

The impact of fish production on economic growth in Algeria during the period (1990-2022)

أثر الانتاج السمكي على النمو الاقتصادي في الجزائر خلال الفترة (2022-1990)

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Abstract:

This research seeks to measure the impact of fish production on economic growth in Algeria during the period (1990-2022), using the autoregressive distributed lag (ARDL) model and utilizing the Eviews 12 program, noting that the gross domestic product was adopted as a variable representing economic growth.

The results of the research concluded that there is a significant and positive impact of fish production on the gross domestic product in the short term and the long term, where the elasticity value reached 8.79% and 0.99%, respectively. Finally, a set of recommendations were presented that can be relied upon by decision-makers to increase the volume of fish production and economic growth.

Keywords: Fish production; economic growth; Algeria; bounds test for cointegration; ARDL model.

JELClassificationCodes: Q22, C13.

ملخص:

يسعى هذا البحث الى قياس أثر الانتاج السمكي على النمو الاقتصادي في الجزائر خلال الفترة (2022-1990)، باستخدام نموذج الإنحدار الذاتي للفجوات المتباطئة الموزعة ARDL. وبالاستعانة ببرنامج Eviews 12. مع الاشارة أنه تم اعتماد الناتج المحلي الاجمالي كمتغير ممثل للنمو الاقتصادي.

وتوصلت نتائج البحث الى وجود اثر معنوي و طردي للانتاج السمكي على الناتج المحلي الاجمالي في الأجل القصير والأجل الطويل، حيث بلغت قيمة المرونة 8.79% و 0.99% على التوالي. وفي الأخير تم تقديم جملة من التوصيات التي يمكن الاعتماد عليها من طرف أصحاب القرار للزيادة في حجم الانتاج السمكي والنمو الاقتصادي.

كلمات مفتاحية: الانتاج السمكي، النمو الاقتصادي، الجزائر، اختبار الحدود للتكامل المشترك، نموذج ARDL.

تصنيفات JEL: Q22، C13.

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INTRODUCTION:

The marine fishing sector is considered as major economic sector with a great potential in generating income, achieving food security, and creating job opportunities. In addition, it represents an important source of protein that enhances the growth of the human body. It also contributes significantly to creating added value for current and future generations. Thanks to the rise in per capita income in most countries of the world, developments in production technologies, the increase in the volume of investment directed to this sector, and awareness of healthy nutrition, activity in this sector increased. In terms of production, job opportunities, and the volume of trade exchange. The latest report issued by the Food and Agriculture Organization in 2022 indicates that global production of fisheries reached about 178 million tons in 2020, while the value of global exports reached 150 billion US dollars, and that more than 20 million people work directly in fisheries and aquaculture.

For Algeria, fishing is an activity that plays an important role in social and economic development, by contributing to improving the standard of living and well-being of coastal communities. In recent decades, it has become a strategic sector no less important than other sectors (agriculture, health, industry, etc.). The state has directed a number of investments in plans to develop and modernize fishing ports, as well as in programs to assist fishing communities to acquire new fishing equipment. Many strategies have also been developed for more effective management of fisheries in the face of various environmental and social challenges. Its aim is to increase national production of fish wealth and enhance the contribution of this sector to the economic and social development of Algeria.

• Research problem:

In order to know the contribution of the fishing sector to the achievement of economic growth in Algeria, we ask the following main question:

What is the impact of fish production on economic growth in Algeria during the period (1990-2022)?

• Research hypothesis:

Based on the above, we adopted the following basic hypothesis:

There is a positive impact of fish production on economic growth in Algeria during the period (1990-2022).

• Significance of the research:

The importance of the research derives from the importance of the marine fishing sector as a fundamental pillar that many countries, especially coastal ones, rely on generating income, achieve food security, and create job opportunities.

• Research objectives:

The research aims at:

- Discussing the concept of marine fishing and its types;
- Reviewing the state of global fish resources;

- Analysing growth indicators of the fishery sector in Algeria;
- Knowing the impact of fish production on economic growth in Algeria.

• **Research Methodology:**

This research adopted the deductive approach in its theoretical part, and the inductive approach in practical one.

1- Theoretical framework

In this part, we will discuss the following points:

1-1- Defining concepts:

Marine fishing means **“the activity of capturing fish that live in marine or regional water areas, whatever the nature of their waters. It includes continental fishing and fishing at sea”**.

The Algerian legislator defined it as **“every work aimed at hunting or extracting animals or harvesting plants whose permanent or predominant life environment is sea water”**.

Sustainable marine fishing means **“fishing using sustainable methods that do not deteriorate the reproductive capacity of the target fish species (no overfishing), and do not harm the ecosystem (such as the seabed).”** Sustainable fishing aims to protect certain species of fish and mollusks such as mussels, oysters, etc (Aquaportal, 2018).

Aquaculture is defined as **“the raising of specific types of aquatic organisms (fish, crustaceans, shellfish, algae, etc.), under human control and specific conditions, and spaces in earthen ponds or floating cages”** (the Saudi Ministry of Environment and Water and Agriculture).

In both cases, marine fishing or aquaculture are exploited for the purpose of marketing, as an economic activity which is submitted to the regulations imposed by the law.

Marine fishing is divided according to the fishing location into (Santiago montenegro):

- **High fishing:** This type of fishing is done in sea waters away from the coast. It is fishing that can be done in two ways: professional fishing (fishermen who work in industries and are responsible for fish services) and sport fishing.
- **Inshore Fishing:** It is done by small boats near the coast. These boats are small and carry strong nets. They only go a little far from the coast.
- **Artisanal fishing:** It is a type of fishing activity that uses traditional techniques with little technological development. It is practiced by small boats in coastal areas not exceeding 10 miles, within the so-called territorial sea.
- **Industrial fishing:** It is fishing aimed at catching large fish. It is carried out by owners of vessels more than 18 meters in length, allowing trawling, longlining and fence fishing to rely on systems incorporating better technology, and enabling industrial fishing to capture large quantities of sea resources.

Furthermore, depending on the purpose of fishing, there are sport fishing and commercial fishing. Sport fishing is that practiced for a recreational purpose, and commercial fishing is that practiced for a commercial purpose.

