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The impact of export diversification on economic growth in OPEC member countries during the period 2007-2021

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Abstract---This paper aims to evaluate the influence of export diversification on the economic growth of specific OPEC nations between 2007 and 2021. Utilizing the Panel Data Method with the assistance of Rstudio software, our study designates economic growth as the dependent variable, while export diversification, capital, and labor serve as independent variables. The findings reveal a noteworthy and negative correlation between labor and economic growth, underscoring the efficacy of labor in fostering economic expansion. Moreover, a significant and inverse correlation is evident between export diversification and economic growth, underscoring the constrained efficacy of export diversification as a strategy to stimulate and enhance economic growth rates.

Keywords---economic growth, export diversification, panel data models.
JEL Classification: F10, C23, O40.

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Introduction

The intersection of export diversification and economic development has been extensively explored in academic literature. However, less attention has been given to understanding how diversification specifically influences the economic trajectories of major oil-exporting nations, notably those within the Organization of the Petroleum Exporting Countries (OPEC). For these nations, where oil and gas exports constitute a substantial part of their GDP, government revenue, and total exports, the question arises: Does diversifying into non-oil tradable industries and reducing reliance on fossil fuel exports accelerate economic development for OPEC members? This study aims to delve into the dynamics of how export diversification impacts growth rates in OPEC member countries, amidst the prevailing dominance of the petroleum industry.

Historically, export diversification has been touted as a strategy for hydrocarbon-reliant countries to expedite their economic development by mitigating their vulnerability to the volatile commodity markets. Yet, empirical evidence on the efficacy of diversification in fostering development, particularly in emerging economies that are significant oil exporters, remains mixed. Most empirical research posits that export diversification contributes positively to growth and macroeconomic stability in developing countries. Theoretically, economies overly dependent on a limited range of export commodities are more susceptible to volatility arising from terms of trade shocks. The diversification into a broader spectrum of manufacturing and service exports is thought to provide a buffer against the adverse effects of fluctuating oil prices, a frequent challenge for OPEC members (Hesse et al., 2008). Additionally, diversification is believed to facilitate the growth of more productive non-oil tradable sectors, catalyzing structural changes and inter-sectoral shifts, thereby enhancing overall economic competitiveness (McMillan & Rodrik, 2011).

However, the relationship between export diversification and growth may be markedly different in resource-rich economies. Premature diversification away from a comparative advantage, such as oil, may lead to inefficient resource allocation and potentially hinder short-term growth (Cadot et al., 2011) . Recent data also shows the global economy’s shifting structure, with oil and gas exports growing faster than manufactures trade, may alter diversification incentives for commodity exporters (Unctad, 2021). Given these issues, the growth effects of diversification for OPEC members remain ambiguous.

Several of the world's largest hydrocarbon-dependent economies are represented by members of the Organization of the Petroleum Exporting Countries (OPEC). The need of diversification increases since oil and gas exports make up a significant portion of these nations' GDP, government income, and total exports. Does diversifying the non-oil tradable industries and moving away from the concentration of fossil fuel exports promote quicker economic development for OPEC members? In light of the petroleum industry's hegemony in these countries, what strategies and laws enable successful diversification? The purpose of this study is to look at how export diversification affects the rates of growth in OPEC member nations.

This research seeks to provide a comprehensive empirical examination of the link between diversity and growth, with a focus on OPEC economies between 2007 and 2021. It models growth outcomes by using strict panel data estimate methodologies. Indexes of export diversification will serve as a stand-in for the relevant independent variable. Other drivers including as investment, institutions, and human capital are taken into consideration by control variables. The goal of the research is to go through the contradicting data about how diversification affects major oil exporters' development.

The research acknowledges and addresses the heterogeneity in parameters across OPEC countries, which vary in income levels and resource endowments. This approach allows for an examination of how differences in the diversification coefficient affect countries with diverse economic backgrounds. Furthermore, the study explores the interplay between oil reserves, institutional quality, and diversification, shedding light on the nuanced ways in which different OPEC economies are impacted by diversification efforts.

