INFLATION AND STOCK RETURNS OF ENERGY COMPANIES: IMPLICATIONS FOR THE COSTS AND COMPETITIVENESS OF THE AGRO-INDUSTRY OVER THE PERIOD 2015–2023, WITH A FOCUS ON AI

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ABSTRACT

This study examines how inflation affects stock prices. Given the limitations of the Efficient Market Hypothesis and the emergence of contemporary approaches emphasizing nonlinearity in financial data, the study investigates the nature of the relationship between inflation and stock returns. The empirical analysis employs OLS and quantile regression. The final parameter estimates indicate that the data deviate from a normal distribution, thereby providing a statistical rationale for the application of quantile regression. In other words, the results suggest that the relationship between inflation and stock prices is not uniform but varies depending on prevailing market conditions. These findings underscore the importance of applying advanced econometric techniques and AI methods in financial market analysis.

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Introduction

An efficient capital market is one in which stock prices fully reflect all relevant available information. Market efficiency may arise when investors behave rationally and access to information does not involve transaction costs. The available evidence suggests that information is widely accessible. Under such circumstances, the concept of the Efficient Market Hypothesis (EMH) provides an essential theoretical framework for understanding the functioning of global capital markets. This hypothesis is based on the assumption that all available information is already incorporated into asset prices (Butet & Kesuma, 2025).

Grossman and Stiglitz (1980) argue that perfectly informationally efficient markets cannot exist, as such efficiency would eliminate the incentives for investors to acquire information. Market efficiency varies depending on the prevailing economic environment, including periods of economic growth, crisis, and stability, implying that the effects of macroeconomic factors, such as inflation, are not constant. Accordingly, the impact of inflation and other macroeconomic variables may differ depending on market conditions, highlighting the need for advanced methodological approaches capable of capturing heterogeneity and nonlinear relationships. In this context, quantile regression represents a suitable analytical tool, as it enables the examination of effects across different points of the conditional distribution of the dependent variable (Jiang & Li, 2020). Since investors are primarily concerned with asset returns expressed in real terms, uncertainty surrounding inflation represents a potentially significant source of risk. In this context, Moerman and van Dijk (2010) emphasize the importance of inflation risk in asset pricing, noting that previous studies have examined the extent to which different asset classes provide protection against inflation. The implications of inflation for financial market development were also investigated by Barnes et al. (1999), who suggest that persistent inflation may adversely affect financial markets, including equity markets, with negative effects potentially being pronounced even in economies experiencing low to moderate inflation rates. One mechanism underlying this relationship involves a reduction in real asset returns, which may exacerbate credit market frictions, restrict the availability of funds for investment financing, and negatively affect long-term real economic activity.

Beyond its effects on real returns and financial market development, an important issue concerns how investors form expectations and adjust their investment decisions in response to inflationary developments. Schnorpfeil et al. (2025) find that investors' expectations regarding the impact of inflation on stock returns are heterogeneous and, on average, excessively optimistic. Their findings indicate that information about negative stock returns during previous inflationary periods reduces investors' expected returns. These changes in expectations also influence actual investment behavior, contributing to a decline in stock purchases. Similarly, Thorbecke (2025) examines the influence of inflation expectations on financial asset prices, suggesting that investors tend to sell assets adversely affected by inflation and purchase assets that benefit from

rising inflation. However, the empirical findings indicate that investors may respond to inflationary pressures with a delay, adjusting their investment decisions only after actual inflation begins to accelerate.

The relationship between inflation expectations and equity market performance was further investigated by Chiang (2024), who examined 15 international stock markets and identified a negative association between expected inflation and real stock returns. The findings suggest that news about rising inflation increases equity market volatility, which subsequently has an adverse effect on stock returns. Furthermore, changes in monetary policy, particularly interest rate increases implemented by the Federal Reserve, were found to have nonlinear effects on real stock returns. The importance of inflation and interest rates during periods of economic disruption was also examined by Li et al. (2026), who analyzed stock returns in advanced economies across different crisis periods. Their findings indicate that inflationary shocks following the COVID-19 pandemic contributed to increased stock return volatility in the United States, the European Union, and the United Kingdom, whereas the effects on the Japanese market were less pronounced. These results highlight differences in the sensitivity of national equity markets to inflationary developments.

