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From oil to opportunity: Exploring the determinants of non-hydrocarbon growth in Algeria

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Abstract---The study aims to identify the determinants of economic diversification outside the hydrocarbons sector to achieve economic take-off in Algeria during the period 2000-2023, using the ARDL model. The study concluded that there is no long-term co-integration relationship between the study variables, with a negative impact of the determinants of economic diversification determinants as indicated by the Hirschman-Heyerdahl index. It found that loans directed to the private sector do not contribute to to enhancing investments or expanding business activities in various economic sector. Meanwhile, fixed capital suffers from significant imbalances in the mechanisms of financial resource allocation, as large budgets are allocated for infrastructure development and community facilities, which generate no direct financial returns. This comes at the expanse of postponing or sometimes canceling sspending on productive investments and large wealth-generating projects that could have a high return in stimulating economic growth and diversifying the economy.

Keywords---Economic diversification, Churchman-Heyerdahl coefficient, Algeria.

Introduction

Algeria suffers from export mono-culture, with the oil sector constituting over 97% the country's total exports. This makes the national economy highly vulnerable to fluctuations in oil prices. Economic

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growth in Algeria is directly tied to the hydrocarbons sector due to the weakness of other sectors, and the absence of export diversification. Therefore, diversifying and developing exports is essential to achieving positive growth in GDP and improving living standards. Empirical studies confirm that higher economic concentration adversely affects export diversification and economic growth.

Research problem:
What are the determinants of economic dversificao i Algeria outside the hydrocarbon sector duing 2000-2023 ?

Objectives of the study:
- Review key empirical studies addressing the research problem.
- Develop an econometric model to examine the economic phenomenon under study.

Methodology:
The study employs an empirical approach, using data from UNCTAD and the World Bank from 200-2023, with a focus on variables relevant to the Algerian economy.

Literature review:

Patrick N. Osakwe 2018 (2018): this paper explores the role of domestic production structures, natural resource endowments, and infrastructure availability in export diversification and concentration in developing countries. Using a sample of 145 emerging economies for the period 2003-2015, the study employs an empirical approach and includes variables such as the export specialization index (measured by the Thiel index), the share of manufacturing in GDP, credit as a percentage of GDP, and resource rents to measure natural resource endowments. It also uses fixed-line phone subscriptions as an indicator of infrastructure availability. The results indicate that diversifying the production structure and improving infrastructure access as essential for enhancing export diversification. However, natural resource endowments tend to concentrate exports, particularly in less developed African countries.

Dan and others (2015) this study examines Algeria's ability to diversify its exports beyond the hydrocarbon sector. Using an analytical approach, the study analyses foreign trade indicators from 1970 to 2014, focusing on the geographical distribution of Algerian exports and imports.
The researchers propose several policy mechanisms, such as import substitution and export promotion. The study concludes that the weakness of Algeria's export performance stems from the reliance on hydrocarbons as the primary revenue source, the marginal contribution of the private sector, and the difficulty of producing internationally competitive products due to limited innovation, research and development.

Farida Lerkat (2015) this study investigates the industrial branches that Algeria should develop to promote economic diversification. It identifies efficient branches within the manufacturing sector that can help integrate Algeria into the global economy. The results show that the lack of integration into the global economy is primarily due to limited diversification and the reliance on a single raw material for exports. The researcher recommends that the government encourage investments in these branches to increase productive capacity and attract foreign investments for technology transfer.

Dierk felicitas (2011) this paper examines the hypothesis that export diversification in Chile is linked to economic growth through external factors such as familiarity with global markets. Covering the period 1961-2001, the researches estimate an enhanced Cobb-Douglas production function bases on time series data. They fd that export diversification plays a significant role in Chile's economy, with GDP increasing by 0,44% for every 1% increase in the number of export sectors.

Anwesha Aditya & Rajat Asharyya (2011) : this study explores the relationship between export diversification and economic growth in 65 countries from 1965 to 2005. Using panel data, the researches find that both export diversification and capital formation are crucial for economic growth, while export concentration increases specialization.