Utilizing recent data that reflects the structural shifts in global energy and trade patterns, this analysis aims to provide contemporary insights into diversification strategies suitable for the current economic climate of hydrocarbon exporters. The findings are intended to contribute to ongoing policy debates, offering evidence-based recommendations on how OPEC members can effectively leverage their natural resource wealth for sustainable development and prosperity. By conducting an in-depth analysis of the implications of diversification on the growth trajectories of major oil-exporting countries, this research fills a critical gap in understanding optimal export strategies for commodity-dependent emerging economies. Focusing exclusively on OPEC nations during a period of significant global trade evolution, the study makes a unique contribution to empirical literature. Incorporating fresh data and methodologies, it seeks to provide more definitive insights into the impact of diversification on hydrocarbon-based economies, ultimately guiding policymakers towards effective development strategies amidst dynamic structural and economic changes.

1. Literature Review

The connection between export diversification and economic development in various contexts has been the subject of several research. (YAKUBU et al., 2022), for example, discovered that export diversification significantly increased economic growth in the G7 nations, demonstrating the possible benefits of diversification tactics.

Furthermore, supporting the potential advantages of diversification, (Alomari & Bashayreh, 2020) showed that trade openness and export diversification had a beneficial impact on economic development. (Munir & Javed, 2018), however, drew attention to the fact that export specialization has a beneficial effect on economic development up to a certain threshold, suggesting a complex link between economic performance and diversification.

The research by (Inuwa et al., 2021) looked at how natural resources affect economic growth in the context of OPEC member nations, highlighting the

significance of financial development and high-quality institutions. Furthermore, in order to lessen reliance on the oil market and boost economic resilience, OPEC member nations must implement export diversification policies, according to (ALIYEV & ALIYEVA, 2022). These results underline how important export diversification is to OPEC member countries' economic growth.

Furthermore, the research by (Karamelikli et al., 2017) illuminated the intricacies of export dynamics in these economies by analyzing the dynamic interaction between oil exports, non-oil exports, imports, and economic development in OPEC nations. Additionally, (Hossein et al., 2012) looked at the causality and long-term link between energy consumption and economic development in OPEC nations, offering insights into the larger factors influencing growth in the economy.

Using the export diversification index (Theil), and applying ARDL model, (Duhu, 2022) find that export diversification has a short- and long-term beneficial but negligible effect on Nigeria's economic development.

In conclusion, the effect of export diversification on economic development in OPEC member nations is a complex and multidimensional matter that is influenced by a range of sectoral, institutional, and economic variables. Understanding this link is essential to creating sustainable development plans and economic policies that work in these nations.

This research provides a significant updated viewpoint on diversification in significant oil exporting nations. It implies that, in light of recent empirical data, the widely recommended strategy of export diversification should be carefully considered. Instead of rushing into diversification, some OPEC countries may see stronger near-term development by focusing on increasing oil export productivity. More nation-specific research is needed to provide customized policy recommendations.

2. Methodology and Data

To assess the influence of export diversification on economic growth in OPEC countries from 2007 to 2021, panel data models were employed utilizing Rstudio software. In this framework, the dependent variable is represented by the economic growth variable, while the independent variables include export diversification, capital, and labor.

The study sample consists of selected OPEC countries during the period 2007-2021. The selection of these nations was contingent upon the accessibility of data for the study variables, as outlined in the table below:

Table 1. Sample and variables

States	Variables	Variable encoding	Data Source
Algeria, Angola*, Saudi Arabia, Equatorial Guinea, Republic of the Congo,	Economic growth	GDP	World Bank
	Capital	ABFF	World Bank
	Labor	L	World Bank

States	Variables	Variable encoding	Data Source
Gabon, Iran, Iraq, Nigeria, United Arab Emirates.	Export diversification	DEX	UNCTAD

* The study was prepared before Angola officially announced its withdrawal from the OPEC organization in December 2023

In our study, the choice of labor and capital as independent variables alongside export diversification is rooted in classic economic theory, which posits that these factors are crucial determinants of economic growth.

