

The impact of monetary and fiscal policies on CO₂ emissions in Algeria during the period (1990-2025)**أثر السياسات النقدية والمالية على انبعاثات غاز ثاني أكسيد الكربون في الجزائر خلال الفترة (1990-2025)****LACHI Oualid¹, BECHIR Sabiha²**¹ University of Adrar, Faculty of Economic Sciences, Management Sciences, and Commercial Sciences, Department of Economics (Algeria), oua.lachi@univ-adrar.edu.dz² Centre de Recherche en Technologies Agro-Alimentaires, Route de Targa Ouzemmour, Campus Universitaire, Bejaia, 06000 (Algeria), sabiha.bechir@crtta.univ-bejaia.dz**Received:** 14/05/2026**Accepted:** 11/06/2026**Published:** 12/06/2026**Abstract:**

Monetary and fiscal policies influence macroeconomic variables: investment, consumption, and the level of production of economies. These policies can indirectly impact the environment, particularly CO₂ emissions. This negatively affects climate change and economic development; for this, the governments and central banks are called upon to guarantee a certain balance between economic growth and the environment. This paper seeks to shed light on the reality of carbon dioxide emissions in Algeria and study the impact of monetary and fiscal policies on carbon dioxide emissions in Algeria during the period 1990-2025 using the ARDL model.

We reached the conclusion that the two policies have an inverse effect on CO₂ emissions through the public spending tool in fiscal policy and the real interest rates tool in monetary policy, while the GDP per capita variable positively affects carbon dioxide emissions during the study period.

Keywords: Monetary Policy; Fiscal Policy; CO₂ Emissions; Algeria; ARDL Model.

JEL Classification Codes: Q54, E61, Q48, C10.

ملخص:

تؤثر السياسات النقدية والمالية على المتغيرات الاقتصادية الكلية كالاستثمار والاستهلاك وعلى حجم الإنتاج، وبالتالي هذه السياسات تؤثر بشكل غير مباشر على البيئة وبشكل خاص على انبعاثات غاز ثاني أكسيد الكربون مما يؤثر سلبا على التغيرات المناخية والتنمية الاقتصادية، ولهذا يجب على الحكومات والبنوك المركزية أن تسعى إلى ضمان توازن بين تحقيق معدلات نمو اقتصادية مرتفعة مع الحفاظ على البيئة، من هذا المنطلق تسعى هذه الورقة البحثية إلى تسليط الضوء على واقع انبعاثات غاز أكسيد الكربون في الجزائر ودراسة مدى تأثير السياسة النقدية والمالية على انبعاثات غاز أكسيد الكربون في الجزائر خلال الفترة 1990-2025 باستخدام نموذج *ARDL*.

وقد توصلنا إلى نتيجة مفادها أن السياستين تؤثران عكسيا على انبعاثات غاز أكسيد الكربون، ذلك من خلال متغير الانفاق الحكومي كأداة للسياسة المالية ومتغير معدلات الفائدة الحقيقية كأداة للسياسة النقدية، بينما يؤثر الدخل الفردي إيجابا على انبعاثات غاز CO_2 .

كلمات مفتاحية: السياسة النقدية، السياسة المالية، انبعاثات غاز CO_2 ، الجزائر، نموذج *ARDL*.

تصنيفات JEL: Q54, E61, Q48, C10.

INTRODUCTION

Climate change constitutes one of the greatest challenges of the 21st century, largely caused by greenhouse gas emissions linked to the intensive exploitation of natural resources. Recently, the dangers of climate change have intensified due to the increased frequency of extreme weather and climate events on a global scale (Dai and Zhang 2023). Most studies in environmental economics that have been carried out over the last two decades show the need to take immediate measures to mitigate environmental pollution (Chishti et al. 2021).

According to the International Energy Agency, in 2022, the largest global emitters are China, the United States, and the European Union, where, during this year, global CO₂ emissions reached 36.8 billion tonnes, illustrating the scale of the environmental crisis. This state forces governments and central banks, while keeping price stability and maintaining economic growth, to make crucial decisions to resolve this problem (Scalia 2023).

