

## Calendar Anomalies in the Grains Futures Market\*

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### Abstract

Calendar anomalies are specific patterns in the price behavior of financial instruments that are associated with specific moments in time—days of the week, months, seasons, or periods of the financial year. Their existence contradicts, to some extent, the efficient market hypothesis (EMH), which holds that security prices should fully reflect all available information and therefore should not exhibit predictable patterns. Numerous studies demonstrate their presence in securities markets. Investor activity in commodity markets suggests the importance of verifying the presence of anomalies among commodity instruments.

The grain futures market is a segment of the commodity market where futures contracts for grains such as wheat, corn, barley, oats, and rye are traded. Its primary function is to hedge price risk and shape expectations for future grain prices. Investors in derivatives markets are not interested in the actual delivery of goods - their transactions are in the nature of financial settlements, not through the actual transfer of grain. Financial investments in grain markets raise questions: Can anomalies characteristic of securities markets be identified in commodity futures markets? And can they form the basis of investment strategies that allow investors to achieve above-average rates of return?

The main objective of the study is to identify calendar anomalies in the market of selected grains futures market. The following instruments were included in the study: Corn, Soybean Oil, Soybean Meal, Oats, Rough Rice, Soybean, Wheat. The research was conducted in 2015-2024.

The study confirmed above-average rates of return during certain time periods. In the case of the day-of-the-week effect, investments made on Fridays were found to be the most profitable, while those made on Thursdays were found to be the least profitable. Regarding the week-of-the-month effect, the fourth week offered the greatest potential for profitability, as did the third week for short selling. An analysis of the month-of-the-year effect revealed that June and July offered the greatest investment potential for short selling. The research also shows that the highest (lowest) rates of return were achieved in the case of the month-of-the-year effect.

**Keywords:** market efficiency, grains, investment, calendar anomaly

### Introduction

The basic function of the financial market is to allocate capital between investors and issuers of financial instruments. Theoretical issues in financial and commodity markets often focus on the relationship between price fluctuations and the impact of information transmission on rates of return (Włodarczyk, 2017). The valuation of assets in financial markets is of interest to its participants: investors, who want to achieve the highest possible returns on their investments; and academics, who are trying to identify and describe market mechanisms (Wojtowicz, 2024). Investors make their decisions focusing on maximizing the rate of return while trying to minimize investment risk. The rationality of investor decisions is the paradigm of classical models of

financial markets. One of the most popular theories describing the mechanism of the financial market is the efficient markets hypothesis proposed by E. Fama. The author points out that in an informationally efficient market, securities prices always and fully reflect available information (Fama, 1970, p. 383). The consequence of the efficient markets hypothesis is that investors cannot obtain above-average profits. E.Fama argues that it is impossible to predict future prices of financial instruments based on past price formation, which means, that the analysis of stock price charts becomes completely worthless for a stock investor. All other publicly available information and even inside information is also reflected in security prices.

However, numerous scientific studies that appeared several years after the presentation of the efficient market theory demonstrated the existence of deviations from the concept of immediate and full reflection of information in stock prices. These deviations, in which the valuation process was inconsistent with the assumptions of information market efficiency, were called market anomalies. An anomaly in the financial market is a specific pattern of securities prices that allows for positive, above-average rates of return. The literature provides numerous studies describing the occurrence of various market anomalies in relation to securities. However, relatively few studies verify the occurrence of anomalies in commodity markets, which constitutes a research gap.

Commodity markets encompass a wide range of products divided into various categories, including precious metals, industrial metals, energy, grains, meat, and other soft commodities. Each has its own unique characteristics that influence price dynamics and trading strategies. Commodity markets encompass a wide range of products divided into various categories, such as precious metals, industrial metals, energy, grains, meat, and other soft commodities. Each commodity has a different supply and demand structure, as well as other factors that influence pricing. The question therefore arises: can anomalies characteristic of securities markets be identified in commodity futures markets? And can they be the basis for investment strategies that allow investors to achieve above-average rates of return?

The main objective of the study is to identify calendar anomalies in the market of selected grains futures market. The following instruments were included in the study: Corn, Soybean Oil, Soybean Meal, Oats, Rough Rice, Soybean, Wheat.

