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ASSESSMENT OF THE EFFICIENCY OF INVESTMENT PORTFOLIOS AND THE IMPACT OF MACROECONOMIC DETERMINANTS ON THE REAL RATE OF CHANGE OF DIVIDEND PAYMENT FOR THE 2017-2022 PERIOD

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Purpose: The aim of the paper is to assess the efficiency of investment portfolios built in the 2017-2022 period, with a particular focus on the COVID-19 pandemic, and to reveal the potential relationship between the real rate of change of dividend payment of the WIG, DAX and S&P500 companies and selected macroeconomic determinants. The analysis will be conducted in the context of the adaptive markets' hypothesis.
Design/methodology/approach: The scientific purpose of the paper is fulfilled by conducting a thorough review of the literature. Empirical data, on the other hand, was studied by quantitative analysis. The authors also employ comparative and descriptive analysis to investigate potential differences between companies listed on selected stock exchanges in terms of dividend payment frequency and rate of change in nominal and real terms. A study of the relationship between the real rate of change of dividends and the macroeconomic determinants of dividend payments was carried out by means of the Fisher equation, Pearson's linear correlation coefficient and Spearman's rank correlation coefficient.
Findings: The assessment of the efficiency of investment portfolios in the 2017-2022 period revealed that, by choosing strong, trend-following investment portfolios, one could earn high and possibly above-average rates of return. The assumptions of the adaptive markets' hypothesis appear to be correct in this context. Furthermore, the results of the empirical analyses demonstrate, that most companies listed on the US Stock Exchange paid dividends without interruption. In addition, in the analyzed period, the DAX companies reported the highest average real dividend growth rate.
Practical implications: Enhanced knowledge in building and assessing the efficiency of investment portfolios during turbulent periods in the financial markets, in the context of the adaptive market hypothesis. Moreover, knowledge of the similarities and differences between dividend-paying companies listed on different stock exchanges is very important for investors and investment fund boards alike. Consequently, better investment decisions can be made as to where to make efficient capital investments.
Social implications: In terms of the social implications of the paper, the most important one seems to be a possible change in attitude of investors towards dividend-paying companies, especially those listed on the international capital market and the acceptance of the adaptive markets' hypothesis' assumptions.

Originality/value: This paper assesses the efficiency of investment portfolios for the 2017-2022 period against the appropriateness of considering the adaptive market hypothesis. Another new feature is the comparison of dividend-paying companies' shares from the perspective of the real rate of change of dividends and the demonstration of the impact of macroeconomic determinants of dividend payments on the inflation-adjusted dividend payment rate of change.
Keywords: investment portfolio, rate of return, determinants of dividend payments, rate of change of dividend payment, dividend-paying company.
Category of the paper: Research paper.

1. Introduction

The primary motivation for investors to invest in financial markets is their desire to generate additional funds (Juza, Dąbrowski, 2021) and, in recent years, characterized by the turbulent global markets (COVID-19 pandemic, Russia's invasion of Ukraine, military, political or economic migrations, climate crises – e.g. the problems of the Panama Canal), combined with a high, double-digit inflation rate, also the desire to protect themselves against a decline in the value of their previously collected funds (Lejman-Gąska, Czech, 2021, pp. 67-80). An increase in investment risk and negative real rates of return have forced investors to seek unconventional investment strategies, and thus build innovative investment portfolios. Functioning in such a rapidly changing environment calls for investors to make various rational and optimal decisions that, on the one hand, translate into the performance of their portfolio and, on the other hand, indirectly affect the efficiency of the entire market. The most recent research clearly indicates that investors are unable to predict future events with accuracy and, at the same time, often succumb to excessive emotions. Therefore, in economic and financial theory, the adaptive market hypothesis (AMH), which postulates that the market experiences volatile prices of financial assets, as investors strive to adjust their strategies to the market developments (Lo, 2004, pp. 15-29; Kołatka, 2021, pp. 33-47; Kołatka, 2020, pp. 132-133; Ammy-Drissa, Garcin, 2020, pp. 1-22; Mensi, Sensoy, Vinh Vo, Kang, 2020, pp. 1-40; Mnif, Jarboui, Mouakhar, 2020, pp. 1-21).

The purpose of this research is to assess the efficiency of investment portfolios developed in the 2017-2022 period, with a particular focus on the COVID-19 pandemic, and to reveal the potential relationship between the real rate of change of dividend payment of the WIG, DAX and S&P500 companies and selected macroeconomic determinants.

The analysis of the efficiency of investment portfolios will be carried out against the simple rates of return. The rates of return of investment portfolios are not only characterized by the change in share price over the holding period, but also by the dividends paid to investors. The amount and changes in dividend payments are linked to the dividend clientèle effect already mentioned by F. Black and M. Scholes (Black, Sholes, 1974) in 1974 and F. Modigliani and M. Miller in 1961 (Miller, Modigliani, 1961). Companies that consistently pay growing

dividends influence the structure and composition of their shareholder structure, which, in addition to capital yield, prefers a stable cash flow in the form of dividends.

The article provides an in-depth analysis of the rates of return of portfolios composed of conservative financial instruments, like shares (equity portfolios that reflect the major Polish indexes – WIG, WIG20, mWIG40 and sWIG80, as well as foreign indexes – S&P 500, DJIA, NKX, FTSE, DAX, CAC), bond portfolios or investment funds employing different strategies, and portfolios composed of alternative investments (raw material, real estate or cryptocurrency portfolios). Subsequently, to deepen the research, a detailed analysis was carried out in relation to the 90 WIG, DAX and S&P500 companies (30 of each index) that had the largest capitalization in the respective index in 2017 and paid dividends in the 2017-2022 period.

It should be noted, that there are studies on the impact of macroeconomic parameters on dividend payments of companies listed on various stock exchanges (e.g. M. Romus, A. Rizga, M.R. Abdillah, N.B. Zakaria, A.K. Giri, J. Pooja, E.F. Brigham, J.F. Houston, T. Basse and S. Reddemann). However, they do not address revealing how selected macroeconomic variables affect the real rate of change of dividend payment.

2. Adaptability of financial markets in the context of investment portfolio design, taking into account the macroeconomic determinants of dividend payments

In 1970, E. Fama presented a synthetic economic theory on the efficiency of financial markets in the context of information (the so-called Efficient Market Hypothesis, EMH), which postulated that it was not possible to earn above-average rates of return in financial markets, and consequently the development of diverse investment strategies is unwarranted and irrational (Fama, 1970, pp. 383-417). However, the constant presence of anomalies, economic bubbles and crashes in financial markets resulted in the emergence of doubts about the validity of this theory and prompted a search for other causes of such events (Grossman, Stiglitz, 1980, pp. 393-408). In the late 1970s, D. Kahneman and A. Tversky proved, through their research, how various psychological, emotional and social factors can influence the actual investment decisions made by investors in the markets. The emphasis on studying and understanding human behavior in the context of making economic decisions gave rise to a new direction in economics, so-called behavioral economics (Kahneman, Tversky, 1979, pp. 263-291). While these considerations have never evolved into a comprehensive theory, they have contributed to the development of the Adaptive Market Hypothesis (AMH), which combines neoclassical and behavioral approaches. The hypothesis proposed by A. Lo is based on the claim that, as a result of constant changes in the market environment, its participants have to make ongoing decisions, thus adapting and adjusting to the new conditions, and so their choices