Determinants of Economic Diversification in Algeria Outside the Hydrocarbon Sector

Economic diversification refers to adopting an increasingly varied structure contributing to GDP. It can involve diversifying revenue sources in the national budget or targeting domestic and export markets. Diversification enhances overall economic performance, especially in low-income countries, by increasing growth and reducing volatility.

Diversification is broad in scope, encompassing large and small companies, public sector institutions, and diverse businesses.

Economic diversification relies on a set of components, which include:

- The economic diversification strategy should be realistic and well designed, tailored to the country's economic characteristics.
- The state must commit to the long-term strategy it has developed.
- There must be cooperation and interaction between the government and the private sector.
- Public investment in infrastructure, education, and human capital is essential.

The study aims to examine the determinants of economic diversification in Algeria beyond the hydrocarbon sector in the short and long term. The propose research model has been formulated as follows:

1. **Study model:**

Based on a group of previous studies that addressed the problem as follows:

- Coury & Chetan (2010), Eric & Nicet-Chenaf (2008), EL Hannani et al (2018), the study model takes the following form:

$$HHI_t = \beta_0 + \beta_1 FDI_t + \beta_2 OP_t + \beta_3 CP_t + \beta_4 K + \varepsilon_t \dots\dots (1)$$

Where:

- β0 is the constant. β1, β2, β3 and β4 are the estimation parameters. εit is the error term. t refers to the time series; t=1,2,. . . ,22)

The following table explains the variables of this study and their sources of measurement:

Table 01: definition of study variables and data sources

Variable	Symbol and type	Measurement	Source	Expected impact
Economic Diversification Index	HHI dependent variable	Hirschman-Hirfindahl coefficient	UNCTAD	/
Foreign Direct Investment	FDI independent variable	Foreign direct investment, net inflows (% of GDP)	World Bank	+
Trade Openness	OP independent variable	Total exports and imports to GDP or what is known as the ratio of foreign trade to GDP	World Bank	+
Private Sector	CP independent variable	Domestic credit to private sector (% of GDP)	World Bank	+
Fixed Capital	K independent variable	Gross fixed capital formation (% of GDP)	World Bank	+

Source: prepared by researches based on the variables of the model under study

2. **Steps For Estimating the Economic Diversification Model Outside the Hydrocarbon Sector**

To understand the determinants of economic diversification outside the hydrocarbon sector in Algeria, we relied on annual data from 2000 to 2023 for a set of economic variables.
This was done using the ARDL model to identify both short and long-term effects. This model is appropriate when determining the joint co-integration between variables.

- Unit root test:

Initially, we test the stationarity of the study variables to understand their statistical properties and degree of integration. Despite the availability of traditional tests for this purpose, we use the KPSS test due to its suitability for short time series, making it a better alternative.

Table 02: KPSS Unit root test results

Variable	Model	LM-Sat At the level	LM-Stat At the first difference	Critical value at 5 %
CP	Intercept	0.637	0.173	0.46
	Trend and intercept	0.07	0.09	0.14
FDI	Intercept	0.568	0.349	0.46
	Trend and intercept	0.09	0.123	0.14
OP	Intercept	0.598	0.123	0.46
	Trend and intercept	0.165	0.08	0.14
K	Inntecept	0.547	0.299	0.46
	Trend and intercept	0.178	0.059	0.14
HHI	Intercept	0.341	0.351	0.46
	Trend and intercept	0.172	0.08	0.14

Source: Author's calculation

The table shows the results of the KPSS test for stationarity at the level and the first difference. It showed that the variables did not stabilize at the level because the LM-STAT value is greater than the critical value at 5%, but at the first difference.

