The Impact of Inflation and Exchange Rate on the Firm Value of Petrochemical Companies Listed on the Tehran Stock Exchange

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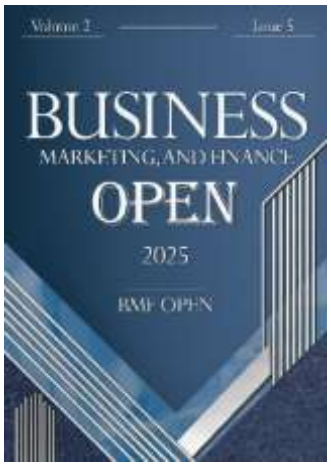

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Abstract: The petrochemical industry, as a key sector of Iran's economy, is influenced by macroeconomic variables, the identification of which is of significant importance. Accordingly, this study investigates the relationship between firm value and the variables of exchange rate and inflation by employing panel data regression models and systematic sampling of 15 petrochemical companies listed on the Tehran Stock Exchange during the period from 2018 to 2023. The findings indicate a positive and significant relationship between the firm value of petrochemical companies and both the exchange rate and inflation. Specifically, the increase in the exchange rate enhances the value of these companies by affecting foreign currency revenues and the central role of exports. Furthermore, the positive and significant effect of inflation on firm value can be attributed to the mechanism of product price adjustments and the increase in nominal revenues. These results underscore the necessity of considering macroeconomic variables in the valuation of petrochemical companies and in the decision-making processes of investors and policymakers.

Keywords: Inflation, Exchange Rate, Firm Value, Petrochemical Industry.

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1. Introduction

Firm value, as a critical macroeconomic variable, fundamentally arises from firms' demand for capital as a factor of production. In fact, the primary decision made by firms concerns the demand for capital. This demand for capital is determined by firms based on their microeconomic behavior aimed at maximizing profit. Existing theories of firm value primarily analyze corporate valuation, with limited discussion on the valuation of state-owned enterprises [1-3]. However, in developing countries, governments play a significant role in capital formation. Consequently, a precise microeconomic analysis of firm value in developing countries such as Iran is not entirely feasible. Nevertheless, by drawing on established theoretical frameworks and empirical studies conducted in developing economies, this study considers the factors most consistently identified as influencing firm value [4, 5].

Several studies have demonstrated that fluctuations in inflation, interest rates, and exchange rates can have significant effects on firm value in Iran. Firm value is one of the most important components of aggregate demand and serves as a key driver in reducing unemployment, promoting economic growth, and addressing economic

challenges in developing countries. As firm value drives employment, production, income generation, infrastructure development, and social services, it plays a crucial role in resource allocation [6, 7]. Nonetheless, there are notable disagreements in prior research that warrant further investigation. Although some studies suggest that inflation and exchange rates have a direct impact on firm value, others propose that these effects are indirect.

Numerous domestic and international studies have examined the relationship between macroeconomic variables and firm value. Golshan et al. (2022), in a study titled "The Impact of Exchange Rate Shocks on the Performance of Energy Companies Listed on the Tehran Stock Exchange: A Case Study of the Petrochemical and Petroleum Distribution Industries," covering the period from December 2008 to March 2019, concluded that there is a positive relationship between the exchange rate and the performance index of the petrochemical and refinery industries, indicating that an increase in the exchange rate leads to higher stock prices [8]. Similarly, Houshmandi et al. (2021), in their study "The Effect of Exchange Rate Fluctuations on the Price Index of Petroleum Products on the Tehran Stock Exchange Using an MS-VAR Model" for the period 2008–2019, found that an increase in the exchange rate boosts the stock index of petroleum products companies, although the stock index itself does not influence the exchange rate [9]. Nematian (2016), in research titled "Examining the Relationship Between Firm Value, Inflation Rate, and Exchange Rate Using Tobin's Q in the Tehran Stock Exchange," emphasized that firm valuation is crucial in investment processes and that inflation is one of the key factors affecting firm value [10]. Tejesh (2024), analyzing monthly data from April 2013 to February 2024 in India, found that although the long-term relationship between stock market returns and inflation and exchange rates is weak, there is a significant short-term relationship [11]. Additionally, Hiendrawati et al. (2024), in a study on "The Impact of Inflation, Interest Rate, and Exchange Rate on Firm Value for Companies Listed on the Indonesia Stock Exchange during 2019–2023," concluded, using linear regression models, that inflation, interest rate, and exchange rate variables do not have a significant effect on firm value [12].