Monetary and fiscal policies appear to be an essential lever to integrate into strategies to combat climate change, because they exert a significant influence on the dynamics of CO₂ emissions, which gives authorities the power to reduce these emissions through using their different tools. This study shows the scale of emissions globally and the need to mitigate them; it also shows the complementary relationship between the economy and the environment, as well as the effects of economic policies on global greenhouse gas emissions and on the environment in general.

During the study period, international reports indicate that carbon dioxide emissions in Algeria are continuously increasing, and among the most contributing sectors are the transport sector, energy production, and the combustion of fossil fuels.

In this study, we will highlight the reality of carbon dioxide emissions in Algeria during the period from 1990 to 2025 and some measures taken to address emissions. Additionally, we will conduct an empirical study using the ARDL model to illustrate the extent of the impact of monetary and fiscal policies on carbon dioxide emissions in Algeria during the period 1990 to 2025.

In this context, a key question deserves to be asked:

What is the impact of monetary and fiscal policies on CO₂ emissions in Algeria during the period 1990-2025?

To answer this question, several hypotheses will be discussed in this study:

- Restrictive monetary and fiscal policy reduces CO₂ emissions.
- Expansionary monetary and fiscal policy increases CO₂ emissions.

For methodological reasons, to respond to the problem of our study, firstly, we will analyze the evolution of global carbon dioxide emissions, and then we will study the evolution of CO₂ emissions in Algeria during the period 1990-2025. Finally, we will examine the existing relationship between economic policy (monetary and fiscal) and carbon dioxide (CO₂) emissions.

This study aims to highlight the impact of a set of fiscal and monetary policy tools on CO₂ emissions in Algeria using a standard model during the period 1990 to 2025.

The impact of monetary and fiscal policies on CO₂ emissions in Algeria during the period (1990-2025)

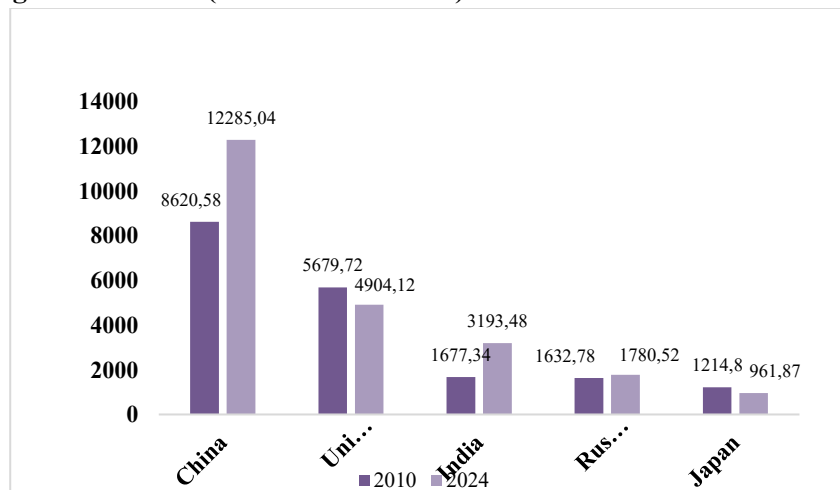
As for the importance of the subject, the study addresses one of the most important issues, which lies in studying the impact of monetary and fiscal policies on carbon dioxide emissions, which is the main cause of climate change, which in turn threatens the safety of the future of sustainable development and future generations.

1-The evolution of global carbon dioxide emissions

During recent years, greenhouse gas emissions have experienced a significant annual increase. This can be explained by several factors, such as the massive consumption of fossil fuels, industrialization, etc., particularly by certain countries such as China, the leading emitter of CO₂ globally for years.