may be temporarily suboptimal. This translates into a growing level of inefficiency in the financial market, which, in turn, leads to the emergence of the new, albeit short-lived, investment opportunities (Lo, 2004, pp. 15-29; Jabłoński, Kika, 2023, pp. 351-370). Regularly unfolding investment opportunities, or adaptability of financial markets, is confirmed, among other things, by the research conducted by A. Urquhart and R. Hudson (Urquhart, Hudson, 2013, pp. 130-142), as well as J. Kim, A. Shamsuddin, together with K.-P. Lim (Kim, Shamsuddin, Lim, 2011, pp. 868-879). Given the above, this paper analyses the rates of return of various investment portfolios developed in the 2017-2022 period to verify the likelihood of achieving the above-average financial results on global markets. The year 2020 was a particularly interesting period. The occurrence of the COVID-19 pandemic, according to C. Hevia and P.A. Neumeyer, has caused the biggest macroeconomic disturbance across all financial markets in over a hundred years (Hevia, Neumeyer, 2020, pp. 25-37). Furthermore, it should be noted that the responses of heads of governments, central banks, and financial market participants to the barrage of sudden and negative news regarding the spread of the SARS-CoV-2 virus appeared emotional and the decisions made by them were not always optimal (Jaworski, 2021, pp. 157-172). Therefore, it seems appropriate to assess the efficiency of investment portfolios in the context of the Adaptive Market Hypothesis.

This paper also provides an extended analysis in the context of the macroeconomic determinants affecting dividend payments to build an investment portfolio that includes dividend-paying companies. A literature review in this respect reveals that the authors of studies on the companies' dividend payment policies include microeconomic, macroeconomic and other factors, namely economic sentiment and a number of market indicators, among the determinants of dividend payment policy[1]. In light of the purpose of the article and the research, the authors reviewed the literature from the perspective of the dividend policy's macroeconomic determinants and market sentiment. The most notable determinants include gross domestic product (GDP), inflation rate (CPI) as an indicator of the average growth of goods and services in the economy, the PMI, and changes in interest rates.

Gross domestic product, as one of the primary indicators of national income, measures the aggregate value of final goods and services produced in a given country over a period of one year. The research conducted by M. Kowerski (Kowerski, 2011, pp. 129-131, 271-279) on the Warsaw Stock Exchange over the 1996-2009 period confirms that the economic situation measured by the GDP change dynamics in year t_{-1} exerts a positive impact on the decisions concerning dividend payments in year t. It should be noted that this relationship applies to companies characterized by a good economic and financial standing, rather than to companies characterized by a subpar economic and financial standing. Moreover, the author believes that during a period of economic prosperity, many companies that have not paid dividends before will start paying them. As for the international research on the impact of gross domestic product

[1] These include, among others, the P/E, P/BV, P/S and DY rates.

(GDP) on the real estate companies' dividend policy, M. Romus, A. Rizga, M.R. Abdillah and N.B. Zakaria (Romus, Rizga, Abdillah, Zakaria, 2020, pp. 1-6) found that the rate of GDP growth has a positive impact on the performance of companies and their dividend policy. The results of international research (Kowerski, 2011, p. 198) also indicate that the higher the GDP growth rate, the greater the likelihood of dividend payments. A.K. Giri and J. Pooja (Giri, Pooja, 2017, pp. 61-78) conducted research on the long- and short-term relationship between the share price and a set of macroeconomic variables. The conclusions concerning the Indian economy, made by utilizing annual data for the 1979-2014 period confirm that economic growth also positively affects the share price.

Another important determinant of dividend policy is inflation, an indicator describing the rate of increase in the prices in a given economy. Not only does it lead to the increased fluctuations in the value of money over time, but its elevated readings (double-digit figures), or the price decreases referred to as deflation, are particularly dangerous for the economy, companies and households. Among the causes of inflation in the economy, H. Hazlitt (Hazlitt, 2007, p. 61) identifies the introduction of an excessive amount of banknotes to the market. In turn, M. Skousen (Skousen, 2011, p. 318) draws attention to the universal cash flow, private consumption and monetary expansion occurring through credit markets. E.F. Brigham and J.F. Houston (Brigham, Houston, 2005, p. 201) identify that during periods of elevated inflation, not only do investors expect rising returns, but also their attitudes towards the concept of a stable dividend policy change. Capital market participants anticipate that dividends will grow at a rate roughly comparable to the rate of companies' earnings growth. The existence of a stable long-term relationship between dividend payments and real economic activity, as well as the price level adjusted by inflation was confirmed by T. Basse and S. Reddemann (Basse, Reddemann, 2011, pp. 33-64). In turn, according to M. Skousen (Skousen, 2011b, p. 86), dividend-paying companies that operate in the high-inflation economic environment often withhold the distribution of their profit as dividends in order to transfer the financial surplus to investments in the assets that will allow them to preserve the real value of their capital. Therefore, companies reinvest the profits generated at a rate that allows them to retain as much profit as possible in real terms. Moreover, in a high-inflation economic environment, the real value of dividends in the period between the resolution on their distribution and the actual payment is also declining at a rapid rate. For only in a low-inflation economic environment can a stable dividend policy translate into the payment of a fixed dividend on an annual basis. This conclusion is also supported by the research conducted by F. Khan, A. Ullah, A.A. Muhammad and K.I. Muhammad (Khan, Ullah, Muhammad, Muhammad, 2019, pp. 111-121) for the 2001-2017 period for macroeconomic variables and the Pakistan Stock Exchange. The authors indicate a negative relationship between the interest rate, inflation rate and GDP growth rate, and the dividend payment ratio.

As regards the impact of exchange rate and interest rate fluctuations on the payment of dividends, a reference should be made to the results of international studies. M. Romus, A. Rizga, M.R. Abdillah and N.B. Zakaria (Romus, Rizga, Abdillah, Zakaria, 2020, pp. 1-6) conclude that the interest rate had no significant impact on the dividend policy and the performance of the companies under review. In turn, the research on the impact of macroeconomic aggregates conducted by H.W. Akani and Y. Swenem in Nigeria for the 1981-2014 period (Akani, Swenem, 2017, pp. 55-63) indicated a significant negative impact of interest rates and the rate of exchange on the dividends paid by manufacturing enterprises. A.A. Muhammad and F. Khan (Muhammad, Khan, 2018, pp. 111-121) observed a negative impact of the interest rate on the dividend payout ratios of textile companies for the 2001-2017 period. Also, attention should be drawn to the research carried out by F. Modigliani and R.A. Cohn (Modigliani, Cohn, 1979, pp. 24-44). The authors claim that the interest rate stands as one of the most important determinants of share price. An increase in the interest rate causes an increase in the discount rate, and thus negatively affects the share price and value. A decrease in share price results in an increase in the dividend rate, which is one of the factors taken into account by investors when evaluating companies.

