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DIVIDEND POLICY IN A CRISIS: A PRE AND POST-COVID-19 COMPARISON OF DJIA AND DAX COMPANIES

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Abstract. This study examines the shifts in dividend policy drivers for companies listed on the Dow Jones Industrial Average (DJIA) and Deutscher Aktienindex (DAX) by comparing the pre-COVID-19 (2015–2019) and post-COVID-19 (2020–2024) periods. Employing a two-stage methodology, we first use factor analysis to distill traditional and cash flow-based profitability indicators into key factors, followed by panel regression models to assess their impact on dividend payouts. Findings indicate that the 2020 crisis significantly altered dividend strategies. For DJIA firms, dividend policy shifted from asset-based profitability (pre-2020) to a strong reliance on equity-based profitability (ROE, CFROE) post-2020, reflecting investor preference for immediate returns during uncertainty. For DAX firms, cash flow-based profitability emerged as the primary driver post-2020, unlike the pre-crisis period where no profitability factor was significant, highlighting distinct market responses to economic shocks in the U.S. and Germany.

Keywords: profitability ratios, cash flow-based profitability ratios, dividend payouts, dividend policy, factor analysis, DJIA companies, DAX companies.

JEL Classification: G30, G32, G35, M41.

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Notations

Abbreviations
CFROA – Cash flow return on assets
CFROE – Cash flow return on equity
CFROS – Cash flow return on sales
DAX – Deutscher Aktienindex
DJ – Dow Jones
DJIA – Dow Jones Industrial average
EBITDA – Earnings before interest, taxes, depreciation and amortization
EPS – Earnings per share,
FCF – Free cash flow
FCF/TA – Free cash flow to total assets
IFRS – International financial reporting standards
ROA – Return on assets
ROE – Return on equity
ROS – Return on sales

1. Introduction

In the global economy, corporate dividend policy is a crucial indicator for investors, reflecting a company's financial stability, future growth opportunities, and management's confidence. This is particularly true in the world's two leading economic regions, the United States and the European Union, where distinct corporate governance models and investor cultures can result in different dividend payout behaviors (Besim & Adaoglu, 2018). The dividend–value link is central in finance and governance, with several theories explaining it. On one hand, the dividend irrelevance theory, proposed by Modigliani and Miller (1961), posits that in perfect markets, a company's dividend decisions do not affect its market value, as shareholders are indifferent between receiving their returns as dividends or as capital gains. In stark contrast, the "Bird-in-Hand" theory, associated with authors like Gordon (1963) and Walter (1963), suggests that investors prefer the certainty of immediate dividend payments over the uncertainty of future capital gains. Several studies test these theories, linking dividend policy to firm value.

According to Graham and Dodd (1934/1996), the primary purpose of a corporation is to distribute dividends to shareholders, suggesting that paying dividends can enhance corporate value by reducing the perceived risk associated with holding the firm's shares, which in turn can increase its market price (Rahgozar, 2015; Nurlita & Gunarsih, 2021; Tijjani & Norfian, 2019). Furthermore, research indicates a positive correlation between the stability of dividend payments and market value, where firms with stable dividends are often perceived as more financially secure, attracting investors and enhancing corporate value (Wambua, 2019). Dividend policy reflects profitability and liquidity—key insights for shareholders and managers alike (Baker et al., 2018). The practice of dividend payments also affects a company's long-term objectives (Baker & Jabbouri, 2017), as either withholding or increasing dividends can send a strategic message to the market.

The focus will be on companies in two different economic and market environments. While DJIA companies reflect the dynamic, investor-focused approach of the U.S. market (Akolor & Gujral, 2024; Baker et al., 2018), DAX companies tend to prioritize long-term stability and moderate risk-taking (Ghafoor et al., 2014). These US–EU differences in dividends and profitability are practically significant.

Another important focus of our study is that we split the analysis into two periods: Before and after 2020. We chose this split to study the impact of the COVID-19 pandemic and the subsequent energy crisis on the dividend policies. This approach enables us to investigate and uncover how dividend payment practices in both economic markets evolved in response to the economic uncertainty and shocks triggered by these crises. The pandemic era forced a critical trade-off upon corporate management: on one hand, the need for cash preservation in the face of uncertain future revenues and incomes, and on the other, the need to signal financial strength and stability to investors through consistent dividend payouts. In our research we also aimed to test whether the link between profitability and dividend payments weakened or strengthened during this period. The study period was aligned with the WHO's announcement of the COVID-19 pandemic, where the "pre-2020" refers to the time before the WHO's declaration on March 11, 2020, and the "post-2020" period refers to the time after this declaration (World Health Organization, 2020). The pandemic had not officially ended during our study; we use "post-COVID" only to label the post-2020 period (after the announcement).

Analyzing dividend decisions reveals market stability and growth prospects, improving financial analysis, investment choices, and firms' dividend strategies.

We formulated two main hypotheses, which we examined for both groups (DJIA and DAX):

H1a: *In the period before 2020, at least one profitability ratio impacts dividend payments*.

H1b: *In the period after 2020, at least one profitability ratio impacts dividend payments*.

H2a: *In the period before 2020, at least one cash flow-based profitability ratio impacts dividend payments*.

H2b: *In the period after 2020, at least one cash flow-based profitability ratio impacts dividend payments*.

The article is structured to first provide a theoretical background on dividend policies and their relationship with corporate value and profitability, followed by a detailed methodology section outlining the data and analytical approaches used. It then presents the results of factor and regression analyses for both DJIA and DAX companies across pre- and post-COVID-19 periods, concluding with insights into the implications for corporate strategies and investor decision-making.

2. Theoretical background

2.1. Corporate value, dividend policy and profitability

The relationship between dividend policy and corporate value has been a long-debated topic in financial literature (Fama & French, 2001; Said, 2024; Baker & Jabbouri, 2017; Ejem & Ogbonna, 2019). Dividend policy influences corporate value both directly and indirectly. The studies of dividend policy focus on what proportion of the generated profits a company distributes to shareholders as dividends and how frequently it does so. Dividend policy can also serve as a signal, as stable or increasing dividends convey a positive message to the market about a company's financial health and long-term growth prospects (Nugraha, 2019). Contrastly, dividend cuts or suspensions can be interpreted negatively by investors, signaling potential financial difficulties.

