Do Digitalisation and Entrepreneurship Influence Export Diversification in Oil-Exporting MENA Countries? A Panel Data Analysis

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ABSTRACT

This research uses panel data analysis to examine the impact of digitalisation and entrepreneurship on the diversification of non-oil exports in 11 oil-exporting MENA countries, including Algeria, Saudi Arabia, Egypt, Qatar and the UAE, from 2009 to 2022. Using a Generalised Least Squares (GLS) model, the findings reveal that digitalisation positively influences export diversification, while entrepreneurship and oil rent have a significantly negative effect. The study aims to provide policymakers with recommendations to better leverage these factors and promote sustainable economic growth through diversified exports.

KEYWORDS: *impact, MENA region, non-oil exports, oil rent, panel data.*

JEL CLASSIFICATION: *F14, O33, L26, Q32.*

1. INTRODUCTION

Diversification is unanimously perceived as the ideal solution to ensure the stability and sustainability of income levels in the future (Hvidt, 2013). The economies of oil-exporting nations in the Middle East and North Africa (MENA) region exhibit significant diversity in geographic location, population density, institutional quality, and proven oil reserves. However, these economies share a critical common characteristic: the predominance of oil exports in their economic structures. This reliance on hydrocarbons has profound implications for their economic growth and incorporation into the global economy (Ross, 2015).

The heavy dependence on oil exports in these countries is often associated with low economic industrialisation, a significant share of oil-related fiscal revenues, high specialisation in oil exports, and a limited proportion of non-oil exports. This scenario subjects these economies to significant risks, primarily due to oil price fluctuations in global markets (van der Ploeg & Poelhekke, 2009). Moreover, it hinders their sustainable development and global economic integration.

Several factors play a crucial role in export diversification and addressing these challenges. Digitalisation facilitates the emergence of non-traditional sectors by providing new opportunities for trade and innovation (Al-Roubaier et al., 2020; Banga & te Velde, 2018). Similarly, entrepreneurship promotes the creation of diversified businesses capable of expanding the export base (Naudé, 2013). However, while oil rent can finance diversification initiatives, it often acts as a constraint by reducing incentives to develop other economic sectors (Lashitew et al., 2020). Furthermore, economic openness and targeted public policies are essential to strengthen this process (Hesse, 2009; Olayiwola & Okodua, 2013). All these

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elements are pivotal in enabling oil-exporting countries to broaden their export base and reduce their reliance on natural resources.

Research Problem: In oil-exporting countries of the MENA region, dependence on hydrocarbons limits economic diversification and exposes these economies to oil price fluctuations. This situation raises the following question: Which factors, particularly digitalisation, entrepreneurship, and oil rent, significantly influence the diversification of non-petroleum exports in these countries?

Research Hypotheses: In order to answer this problem, the hypotheses of the study are as follows:

- Digitalisation significantly promotes the diversification of non-oil exports.
- Entrepreneurship significantly promotes the diversification of non-oil exports.
- Oil rent hurts the diversification of non-oil exports.

Study Objectives: This research aims to empirically analyse the impact of digitalisation, entrepreneurship, and oil rent on the diversification of non-oil exports in 11 oil-exporting MENA countries from 2009 to 2022.

The Importance of the Research: This study provides a focused analysis of oil-exporting nations in the MENA region. It enriches the literature by examining the interplay between oil rent, digitalisation, entrepreneurship, and the diversification of non-oil exports. The findings offer concrete policy recommendations to promote sustainable economic development.

Research Limitations: The study focuses on a sample of 11 oil-exporting MENA countries, excluding others due to data unavailability. The analysed period spans from 2009 to 2022.

Research Methodology: The study employs a descriptive approach to analyse the theoretical framework of these factors' impact on export diversification. Additionally, it uses an econometric approach to evaluate the impact of digitalisation, entrepreneurship, and oil rent on export diversification.

Research Content: The article is organised as follows: The next section reviews resource-rich economies' non-oil export literature. The third section discusses empirical techniques, variables, and estimated models. The last section presents the results and the discussion. The conclusion summarises the main findings, analyses study limitations, and offers further research.

2. LITERATURE REVIEW

Exports are essential for enhancing a nation's economic success. The main factor in this relationship is the export-led growth hypothesis, which asserts a positive correlation between rising export value and economic growth (Olayiwola & Okodua, 2013). Three arguments can be employed to provide the theoretical basis for the export-economic growth hypothesis (Cuadros & Alguacil, 2004). Firstly, the export sector can produce beneficial externalities for other sectors via enhanced management practices and production processes. The export expansion increases productivity by facilitating economies of scale. Finally, exports are expected to enhance terms of trade, thereby facilitating improved access to international markets.