Among the remaining dividend payment determinants, classified as market sentiment indicators, synthetic parameters calculated by the European Commission, the Institute of Economic Development of the Warsaw School of Economics or the PMI index were named. The latter, also referred to as the Logistics Managers' Index of the Polish industrial sector[2], is subject to particular attention by economists and market analysts alike. The PMI is calculated through surveys taken on a monthly basis by officers of more than 300 Polish companies. It evaluates changes in orders, production, employment, speed of delivery and inventories. Any reading above 50 indicates an improvement in relation to the previous period, while a reading below this value indicates a deterioration in the enterprises' situation. M. Kowerski (Kowerski, 2011, p. 308) indicates that the better the economic sentiment in June of a given year, the higher the probability of dividend payments in the same year. This delay is caused by the dividend payment procedure, as decisions on the payment of dividends are made primarily on the basis of the financial performance for the previous annual period. A positive sentiment among entrepreneurs affects decisions to recommend dividend payments or to increase the amount of dividend for the previous period. However, should managers decide to pay dividends on the basis of an overly optimistic outlook on the future, the money transfer to shareholders may not be tailored to the current capabilities of the company. This is why the level of dividend payment is often determined by the individual's sentiment.

The research conducted to date for the 2017-2022 period, with a particular focus on the COVID-19 pandemic, has not yet included a comparison of the efficiency of investment portfolios composed of the so-called "covid" companies with portfolios composed of

[2] Study conducted by the 'Markit Economics' research entity.

conservative and alternative investments. To the best of the authors' knowledge, the literature was also lacking information on how the real rate of change of dividend payment correlates with the macroeconomic determinants of dividend payments.

Based on the literature review and the identified research gaps, the following research hypotheses were defined:

H_1: During the COVID-19 pandemic, the rate of return of portfolio composed of the so-called "covid" companies was significantly higher than portfolios composed of conservative financial instruments (equity portfolios that reflected the major Polish indexes – WIG, WIG20, mWIG40 and sWIG80, as well as foreign indexes – S&P 500, DJIA, NKX, FTSE, DAX, CAC, as well as bond portfolios or investment funds employing different strategies);

H_2: During the COVID-19 pandemic, the rate of return of portfolios composed of the so-called "covid" companies was significantly higher than portfolios based on alternative investments (raw material portfolios, real estate portfolios or cryptocurrency portfolios);

H_3: Changes in the inflation rate substantially affect the rate of change of dividend payment of the WIG, DAX and S&P500 companies;

H_4: Changes in the real rate of change of dividend payment are strongly determined by the GDP level and country-specific interest rates.

3. Sample selection and methodology

The research objective of the paper is fulfilled through a thoroughly conducted study of historical market data by means of quantitative analysis, as well as the comparative and descriptive method. In view of the above, the first part of the study covered the selection and characterization of investment portfolios. Over a dozen portfolios were selected, taking into account the different investment motives of investors. Firstly, a portfolio of the so-called "covid" companies, namely the companies that benefited the most in financial and economic terms during the COVID-19 pandemic, as they were the most popular from the investors' perspective and were characterized by high liquidity (high daily turnover) and considerable capitalization growth. This portfolio was then compared with portfolios composed of conservative financial instruments (equity portfolios reflecting the main Polish indexes – WIG, WIG20, mWIG40 and sWIG80, as well as foreign indexes – S&P 500, DJIA, FTSE, DAX, CAC, NKX, plus bond or investment fund portfolios) and alternative instruments (raw material, real estate and cryptocurrency portfolios). Table 1 shows the compositions and strategies of the individual investment portfolios for the 2017-2022 period compared in the study.

Table 1.
Features of investment portfolios reflecting conservative and alternative investments

Investment type	Portfolio	Name of portfolio	Composition	Strategy of portfolio / Risk level
Conservative investment portfolios	**1**	"Covid" companies	ASBISc Enterprises PLC (ASB), Mabion (MAB), Mercator Medical (MRC), PZ Cormay (CRM), BioMaxima (BMX), Synthaverse (SVE) – previously known as Biomed-Lublin Wytwórnia Surowic i Szczepionek (BML), Blirt (BLR) – the company was removed from the public stock exchange on September 6th, 2022, Inno-Gene, Harper Hygienics (HRP) and X-Trade Brokers (XTB).	Aggressive – leveraging market trends, investing in trending Polish joint-stock companies during the COVID-19 pandemic/ High
	2	WIG	All shares of companies listed on the WSE's main market	Aggressive / High
	3	WIG20	Shares of the largest and most liquid companies listed on the WSE	Aggressive / High
	4	mWIG40	Shares of medium-sized companies listed on the WSE	Aggressive / High
	5	sWIG80	Shares of small companies listed on the WSE	Aggressive / High
	6	S&P 500	Shares of the 500 largest NYSE and NASDAQ companies by market capitalization	Aggressive / High
	7	DJI	Shares of the largest companies listed in the US	Aggressive / High
	8	FTSE	Shares of companies listed in the UK	Aggressive / High
	9	DAX	Shares of the biggest and most liquid companies listed in Germany	Aggressive / High
	10	CAC40	Shares of the biggest and most liquid companies listed in France	Aggressive / High
	11	NKX	Shares of companies listed in Japan	Aggressive / High
	12	Small and Medium-Sized Company Treasury Open-End Investment Fund	Shares of the best Polish small and medium-sized companies	Aggressive / High
	13	Growth Company Treasury Open-End Investment Fund	Shares of the most dynamic Polish and foreign growth companies	Aggressive / High
	14	10-Year Poland Bond Yield (10PLY.B)	Polish 10-year government bonds	Capital Protection / Low
	15	PKO Treasury Bond Open-End Investment Fund	Government bonds, treasury bills and corporate bonds	Capital Protection / Low
	16	Santander Treasury Bond Open-End Investment Fund	Securities and money market instruments denominated in PLN or foreign currencies with a hedge against foreign exchange risk	Capital Protection / Moderate
	17	PZU Polish Bond Open-End Investment Fund	Debt securities, money market instruments and bank deposits	Passively managed index fund aiming to follow the rates of return of the Treasury BondSpot Poland (TBSP) index / Low
	18	PKO Long-Term Bond Open-End Investment Fund	Polish and foreign debt instruments	Stable growth / Moderate
	19	NN Short-Term Bond Open-End Investment Fund	Short- and medium-term debt financial instruments	Capital Protection / Moderate
	20	PZU Developed Market Bond Open-End Investment Fund	Bonds issued by developed countries and denominated in the issuer's currency	Passively managed index fund aiming to follow the rates of return of the JPMorgan Government Bond Index Global / Low
	21	Quercus Capital Protection Open-End Investment Fund	Debt instruments issued, guaranteed or backed by the State Treasury or the National Bank of Poland or public companies with shares listed on the WSE, deposits, titles of participation issued by entities, whose investment policy envisages investing in debt instruments and deposits	Capital Protection / Low

Cont. table 1.

Alternative investment portfolios	**22**	Precious metals	Gold	Capital Protection / Low
	23	PKO Gold Market Share Open-End Investment Fund	Equity instruments issued by companies, whose principle object of economic activity is the exploration, exploitation, production, processing, distribution or trade of gold and other precious metals, and futures contracts on shares of share indexes of such companies	Asset-value growth / High
	24	Allianz Gold Market Share Open-End Investment Fund	Participation units in investment funds, titles of participation in foreign funds investing in broadly defined raw material markets (metals, power resources, food), including shares in companies with economic activity focused around raw material markets, direct investments in equity and debt securities	High growth / High
	25	Vanguard Real Estate ETF	Fund investing in REITs with real estates located worldwide – office buildings, hotels and other immovable property	Stable Growth – the fund reflects the performance of the S&P Global ex-U.S. index. Property / Moderate
	26	Cryptocurrency	Bitcoin	Aggressive / High

Source: Own study based on market data.

