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Calendar anomalies as an example of interferences of the efficient market hypothesis – pandemic and post-pandemic economic reality

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Abstract

The purpose of this paper is to review the state of research about calendar effects as an example of biases in the efficient market hypothesis carried out in the era of pandemic and post-pandemic economic reality (2020–2023). Based on the method of reviewing and critical analysis of the literature, a summary of the previous state of research on the issue of calendar effects conducted in 2020–2023 was prepared. Drawing on research results coming from different corners of the world, it is still possible to recognize the occurrence of calendar anomalies in the vast majority of them in accordance with their previous correlations. As can be seen, the increase in uncertainty has not led to the disappearance of the occurrence of the majority of calendar anomalies. Reviewing the state of research, a certain research gap was also noticed, which concerns the failure to address the topic of calendar effects in the era of post-pandemic economic reality, accompanied by Russia's armed aggression against Ukraine.

Keywords: stock exchanges, efficient market hypothesis, market anomalies, calendar anomalies, behavioural finance

JEL: G01, G11, G15, G41

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1. Introduction

A fundamentally strong economy is the goal of most governments around the world. One of the determinants of its existence is the operation of a developed capital market. This process, in turn, brings the need for its efficiency to occur. The term efficiency in relation to the capital market is defined in three planes: allocative, transactional and informational (Mikołajek-Gocejna, Urbaś 2017, p. 36). The last type of capital market efficiency is a prerequisite for the occurrence of the previous two (Kubacki 2017, p. 124).

Undoubtedly, the greatest breakthrough in the field of research on the efficiency of capital markets seems to have been in 1965. It was then that Fama (1965) created the first definition of an informationally efficient market. Despite Fama's winning the Nobel Prize in 2013, which indicates his great contribution to the field of economics, the efficient market hypothesis is still being challenged and its many opponents can be found (Janicka 2008, p. 169). On the one hand, supporters of the neoclassical current believe that the market is in equilibrium because incoming information is reflected in the price almost immediately, making it significantly more difficult to obtain an above--average return. On the other hand, representatives of the behavioural finance stream (e.g. Kahneman, Tversky 1979, 1982) assume that the market is out of equilibrium due to, among other things, too rapid or slow impact of information on the price of the instrument (Buzala 2015, p. 98), which raises doubts about the correctness of the conclusions put forward by the creator of the efficient market hypothesis.

The present situation generates some ambiguities. On the one hand, investors strive to make markets as efficient as possible. On the other hand, tempted by the prospect of profits greater than the average return in the market, they use various methods that contradict the assumptions of the efficient market hypothesis. Such behaviour of market participants leads to the formation of a kind of market anomaly, which in the economic literature is understood as interference from the expected result, a departure from the rule (Szymański, Wojtalik 2020, p. 29). One can also find an attempt to define market anomalies in the form of biases from the rules presented in the efficient market hypothesis, which are manifested by an unexpected change in the price (up or down) of a given financial instrument (Buczek 2005, p. 39). According to Peters (1997, p. 36), this is a situation that makes it possible to earn above-average profits.

From the point of view of this study, the topic of calendar effects (also called seasonal effects) seems to be extremely important. It enjoys one of the greatest interests of capital markets researchers (e.g. Dragota, Oprea 2014; Rossi 2015; Żebrowska-Suchodolska 2021). It is a widely identifiable category encompassing anomalies resulting from investor behaviour that biases from the assumptions of the efficient market hypothesis, which occur cyclically in particular periods or moments of time (Jasiniak 2022, p. 22).

More recently, studies of this group of anomalies can be observed to consider their occurrence from the point of view of the impact of the COVID-19 pandemic and the post-pandemic economic reality (in which Russia's armed aggression against Ukraine takes place) (Luo, Tian 2020; Özkan 2021; Chatzitzisi, Fountas, Panagiotidis 2021; Żebrowska-Suchodolska 2021; Bassiouny, Kiryakos, Tooma 2023). The significant destabilization of economic conditions caused by the spread of the COVID-19 pandemic led to severe turbulence in the capital markets, which was observed especially in the first half of 2020. According to some researchers, the increase in stock market price volatility during the current turmoil was higher than during the periods of the previous great crises of 1930, 1987 and

2008 (Thakur 2020; Zhang, Hu, Ji 2020). A similar situation could be observed in early 2022, when Russia's armed aggression against Ukraine began. Given the strong economic interconnectedness of modern economies, the ongoing armed conflict is a significant cause of economic shock across Europe. Its effects are mainly associated with a slowdown in economic growth, or the occurrence of uncertainty affecting the situation in global financial markets (Węgrzyn, Topczewska 2023, p. 130).

The years of the COVID-19 pandemic and the war in Ukraine (2020–2023) saw periods of historically high readings of the VIX index value,[1] which gave rise to predictions of above-average volatility in the prices of financial instruments in global markets. Situations of increased uncertainty in the markets (caused by pandemics or war) create motivations for scientific exploration that can be used in discovering new correlations (or confirming existing ones) taking place in global capital markets. These include, undoubtedly, the topic of calendar effects being taken up at this time by global researchers in the era of pandemic and post-pandemic economic realities.

