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Short-Term and Long-Term Asymmetric Effects of Macroeconomic Variables on Foreign Direct Investment Flows Using the PMG Approach (Case Study: Selected OPEC Member Countries)

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A B S T R A C T

The motivation behind attracting foreign direct investment (FDI) stems from the widespread belief that beyond providing financial resources, FDI serves additional purposes such as promoting technology transfer, enhancing skills and management practices to improve the quality of the domestic labor force, expanding export markets, raising the standards of domestic production, and facilitating a transition toward a market-based economy. The objective of this study is to analyze and examine the short-term and long-term asymmetric effects of macroeconomic variables on FDI flows in selected OPEC member countries, including Iran, Iraq, Saudi Arabia, Kuwait, Venezuela, the United Arab Emirates, Gabon, and the Republic of the Congo over the period from 2007 to 2022. Accordingly, the Pooled Mean Group (PMG) estimation method within the framework of panel data was employed. The results indicate that the asymmetric effects of trade openness, economic growth, and innovation on FDI flows in both the short and long term are positive and statistically significant for this group of countries. Conversely, the asymmetric effects of exchange rate and inflation on FDI flows in the short and long term are negative and statistically significant. Additionally, the error correction coefficient in the model was estimated to be negative and statistically significant at the 1% level, with a value of -0.43. This implies that the system adjusts toward its long-term equilibrium at a speed of 43%, meaning that in each period, 43% of the existing disequilibria are corrected in the direction of achieving long-term balance.

Keywords: *Macroeconomic Variables, Foreign Direct Investment, Pooled Mean Group Approach, OPEC Member Countries*

1. Introduction

Foreign direct investment (FDI) has become one of the key components of global economic development strategies, particularly for developing and resource-rich countries seeking to diversify their economies, create employment opportunities, and accelerate industrialization. As a long-term commitment by foreign entities, FDI goes beyond short-term capital movements and carries with it the potential for technology transfer, knowledge diffusion, export promotion, and overall productivity growth (Hamid et al., 2022). The significance of FDI is particularly pronounced in oil-exporting and developing economies, such as those of OPEC member states, which aim to reduce dependency on volatile oil revenues by attracting stable and productive foreign capital inflows (Hoa et al., 2021).

The dynamics of FDI are influenced by a multitude of macroeconomic, institutional, and structural factors. Economic openness, as a manifestation of liberal trade and investment policies, has consistently been shown to have a positive impact on FDI attraction. Countries that engage more freely with the global economy tend to provide more attractive environments for foreign investors by reducing trade barriers and facilitating cross-border business operations (Nikpey Pasian et al., 2022). A liberalized trade regime signals policy consistency, reduces transaction costs, and increases market accessibility, all of which are conducive to long-term investment planning. At the same time, trade openness supports integration into global value chains, enhancing the strategic relevance of host countries in multinational corporate investment decisions (Bao & Le, 2021).

Alongside openness, exchange rate stability plays a crucial role in determining FDI flows. Volatility in exchange rates introduces a layer of uncertainty that can significantly deter foreign investors. High fluctuations erode predictability in returns, increase hedging costs, and undermine the financial viability of investment projects (Feshari, 2019). In contrast, a stable exchange rate regime allows for better financial forecasting, risk management, and profitability assessment, particularly for capital-intensive and export-oriented projects (Chen & Peng, 2019). Moreover, real exchange rate appreciation or depreciation can affect the relative cost of inputs and profitability margins, thereby shaping investment strategies in sectors such as manufacturing, real estate, and services (Kong et al., 2016).

Inflation is another macroeconomic factor with substantial implications for FDI attraction. Persistent inflation reduces the purchasing power of returns on investment, increases input costs, and distorts price signals, all of which erode investor confidence (Safarzadeh & Khodaveisi, 2019). In economies with high or unpredictable inflation, the time value of money is difficult to preserve, particularly in long-term projects where future revenue streams are critical to capital budgeting decisions. Consequently, countries that maintain low and stable inflation tend to receive higher levels of FDI due to lower investment risk and better economic stability (Nguea, 2020). Importantly, inflation often reflects the broader macroeconomic management capacity of the host country, making it a proxy for policy effectiveness in the eyes of foreign investors (Kordi & Mashhadi Khodaparast, 2016).