The literature on economic policy is rich with analyses attempting to identify the main reasons behind the development and underdevelopment of states benefiting from natural resource rents worldwide. Researchers strive to explain the influence of natural resources on economic growth and how these resources lead to economic and political dysfunction. The findings suggest that these effects can be explained economically, politically, and institutionally. Economic explanations argue that natural resources primarily cause delayed economic development in resource-abundant nations. The "resource curse" theory posits that countries deriving a significant portion of their revenue from natural resources tend to experience slow economic growth and crowd out non-oil sectors (Sachs & Warner, 1995; Sid Ahmed, 1998).

Entrepreneurship is seen as a vital catalyst for economic diversity. Establishing an active entrepreneurial sector can help reduce dependence on hydrocarbons by fostering the emergence of new industries and stimulating innovation in non-traditional sectors. Entrepreneurs play a crucial role in identifying market opportunities, introducing new technologies, and creating jobs in diverse fields.

Empirical studies highlight the importance of entrepreneurship in diversifying resource-dependent economies. Auty (1994) emphasised the role of entrepreneurship in breaking away from the resource-based growth model, demonstrating how innovation and entrepreneurial risk-taking can transform economic structures. Similarly, Hausmann et al. (2007) showed that economies that successfully diversify often actively promote entrepreneurship, leading to a broader range of exported products.

However, some research, such as that by Naudé (2011), indicates that entrepreneurship in resource-rich countries tends to focus on low-value-added sectors, often linked to the oil sector. This situation limits entrepreneurship's ability to drive significant export diversification. Implementing policies that support entrepreneurship is crucial, including improving access to financing, enhancing entrepreneurial skills, and creating a more favourable regulatory environment.

Digitalisation is increasingly crucial in global economic transformation (Al-Roubaier et al., 2020; Neffati & Jbir, 2024). Digitalisation increases non-oil revenues, modernises production and distribution processes, opens new markets, and creates opportunities in non-oil sectors (Neffati & Jbir, 2024). Digitalisation can catalyse export diversification by facilitating access to information, reducing transaction costs, and improving business efficiency, especially in economies heavily dependent on natural resources.

Empirical research supports this positive relationship between digitalisation and export diversification. Neffati and Jbir's (2024) study investigates the effects of economic diversification and digitalisation on economic growth in Saudi Arabia from 1990 to 2021, emphasising non-oil sectors. The findings indicate a favourable and sustained correlation between digitalisation, economic diversification, and non-oil growth. Digitalisation significantly contributes to non-oil revenue growth, reducing dependence on the oil sector, and promoting economic diversification. Moreover, digitalisation is pivotal to the Kingdom's economic transformation by fostering the creation of new knowledge and attracting foreign investment in communication and information technology (ICT).

Banga and Te Velde (2018) show that the adoption of digital technologies in developing countries can stimulate economic diversification by enabling businesses to connect to global

value chains. E-commerce platforms, artificial intelligence, and cloud services allow small and medium-sized firms (SMEs) to penetrate new markets and expand their product lines.
Trade openness is often seen as a critical factor in promoting export diversification, particularly in resource-dependent economies (Cuadros & Alguacil, 2004; Olayiwola & Okodua, 2013). For countries in the MENA region, where hydrocarbons dominate exports, trade openness can play a crucial role by facilitating access to new markets, attracting foreign investment, and encouraging the development of non-traditional sectors.

Economic literature supports the notion that trade openness can foster export diversification by exposing local economies to international competition, which drives innovation and efficiency. Sachs and Warner (1995) show that nations that are more open to international trade tend to diversify their economies faster than those with protectionist trade policies. Trade openness also allows countries to access new technologies and benefit from knowledge transfer, aiding the development of new export industries.

The influence of trade openness on export diversification in the MENA region has been examined with complex findings. According to Hesse (2008), trade openness is generally associated with greater export diversification, but this effect depends on the institutional framework and economic policies. Countries that have successfully diversified their exports have accompanied trade openness with structural reforms to improve the business climate, strengthen institutions, and support the development of SMEs enterprises.