Nevertheless, empirical research has not reached a consensus regarding the direction and magnitude of the relationship between inflation and stock returns. Chirilă and Chirilă (2026) emphasize that some studies support the Fisher hypothesis, whereas others identify a negative relationship between inflation and stock returns, particularly in the short run. The authors highlight the importance of the investment horizon in explaining this relationship. Against this background, they investigate the effects of headline, expected, and unexpected inflation on sectoral stock returns in Poland using GARCH models and quantile regression techniques. The relevance of investment horizons and the measurement of inflation expectations is also emphasized by Taşkıran (2026), who examines the responses of the Turkish stock market to inflation surprises over the period 2018–2025. The findings suggest that the relationship between inflation surprises and stock returns depends on how inflation expectations are measured and the time horizon considered, while some market responses are statistically insignificant.

Differences in empirical findings also highlight the importance of examining nonlinearities and asymmetries in equity market responses to inflationary shocks. In this context, Ayadi, Ben Jedidia, and Ben Mbarek (2026) investigate equity market responses in G7 economies, considering the possibility that the effects of unexpected inflation on real stock returns depend on both the prevailing inflation environment and the direction of inflation shocks. During periods of elevated inflation, positive inflation surprises may trigger more pronounced declines in stock prices due to expectations of tighter monetary policy, whereas similar shocks may produce weaker effects under low and stable inflation conditions. Furthermore, the negative impact of inflation exceeding expectations may be stronger than the positive impact associated with inflation falling below expectations.

In addition to the prevailing inflation environment and the direction of inflation shocks, the composition of inflation is another important factor in understanding equity market movements. Fang et al. (2026) investigate the relationship between inflation risks and returns across different financial asset classes, paying particular attention to differences among inflation components. Their findings indicate that stock returns respond negatively to core inflation shocks, whereas their relationship with energy inflation is positive. The authors further suggest that the negative response to core inflation cannot be fully explained by anticipated changes in monetary policy, emphasizing the importance of distinguishing between different sources of inflationary pressures. Another important dimension of the inflation–equity relationship concerns the role of inflation risk in financial asset valuation. Letourneau, Power, and Smith (2026) suggest that an increase in expected inflation risk is associated with lower current stock prices and higher expected stock returns. Moreover, firms' sensitivity to inflationary developments may depend on their ability to pass rising production costs on to consumers through higher selling prices. Taken together, the reviewed studies suggest that the relationship between inflation and stock returns is neither uniform nor necessarily linear.

In addition to these considerations, the relationship between technological transformation and corporate performance represents another important dimension of contemporary economic research. In this regard, Milanović et al. (2026) examine the relationship between digitalization and the financial performance of companies operating in the agricultural sector, highlighting the strategic importance of technological transformation while also recognizing that the associated organizational and implementation costs may negatively affect company returns. Their findings provide an additional perspective on the relationship between technological development and corporate performance, particularly in sectors that are highly relevant to the broader agro-industrial environment. This perspective is important for understanding how digital transformation, alongside macroeconomic pressures such as inflation and rising energy costs, may influence business performance and competitiveness across interconnected economic sectors. Instead, it depends on inflation expectations, the characteristics of inflationary shocks, investment horizons, monetary conditions, and the specific features of individual financial markets. The diversity of empirical findings highlights the importance of considering both the direct effects of inflation on equity returns and the mechanisms through which inflationary developments influence investor expectations, market volatility, and financial asset valuations. Following the theoretical framework of market efficiency, a substantial body of research has examined the relationship between inflation and stock prices. Early studies suggest the existence of a negative relationship between inflation and stock returns. In particular, Fama (1981) demonstrates that inflation has a negative effect on real stock returns, a finding commonly explained by the impact of inflation on real economic activity.

On the other hand, according to the Fisher effect (Fisher, 1930), nominal returns should incorporate expected inflation, implying that stocks may serve as a hedge against inflationary pressures. Consistent with this view, some studies have identified a positive long-run relationship between inflation and stock prices (Boudoukh & Richardson, 1993).