## **Market Anomalies – Literature Review**

In the 1950s, many economists undertook research on financial market mechanisms. In 1953, M. Kendall noticed that changes in stock prices resemble random (Kendall, 1953). Samuelson also pointed out that stock prices on the financial market depend on many independent factors and that their volatility resembles random wandering. Therefore, it is impossible to predict future prices of financial instruments, including stock prices, based on an analysis of their past price changes (Samuelson,1965). These concepts formed the basis for the efficient market hypothesis. Its author was E. Fama, who formulated a comprehensive theory based on the following assumptions: successive changes in stock prices are independent of each other, and changes in stock prices are described by a certain probability distribution. He emphasizes that, taking into account all available information, the actual prices of financial instruments at a given moment are almost the same as their intrinsic values (Fama, 1965) In another paper, E. Fama defines an efficient market in terms of information as a market in which prices always fully reflect all available information (Fama, 1970). The basis of the efficient market hypothesis is the assumption that investors are fully rational, understood as the ability to properly assess incoming information and, on this basis, estimate the probability of future events. Many economists disagreed with Fama's theory, arguing that it ignores information asymmetry and irrational investor behavior. J.E. Stiglitz and S.J. Grossman (1980) argue that in efficient markets, investors would have no incentive to incur the costs of obtaining information, as this would not give them any advantage. Proponents of behavioural economics highlight the psychological factors that significantly influence securities prices, such as herd behaviour, panic and cognitive heuristics. Research shows that investors do not make investment decisions in accordance with the assumptions of the efficient market hypothesis. Psychologists emphasise that the human mind perceives reality and processes information imperfectly, often leading to cognitive errors and incorrect valuation of financial assets. As R. Shiller points out, markets are not fully informationally efficient because investor psychology, collective moods and social narratives impact asset pricing. Information efficiency in its classical form is unable to explain phenomena such as bubbles and crashes because it ignores human nature (Shiller, 2000).

Just a few years after the efficient market theory was introduced, studies began to emerge that highlighted deviations from the financial market concept proposed by E. Fama. The first discoveries of financial market anomalies were published in the 1970s. These anomalies are defined as regularly occurring phenomena that cannot be fully explained by classical theories of rational investors and efficient markets. R. H. Thaler, one of the founders of behavioural finance, defines them as systematic deviations in the behaviour of financial markets

from the predictions of the efficient market hypothesis (Thaler, 1987). One of the best-identified anomalies is the so-called “January effect.” Empirical studies documented in numerous works, including Rozeff and Kinney (1976), Branch (1977), Dyl (1977), Lakonishok and Smidt (1988), Haugen and Lakonishok (1988), Dimson (1988), indicate that higher rates of return occur in the first months of the year than in the remaining months. Furthermore, it has been noted that on the American capital market, this phenomenon primarily affects companies with relatively small capitalization (Szyszka, 2003). Rozeff and Kinney (1976) studied the US stock market between 1904 and 1974 and found that average monthly returns in January are significantly higher than in other months of the year. Gultekin and Gultekin (1983) then examined stock market indices in sixteen countries between 1959 and 1979, proving the existence of monthly seasonality and a strong positive January effect in most cases. The abnormal returns in January were most often explained by a return to normal levels following the sell-off in December, which was caused by tax considerations. It is also worth noting that this issue is reflected in capital markets where the tax year does not begin in January. Research into the Australian stock market, where the fiscal year ends in June, showed that higher average monthly returns were recorded not only in January, as in the US, but also in July, i.e. immediately after the end of the Australian fiscal year. This is interpreted as a consequence of tax-loss selling associated with the end of the local fiscal year (Schwert, 1983). Another popular anomaly is the 'Halloween effect', which is associated with the well-known investor saying, 'Sell in May and go away', and suggests that investments made between November and May offer the highest returns. Bouman and Jacobsen (2002) found that the Halloween effect occurs in global capital markets. They examined 37 emerging and developed capital markets between 1973 and 1998, proving the existence of above-average returns on investments made between November and April, even when transaction costs were taken into account.