Beyond macroeconomic fundamentals, the structural characteristics of an economy, such as its level of innovation, human capital, and institutional quality, significantly shape FDI patterns. Innovation, particularly in the form of research and development (R&D), is a signal of technological advancement and productivity potential. As innovation increases, the host country becomes more attractive to technology-seeking FDI, especially in high-tech and knowledge-intensive industries (Moleiro Martins et al., 2023). Moreover, innovation enhances domestic firms' absorptive capacities, thereby facilitating spillover effects from foreign investment and increasing the likelihood of sustainable development outcomes (Kogabayev & Maziliauskas, 2017). In this context, foreign investors often favor host countries with strong innovation ecosystems and active industrial policies that support science, technology, and innovation infrastructure.

Economic growth and market size have long been established as classical determinants of FDI. A growing economy not only indicates higher demand potential but also reflects improved returns on investment and lower country risk. Rising GDP and expanding consumer markets enhance the profitability prospects of new ventures, particularly in consumer-oriented sectors such as retail, real estate, finance, and telecommunications (Ranjbar & Rassekh, 2022). Additionally, economies with consistent growth trajectories tend to provide better infrastructure, stable policy frameworks, and an enabling business environment, all of which lower the cost and risk of doing business (Shahabadi et al., 2021). This is particularly true in emerging markets, where large-scale investment opportunities exist in infrastructure, energy, and industrial sectors, often supported

by public-private partnerships and foreign investor incentives (Madani & Madani, 2020).

On the institutional side, governance quality, rule of law, and political stability also matter greatly. FDI is more likely to be directed toward countries with transparent regulatory regimes, effective contract enforcement, and low levels of corruption (Kordi & Mashhadi Khodaparast, 2016). Weak institutions can act as a barrier to investment by increasing transaction costs, limiting dispute resolution mechanisms, and fostering rent-seeking behavior. In contrast, well-functioning institutions enhance predictability, reduce operational risks, and ensure fair competition, all of which are essential for sustained foreign investor engagement (Simeon Oludiran & Nicaise Abimbola, 2018). Moreover, institutional efficiency is often intertwined with broader issues such as economic freedom, investor protection, and bureaucratic quality, making it a decisive factor in location choice for multinational corporations (Hamid et al., 2022).

It is also important to consider the sectoral dimension of FDI. Some sectors are more sensitive to specific economic signals than others. For instance, the manufacturing sector is particularly responsive to trade policies, exchange rate regimes, and innovation capacities, while the extractive industries may be more influenced by natural resource endowments and political stability. Services, on the other hand, depend heavily on regulatory frameworks, human capital availability, and technological infrastructure (Hoa et al., 2021). As such, policy approaches to attract FDI must be sector-specific and aligned with the strategic development priorities of the host country (Nikpey Pasian et al., 2022).

In the context of OPEC member states, the analysis of FDI flows takes on additional relevance. These countries, often characterized by a high dependency on oil revenues, face the dual challenge of economic diversification and structural transformation. FDI is viewed not merely as a source of capital but as a mechanism to achieve broader developmental goals, including employment generation, industrial upgrading, and export diversification (Moleiro Martins et al., 2023). However, the volatility of global oil prices, institutional weaknesses, and geopolitical risks often constrain their ability to attract and retain high-quality FDI (Nguea, 2020). Therefore, understanding the asymmetric and long-run effects of macroeconomic and structural factors on FDI inflows in OPEC economies provides critical insights for policymakers aiming to design more resilient and attractive investment climates.

This study contributes to the literature by examining the short- and long-term asymmetric impacts of trade openness, exchange rate movements, inflation, economic growth, and innovation on FDI flows in selected OPEC member countries.

2. Methods and Materials

In this study, the Pooled Mean Group (PMG) approach is employed using panel data. The PMG estimator was introduced by Pesaran et al. (2001). This estimator is based on the Maximum Likelihood (ML) method and the Auto-Regressive Distributed Lag (ARDL) model. The PMG imposes a restriction on the long-term parameters such that they are assumed to be identical across panel members, while allowing the short-term parameters (i.e., the speed of adjustment), intercepts, and the variance of the error terms to vary across cross-sectional units. Therefore, following the model used by Pesaran et al. (2001), the empirical model in this study is specified as follows:

(1)

$$\Delta FDI\_it = \beta_0 + \beta_1 \Delta FDI\_(it-k) + \beta_2(+) \Delta TRO\_(it-k(+)) + \beta_3(-) \Delta TRO\_(it-k(-)) + \beta_4(+) \Delta EXR\_(it-k(+)) + \beta_5(-) \Delta EXR\_(it-k(-)) + \beta_6(+) \Delta INF\_(it-k(+)) + \beta_7(-) \Delta INF\_(it-k(-)) + \beta_8(+) \Delta EG\_(it-k(+)) + \beta_9(-) \Delta EG\_(it-k(-)) + \beta_{10}(+) \Delta INN\_(it-k(+)) + \beta_{11}(-) \Delta INN\_(it-k(-)) + \lambda_1 it + u\_it$$

In this equation, Δ indicates the first difference of the variables. The term *k* denotes the optimal lag length in the system. The coefficients β represent the short-term parameters. The coefficient λ is referred to as the error correction term (ECT), which reflects the speed of adjustment toward the long-run equilibrium. In essence, the ECT shows the percentage of disequilibrium that is corrected in each period by the explanatory variables in order to reach the long-term equilibrium. The term *u* represents the vector of error components. The symbol (+) denotes positive shocks or fluctuations of the macroeconomic variables, while the symbol (−) represents negative ones. The variables used in this study include:

FDI (Foreign Direct Investment flows): Data for this variable were obtained from the World Bank database. Foreign direct investment refers to investments made by a company or an individual in one country into business interests located in another country for the purpose of trade or production.

TRO (Trade Openness): Defined as the ratio of the sum of exports and imports to GDP. Data on exports, imports,

and GDP used to calculate this variable were obtained from the World Bank. The trade openness index measures the degree to which a country is involved in the global trading system.

EXR (Exchange Rate): Data for this variable were sourced from the International Monetary Fund (IMF). The exchange rate is the rate at which one currency can be exchanged for another between countries or economic regions.

INF (Inflation): Data for this variable were obtained from the World Bank. Inflation is generally understood as a disproportionate increase in the general price level of goods and services in an economy.

EG (Economic Growth): Data for this variable were obtained from the World Bank. Economic growth refers to the increase in the production of economic goods and services from one period to another.

INN (Innovation): Due to the unavailability of direct data on innovation, expenditures on research and development (R&D) obtained from the World Bank are used as a proxy. Innovation refers to the selection of appropriate ideas and the effective implementation of processes that transform those ideas into products, services, and processes for the purpose of generating profit and growth.

3. Findings and Results

One of the main assumptions in econometric methods used for panel data is that error terms across cross-sections are independent. If cross-sectional dependence exists, it may lead to bias in test results. To examine cross-sectional independence, the Pesaran cross-sectional dependence test is employed. The null hypothesis of this test states that error terms are not correlated, indicating no cross-sectional dependence.

Table 1

Pesaran Cross-Sectional Dependence Test

Dependent Variable	Test Statistic	Probability
FDI	2.77	0.00

As shown in the table above, the null hypothesis of no cross-sectional dependence is rejected because the p-value is less than 0.05. Therefore, the model exhibits cross-sectional dependence, and conducting unit root tests without accounting for this dependence would yield misleading results.

Before estimating the model, the stationarity of the variables must be tested because non-stationary variables can lead to spurious regression. A panel series is considered stationary if its mean and variance remain constant over time. In this study, the Augmented Dickey-Fuller (ADF) test is used, as the Pesaran test indicated the presence of cross-sectional dependence in the model. The results of the unit root tests are presented in Table 2.

Table 2

Unit Root Tests

Stationarity Level	Augmented Dickey-Fuller (ADF)	Variables
Non-stationary at level	-3.41 (0.07)	FDI
Stationary at first diff	-5.05 (0.02)	DFDI
Stationary at level	-5.23 (0.01)	TRO
Non-stationary at level	-2.40 (0.36)	EXR
Stationary at first diff	-4.60 (0.00)	DEXR
Non-stationary at level	-0.45 (0.56)	INF
Stationary at first diff	-6.60 (0.00)	DINF
Stationary at level	-3.97 (0.02)	EG
Stationary at level	-6.45 (0.00)	INN

According to the results of the Augmented Dickey-Fuller unit root test, it is evident that foreign direct investment (FDI), exchange rate (EXR), and inflation (INF) are non-stationary at level but become stationary after first differencing. Other variables, including trade openness (TRO), economic growth (EG), and innovation (INN), are

stationary at level. Therefore, since some variables are non-stationary at level and become stationary after differencing, cointegration testing is necessary to avoid spurious regression.