However, subsequent research suggests that the relationship between inflation and capital markets is not unambiguous. Boyd et al. (2005) demonstrate that the effects of inflation depend on prevailing economic conditions, while Geske and Roll (1983) point to the possibility of reverse causality between inflation and stock prices. These findings suggest the existence of complex and nonlinear relationships that may not be adequately captured by conventional linear models.

The subject of this study is the analysis of the impact of inflation on the stock prices of companies operating in the energy sector, with particular emphasis on Chevron Corporation, ExxonMobil Corporation, and ConocoPhillips. The research focuses on examining the dynamics and nature of the relationship between macroeconomic factors and capital markets, recognizing that this relationship is not uniform and may vary depending on prevailing market conditions.

The primary objective of this study is to determine the nature and magnitude of the effect of inflation on the stock prices of the selected companies and to examine whether this effect varies across different quantiles of the distribution.

Research Results

The analysis uses daily stock market data obtained from Stooq, with company stock returns serving as the dependent variable and inflation as the independent variable. Based on the study conducted by Kádárová et al. (2023), the following equation is proposed:

$Y_{it} = \alpha + \beta X_{it} + \varepsilon_{it}$ where:

Y_{it} – denotes the dependent variable for company *i* at time *t*;

X_{it} – denotes the independent variable for company *i* at time *t*;

α – represents the intercept;

ε_{it} – denotes the error term for company *i* at time *t*.

Table 1. Descriptive Statistics

	Inflation	Chevron Corporation	Exxonmobil Corporation	ConocoPhillips
Mean	3.761	5.315	5.357	5.457
Standard deviation	26.153	0.958	0.886	0.769
Median	1.762	5.810	5.630	5.682
Minimum	-0.136	1.838	1.825	1.514
Maximum	8.001	5.999	5.999	5.999
Skewness	2.153	-2.364	-2.536	-3.710
Kurtosis	1.800	8.472	10.117	17.056

Source: Authors' calculations

The descriptive statistics reveal specific characteristics of the distributions of inflation and the stock prices of the selected companies, which are relevant to the subsequent econometric analysis. Regarding inflation, both the mean (3.761) and the median (1.762) are positive, suggesting that inflationary conditions predominated during the period under observation. However, the fact that the mean exceeds the median, together with a skewness coefficient of 2.153, indicates pronounced positive skewness, reflecting the potential presence of occasional inflationary spikes. The standard deviation is exceptionally high (26.153), suggesting substantial variability in inflation over time. The kurtosis value of 1.800 is below the benchmark value of 3, indicating a distribution with relatively light tails compared with the normal distribution.

On the other hand, the estimated parameters for the companies analyzed in this study exhibit similar statistical characteristics. The mean values fall within a very narrow range, while the standard deviations are relatively low. Nevertheless, the skewness coefficients indicate pronounced asymmetry in the distributions. These findings are consistent with developments in financial markets, given that stock returns are highly sensitive to emerging shocks.

Table 1 presents the results obtained using Ordinary Least Squares (OLS) regression. These results indicate that the relationship between the variables is statistically significant, although differences can be observed in the direction and magnitude of the estimated effects.

Table 2. Linear Regression – Ordinary Least Squares (OLS)

Company	OLS coefficient
Chevron Corporation	2.2848**
ConocoPhillips	-2.5575**
Exxonmobil Corporation	-0.0476***

Source: Authors' calculations. *, **, and *** denote statistical significance at the 1%, 5%, 10% levels, respectively.