A further example of a calendar anomaly is the turn-of-the-month effect. This anomaly, which is observed in some financial markets, is characterised by the possibility of achieving significantly higher returns on stocks at the beginning or end of the month than on other days. As early as 1987, Ariel published the results of his research on returns on the US market. He proved that the average return on shares is positive in the days immediately preceding and in the first half of calendar months, while in the second half of the month it is close to zero. This phenomenon, known as the “monthly effect,” suggests that profits at the beginning of the month are higher than profits after the middle of the month. By contrast, Barone (1990) identified the opposite monthly effect, based on his research into the Italian market. This consisted of lower returns at the beginning of the calendar month, followed by significant increases towards the end. Lakonishok and Levi (1982) also confirmed the existence of the day-of-the-week effect. Based on their research, conducted between 1962 and 1973, they found that rates of return were significantly higher on Fridays and significantly lower on Mondays. Furthermore, Lakonishok and Smidt (1988) discovered that the average return on the last day of the month was significantly higher than on other days. The largest gains were concentrated between the end of the second-to-last day of the month and the fourth day of the new month. Roughly half of the market's total monthly gains occurred during this short sequence of days. They also identified positive rates of return in the days leading up to public holidays. Cross (1973), on the other hand, observed the day-of-the-week effect. His research showed that the average returns on the S&P 500 index were higher on Fridays than on Mondays between 1953 and 1970. Gibbons and Hess (1981) reached similar conclusions when they conducted research on US stocks in the S&P 500 and CRSP indices between 1962 and 1978. They found that investments made on Fridays had above-average returns, whereas those made on Mondays had negative returns. Based on daily quotations of American stocks from 1953 to 1977, French (1980) also showed that the average rate of return on stocks included in the Standard & Poor's Composite Index was lower (and even negative) after weekends than on other days of the week.

Seasonality studies were also conducted over much shorter time intervals. Smirlock and Starks (1986) found that, on average, negative rates of return were recorded during the first hour of Monday sessions, while on other days of the week, average rates of return at the beginning of the session were positive. Harris (1986) reached similar conclusions and also noted that stock prices tended to rise sharply in the last 15 minutes of the session. It should be emphasized that many empirical studies on calendar anomalies show ambiguous results. Differences can be observed in different markets, financial assets, and countries. Therefore, despite the large number of publications devoted to calendar anomalies, one of the remaining questions is how markets evolve over time. In summary, calendar anomalies suggest that behavioral, institutional, or regulatory factors influence investor behavior. Although many of them have weakened or disappeared as markets and technologies have developed, they continue to be the subject of research and attempts to use them in investment strategies.

## **Grains futures market**

The futures market is an organized system in which participants enter into standardized contracts obligating them to deliver a specified quantity of goods in the future at a predetermined price (Hull, 2018). Investors and academics view commodities as a distinct asset class from other alternative investments. Derivatives are seen by investors as alternative investments, with the important advantage of allowing for diversification of investment risk. They allow investors to take long or short positions in anticipation of changes in the price of a commodity without having to physically own the commodity, thus providing the opportunity to profit from both rising and falling prices of the underlying instruments. The literature suggests that commodity futures contracts can improve the risk-return distribution of a portfolio thanks to their relatively low correlation with stocks and bonds. However, commodities are characterised by high volatility and often exhibit strong movements at extremes. Consequently, portfolios that include commodity instruments can be highly volatile, which limits their investment value. The valuation of commodity futures contracts is more complex than the valuation of financial assets due to the hybrid nature of the underlying commodity—firstly, commodities serve as consumer and processing goods; secondly, they also share characteristics with financial assets, have a unique market equilibrium price, and are subject to speculation (Fabozzi, Füss, Kaiser, 2008).

The grain futures market is a segment of the commodities market where futures contracts are traded on agricultural products, mainly wheat, corn, soybeans, oats, rice, and other grains. Its functioning is crucial for the stability and efficiency of the entire agricultural sector and for the global food system. It is worth pointing out the most important differences between the grain market and the market for derivatives issued on these products. The most important function of the grain market is the execution of actual transactions (trade, production, processing) and, consequently, the physical delivery of goods. Market participants include agricultural producers, processors, traders, exporters, and importers. On the other hand, the grain derivatives market (financial) includes transactions in financial instruments based on grain prices, e.g., futures contracts, options, and commodity swaps. Price is mainly determined by market expectations of future prices, interest rates, storage costs, risk and investor sentiment. Participants include financial investors, hedge funds, banks and traders.

Financial investors in commodity markets profit from price movements of underlying commodities without having to meet the logistical and warehousing requirements associated with direct purchase. The participants in the futures markets are mainly speculators – investors who do not have physical grain but try to profit from changes in the prices of contracts; and arbitrageurs – they take advantage of the price differences between the spot and futures markets. Unlike many other commodity markets, grains are closely linked to food security, which means that even small changes in one area (e.g., weather or politics) can significantly affect prices and availability. Important supply factors include, above all, weather and climate conditions, production, logistics, and storage costs. The geopolitical situation also has a significant impact on this market.