As previously noted, given that some variables were non-stationary at level and became stationary after first differencing in the unit root tests, cointegration testing is required to avoid spurious regression. Various tests are available to assess cointegration among variables. In this study, the Pedroni cointegration test is used. In this method, the null hypothesis states that there is no cointegration, while the alternative hypothesis indicates the presence of cointegration among the model variables. The results of this test for the model are presented in the table below.

Table 3

Pedroni Cointegration Test

Index	Statistic	Probability
Group ADF Statistic	7.99	0.00

In the Pedroni method, since the group ADF statistic has a p-value less than 0.05, the null hypothesis is rejected. This confirms the presence of cointegration among the variables, indicating a long-run relationship between them and eliminating the risk of spurious regression in the estimated models. Therefore, it can be concluded that at least one causal relationship exists among the variables in the model.

To distinguish between the positive and negative effects of the examined variables on foreign direct investment (FDI) flows in the short and long term, the Pooled Mean Group (PMG) estimation approach is employed. The PMG estimator is both efficient and consistent compared to other estimators used in panel data studies. To ensure the appropriateness of the PMG estimator for the number of cross-sectional units and the time period studied, the Hausman test must first be performed. If the p-value of the chi-square statistic in the Hausman test is greater than 0.05, it indicates that the PMG model is both consistent and efficient. Therefore, the results of the Hausman test are presented in the table below.

Table 4

Hausman Test

Test	Chi-Square	Probability
Hausman Test	2.09	0.97

According to the Hausman test results, since the p-value of the chi-square statistic is greater than 0.05, the PMG method is found to be both consistent and efficient for this study. Thus, it can be applied to decompose the short- and long-term positive and negative effects of variables on FDI flows.

The results of the short- and long-term asymmetric effects of macroeconomic variables used in this study on FDI flows in selected OPEC member countries are presented in the following table:

Table 5

Positive and Negative Long-Term and Short-Term Effects Using the PMG Method

Variables	Coefficients (Long Term)	t-Statistic	Probability
Short Term			
TRO_P	0.15	6.43	0.00
EXR_P	-0.17	-5.95	0.00
INF_P	-0.14	-5.78	0.00
EG_P	0.12	4.99	0.00
INN_P	0.10	4.47	0.00
TRO_N	-0.15	-4.51	0.00
EXR_N	0.19	5.87	0.00
INF_N	0.16	5.93	0.00

DEG_N	-0.11	-4.67	0.00
INN_N	-0.09	-4.73	0.00
Short Term			
COINTEQ01	-0.43	-6.14	0.00
D(TRO_P)	0.14	6.80	0.00
D(EXR_P)	-0.13	-5.76	0.00
D(INF_P)	-0.17	-5.98	0.00
D(EG_P)	0.12	5.38	0.00
D(INN_P)	0.12	5.35	0.00
D(TRO_N)	-0.19	-5.63	0.00
D(EXR_N)	0.23	5.85	0.00
D(INF_N)	0.18	5.76	0.00
D(DEG_N)	-0.15	-5.53	0.00
D(INN_N)	-0.08	-5.40	0.00
C	0.90	5.23	0.00

According to the above results, positive changes in trade openness (i.e., increases in trade openness) have a positive and significant effect on foreign direct investment (FDI) flows in both the short and long term, while negative changes in trade openness (i.e., decreases in trade openness) have a negative and significant effect on FDI flows in the short and long term. In other words, there is a direct relationship between trade openness and FDI flows. The more open a country's economy is, the better positioned it will be to participate in global and international markets. Trade liberalization—through reducing quantitative restrictions and partially eliminating tariffs—minimizes trade barriers and creates the conditions for economic integration. In this process, the country's ability and role in global interdependence increases. Furthermore, trade liberalization can influence various international economic indicators through its effect on foreign trade volume, thereby opening new paths for productive and positive economic exploitation. Key economic benefits include technological spillovers, access to capital and financial resources, international labor division, access to broader and newer consumer markets, and participation in global production chains. Trade openness implies reduced restrictions and tariffs, which lowers trade barriers and increases the volume of foreign trade. In other words, an increase in foreign trade—exports and imports—provides countries with various advantages along the path of economic growth and development.