From **Fig.1**, we see that the top five emitters globally are China, the United States, India, Russia, and Japan. In 2024, China is still the most polluting country, with more than 12,285 million metric tons, India with 3,193 million tons, and more than 1,780 million tons for Russia. Unlike these countries in the same figure, we see that the emissions of the United States, as well as those of Japan, have decreased compared to 2010, thanks to their strict environmental policies and their commitments to renewable energies.

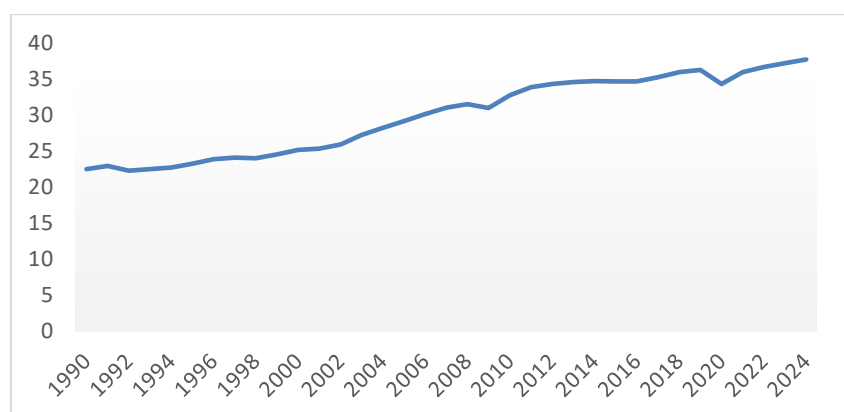
Fig (1): Major global emitters (Million metric tons)



Source: Created by the authors using data from the World Bank

The graphical analysis in Figure 2 summarizes the evolution of CO₂ emissions from 1990 until 2024, showing that the latter have continued to increase since the start of the study period, going from 22.52 billion metric tons in 1990 to 37.78 billion metric tons in 2024. This increase can be explained by the growth of economic activity, the increase in household final consumption expenditure, as well as investment in polluting activities.

Fig (2): Evolution of CO2 emissions globally from 1990 to 2024 (Billions of metric tons)



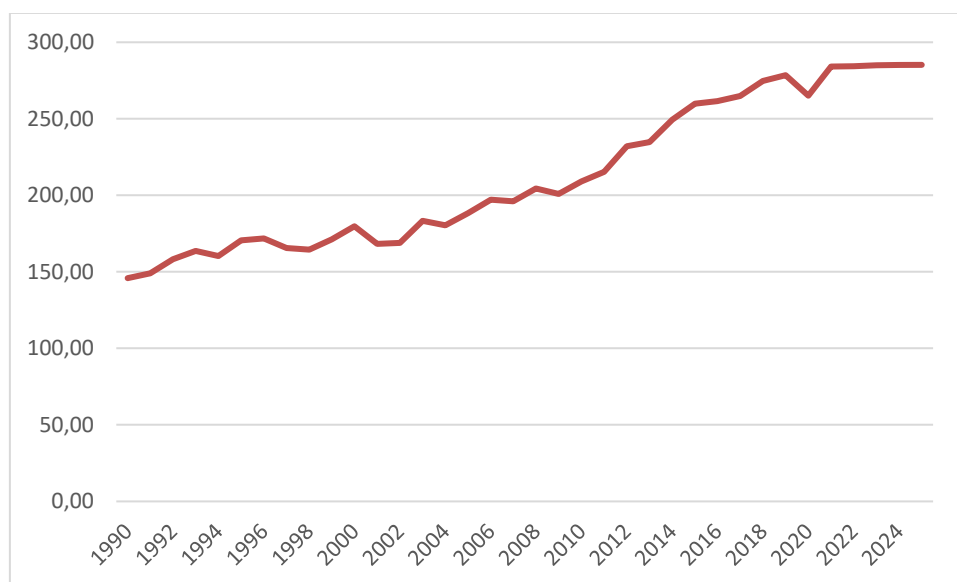
Source: Created by the authors using data from the World Bank