The main purpose of this paper is to review the state of research in the field of interferences of the efficient market hypothesis (using the example of calendar effects), which is carried out in the era of pandemic and post-pandemic economic reality. The author wishes to find an answer to the research question posed, which is as follows: Do the conclusions of empirical research on calendar (seasonal) effects in the era of increased uncertainty in global financial markets coincide with the research results of authors verifying these issues in earlier years? Achieving the purpose of the paper and finding an answer to the research question posed is to be supported by the main hypothesis (H) of the study formulated on the basis of previous studies in this area (Aussenegg, Goetz, Jelic 2015; Vasileiou, Samitas 2015; Chia, Lim 2016) which is as follows: "In the era of increased uncertainty in the markets, it is possible to indicate the occurrence of calendar anomalies." The main hypothesis of the study was supported by the following supporting hypotheses:

H1: In the era of increased volatility in the markets, it is possible to observe a half-year effect.

H2: In the era of increased volatility in the markets, it is possible to observe a month effect.

H3: In the era of increased volatility in the markets, it is possible to observe a day-of-the-week effect.

H4: In the era of increased volatility in the markets, it is possible to observe the effect of the turn of the month.

The paper will consider a selection of the calendar effects presented by researchers, the verification of the occurrence of which took place in 2020–2023, i.e. during the outbreak and spread of the COVID-19 pandemic and immediately after its end, when the economic reality faced a new threat – the armed aggression of Russia against Ukraine. The research method used in the study will be the method of analysis and criticism of the literature on the subject (Cooper 1988, p. 107).

The paper is divided into several parts. The first will present the assumptions of the efficient market hypothesis and biases from it using the example of calendar anomalies. In the next, attention will be focused on the scientific exploration of this issue in 2020–2023, when two "black swans" (Taleb 2010 p. 48) were recorded in the markets, i.e. the COVID-19 pandemic and Russia's armed aggression against Ukraine. The last (summary) section will be concerned with identifying the main conclusions of from the studies analysed, research limitations and possible further directions for research on calendar effects that can be undertaken in the years to come.

[1] CBOE Volatility Index (VIX) data, https://pl.investing.com/indices/volatility-s-p-500 (accessed 5.03.2024).

2. Efficiency of markets and interferences of its occurrence – examples of calendar anomalies

The main assumption of classical financial theory is the rationality of investors, who, when making investment decisions, always seek to maximize their benefits, and the information they acquire is interpreted correctly (Howells, Bain 1999, p. 451). Both investors and financial analysts base their analyses on the assumptions of the efficient market hypothesis (Fama 1965). According to it, an efficient market is considered to be, "a market in which a significant number of participants enter into transactions in order to maximize their profits, with each investor trying to anticipate future prices of individual securities that perfectly represent their intrinsic values." Fama pointed out in the definition several characteristics that the efficient market of the time should possess. These included investors' consideration of the news available on the market, oscillation of the valuation of financial instruments around their intrinsic value, and independence of subsequent price changes (Ciołek 2015, p. 30).

The occurrence of the aforementioned conditions in full did not occur in any capital market. Indeed, it is difficult to consider it appropriate, to say that the exceptionless fulfilment of the above conditions will guarantee a given capital market the title of information efficient, and any bias will make the market undeserving of this title. Fama made a similar assumption and identified three forms of information efficiency of capital markets: weak, semi-strong and strong.

The above division of the forms of efficiency of capital markets derives from the very definition of an efficient market as defined by Fama. According to it, prices fully reflect the available information. This available information is divided into three groups: historical, public and confidential. To continue, when the prices of securities reflect all past news concerning the issuer, as well as the market as a whole, we are talking about capital market efficiency in a weak form. Semi-strong efficiency is when the prices of financial instruments take into account not only historical data, but also all publicly available information, in closer or further connection with the listed issuer. A strong form of efficiency means a situation in which all information available in the market is included in the prices of financial instruments. We are talking about the previously mentioned historical data, public information announced on an ongoing basis and so-called confidential (private) information (Bisen, Pandey 2015, p. 19). In the subsequent evolution of the concept of information efficiency, one can see a move away from the assumption of "instantaneous" adjustment of securities prices in response to received information. The possibility of the existence of above-average profits was also allowed, which were supposed to correspond to the amount of expenses incurred to enter into a transaction on the market (Fama 1991, p. 1601; Buzała 2015, p. 100).

Studies conducted by many authors (e.g. Cross 1973; Kamaly, Tooma 2009; Buła 2014; Özkan 2021) did not allow a clear and complete confirmation of even a weak form of information efficiency. Moreover, during the years of exploring this issue, certain kinds of biases (interferences) of the market efficiency hypothesis began to be noticed, which over time were referred to as capital market anomalies (Mahdian, Perry 2002, p. 141; Zielonka 2008, pp. 35–36).

