillator, ATR, and many others). The decisive factor in their selection is a specific investment strategy and the method of analysis conducted by the trader, which becomes a strongly individualized aspect.

In the case of measurements conducted in engineering, the aspect of forecasting future changes in practice does not exist and it is measured or in another case - calculated basing on the normative assumptions and formulas. This factor is generally not taken into account in the scope of conducted measurements. Only a general assumption is made as to the possibility of changes occurring under the influence of a given factor. For example increase in temperature due to the presence of people, which is characteristic for objects where the emission of heat from people is significant, due to the presence of many people in the rooms at the same time (as it is shown in works by the author since the end of the 1990s until now). As a result, the expected changes can be predicted based on previous measurements, and the collected new measurement results confirm certain assumptions and complement them. A similar situation occurs in the financial markets concerning the use of so-called expert advisors and indicators, whose effectiveness is shown on historical data. In this case, some parameters (e.g. interval, number of days taken into account in the calculation of the moving average, etc.) depend on the result of the indicator test on historical data concerning past events. It is very controversial whether the technical analysis (analysis of historical charts, previous oscillations, resulting formations as graphical layouts or resulting from relevant conversions) works (some recognized traders believe that it does not or at least cannot be the only determinant of investment decisions). However, in trading, for some people, it is a determinant of the assessment of future course behavior (often even independently of the so-called fundamental analysis, i.e. without taking into account sudden market events, which may raise significant controversy as to the characteristics of such a model of behavior in taking investment actions.

In the case of analysis of historical data (previous measurement results), it is also possible, in a certain sense, to form a view of the reaction of the room's microclimate to previous changes. In engineering, there is a process of searching for multiple, the same, similar situations in which a

given stimulus then caused a specific change. It should be noted that classical technical analysis does not analyze the nature and reason of the impulse, but the process of change seen on the price change charts (and some various formations - such as flags, triangles, head-arm, saucers, etc.). Thus technical analysis focuses often on the formations and not on the relationship between nature of the power of the impulse and (if it is possible although) range of the change. In contrast, Forex trading often uses analysis of whether there is an impulse or correction. In the first case, it concerns a change in e.g. currency pair exchange rate under the influence of e.g. significant demand (the exchange rate of a given currency pair increases).

It is rare to predict a change in the exchange rate under the influence of a stimulus. In the case of financial markets, the stimulus is the suddenness of a given change. It should be noted that the sudden introduction of a sufficiently high volume in a purchase or sale causes a sudden change in the exchange rate. The reaction is closely dependent on the market order book. Therefore, if the change is too sudden, it is often in the interest of speculative investors who want to make long-term sales during the consolidation period, to introduce their capital to the market at some volume and rate that it is possible to execute the transaction in its entirety (taking into market the entire volume to be transacted) to do so at a rate within a certain range. Hence, it is often done over a longer period (counting not only hours but often days, weeks or even months). In this way, Smart Money investors work towards maintaining control over the market and not influencing it against its interest (a transaction executed immediately may not be possible to be executed abruptly through low liquidity in the market, as well as it may trigger e.g. a sellout process, contrary to the assumption of waiting e.g. a price increase and only later on reselling the currency at a higher price (closing a long positions with a profit).

In engineering, it should be pointed out that the process of microclimate control also occurs, which is an obvious consequence of microclimate control - by controlling the installation in automated processes.

Thus, the following situations are of interest in this area. They allow for analogous case studies and analyses.

a. For financial markets: rapid introduction of a clearly defined volume (expressed graphically by a wide candle spread and indeed a nominal volume value). Then the analysis of the changes in the price chart. This then requires statistical analysis. It should be noted that the response to the impulse (introduction of the volume) may not be adequate due to the opposite side of the transaction and the capital lying there in the form of supply or demand, respectively (sudden introduction of the volume may meet with a breakthrough on rates or lack of market response. - It is not clear and may not be predictable even for smart money having access to the deep market.

b. In case of changes in microclimate parameters. - As a result of a given impulse/stimulus (e.g. a sudden opening of windows or a temporary loss of electricity, or temporary heating lasting a relatively short time) - searching on the charts for answers in the direction of finding the relation between the factor influencing the microclimate and the

answer in the form of e.g. a decrease or increase in air temperature).

c. In the case of financial markets: a change of an incidental caused nature, continuous, affecting continuously in the next period under consideration. This is a typical situation concerning the announcement of important macroeconomic data affecting the market in the long term (e.g. interest rate cuts). Therefore, under the influence of the scale of the change (expressed as a change in the spread on a downward or upward candle) a sudden market response is obtained (which should be considered in a relatively longer range of time, at least a few 15-minute candles to know the market's relatively undisturbed response to the impulse). Based on the previous analysis of changes in terms of the instrument in question, it is possible to obtain a reflection of the possible range of changes. In practice, however, the markets often react unpredictably way and each time the response may be inadequate to previous experience (smaller or larger, none or the opposite).