As illustrated in Table 1, different financial instruments with different risk levels were taken into account in the research. It was focused around the analysis of the rates of return of portfolios composed of shares. The analysis takes into account investment portfolios composed of indexes listed on the Polish (WIG, WIG20, mWIG40 and sWIG80), US (S&P 500 and DJI), UK (FTSE), German (DAX), French (CAC40) and Japanese (NKX) stock exchanges, together with portfolios that are represented by investment funds that rely on aggressive investment strategies. In contrast, safe portfolios composed of bonds, as they are most usually picked by less experienced investors or by those who prefer safer strategies, were built. Finally, portfolios based on precious metals (gold) and real estates were presented, as they protect investors against money depreciation during periods of elevated inflation or war, as well as cryptocurrencies, which are very popular among young participants in the financial markets. By including such a diverse range of assets in the research, the portfolios were better diversified and eliminated, among other things, asset allocation risk.

In addition, to further deepen the discussion, the paper envisages selecting companies according to the classification of dividend payments. The research included 90 companies listed on the Polish, German and US markets (30 companies in each country) with the largest market capitalization in the respective index at the end of 2017 (WIG, DAX and S&P500 respectively). Then the authors analyzed, for each market, only those issuers, who paid dividends in the 2017-2022 period with a maximum of 1-year dividend interruption period (dividend payment period of 5 to 6 years). This approach involved discarding the companies that failed to pay dividends more than once and focusing the analysis on the companies that can be referred to as dividend-paying. It is worth noting that the research included particularly unusual year 2020, which was dominated by the worldwide SARS-CoV-2 pandemic and its impact on the individual companies' operation and dividend payments. Therefore, a possible 1-year dividend interruption period was taken into account. Tables 2 to 4 present the selected WIG, DAX and S&P500 companies.

Table 2.
Polish companies and dividends paid in the 2017-2022 period

Name of the issuer	Dividend payments in a given year in PLN (WIG)					
	2017	**2018**	**2019**	**2020**	**2021**	**2022**
Alior	0.00	0.00	0.00	0.00	0.00	0.00
Amrest	0.00	0.00	0.00	0.00	0.00	0.00
Assecopol	3.01	3.01	3.07	3.01	3.11	3.36
BgzBnpp	0.00	0.00	0.00	0.00	0.00	0.00
Budimex	14.99	17.61	6.30	4.56	16.70	38.37
BzWbk	5.40	3.10	0.84	0.44	0.13	0.05
Ccc	2.59	2.30	0.48	0.00	0.00	0.00
Cyfrplsat	0.32	0.00	0.93	1.00	1.20	1.20
Enea	0.25	0.00	0.00	0.00	0.00	0.00
Energa	0.19	0.00	0.00	0.00	0.00	0.00
Eurocash	0.73	0.73	1.00	0.00	0.48	0.00
GrupaAzoty	0.79	1.25	0.00	0.00	0.00	0.00
Handlowy	4.53	4.11	3.74	0.00	1.20	5.47
Ingbsk	0.00	3.20	3.50	3.80	5.10	5.30
Kghm	1.00	0.00	0.00	0.00	1.50	3.00
Lotos	1.00	1.00	3.00	1.00	0.00	3.50
Lpp	35.74	40.00	60.00	0.00	450.00	350.00
Mbank	0.00	5.15	0.00	1.15	0.00	0.00
Millenium	0.00	0.00	0.00	0.00	0.00	0.00
OrangePl	0.00	0.00	0.00	0.00	0.00	0.25
Pekao	8.68	7.90	6.60	0.00	3.21	4.30
Pge	0.00	0.00	0.00	0.00	0.00	0.00
Pgnig	0.20	0.00	0.11	0.09	0.21	0.00
PknOrlen	3.00	3.00	3.50	1.00	3.50	3.50
PkoBp	0.00	0.55	1.33	0.00	0.00	1.83
Puławy	6.20	4.46	1.76	5.45	0.00	6.60
Pzu	1.40	2.50	2.80	0.00	3.50	1.94
Synthos	1.03	0.00	0.00	0.00	0.00	0.00
TauronPe	0.00	0.00	0.00	0.00	0.00	0.00
Żywiec	29.00	26.00	30.00	15.00	32.00	20.00

Source: Own study based on market data.

Table 3.
German companies and dividends paid in the 2017-2022 period

Name of the issuer	Dividend payments in a given year in EUR (DAX)					
	2017	**2018**	**2019**	**2020**	**2021**	**2022**
Adidas	2.00	2.60	3.35	0.00	3.00	3.30
AllianzVna	7.60	8.00	9.00	9.60	9.60	10.80
Basf	3.00	3.10	3.20	3.30	3.30	3.40
Bayer	2.70	2.76	2.80	2.80	2.00	2.00
Beiersdorf	0.70	0.70	0.70	0.70	0.70	0.70
Bmw	3.50	4.00	3.50	2.50	1.90	5.80
Commerzbank	0.00	0.00	0.20	0.00	0.00	0.00
Continental	4.25	4.50	4.75	3.00	0.00	2.20
Daimler	3.25	3.65	3.25	0.90	1.35	5.00
DeutscheBoerse	2.35	2.45	2.70	2.90	3.00	3.20
DeutscheBank	0.19	0.11	0.11	0.00	0.00	0.20
DeustschePost	1.05	1.15	1.15	0.13	1.02	1.35
DtTelekom	0.60	0.65	0.70	0.60	0.60	0.06
Eon	0.21	0.30	0.43	0.46	0.47	0.49
FresenMedCareKGAA	0.96	1.06	1.17	1.20	1.34	1.35
Freseniu+CoKGAA	0.62	0.75	0.80	0.84	0.88	0.26
HeidelbergCement	1.60	1.90	2.10	0.60	2.20	2.40
Henkel+CoKGAAVzo	1.62	1.79	1.85	1.85	1.85	1.85
InfineonTech	0.22	0.25	0.27	0.27	0.22	0.27
LufthansaVna	0.50	0.80	0.80	0.00	0.00	0.00
Linde	3.15	3.30	3.50	3.85	4.24	4.68
MerckKGAA	1.20	1.25	1.25	1.30	1.40	1.85
MuenchRueckversVna	8.60	8.60	9.25	9.80	9.80	11.00
ProsiebenSat1	1.90	1.93	1.19	0.00	0.49	0.80

RweSt	0.13	1.50	0.70	0.80	0.85	0.90
Sap	1.25	1.40	1.50	1.58	1.85	1.95
Siemens	3.60	3.70	3.80	3.90	3.50	4.00
ThyssenKrupp	0.15	0.15	0.15	0.00	0.00	0.00
Vonovia	1.05	1.24	1.35	1.47	1.58	1.66
VolkswagenVzo	2.06	3.96	4.86	4.86	4.86	26.62

Source: Own study based on market data.