Several examples of groups of market anomalies can be distinguished in previous studies of global capital markets. There are many classifications of them, but the following categories appear most often (Czerwonka, Gorlewski 2012, p. 160; Fuksiewicz 2021, pp. 92–93):

– calendar effects (seasonal anomalies),

– momentum strategies,

– fundamental anomalies (related to market indicators of companies),
– interdependence of returns,
– market over-reactivity and sub-reactivity,
– anomalies related to the individual characteristics of the subject,
– anomalies related to the reaction of investors to incoming information on the market.

The first of the above-mentioned categories of market anomalies and, at the same time, one of the most widely recognized among capital markets researchers (e.g. Dragota, Oprea 2014; Rossi 2015; Żebrowska-Suchodolska 2021) are calendar (seasonal) effects. They are a widely identifiable category that includes anomalies resulting from investor behaviour deviating from the assumptions of the efficient market hypothesis, which occur cyclically at particular periods or moments in time (Jasiniak 2022, p. 22). Based on their past formation, perceived by investors and financial scientists, it was possible to achieve above-average returns from placing funds in capital markets based on their fundamental assumptions. According to their occurrence, returns are cyclical and depend on a given month, day of the week or season. Among the most popular calendar effects, one can point to (Grotowski 2008, pp. 58–59):

– the effect of the year (e.g. "election year in the US"),
– the effect of the half-year (e.g. "Halloween"),
– the month effect (e.g. "January", "December Santa Claus Rally", "May", "September", "October"),
– the effect of the day of the week (e.g. "Monday", "Friday"),
– the effect of holiday ("day off", "vacation"),
– the effect of the turn of the month/year.

The first of the calendar anomalies cited is the effect of the year. The most significant of the seasonal effects based on this time frame is the "US Presidential Election Cycle Theory", described extensively in the (mainly American) literature (Woolley 1991; Anzia 2011; Smith 2016, among others). Initially occurring in the real estate market in the United States, the phenomenon began to be observable in the financial market as well. In accordance with it, the US stock market in different years of the presidential term achieves different values of stock price returns (Hirsch 2022). The first year after the election of a new president is characterized by far the lowest returns achieved by investors. This is followed by a second year of stabilization, after which the third year of the presidential cycle takes place, in which the highest positive returns achieved by investors are to be expected. This phenomenon is explained by presidential actions related to the incumbent's gaining re-election. These actions are aimed at improving the economy, which in turn is well received by investors (Fuksiewicz 2021, p. 96). The final year of the cycle is a year of new elections, in which a new president takes office or the current president continues in office. Regardless of the results, however, this is a weaker year than the third one, which systematically transitions into the next presidential cycle involving a weakening of investor sentiment. The significance of this anomaly extends its effect beyond the US market. However, it has been noted that the cycles appropriate to the holding of elections (presidential, parliamentary) in force in a given country should be used to forecast the behaviour of individual financial markets (Świder 2019, p. 78).

Another group of seasonal effects are half-year effects. According to the assumptions, one can observe the occurrence of higher-than-average returns in the first half of the year compared to the second (Sakakibara, Yamasaki, Okada 2013; Krauskopf 2023). Another variation of this anomaly is the observation of statistically lower returns achieved by investors between early May and late

October compared to those recorded between early November and late April called the "Halloween effect" (Abu Zarour 2007).

Very popular (if not the most popular) among calendar anomalies is the effect of the month. According to its assumptions, it is possible to identify months during the year that are characterized (based on historical observations) by higher or lower returns, respectively (Jasiniak 2022, pp. 22–23). One of the month effects is the "January effect" (Budka, Kosiński, Sobczak 2017, p. 8, Lisicki 2018). This type of calendar anomaly is one of the most widely described in the literature (Szyszka 2009, p. 166). It was first mentioned as early as 1942. At that time it was described by American economist Wachtel (1942), who observed such a relationship on the basis of studies of the behaviour of companies belonging to the Dow Jones Industrial Average stock index from 1927 to 1942. The discussion of the "January effect" flared up again in the 1970s as a result of research by Rozeff and Kinney (1976) confirming Wachtel's earlier conclusions. Another explanation for this anomaly pointed to the occurrence of so-called window dressing by stock portfolio managers (Haugen, Lakonishok 1988). Extremely importantly, the occurrence of the effect of the first month of the year has been noted not only in the US stock market or other mature financial markets. The finding of its existence is also taking place in less developed world markets like Turkey (Eyuboglu, Eyuboglu 2016), Macedonia (Svrtinov et al. 2017), Pakistan (Ullah, Ullah, Ali 2016) and Taiwan (Shiu, Lee, Gleason 2014).

Another month effect is the "December effect", also known as the "Santa Claus Rally" (Agrrawal, Sakves 2015, pp. 133–135). It is associated with the pre-Christmas optimism of investors, who also see in the upcoming Christmas period the chance to make above-average profits (Borowski 2017, p. 116). The desire to participate in the previously indicated "January effect", which investors do not want to miss at all costs, is also indicated as the reason for the "Santa Claus Rally". Another source of its occurrence is also indicated by the reduced turnover resulting from the large number of holidays, which causes the market to "pull up" more easily (Pisani 2018). The "January effect" and "December effect" form one of the most frequently observed calendar anomalies in stock markets called "turn-of--the-month (year) effect". It is justified by short-term selling of securities for tax reasons (tax-loss selling hypothesis). According to regulations in many tax systems around the world, a loss incurred on some securities can be written off against a gain made on others. This results in a reduction of the tax base in capital gains tax. The increased supply of stocks due to tax targets causes declines in stock markets at the end of the year. However, at the beginning of the following month (year), investors decide to replenish their portfolios, which leads to an increase in demand and stock prices (Jasiniak 2022, pp. 22–23).