Given the critical role of the petrochemical industry in the national economy and the importance of maintaining and enhancing the value of these companies, a precise analysis of macroeconomic impacts on this sector is essential. This study aims to assist managers and investors in the petrochemical industry in making more informed decisions. Theoretically, this research contributes to the development of analytical models regarding the impact of macroeconomic factors on various industries. Practically, the findings can support petrochemical company managers in managing economic risks and improving financial strategies. Accordingly, the present study seeks to answer the fundamental question: How do exchange rates and inflation rates affect the firm value of petrochemical companies listed on the Tehran Stock Exchange?

2. Methodology

This study was applied in terms of purpose and descriptive-survey in nature, conducted using a quantitative approach. The statistical population consisted of accountants, financial analysts, and accounting experts employed in private sector companies located in Tehran. Using simple random sampling and based on the Morgan table, a total of 150 individuals were selected as the sample.

The data collection instrument was a researcher-made questionnaire designed based on a review of the theoretical literature and previous research. The questionnaire included two sections: the first section contained demographic information (age, gender, work experience, and familiarity with accounting software), and the second section comprised 18 items measured on a five-point Likert scale to assess the research variables.

The independent variable, "use of accounting software," was measured across three dimensions: type of software used, users' skill level, and daily usage frequency. The dependent variables consisted of two components: "financial report accuracy" (reduction of errors, data correctness) and "report timeliness" (reduction in report preparation time, data timeliness).

To assess the face and content validity of the questionnaire, input was obtained from seven university professors and accounting experts. Instrument reliability was examined using Cronbach's alpha and composite reliability (CR). The Cronbach's alpha values for all variables were above 0.70, and the convergent validity of the model was confirmed with an Average Variance Extracted (AVE) value above 0.60.

Data analysis was conducted using SmartPLS 4 software through the structural equation modeling technique with a partial least squares approach (PLS-SEM). This method enabled simultaneous analysis of relationships among multiple variables and the validation of both the measurement and structural models. The research model included the independent variable "accounting software" and the two dependent variables "report accuracy" and "report timeliness."

To evaluate the measurement model, reliability, convergent validity (AVE), and discriminant validity (Fornell-Larcker criterion) were examined. In assessing the structural model, path coefficients, R^2 values for the dependent variables, and bootstrapping tests were used to determine the significance of the coefficients.

3. Findings and Results

Descriptive statistics involve a set of methods used to collect, summarize, classify, and describe numerical facts. In essence, this type of analysis describes the research data and provides an overall pattern or design of the data for faster and more effective use. Descriptive statistics convey information regarding the central tendency and dispersion of the research data. The descriptive statistics of the main variables in the model are presented as follows:

Table 1. Descriptive Statistics of the Research Variables

Variables	FIRM VALUE	INF	EXC	EGR	ROA	Size	AGE
Mean	3.27	43.05	25514	0.21	0.18	14.60	18.22
Median	2.34	46.15	25590	0.26	0.17	14.38	16
Maximum	35.25	47.10	43472	0.71	0.83	19.77	49
Minimum	0.67	31.20	10783	-3.15	-0.46	11.11	4
Standard Deviation	3.07	0.49	0.62	0.23	0.16	1.56	9.26
Skewness	4.24	-0.20	-0.58	-1.35	0.24	0.66	1.18
Kurtosis	30.09	1.04	2.38	3.66	4.16	3.57	3.99
Jarque-Bera	29.397	128.3	384.5	248.4	58.19	66.93	422.8
Probability	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Observations	90	90	90	90	90	90	90

As shown in Table 1, the maximum firm value is 35.25 and the minimum firm value is 0.67. The mean firm value over the study period is 3.27. Similarly, the minimum economic growth rate of the companies is -3.15, the maximum is 0.71, and the mean is 0.21, indicating that the average economic growth rate of the companies is 0.21. Other variables can be interpreted in a similar manner.