2-The evolution of CO2 emissions in Algeria during the period 1990-2025

We notice from the graphic curve a continuous increase in carbon dioxide emissions in Algeria during the study period, as it moved from 145.89 million tons in 1990 to 285.25 million tons in 2025, thus recording an increase of 95% during the study period, which is estimated at 35 years, as carbon dioxide emissions in Algeria represent the year 1990, an estimated 0.66% of global emissions estimated at 22 billion tons, compared to 0.74% of global emissions in 2025, estimated at 38.11 billion tons. Through this, we can say that Algeria's contribution to global emissions of carbon dioxide is very low and relatively stable during the study period.

fig3

Fig (3):Algeria's annual carbon dioxide (CO2) emissions (in million metric tons)



Source: Created by the authors using data from the World Bank

According to World Bank data, the transport sector is considered one of the most important sectors contributing to the increase in gas emissions by a rate ranging between 23% in 1990 and approximately 30% in 2025, while the fuel exploitation sector had a very high contribution rate of approximately 41% at the beginning of the study period, only to see a

The impact of monetary and fiscal policies on CO₂ emissions in Algeria during the period (1990-2025)

decrease to less than 16% during the late period of the study, especially after government measures represented in raising fuel prices and preventing the use of premium gasoline containing lead in the period between 2020 and 2021. And replace it with completely unleaded gasoline, which is considered environmentally friendly. The energy industry sector also contributed significantly to the rise in carbon dioxide emissions from 15% in 1990 to 22% in 2022. In addition, there are other sectors that contributed to the development and rise in carbon dioxide emissions in Algeria, but in lower proportions, such as agriculture, industry, buildings, etc.

3-The relationship between monetary, budgetary policies and CO₂ emissions

Several studies have been carried out to determine the impact of monetary and fiscal policy on CO₂ emissions. According to (Chishti et al. 2021), in their study on BRICS countries, for the period from 1985 to 2014, the authors studied the impact of tax policy on carbon dioxide emissions; The results show that restrictive fiscal policy decreases emissions while expansionary fiscal policy worsens the situation over time. Several other studies have confirmed this theory in different countries, for example (Di Bucchianico et al. 2025; Ramlogan and Nelson 2024; Mahmood et al. 2022; Bletsas et al. 2022; Anastasiou et al. 2024).

Recent studies have examined the impact of monetary policy on CO₂ emissions, some demonstrating that expansionary monetary policy increases emissions and worsens the environmental situation, and that restrictive policy reduces emissions in the short and long term, citing (Chishti et al. 2021; Mbassi et al. 2023; Qingquan et al. 2020; AlShafeey and Saleh Saleh 2024; Amaefule et al. 2022; Mahmood et al. 2022; Bletsas et al. 2022). On the other hand, (Ramlogan and Nelson 2024), in their studies, demonstrated that the interest rate influences CO₂ emissions more in the long term than in the short term, with its impact remaining low in the short term.

4- Econometric Study of the Impact of Monetary and Fiscal Policies on CO₂ Emissions during the Period 1990-2025 in Algeria

4-1-Data and Econometric Methodology

In this section, to address our research problem, we conduct an econometric analysis to examine the impact of economic policy on greenhouse gas emissions in Algeria. In EVIEWS 12, the study is based on an ARDL (Auto-Regression Distributed Lag) model approach. This investigation aims to examine whether a long-run relationship exists between economic policy and CO₂ emissions in Algeria.

4-2-Data Description: Nature and Sources of the Data

The data used in this study are annual and cover the period from 1990 to 2025. All statistical data used in this study are collected from the World Bank database. After reviewing the existing literature, the dependent variable is greenhouse gas emissions, represented by CO₂ emissions (ghge). The independent variables are the interest rate (ir), which represents