3. MATERIAL AND METHOD

3.1 Research Population and Sample

This study investigates the impact of digitalisation, entrepreneurship, and oil rent on export diversification in 11 oil-exporting countries within the MENA region: Egypt, Algeria, Kuwait, Saudi Arabia, Tunisia, Qatar, Jordan, Morocco, Oman, United Arab Emirates, and Bahrain. Several oil-exporting nations were omitted from the analysis due to insufficient statistical data. The empirical study covers the period from 2009 to 2022. The software used for various estimations is STATA version 17. All variables employed in the study are derived from the World Bank database.

3.2 Selected Variables

• Dependent Variable:

The dependent variable is non-oil exports expressed as % of GDP (NOILEXP).

• Independent Variables:

- The density of new businesses created is a proxy for the level of entrepreneurial activity (ENTRE).
- Trade openness (TRADE)
- Oil rent as a percentage of GDP (RENT).
- Internet usage serves as an indicator of the level of digital infrastructure advancement (DIGITAL).

3.3 Empirical Model

The empirical analysis is based on estimating the following panel data model:

$$NOILEXP_t = \alpha + \beta_1 ENTRE_{i,(t)} + \beta_2 TRADE_{i,(t)} + \beta_3 RENT_{i,(t)} + \beta_4 DIGITAL_{i,(t)} + u_{i,(t)} + \varepsilon_{i,(t)} \quad (1)$$

Where ui,t represents individual effects; εt is the error term; the indices i et t represent the country and year, respectively.

3.4 Methodology

Before estimating the primary model, a series of preliminary tests will be executed to check the validity of the results. Additional tests will then be carried out to determine the most appropriate estimation method among Ordinary Least Squares (OLS), fixed effects (FE), and random effects (RE) models. The results of these tests will guide the selection of the optimal method for estimating the primary equation.

4. RESULTS AND DISCUSSION

4.1 Descriptive Statistics

Table 1 shows an overview of the main descriptive statistics for each variable, providing information on their distribution characteristics. Overall, all variables exhibit a normal distribution since the skewness values do not exceed 3, and the kurtosis values remain below 10. However, most variables have standard deviation values exceeding 3, suggesting the need for a logarithmic transformation to stabilise variance and improve the normality of the data.

This transformation ensures better interpretability and reliability of the results, especially when dealing with panel data models that are sensitive to the distributional properties of variables.

Table 1. Descriptive statistics of different variables

Variables	Obs	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis
NOILEXP	154	30.611	28.456	.052	81.68	.61899	1.6809
ENTRE	154	1.587	1.415	.041	6.888	1.4876	5.2402
TRADE	154	76.52	31.752	22.674	188.0	1.3081	5.1669
RENT	154	15.935	14.446	0	58.36	.862	3.1460
DIGITAL	154	67.655	24.707	11.23	100	-.32157	2.0432

Source: own calculations

4.2 Correlation matrix Multicollinearity Analysis

A correlation matrix was computed. A correlation coefficient between 0.7 and 0.9 is considered high and may indicate potential multicollinearity issues during estimation. Overall, the correlation matrix shows no strong correlation among the independent variables, suggesting that multicollinearity is not a problem.

The Variance Inflation Factor (VIF) was also calculated to detect any potential multicollinearity among the independent variables. As shown in Table 2, the average VIF is 3.62, well below the critical threshold of 10. This result confirms the absence of multicollinearity in the model, which ensures the reliability of the regression estimates.

Table 2. Correlation matrix and Multicollinearity Investigation

Variables	(1)	(2)	(3)	(4)	(5)
(1) NOILEXP	1.000				
(2) ENTRE	-0.213*	1.000			
(3) TRADE	-0.212*	0.243*	1.000		
(4) RENT	-0.745*	0.079	0.180	1.000	
(5) DIGITAL	-0.294*	0.598*	0.346*	0.172	1.000
VIF		2.08	1.24	4.79	1.78
1/VIF		0.481843	0.804234	0.208878	0.562653

**** p<0.01, ** p<0.05, * p<0.1*

Source: own calculations

4.3 Preliminary Tests for Panel Data Estimation

Before estimating the primary model, preliminary tests were performed to verify the validity and robustness of the findings. First, the linearity of the dependent variable (NOILEXP) was verified, demonstrating its linear behaviour and confirming its suitability for the panel regression model. Second, the normality of residuals was assessed, revealing a normal distribution and ensuring the statistical tests' consistency and reliability. Third, an outlier analysis was performed, and no significant outliers were detected, indicating that extreme values do not disproportionately influence the dataset. Finally, model specification tests confirmed the correct formulation of the model, providing further confidence in the appropriateness of the chosen approach.