As observed, the table presents, respectively, the mean, median, maximum, minimum, skewness, kurtosis, standard deviation, Jarque-Bera statistic, and the probability associated with the Jarque-Bera test for each research variable. The standard deviation represents the average squared deviation of each data point from the mean and is an indicator of data dispersion. According to the results, some skewness and kurtosis coefficients fall within the

ranges of (-3, 3) and (-5, 5), respectively. Thus, the sufficient condition for the normality of the data distribution is confirmed, indicating that the data follow a bell-shaped pattern. Consequently, the researcher is permitted to use appropriate statistical tests based on the given conditions. The Jarque-Bera statistic suggests that the residuals of the model are not normally distributed. Nonetheless, the model fit is deemed successful and the results are considered reliable.

Inferential statistics comprise methods that generalize the information obtained from a sample to the entire population. The primary goal of inferential statistics is to make inferences about population characteristics based on sample data, which will be discussed below.

Stationarity is one of the prerequisites for estimating an appropriate regression model. Therefore, the stationarity or unit root test is conducted separately for each variable in the model. The results, obtained using EViews software and the Levin, Lin, and Chu unit root test, are presented below:

Table 2. Results of the Unit Root Test for the Research Variables

Variable	Test Statistic	Probability	Conclusion
FIRM_VALUE	-19.76	0.000	Stationarity Confirmed
INF	-2.47	0.000	Stationarity Confirmed
EXC	-4.48	0.000	Stationarity Confirmed
EGR	3.67	0.000	Stationarity Confirmed
ROA	-6.24	0.000	Stationarity Confirmed
SIZE	-6.73	0.000	Stationarity Confirmed
AGE	-8.43	0.000	Stationarity Confirmed

Since the probability values for all unit root tests are less than 0.05, it is concluded that the null hypothesis of having a unit root is rejected for all the variables. Therefore, the variables are stationary. As a result, the model can be estimated without concern for the occurrence of spurious regression.

The cointegration test examines the existence of a long-term relationship among the model variables. This test is also employed to ensure the absence of spurious regression. Although it is necessary when some variables are non-stationary, in this case, given that all variables are stationary, the test could be omitted. Nevertheless, for greater rigor, it has been conducted. The results of the Kao residual-based cointegration test for the model variables are presented below:

Table 4. Results of the Cointegration Test

Test Type	t-Statistic	Probability
Kao Residual Cointegration Test	10.22	0.000

Since the probability value for the Kao cointegration test statistic is less than 0.05, the null hypothesis of no long-term relationship among the model variables is rejected. Thus, it can be concluded that the model variables are cointegrated.

To initiate hypothesis testing using panel data regression analysis, it is first necessary to determine whether the appropriate model is a panel model or a pooled ordinary least squares (OLS) model. In other words, it must be established whether fixed or random effects are present. The F-Limer or Chow test is applied for this purpose.

In this test, the null hypothesis (H_0) asserts the homogeneity of intercepts, while the alternative hypothesis (H_1) asserts their heterogeneity. Acceptance of H_0 implies that intercepts are identical across cross-sections, thus validating the use of a pooled regression model. Rejection of H_0, however, supports the panel data approach. The test results are presented below:

Table 5. Result of the F-Limer Test

Test Type	F-Statistic	Probability	Result
F-Limer Test	2.16	0.000	Panel model (fixed or random effects present)

Since the probability value of the F-Limer test is less than 0.05, the null hypothesis of a pooled regression model is rejected. Therefore, the appropriate estimation model includes either fixed or random effects, and a simple pooled model is not applicable.