Table 4.
US companies and dividends paid in the 2017-2022 period

Name of the issuer	Dividend payments in a given year in USD (S&P500)					
	2017	2018	2019	2020	2021	2022
Alphabet Inc. Class A	0.00	0.00	0.00	0.00	0.00	0.00
Alphabet Inc. Class C	0.00	0.00	0.00	0.00	0.00	0.00
Amazon.com Inc.	0.00	0.00	0.00	0.00	0.00	0.00
Apple Inc.	2.46	2.82	3.04	2.62	0.87	0.91
AT&T Inc.	1.47	2.00	2.04	2.08	2.08	1.35
Bank of America Corporation	0.39	0.54	0.66	0.72	0.78	0.86
Berkshire Hathaway Inc. Class B	0.00	0.00	0.00	0.00	0.00	0.00
Chevron Corporation	4.32	4.48	4.76	5.16	5.31	5.68
Cisco Systems Inc.	1.13	1.28	1.38	1.43	1.47	1.51
Coca-Cola Company	1.48	1.56	1.60	1.64	1.68	1.76
Comcast Corporation Class A	0.79	0.92	0.63	0.90	0.98	1.06
Exxon Mobil Corporation	3.06	3.23	3.43	3.48	3.49	3.55
Facebook Inc. Class A	0.00	0.00	0.00	0.00	0.00	0.00
General Electric Company	0.72	0.26	0.04	0.04	0.18	0.32
Home Depot Inc.	3.56	4.12	5.44	6.00	6.60	7.60
Intel Corporation	1.08	1.20	1.26	1.20	1.39	1.46
Johnson & Johnson	3.32	3.54	3.75	3.98	4.19	4.45
JPMorgan Chase & Co.	2.04	2.48	3.30	3.60	3.70	4.00
Merck & Co. Inc.	1.89	1.99	2.26	2.48	2.64	2.80
Microsoft Corporation	1.59	1.72	1.89	2.09	2.30	2.54
Oracle	0.72	0.76	0.91	0.96	1.20	1.28
PepsiCo Inc.	3.17	3.59	2.84	4.02	4.25	4.53
Pfizer Inc.	1.28	1.36	1.44	1.52	1.56	1.60
Philip Morris International Inc.	4.22	4.49	4.62	4.74	5.65	5.04
Procter & Gamble Company	2.74	2.84	2.95	3.12	3.40	3.61
Verizon Communications Inc.	2.32	2.37	2.42	2.47	2.52	2.57
Visa Inc. Class A	0.69	0.88	1.05	1.22	1.34	1.58
Wal Mart	2.04	2.08	2.12	2.16	2.20	2.24
Walt Disney Company	1.62	1.72	1.76	0.00	0.00	0.00
Wells Fargo & Company	1.54	1.64	1.92	1.22	0.60	1.10

Source: Own study based on market data.

The research was carried out in the following stages:

1. Stage one – selecting the investment portfolio comprising the so-called "covid" companies and over a dozen other investment portfolios composed of conservative financial instruments and alternative investments;
2. Stage two – analyzing the rates of return of the investment portfolios built and assessing the efficiency of the investment decisions made by investors in the 2017-2022 period;
3. Stage three – selecting the companies that paid dividends between 2017 and 2022 for the 2016-2021 period without interruption or with one period of no distribution of profit among shareholders – the group was described as dividend-paying (dividend-paying WIG, dividend-paying DAX and dividend-paying S&P500 respectively). The remaining companies that paid no dividends or paid dividends with no regularity were excluded from the further stage of the research;

4. Stage four – an analysis of the frequency of dividend payments and an analysis of the average nominal and real rate of change of dividend payment for the 2018-2022 period (payments for the 2017-2022 period) was carried out on the selected groups of companies. It was then examined whether and to what extent the real rate of change of dividend payment of the WIG, DAX and S&P500 companies was determined by selected macroeconomic parameters.

4. Assessment of the efficiency of investment portfolios and the analysis of the impact of macroeconomic determinants on the real rate of change of dividend payment – research results for the 2017-2022 period

An analysis of the rates of return of selected investment portfolios displaying different characteristics demonstrated how, in the course of the last 6 years, i.e. between 2017 and 2022, investors have changed their investment strategies and adjusted their risk levels to market conditions – see Table 5. In 2017, the investment in Bitcoin (P_{26}) yielded record profits, earning a rate of return of almost 1300%. Practically all investment portfolios composed of equity market companies also earned high rates of return (with the exception of Portfolio 1, which earned a negative rate of return amounting to more than 10%). The highest rate of return was earned by Portfolio 13 (P_{13} = 37.82%), an investment fund that acquired shares of both domestic and foreign growth companies. According to the theory, when equity markets rise, investors are less interested in the debt instrument market, where the rates of return stood at 2.41-4.66%, or the real estate market (4.55%). Gold also generated a double-digit return, i.e. P_{22} = 12.47%.

Table 5.
Rates of return of investment portfolios in the 2017-2022 period

Investment type	Portfolio	Rate of return [%]					
		2017	2018	2019	2020	2021	2022
Conservative investment portfolios	1	-10.25	-30.20	1.97	996.98	2.82	-1.21
	2	22.81	-9.71	-0.78	-3.43	19.57	-18.00
	3	25.78	-7.58	-6.58	-9.82	12.85	-21.63
	4	15.41	-19.76	-0.99	0.08	29.73	-22.82
	5	1.74	-27.79	13.29	32.04	21.54	-14.08
	6	18.42	-7.01	28.71	15.29	28.79	-19.95
	7	24.33	-6.03	22.24	6.02	20.23	-9.40
	8	7.24	-12.21	12.48	-14.92	12.17	0.40
	9	11.37	-17.97	25.22	2.49	15.72	-13.09
	10	8.81	-10.55	27.48	-8.11	27.98	-10.30
	11	16.18	-14.85	20.93	18.27	5.63	-10.95
	12	21.27	-14.16	22.11	50.33	11.72	-20.02
	13	37.82	-8.93	32.96	115.20	2.48	-63.09
	14	3.44	3.23	2.41	1.51	1.96	6.06
	15	3.40	0.98	0.99	-0.18	-2.28	-0.91
	16	4.66	2.87	1.53	6.51	-10.39	-1.21
	17	-	2.21	3.04	5.88	-10.35	-5.44
	18	4.82	2.54	1.73	3.85	-9.50	-8.80
	19	4.14	1.02	4.15	4.00	-0.16	2.34
	20	-	2.14	5.67	4.66	-3.54	-10.63
	21	2.41	2.16	2.22	1.71	0.32	2.69

Cont. table 5.

Alternative investment portfolios	**22**	12.47	-2.66	18.19	24.17	-5.83	1.23
	23	1.25	-8.68	52.68	29.01	-24.99	-6.98
	24	-3.57	-15.17	9.74	-13.02	-20.04	-6.19
	25	4.55	-5.67	31.78	-3.47	45.27	-26.70
	26	1291.38	-72.15	90.13	303.68	57.83	-65.20

Source: Own study based on market data.

Year 2018 saw a correction in the higher-risk financial instrument markets, as well as raw material, real estate and cryptocurrency markets. It is also worth noting that yields on 10-year government bonds declined, which effectively resulted in negative real rates of return on this type of investment. Global equity markets rebounded in 2019, with only Portfolios 2, 3 and 4 – reflecting the WIG, WIG20 and mWIG40 indexes – earning negative rates of return. The highest rate of return was earned by Portfolio 26, which demonstrates a trend that could be observed in 2017, 2019, 2020 and 2021. Namely, when stock markets experience big increases, investors try to take advantage of the so-called "good climate and superior investor sentiment in the markets" and make riskier decisions by investing in cryptocurrencies that are in no way controlled by any supervisory authority. Therefore, it can be concluded that during the bull market investors rely on the highest risk investments in an attempt to quickly earn superb returns. On the other hand, the US-China trade war elevated the price of investment gold, which translated into double-digit rates of return for Portfolios 22 and 23.