- **Breusch-Pagan LM Test:**

This test aims to verify the presence of panel effects in the data. The null hypothesis of the test suggests that there is no significant difference between countries, meaning that there are no panel effects (fixed or random effects). If the "chibar2" statistic is significant, it indicates the presence of panel effects, which justifies further analysis to determine whether they are fixed or random.

According to the results presented in Table 3, the Lagrange Multiplier test indicates the existence of panel effects. The test statistic (Chibar2) is 457.07, with a p-value below the 0.05 significance threshold. These results lead us to reject the null hypothesis H0 of no panel effects. This result justifies further analysis to determine whether the effects are fixed or random.

- **Hausman test:**

This test helps determine the most appropriate type of panel model (fixed effects or random effects) based on the statistical significance of the test. If the p-value is sufficiently low, the FE model is preferable to the RE model.

This specification test aims to ascertain whether the model should use fixed or random effects. The selection criterion is based on the comparison of the probability value; specifically, if the p-value is below 1%, 5%, or 10%, the FE model is deemed optimal.

According to the Hausman test results presented in Table 3, the Chi2(4) statistic is 2.05, with an associated p-value of 0.7269. The p-value (0.7269) is significantly higher than the conventional significance level (1%, 5%, or 10%). These results indicate that the random effects model is the most appropriate.

- **Wooldridge Test:**

According to the Wooldridge test in Table 3, the F-statistic is 4.368, with an associated p-value of 0.0631. The p-value is more significant than the conventional significance level of 0.05. These results indicate that there is no solid statistical evidence supporting the presence of error autocorrelation.

- **Modified Wald test:**

The modified Wald test results for heteroscedasticity in Table 3 show that the Chi2 statistic's p-value is 0.000, significantly lower than the 0.05 significance level. Therefore, we strongly reject the null hypothesis, which states that the error variance is the same for all individuals. These results provide strong statistical evidence in favour of heteroscedasticity in the data. This conclusion implies that the error variance is not constant across observations. It would,

therefore, be prudent to use estimation methods robust to heteroscedasticity to obtain more reliable statistical inferences.

4.4 Discussion

Based on previous tests, the RE model is the most appropriate. Given the presence of error heteroscedasticity, the Generalised Least Squares (GLS) model is the most suitable. Below, we will present the four estimated models: the OLS model, the FE model, the RE model, and the GLS model.

The NOILEXP variable was taken as a dependent variable. The other variables, ENTRE, TRADE, RENT, and DIGITAL, were chosen as independent explanatory variables. As shown in Table 4, the OLS model estimation revealed that the ENTRE and RENT variables are significantly negatively correlated with the NOILEXP variable at the 5% and 1% levels, respectively, in explaining the variation of the NOILEXP variable. The relationship between the DIGITAL and NOILEXP variables is positive and significant at the 5% threshold. Furthermore, the TRADE variable is positively associated with NOILEXP but not significant. The R^2 value is used to measure the proportion of variation in the dependent variable NOILEXP related to variation in the independent variables (ENTRE, TRADE, RENT, DIGITAL). In the OLS model estimation, the R^2 value is 0.5599, indicating that the independent variables can explain 56% of the dependent variable.

Table 3. Results of different tests and comparison between the OLS model, FE model, RE model, and GLS model

Variables	Parameters	Dependent Variable: NOILEXP			
		OLS Model	**FE Model**	**RE Model**	**GLS Model**
ENTRE	**Coefficient**	**-.2231122****	-.1218527	-.1344557	**-.1497094****
	Std-err	**.0920884**	.1063671	.099142	**.0444245**
	P-value	**(0.017)**	(0.254)	(0.175)	**(0.001)**
TRADE	**Coefficient**	.172052	.055533	.1233843	-.1322659
	Std-err	.1688925	.4040288	.3483286	.1047405
	P-value	(0.310)	(0.891)	(0.723)	(0.207)
RENT	**Coefficient**	**-.4691098*****	**-.3662747****	**-.3936961*****	**-.3999509*****
	Std-err	**.0289515**	**.0915461**	**.0746735**	**.0145365**
	P-value	**(0.000)**	**(0.000)**	**(0,000)**	**(0.000)**
DIGITAL	**Coefficient**	**.6572421****	**.2485409***	**.2492899***	**.2087574****
	Std-err	**.2661301**	**.1502918**	**.1444477**	**.0932197**
	P-value	**(0.015)**	**(0.100)**	**(0.084)**	**(0.025)**
Constant	**Coefficient**	**.9275067****	2.764816	2.565061	**3.994287*****
	Std-err	**1.349346**	1.868914	1.684545	**.5454863**
	P-value	**(0.493)**	(0.141)	(0.128)	**(0.000)**
Specification tests		**Breusch Pagan LM Test**			Chibar2 (01) = 457.07 P-value = 0.0000
		Hausman Test			Chi2 (04) = 2.05 P-value = 0.7269
		Wooldridge Test			F(1, 10) = 4.368 Prob > F= 0.0631
		Modifié Wald Test			Chi2 (11) = 8.7e+05 Prob > chi2 = 0.0000
SignificanceTest		R^2= 0.5599	F(4,139) = 11.09 (0.0000)	Wald chi2(4) = 56.53 0.0000	Wald chi2(4) = 1070.59 (0.0000)