In recent years, the grain market has been significantly affected by two important factors: the COVID-19 pandemic and the war in Ukraine. The COVID-19 pandemic had a significant, albeit varied in time and space, impact on the grain market. Unlike many other sectors of the economy, the grain market did not collapse completely, but experienced supply, logistics, and demand shocks that translated into increased price volatility and disruptions in global supply chains. During the early months of the pandemic, many countries imposed restrictions on international transport. There were also issues with the availability of containers, drivers and port workers, which hindered grain exports. Sea freight prices also increased significantly, raising transaction costs and limiting export supply. Uncertainty about global trade and a possible decline in production also prompted a reaction from financial investors. Although volatility in the futures markets posed a threat, especially in the early stages, it also created opportunities for investors. Financial investors increased their activity, raising the correlation between the commodity and financial markets (World Bank, 2021). The outbreak of war in Ukraine also had a significant impact on the grain market. The immediate effects were reduced supply and uncertainty, resulting in sharp rises in grain prices on both the spot and financial markets. Lower yields resulted from the smaller area under cultivation, which was caused by military operations, land losses and infrastructure damage. The blockade of Black Sea ports and threats to maritime transport also significantly reduced opportunities for grain exports (How the Russian invasion of Ukraine has further aggravated the global food crisis. European Council). The high volatility of grain markets, caused by the pandemic and the war in Ukraine, increases risks such as margin calls, liquidation, liquidity and counterparty risk, and model risk, but also creates opportunities such as the strategic use of options and volatility premiums. The key for investors is to manage leverage carefully, maintain liquidity and employ investment strategies that are tailored to the new conditions.

## **Research methodology**

Calendar anomalies were identified on the basis of the six most popular grain futures contracts. The study included the following assets: corn, soybean oil, soybean meal, oats, rough rice and wheat. Investing.com was the source of the data used in the study. Analysis was conducted on the basis of daily, weekly and monthly

prices between 2015 and 2024. The ten-year study period covered the pre-pandemic period, the pandemic itself, and the potential effects of the Russian invasion of Ukraine. Transaction costs were not included in the study. To determine the rates of return of the analysed instruments, logarithmic measures were used in accordance with the following formula:

$$r = \ln\left(\frac{P_t}{P_{t-1}}\right),$$

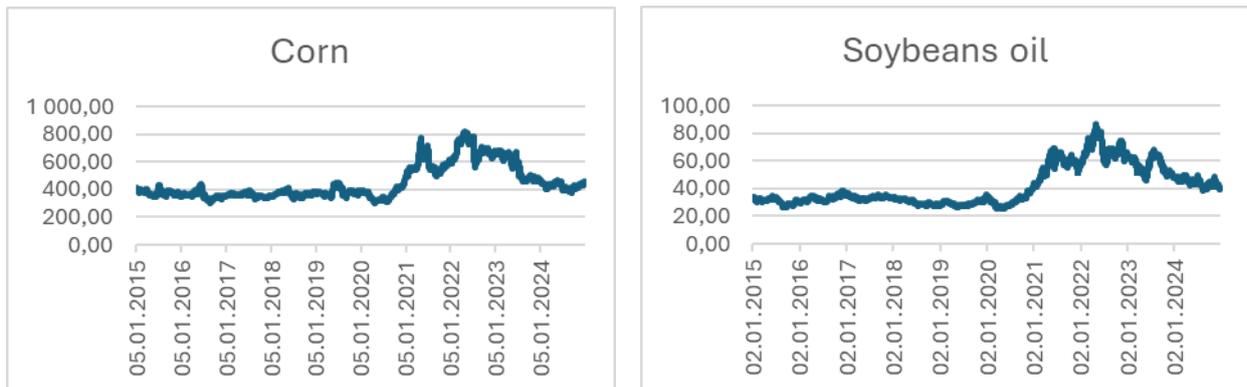
where:

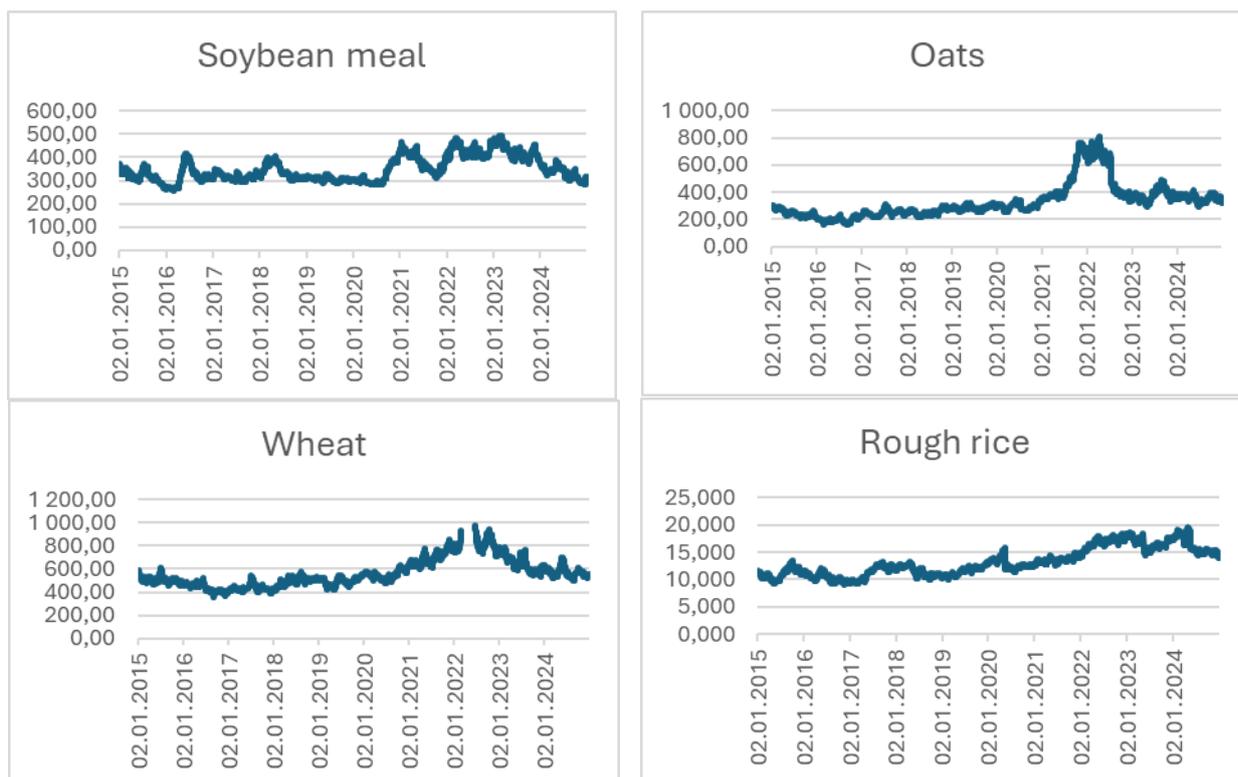
- r – a logarithmic rate of return for the period from t-1 to t 9,
- $P_t$  – selected grain closing price in the period t,
- $P_{t-1}$  – selected grain closing in the period t-1.

The study examined three calendar anomalies: the month-of-the-year effect, the week-of-the-month effect and the day-of-the-week effect. The results for each instrument were then averaged, and the standard deviation was calculated. These results were then presented in tabular form.

## Results and discussion

According to the efficient market hypothesis, the prices of financial instruments always reflect all available information. From an investment perspective, an efficient market does not offer opportunities for above-average returns. During the period under review, grain prices were characterized by significant fluctuations. For all cereals examined, a relatively stable period can be observed from 2015 to 2021. Slightly greater price volatility can be seen in the case of soybean meal. In 2016 and 2018, prices for this grain experienced significant increases and decreases. Rough rice prices also exhibited specific volatility. However, it should be emphasized that all instruments examined recorded significant increases during the outbreak of war in Ukraine. When using commodity derivatives, including those for grains, it is important to remember that their market prices are influenced by a variety of external factors. Therefore, the process of valuing them differs from that of traditional financial instruments. The high volatility of grain prices, primarily resulting from the outbreak of war in Ukraine, increases risk and opportunity alike (through the strategic use of options, spread trading and volatility premiums, for example). The key for investors is to manage leverage carefully, maintain liquidity and use hedging tools that are tailored to the new conditions. In these circumstances, one might ask whether there are investment strategies based on the seasonal distribution of rates of return that could offer investors the opportunity to achieve above-average returns. Figure 1 shows the prices of the cereals surveyed in 2015-2024.