The year 2020 went down in history as a year of uncertainty, panic and, as a result, a crash in financial markets caused by the COVID-19 pandemic. World stock markets suffered heavy losses and only a few closed the year with a gain. The "covid" company portfolio (P_1), which included companies directly and indirectly involved in the fight against the SARS-CoV-2 virus, earned a record high rate of return. As indicated by Jabłoński and Kika, following market trends alone allowed investors to generate an above-average rate of return during that period (Jabłoński, Kika, 2023). Going back to economic theory, it should be mentioned that the principle stating that in times of stock market fluctuations and losses it is recommended to invest in gold, as both investments are characterized by a negative correlation, also proved to be true. Accordingly, if investors had purchased Portfolios 22 and 23, they would have obtained returns of 24.17% and 29.01% respectively (only Portfolio 24 suffered a loss, although it was built around gold).

The year 2021 saw euphoric and rebounding financial markets, as SARS-CoV-2 vaccinations began. Investors were again acquiring shares, their market valuations were rising and rates of return were reaching double digits. The highest rates of return could be earned on the French (P_{10}), US (P_6) and Polish stock exchanges, although, in the latter case, investors had to give preference to the indexes of small and medium-sized companies (P_4 & P_5). Unfortunately, during the analyzed period, investors, who had previously relied on safe solutions to protect their capital against inflation and those earning small, but stable rates of return, suffered heavy losses. The yield on government bonds as low as 1.96% (P_{14}) contributed to negative rates of return on portfolios composed of investment funds acquiring these assets

(P_{16} = -10.39, P_{17} = -10.35, P_{18} = -9.50), which caused a huge stir among fund managers and investors alike, for it violated the principle stating that investing in government bonds is associated with zero risk. It is worth noting that interest in precious metals also declined in favor of the stock market and cryptocurrencies. On the other hand, due to rising inflation, the real estate market was very popular, with a return of 45.27% (P_{25}).

The year 2022 came as a surprise in terms of political events, as it started with Russia's invasion of Ukraine, which translated into declines in all global stock markets (only Portfolio 8 earned a rate of return of 0.40%). The speculations about the spread of the conflict also caused gold, previously regarded as a best hedge in wartime, not to increase, but rather keep its value. It is worth noting, at this point, that the initial reaction of investors to the news of the war resulted in a rapid increase in the price of gold, but this trend was soon reversed, and gold dropped from over USD 1950/oz to below USD 1650/oz. The final rate of return on the Portfolio 22 totaled 1.23%.

The analysis of the rates of return in the context of investing in conservative financial instruments and alternative investment portfolios revealed that the present-day investors do not get attached to their portfolios, but rather try to quickly adapt them to the prevailing conditions and trends in the financial markets. Investors manage their assets in a flexible and very efficient way, taking into account every single, even the slightest type of risk, while also trying to take advantage of all the opportunities the market has to offer. Examples include the rate of return of portfolios composed of the so-called covid companies (P_1) during the COVID-19 pandemic, which was significantly higher than that of portfolios composed of conservative financial instruments (equity portfolios that reflected the major Polish indexes – WIG, WIG20, mWIG40 and sWIG80, as well as foreign indexes – S&P 500, DJIA, NKX, FTSE, DAX, CAC, as well as bond portfolios or investment funds employing different strategies) and portfolios composed of alternative investments (raw material, real estate or cryptocurrency portfolios). In view of the above, it seems appropriate to look for unusual investment strategies that combine diverse investment approaches or motives, since the present-day world of finance is based on the adaptive market hypothesis.

To extend and deepen the first part of the study, an analysis was undertaken to take into account how the dividend payment policy affects the composition of the investment portfolio. This analysis addresses the impact of macroeconomic determinants of dividend payments on the real rate of change of dividends paid by the WIG, DAX and S&P 500 companies for the 2017-2022 period. In the analyzed 2017-2022 period, the analyzed markets differed greatly in terms of the number of companies that have paid dividends without interruption. The biggest share of companies with the largest capitalization in the WIG, DAX and S&P500 indexes at the end of 2017, that have paid dividends without interruption during the 2017-2022 period (6 years of dividend payments), is attributable to the S&P500 companies (as many as 80% of issuers). They are followed by the companies listed on the German Stock Exchange (76.67% of issuers),

and only 16.67% of the WIG companies. A full breakdown of how systematically companies paid dividends in the analyzed period is shown in Table 6.

Table 6.
Breakdown of how systematically companies paid dividends in the 2017-2022 period (%)

Percentage of companies that paid dividends by:	WIG	DAX	S&P500
no payment	20.00%	0.00%	16.67%
1 year	13.33%	3.33%	0.00%
2 years	6.67%	0.00%	0.00%
3 years	10.00%	6.67%	3.33%
4 years	6.67%	3.33%	0.00%
5 years	26.67%	10.00%	0.00%
6 years	16.67%	76.67%	80.00%

Source: Own study.

An analysis of Figure 1 shows that the US and Polish companies featured a similar share of companies that have never paid dividends and a comparable share of US and German companies that have paid dividends without interruption over a period of 6 years.

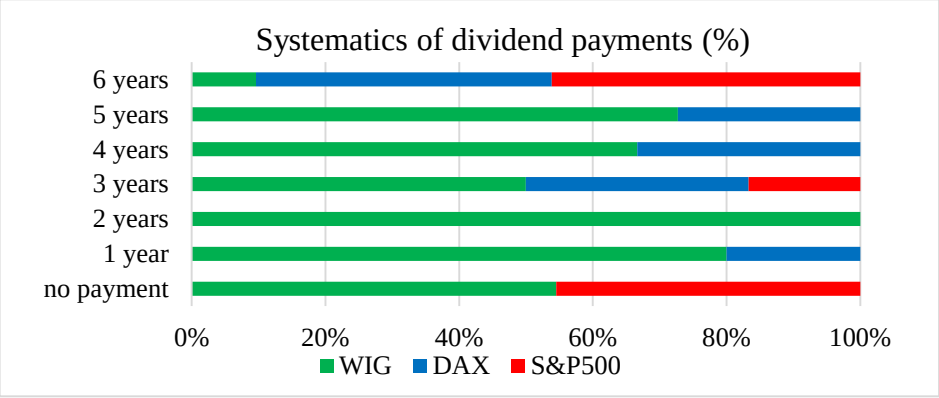

Figure 1. Systematics of dividend payments in the 2017-2022 period (%).

Source: Own study.

Based on the preliminary analysis conducted, a large disparity among the selected markets becomes evident. With regard to the selected US companies, from the perspective of how systematically the companies are paying dividends, they either distribute their profit to shareholders without interruption or make no dividend payments at all. On the other hand, if the possibility of a 1-year interruption in the systematic payment of dividends (payment of dividends for 5 or 6 years) is taken into account, the largest number of companies belong to the DAX index (86.67% of companies), followed by the S&P500 (80%) and the WIG (43.33%). They are also the companies that will serve as a study material for the second phase of the research. For further analysis, this group of companies was defined as WIG dividend-paying companies (13 companies), DAX dividend-paying companies (26 entities) and S&P500 dividend-paying companies (24 issuers) (Table 7).