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1-2- Analysis of the main indicators of marine fishing in Algeria:

1-2-1- Fish production:

The national programs developed by Algeria to encourage investment in the fishing sector, in addition to a set of legal texts regulating the profession, such as specifying fishing methods, minimum commercial sizes, and the type of boxes used in storage (Hakima Mokhtar Rahmani, 2016, p. 65), in addition to the capabilities that Algeria possesses in this field (an area allocated for marine fishing is estimated at 9.5 million hectares, 194 types of fish) (Khadija Touati, 2022, p. 399) had a positive impact on fish production in Algeria during the period (1990-2022), with an average annual production estimated at 109,795 tons and an annual growth rate of 1.6% on average.

Table 1 and Figure 1 show us that the development of fish production witnessed fluctuations during this period. A decrease in rates ranging between 26% and 2% appears during certain years of the study period, and this is due to natural conditions such as climate changes experienced by the coast, the non-renewal of the marine fleet during the 1990s, a decrease in cooling and storage means for this product, and global health crises, such as the Corona pandemic 2019. On the other hand, other years of the study period witnessed an increase in the volume of fish production by rates ranging from 0.8% to 31%. This is due to the economic plans implemented by the government to develop the sector.

Table (1): Evolution of fish production (tons) and growth rate during (1990-2022)

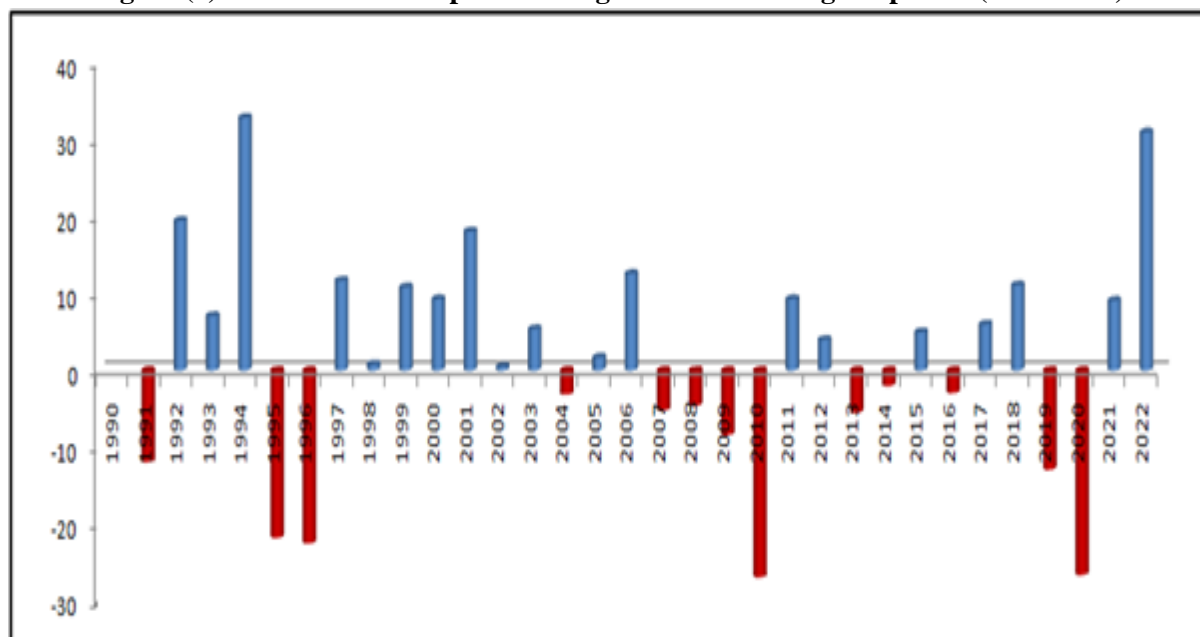
Years	1990	1991	1992	1993	1994	1995	1996
Production	90603	79852	95421	102200	135799	106248	82318
Growth rate%	-	-11,9	19,5	7,1	32,9	-21,76	-22,5
Years	1997	1998	1999	2000	2001	2002	2003
Production	91907	92620	102649	113157	133623	134320	141528
Growth rate%	11,7	0,8	10,83	9,3	18,1	0,5	5,4
Years	2004	2005	2006	2007	2008	2009	2010
Production	137108	139459	157021	148842	142035	130120	95168
Growth rate%	-3,1	1,7	12,6	-5,2	-4,6	-8,4	-26,9
Years	2011	2012	2013	2014	2015	2016	2017
Production	104000	108207	102220	100150	105200	102140	108300
Growth rate%	9,3	4,0	-5,5	-2,0	5,0	-2,9	6,0
Years	2018	2019	2020	2021	2022	Average	
Production	120354	104880	76955	83979	109978	109795	
Growth rate%	11,1	-12,9	-26,6	9,1	31,0	1.6	

Source: (Minister of Fishing and Fishery Products).

- (World bank).

The growth rate of fish production in Algeria for the period (1990-2022) can be illustrated through the following figure:

Figure (1): Evolution of fish production growth rate during the period (1990-2022)



Source: Made by the researcher based on the data in Table 1.

Algeria's fish production witnessed a significant increase in the year 2023, as it rose to 120,000 tons over the production of 2022. This increase came thanks to the modernization of the marine fishing fleet, in addition to the trend towards marine and continental aquaculture, within sector plan extending to year 2030 (Toufik Aknini, 2023).

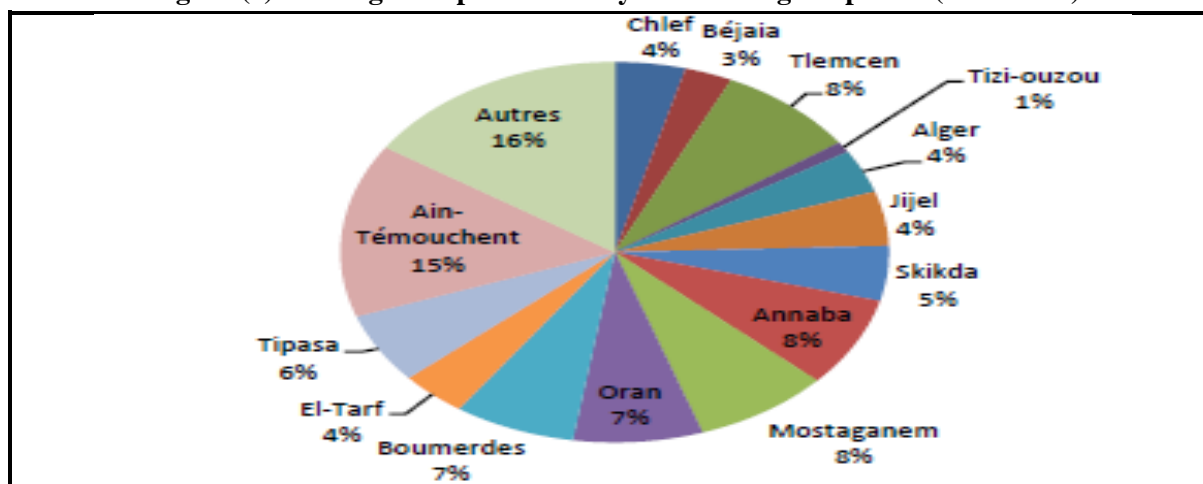
In this regard, there are 42 marine aquaculture projects, including two farms that were completed during 2023, with the cultivation of 79 floating cages. As for freshwater aquaculture, it includes 3 branches and 51 productive farms, of which 10 farms entered production this year, in addition to 52 projects under implementation.