- Application of the Autoregressive Dstribbuted Lag (ARDL) approach

In this study, the ARDL method will be used, which is one of the dynamic modeling methods introduced by Pesaran. It is characterized by its ability to be used in cases where there is a mix of variable integration degree. To estimate the ARDL model, the following steps will be followed :

a) Estimating the ARDL Model :

First, we will estimate the model parameters and determine the optimal lag length for each variable in the study.

Table 03 : results of the ARDL model in the short term

Dependent Variable: HHI Selected Model: ARDL(2, 0, 0,0, 0) AdjRsq= 0.696402 DW= 2.35 Prob F(0.000)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
HHI(-1)	0.309746	0.247832	1.249822	0.2305
HHI(-2)	-0.783102	0.245376	-3.191442	0.0061
FDI	0.010446	0.011773	0.887305	0.3889
CP	-0.006586	0.002840	-2.318637	0.0349
OP	-0.003097	0.001341	-2.308857	0.0356
K	-0.003790	0.001104	-3.433464	0.0037
C	1.489604	0.357319	4.168834	0.0008

Source : Author's calculation

The table presents the results of the estimation using the least-squares method, where the p-value of Fisher's test is 0.00. This indicates the presence of model quality and the ability of the independent variables (FDI, CP, K, OP) to explain 69.64 % of the economic variation.
Additionally, the optimal lag structure for the model was determined to be (2,0,0,0), as shown in the following figure :

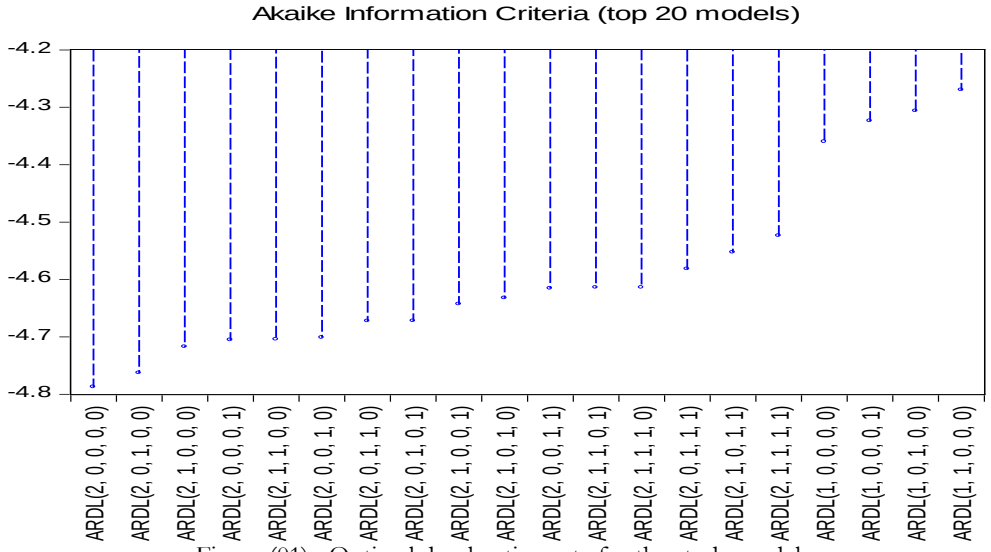

Figure (01) : Optimal deceleration rate for the study model
Source : Author's calculation

b) Boundary testing method :

The purpose of using the boubds testing approach is to determine wheter there is a long-term relationship between the internal variables in the study model, based on the the F-statistic. This is evaluated as follows:

- H0: No long-term relationship.
- H1: A long-term relationship .

Table 04: bounds test results

Test Statistic	Value	Signif	I(0)	I(1)
F-statistic	**1.92865**	10 %	2.45	3.52
K		5 %	2.86	4.01
		2. 5%	3.25	4.49
		1 %	3.74	5.06

Source: Author's calculation

The results of the bounds test and the table above concluded that the calculated F value, which is 1.928655, is greater than the critical table values at significance levels of 10%, 5%, and 2. 5%. Therefore, we reject the null hypothesis that indicates the absence of a long-term co-integration relationship and accept the alternative hypothesis, which suggests the existence of a long-term equilibrium relationship between the study variables.
Accordingly, since there is no long-term equilibrium relationship between the variables, the model's coefficients on the long-term will not be estimated.

c) Model validation tests:

In this section, we will check for the absence of standard issues based on a set of personal tests.