Other common month effects are the "May effect" and the "September effect". May records statistically some of the lowest historical returns in the markets, while September is characterized by averaging higher returns. The usual explanation for this phenomenon is the closing of open positions by investors before the vacations, which is associated with the sale of securities and their reopening resulting in increased demand for them (Grotowski 2008, pp. 58–59). There is also a saying of sorts among those involved in the financial market that perfectly reflects the principles of these two calendar effects. In the original it reads as follows: "Sell in May and go away, do not return until St. Leger's Day" (Nia, Headland 2023). It indicates, when translated, to sell all your securities in May and not decide to buy them again until September (after the vacation).

An interesting, and somewhat ironic, effect of the month is the "October effect" also known as the "Mark Twain" effect. The genesis of the name comes from Mark Twain's novel "Pudd'nhead

Wilson" which includes the quote, "October is a particularly dangerous month for speculating on the stock market. Other such months are July, January, September, April, November, May, March, June, December, August and February." (Fuksiewicz 2021, p. 98). This statement suggests that a decline in stock prices should be expected in October, as reflected in the literature (Balaban 1995; Wonham 2015; Murray, 2021).

Another group of calendar anomalies includes day-of-the-week effects. They distinguish the existence of significantly different returns on different days of the week. The day-of-the-week effect does not necessarily mean the occurrence of different returns only in the weekend range. It can also be any other arbitrary day on which repetitive patterns of return incidence can be observed (Mościbrodzka 2020, p. 83). Nevertheless, the most frequently mentioned days of the week on which the occurrence of significantly different returns has been observed are Monday and Friday. Research on the "Monday effect" and the "Friday effect" was conducted as early as the 1970s (Cross 1973; French 1980). The authors pointed out that Monday returns were very often negative and lower than the weekly average, while those recorded on Fridays were characterized by higher values (Lakonishok, Smidt 1988). Moreover, the cyclicality of the weekly intervals of the formation of returns was observed not only in the US market. Research conducted in this direction confirmed earlier observations for listed companies from Australia (Easton, Faff 1994), Canada (Athanassakos, Robinson 1994), Japan (Jaffe 1985), as well as Poland (Szyszka 1999). The occurrence of the effect of these two days per week was explained by the different level of activity of individual and institutional investors. This is because the former most often analyse their portfolios over the weekend (when they generally rest from their professional work) and make their adjustments (mainly sales) on the first possible day, i.e. Monday (Penman 1987, pp. 202–203). The pattern of institutional investors is different. Recently, however, studies that deny the existence of the Monday-Friday effect have begun to appear with increasing frequency (Landmesser 2006; Mishra 2017) and indicate that the effects of individual days of the week occur in a variable manner.

The holiday effect is also an interesting calendar anomaly. One can encounter other names for this bias from market efficiency such as the "day-off effect" or the "vacation effect" (Grotowski 2008, p. 59). It is characterized by high positive returns quoted on the days preceding the days when there are no trading sessions and relatively lower returns on the days that immediately follow the day off. Such effects were noted as early as the 1980s. A study of the US market indicated that returns on days preceding holidays were, on average, several times higher than the average returns of other trading sessions (Lakonishok, Smidt 1988). This effect also applied to other markets (such as the British, or Japanese). However, it was obvious to point out that each country has different holidays around which this example of a calendar anomaly can be observed (Kim, Park 1994; Groette 2024).

Another group of seasonal anomalies is the "turn-of-the-month effect", which has already been mentioned in the context of the "December effect" and the "January effect". It consists of significantly higher average returns in the last days of the previous month and the first days of the following month (Mościbrodzka 2020, pp. 92–93). The reasons for the occurrence of this phenomenon are attributed to the fact that investors receive remuneration for their professional activities, interest, dividends at the end of the month. Part of the funds received are reinvested just at the turn of the month causing the occurrence of higher than average returns (Szymański, Wojtalik 2021, p. 321). One of the first studies in this area confirmed the occurrence of the turn-of-the-month effect in the US market in 1969–1986 (Ogden 1990). This effect has also been studied in many global markets (e.g. Cadsby, Ratner 1992;

Liu 2013; Arendas, Kotlebova 2019). Each time, the existence of this anomaly has been demonstrated in the vast majority of the markets studied, with the observation that the effect shifts to earlier dates (than the four session days of the turn of the month initially assumed).

The description of the above examples of calendar anomalies is not a closed catalogue of their types. The authors continue to explore this topic in search of more and more examples of interferences from the efficient market hypothesis. Nevertheless, the intention of the author of this paper was to give an idea of the essence of individual seasonal effects and the basic implications of them before presenting the main part of the paper showing the state of research on the occurrence of this issue in the era of pandemic and post-pandemic economic reality.