Corporate valuation plays a crucial role in dividend policy and impacts financial decision-making. The more profitable a company is, the greater its ability to pay dividends while retaining sufficient resources for reinvestment (Baker & Weigand, 2015; Allen & Michaely, 2003). Retained earnings can be reinvested into the company, increasing its equity and contributing to corporate value growth.

Damodaran (2007) determined that one of the key measures of investor returns is return on capital, which assesses a company's profitability relative to the capital invested by shareholders. Corporate finance extends beyond mere profit generation – it is a fundamental aspect of strategic decision-making, influencing investor returns. It encompasses the management of financial resources, investment decisions, capital structure, and financing strategies. Companies can maximize profits by efficiently allocating resources, leading to share price appreciation. The relationship between corporate social responsibility and default risk demonstrates that corporate behavior impacts not only financial performance but also investor perception (Wang & Yang, 2024). As returns increase, investor confidence may also grow, ultimately contributing to economic growth (Modigliani & Miller, 1958; Miller, 2006). Key findings suggest that companies with stable dividend payments attract long-term investors seeking reliable income sources, thereby enhancing shareholder loyalty and potentially reducing the cost of equity (Fama & French, 2001).

According to Modigliani and Miller (1961), in perfect markets, dividend levels do not influence corporate value. Shareholders are indifferent to receiving returns in the form of dividends or capital gains from stock price appreciation, provided the company does not alter its investment policy. Investment policy determines how a company utilizes its profits, directly affecting the amount of free cash flow available to shareholders. If the company generates positive results. Investment policy plays a crucial role in shaping dividend payments, as investment decisions impact profitability.

Modigliani and Miller (1961) also argued that changes in dividends could provide information to the market about a company's future profitability. Understanding investor returns requires a grasp of the key role played by market conditions and economic indicators. Metrics such as inflation rates, interest rates, and market volatility impact asset performance and portfolio optimization. Historical data analysis reveals that interactions between different assets exhibit dynamic correlations; for example, shareholders may respond differently to changing interest rates and inflation risks. Mats (2024) emphasized that diversified portfolios containing weakly correlated assets can reduce risk and achieve more favorable investment outcomes.

Many researchers have examined the relationship between profitability and dividend payments. Since profitability is seen as an indicator of a company's ability to generate earnings, it directly influences its capacity to distribute dividends to shareholders. Profitability ratios can be calculated based on either the net income of the company or the company's cash flow, while traditional profitability ratios are calculated based on the net profit of the company. Meanwhile, cash flow-based profitability focuses on the company's operating cash-flows. We can find evidence of the relationship between traditional profitability ratios and dividend payouts. Also, many researchers found that there is a relation between cash flow-based profitability ratios.

Bushra and Mirza (2015) found a positive and significant relationship between Return on Assets (ROA) and dividend yield at Karachi Stock Exchange companies, confirming that firms with higher profitability through effective asset utilization are more likely to distribute dividends. Kusuma et al. (2018) found that for coal mining companies on the Indonesia Stock Exchange, a significant relationship exists where a higher ROA leads to an increase in dividend payouts. Abdelsalam et al. (2008) found that firms with higher profitability, as indicated by ROA, are more likely to distribute dividends, particularly in emerging markets where such signals are critical for attracting external capital; the study was made based on the top 50 Egyptian listed companies. Haddad (2024) examined 30 industrial companies listed on the Amman Stock Exchange, where a significant relation was found between dividends and ROA.

Evidence can also be found in terms of Return on Equity (ROE) and dividend payment as well. Nurhikmawaty et al. (2020) show that an increase in ROE leads to a higher dividend payout ratio in real estate companies at the Indonesia Stock Exchange. Pinto et al. (2022) find that companies with higher profitability typically pay out larger dividends due to confidence in their future earnings. Yahaya (2009), by examining the consumer goods firm on the Nigeria Stock Exchange, highlighted that a significant relationship was found between dividend payment and both ROA and ROE ratios. Al-Shattarat et al., (2023) also found a strong connection between dividend payments and ROA, ROE in industrial firms listed on the Amman Stock Exchange (ASE).

Research also found a significant relationship between net profit margin (Return on Sales – ROS) and dividend payouts. Labhane and Das (2015) report that firms maintaining healthy profit margins are substantially more likely to pay out dividends due to the

available free cash flow, which enhances the capacity for dividend payments. Grace et al. (2019) published similar findings by examining Nigerian listed manufacturing firms.

Many researchers can also approve the relationship between cash flow and dividend policies. Examining the key determinants of dividend policy, Naceur et al. (2006) concluded that large companies with stable profitability levels could generate greater cash flow, enabling them to pay higher dividends. According to Ambarwati (2014), free cash flow strengthens the positive relationship between profitability and dividend policy. This suggests that the optimal level of profitability signals to investors the company's ability to distribute profits to shareholders.

Investors often consider the effects of dividend payments as a key component of their overall return strategy. Dividends represent direct cash flows to shareholders. Companies maintaining consistent or growing dividend payments may signal financial health and stability, which can attract more investors and potentially increase share prices (Frankfurter et al., 2003). Frankfurter et al. (2003) suggested that this phenomenon indicates a link between dividend payments and market perception. Companies that prioritize dividend payments can attract loyal shareholders, thereby reducing investment risk. It is important to examine the sustainability of dividend payments, as ongoing payouts may divert capital from investments that could generate future growth. Usman et al. (2024) found that cash flow-based profitability indicators play a significant role in evaluating and assessing corporate efficiency and return-generating capacity. Thapa (2021) study indicates that cash flow is a significant determinant of the dividend payout ratio among Nepalese retail banks, providing evidence that firms with healthy cash inflows are more likely to return profits to shareholders. Zafar et al. (2023) found that cash flow has a direct impact on dividend policies in small and medium-sized enterprises, suggesting that companies with higher cash flows are more likely to maintain consistent dividend payments. Gill et al. (2010) pointed out that the cash dividend payout ratio is more reflective of a company's financial health than just net earnings. Their findings indicate that accounting earnings can be indicative of profitability, but it is the after-tax cash flow that affects the actual ability to distribute dividends.