Positive changes in the exchange rate (i.e., currency depreciation) have a negative and significant effect on FDI flows in both the short and long term, while negative changes in the exchange rate (i.e., currency appreciation) have a positive and significant effect on FDI flows. This implies an inverse relationship between the exchange rate and FDI flows. Exchange rate fluctuations can influence the profitability of investments and play a critical role in capital inflows and outflows. The rationale is that under exchange rate uncertainty, investors are unable to plan for the future and formulate necessary strategies. Such volatility increases transaction risk in international dealings and thus becomes a barrier to international capital flows. Additionally, exchange rate volatility affects the valuation of national assets, complicates the estimation of project costs and revenues, and leads to broad changes in national profit margins. Overall, exchange rate fluctuations reduce the ability to attract financial resources and diminish investment efficiency due to the associated risks in the economic environment. Consequently, foreign investors, who seek profitability and predictability in project returns, tend to prefer countries with lower macroeconomic volatility for their investments.

Positive changes in inflation (i.e., rising inflation) have a negative and significant effect on FDI flows in both the short and long term, whereas negative changes in inflation (i.e., falling inflation) have a positive and significant effect on FDI flows. In other words, there is an inverse relationship between inflation and FDI flows. When the host country has low inflation, the decline in asset value and the reduction in net investment return is minimized, thus lowering investment risk and encouraging FDI. Moreover, inflation reduces the present value of investments that mature over longer periods, resulting in losses for long-term projects. High and volatile inflation leads to uncertainty, which erodes investor motivation and delays decision-making, disrupts resource allocation, and negatively affects investment profitability.

Positive changes in economic growth (i.e., rising growth rates) positively and significantly affect FDI flows in both the short and long term, while negative changes in economic growth (i.e., declining growth rates) have a negative and significant impact. That is, there is a direct relationship

between economic growth and FDI flows. An upward trend in GDP and an expanding market size attract potential investors. Countries with high GDP growth and large market sizes can more easily attract foreign investors. Beyond GDP growth, the availability of basic infrastructure and a favorable business environment can significantly facilitate FDI inflows. In emerging economies, higher GDP growth has been observed to enhance the attractiveness of foreign investment. In other words, economic growth helps create investment opportunities for foreign investors.

Positive changes in innovation (i.e., increased innovation) positively and significantly affect FDI flows in both the short and long term, while negative changes in innovation (i.e., decreased innovation) have a negative and significant effect. In other words, there is a direct relationship between innovation and FDI flows. Innovation is a key pillar that supports competitiveness, development, and growth strategies by enabling entry into new markets, increasing market share, and preparing countries to face competitive environments. It also fosters economic growth. Innovation allows countries to outperform competitors and strengthen their market position. Through innovation, countries can design new products and improve existing offerings, which contributes to attracting more foreign investors.

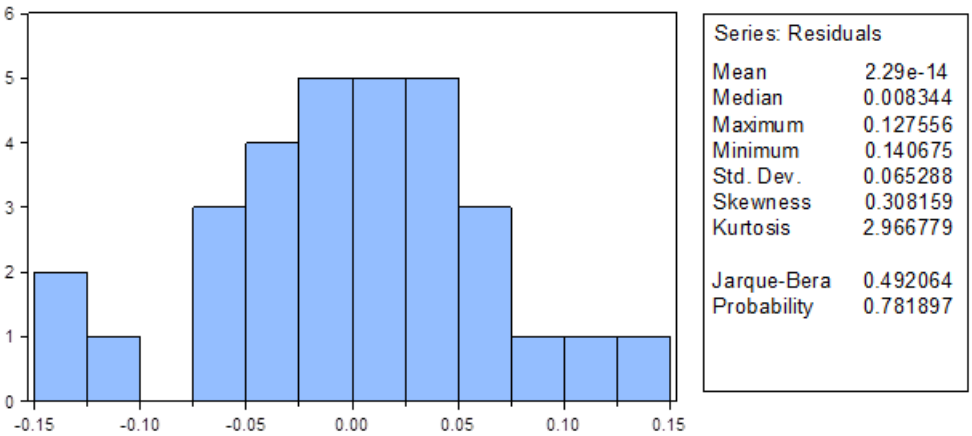
In the PMG method used in this study, as shown in the table above, the error correction term (ECT) coefficient was estimated. The ECT coefficient represents the speed of adjustment toward long-run equilibrium and shows how quickly the model returns to equilibrium. If this coefficient is negative and statistically significant, it indicates that short-term deviations are corrected over time toward the long-run equilibrium. The numerical value of this coefficient quantifies the speed of such adjustment. Furthermore, if the ECT coefficient is negative and significant, it implies a long-run causal relationship from the independent variables to the dependent variable.