As for accompanying entrepreneurship and innovative projects in the fishing sector, there are 71 projects that have been granted the label of a startup, and these projects will be accompanied at the level of fishing directorates and chambers to become productive projects that contribute to creating job and increasing the amount of fish production in Algeria (Algerian Radio, 2023).

At the regional level, sector statistics show that the state of Ain Temouchent ranks first in fish production during the period (2010-2019), achieving an average production of about 15,515 tons, i.e. approximately 15% of the average total national production. The state of Tlemcen occupies the second place with an average production of 8,670 tons, followed by Mostaganem, Annaba, and Oran, with a production of 8,424, 8,056, and 8,025 tons, respectively (Statistics National Office, January 2022, p. 11).

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Figure (2): Average fish production by state during the period (2010-2019)



Source: (Statistics National Office, January 2022, p. 11).

1-2-2- Fishing fleet:

In 2019, the total number of fishing vessels reached 5,793 vessels, representing a positive growth of 3.1% compared to last year. This fleet is dominated by ships less than 6 meters in length (43.8%). It is divided into three main sections: small boats (61.3%), sardine fishing boats (28.7%), and fishing vessels (9.5%). It should be noted that 44.4% of this fleet are inactive ships (National Statistics Office, 2022, p. 1).

The following table shows us the development of the fishing fleet in Algeria, which witnessed an upward trend during the period (2000-2019), with an increase estimated at 3,241 fleets and a growth rate of 58.4%.

Table (2): Development of the fishing fleet in Algeria during the period (2000-2019)

Years	2000	2001	2002	2003	2004	2005	2006
Number	2 552	2 692	2 898	3 292	3 643	3 984	4 179
Years	2007	2008	2009	2010	2011	2012	2013
Number	4 442	4 445	4 532	4 191	4 327	4 414	4 580
Years	2014	2015	2016	2017	2018	2019	Average
Number	4 787	5 034	5 329	5 494	5 617	5 793	4311

Source: (Minister of Fishing and Fishery Products).

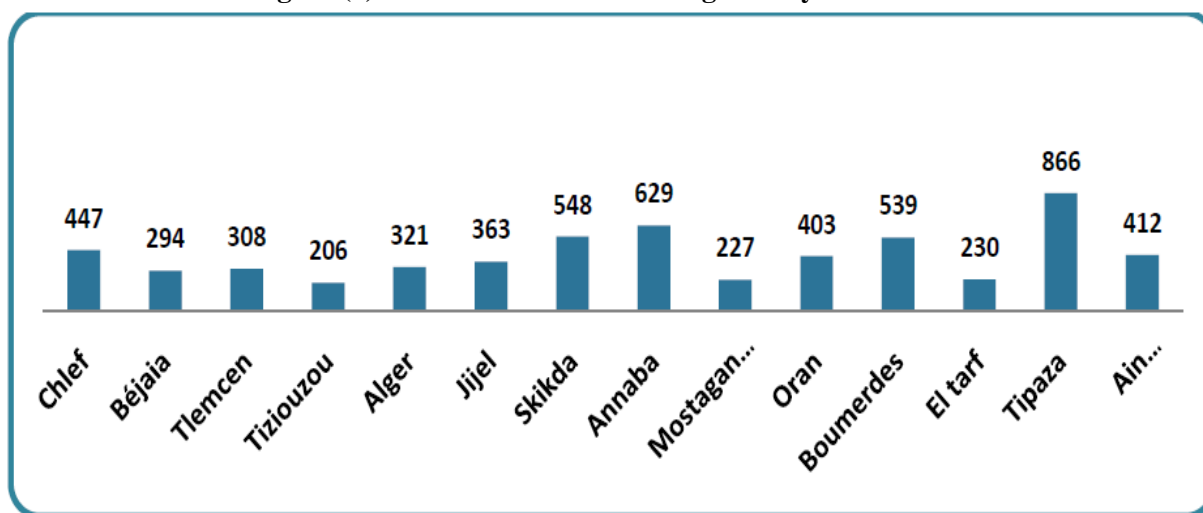
The development of the national fleet showed the following (National Statistics Office, 2022, p. 1):

- Small boats, which represent more than 60% of the total vessels, decreased by 3.3% compared to 2018. Add to this is the significant inactivity rate of fishing units, as 57% of the vessels are inactive. This sector is dominated by vessels less than 6 meters in length, accounting for approximately 71% of the total small boats.
- The same applies to fishing vessels whose number has decreased by one unit. Most of these ships are between 12 and 24 meters long. The rest belong to the category of more than 24 meters in length.

- On the other hand, sardine fishing boats increased by 21.6% compared to 2018. Nearly 78% of the vessels are active. they are between 12 and 24 meters in length.
- As for tuna boats, the year 2019 recorded an increase of 5 units compared to 2018, as their number increased from 19 to 24 units, including two inactive tuna boats.

The distribution of the national fishing fleet according to the coastal states in 2019 reveals that Tipaza holds the largest share with 866 fishing vessels, or 15% of the national fleet, followed by Annaba, Skikda, Boumerdes and Chlef with 629 units, 548 units, 539 units, and 447 units, respectively.

Figure (3): Distribution of the fishing fleet by state in 2019



Source: (National Statistics Office, 2022, p. 2).