Table 7.
WIG, DAX and S&P500 dividend-paying companies

Name of the issuer	Dividend payments in a given year in PLN (WIG)					
	2017	**2018**	**2019**	**2020**	**2021**	**2022**
Assecopol	3.01	3.01	3.07	3.01	3.11	3.36
Budimex	14.99	17.61	6.30	4.56	16.70	38.37
BzWbk	5.40	3.10	0.84	0.44	0.13	0.05
Cyfrplsat	0.32	0.00	0.93	1.00	1.20	1.20
Handlowy	4.53	4.11	3.74	0.00	1.20	5.47
Ingbsk	0.00	3.20	3.50	3.80	5.10	5.30
Lotos	1.00	1.00	3.00	1.00	0.00	3.50
Lpp	35.74	40.00	60.00	0.00	450.00	350.00
Pekao	8.68	7.90	6.60	0.00	3.21	4.30
PknOrlen	3.00	3.00	3.50	1.00	3.50	3.50
Puławy	6.20	4.46	1.76	5.45	0.00	6.60
Pzu	1.40	2.50	2.80	0.00	3.50	1.94
Żywiec	29.00	26.00	30.00	15.00	32.00	20.00
Name of the issuer	**Dividend payments in a given year in EUR (DAX)**					
	2017	**2018**	**2019**	**2020**	**2021**	**2022**
Adidas	2.00	2.60	3.35	0.00	3.00	3.30
AllianzVna	7.60	8.00	9.00	9.60	9.60	10.80
Basf	3.00	3.10	3.20	3.30	3.30	3.40
Bayer	2.70	2.76	2.80	2.80	2.00	2.00
Beiersdorf	0.70	0.70	0.70	0.70	0.70	0.70
Bmw	3.50	4.00	3.50	2.50	1.90	5.80
Continental	4.25	4.50	4.75	3.00	0.00	2.20
Daimler	3.25	3.65	3.25	0.90	1.35	5.00
DeutscheBoerse	2.35	2.45	2.70	2.90	3.00	3.20
DeustschePost	1.05	1.15	1.15	0.13	1.02	1.35
DtTelekom	0.60	0.65	0.70	0.60	0.60	0.06
Eon	0.21	0.30	0.43	0.46	0.47	0.49
FresenMedCareKGAA	0.96	1.06	1.17	1.20	1.34	1.35
Freseniu+CoKGAA	0.62	0.75	0.80	0.84	0.88	0.26
HeidelbergCement	1.60	1.90	2.10	0.60	2.20	2.40
Henkel+CoKGAAVzo	1.62	1.79	1.85	1.85	1.85	1.85
InfineonTech	0.22	0.25	0.27	0.27	0.22	0.27
Linde	3.15	3.30	3.50	3.85	4.24	4.68
MerckKGAA	1.20	1.25	1.25	1.30	1.40	1.85
MuenchRueckversVna	8.60	8.60	9.25	9.80	9.80	11.00
ProsiebenSat1	1.90	1.93	1.19	0.00	0.49	0.80
RweSt	0.13	1.50	0.70	0.80	0.85	0.90
Sap	1.25	1.40	1.50	1.58	1.85	1.95
Siemens	3.60	3.70	3.80	3.90	3.50	4.00
Vonovia	1.05	1.24	1.35	1.47	1.58	1.66
VolkswagenVzo	2.06	3.96	4.86	4.86	4.86	26.62
Name of the issuer	**Dividend payments in a given year in USD (S&P500)**					
	2017	**2018**	**2019**	**2020**	**2021**	**2022**
Apple Inc.	2.46	2.82	3.04	2.62	0.87	0.91
AT&T Inc.	1.47	2.00	2.04	2.08	2.08	1.35
Bank of America Corporation	0.39	0.54	0.66	0.72	0.78	0.86
Chevron Corporation	4.32	4.48	4.76	5.16	5.31	5.68
Cisco Systems Inc.	1.13	1.28	1.38	1.43	1.47	1.51
Coca-Cola Company	1.48	1.56	1.60	1.64	1.68	1.76
Comcast Corporation Class A	0.79	0.92	0.63	0.90	0.98	1.06
Exxon Mobil Corporation	3.06	3.23	3.43	3.48	3.49	3.55
General Electric Company	0.72	0.26	0.04	0.04	0.18	0.32
Home Depot Inc.	3.56	4.12	5.44	6.00	6.60	7.60
Intel Corporation	1.08	1.20	1.26	1.20	1.39	1.46
Johnson & Johnson	3.32	3.54	3.75	3.98	4.19	4.45
JPMorgan Chase & Co.	2.04	2.48	3.30	3.60	3.70	4.00
Merck & Co. Inc.	1.89	1.99	2.26	2.48	2.64	2.80
Microsoft Corporation	1.59	1.72	1.89	2.09	2.30	2.54
Oracle	0.72	0.76	0.91	0.96	1.20	1.28
PepsiCo Inc.	3.17	3.59	2.84	4.02	4.25	4.53
Pfizer Inc.	1.28	1.36	1.44	1.52	1.56	1.60
Philip Morris International Inc.	4.22	4.49	4.62	4.74	5.65	5.04

Cont. table 7.

Procter & Gamble Company	2.74	2.84	2.95	3.12	3.40	3.61
Verizon Communications Inc.	2.32	2.37	2.42	2.47	2.52	2.57
Visa Inc. Class A	0.69	0.88	1.05	1.22	1.34	1.58
Wal Mart	2.04	2.08	2.12	2.16	2.20	2.24
Wells Fargo & Company	1.54	1.64	1.92	1.22	0.60	1.10

Source: Own study.

Considering the rate of change of dividends paid in nominal terms, it should be noted that the highest average annual change was observed for WIG dividend-paying companies (88.09% in 2021) and the lowest (negative) for DAX dividend-paying companies (-9.55% in 2020) (Table 8).

Table 8.
Average dividend change rate

Company groups	2018	2019	2020	2021	2022
WIG dividend-paying companies	-1.41%	6.86%	-4.39%	88.09%	33.35%
DAX dividend-paying companies	53.92%	3.53%	-9.55%	43.07%	40.54%
S&P 500 dividend-paying companies	8.83%	3.77%	5.90%	15.96%	10.41%

Source: Own study.

It should be noted, that German dividend-paying companies have the highest average annual rate of change of dividend payment in nominal terms (26.3%) and US companies the lowest average annual rate of change of dividend payment in nominal terms (8.97%). However, it is the S&P 500 dividend-paying companies that show an average positive rate of change of dividend payment in each of the analyzed periods. The features of each group of companies are also preserved for the average inflation-adjusted rate of change of dividend payment (Table 9).

Table 9.
Average real rate of change of dividend payment

Company groups	2018	2019	2020	2021	2022
WIG dividend-paying companies	-2.48%	3.34%	-6.63%	73.20%	14.36%
DAX dividend-paying companies	51.35%	2.00%	-9.28%	35.87%	29.42%
S&P 500 dividend-paying companies	6.80%	1.43%	4.44%	8.37%	3.67%

Source: Own study.

Taking inflation into account for the 2018-2022 period, German dividend-paying companies featured an average real annual rate of change of dividend payment of 21.87%, Polish dividend-paying WIG companies stood at 16.36%, while US companies rate of change amounted to 4.94%. Despite making the inflation adjustment, the S&P 500 dividend-paying companies continue to feature an average real positive rate of change of dividend payment in each of the analyzed periods.