In this study, as indicated in the above table and based on the t-statistic, the ECT coefficient is -0.43, which is statistically significant at the 1% level. This implies that the system adjusts toward its long-run equilibrium at a speed of 0.43 per period—meaning that 43% of the existing disequilibrium is corrected each period. Therefore, given the negative and significant ECT coefficient, a long-term relationship among the variables is confirmed. It can thus be concluded that a long-run relationship exists from the independent variables (trade openness, exchange rate, inflation, economic growth, and innovation) to FDI flows in the selected OPEC member countries.

If the assumption of normality in the distribution of error terms is violated, the classical assumptions in panel data studies are compromised, resulting in biased and inefficient estimations. In the PMG method, the *EVIEWS* software provides the Jarque-Bera normality test for error terms, and the results of this test are presented in Figure 1.

Figure 1

Jarque-Bera Normality Test for Error Terms Using the PMG Method



Based on the results in Figure 1, since the p-value in the Jarque-Bera test exceeds 0.05 and the figure shows that the

error terms maintain a bell-shaped curve, the null hypothesis of the test is not rejected. Therefore, the error terms in the model are normally distributed.

4. Discussion and Conclusion

The findings of this study offer significant insights into the asymmetric short-term and long-term effects of key macroeconomic variables—namely trade openness, exchange rate, inflation, economic growth, and innovation—on foreign direct investment (FDI) flows in selected OPEC member countries. Utilizing the Pooled Mean Group (PMG) estimation approach, the study confirms that both the direction and magnitude of these variables exert differentiated impacts on FDI inflows over different time horizons. In particular, the positive changes in trade openness and economic growth were found to positively and significantly affect FDI both in the short and long term, while negative changes in these variables yielded significant negative effects. Likewise, positive changes in innovation promoted FDI inflows, while negative shocks to innovation reduced them. Conversely, the results suggest that positive shocks to the exchange rate (i.e., depreciation) and inflation have negative effects on FDI flows, while negative changes in these variables (i.e., appreciation and disinflation) increase FDI, demonstrating a distinct inverse relationship.

These outcomes align with the theoretical foundations of international investment behavior and are well-supported by empirical literature. For instance, the positive relationship between trade openness and FDI flows confirms the notion that liberalized economies attract more foreign investors due to reduced trade barriers, increased market accessibility, and integration into global value chains (Bao & Le, 2021; Nikpey Pasian et al., 2022). A country's openness not only facilitates the movement of goods and capital but also signals policy predictability and competitive market structures. Similarly, the study by (Moleiro Martins et al., 2023) indicates that openness, when coupled with innovation and economic freedom, serves as a strong determinant of Chinese outward FDI inflows. The dual significance of trade openness in both the short and long term also suggests that consistent liberalization policies are more effective than temporary trade reforms in promoting sustained FDI engagement.

The inverse relationship between exchange rate volatility and FDI flows identified in this study reflects the importance of macroeconomic stability in shaping foreign investment decisions. High levels of exchange rate volatility introduce uncertainty in forecasting returns, discourage long-term planning, and increase the cost of financial hedging. These findings correspond with (Feshari, 2019), who showed that instability in Iran's real exchange rate significantly discouraged FDI inflows. Likewise, (Chen & Peng, 2019) noted that exchange rate appreciation in China reduced the competitiveness of exports and, in turn, limited the profitability margins for foreign investors, particularly in tradable sectors. (Kong et al., 2016) also confirms the sensitivity of investment patterns to currency dynamics in the real estate sector, suggesting that any country aiming to attract long-term capital must ensure exchange rate predictability.

Inflation, another macroeconomic variable examined, was shown to have a strong negative impact on FDI in both the short and long term when it increased, whereas reduced inflation corresponded with an increase in FDI inflows. This outcome reinforces the conclusions of (Safarzadeh & Khodaveisi, 2019), who found that inflation not only reduces real returns on investment but also signals monetary instability, thus deterring investor confidence. Inflation increases the cost of inputs, distorts future cash flow projections, and increases the risk of underperformance in capital-intensive projects. As a result, countries that maintain stable inflation environments are more likely to enjoy consistent and higher levels of foreign investment.