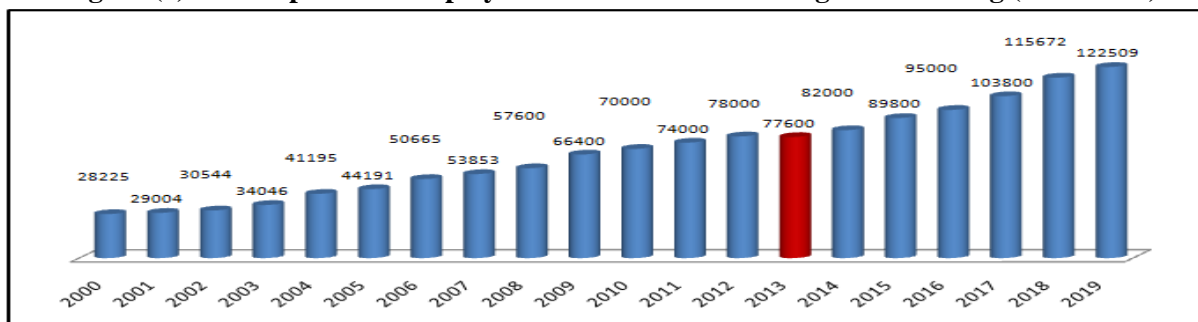
As for the distribution by ports during the same year, it indicates that the port of Annaba has the largest number, with 535 ships, followed by the ports of Tenes and Bouharoun, with 447 and 333 ships, respectively. Algeria has worked to strengthen the capabilities of the Algerian fishing fleet in 2023 by increasing the number of large vessels more than 24 meters in length to more than 100 vessels, including 33 vessels intended for tuna fishing on the high seas (Souikat Abdel Moneim, 2023).

1-2-3- Human capabilities:

The total number of jobs in the marine fishing sector increased from 28,225 positions in 2000 to 122,509 positions in 2019, an increase of 94,284 positions and a growth rate of 334.04%. The development of employment in the marine fishing sector was marked by an ascending trend, with the exception of 2013, when a slight decrease of 1% was observed. The development witnessed by the marine fleet and fishing production in Algeria was accompanied by an increase in the labor force in the sector, as shown in the following figure:

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Figure (4): Development of employment in the marine fishing sector during (2000-2019)



Source: Made by the researcher based on: (Minister of Fishing and Fishery Products).

- (Statistics National Office, January 2022, p. 32).

The same applies to direct employment, which represents 52% of total employment, as it moved from 28,456 positions in 2010 to 63,964 positions in 2019, with a growth rate of 124.78%.

On average, of the 39,945 marine registrations, 85% are considered fishermen, 10% as coastal skippers and 5% as mechanics. The number of Fishermen witnessed a continuous increase throughout the period, except for a 1.4% decline recorded in 2013.

The same trend is observed for coastal skippers, as the annual growth is estimated at 5%. This growth led to the creation of 3,074 positions over 20 years. However, this category showed an estimated decrease of 1.9% in 2018 compared to 2017.

With regard to mechanics, after a decrease of 1.6% in 2011, a successive increase was observed throughout this period, as it reached to 2731 positions in 2019 compared to 1443 positions in 2000.

As for indirect employment, the period 2000-2019 was characterized by the creation of 48,599 positions, as it increased from 3159 in 2000 to 51758 positions in 2021.

Table (3): Development of professional categories in the marine fishing sector (2000-2019)

Professional categories	2000	2001	2002	2003	2004	2005	2006
Direct employment (maritime registrants)	25066	26857	27380	29802	29219	29661	32246
including - Coastal skippers	2837	3337	3337	3461	3516	3624	3846
Mechanics	1443	1 585	1478	1 527	1674	1615	1772
Sailors fishermen	20786	21935	22565	24814	24029	24422	26628
Indirect employment	3159	2147	3164	4244	11976	14530	18419
Total	28225	29004	30544	34046	41195	44191	50665
Professional categories	2007	2008	2009	2010	2011	2012	2013
Direct employment (maritime registrants)	37157	38419	40678	41544	42760	43600	44479
including - Coastal skippers	3864	4284	3646	3699	3832	4247	4601
Mechanics	2262	1989	1883	1890	1860	2024	2236
Sailors fishermen	31031	32146	35149	35955	37068	37329	37642
Indirect employment	16696	19181	25722	28456	31240	34400	37521
Total	53853	57600	66400	70000	74000	78000	82000
Professional categories	2014	2015	2016	2017	2018	2019	Average
Direct employment (maritime registrants)	44479	48072	49836	53921	56206	58545	39945
including - Coastal skippers	4601	5065	5375	5449	5347	5911	3993

Mechanics	2236	2509	2518	2595	2699	2731	2021
Sailors fishermen	37642	40498	41943	45877	48160	49903	32128
Indirect employment	37521	41728	45164	49879	59466	63946	27260
Total	82000	89800	95000	103800	115672	122509	67205

Source: (Statistics National Office, January 2022, p. 32)

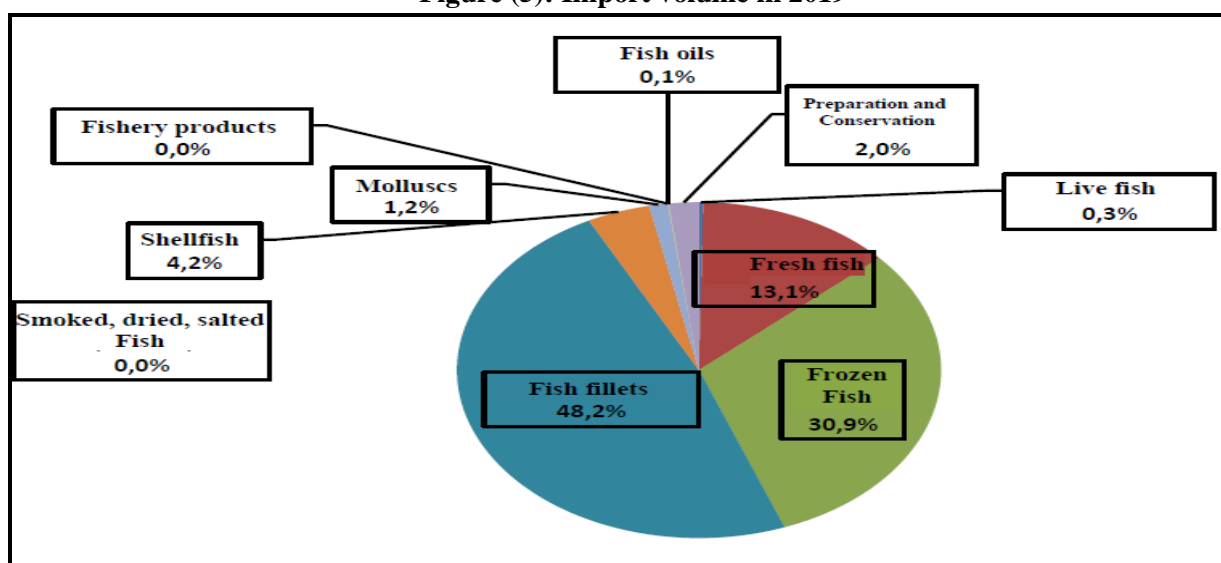
1-2-4- Fish exports and imports:

1-2-4-1- Fish imports:

Imports of fishery products witnessed an increase from 7,903 tons in 2000 to 35,063 tons in 2019, with an estimation of 27,160 tons, and a growth rate of 343.66%. The development of the volume of fish imports was characterized by an upward trend from 2000 to 2014, as it moved from 7,903 tons to 45,808 tons, recording a positive growth estimated at 479%. Then the volume of fish imports decreased by 35.6% in 2018 compared to 2014.

On the other hand, the year 2019 witnessed positive growth estimated at 13.6% compared to 2018. This growth is mainly due to the increase recorded in imports of fish fillets and fresh fish by 37.9% and 44.5%, respectively. Apart from these two products, imports of frozen fish, which represent 31% of total imports, decreased by 3.7% compared to the previous year (National Statistics Office, 2022, p. 6).

Figure (5): Import volume in 2019



Source: (National Statistics Office, 2022, p. 7).

In terms of value, 2019 imports raised to 117.8 million US dollars, compared to 16.9 million dollars in 2000, an increase of 29.9% annually. The highest amount was recorded in 2014, raising to 144.2 million US dollars. It should be noted that two decreases of 21% and 18.3% were recorded in 2015 and 2018, respectively. This is what the following table shows:

Table (4): Development of fish imports during the period (2000-2019)

Years	2000	2001	2002	2003	2004	2005	2006
Quantity (tons)	7 903	7894	11242	21797	22902	20501	19446
Value (million dollars)	16,9	13,9	9	16,5	23,1	21,0	24,3
Years	2007	2008	2009	2010	2011	2012	2013

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Quantity (tons)	18041	18201	28054	25552	29173	36094	34946
Value (million dollars)	21,7	31,4	53,2	40,7	58,6	86,9	99,4
Years	2014	2015	2016	2017	2018	2019	Average
Quantity (tons)	45808	43430	44333	40307	30863	35065	37207
Value (million dollars)	144,2	114	116,4	121,8	99,5	117,8	58,6

Source: (Minister of Fishing and Fishery Products).

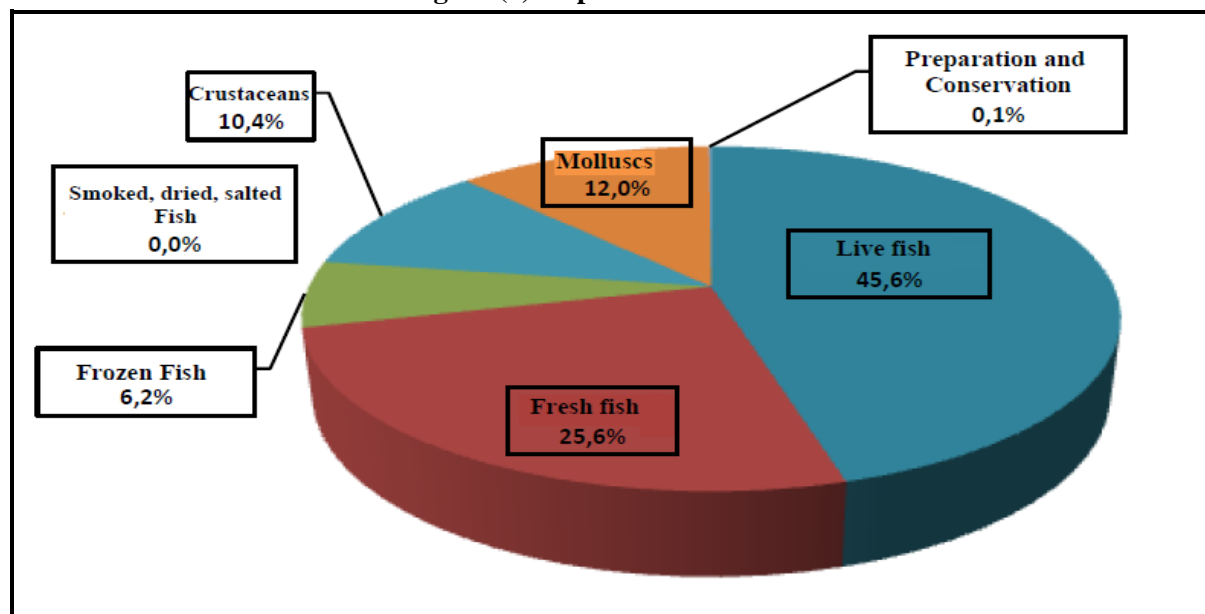
- (Statistics National Office, January 2022, p. 42).

1-2-4-2- Fish exports:

Exports of fishery products witnessed an increase from 1,452 tons in 2000 to 1,999 tons in 2019, an increase estimated at 547 tons, with a growth rate of 37.67%. This increase is small compared to the increase witnessed in imports of fishery products during the same period.

The volume of exports during the period (2000-2019) witnessed significant fluctuations. The year 2018 witnessed a noticeable increase of approximately 149% compared to 2017; and in 2019, the volume of fishing sector exports reached 1,999 tons worth \$9.1 million. Compared to 2018, the exported quantity was estimated at 4,159 tons worth \$12.4 million, a decrease of approximately 52% in volume and 26.2% in value. Almost all fishing products were affected by this decline, especially mollusks and fresh fish, by -81.2% and -56.8%, respectively. On the other hand, the volume of live fish, which constitutes 39.3% of the total export volume, increased by 98.8%, from 395.2 tons in 2018 to 785.6 tons in 2019 (National Statistics Office, 2022, p. 8).