Thus, it should be pointed out that the publication of macroeconomic data cannot be a determining factor in determining possible changes. It is not possible to predict the permanent reaction of the market or even the direction of change. There are many cases where the exchange rate has behaved inadequately to the announced and expected or unexpected changes.

In case of changes in microclimate parameters - the changes are always adequate to the stimulus (impulse). For example, switching on the heating causes the room temperature to rise. Thus, in the above case (a) the change in both cases is barely different. Considering case (c) engaging of the volume during the consolidation period, in this case in a longer range of time we then get the market response after a breakthrough, after a period of buy-out and sold-out, which approximately lasts the longer the consolidation period lasts (this is a generalized view, which in some cases may not work at all). In any case, this type of situation deserves special attention.

In this case, there may be a statistical relationship between the scale and strength of the stimulus (impulse) and the response in the form of a target course change. The condition is that no significant disruption occurs in the meantime, e.g. due to the announcement of important macroeconomic data or the introduction of significant speculative capital to influence the market. During the period of stability of change, the following relationship can be identified:

$$BV = T * \square P \quad (1)$$

where:

BV - is the Bounded Volume indicator [h*pips],

T - maximal observed time of accumulation [h],

$\square P$ - the difference between the highest and lowest price in the area of accumulation [pips] (it is important to notice that $\square P$ is simulated and not quite accurate value, based only on maximal and minimal values of price, not on weighted average), [pips].

Proposed Bounded Volume indicator (formula 1) value is based on a set of selected analogous past events for a given instrument, over a reasonable range of time allowing to consider them as comparable events, which will then be distributed (to an unknown extent) in the period after the consolidation is completed and the above resistance level is broken or the exchange rate falls below the support level (if this break-out is actual, and not e.g. related to upthrust or spring, according to the Richard Demille Wyckoff method).

BV value can be detected on the chart as the area of accumulation. It is used to achieve change in price (downward or upward) in some time and its strength depends on T and $\square P$. By the analogy, it should be noted that it is possible to apply an indicator related to the impact of the microclimate forming factor adequately in engineering. It is similar to the distribution of energy cumulated in a heated room. - The main difference is that there is no consolidation period, but only the energy provided in sometimes relatively short time, expressed in joules, which then has the effect of e.g. temperature increase in a room (caused by heat emitted by persons who entered the room although this impulse lasts some specific time). So, Cumulated Energy indicator can be described as E_c (formula 2). It is important that E_c not considers specific conditions influencing heat streams – it must be concerned separately.

$$E_c = T' * \square \quad (2)$$

where:

E_c – Cumulated Energy indicator (e.g. for the heat source in the tested room) [J],

T' – time of the heat emission by the energy source (e.g. additional heat stream from persons)[s],

\square - heat stream emitted in the very moment [J/s].

Thus, due to the similarities between the two situations in question, it is possible to define these two indicators in two different areas - i.e. for stock markets and for indoor air temperature research.

IV. SUMMARY AND CONCLUSIONS

Some preliminary assumptions considering the possibility of data analysis in building physics with the use of the financial market trading indicators:

- As far as stock markets and engineering measurements are concerned, there is a certain similarity in some phenomena influencing the shaping of charts because of changes in the valuation of financial instruments and respectively - e.g. changes in selected microclimate parameters;
- Similarities occur in limited, specific cases, but the common feature is the appropriate response to an impulse, which results in a specific response;
- The aim of the research conducted so far was to provide a preliminary answer to the question if there is a relationship between impulse and response, analogously to microclimate changes in building measurements. The preliminary results of the analyses indicate that this

dependence can be demonstrated in a similar way to the changes in air temperature caused by the introduction of a heat stream. The above analogy has been the subject of two indicator concepts, which can be used as an indication to compare both situations - financial markets and building measurements. The analogy allows the transfer of experience from one area to another and the search for common relationships. The current results of the research will be a contribution to further work, which will be reflected in subsequent publications;

- In the case of a consolidation, where a certain volume is involved, an analogous market response should be expected (with a relatively small, weakly or not at all noticeable impact of other factors). Similarly, as in the case of microclimate measurements, a response proportional to the stimulus should be expected. This is expressed by the currently proposed BV indicator;
- While the BV indicator does not respond to the form of a change in the price of the instrument under test, it may provide some additional indication that may help make decisions in financial markets. At the same time, it should be borne in mind that its effectiveness may be negligible and may produce different-than-expected results leading to losses (it is not an indicator ensuring positive market outcomes).
- In the case of microclimatic studies, it should be pointed out that a significant similarity between the charts of exchange rates of currency pairs or relating to CFDs and adequate price charts of e.g. temperature changes includes the influence of different and completely different factors. However, to some extent, there are similarities that can be used in the analysis of microclimate data. It is possible, for example, to use moving averages in a manner analogous to financial markets, which is currently the subject of research conducted by the Author. Research aimed at developing assumptions for the above indicators are still conducted. Further results of the research will be published soon.

ACKNOWLEDGMENT

Author thanks to Professor Leszek Wolski for the large-volume and sacral buildings research supervising at the Warsaw University of Technology.

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