2.2. Dividend theories

As it was mentioned in the previous section corporate dividend policies and dividend payouts play a fundamental role in shaping financial strategies and influencing investor perceptions, reflecting broader paradigms in corporate finance. Many theories were formulated over time, and each theory offers a different perspective on the relationship between dividends and corporate value, accounting for market conditions, shareholder preferences, taxation implications, and management dynamics. Although each theory has a different perspective, each is related to dividend payouts and the investors' perception of dividend payments. Table 1 shows the most prominent theories and the main point of each theory.

Dividend Irrelevance Theory perspective, popularized by Modigliani and Miller (1961). This theory asserts that corporate dividend decisions do not affect the company's market value. It states that shareholders are indifferent to dividends versus capital gains. From this standpoint, it doesn't matter to shareholders whether their return is in the form of dividends or capital gains, as both contribute to the overall value of their investment. According to this ideology, in an efficient market, investors can create their own returns by selling shares, if they wish, questioning the necessity of regular dividend payments.

Table 1. Dividend theories (source: Modigliani & Miller, 1961; Gordon, 1963; Lintner, 1956; Miller, 2006; Jensen & Meckling, 1976)

Theory	Essence
Dividend Irrelevance Theory	Dividend payments do not affect the company's market value. Investors are indifferent between dividends and capital gains, as they can create their own returns by selling shares.
Bird in Hand Theory	Investors prefer immediate dividends over future capital gains since current dividends are perceived as more certain, reducing investment risks.
Tax Effect Theory	Lower dividend payouts reduce the cost of capital and increase the stock price, as dividends are taxed at a higher rate than capital gains.
Agency Theory	Dividend policy arises from the conflict between managers and shareholders. When managers hold a significant share in the company, they become more invested in the company's performance, thus reducing conflicts.

The Bird in Hand Theory suggests that investors would prefer immediate dividends over future capital gains, as the dividends paid today are seen as more certain than potential future capital gains. Walter (1963) argued that investors prefer immediate dividends because they can reinvest them and generate further returns. Similarly, Gordon (1963) believed that dividend payments reduce the risks associated with investments since they represent more certain returns. According to the "Bird in Hand" theory, the risk for an investor comes from reinvesting profits, which leads to the conclusion that higher dividend payouts induce higher expected returns from investors, thereby increasing the cost of capital. Lintner (1956) added that dividends are attractive because they help reduce information asymmetry. A company paying dividends assures investors of its solid performance. In this context, information asymmetry refers to situations where market participants have different information about decision-making processes. This theory assumes that investors value immediate cash returns more than uncertain future profits. This supports the significant role that dividend payouts play from investor prescriptive. Although retained earnings might lead to greater growth in the long run, many investors prefer immediate payouts because they provide liquidity and offer the possibility of reinvestment or immediate use (Shefrin, 2018; Easterbrook, 1984).

The Tax Effect Theory postulates that different tax treatments between dividends and capital gains can influence dividend policies. Typically, dividends are taxed at a higher rate than capital gains, leading investors to prefer companies that reinvest profits rather than distribute them as dividends. Generally, it is true that the taxation of dividends and capital gains differs, and since most investors are concerned with after-tax returns, the impact of taxes can influence both the demand for dividends and the supply of them. Al-Malkawi et al. (2010) argues that the tax effect hypothesis suggests that a lower dividend payout ratio reduces the cost of capital and increases stock prices. In other words, lower dividend payout ratios contribute to maximizing the company's value. According to Poterba and Summers (1984), due to potential tax liabilities associated with dividends, investors often prefer retained earnings over dividends. Investors with higher tax rates tend to favor companies that reinvest earnings for long-term growth rather than paying them out immediately.

Jensen and Meckling's (1976) agency theory is based on the conflicts of interest between managers and shareholders. According to this theory, the interests of corporate managers (agents) and shareholders (principals) may not always align, leading to potential conflicts. Shareholders entrust managers with the company's governance, but the interests of both parties do not always coincide. Managers may have interests that do not align with the goals

of shareholders as they prioritize their own objectives. Jensen (1986) argued that a high level of retained earnings encourages managers to pursue their own interests.

3. Methodology

3.1. Data used

The data used in our research are companies' financial statements. The focus was on examining the profitability ratios and cash flow-based profitability ratios of companies with different economic environments (EU and the USA). The company groups were selected in such a way that they had relatively similar sample sizes. For the study, we used data from the companies in the Deutscher Aktienindex (DAX index companies) that reflect the performance of the 40 most important listed companies in Germany. The second company group is the Dow Jones Industrial Average companies (DJIA), which comprise nearly the same number of companies, specifically 30.

These two indices were selected due to their significance as economic indicators in their regions and their distinct structural characteristics. The DJIA, composed of 30 major U.S. companies, is price-weighted and reflects general economic trends driven by the largest share-priced firms, providing insight into the overall U.S. market and economy. In contrast, the DAX, comprising 40 of Germany's largest companies, is capitalization-weighted and heavily influenced by the manufacturing and chemical sectors, reflecting Germany's export-oriented economy and sectoral dynamics. The choice of these indices allows for a comparative analysis of developed markets with different sectoral compositions and weighting methodologies, which can affect their response to economic shocks such as the COVID-19 pandemic. In this study the sampling criterion was purposive sampling, where all companies included in the respective stock market indices were selected. This approach ensured that the sample was fully representative, as it encompassed the entire population of firms within each index during the study period. The study was conducted for the period between 2015 and 2024.

3.2. Factor analysis and regression analysis

Factor analysis is used for data reduction, summarization, and identification of underlying relationships between variables in a dataset. It condenses numerous variables into fewer dimensions or factors, which are thought to account for the observed correlations among variables. This approach allows for a reduction in the number of variables while preserving the main informational content.

In factor analysis, variables with similar behavior are grouped together, leading to fewer but more meaningful factors (Matsunaga, 2010). Since profitability ratios and cash flow-based profitability ratios are likely interrelated, we used factor analysis to uncover common factors. Since the research concludes with many ratios, this analysis helps to form a more complex opinion based on fewer factors. To help identify significant factors that explain variance we applied the Kaiser criterion, which suggests retaining factors with an eigenvalue greater than one, as they explain more variance. Factors with an eigenvalue less than one tend to distort and complicate the analysis. We also applied a Varimax rotation in factor analysis to minimize correlations between factor loadings, making it easier to identify the factor composition. This technique rotates the structure to maximize the density of variables that are associated with each factor, categorizing the variables into fewer, more defined factors.