When the F-Limer test indicates the appropriateness of a panel data model, the Hausman test is subsequently used to determine whether a fixed effects model or a random effects model is more suitable.

In this test, acceptance of H_0 indicates that the random effects model is preferable (no correlation between individual effects and explanatory variables), whereas acceptance of H_1 favors the fixed effects model (correlation exists between individual effects and explanatory variables). Given the results indicating a panel model with effects, the Hausman test is necessary. The results are as follows:

Table 6. Result of the Hausman Test

Test Type	Chi-Square Statistic	Probability	Result
Hausman Test	49.7	0.000	Model has fixed effects

Since the probability value of the Hausman test is less than 0.05, the null hypothesis that the model has random effects is rejected. Consequently, it is concluded that the model has fixed effects across cross-sections (in this case, across companies), and the regression model is estimated accordingly.

To assess whether autocorrelation is present in the regression equation, the LM test is employed.

In this test, the null hypothesis (H_0) states that no autocorrelation exists ($cov(u_i, u_j) = 0$), while the alternative hypothesis (H_1) suggests the presence of autocorrelation ($cov(u_i, u_j) \neq 0$). The outcome is determined based on the probability value of the F-statistic. The results are presented below:

Table 7. Result of the LM Autocorrelation Test

Test Type	F-Statistic	Probability	Result
LM Autocorrelation Test	1.19	0.15	No autocorrelation present

Given that the probability value of the F-statistic exceeds 0.05, the null hypothesis that there is no autocorrelation is accepted. Therefore, it can be concluded that there is no autocorrelation problem in this regression model.

To assess the presence or absence of multicollinearity among the independent variables, the correlation coefficients table was initially examined. However, as correlation coefficients only capture bivariate collinearity, the Variance Inflation Factor (VIF) criterion was used to detect potential multicollinearity among multiple variables. The VIF test results, obtained using EViews software, are presented below:

Table 6. Variance Inflation Factor (VIF) Test Results

Variable	VIF Value
INF	1.73
EXC	2.04
EGR	1.02
ROA	1.41
SIZE	1.00
AGE	1.23

As shown in the table, since all VIF values are below 5, it can be concluded that multicollinearity is not present. The results of the White test for heteroscedasticity are presented below:

Table 7. White Test Results for Heteroscedasticity

Test Type	Chi-Square Statistic	Probability	Conclusion
White Test for Heteroscedasticity	28.39	0.16	No heteroscedasticity present

According to the results, as the probability value exceeds 0.05, the null hypothesis of homoscedasticity is not rejected, indicating that heteroscedasticity is not present in the model.

Based on the results of the fitted regression model, the F-statistic value is 17.36 with a probability value of 0.000, indicating the overall significance of the model (since the probability is less than 0.05). The most critical statistic in the regression analysis is the adjusted R-squared, which is 0.80. This indicates that 80% of the variation in the dependent variable is explained by the independent variables included in the model, demonstrating an acceptable model fit. As observed, all variables are statistically significant with positive coefficients, and all corresponding t-statistics exceed 2. Thus, an increase (or decrease) in any of the independent or control variables leads to an increase (or decrease) in firm value. Additionally, the Durbin-Watson statistic, which measures autocorrelation in the residuals, falls within the acceptable range of 1.5 to 2.5, confirming the absence of autocorrelation.