*** p<0.01, ** p<0.05, * p<0.1

Source: Author calculations

In the FE model estimation, the RENT and DIGITAL variables remain significant with negative and positive relationships, thus confirming the results obtained with the OLS model. However, the ENTRE and TRADE variables show no statistical significance in this model, suggesting that the effect of these variables might be weaker or less apparent when controlling for fixed effects.

In the RE model, the findings remain similar to those obtained with Fixed Effects, with RENT and DIGITAL remaining significant. However, the coefficients of ENTRE and TRADE continue to be non-significant.

The GLS model estimation shows that the ENTRE and RENT variables have negative and significant relationships with NOILEXP at the 5% and 1% level, respectively. Similarly, the DIGITAL variable maintains a positive and significant relationship at the 5% threshold. The TRADE variable remains non-significant. The results of the OLS model closely resemble those of the GLS model, strengthening the robustness of the conclusions derived from the OLS estimation.

The negative relationship between entrepreneurship and non-hydrocarbon exports could indicate that a high concentration on domestic entrepreneurship diverts resources from export activities in selected economies. These findings align with the work of Naudé (2011), who highlighted that entrepreneurship in resource-rich countries is often concentrated in low-value-added sectors. This orientation reduces entrepreneurship's potential to promote significant export diversification.

Furthermore, the strong negative and significant relationship between RENT and NOILEXP supports the "Dutch disease" hypothesis, where rents from natural resources (or other economic rents) may hinder economic diversification and reduce the competitiveness of non-oil exports (Gelb, 2010).

The positive and significant relationship between digitalisation and NOILEXP aligns with recent research findings that emphasise the role of digital transformation in improving export competitiveness (Neffati & Jbir, 2024). Digital technologies enable companies to access new markets, improve their productivity, and reduce transaction costs, which promotes non-oil exports.

4. CONCLUSIONS

This study examined the influence of digitalisation, entrepreneurship, on non-hydrocarbon export diversification in MENA region oil-exporting countries between 2009 and 2022. The results confirm that digitalisation plays a crucial role in export diversification. Indeed, its positive and significant effect indicates that digital technologies improve the competitiveness of nations in the region.

However, the hypothesis that entrepreneurship contributes positively to diversification was disproven. The findings show that entrepreneurship has a negative effect, likely due to the orientation of entrepreneurial initiatives toward local markets, which limits their contribution to non-oil exports. Moreover, the negative impacts of oil rent confirm its contribution in maintaining the "Dutch disease," hindering diversification efforts in non-oil sectors.

Finally, although trade openness is positively associated with diversification, this effect is insignificant, suggesting that other contextual factors influence this process. These results emphasise the importance of promoting digitalisation, reorienting entrepreneurship toward export sectors, and reducing the adverse effects of oil rents to ensure sustainable economic diversification in the MENA region.

In conclusion, this study highlights several recommendations to promote non-hydrocarbon export diversification in MENA region countries. Adopting reforms focused on reorienting entrepreneurship toward export sectors is essential, as well as efficiently managing oil rents to limit their adverse effects on the economy and promoting digitalisation to improve competitiveness and international economic integration.

For future analyses, it is recommended that the scope of research be broadened by including more countries and incorporating institutional variables. These institutional factors, often underestimated, can constitute significant obstacles to developing non-oil sectors while influencing the distribution of natural resources. A better understanding of their role could provide concrete solutions to strengthen economic diversification and ensure sustainable and sustained growth.

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