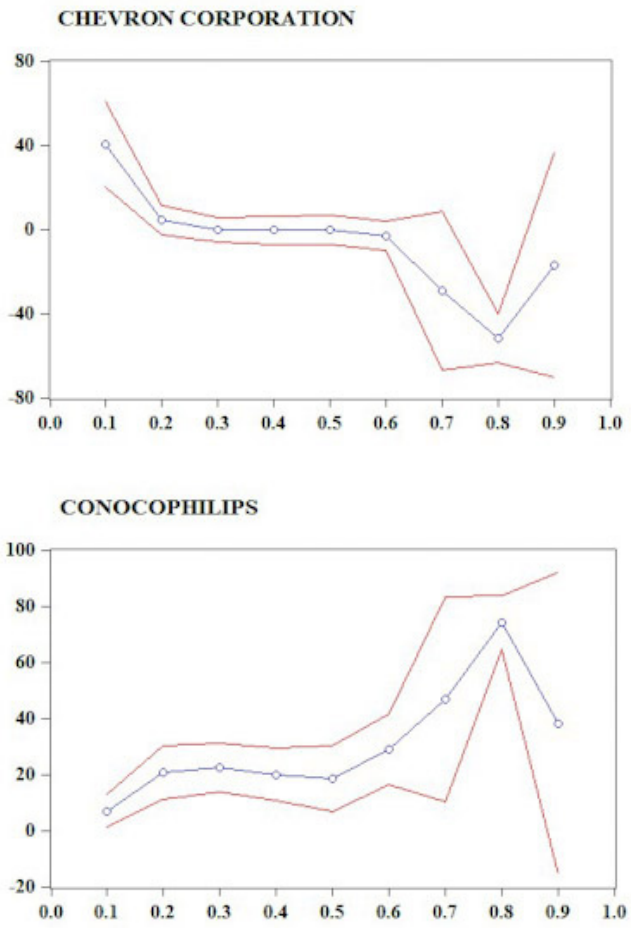
The first company examined is Chevron Corporation, for which the estimated coefficient is 2.2848. This coefficient is statistically significant and indicates a positive relationship between inflation and the company's stock price. The result suggests that an increase in inflation is associated with an increase in Chevron's stock price. One possible explanation is that energy companies may benefit from inflationary pressures, particularly during periods of rising oil and energy prices, which can contribute to higher revenues and improved market valuations.

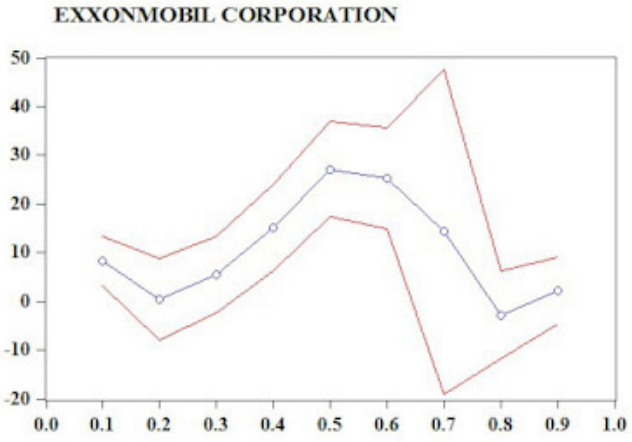
The next company examined exhibits a different pattern. In the case of ConocoPhillips, the estimated coefficient is negative and statistically significant (-2.5575), indicating a negative relationship between inflation and the company's stock price. This finding suggests that higher inflation is associated with a decline in the value of ConocoPhillips shares. The result may indicate greater sensitivity to macroeconomic instability or the influence of company-specific business factors that contribute to declining stock prices under conditions of elevated inflation.

The final company examined, ExxonMobil Corporation, exhibits a negative coefficient (-0.0476). Given the comparatively weaker level of statistical significance, this result may indicate a weak negative relationship between inflation and the company's stock price. It may also suggest that ExxonMobil is relatively more resilient to inflationary shocks than the other companies included in the analysis.

Overall, the coefficients obtained using Ordinary Least Squares (OLS) regression indicate that inflation does not have a uniform effect across all companies in the energy sector. While a positive relationship is observed for some companies, a negative relationship is identified for others, suggesting heterogeneity in the effects of inflation. These findings further justify the application of quantile regression, which enables a more in-depth examination of how the effects of inflation vary across different points of the conditional distribution of the dependent variable.

