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The summary of doctoral dissertation

Profitability of investments in context of the momentum effect on the Warsaw Stock Exchange in 2008-2018

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From the 1970s, from the moment when E. Fama defined the effective market hypothesis (HRE), there was an uninterrupted discussion on the real efficiency of capital markets¹. Investors and other participants of the financial markets asked themselves an important question: are they information-efficient? Information efficiency, as one of the assumptions of HRE, meant that emerging public or private information about shares of certain companies was immediately reflected in their prices. It determined the information efficiency of the capital markets². Confirmation of this phenomenon was evidence that strengthened the efficient market hypothesis. A number of facts and studies have shown, that although this theory is commonly believed to be true, there were frequent and repetitive exceptions to it³. These exceptions were referred to as **anomalies**, i.e. significant deviations from the model resulting from the HRE⁴. One of the strongest and most common anomalies was the one commonly known as the **momentum effect**. In stock exchanges, the momentum effect relates to this phenomenon; that stocks of companies whose prices recorded high, positive or negative historical rates of return in its classic form, in the period from 1 to 12 months; tend to maintain a similar trend of price changes also for the next 1 to 12 months in the future⁵. The confirmation of the momentum effect in capital markets in Poland and worldwide⁶ highlighted a number of knowledge gaps that needed to be investigated and filled. This also applied to aspects of the

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- 1 Rouwenhorst G., *European equity markets and the EMU*, „Financial Analysis journal” 1999, Vol. 55, no. 3.
 - 2 Ciołek M. *Efektywność Informacyjna Polskiego Rynku Akcji*, CeDeWu sp.z o.o., Wydanie II, 2019, s. 35-40.
 - 3 Jensen M., *Some Anomalous Evidence Regarding Market Efficiency*, Journal of Financial Economics, Vol. 6, no. 2/3, 1978, s. 95-101.
 - 4 Buczek S., *Anomalie na polskim rynku akcji, czyli jak wykorzystać nieracjonalne zachowania inwestorów*, w: W. Bień (red.): *Rynki kapitałowe*, Szkoła Główna Handlowa w Warszawie – Kolegium Zarządzania i Finansów, Monografie i opracowania naukowe, Warszawa 2005, s. 39.
 - 5 Kahneman D., Tversky A., *Prospect theory: an analysis of decision under risk*, „Econometrica” 1979, Vol. 47, no. 2, s. 263–292.
 - 6 Pawłowska J., *Efektywność strategii momentum w inwestowaniu na Gieldzie Papierów Wartościowych w Warszawie*, [w:] *Zeszyty Naukowe Uniwersytetu Szczecińskiego*, nr 855, Finanse, Rynki Finansowe, Ubezpieczenia nr 74. t.1 (2015), s. 447-454.

Polish stock market. Questions related to the momentum effect were, inter alia, answer to the question: *is the momentum effect still present on share prices listed on the WSE?* Another one related to the fact: *whether and how the occurrence of the momentum effect depends on the situation on the stock exchange?* Due to the marginal availability of the short sale instrument on the WSE⁷, the question also to justify: *are the profits generated mainly by rising or falling stocks, where the source of profits is short selling?* The question was also significant: *the smaller the number of shares taken into account for the construction of the portfolio based on the momentum effect, the higher its rate of return will be.* The very essence of the momentum effect also required further research and analysis. Its classic form has not exhausted the research in this area. The area indicated by M. Gränitz, a completely unknown issue; there was a suggestion of the momentum effect during the trading session (session momentum effect) and between the closing and opening prices on the next day (off-session momentum effect), when there is no stock trading⁸. So far, this issue and its determining area have not been yet investigated. *Understanding the actual place where the momentum effect arises, made it possible for the creation of new investment procedures for investors using the knowledge obtained in this way.* Apart from the theoretical aspects, it made it possible to expand the process of researching the phenomenon of this anomaly itself. Of course, the application aspects were also important here, giving indications for investors based on the strategies of the momentum effect.

The answers to the above questions correlated directly with the main objective of this dissertation, which was assumed to be: *verification of the existence of the momentum effect and its impact on the profitability of shares on the WSE.* The realization of the key objectives of the dissertation required the creation of a number of partial objectives, both theoretical and empirical. The theoretical goals were focused on the following research aspects, i.e.:

- indicating the place of behavioral finance among economic sciences (T1),
- defining the momentum effect and organizing knowledge about its occurrence on the most important stock exchanges in the world (T2),
- systematization of the methodological base of the study of the momentum effect (T3),
- identifying the causes of creation of the momentum effect in the context of the rational and behavioral approach (T4).