3. Research on the occurrence of calendar effects in the era of pandemic and post-pandemic economic reality

In this part of the paper, the attention will be focused on the presentation of the scientific output devoted to the issues of calendar effects, which covered the period from 2020 to 2023. During this period, two "black swans" (Taleb 2010, p. 48) were recorded in the world markets in the form of the COVID-19 pandemic and Russia's armed aggression against Ukraine. The author's main intention is to find out whether the topic of calendar effects was addressed during the indicated period, in which periods of increased uncertainty in the markets (as measured by the VIX index) were recorded, and what results were obtained by researchers in exploring this issue during the indicated period.

The COVID-19 pandemic itself was relevant to investor sentiment, which was verified in the German market, among others (Yahya et al. 2021). The author's research in this regard indicated its significant impact after taking into account calendar anomalies, meteorological conditions or country-specific factors. The results also show that the higher level of stock returns during periods of social isolation can be explained by investors' tendency to buy stocks at depressed prices. However, calendar anomalies here accounted for only one factor in the volatility of returns.

An important issue from the point of view of biases of the efficient market hypothesis undertaken by financial market researchers in the era of increased volatility in 2020–2023 is the area of verification of the adaptive market hypothesis (Lo 2004). It was formed by combining the efficient market hypothesis with conclusions from the field of behavioural finance. According to it, investors make mistakes, but learn from them and adapt to changes in the market (Kasolik 2016, p. 54). Researchers in the era of the COVID-19 pandemic indicated that the adaptive market hypothesis explains the behaviour of commodity prices traded on the Chicago Board of Options Exchange (Shahid 2022, p. 13). Commodity investment returns provided opportunities for above-average returns in the era of pandemics, which was associated with a low level of predictability of investment decisions with a significant level of risk.

The adaptive market hypothesis also made it possible to explain the emergence of calendar anomalies (which are the main focus of this study). Using heteroskedastic GARCH models on a group of 16 major stock market indices from 10 countries, it was proven that calendar effects exhibit variable behaviour over time, evolving according to patterns that shift markets between periods of efficiency and inefficiency (Bassiouny, Kiryakos, Tooma 2023). This was particularly evident in the case of day-of-the-week effects (the "Monday effect" and the "Friday effect"), which reappeared in most of the markets studied, especially during periods of lockdowns in economies.

Weekday effects in an era of increased volatility in markets were studied in the Malaysian market in the period January 2020 – May 2021 (Liew et al. 2022). Using the classical method of least squares along with the generalized autoregressive specification of conditional heteroskedasticity, the effects of successive lockdowns and the overall stock market sentiment index were also tested. The study confirmed the binding "Monday effect" associated with lower-than-average returns. Its persistence during the COVID-19 pandemic was explained by the accumulation of negative public health information that hit the market over the weekend, during which there were no stock market sessions. In contrast, the averaged Tuesday and Thursday returns were unequivocally positive. An important practical implication of this study is that it provides market participants with the knowledge that the weekday effect is not going away, even though waves of COVID-19 cases have severely affected the country's economy.

Similar results from the area of verification of calendar effects in periods of above-average uncertainty were obtained on the Turkish market, specifically, based on the quotations of the BIST 100 broad market index there. It was indicated that negative shocks (such as the COVID-19 pandemic) lead to significantly higher price volatility of the said index than positive shocks (Çelik 2021, pp. 76–77). During the one-year research period (January 2020 – February 2021), it was proven that pandemic conditions lead to the occurrence of negative returns on Fridays (contradicting the previous correlations shown in the "Friday effect") and during periods adjacent to holidays (days without sessions in the Turkish market). This was explained by the fact that investors prefer to withdraw from the market (even at the expense of showing a loss) rather than stay with a position taken before days when they have no de facto opportunity to change it. In another study (Özkan, Zeytinoğlu 2022) from the Turkish market, it was observed that the month effects recognized in global markets ("January effect", "August effect") did not take place on the example of the BIST 100 index. However, the existence of the "February effect" was proven.

Month effects were also recognized in other markets. In Pakistan, using the example of the stocks of 496 entities listed on the stock exchange there (Tauseef 2023), it was proven that one of the month effects (the "January effect") is particularly correlated with events such as financial crises, the COVID-19 pandemic or unexpected political announcements, which are important factors that increase the level of uncertainty in the markets. Moreover, this effect was only noticeable for companies with higher--than-average market capitalization, suggesting that calendar anomalies in an era of increased volatility may vary by entity size. In India, on the other hand, during a study of selected stock market indices, it was determined that statistically significant negative returns occurred only in March, which came to be known as the "March effect" (Elangovan, Irudayasamy, Parayaltam 2022). It had not previously been recognized in the literature, and its justification was seen in the fact that the pandemic state of the world was declared precisely in March 2020.