⇒ **Labor (L):** Represented by the workforce size, this variable is a primary component of production and economic activity. It encompasses the total number of people employed in the OPEC countries, reflecting the human resource available for generating economic output.
⇒ **Capital (ABFF):** This is measured as gross fixed capital formation, indicating the net increase in physical assets within a nation. Capital investment in infrastructure, machinery, and technology is essential for enhancing productivity and, consequently, economic growth.
⇒ **Export Diversification (DEX):** Measured as the degree of variation in the export portfolio of a country, diversification is a strategy to reduce dependency on a limited range of export goods. A diversified export base is hypothesized to contribute to economic stability and growth.

These variables are encoded as detailed in Table 1 and sourced from reliable international databases, ensuring the accuracy and relevance of our analysis."
To examine the influence of export diversification on economic growth in OPEC countries, the logarithmic model is articulated as follows:

$$\mathrm{LGDP} = \beta_0 + \beta_1 \mathrm{LABFF} + \beta_2 \mathrm{LL} + \beta_3 \mathrm{LDEX} + \varepsilon_{it}$$

Where:
GDP: Logarithm of economic growth, expressed in terms of GDP (constant 2010 US$);
LABFF: Gross fixed capital formation (constant 2010 US$);
LL: Workforce logarithm;
LDEX: Export diversification;
$\beta_0, \beta_1, \beta_2, \beta_3$: Model parameters
ε_{it}: Random error

3. Results

To evaluate the hypothesis concerning impact of export diversification on economic growth in OPEC countries spanning from 2007 to 2021 and validate its accuracy, the primary panel regression models—specifically, (PRM), (REM), and (FEM)—are utilized for estimation. This is illustrated in the table below:

Table 2. Results of Panel model (PRM), (REM), (FEM)

	Aggregate regression model (PRM)	Fixed effects model (FIVE)	Stochastic effects model ((REM)
C	3.704534 (2.2e-16***)	-	5.077719 (2.2e-16***)
THE	0.643185 (2.2e-16***)	0.721713 (2.2e-16 ***)	0.741623 (2.2e-16***)
LABFF	0.258642 (1.437e-12***)	0.081329 (3.098e-08 ***)	0.083802 (1.165e-09 ***)
LDEX	-1.572371 (1.923e-07***)	-0.07121 (0.4146)	1.2674E-13 (1.676e-14 ***)
R2	0.8494	0.49303	0.5479
F-statistic	93.1129	0.4483	169.775
Prob (F-statistics)	2.22e-16***	2.22e-16***	2.22e-16***

The estimation results of the three panel regression models reveal that all model coefficients are statistically significant at a 5% level (since the probability, Prob, is greater than 0.05), except for the export diversification variable, which is not statistically significant in the Fixed Effects Model (FEM). Furthermore, the statistical significance of the three models is indicated by the Fisher test probability.

-2 Panel Model Comparison Tests:
To identify the suitable model, the following statistical tests were utilized:
- Restricted F-test (Fisher's F-test):

This examination is conducted to contrast the (PRM) with the (FEM). The hypotheses for this test are illustrated below:

The assembly model is appropriate.....: H0

The static effects model is appropriate..... ..... : 1H

The general formula for the Restricted F-test is as follow (Greene, 2012):

$$F(N-1, NT-N-K) = \frac{(R^2_{FEM} - R^2_{PRM}) / (N-1)}{(1-R^2_{FEM}) / (NT-N-K)}$$

Where:
- K denotes the count of estimated parameters.
- R^2_{FEM} signifies the coefficient of determination for the FEM.
- R^2_{PRM} signifies the coefficient of determination for the PRM.

If the P-value fall below 0.05, it provides support for the alternative hypothesis, suggesting that the FEM is the more suitable choice.

Table 3. F Fisher test results

Test Type	Test Value	(P.VALUE)
A Test F Fisher	502.46	2.2e-16***

The outcomes of the Fisher's F-test indicate a probability value below 5%, leading to acceptance of the alternative hypothesis. Consequently, the FEM is deemed to be the more appropriate model.

We need to verify the presence or absence of a random effect with Lagrange Multiplier Test, this test was proposed by Breusch-Pagan in 1980, aiming to examine the presence of random effects. It utilizes the residuals from the Ordinary Least Squares (OLS) estimation method. The test is based on the following assumptions:

The presence of an individual effect (no random effect): $_{H\,0}$:$\sigma_\varepsilon^2 = 0$ .....