One of the most compelling results of this study is the positive and significant impact of innovation on FDI, confirming its crucial role in contemporary investment flows. In economies that demonstrate a commitment to research and development, technology upgrading, and knowledge-based industries, FDI tends to gravitate toward sectors with higher growth potential and strategic value. This supports the findings of (Kogabayev & Maziliauskas, 2017), who emphasized innovation as a core driver of competitive advantage and national development. Likewise, (Moleiro Martins et al., 2023) demonstrated that technology and innovation are essential factors for attracting FDI into emerging markets. Innovation not only increases the absorptive capacity of domestic firms but also enables integration with global production networks, thus amplifying the developmental impact of FDI.

The role of economic growth as a positive determinant of FDI flows is also validated in this study, in both the short and long term. A growing economy signals market potential, increased demand, and improved infrastructure—all critical factors for investment attractiveness. The alignment of this result with prior literature is evident in the work of

(Shahabadi et al., 2021), who found that total factor productivity and economic expansion were positively correlated with FDI in industrial blocs. (Ranjbar & Rassekh, 2022) similarly highlighted the complementary role of economic complexity and growth in enhancing FDI effectiveness. (Hoa et al., 2021) and (Madani & Madani, 2020) both support the idea that regions experiencing sustained GDP growth and increased urbanization are particularly successful in attracting investment, due to rising consumer demand and improved infrastructure. Importantly, the consistent positive impact of economic growth across time horizons reflects its foundational role in strategic investment decisions.

The estimation of the error correction term (ECT) in the PMG model provided additional evidence of the existence of long-run equilibrium relationships among the variables. The negative and statistically significant ECT coefficient, valued at -0.43, indicates that 43% of the short-term disequilibria are corrected toward the long-term equilibrium in each period. This result highlights the robustness of the long-term link between macroeconomic conditions and FDI flows, suggesting that despite short-term volatilities, the system tends to revert to a stable equilibrium influenced by the fundamental drivers identified. This finding resonates with the conclusions of (Nguea, 2020) and (Kordi & Mashhadi Khodaparast, 2016), who emphasized the role of structural adjustments and macroeconomic governance in maintaining long-run investment stability.

Taken together, the results of this study offer a coherent empirical narrative: macroeconomic fundamentals, innovation capacity, and openness to global markets are crucial levers for shaping the pattern and sustainability of FDI flows. The asymmetric nature of the impacts also suggests that policymakers need to consider not only the levels of change in these variables but also the direction and context in which such changes occur. For example, reducing inflation or exchange rate volatility has a significantly different implication than increasing them—thus, economic reforms must be targeted, nuanced, and sensitive to investor expectations. The validation of these findings across multiple empirical studies reinforces their policy relevance and applicability to the development strategies of OPEC and other resource-based economies.

Despite the robustness of the PMG estimation method and the richness of the panel dataset, this study is not without limitations. First, the focus on selected OPEC member countries may limit the generalizability of the findings to non-resource-based economies or regions with different institutional contexts. Second, the study primarily utilizes macro-level indicators, which may mask micro-level heterogeneities such as firm-specific investment behavior or sectoral dynamics. Third, due to data constraints, innovation was proxied through research and development expenditures, which may not capture all dimensions of innovation such as process innovation, digital transformation, or patent activity.

Future research could expand the geographical and economic scope of the analysis by including non-OPEC or low-income countries to assess whether similar asymmetric effects are observed. Incorporating sectoral-level data would also enrich the findings and provide more granular insights into which industries are most responsive to macroeconomic changes. In addition, future studies could examine the role of institutional quality, environmental sustainability, and digital infrastructure as mediating factors in the FDI–macroeconomy relationship. Using alternative methodologies such as threshold regression or structural equation modeling may also reveal nonlinearities and deeper causal pathways.

For policymakers, the results of this study emphasize the importance of maintaining macroeconomic stability, promoting innovation, and ensuring sustained economic growth as strategic pillars for attracting FDI. Efforts to liberalize trade, stabilize the exchange rate, and control inflation should be pursued alongside targeted investments in innovation ecosystems and digital infrastructure. Governments should also adopt a long-term perspective, recognizing that consistent policy frameworks and predictable regulatory environments are more effective in fostering investor confidence than reactive or short-term reforms. Tailored investment promotion strategies aligned with national development goals will further enhance the quality and quantity of FDI inflows.

Authors' Contributions

Authors contributed equally to this article.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

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Ethics Considerations

In this research, ethical standards including obtaining informed consent, ensuring privacy and confidentiality were considered.

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