**Fig. 1. Grain contract prices in 2015-2024**

In the first stage of the research, the possibility of achieving above-average rates of return on investments made on specific days of the week was verified. Detailed research results are presented in Table 1.

**Table 1. Rates of return by day of the week**

<i>Day</i>	<i>Corn</i>	<i>Soybeans oil</i>	<i>Soybean meal</i>	<i>Oats</i>	<i>Rough rice</i>	<i>Wheat</i>	<i>Mean</i>	<i>Std.dev.</i>
Monday	0.00%	0.01%	-0.04%	0.01%	-0.05%	0.02%	-0.01%	0.000258
Tuesday	0.00%	0.00%	0.00%	-0.01%	0.00%	-0.03%	-0.01%	0.000124
Wednesday	0.00%	0.06%	0.07%	0.00%	0.06%	-0.04%	0.02%	0.000411
Thursday	-0.06%	-0.08%	-0.07%	0.03%	0.00%	0.03%	-0.02%	0.000465
Friday	0.08%	0.06%	0.01%	-0.01%	0.03%	0.11%	0.05%	0.000415

*Source: own study*

According to the analyses conducted, the highest average rate of return was recorded on Friday (0,05%), while the lowest was recorded on Thursday (-0,02%). Negative rates of return were also recorded on Monday and Tuesday. High positive investment returns were seen in almost all instruments, with the exception of Oats. Highly positive investment returns were seen across almost all instruments, with the exception of oats, which yielded an average return of -0.01% on Friday. However, the average negative returns recorded on Mondays and Tuesdays did not, in practice, allow investors to develop an effective strategy, as the yields of individual instruments varied greatly. Negative Monday returns were recorded only for two commodities: soybean meal and rough rice. In other cases, they were close to zero.

The second stage of the study involved verifying the occurrence of weekly anomalies within a month. The aim was to identify any weeks during the month when the rate of return was above average. The results of the study are presented in Table 2.

**Table 2. Rates of return by week of the month**

<i>Week</i>	<i>Corn</i>	<i>Soybeans oil</i>	<i>Soybean meal</i>	<i>Oats</i>	<i>Rough rice</i>	<i>Wheat</i>	<i>Mean</i>	<i>Std.dev.</i>
I week	0.14%	0.06%	-0.27%	0.32%	-0.14%	-0.11%	0.00%	0.001954
II week	0.09%	-0.28%	0.13%	-0.37%	0.27%	-0.31%	-0.08%	0.002510
III week	-0.35%	-0.41%	-0.48%	-0.19%	0.26%	-0.34%	-0.25%	0.002468
IV week	0.34%	0.38%	0.74%	-0.14%	-0.15%	0.68%	0.31%	0.003519
V week	-0.38%	1.10%	-0.74%	1.25%	-0.23%	0.08%	0.18%	0.007461

Source: own study.

An analysis of the distribution of rates of return shows that the highest returns were achieved in week IV (0.31%) and week V (0.18%). However, it should be added that there were significantly fewer periods in which the fifth week of the month was observed compared to the number of other weeks in the month. It is worth noting that a relatively high average negative return was recorded for week III (-0.25%), which allows investors to make profits as a result of short selling. A detailed analysis of the profitability of individual grains in week IV shows that soybean meal (0.74%) and wheat (0.68%) achieved relatively high results. Positive rates of return were also observed for Corn and Soybean oil, while Oats and Rough rice recorded negative results. The rates of return in week III were slightly more consistent. Negative values were observed for almost all of the instruments surveyed, with Rough rice being the only exception. This suggests that investment strategies based on this calendar anomaly may be more stable.

In the third stage of the research, the occurrence of the most popular stock market anomaly—the month-of-the-year effect – was assessed (Table 3.).