Absence of an individual effect (presence of random effect): H_1: $\sigma_\varepsilon^2 \neq 0$, ...

where: σ_ε^2 is the variation of the unobserved random impact distribution.
The general formula for this test is given as follows:

$$LM = \frac{nT}{2(T-1)}\left[\frac{\sum_{i=1}^{n}(\sum_{i=1}^{T}\varepsilon_{it})^2}{\sum_{i=1}^{n}\sum_{i=1}^{T}\varepsilon_{it}^2} - 1\right]^2$$

If the Lagrange Multiplier test yield a statistical value surpassing the critical threshold of the chi-square distribution with one degree of freedom $\varkappa_1^2$, it lends credence to the alternative hypothesis, signifying the presence of random effects.

Table 4. Lagrange Multiplier test results

Test Type	Test Value	(P.VALUE)
Lagrange Multiplier	733.99	2.2e-16***

The outcomes of the Lagrange Multiplier test reveal a p-value below 5%, prompting the acceptance of the alternative hypothesis, signifying the existence of random effects.

With Hausman, we can verify that the regression model is appropriate or not, this test is executed to juxtapose FEM with REM, facilitating the determination of the more suitable model. (Hausman, 1978) The hypotheses for the Hausman test, are outlined as follows:

A random regression model is appropriate: ..... H_0

A fixed regression model is appropriate: ..... H_1

Table 5. Hausman test results

Test Type	Test Value	(P.VALUE)
Hausman Test	1.8665	0.6006

The findings of the Hausman test indicate a p-value exceeding 5%, leading to the acceptance of the null hypothesis. This suggests that the REM is considered suitable for the analysis. The quality of the estimated model is confirmed by the Heterogeneity Test (Breusch-Pagan)

Table 6. Heterogeneity test (Breusch-Pagan)

Test Type	Test Value	(P.VALUE)
Heterogeneity Test (Breusch-Pagan)	83.086	7.544e-12

The outcomes of the Breusch-Godfrey test for autocorrelation of residuals unveil a p-value below 5%, prompting the rejection of the null hypothesis. This signals that the REM is afflicted by heteroscedasticity, pointing to an issue of non-constant variance.

Table 7. Autocorrelation test for residues

Test Type	Test Value	(P.VALUE)
Autocorrelation test for residues (Breusch Godfrey/Wooldridge test)	27.309	0.07

The results of the Breusch-Godfrey/Wooldridge test for autocorrelation of residuals reveal a p-value below 5%, leading to the acceptance of the null hypothesis. This indicates that the REM is free from the concern of autocorrelation of residuals.

The Random Effects Model, assessing the influence of export diversification on economic growth in OPEC countries, encounters the challenge of heteroscedasticity. In response to this issue, the model estimation was conducted employing the Error Standard Robust method, specifically adopting the (vcovHC-arellano) approach. The outcomes of estimating the Random Effects Model using the Error Standard Robust method can be encapsulated by the following equation:

$$\begin{array}{c} \text{LGDP= } (5.077719)+(2.347^{e}\text{-}16)\text{LL}+(0.083802)\ \text{LABFF } -(0.084984)\text{LDEX } +\varepsilon_i \\ \text{T-value} \quad [9.27] \qquad [5.11] \qquad [1.25] \qquad [-2.13] \\ p-\text{value} \quad \text{prob}\,(2.35e-16\ ***) \quad (9.91e-07\ ***) \quad (0.21) \quad (0.035\ *) \\ R^2 = 0.5479 \qquad F_{p-\text{value}} = 2.2e-16 \end{array}$$

Partial Significance:

The findings reveal that all model parameters exhibit statistical significance (prob=0.001, less than 0.05), with the exception of the capital variable, which

lacks statistical significance. Additionally, the constant term demonstrates statistical significance.

Overall Significance:

The computed Fisher statistic yields a p-value that is statistically significant at a 5% significance level. Consequently, the alternative hypothesis is embraced, signifying that export diversification indeed exerts an impact on economic growth in OPEC countries. This underscores the overarching significance of the estimated model and its appropriateness for analysis.