In a later phase of the research, linear relationships between the average real rate of change of dividend payment and macroeconomic indicators were identified. For the parameters used in the analysis, the r-Pearson correlation coefficient and the Spearman's rank correlation coefficient (also known as the Spearman's rho) were calculated. The use of Spearman's Rho in the research allows for the determination of whether there is a correlation between two variables (when the variables do not meet the assumptions of parametric tests), such as the normality of

the distribution or the quantitative nature of the tested variables. Table 10 shows the economic parameters of each country.

Table 10.
Macroeconomic parameters of each country

Country	Parameters	2017	2018	2019	2020	2021
Poland	GDP	5.10	4.90	3.40	-1.80	8.50
	PMI	55.00	47.60	48.00	51.70	56.10
	Inflation (CPI)	1.10	3.40	2.40	8.60	16.60
	Interest rate	3.30	2.84	2.11	1.23	3.64
Germany	GDP	2.90	0.90	-2.30	-4.30	1.80
	PMI	57.00	51.70	52.90	47.00	48.70
	Inflation (CPI)	1.70	1.50	-0.30	5.30	8.60
	Interest rate	0.43	0.23	-0.19	-0.57	-0.18
USA	GDP	2.60	3.00	2.30	-2.40	5.50
	PMI	55.10	53.80	52.40	57.10	57.70
	Inflation (CPI)	1.90	2.30	1.40	7.00	6.50
	Interest rate	2.41	2.69	1.92	0.92	1.51

Source: Own study.

The levels of gross domestic product (GDP), interest rate and PMI were included in the values at the end of the year, in which the company generated its profit, whereas CPI inflation level referred to the level at the end of the period, in which the dividend was paid. The country's interest rate level was assumed to be the 10-year government bond yield.

For each pair of indicators of the average real rate of change of dividend payment (X) and macroeconomic indicators (Y), the following hypotheses were adopted:

H0: The indicator of the average real rate of change of dividend payment (X) is independent of the macroeconomic indicator (Y)

and

H1: The indicator of the average real rate of change of dividend payment (X) is dependent of the macroeconomic indicator (Y).

A significance level of $p = 0.05$ was used to assess the statistical significance of the analyzed relationships.

Table 11 shows the results of the Pearson's linear correlation calculations.

Table 11.
Pearson's linear correlation coefficients

Parameters	WIG dividend-paying companies	DAX dividend-paying companies	S&P500 dividend-paying companies
GDP	-0.73	0.31	-0.71
PMI	0.13	0.08	0.39
Inflation (CPI)	0.40	0.47	0.36
Interest rate	-0.67	0.11	-0.62

Source: Own study.

The calculations revealed that, among the WIG, DAX and S&P500 dividend-paying companies, there was a strong negative correlation between the average real rate of change of dividend payment and the GDP of a given country in the case of Polish and US companies. On the other hand, companies listed on the German stock exchange featured a moderate positive

relationship between the average real rate of change of dividend payment and CPI inflation. In contrast, in the case of Polish and US listed companies, there was a strong negative correlation between the average real rate of change of dividend payment and the interest rate applicable in the respective country. The findings of the Pearson's linear correlation calculations for the analyzed variables were not fully confirmed by the Spearman's rank correlation coefficient analysis (Table 12).

Table 12.
Spearman's rank correlation coefficients

Parameters	WIG dividend-paying companies	DAX dividend-paying companies	S&P500 dividend-paying companies
GDP	-0.10	0.40	-0.80
PMI	0.30	0.00	0.20
Inflation (CPI)	0.80	0.60	0.20
Interest rate	-0.10	0.30	-0.60

Source: Own study.

A strong negative relationship was only confirmed between S&P500 dividend-paying companies and the country's GDP and interest rate. In turn, according to the Spearman's rho, a strong positive relationship became evident for Polish and German dividend-paying companies with respect to CPI inflation.

5. Conclusions

An assessment of the efficiency of investment portfolios selected in the research clearly indicated that, in the 2017-2022 period, a number of short-term investment opportunities emerged in the financial markets that had the potential to translate into above-average rates of return for investors. Examples include the performance of portfolios composed of conservative financial instruments, such as shares, but also the performance of alternative investment portfolios composed of cryptocurrencies or precious metals (gold). The findings also provide an excellent illustration of a process that has been happening in the financial markets for centuries, namely a trend to buy a particular security or asset. Chasing the trend proved to be the best investment strategy in 2020, as the investment strategy based on buying listed companies directly or indirectly involved in the struggle against the SARS-CoV-2 virus (P_1) generated an above-average return of 996.98%. Also, the Bitcoin fad (P_{26}) yielded an average return of 268% during the analyzed period. This means that the adaptive market hypothesis, which suggests that adapting to new conditions in the environment results in sub-optimal decisions in short-term, and thus offers unique investment opportunities, appears to be valid.

The research conducted also indicates the highest share of US and German dividend-paying companies, which boasted the largest capitalization in the WIG, DAX and S&P500 indexes at the end of 2017 and paid dividends without interruption in the 2017-2022 period. Only 16.67%

of all Polish dividend-paying companies under review paid dividends without interruption. However, if the possibility of a one-year interruption in paying dividends is taken into account, the share of DAX dividend-paying companies climbs to 86.67% compared to S&P500 dividend-paying companies and WIG dividend-paying companies (80% and 43.33% respectively).

With inflation taken into account for the 2018-2022 period, German dividend-paying companies had an average real rate of change of dividend payment of 21.87%, Polish WIG dividend-paying companies stood at 16.36% and US companies ranked the lowest with 4.94%. However, it is worth noting that the latter not only paid steadily increasing dividends, but also made cash transfers to shareholders usually on a quarterly basis, as opposed to the annual payments made by the WIG and DAX dividend-paying companies.

Based on the conducted research, the adopted research hypotheses were verified in the following way:

H_1: During the COVID-19 pandemic, the rate of return of portfolio composed of the so-called "covid" companies was significantly higher than portfolios composed of conservative financial instruments (equity portfolios that reflected the major Polish indexes – WIG, WIG20, mWIG40 and sWIG80, as well as foreign indexes – S&P 500, DJIA, NKX, FTSE, DAX, CAC, as well as bond portfolios or investment funds employing different strategies). The hypothesis was verified positively.

H_2: During the COVID-19 pandemic, the rate of return of portfolios composed of the so-called "covid" companies was significantly higher than portfolios based on alternative investments (raw material portfolios, real estate portfolios or cryptocurrency portfolios). The hypothesis was verified positively.

H_3: Changes in the inflation rate have no significant impact on the rate of change of dividend payment of the WIG, DAX and S&P500 companies. At the same time, the hypothesis was not confirmed by the Pearson's linear correlation coefficient. The hypothesis was verified negatively.

H_4: Only Polish and US listed companies under analysis exhibited a strong negative relationship between the average real rate of change of dividend payment and the country's effective interest rate. Negative verification of the hypothesis was confirmed by the Spearman's rho coefficient for US companies. The hypothesis was verified negatively in part.

In conclusion, investors should primarily consider the geopolitical and macroeconomic environment when building and managing their investment portfolios, as current times bring about dynamic processes that necessitate instant and flexible decision-making by investors. In doing so, investors present themselves with the opportunity to maximize investment returns. Furthermore, based on the research conducted on the dividend payment rates of change in nominal and real terms by the WIG, DAX and S&P500 companies, several recommendations can be made for capital market investors. Investors, who are expecting higher dividend payment

dynamics, should include issuers listed on the German Stock Exchange in their portfolios. However, if they take into account the diversity of companies listed on a given stock exchange, they should instead focus on the German and US markets.

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