**Table 3. Rates of return by month of the year**

<i>Month</i>	<i>Corn</i>	<i>Soybeans oil</i>	<i>Soybean meal</i>	<i>Oats</i>	<i>Rough rice</i>	<i>Wheat</i>	<i>Mean</i>	<i>Std.dev.</i>
<b>January</b>	-0.88%	1.54%	1.52%	-3.38%	-2.29%	0.00%	-0.58%	0.018309
<b>February</b>	1.36%	-1.43%	-0.56%	-2.42%	1.11%	-0.08%	-0.34%	0.013309
<b>March</b>	2.68%	1.99%	-0.29%	1.12%	3.74%	0.95%	1.70%	0.012948
<b>April</b>	0.26%	-1.33%	-0.96%	2.85%	0.93%	1.72%	0.58%	0.014539
<b>May</b>	-1.78%	2.05%	1.78%	0.83%	-1.96%	0.32%	0.21%	0.015776
<b>June</b>	-8.31%	-1.32%	-3.39%	-4.66%	-2.03%	-3.94%	-3.94%	0.022525
<b>July</b>	-2.53%	1.05%	-4.94%	-2.69%	-0.22%	-1.98%	-1.88%	0.019055
<b>August</b>	4.93%	-2.65%	0.06%	5.24%	0.75%	2.35%	1.78%	0.027645
<b>September</b>	1.34%	2.89%	2.88%	5.37%	-2.41%	0.49%	1.76%	0.024047
<b>October</b>	-1.28%	0.09%	-0.20%	-1.95%	4.71%	-0.94%	0.07%	0.021800
<b>November</b>	4.09%	-0.68%	2.19%	-0.47%	-2.30%	1.36%	0.70%	0.020988
<b>December</b>	2.51%	0.69%	1.33%	2.20%	3.10%	0.74%	1.76%	0.009051

Source: own study.

An analysis of the distribution of rates of return in individual months of the year provides interesting results. From an investment perspective, the most attractive is potentially the negative rate of return in June (average value -3.94%). Slightly lower profits from short selling could also be achieved in the following month, July, when the average return was -1.88%. The highest positive rates of return were recorded in August (1.78%), September (1.76%), December (1.76%), and March (1.70%). Positive returns were observed in August for almost all grains except soybean oil. In September, most instruments also recorded positive returns, with rough rice being the exception this time. In December, however, all instruments showed positive returns. When

analyzing June returns, it is worth noting that negative values were observed for all grains surveyed. In July, almost all instruments also recorded negative results, with the exception of soybean oil. This distribution of rates may suggest that the most effective investment strategy based on the anomaly of the month of the year would be short selling in June and July.

## Conclusions

The efficient market hypothesis means that investors cannot beat the market. Identifying deviations from the efficient market model gives market participants the opportunity to develop investment strategies that allow them to achieve above-average rates of return. Among the most common anomalies on stock markets are calendar effects. Investors seeking to maximize their returns are looking for both new asset classes and new investment strategies. In order to diversify investment risk, they are increasingly including commodity derivatives in their portfolios. Calendar anomalies identified in securities markets have provided investors with the opportunity to generate additional returns at specific points in time. When searching for new, effective investment strategies, the question arises as to whether it is possible to identify and exploit seasonal anomalies in commodity derivatives markets to achieve above-average rates of return.

The results of previous studies on the occurrence of calendar anomalies in grain markets are inconclusive. Seasonality related to the harvest and storage cycle has been identified, with grain futures prices exhibiting recurring patterns throughout the year (Sørensen, 2000). Newer studies show that some anomalies are weaker than they were a decade or two ago. This suggests partial arbitrage and that the market is more efficient in terms of information (Li, Liu, Miao, Tse, 2024). Therefore, the main objective was to identify calendar anomalies in the futures market for corn, soybean oil, soybean meal, oats, rough rice, soybeans, and wheat. The study focused on identifying three potential anomalies: the day-of-the-week effect, the week-of-the-month effect, and the month-of-the-year effect.

The study confirmed above-average rates of return in certain time periods. In the case of the day-of-the-week effect, investments made on Friday were found to be the most profitable, while those made on Thursday were found to be the least profitable. In the case of the week-of-the-month effect, the fourth week had the greatest potential for profitability, as did the third week for short selling. When analysing the distribution of rates of return in individual months of the year, it was found that June and July offered the greatest investment potential for short selling. The research shows that the highest (lowest) rates of return were achieved in the case of the month-of-the-year effect. It was observed that the longer the investment period, the potentially stronger the calendar effects. The above-average rates of return identified for the day-of-the-week and month-of-the-year effects indicate the presence of anomalies. However, due to their relatively low values, they are of limited practical investment value. The month-of-the-year effect is the only one that gives investors the opportunity to exploit anomalies to achieve additional profits. The relatively high volatility of grain market prices, supply and demand conditions, and the specific characteristics of individual grain types suggest areas for further research.

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