We also used a panel regression model, the goal of which was to explore the relationship between the dependent and independent variables. We examined the relationship between profitability ratios, cash flow-based profitability ratios, and dividend-to-equity (DIV/Equity) ratios. This helps determine how profitability ratios influence dividend payouts. The dependent variable was the DIV/Equity.

The panel regression relationship between the explanatory variables and the dividend payout ratio as the dependent variable – reduced into factors of variables – can be described by the following equation:

$$\frac{DIV}{E} = \beta_0 + \beta_1 X_{it} + \gamma_i + u_{it},$$

where β is a coefficient, X_{it} are observable individual characteristics, γ_i is a time-invariant unobserved individual effect and u_{it} are independent errors (possibly correlated over time).

In the regression models, the explanatory variables are represented by the factors obtained from factor analysis, as detailed in the tables in the Chapter 3. These factors summarize underlying dimensions extracted from multiple observed variables, capturing the main drivers of market behavior. The specific factors incorporated vary depending on the time period analyzed and the index group considered, ensuring that the model accounts for temporal and regional differences in market dynamics.

4. Result and analysis

4.1. Descriptive statistic

Table 2 presents the descriptive statistical analysis results applied to the profitability indicators of DAX and DJ companies.

DJIA firms show higher traditional profitability – especially ROS and ROE – than DAX firms. This higher profitability comes with greater volatility (higher standard deviations, except for ROS). The largest gaps are in ROE and EBITDA/Sales: DJIA ROE mean 0.4483 (SD 2.0547) vs. DAX 0.1505 (SD 0.3943); DJIA ROE max 30.8348.

Table 2. Descriptive statistics of profitability indicators for the two corporate groups

Variables	Mean	std.dev	max	min	median
ROS_DAX	0.0827	0.1657	1.0449	–5.8342	0.0650
ROS_DJ	0.1517	0.1106	0.5585	–0.2842	0.1461
ROA_DAX	0.0365	0.0476	0.1238	–0.4672	0.0417
ROA_DJ	0.0875	0.0709	0.6530	–0.1383	0.0783
ROE_DAX	0.1505	0.3943	8.0095	–2.0733	0.1220
ROE_DJ	0.4483	2.0547	30.8348	–9.6893	0.2583
EBITDA/Sales_DAX	0.1968	0.1470	1.0722	–0.0527	0.1714
EBITDA/Sales_DJ	0.2720	0.1544	0.7085	–0.0723	0.2659

Table 3 shows the results of the descriptive statistics. There is extreme volatility in cash flow-based profitability with moderate means and a relatively large standard deviation in DAX companies. Although DJ companies have higher cash flow-based profitability, the standard deviation is also considerably higher, indicating greater dispersion.

Table 3. Descriptive statistics of cash flow-based profitability indicators and EPS for the two corporate groups

Variables	Mean	std.dev	max	min	median
CFROS_DAX	0.1709	0.4439	3.9689	–2.8800	0.1069
CFROS_DJ	0.2371	0.3356	4.3589	–0.5045	0.1921
CFROA_DAX	0.0573	0.0613	0.1497	–0.0546	0.0577
CFROA_DJ	0.1245	0.0987	0.5743	–0.0773	0.1088
CFROE_DAX	0.1938	0.3517	1.3559	–0.8410	0.1936
CFROE_DJ	0.6212	2.1777	45.1976	–9.7706	0.3461
FCF/TA_DAX	0.0317	0.0342	0.1299	–0.0994	0.0290
FCF/TA_DJ	0.0922	0.0781	0.5453	–0.1296	0.0876
EPS_DAX	7.4598	9.6096	46.2624	–6.8949	5.5937
EPS_DJ	7.7669	7.5258	62.2768	–11.5318	6.1607

4.2. Factor analysis and regression of the DAX companies in the pre- and post-2020 periods

The goal of factor analysis is to reduce the number of explanatory variables being analyzed due to their interrelationships, thus uncovering deeper correlations. During the analysis, we examined the relationships between different variables and aimed to reduce the variance of the original variables to as few factors as possible.

To assess the potential impact of the COVID-19 pandemic and the economic shifts, the analysis was conducted separately for two distinct periods. Table 4 presents the results of factor analysis for DAX index companies before 2020.

Table 4 presents the results of the first step in the factor analysis, which aims to reduce the number of variables. The decision on which factors to retain is based on the Kaiser criterion, which suggests keeping factors with an eigenvalue greater than 1.

Table 4. Factor analysis results for the DAX index (Pre-2020 period)

Factor analysis/correlation			Number of obs = 160	
Method: principal factors			Retained factors = 3	
Rotation: (unrotated)			Number of params = 21	
Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	2.74717	1.22423	0.3434	0.3434
Factor2	1.52295	0.47277	0.1904	0.5338
Factor3	1.05018	0.11780	0.1313	0.6650
Factor4	0.93237	0.18470	0.1165	0.7816
Factor5	0.74768	0.14712	0.0935	0.8750
Factor6	0.60055	0.30075	0.0751	0.9501
Factor7	0.29980	0.20050	0.0375	0.9876
Factor8	0.09930		0.0124	1.0000
LR test: independent vs. saturated: chi2(28) = 454.60 Prob>chi2 = 0.0000				

Factor 1 explains 34.3% of the total variance, while the three factors (Factor 1, Factor 2, Factor 3) collectively account for 66.5% of the variance among the variables.

As the next step of the factor analysis, a varimax rotation was performed to simplify the factor structure and make it more interpretable. Table 5 summarizes the results after this rotation.

After the varimax rotation, the distribution among the factors has been rearranged. Before the rotation, the first factor was dominant, whereas after the rotation, the variance was more evenly distributed among Factor 1 (29.7%), Factor 2 (18.7%), and Factor 3 (18.2%).