Figure (6): export volume in 2019



Source: (National Statistics Office, 2022, p. 8)

In terms of value, exports amounted to US\$9.1 million in 2019 compared to US\$4.7 million in 2000, a growth rate of 93.6% annually. The highest value was recorded in 2008 at 15.1 million US dollars. This is as shown in the table below.

Table (5): Development of fish exports during the period (2000-2019)

Years	2000	2001	2002	2003	2004	2005	2006
Quantity (tons)	1452	1647	2479	1852	2358	2249	2109
Value (million dollars)	4,7	5,4	5,9	6,9	11,0	11,8	11,9
Years	2007	2008	2009	2010	2011	2012	2013
Quantity (tons)	2186	3122	2124	1696	1494	1638	1504
Value (million dollars)	12,2	15,1	9,7	6,9	6,7	6,5	6,3
Years	2014	2015	2016	2017	2018	2019	Average
Quantity (tons)	1949	1900	2255	1670	4159	1999	1850
Value (million dollars)	7,8	6,3	6,7	7,4	12,4	9,1	8,5

Source: (Minister of Fishing and Fishery Products).

- (Statistics National Office, January 2022, p. 42)

Algeria exports no less than 5,000 tons of fishing products in 2023. In addition to exporting live tuna to fattening farms in Tunisia, Turkey and Malta, octopus and shrimp to European markets, and canned goods to the Arab and African markets. The government relies on fishing products to increase the volume of exports outside of fuel, and to revive the public treasury with hard currency (Maryam Sharfi, 2024).

2- Standard framework

In this part, we will discuss the following points:

2-1- Determine the model variables:

In order to measure the impact of fish production on economic growth in Algeria during the period (1990-2022), we take the basic formula of the model in its logarithmic form as follows:

$$\text{LogGDP}_i = B_0 + B_1 \text{LogFP}_i + \varepsilon_i$$

We point out here that the logarithm (Log) was used to estimate the relationship due to the good results it showed compared to the results before the introduction of the logarithm. This is in addition to the fact that it reduces the characteristic of the non-stationarity of the variance of the random error term. Besides, the values of the coefficients of the variables can be interpreted as elasticities, revealing accuracy in interpretation and diagnosis.

The variables included in the model are defined as follows:

GDP : Gross Domestic Product (million dollars) as a measure of economic growth in Algeria.

EXPF : Fish production (thousand tons).

ε_i : The term of random error, expressing the effect of other variables that were not included in the model and that may be unmeasurable or unknown, assuming that its values are normally distributed with an expectation equal to zero and a constant variance.

B_0, B_1 : represents the model parameters.

The study covers the period between 1990 and 2022. As for the data sources related to the variables of the model relied on in the estimation process, they were obtained from the World Bank database.

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To measure this relationship, we will rely on the Autoregressive Distributed Lag (ARDL) model.

2-2- Measuring the model:

2-2-1- Unit Root Tests for the Variables:

The stability of the model variables is studied based on the Dickey-Fuller (ADF) and Phelp's-Perron (PP) tests, and the results appear in the following table (see Appendix 01):

Table (6): unit root test

Type of I(1)
log(GDP _t) ,Log(FP _t)

Source : Outputs of the Eviews12 program.

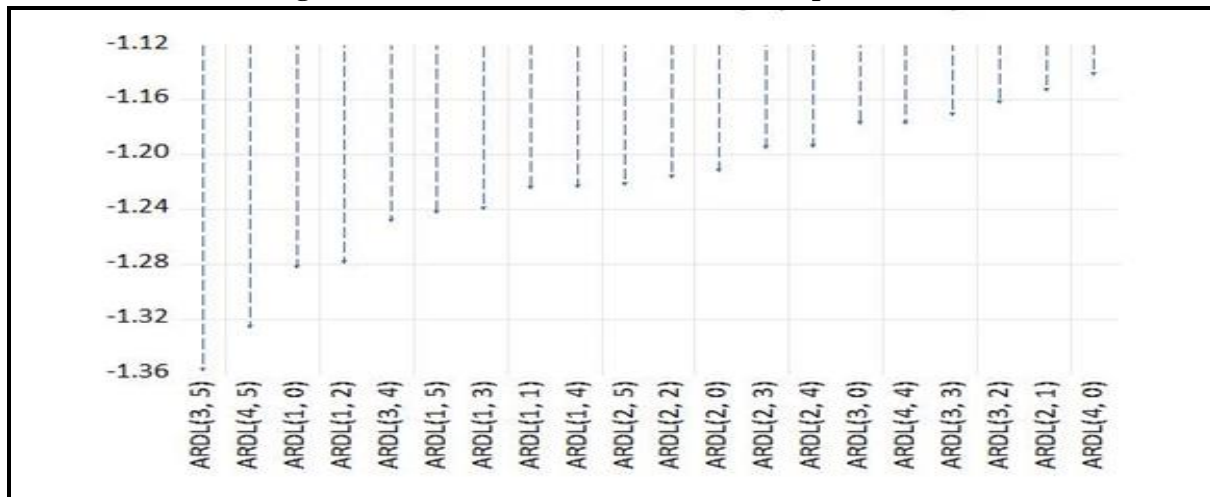
The results of the unit root tests using both the ADF and PP test, shown in Appendix 01, revealed that all series contain a unit root, and therefore the series are unstable during the period studied at the level, and this is confirmed by the PP test, as the absolute values of the estimated statistics are less than the critical values At a significance level of 5%.

After conducting the first difference, all the series stabilized at the 5% level of significance, and this is for both the ADF and PP tests. Hence, the series are stable during the study period at the first difference, and therefore in this case it is possible to rely on the ARDL cointegration methodology.

2-2-2- Determine the optimal degree of delay:

The optimal ARDL model in terms of the number of delays for the variables included in the model is ARDL(3,5), based on the Akaike criterion (minimum value), as shown in the following figure:

Figure (7): Akaike Information Criteria (top 20 model)



Source : Outputs of the Eviews12 program.

2-2-3- Cointegration test (Bounds test):

To detect the existence of a long-term relationship between variables, the bounds test is used, by comparing the F value calculated for the coefficients of the independent variables with the value of the critical F statistic, according to the limits set by Pesaran and al.