Interpretation of explanatory power:

The derived value of the coefficient of determination, R-squared (R^2=0.5479), signifies that the independent variables elucidate 54.79% of the variance in economic growth. The remaining percentage accounts for other variables or factors not encompassed within the model.
From this model, it is evident that:

a. Labor (LL) positively impacts economic growth (LGDP) in an inverse correlation. This signifies that a 1% augmentation in labor is linked to an anticipated upturn in economic growth (LGDP) by approximately 0.74%.
b. Export diversification (LDEX) yields a negative impact on economic growth (LGDP) in an inverse relationship. This implies that a 1% increase in export diversification is linked to an anticipated decrease in economic growth (LGDP) by approximately 0.08%.
c. The statistical analysis does not reveal a significant impact of capital on economic growth.

In analyzing the impact of export diversification on economic growth in OPEC countries from 2007 to 2021, our findings present a complex picture. The primary panel regression models used for this assessment include the Aggregate Regression Model (PRM), Fixed Effects Model (FEM), and Stochastic Effects Model (REM).

The positive coefficients for labor (LL) across all models consistently suggest that an increase in the workforce positively correlates with economic growth. This finding aligns with the theoretical understanding that a larger workforce enhances production capabilities, thereby contributing to economic growth. Specifically, a 1% increase in labor is associated with an approximate 0.74% increase in economic growth, as indicated by the Random Effects Model.

The relationship between capital (LABFF) and economic growth, however, presents a more nuanced picture. While the coefficients are positive, indicating a potential beneficial impact on economic growth, the lack of statistical significance in some models suggests that the role of capital in driving economic growth in OPEC countries might be less straightforward. This could be attributed to variations in how capital is utilized across different countries or sectors.

The impact of export diversification (LDEX) on economic growth is particularly intriguing. The negative coefficient in the PRM and its statistical insignificance in

the FEM indicate a complex relationship. It suggests that increasing export diversification might not always positively affect economic growth, possibly due to the varying nature of exports and market dynamics in OPEC countries. A 1% increase in export diversification is linked to an anticipated decrease in economic growth by approximately 0.08%, as per the Random Effects Model. This finding challenges the conventional wisdom and calls for a deeper examination of the types of diversification and their contextual effectiveness.

The selection of the most appropriate model was determined through a series of tests. The Fisher's F-test favored the Fixed Effects Model, while the Lagrange Multiplier and Hausman tests indicated the Random Effects Model as more suitable. The Random Effects Model, however, encountered issues of heteroscedasticity, addressed by employing the Error Standard Robust method.

Despite these challenges, the Fisher statistic confirms the overall significance of our model, with a 54.79% explanatory power for the variation in economic growth. This underscores the robustness of our analysis in capturing the key factors influencing economic growth in OPEC countries.

4. Discussion

Our study indicates a negative correlation between export diversification and economic growth in OPEC countries, contrary to the commonly held belief that diversification universally promotes economic growth. This finding aligns with the notion that for oil-dependent economies, shifting focus away from a dominant sector like oil can initially disrupt the established economic balance, thereby affecting growth negatively. This underscores the complexity of diversification strategies in economies with a high reliance on a single export commodity, such as oil. Our results resonate with the arguments of Cadot et al. (2011), who cautioned against premature diversification from a comparative advantage such as oil.

The positive yet moderate impact of labor on economic growth reflects the unique labor market dynamics in OPEC countries. Despite a growing workforce, these economies have not fully leveraged this human capital in stimulating significant economic growth, possibly due to the dominance of the public sector and the underdevelopment of other sectors. This aligns with the findings of studies that emphasize the need for a diversified economy to utilize labor effectively, as seen in the work of McMillan & Rodrik (2011).

The lack of significant impact of capital on economic growth could be attributed to the high capital intensity of the oil sector in OPEC countries, which does not proportionately translate into broader economic growth due to limited employment generation. This finding raises important questions about the effectiveness of capital allocation in these economies and calls for a reevaluation of investment strategies, moving beyond the oil sector to stimulate more inclusive economic growth.

Our study contributes to the ongoing debate about the effectiveness of export diversification in oil-dependent economies. While studies like those by Yakubu et

al. (2022) and Alomari & Bashayreh (2020) have highlighted the positive impacts of diversification in different contexts, our findings suggest a more nuanced picture for OPEC countries. This difference can be attributed to the unique economic structures and dependency on oil exports in these nations, which may not mirror the dynamics observed in more diversified economies.