Table 5. The results of factor analysis after varimax for the DAX index (Pre- 2020 period)

Factor analysis/correlation			Number of obs = 160	
Method: principal factors			Retained factors = 3	
Rotation: orthogonal varimax (Kaiser off)			Number of params = 21	
Factor	Variance	Difference	Proportion	Cumulative
Factor1	2.37244	0.87864	0.2966	0.2966
Factor2	1.49380	0.03974	0.1867	0.4833
Factor3	1.45406		0.1818	0.6650
LR test: independent vs. saturated: chi2(28) = 454.60 Prob>chi2 = 0.0000				

Due to this method, we have minimized the correlation between the variables through the factors, making the factors easier to interpret. Based on the LR test ($p < 0.05$), we can conclude that the data are likely related and not random. In Table 6, we present which variables are most strongly associated with each factor.

Table 6. The correlation of explanatory variables with factors for the DAX index (Pre-2020 period)

Variable	Factor1	Factor2	Factor3	Uniqueness
ROS	–0.1390	0.8248	0.0050	0.3004
ROA	0.6383	0.6167	0.2609	0.1442
ROE	0.1643	0.2668	0.8035	0.2561
CFROS	0.1012	–0.2650	0.5710	0.5935
CFROA	0.9091	–0.1640	0.1426	0.1262
CFROE	0.2361	–0.5142	0.6040	0.3150
EPS (Basic)	–0.5824	–0.0096	0.0898	0.6527
FCF/TA	0.8289	0.0193	0.1453	0.2915

In Table 6, we have highlighted the values of the indicators that are significantly determined by the respective factors. Based on the results, Factor 1 strongly represents asset-based profitability, as it correlates most strongly with CFROA (0.9091), FCF/TA (0.8289), and ROA (0.6383). Factor 2 is dominated by ROS (0.8248). While Factor 3 is most strongly associated with ROE (0.8035) and CFROE (0.6040). While Factor 1 mainly represents a combined profitability dimension, Factor 2 reflects sales-based profitability, and Factor 3 captures return on equity-based metrics. The relatively low uniqueness values for ROA (0.1442), ROE

(0.2561), and CFROA (0.1262) indicate that they fit well within the factors, meaning there is little that the factors do not explain.

In this case, the dependent variable is the dividend payout ratio relative to equity, which reflects the companies' willingness to pay dividends. The explanatory variables will be the stronger factors that emerged from the previous factor analysis. First, we've done a panel regression using a fixed effects model, followed by a random effects model. In Table 7, we present the results obtained from the random effects model regression (Based on the result of the Hausman test) for the DAX index companies.

The within-group R-squared shows how well the model explains the temporal variation of the individual subjects. This value is quite low (12.6%), indicating that the model is only able to explain a moderate portion of the dependent variable's changes. Based on the differences between the companies, it is observed that the model can explain 9.19% of the differences between them. The total R-squared value refers to all observations and illustrates that the model explains 9.73% of the total variance.

The coefficient of Factor 1 is 0.005. Considering the p-value (0.162), this is not statistically significant, meaning there is no statistical evidence to suggest that Factor 1 has a significant impact on the DIV/Equity ratio. The coefficient of Factor 2 is –0.012. With a p-value of 0.000, this result is statistically significant at the 1% level, indicating a negative relationship with the dependent variable. Factor 3 has a coefficient of 0.003 and a p-value of 0.103, making it marginally non-significant. The constant takes a value of 0.052, meaning that if the companies did not generate any profits, losses, or cash flow, the dividend payout ratio would be 5.2% of the equity. However, in this context, this is difficult to interpret. This deviation from zero is not coincidental, as $p < 0.01$, thus it can be said to have a statistically significant effect on the dependent variable. The sigma_u and sigma_e relate to the between-firm and time-specific errors, respectively. Based on the former's value, there are differences between the individual subjects, as the basic specific characteristics of the examined units vary.

Table 7. Random effects model panel regression for DAX index companies (Pre- 2020 period)

R-sq	Within	0.1260				sigma_u	0.026498
	Between	0.0919				sigma_e	0.017530
	Overall	0.0973				rho	0.695579
DIV/Equity	Coef.	St.Err	T-value	P-value	95% Conf	95% Conf	Sig
Factor1	0.005	0.003	1.400	0.162	–0.002	0.011	
Factor2	–0.012	0.003	–4.210	0.000	–0.018	–0.007	***
Factor3	0.003	0.002	1.630	0.103	–0.001	0.007	
Constans	0.052	0.005	10.220	0.000	0.042	0.062	***

Note: *** $p < .01$, ** $p < .05$, * $p < .1$.

The rho of 69.57% shows most variance stems from individual effects, indicating strong subject-specific influence on the dependent variable. Table 8 shows random-effects panel estimates after 2020.

Based on the Kaiser criterion, four factors will be formulated. Factor 1 explains 35% of the total variance. The next step was a varimax rotation, which can be seen in Table 9.

Table 8. Factor analysis results for the DAX index (Post-2020 period)

Factor analysis/correlation			Number of obs = 125	
Method: principal factors			Retained factors = 4	
Rotation: (unrotated)			Number of params = 26	
Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	2.80060	1.10255	0.3501	0.3501
Factor2	1.69805	0.40092	0.2123	0.5623
Factor3	1.29713	0.27746	0.1621	0.7245
Factor4	1.01968	0.34439	0.1275	0.8519
Factor5	0.67529	0.37092	0.0844	0.9363
Factor6	0.30438	0.13875	0.0380	0.9744
Factor7	0.16562	0.12637	0.0207	0.9951
Factor8	0.03925		0.0049	1.0000
LR test: independent vs. saturated: chi2(28) = 580.66 Prob>chi2 = 0.0000				

Table 9. The results of factor analysis after varimax for the DAX index (Post- 2020 period)

Factor analysis/correlation			Number of obs = 125	
Method: principal factors			Retained factors = 4	
Rotation: orthogonal varimax (Kaiser off)			Number of params = 26	
Factor	Variance	Difference	Proportion	Cumulative
Factor1	2.12001	0.36187	0.2650	0.2650
Factor2	1.75814	0.22254	0.2198	0.4848
Factor3	1.53559	0.13386	0.1919	0.6767
Factor4	1.40173		0.1752	0.8519
LR test: independent vs. saturated: chi2(28) = 580.66 Prob>chi2 = 0.0000				

Based on the varimax rotation, the variance is more evenly distributed among Factor 1 (26.5%), Factor 2 (21.98%), Factor 3 (19.19%), and Factor 4 (17.52%). Table 10 presents the rotated factor matrix, which details the correlations between the original variables and each factor.