Table (7): Results of the Bounds test

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic k	7.180430 1	Asymptotic: n=1000		
		10%	3.02	3.51
		5%	3.62	4.16
		2.5%	4.18	4.79
		1%	4.94	5.58
Actual Sample Size	28	Finite Sample: n=35		
		10%	3.223	3.757
		5%	3.957	4.53
		1%	5.763	6.48
		Finite Sample: n=30		
		10%	3.303	3.797
		5%	4.09	4.663
		1%	6.027	6.76

Source : Outputs of the Eviews12 program.

We note from the table above that the calculated F statistic of (7.18) is greater than the tabulated F values at the 1% level, which means that there is a long-term cointegration relationship between the model variables.

2-2-4- Estimating the relationship in long-term and short-term:

After confirming the existence of a long-term equilibrium relationship between fish production and GDP in Algeria, we estimate the relationship in the short and long term, and the results appear in the following table:

Table (8): Results of estimating long-term and short-term

ARDL Long Run Form and Bounds Test				
Dependent Variable: DLOG(GDP)				
Selected Model: ARDL(3, 5)				
Case 2: Restricted Constant and No Trend				
Date: 03/04/24 Time: 13:58				
Sample: 1990 2022				
Included observations: 28				
Conditional Error Correction Regression				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.297189	1.207837	-2.729829	0.0138
LOG(GDP(-1))*	-0.113331	0.041739	-2.715246	0.0142
LOG(FP(-1))	0.996809	0.271379	3.673131	0.0017
DLOG(GDP(-1))	-0.277172	0.210864	-1.314461	0.2052
DLOG(GDP(-2))	-0.438399	0.215573	-2.033651	0.0570
DLOG(FP)	0.306384	0.196443	1.559661	0.1362
DLOG(FP(-1))	-0.775461	0.227252	-3.412335	0.0031
DLOG(FP(-2))	-0.644272	0.239661	-2.688265	0.0150
DLOG(FP(-3))	-0.484173	0.200117	-2.419454	0.0264
DLOG(FP(-4))	-0.341851	0.181161	-1.886999	0.0754
* p-value incompatible with t-Bounds distribution.				
Levels Equation				
Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(FP)	8.795535	3.375611	2.605612	0.0179
C	-29.09338	15.64516	-1.859577	0.0794
EC = LOG(GDP) - (8.7955*LOG(FP) - 29.0934)				

Source : Outputs of the Eviews12 program.

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The table shows us the following:

- The fish production variable has a positive and significant impact on the GDP in Algeria during the study period in the long term, as an increase in fish production by 1% leads to an increase in the GDP by 8.79%.
- The fish production variable has a positive and significant impact on the GDP in Algeria during the study period in the short term, as an increase in fish production by 1% leads to an increase in the GDP by 0.99%.
- The value of EC_{i-1} is significant and negative (-0.113331). This indicates that the long-term model corrects the errors of the short-term model within a period of 9 years.

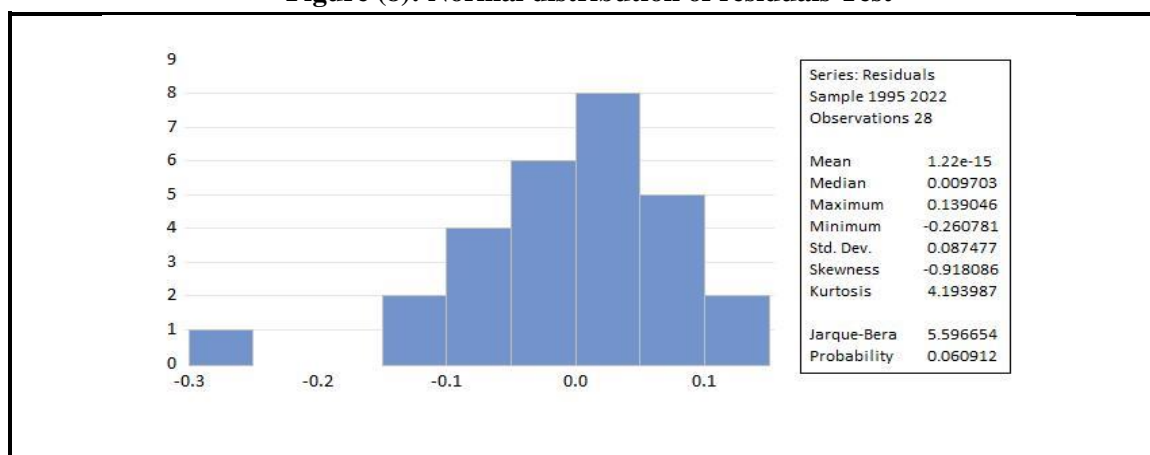
2-2-5- Model validity test:

The validity of the model can be determined through the following statistical tests:

2-2-5-1- Normal distribution of residuals test:

From the figure, we find that the corresponding value of the Jarque-Bera test is 5.59, which is greater than the 5% significance level, and therefore the residuals of the model follows a normal distribution.

Figure (8): Normal distribution of residuals Test



Source : Outputs of the Eviews12 program.

2-2-5-2- Heteroscedasticity test (ARCH):

From the table below, we find that the probability value of the F statistic (0.097) is greater than the critical value at the significance level of 0.05, and therefore the residuals do not suffer from the problem of heterogeneity of variance.

Table (9): Heteroscedasticity Test

Heteroskedasticity Test: ARCH			
F-statistic	0.097313	Prob. F(1,25)	0.7577
Obs*R-squared	0.104690	Prob. Chi-Square(1)	0.7463

Source : Outputs of the Eviews12 program.

2-2-5-3- Error autocorrelation test:

From the table below, we find that the probability corresponding to the Breusch-Godfrey Serial Correlation LM test (1.03) is greater than the significance level of 0.05, so we reject the null hypothesis that there is no autocorrelation of errors.