Figure 1. Graphical Representation of the Effects of Inflation on Company Stock Returns Across Quantiles





Source: Author's own illustration

The graphs presented above provide a consistent representation of the changes in inflation coefficients across different quantiles of the stock price distribution, enabling a more in-depth analysis compared with conventional OLS regression. This approach is particularly relevant in the context of applying advanced methods such as artificial intelligence, as it facilitates the identification of nonlinear and heterogeneous effects.

First, Chevron exhibits a significant variation in the effect of inflation across the quantile distribution. In the lower quantiles (0.1–0.3), the impact of inflation is positive and relatively strong, indicating that inflation has a stimulating effect under conditions of lower stock prices. At the median quantiles, this effect becomes relatively stable and approaches zero, suggesting a reduced sensitivity to inflation.

The higher quantiles indicate a sharp decline in the coefficient into negative territory, suggesting that inflation has a negative impact when stock prices are high. This pattern may be attributable to heightened market expectations or price corrections under inflationary pressures. The wide confidence intervals at higher quantiles indicate greater uncertainty and the presence of extreme values.

For the next company, ConocoPhillips, a predominantly positive effect of inflation is observed across most of the quantile distribution. The effect is moderate in the lower and middle quantiles, whereas a substantial increase in the coefficient occurs in the higher quantiles (0.7–0.8). These findings suggest that inflation has a strong positive impact under conditions of high stock prices.

This finding may suggest that the company has the capacity to pass inflationary pressures on to the prices of its products, thereby increasing its revenues. However, a decline in the coefficient, accompanied by substantial variability, is observed at the highest quantile (0.9), suggesting a less stable relationship under extreme market conditions.

The next company, ExxonMobil, exhibits a nonlinear relationship between inflation and stock prices. In the lower quantiles, the effect is weak and variable, whereas it reaches its peak in the middle quantiles (0.4–0.6), indicating that inflation exerts its strongest positive influence within this part of the distribution.

However, an examination of the higher quantiles reveals a sharp decline in the coefficient, with a transition into negative territory. This suggests that inflation may have a destabilizing effect when stock prices are high. These findings confirm the presence of asymmetric effects that cannot be captured by conventional OLS models.

The parameters estimated through quantile regression have direct implications for the application of artificial intelligence methods in finance. First, the observed nonlinearity and heterogeneity of inflation effects indicate that traditional linear models, such as OLS, may be insufficient to adequately model the relationship between macroeconomic variables and stock prices. For this reason, contemporary AI models, such as neural networks, random forests, and gradient boosting, offer advantages because they can capture complex, nonlinear dependencies in the data. These findings are also supported by the studies of Campisi et al. (2024) and Ravichandran and Afjal (2025).

Furthermore, quantile regression can serve as a bridge between classical econometrics and AI-based approaches, as it enables the analysis of different parts of the distribution and the identification of asymmetric effects. These results are particularly useful as inputs for AI models, as they indicate that the impact of inflation is not constant but rather depends on the level of stock prices.

Conclusion

The findings obtained in this study indicate, first and foremost, that inflation, as a macroeconomic variable, does not affect stock prices uniformly across all companies. Its impact is markedly nonlinear and depends on the position within the distribution of the variable under consideration. While OLS regression estimates the average effect of inflation, quantile regression reveals substantial heterogeneity, demonstrating that both the direction and magnitude of this effect vary across different quantiles. Notable differences emerge across companies, with some exhibiting a positive relationship with inflation and others a negative one, highlighting the specific characteristics of their business models and their varying degrees of sensitivity to macroeconomic factors.

Descriptive statistics further confirm the presence of asymmetry, high variability, and extreme values, suggesting that the data may deviate from a normal distribution. These characteristics provide a methodological rationale for employing quantile regression as a more suitable analytical approach than conventional linear models. Furthermore, the observed nonlinearity and complexity of the relationship between inflation and stock prices underscore the relevance of contemporary artificial intelligence and machine learning methods. These approaches enable the modelling of complex dependencies and may contribute to more accurate predictions of financial market movements. Ultimately, the findings contribute to a deeper understanding of the dynamics between

macroeconomic factors and capital markets, highlighting the need to incorporate advanced econometric techniques and AI-based methods into future research.

Conflict of interests

The authors declare no conflict of interest.

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