Among the calendar effects characterized by occurrence over longer time intervals during the study period partially identical to the duration of the COVID-19 pandemic, consideration was given to the shaping of the "Halloween effect" and the impact of the "January effect" itself on its characteristics (Krawiec, Górska 2021). The study was conducted on the market of selected commodities (cotton, sugar, cocoa, coffee, frozen orange juice concentrate and rubber). The occurrence of the "Halloween effect" was observed only for cotton, while the opposite effect was noted for sugar. Moreover, the "January effect" taken into account as a disturbing factor did not affect sugar returns to any extent, while it was significant in shaping cotton returns.

Studies of calendar anomalies under conditions of increased uncertainty in the markets have not escaped mutual funds either. On a sample of 40 global stock funds over the period 2005–2020, which included such "black swans" as the global financial crisis and the COVID-19 pandemic, the statistically significant occurrence of the "turn-of-the-month effect" was noticed in nearly 60% of the research sample (Shah, Baser 2022). Based on the findings, the paper even proposed a mutual fund placement strategy for investors to start and stop investments to take advantage of the "turn-of-the-month effect" in order to achieve the highest possible returns. Interestingly, it was also said to apply to periods of global economic shocks.

This anomaly was also analysed for the stock markets of the BRICS countries (Brazil, Russia, India, China and South Africa). Using a regression model, it was noted that in the observation window covering the last day of the "old" month and the first four days of the "new" one, it was possible to achieve above-average returns for all the indicated markets (Chawla, Garg, Tripathi 2023). This was also true for the last of the sub-periods of the study covering 2020–2022. In the Indian market, moreover, correlations verifying the "turn-of-the-month effect" from the point of view of the size of entities or the activity of individual and institutional investors were also noticed (Satish, Agouda 2023). It was proven that there were higher-than-average returns at the turn of the month, but only for indexes grouping smaller entities (outside the blue chip segment). It was also discovered that the vast majority of trading during this time was attributable to institutional investors.

The research on calendar anomalies did not focus exclusively on classic financial instruments like stocks, stock indexes or collective investment funds. The effects of: "day of the week", "month of the year" and "turn of the month" were studied for commodities (natural gas, oil, platinum, silver and gold) listed on the Pakistan Stock Exchange (Naz, Baig, Zahra 2022). An important feature of the study was the division into research sub-periods before and during the COVID-19 pandemic. The "day-of-the-week effect" (Monday) was noticed by the authors in the case of oil and silver quotations. In addition, its occurrence could be indicated both during the pandemic period and the one immediately preceding it. One of the most popular calendar effects – the "January effect" was, in turn, shown on gold quotations. This indicates that year-end selling not only causes the stock market to generate abnormal returns, but also affects trade in certain commodities. Studied last, the "turn-of-the-month effect" was in turn demonstrated for each of the five commodities studied, with the impact of the COVID-19 pandemic being negligible in this case.

The "turn-of-the-month effect" was also verified for other commodities. In recent years, the performance of 8 major commodities (cotton, sugar, cocoa, coffee, corn, rice, wheat, and soybeans) has been considered in studies of this anomaly (Árendáš, Kotlebová 2023). Research results from the 2001–2021 period indicated significant statistical correlations of changes in returns related to the "turn--of-the-month effect" for sugar, coffee and rice. However, specifying only the pandemic period (2020–2021) caused this calendar anomaly to occur to a different degree. In the case of rice, the effect was more pronounced, while in the case of sugar and coffee it disappeared during the period of increased uncertainty in the markets. Thus, in the context of agricultural crops, the impact of the COVID-19 pandemic could be seen, which was not seen in the case of precious metals and natural gas and oil.

The subject of calendar anomalies has also not escaped in recent years a fairly new form of financial instruments, which include cryptocurrencies (Dumrongwong 2021; Özdemir 2022; Miralles-Quirós, Miralles-Quirós 2022; Naz et al. 2023). Excluding the COVID-19 pandemic period from the entire research period, no significant differences were seen between the formation of calendar

anomalies on the example of cryptocurrencies (Dumrongwong 2021). Ethereum was characterized by a strong "January effect", while in the case of Litecoin the "Monday effect" was confirmed, which provided opportunities for above-average profits from short selling.

With regard to the most popular of cryptocurrencies, Bitcoin, a novel approach was proposed indicating the possible existence of an "hour effect" on its quotes, which was also confirmed in the pandemic years 2020–2021 (Miralles-Quirós, Miralles-Quirós 2022). The researchers' conclusions indicate that calendar effects are not unique to the recent COVID-19 pandemic event. The cited results show no evidence that the COVID-19 pandemic affects the variability of calendar effects on cryptocurrencies.

Among the described area, one can also find a number of studies treating market anomalies in an era of increased uncertainty, which refer to the domestic Warsaw Stock Exchange (Stanek 2020; Szymański, Wojtalik 2020; Fuksiewicz 2021; Suliga 2021; Suliga 2023). Based on the results on the initial phase of the COVID-19 pandemic (Suliga 2023), it was indicated that some of the interferences of the efficient market hypothesis weakened and their duration shortened. On some (individual) companies, the "December Santa Claus Rally effect" ended prematurely (Stanek 2020). However, it was still possible to find examples of calendar effects that operated on the Warsaw Stock Exchange in an era of increased market uncertainty. These included the "Monday effect" noted for smaller companies or the "January effect" (Szymański, Wojtalik 2020, pp. 37–38). Therefore, one can find voices indicating that, despite significant destabilizations in global markets in recent years, calendar anomalies continue to be an important factor countering the efficient market hypothesis (Fuksiewicz 2022).