Table 10. The correlation of explanatory variables with factors for the DAX index (Post-2020 period)

Variable	Factor1	Factor2	Factor3	Factor4	Uniqueness
ROS	–0.1378	0.3985	–0.3452	0.7679	0.1134
ROA	0.3301	0.8855	–0.2194	0.1079	0.0471
ROE	–0.0549	0.8378	0.4197	–0.0042	0.1189
CFROS	0.0751	–0.1129	0.3421	0.8746	0.0996
CFROA	0.8537	0.2068	0.3632	–0.0854	0.0893
CFROE	0.2566	0.0343	0.9013	0.1003	0.1105
EPS (Basic)	–0.7755	0.0760	0.1735	0.0380	0.3613
FCF/TA	0.7665	0.2254	0.3174	0.1290	0.2444

Based on the results, Factor 1 correlates most strongly with CFROA (0.8537), FCF/TA (0.7665), and EPS (–0.7755). Factor 2 is dominated by two traditional profitability ratios, ROA (0.8855) and ROE (0.8378). Factor 3 is most strongly associated with CFROE (0.9013). In case of Factor 4 is defined by sales-based profitability, CFROS (0.8746) and ROS (0.7679). In Table 11, we present the results obtained from the random effects model regression.

Table 11. Random effects model panel regression for DAX index companies (Post-2020 period)

R-sq	Within	0.0659				sigma_u	0.020035
	Between	0.0762				sigma_e	0.016628
	Overall	0.0680				rho	0.592124
DIV/Equity	Coef.	St.Err	T-value	P-value	95% Conf	95% Conf	Sig
Factor1	–0.008	0.003	–2.75	0.006	–0.014	–0.002	***
Factor2	–0.002	0.002	–0.89	0.375	–0.006	0.002	
Factor3	0.003	0.003	1.07	0.285	–0.003	0.009	
Factor4	0.001	0.002	0.56	0.578	–0.003	0.006	
Constans	0.045	0.004	11.51	0.000	0.038	0.053	***

Note: *** $p < .01$, ** $p < .05$, * $p < .1$.

The within-group R-squared value indicates that the model explains 6.59% of the within-variable changes over time. The between-group R-squared value shows that the model explains 7.62% of the differences between the companies. The results show that Factor 1 is significant with the dependent variable. It has a negative coefficient of –0.008, which is statistically significant ($p = 0.006$), suggesting that as the value of Factor 1 increases, the dividend-to-equity tends to decrease.

Comparing the pre- and post-2020 periods for the DAX companies, the analysis reveals significant structural shifts in the determinants of dividend policy, likely influenced by the economic uncertainty of the pandemic and subsequent crises. Before 2020, the factor analysis identified three underlying factors explaining 66.5% of the total variance. In the panel regression for this period, only Factor 2 (representing ROS) had a statistically significant, negative impact on dividend payouts. This suggests that prior to the crisis, companies with lower sales-based profitability were associated with higher dividend-to-equity ratios. In contrast, the post-2020 required four factors to explain a higher portion of the total variance (85.19%), indicating a more complex relationship among the profitability metrics. After 2020, the sales-based factor became insignificant. Instead, Factor 1 emerged as a statistically significant variable, also with a negative coefficient. The negative relationship may suggest that even companies with strong cash-flow-based profitability opted for cash preservation over higher dividend payouts in the uncertain economic environment.

4.3. Factor analysis and regression of the DJIA companies in the pre- and post-2020 periods

After that, we performed the factor analysis results for the DJIA data (Table 12).

For the DJIA, Factor 1, Factor 2, and Factor 3 will be relevant for the analysis, as the eigenvalue values are greater than 1. Factor 1 alone explains 47.68% of the variance, while the second factor explains 19.85%, and the third factor 14.25%. These values are generally higher than those obtained for the DAX index.

Table 12. Factor analysis results for the DJIA index (Pre-2020 period)

Factor analysis/correlation		Number of obs = 110		
Method: principal factors		Retained factors = 3		
Rotation: (unrotated)		Number of params = 21		
Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	3.81434	2.22607	0.4768	0.4768
Factor2	1.58828	0.44858	0.1985	0.6753
Factor3	1.13970	0.38085	0.1425	0.8178
Factor4	0.75884	0.18733	0.0949	0.9126
Factor5	0.57151	0.50687	0.0714	0.9841
Factor6	0.06464	0.02858	0.0081	0.9922
Factor7	0.03606	0.00944	0.0045	0.9967
Factor8	0.02662	.	0.0033	1.0000
LR test: independent vs. saturated: chi2(28) = 914.92 Prob>chi2 = 0.0000				

After conducting the factor loading analysis, we used the varimax rotation for the DJIA companies (Table 13).

Table 13. The results of factor analysis after varimax for the DJIA index (Pre-2020 period)

Factor analysis/correlation			Number of obs = 110	
Method: principal factors			Retained factors = 3	
Rotation: orthogonal varimax (Kaiser off)			Number of params = 22	
Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	2.61412	0.54953	0.3268	0.3268
Factor2	2.06458	0.20096	0.2581	0.5848
Factor3	1.86362	.	0.2330	0.8178
LR test: independent vs. saturated: chi2(28) = 914.92 Prob>chi2 = 0.0000				

Based on the varimax rotation, the variance is more evenly distributed among Factor 1 (32.68%), Factor 2 (25.81%), and Factor 3 (23.30%). Table 14 presents the rotated factor matrix.

Table 14. Correlation of explanatory variables with factors for the DJIA (Pre-2020 period)

Variable	Factor1	Factor2	Factor3	Uniqueness
ROS	0.2814	0.1769	0.8895	0.1769
ROA	0.7662	0.3072	0.3078	0.3072
ROE	0.3432	0.8746	0.1705	0.8746
CFROS	0.1567	0.0123	0.9041	0.0123
CFROA	0.9438	0.1572	0.1192	0.1572
CFROE	0.2199	0.8403	0.0039	0.8403
EPS (Basic)	–0.3682	0.6613	0.1148	0.6613
FCF/TA	0.8549	0.0747	0.3222	0.0747

In Table 14, we highlighted the indicators' values significantly determined by the respective factors. The analysis reveals a distinct and well-differentiated factor structure for the DJIA companies (pre-2020 period), with each of the three factors having a clear financial meaning.