7 <https://businessinsider.com.pl/poradnik-finansowy/co-to-jest-krotka-sprzedaz/h9dsd7d> [access: 25.07.2021].

8 Gränitz M., *Der Momentum-Effekt und Momentum-Handelsstrategien Eine quantitative Analyse*, Dissertation zur Erlangung des akademischen Grades Doktor der Wirtschafts- und Sozialwissenschaften, Kassel, Oktober 2014, s. 289-290.

Keeping in mind the fact, that this dissertation focused on the study of the momentum effect on the Polish capital market, the empirical objectives of the dissertation focused on:

- examining the effectiveness of various equity portfolios on the WSE using the momentum effect strategies in 2008 - 2018 (C1),
- systematization of the momentum effect on the WSE in periods of different economic conditions in 2008 - 2018 (C2),
- analysis of the effectiveness of equity portfolios based on the momentum effect for its long and short positions (C3),
- systematization of the momentum effect during the session and outside of it (C4).

In order to achieve the above-mentioned objectives, the main hypothesis and partial hypotheses were adopted in the work. The main research hypothesis concerned the existence of the session and off-session form of the momentum effect. It was assumed that: *on the Warsaw Stock Exchange in 2008-2018 the momentum phenomenon occurs during the session and outside of it and has an impact on the profitability of shares*. Additionally, three partial research hypotheses were put forward:

- H1 - On the Warsaw Stock Exchange, the momentum effect occurs in periods of recession and growth.
- H2 - Most of the profits on portfolios invested in momentum effect strategies come from long positions.
- H3 - The smaller the number of shares taken to build a portfolio based on the momentum effect, the higher the rate of return.

The **subject of research** in this dissertation were the share prices of companies listed on the WSE, included in the WIG and WIG20 indexes. The **subject of the research** was the momentum effect and investment portfolios based on them. The **time scope** covered the analysis of the prices of WIG and WIG20 shares on the WSE in 2007-2019. The results of the research carried out at work were intended to show double effects. On the one hand, they were used to achieve the assumed empirical objectives and to verify the research hypotheses set out at the beginning of this dissertation. On the other hand, they were to result in recommendations so important for the actions and attitudes of investors on the stock exchange. This was related

to the implementation of the application objective of the work expressed in *recommendations for investments based on the momentum effect*.

The basic method of scientific explanation of the described and analyzed phenomena at work was deductive reasoning. At the same time, it should be noted that the inductive approach was also used. In addition to the indicated methods, defined algorithms of procedure were used for the development and analysis of data. They were used to design and conduct researches. Momentum matrices were used to present the results at various levels of aggregation, aggregating data on the rise or fall of stock prices in portfolios. On the other hand, the methods of statistical description⁹ as well as statistical methods were used to analyze the obtained results; in particular, those related to testing the significance of the results themselves or the differences between their individual groups. It is also worth mentioning the methods of examining correlation relationships. The structure of the work included theoretical and practical parts. The theoretical part focused on the *location of behavioral finance among economic sciences*. Behavioral finance constituting the substantive basis for the description of the momentum effect as an anomaly in opposition to the effective market hypothesis¹⁰. At the same time, the paper defines and characterizes the essence of the momentum effect. There were also summarized the momentum research conducted on the most important stock exchanges in the world and the Warsaw Stock Exchange. An attempt was also made to describe the rational and behavioral reasons for the emergence, strengthening and weakening of the momentum effect on capital markets. In the next steps, the focus was on the *systematization of the methodological bases of the study of the momentum effect*. The main aspect of the considerations was to gather knowledge on the methodological aspects of the study of the momentum effect in its classic form. The theoretical part of this dissertation based on the analysis of Polish and foreign literature on the subject in this area. In the next step, an alternative, i.e. session and off-session form of perceiving the momentum effect as an alternative to its classical form was defined. In part of the dissertation, methodology of examining both session and off-session forms of this anomaly was proposed. The empirical part of the work presents the results of the research. Three studies were conducted in the dissertation. The first two concerned the classic momentum effect for all shares included in the WIG index and their limited number of listed shares, companies included in the WIG20 index.

9 Makać W., Urbanek-Krzysztofiać D., *Metody opisu statystycznego*, Wydawnictwo Uniwersytetu Gdańskiego, Gdańsk 2021.

10 Thaler R., *Toward a Positive Theory of Consumer Choice*, Journal of Economic Behavior and Organization, 1 (1980), s. 39–60.