The presentation of the above results achieved by researchers of calendar anomalies was intended to answer the basic research question accompanying this paper. It reads as follows: "Do the conclusions from empirical research on calendar (seasonal) effects in an era of increased uncertainty in global financial markets coincide with the research results of authors verifying these issues in earlier years?" Based on the implications of the cited studies, in the vast majority of them, it is possible to point to the position of researchers, which indicates that despite the significant destabilization and increased uncertainty in global markets, calendar anomalies are still a bias from the efficient market hypothesis (Szymański, Wojtalik 2020; Dumrongwong 2021; Liew et al. 2022; Shah, Baser 2022; Bassiouny, Kiryakos, Tooma 2023). Admittedly, it is possible to find examples in contemporary studies contradicting the existence of prior calendar effects (or narrowing them down to only certain groups of financial instruments) (Krawiec, Górska 2021; Satish, Agouda 2023), or the emergence of entirely new ones (Elangovan, Irudayasamy, Parayaltam 2022; Özkan, Zeytinoğlu 2022), but they are rather exceptions to the rules presented in studies prior to the COVID-19 pandemic era. This forms the basis for adopting the research hypothesis posed at the beginning of the paper, indicating that, "in the era of increased uncertainty in the markets, it is possible to indicate the occurrence of calendar anomalies" and three supporting hypotheses (H2, H3, H4) indicating the occurrence of month (especially the "January effect"), day of the week ("Monday effect", "Friday effect") and turn-of-the-month effects. In the case of the half-year effect (H1), it could only be observed for certain commodities, which prevented this supporting hypothesis from being fully accepted.

While the pandemic conditions of the markets and the occurrence of calendar effects during this period are the subject of research by a growing group of experts, it is somewhat surprising to the author that there is a complete lack of consideration of the significance of Russia's aggression in Ukraine, which began in February 2022, on this issue. Some justification for this may be that this war is taking

place all the time, and its long-term effects (including those on financial markets) are still difficult to resolve. For this reason, researchers are somehow holding back from considering calendar effects in the post-pandemic, yet also rather uncertain geopolitical situation in Europe.

Therefore, the author of this paper hereby set out to at least partially fill this research gap by conducting research during both the COVID-19 pandemic and the war years in Ukraine (Lisicki 2025). In the conducted research, the main aim was to verify the occurrence of one of the most common market anomalies, the "January effect", in the time of the pandemic and the post-pandemic economic reality (2020–2024). This period was characterized by increased uncertainty (volatility), which has been noted by analysing the values of the VIX index ("CBOE volatility index"). On a group of 18 indices of the main market of the WSE (WIG20, mWIG40, sWIG80, sector indices, WIG-DIV, WIG-ESG) it was noticed that above-average volatility was recorded in the month of January in the years 2020–2022. However, the "January effect" occurred in only one of these years (2021). In the remaining years (2020 and 2022), no statistical significance in the calculated average abnormal returns was recorded. Moreover, in 2022 these returns were negative, which is in contrast to previous observations made as part of the "January effect". In subsequent years of the war, no statistically significant correlations were seen regarding the "January effect". Nevertheless, formulating conclusions on the occurrence of calendar anomalies in the post-pandemic economic era requires further research undertaken by financial market researchers.

4. Summary

An efficient capital market is one of the cornerstones of the functioning of modern economies. Nevertheless, over the years, the efficient market hypothesis (Fama 1965) continues to be challenged and many opponents of it can be found (Janicka 2008, p. 169). On the one hand, investors strive to make markets as efficient as possible. On the other hand, they use various methods that contradict the assumptions of the efficient market hypothesis. Such behaviour of market participants leads to the formation of a certain type of market anomaly, which in the economic literature is understood as a deviation from the expected result, a departure from the rule (Szymański, Wojtalik 2020, p. 29).

Of the types of anomalies, a group that is popular among researchers are calendar anomalies (effects) (Dragota, Oprea 2014; Rossi 2015; Żebrowska-Suchodolska 2021; Özkan 2021; Suliga 2023). They result from investor behaviour that deviates from the assumptions of the efficient market hypothesis, which occur cyclically at particular periods or moments in time (Jasiniak 2022, p. 22).

In the era of certain destabilization of global markets caused by "black swans" like the COVID-19 pandemic and the war in Ukraine, it was possible to observe strong turbulence in financial markets, which caused elevated uncertainty and, according to researchers, was even stronger than in the periods of the previous great crises of 1930, 1987 and 2008 (Thakur 2020; Zhang, Hu, Ji 2020). Situations of increased uncertainty (caused by pandemics, war or global economic crises) create motivations for scientific exploration, which is tasked with both discovering new and confirming previously noted relationships taking place in the world.