ROA, CFROA, and FCF/TA strongly correlate with Factor 1, indicating that it is related to the profitability of the company's assets. Factor 2, the ROE, the CFROE, and the basic EPS stand out. In case of Factor 3, it is clearly defined by sales-based profitability, with dominant loadings from CFROS (0.9041) and ROS (0.8895)

After that, we've done a panel regression using both fixed effects and random effects models. In the case of the DJIA, the fixed effect model was chosen (Based on the result of the Hausman test). In Table 15, we present the results obtained from the fixed effects model regression for the DJIA index companies.

Table 15. Fixed effects model panel regression for DJIA companies (Pre-2020 period)

R-sq	Within	0.0444				sigma_u	0.033919
	Between	0.0429				sigma_e	0.017004
	Overall	0.0193				rho	0.799103
DIV/Equity	Coef.	Std. Err.	T-value	P-value	95% Conf	95% Conf	Sig
Factor1	0.008	0.005	1.68	0.096	–0.001	0.018	*
Factor2	–0.003	0.003	–0.83	0.412	–0.009	0.004	
Factor3	0.003	0.006	0.49	0.627	–0.008	0.014	
Constans	0.046	0.002	28.36	0.000	0.043	0.049	***

Note: *** $p < .01$, ** $p < .05$, * $p < .1$.

According to the within-group R-squared, the variables explain 4.44% of the variance in the dependent variable. The value of the between-group differences indicates that the model can explain 4.29% of the differences between the companies. The total R-squared value refers to all observations and shows that the model explains 1.93% of the total variance, indicating that the model fits only modestly.

The sigma_u value is 0.033919, indicating the variance between groups. This suggests that there is some difference between the groups, but the relatively low value implies that the variance between the groups is not excessively large. The sigma_e value is 0.017004, indicating the within-group error variance. This value is relatively low, suggesting that within-group variations are also relatively small, which further demonstrates that the model fits well with the within-group data.

The rho value shows that 79.91% of the total variance comes from differences between the groups. This is a relatively high value, indicating that differences between the groups have a significant impact on the model. The F-test value with a p-value below 5% indicates strong statistical significance, meaning the impact of the independent variables on the dependent variable is not random. Based on the results, Factor 1, which primarily represents asset-based profitability (ROA, CFROA, and FCF/TA), has a positive coefficient of 0.008 and is statistically significant at the 10% level ($p = 0.096$).

After that, we analyzed the DJIA index companies port-2020 period following the same steps that were already presented in the previous analysis (Table 16).

Table 16. Factor analysis results for the DJIA index (Post-2020 period)

Factor analysis/correlation		Number of obs = 108		
Method: principal factors		Retained factors = 3		
Rotation: (unrotated)		Number of params = 21		
Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	3.45459	1.51702	0.4318	0.4318
Factor2	1.93757	0.80837	0.2422	0.6740
Factor3	1.12920	0.18540	0.1412	0.8152
Factor4	0.94380	0.51726	0.1180	0.9331
Factor5	0.42654	0.35200	0.0533	0.9865
Factor6	0.07455	0.05181	0.0093	0.9958
Factor7	0.02274	0.01174	0.0028	0.9986
Factor8	0.01100	.	0.0014	1.0000
LR test: independent vs. saturated: chi2(28) = 1021.65 Prob>chi2 = 0.0000				

Based on Table 16, for the DJIA, Factor 1, Factor 2, and Factor 3 will be relevant for the analysis, as the eigenvalue values are greater than 1. The first three factors for the DJIA explain 81.52% of the total variance. After that we used the varimax rotation for the DJIA companies (Table 17).

Table 17. The results of factor analysis after varimax for the DJIA index (Post-2020 period)

Factor analysis/correlation			Number of obs = 108	
Method: principal factors			Retained factors = 3	
Rotation: orthogonal varimax (Kaiser off)			Number of params = 28	
Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	3.38407	1.38237	0.4230	0.4230
Factor2	2.00170	0.86612	0.2502	0.6732
Factor3	1.13558	.	0.1419	0.8152
LR test: independent vs. saturated: chi2(28) = 1021.65 Prob>chi2 = 0.0000				

Based on the varimax rotation, the variance is more evenly distributed among Factor 1 (43.18%), Factor 2 (24.22%), and Factor 3 (14.12%). Table 18 presents the rotated factor matrix, which details the correlations between the original variables and each factor.

In Table 18, we highlighted the indicators' values significantly determined by the respective factors. Factor 1 is defined by basic EPS (0.9425), ROA (0.9356), and CFROA (0.9314). On the other hand Factor 2 clearly represents equity-based profitability, driven by extremely strong correlations with CFROE (0.9911) and ROE (0.9854). Factor 3 is only defined by FCF/TA (0.9618). Then we've preformed fixed effects panel regression (Table 19).

Based on the regression, only Factor 2 suggests a positive and statistically significant relationship with the dependent variable ($p < 0.001$).

For Factor 1, a 1-unit increase in this variable decreases the dependent variable by 0.016 units. The p-value is 0.738, indicating that the variable is not statistically significant, and its

effect may be random. For Factor 2, the value is 0.312, suggesting a positive and statistically significant relationship with the dependent variable ($p < 0.001$).

Table 18. Correlation of explanatory variables with factors for the DJIA (Post-2020 period)

Variable	Factor1	Factor2	Factor3	Uniqueness
ROS	0.7088	–0.0911	0.3941	–0.0911
ROA	0.9356	0.0399	0.0627	0.0399
ROE	0.0732	0.9854	0.0119	0.9854
CFROS	0.4896	–0.0843	–0.2048	–0.0843
CFROA	0.9314	0.1226	–0.0816	0.1226
CFROE	0.0723	0.9911	–0.0077	0.9911
FCF/TA	–0.0089	0.0115	0.9618	0.0115
EPS (Basic)	0.9425	0.1272	–0.0484	0.1272

Based on R-squared value, we can see that the model explains 50.04% of the variation within groups, meaning this is a good fit for the within-group data. Overall, the model explains 31.60% of the total variance. For the first factor, a 1-unit increase results in a 1.6% decrease in the dependent variable. Based on the coefficient of Factor 2, if it increases by one unit, the dependent variable increases by an average of 31.2%.