The third study concerned the analysis of the session and off-session momentum effect. In the theoretical part, empirical objectives were achieved along with the main goal of the work, which was to *verify the existence of the momentum effect and its impact on the profitability of shares on the WSE*. Thus, the profitability of various equity portfolios using momentum strategies was examined. At the same time, the obtained research results were related to various economic periods on the Warsaw Stock Exchange. Thus, the H1 hypothesis was verified, stating that *the momentum effect on the Warsaw Stock Exchange occurs in periods of recession and growth*. In the next step, the hypothesis H2 was verified that: *most of the profits from portfolios invested in the momentum effect come from long positions* and the hypothesis H3 assuming that: *the smaller the number of shares taken to build the portfolio based on the momentum effect, the higher the rate of return*. The last research carried out in this part of the work concerned the session and off-session momentum effect. The presented results showed their nature, which was the fulfillment of the last empirical objective, which was the *systematization of the momentum effect during the session and beyond*. The study of the session and off-session momentum effect also referred to the main hypothesis that *on the Warsaw Stock Exchange in 2008-2018 the momentum phenomenon occurs during the session and outside of it and has an impact on the profitability of shares*.

The results of the dissertation clearly broadened the knowledge about the essence of the momentum effect. Behavioral finance was indicated as the substantive basis for the study of this anomaly. The irrationality of people's behavior was emphasized, including the influence of the market crowd on the decisions made by investors, which could cause anomalies in capital markets. Apart from presenting the essence of the momentum effect, an attempt was made to describe the rational and behavioral causes and premises; the emergence, strengthening and weakening of the described anomaly on capital markets. Thanks to the analysis of research conducted in the world and theoretical sources, the methodological aspects of the study of the momentum effect were defined. The procedure for carrying out the study of this anomaly, which is the subject of the analysis in this paper, is defined here. As a completely new area, a new way of capturing the essence of the momentum effect was shown in the context of the session as well as outside it. By research hypotheses presented in the paper, indications were obtained that the economic situation has a partial impact on the shaping of the momentum effect on capital markets. At the same time, long positions were verified as the primary source of profit in momentum strategies. Finally, it is shown that the profits obtained from the momentum strategy depend on the number of shares charged to the portfolios used to investigate this anomaly. It was found that the reduction in the number of shares increases the

profitability of the portfolios of which they are components. At the same time, thanks to the research and the implementation of the empirical objectives of the work, **recommendations for real investments were issued**, which was the implementation of the application objective of the work. The most important indications include such aspects as: the importance of the number of shares selected for portfolios, the principle of using short selling, especially in the aspect of its limited use in Polish conditions. The issue of stocks of companies with a very bad economic situation and the risks associated with their use in momentum strategies was also addressed. The issue of business cycles on capital markets and their impact on investments with the use of the momentum strategy was also discussed. It turned out to be important to supplement these strategies with methods of technical or fundamental analysis. Finally, a number of new investment aspects related to the session and off-session forms of the momentum effect are presented. The tendency showing that the momentum effect in its classical form arises in the off-session period. During the session period, a reverse tendency was noticed, which weakened this phenomenon. Using the data from the literature on the subject and the results of the research conducted in the dissertation, it was found that the assumed **objectives** were achieved and the **research hypotheses** were verified. By means of empirical research, in particular concerning the session and off-session momentum effect, the scope of knowledge was extended both for theoretical areas and potential real investments in capital markets. The results of the work also revealed a number of potential areas and directions for **further researches**. Their exploration will probably develop knowledge about the essence of the momentum effect itself, also contributing to economics, behavioral finance, and real investment. Among other things it is needed further expand the knowledge on the essence of the session and off-session momentum effect. The issue of the nature of the remaining deciles, different from those used to create portfolios to study this anomaly, also seemed to be significant. The research on the length of periods with positive correlations of past and future rates of return should probably be continued. Especially for investors, the issue of the momentum effect created not on portfolios themselves, but on individual, individual securities. It would open the way to completely new investment methods. This will require a new methodology for testing such a form of the momentum effect. Finally, another direction that was indicated, was the methodological aspects of the momentum effect study, in particular regarding the methods of selecting stocks for portfolios. These and other aspects have opened the way for further, innovative considerations in the field of the momentum effect, anomaly in opposition to the efficient market hypothesis.