1. Contrast instability test:

This test involves the following two hypotheses:

- ✓ H0: stability of the random error variance.
- ✓ H1: instability of the random error variance.

Table 05: results of the variance stability test

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	2.435435	Prob. F(1,14)	0.1409
Obs*R-squared	3.260003	Prob. Chi-Square(2)	0.7301

Source: Author's calculation

From the results of the Breusch-Pegan-Godfrey test, there is no serial correlation because prob. F=0,1409 and is greater than 5%, and therefore we accept the null hypothesis that the variance of the random error term in the estimated function is constant.

2. Residual variance homogeneity test:

This test involves the following two hypotheses:

Table 06: results of the residual variance homogeneity test

Heteroskedasticity Test: ARCH			
F-statistic	1.563037	Prob. F(1,19)	0.2264
Obs*R-squared	1.596252	Prob. Chi-Square(1)	0.2064

Source: Author's calculation

Based on the test results shown in the table above, it is evident that the p-value of 0.2264 is greater than 5%. Therefore, we accept the null hypothesis, which indicates that the model is free from heteroscedasticity issues in the residuals.

3. Testing the validity of the functional form:

The results of testing the validity of the functional form, as shown in the table below:

Table 07: results of the Ramsey test

Ramsey RESET Test			
	Value	df	Probability
t-statistic	0.538028	14	0.5990
F-statistic	0.289474	(1, 14)	0.5990

Source: Author's calculation

It is evident that the value of the probability of the F-statistic equals 0.5990, which is greater than 5%. this confirms the validity and suitability of the functional form used in the estimation.

Summary and Interpretation of Study Results

This research paper addresses the determinants of economic diversification outside the the hydrocarbons sector to achieve economic takeoff in Algeria during the period 2000-2023. The empirical results of the study can be summarized as follows:

1. Trade Openness (OP):

The variable OP, which represents trade openness appeared with a negative sign and statistical significance at 5% when estimating the equation in the short term for the period 2000-2023. If the index increases by one unit, it has an inverse impact on economic diversification in Algeria, as the majority of its exports are oil-based. This index outside the hydrocarbons sector is considered economically closed.

2. Private Sector Credit (CP):

The variable CP, representing loans directed to the private sector during the period 2000-2023, also showed a negative sign and statistical significance at 5%. An increase in the index by one unit negatively affects economic diversification, reducing it by 0.003 in the short term. Private sector loans do not enhance investments or expand business scope, likely due to the absence of feasibility studies for private projects and the lack of continuous ad periodic follow-up, especially after financing phase. Additionally, weaknesses in loan recovery processes due to legal loopholes exacerbate the problem.
Overall, the private sector still exhibits a very marginal contribution, given the dominance of the public sector and its control over most economic and commercial activities.

3. Fixed Capital (K):

The variable K, representing fixed capital as a percentage of GDP, appeared with a negative sign and statistical significance at 1% in the short-term equation for the period 2000-2023. An increase in the index by one unit negatively impacts economic diversification, reducing it by 0.003 in the short term. This result can be attributed to significant flaws in financial resource allocation mechanisms. Large budgets are allocated to completing infrastructure and community facilities, often without financial returns. This type of spending is characterized by low efficiency and poor financial management, at the expense of postponing or sometimes canceling spending on productive investments major wealth-generating projects with high returns that could stimulate economic growth and diversification.

4. Foreign Direct Investment (FDI):

The variable FDI, representing foreign direct investment, did not show any impact when estimating the short-term equation for the period 2000-2023 in Algeria. This is because most foreign capital is

concentrated in extractive activities, especially oil and gas, which does not significantly contribute to diversifying the economic base.

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