Table (10): Error autocorrelation test

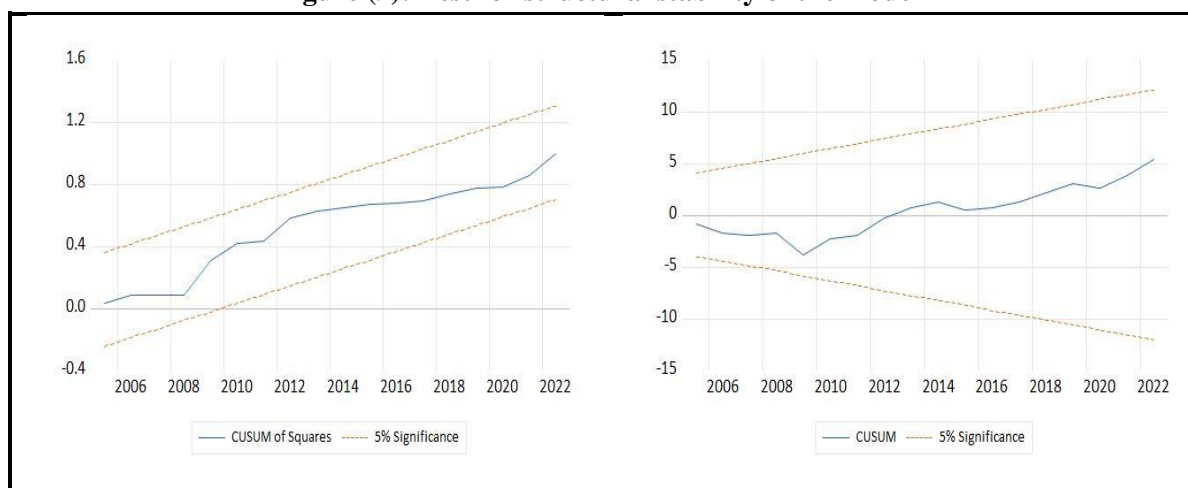
Breusch-Godfrey Serial Correlation LM Test			
Null hypothesis: No serial correlation at up to 2 lags			
F-statistic	1.035684	Prob. F(2,18)	0.3752
Obs*R-squared	2.992804	Prob. Chi-Square(2)	0.2239

Source : Outputs of the Eviews12 program.

2-2-5-4- Test for structural stability of the model:

It is clear from the figure below that the estimated coefficients of the model are structurally stable over the period under study, as the graph of the two test statistics (CUSUM,CUSUMSQ) for this model fell within the critical limits at the 5% significance level.

Figure (9): Test for structural stability of the model



Source : Outputs of the Eviews12 program.

Conclusion:

The most important conclusions reached in this research are as follows:

- Marine fishing is the activity of capturing fish that live in marine or territorial water areas. It includes continental and sea fishing.
- Fish production in Algeria witnessed positive growth during the period (1990-2022), with an increase estimated at 100,375 tons and a growth rate of 21.4%.
- The fishing fleet in Algeria witnessed an upward trend during the period (2000-2019), with an increase estimated at 3,241 fleet and a growth rate of 58.4%.
- The total number of positions in the marine fishing sector increased from 28,225 positions in 2000 to 122,509 positions in 2019, an increase of 94,284 positions and a growth rate of 334.04%.
- Imports of fishery products witnessed an increase from 7,903 tons in 2000 to 35,063 tons in 2019, with an estimation of 27,160 tons, and a growth rate of 343.66%.

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- Exports of fishery products witnessed an increase from 1,452 tons in 2000 to 1,999 tons in 2019, with an estimation of 547 tons, and a growth rate of 37.67%.
- There is a significant and positive impact of fish production on the GDP in the long term, as the elasticity value reached 8.79%.
- There is a significant and positive impact of fish production on the gross domestic product in the short term, as the elasticity value reached 0.99%.

In the light of these results, we recommend the following:

- Updating and modernizing the statistical information system for marine fishing and aquaculture in Algeria, with the aim of supporting the decision-making mechanism at the government level, with regard to setting policies and development programs related to marine fishing and aquaculture.
- Supporting financing of aquaculture production projects in areas identified by the National Fisheries and Aquaculture Development Plan through the Economic Recovery Support Programme.
- Improving the social and economic conditions of fishermen and aquaculturists.
- Strengthening international cooperation in the field of marine fishing to ensure its development and modernization, through the transfer of modern technologies in this field.
- Strengthening the partnership between the fishing sector and other vital sectors, especially in the field of scientific research.
- Encouraging young people to establish small and medium enterprises in the field of marine fishing and aquaculture, with the need to provide them with accompaniment.

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Appendix 1: unit root test

UNIT ROOT TEST TABLE (PP)			
<u>At Level</u>			
		LOG(GDP)	LOG(FP)
With Constant	t-Statistic	-0.4377	-2.5191
	<i>Prob.</i>	0.8907	0.1205
		n0	n0
With Constant & Trend	t-Statistic	-2.1737	-2.4034
	<i>Prob.</i>	0.4873	0.3710
		n0	n0
Without Constant & Trend	t-Statistic	1.2912	0.6219
	<i>Prob.</i>	0.9469	0.8455
		n0	n0
<u>At First Difference</u>			
		d(LOG(GDP))	d(LOG(FP))
With Constant	t-Statistic	-5.2329	-5.5806
	<i>Prob.</i>	0.0002	0.0001
		***	***
With Constant & Trend	t-Statistic	-5.1337	-7.5182
	<i>Prob.</i>	0.0013	0.0000
		***	***
Without Constant & Trend	t-Statistic	-4.7980	-5.8425
	<i>Prob.</i>	0.0000	0.0000
		***	***
UNIT ROOT TEST TABLE (ADF)			
<u>At Level</u>			
		LOG(GDP)	LOG(FP)
With Constant	t-Statistic	-0.3287	-2.6578
	<i>Prob.</i>	0.9097	0.0924
		n0	*
With Constant & Trend	t-Statistic	-1.9555	-2.6154
	<i>Prob.</i>	0.6025	0.2764
		n0	n0
Without Constant & Trend	t-Statistic	1.4470	0.1294
	<i>Prob.</i>	0.9602	0.7165
		n0	n0
<u>At First Difference</u>			
		d(LOG(GDP))	d(LOG(FP))
With Constant	t-Statistic	-5.2367	-4.9832
	<i>Prob.</i>	0.0002	0.0003
		***	***
With Constant & Trend	t-Statistic	-5.1352	-4.6735
	<i>Prob.</i>	0.0012	0.0041
		***	***
Without Constant & Trend	t-Statistic	-4.7612	-5.0635
	<i>Prob.</i>	0.0000	0.0000
		***	***

Notes: (*) Significant at the 10%; (**) Significant at the 5%; (***) Significant at the 1%. and (no) Not *MacKinnon (1996) one-sided p-values.

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Source : Outputs of the Eviews12 program.