The findings of this study have important policy implications. They suggest that a one-size-fits-all approach to export diversification may not be suitable for all economies, especially those heavily reliant on oil exports. Policymakers in OPEC countries should carefully consider the stages and sectors in which diversification efforts are implemented to avoid negative short-term impacts on economic growth. Furthermore, there is a need for comprehensive strategies that go beyond export diversification, such as enhancing the private sector, investing in technological advancements, and improving institutional quality to support sustainable economic growth.

This study is not without limitations. The focus on OPEC countries provides a specific context that may not be generalizable to other oil-independent economies. Future research could explore the impact of export diversification in countries with different economic structures or at various stages of development. Additionally, examining the role of other variables, such as technological innovation and institutional quality, in mediating the relationship between export diversification and economic growth could provide deeper insights.

5. Conclusion

This research aimed to examine the impact of export diversification on economic growth in oil-dependent OPEC countries during the period 2007-2021. By employing panel data models and robust statistical techniques, the study assessed the relationship between economic growth and key variables: export diversification, labor, and capital. The Random Effects Model emerged as the most appropriate, revealing significant insights into the economic dynamics of OPEC nations. To sum up, the findings of the study can be condensed in the following manner:

Export Diversification: Contrary to the prevalent economic notion that diversification is invariably beneficial for growth, our study revealed a significant inverse relationship between export diversification and economic growth, with a probability value of 0.035. This intriguing finding suggests that in the context of OPEC countries, where there is a heavy dependence on oil exports, the immediate advantages of diversifying exports might be offset by existing structural imbalances and economic dependencies. The vulnerability of these economies to fluctuations in oil prices further complicates their diversification efforts, indicating a need for a more nuanced approach to diversifying their economies.

Labor's Impact: The influence of labor on economic growth, while positive, was found to be modest. Specifically, a 1% increase in labor input correlates with an approximate 0.74% increase in economic growth. This points to an underutilization of the labor force's potential, possibly attributed to the dominance of the public sector over the private sector and a lack of diversification

in the job market. The finding emphasizes the need for labor market reforms and the development of other economic sectors to fully harness the potential of the workforce.

Capital's Contribution: Interestingly, our study did not observe a statistically significant impact of capital on economic growth in the OPEC countries. This could reflect the capital-intensive nature of the oil sector in these economies, where substantial investments are concentrated. However, this concentration does not appear to contribute equivalently to broader economic growth, possibly due to the limited employment opportunities generated outside the oil sector. This underscores the importance of diversifying investment into other sectors that can stimulate more inclusive economic development.

6. Recommendations:

Based on our findings, we recommend the following for policy considerations in OPEC countries:

Balanced Diversification Strategy: Policymakers should approach export diversification with caution, recognizing the potential short-term adverse effects on economic growth. Diversification efforts should be strategic, gradual, and accompanied by supportive policies that strengthen other sectors, particularly those that are labor-intensive, to ensure balanced economic development.

Labor Market Reforms: There is a need for reforms targeting the efficient use of the labor force. These reforms should focus on enhancing private sector development, improving education and skill training, and encouraging entrepreneurship, which could lead to better utilization of human capital and subsequently boost economic growth.

Revisiting Capital Allocation: Given the lack of significant impact of capital on overall economic growth, there is a need to reassess investment strategies. Diversifying investments into sectors other than oil, particularly those that are more labor-intensive and technologically advanced, could lead to more inclusive and sustainable economic growth.

7. Implications and Future Directions:

The findings of this research provide valuable insights for policymakers in OPEC countries. They underscore the complexity of export diversification in oil-dependent economies and highlight the need for a strategic approach that considers existing economic structures and vulnerabilities. Future research could further explore the mechanisms through which labor and capital can be more effectively utilized to support economic growth in these countries, especially in light of the evolving global economic landscape and the shifting dynamics in the oil market.

This study offers a critical perspective on the challenges and opportunities of economic diversification in OPEC countries, contributing to a more nuanced understanding of their economic development strategies in an era of global economic shifts.

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