Table 8. Final Output of the Regression Model

Variable	Coefficient	Standard Error	t-Statistic	Probability
INF	0.34	0.05	6.43	0.000
EXC	0.40	0.04	9.53	0.000
EGR	0.15	0.03	5.10	0.000
ROA	0.20	0.08	2.42	0.010
SIZE	0.11	0.02	4.04	0.000
AGE	0.31	0.05	5.92	0.000
C (Constant)	0.26	0.05	5.19	0.000

R-squared: 0.81; Adjusted R-squared: 0.80; Durbin-Watson statistic: 1.74; F-statistic: 17.36; Model Significance: 0.000

The hypothesis testing results indicate that the exchange rate has a positive and significant effect on the firm value of petrochemical companies listed on the Tehran Stock Exchange. Specifically, an increase in the exchange rate significantly raises the firm value (regression coefficient = 0.40, $p < 0.05$). This positive relationship reflects the dependence of the petrochemical industry on foreign currency revenues and the role of exports in product pricing, consistent with findings from multiple domestic and international studies, thereby confirming the first research hypothesis. Similarly, inflation, as a macroeconomic variable, has a positive and significant effect on the firm value of petrochemical companies. An increase in inflation leads to a rise in firm value (regression coefficient = 0.34, $p < 0.05$), which can be attributed to the adjustment of product prices and the increase in nominal revenues. These results not only confirm the second research hypothesis but also emphasize that exchange rate and inflation fluctuations serve as key factors in determining firm value, holding particular importance for financial analysts and economic policymakers.

4. Discussion and Conclusion

Today, given the growth of business entities and the establishment of joint-stock companies, and considering that shareholders have diverse interests and expectations, the ultimate objective—common to all shareholders—is to maximize the present value of the investment made in the company. This value is realized through existing assets

and operational efficiency. Therefore, the value of shareholders' equity consists of two components: the expected value of maintaining current operational resources and the value derived from the expansion of future operational activities. Determining firm value and identifying its influencing factors in capital markets have consistently been challenging topics for investors and financial analysts. They have continuously sought to identify the determinants of firm value to more accurately estimate the real value of companies. Among the factors that can affect firm value are the exchange rate and inflation rate, which require careful examination.

The findings of this study, aimed at investigating the impact of inflation and exchange rate on the firm value of petrochemical companies listed on the Tehran Stock Exchange, reveal a significant relationship between the exchange rate and the firm value of active petrochemical companies. An increase in the exchange rate has led to an increase in firm value. This finding aligns with the results of studies [8-11].

Another important result of this study demonstrates a significant relationship between the other key variable, inflation rate, and firm value. Based on the obtained regression coefficient, a positive relationship between inflation and firm value is confirmed, indicating that an increase in inflation rate is associated with an increase in firm value. This result is consistent with the prior findings [10-12].

Given the discovered relationships between firm value and both inflation and exchange rates among the sample companies, the following recommendations are offered:

1. Regulatory bodies, such as the Securities and Exchange Organization, the Iranian Institutional Investors Association, the Brokers Association, brokerage and investment companies, and all capital market participants, should carefully consider the relationships between firm value, exchange rates, and inflation identified in this study, as they can provide valuable insights for decision-making.
2. Strengthening currency and inflation risk management policies in petrochemical companies: Given the sensitivity of firm value to exchange rate and inflation fluctuations, petrochemical companies should develop and implement effective strategies for managing currency and inflation risks. This could include the use of financial derivatives, hedging, and detailed financial planning to mitigate the effects of economic fluctuations. Such measures will help maintain profitability stability and enhance market value.
3. Designing targeted macroeconomic policies to stabilize the exchange rate and control inflation: From a policymaking perspective, the findings emphasize the importance of adopting coherent and sustainable monetary and exchange rate policies that can reduce severe exchange rate and inflation volatility. Stabilizing these key macroeconomic indicators will not only foster investor confidence but also improve the financial and operational conditions of petrochemical companies, ultimately increasing their value. These policies may include optimizing the management of foreign exchange resources, controlling liquidity, and promoting non-oil exports.

Authors' Contributions

Authors equally contributed to this article.

Ethical Considerations

All procedures performed in this study were under the ethical standards.

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Conflict of Interest

The authors report no conflict of interest.

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