Within-group variance is 0.3699 and between-group 0.2177, indicating moderate residual variability; rho = 25.73% attributes a quarter of variance to between-group differences. A significant Chi-squared test supports model fit, and the fixed-effects results for DJIA imply profitability and cash flow matter; with Factor 2 significant, ROE and CFROE affect dividend payout.

Table 19. Fixed effects model panel regression for DJIA companies (Post-2020 period)

R-sq	Within	0.5004				sigma_u	0.217736
	Between	0.0003				sigma_e	0.369902
	Overall	0.3160				rho	0.257327
DIV/Equity	Coef.	Std. Err.	T-value	P-value	95% Conf	95% Conf	Sig
Factor1	–0.016	0.048	–0.33	0.738	–0.111	0.078	
Factor2	0.312	0.037	8.39	0.000	0.239	0.385	***
Factor3	–0.025	0.049	–0.51	0.613	–0.120	0.071	
Constans	0.058	0.055	1.04	0.298	–0.051	0.166	

Note: *** $p < .01$, ** $p < .05$, * $p < .1$.

Comparing the pre- and post-2020 periods for the DJIA companies, the pre-2020 model only modestly explained the variance in dividend payouts, with an overall R-squared of just 1.93%. In contrast, the post-2020 model demonstrated a significantly better fit, explaining 31.60% of the total variance. This shows that company behavior truly changed after the pandemic. Before 2020, many other factors influenced dividends. But after the crisis, the profitability numbers we analyzed became much more important in deciding dividend payouts. The analysis also shows that while the underlying factor structure remained stable, the key driver of dividend policy shifted significantly, likely in response to the economic climate shaped by

the pandemic. In both periods, the factor analysis identified three distinct and stable dimensions of profitability. This indicates that the fundamental relationships between profitability metrics for DJIA firms were robust and did not structurally change after 2020. However, the regression analysis reveals a shift in which of these dimensions influenced dividend payouts. In the pre-2020 period, only Factor 1 (asset-based profitability) had a statistically significant (though marginal at the 10% level) positive impact on dividend payouts. This suggests that before the crisis, higher returns on assets were associated with higher dividend payments. In the post-2020 period, this relationship disappeared. Instead, Factor 2 (equity-based profitability), primarily driven by ROE and CFROE, became the highly significant driver with a strong positive coefficient ($p < 0.001$). This aligns with the "Bird-in-Hand" theory, suggesting that in uncertain times, investors prized direct and high returns on their equity, and companies with strong ROE and CFROE were better positioned and more willing to meet these expectations with higher dividend payouts.

5. Conclusions

In general, DJIA companies are more profitable with greater potential, but their equity-based returns are more volatile. These gaps reflect differing market conditions and likely distinct management strategies versus DAX companies.

DAX companies generally have more stable financial indicators in certain areas, particularly in equity-based returns like ROE and CFROE. Based on their smaller relative standard deviation for these key metrics, the financial performance of DAX companies can be seen as less volatile in this regard. This stability might suggest that German companies aim for more predictable returns on equity. Since their volatility in this area is low, dividend capacity tied to equity returns might fluctuate less. In contrast, the higher volatility of DJIA companies in terms of ROE and CFROE suggests that their performance can be more variable, meaning the potential for very high returns is accompanied by higher risks. The high risks associated with DJIA companies' equity-based indicators imply that, despite higher overall profitability, the potential for high dividend payouts is accompanied by greater performance fluctuations

Overall, our analysis reveals a nuanced picture. For DAX companies, the influence of cash flow-based profitability on dividends shifted significantly: while it was not statistically significant in the pre-2020 period, it became the primary significant driver after 2020. In contrast, for DJIA companies, a profitability factor was significant in both periods, but the key driver shifted from asset-based profitability before the pandemic to equity-based profitability after 2020. The consistently stronger and more significant relationships found in the DJIA models suggest that American companies' dividend policies are more closely tied to their performance metrics than those of German companies, highlighting the different economic and corporate governance environments.

Our first hypothesis (H1), stating that at least one profitability ratio impacts dividend payments, can be accepted for both company groups. For DJIA companies, this relationship was particularly strong in the post-2020 period, where the equity-based profitability factor showed a highly significant impact.

Our second hypothesis (H2), stating that at least one cash flow-based profitability ratio impacts dividend payments, can be accepted for both company groups. For the DJIA companies, this was evident in both the pre- and post-2020 periods. For the DAX companies, the support for H2 comes specifically from the post-2020 period, where the cash-flow-based

factor became the sole significant driver, highlighting a structural shift after the pandemic, where these metrics gained importance.

For DAX companies, the relationship between profitability indicators and dividend payments is weaker. These companies should adopt a more flexible dividend policy, adapting to changes in the economic environment. For DAX companies, stabilizing cash flow ratios and optimizing cash flow generation capacity are recommended for long-term sustainability.

Since DJIA companies' dividend payments are more strongly linked to profitability ratios, these companies are advised to consistently maintain dividend-based incentives. This increases investor satisfaction and engagement.

In investor decision-making, it is advisable to pay more attention to the trends in performance and cash flow-based profitability indicators over time for DJIA companies, while for DAX companies, the link between dividend payments and cash flow indicators exists but is less robust.

This study is constrained by its focus solely on DJIA and DAX companies, which may not fully represent broader market dynamics or the behavior of smaller firms. The post-2020 period also includes ongoing economic effects, such as inflation and energy crises, which may confound the isolation of COVID-19-specific impacts on dividend policies. Additionally, the reliance on quantitative financial metrics limits insights into qualitative factors like management strategies or market sentiment. Future research could expand to include other global indices or smaller firms to enhance generalizability. Exploring qualitative influences, such as corporate governance practices, or extending the analysis to capture long-term post-crisis trends could further enrich understanding of dividend policy dynamics.

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Author contributions

HM and TG were responsible for the research design and for planning the study. JA was responsible for data collection. TG and JA were responsible for the methodology. HM and TG were responsible for data interpretation. HM and TG were responsible for producing the empirical results. JA and HM prepared the literature review. HM, TG, and JA wrote the first draft of the article. HM and TG were responsible for the final conclusions.

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