The purpose of this paper was to review the state of research in the field of biases of the efficient market hypothesis occurring on the example of calendar anomalies (effects) that are carried out in the era of pandemic and post-pandemic economic realities. Using the method of analysis and criticism of the literature, the work of researchers on the occurrence of the present anomaly in 2020–2023 was

considered. Based on the research results coming from different sides of the world, it is possible to continue to see the occurrence of calendar anomalies in the vast majority of them (Dumrongwong 2021; Liew et al. 2022; Shah, Baser 2022; Fuksiewicz 2022; Chawla Garg, Tripathi 2023) in line with existing relationships. This is especially true of the month effect ("January effect") (Naz, Baig, Zahra 2022; Tauseef 2023; Lisicki 2025), the "turn-of-the-month effect" (Shah, Baser 2022), and the weekday effect ("Monday effect", "Friday effect") (Liew et al. 2022; Bassiouny, Kiryakos, Tooma 2023). This confirms the hypothesis adopted at the beginning of the study, which indicated the existence of previously recognized deviations from the assumptions of the efficient market hypothesis in the form of calendar effects during periods of increased uncertainty in the markets and also three supporting hypotheses (H2, H3, H4) indicating the occurrence of month (especially "January effect"), day of the week ("Monday effect", "Friday effect") and turn-of-the-month effects.

The research implications of the presented body of research to date warrant further consideration of the operation of biases of the assumptions of the efficient market hypothesis (not only on the example of calendar anomalies). As can be seen from the research presented so far, the COVID-19 pandemic did not cause them to disappear. They continue to occur, which, on the one hand, should be understood as a real deviation from the principles presented by Fama (1965), and, on the other hand, as an investment opportunity to achieve above-average profits. This provides some knowledge for their formation in an era of successive elevated levels of uncertainty in the markets caused by events such as armed conflicts, financial crises or pandemics.

One limitation of the paper's conclusions is the complete lack of research on the significance of Russia's aggression in Ukraine, which began in February 2022, on the formation of calendar effects on stock markets (albeit from countries neighbouring the site of the armed conflict). It could complement the conclusions obtained from a review of the existing body of work dealing with the occurrence of calendar effects during the period of increased uncertainty accompanying the COVID-19 pandemic. The present analysis represents an important research gap that should be addressed in studies by researchers associated with the capital market, as well as investors themselves. To some extent, it is attempted to be filled by the author of this paper with research verifying the occurrence of the "January effect" in pandemic and post-pandemic economic realities (Lisicki 2025). However, the inference on the basis of a single study is characterized by a limited level of relevance, so it is important for financial market researchers to try to address this issue in their deliberations.

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Anomalie kalendarzowe jako przykład odstępstw od hipotezy rynku efektywnego – pandemiczna i postpandemiczna rzeczywistość gospodarcza

Streszczenie

W toku badań nad weryfikacją hipotezy rynku efektywnego zaczęto dostrzegać niezgodności z jej założeniami. Z biegiem czasu zaczęto je nazywać anomaliami rynku kapitałowego. Bez wątpienia do najczęstszych anomalii rynkowych należą efekty kalendarzowe (sezonowe), które wskazują na pewnego rodzaju cykliczne zaburzenia efektywności rynku. Celem niniejszego opracowania jest dokonanie przeglądu badań poświęconych odstępstwom od hipotezy rynku efektywnego (na przykładzie efektów kalendarzowych), prowadzonych w pandemicznej i postpandemicznej rzeczywistości gospodarczej (lata 2020–2023). Autor pragnie zweryfikować hipotezę wskazującą, że w dobie podwyższonej niepewności na rynkach, która towarzyszyła pandemii COVID-19 oraz konfliktowi zbrojnemu w Ukrainie, można się spotkać z występowaniem wcześniej rozpoznanych odstępstw od hipotezy rynku efektywnego, do których należą efekty kalendarzowe.

Na podstawie analizy i krytyki piśmiennictwa dokonano przeglądu stanu badań nad efektami kalendarzowymi prowadzonych w latach 2020–2023. Bazując na rezultatach badawczych płynących z różnych stron świata, można w zdecydowanej większości w dalszym ciągu obserwować występowanie anomalii kalendarzowych zgodnie z ich dotychczasowymi zależnościami. Dotyczy to przede wszystkim efektu miesiąca („efekt stycznia"), „efektu przełomu miesiąca" czy efektu dnia tygodnia („efekt poniedziałku", „efekt piątku"). Jak zweryfikowano, wzrost niepewności nie doprowadził do zaniku występowania anomalii kalendarzowych, co stanowi solidną podstawę do prowadzenia dalszych rozważań nad ich kształtowaniem.

Dokonując przeglądu badań, dostrzeżono również pewną lukę badawczą. Nie podejmuje się mianowicie tematyki efektów kalendarzowych w postpandemicznej rzeczywistości gospodarczej i w czasie zbrojnej agresji Rosji na Ukrainę (generującej zwiększoną niepewność na rynkach).

Słowa kluczowe: giełdy papierów wartościowych, hipoteza rynku efektywnego, anomalie rynkowe, efekty kalendarzowe, finanse behawioralne