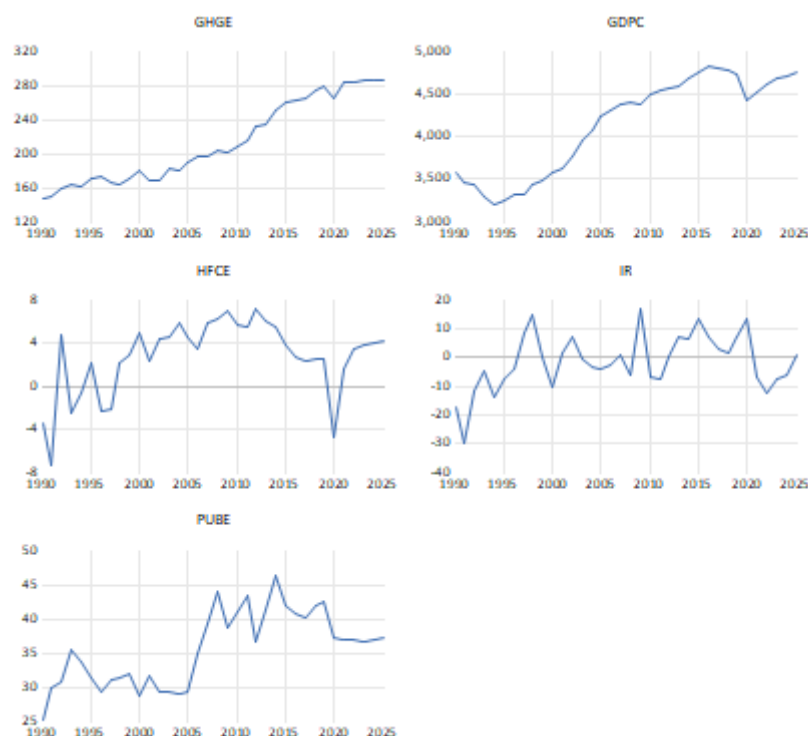
monetary policy; GDP per capita (gdpc), household final consumption expenditure (hfce), and public expenditure (pube), which represent fiscal policy.

The graphical representation (Fig. 4) illustrates that greenhouse gas emissions (CO₂) show an increasing trend, demonstrating that emissions have been rising constantly throughout time, with a little increase in the later years, so greenhouse gas emissions and the economy (GDP per capita) have both been going up over time.

In the same graph, the household final consumption expenditure (HFCE) recorded relatively low rates due to the conditions of the national economy at the beginning of the study period. Then, there was an improvement from the beginning of 2000 until 2020, where it recorded very low rates as a result of the COVID-19 health crisis. Real interest rates (ir) also declined significantly in the 1990s due to the high inflation rates and the economic crisis that Algeria went through during the nineties period, and with the beginning of the 21st century, they recorded relatively stable rates until the end of the study period.

Finally, public expenditure (PUBE) shows an overall increasing tendency until the mid-2010s, following which it stabilizes and modestly drops near the conclusion of the period. This predicts a time of expansionary fiscal policy followed by consolidation.

Fig (4):Graphical illustration of the Algerian variables



Source: Authors' illustration generated by EVIEWS

4-3-Results and discussion

From the correlation matrix, we observe differences in the degree of correlation between the variables. The endogenous variable (GHGE) is strongly correlated with GDP per capita and public expenditure, respectively, with a correlation coefficient of 88% and 69%; in contrast, a weakly correlated with HFCE and IR **table.1**.

The impact of monetary and fiscal policies on CO₂ emissions in Algeria during the period (1990-2025)

Table (1):Correlation matrix of the study variables

	GHGE	GDPC	HFCE	PUBE	IR
GHGE	1	0.88	0.26	0.69	0.28
GDPC	0.88	1	0.49	0.77	0.32
HFCE	0.26	0.49	1	0.38	0.30
PUBE	0.69	0.77	0.38	1	0.35
IR	0.28	0.32	0.30	0.35	1

Source:Authors' output fromEviews

4-4-The stationarity test of the variables

One of the main conditions for the application of the ARDL approach is that the dependent variable must be integrated of order I(1), while the explanatory variables may be integrated of order I(0) or/ and I(1). This approach is practical because it can deal with a mixture of I(1) and I(0). The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests are applied in our study to verify that the stationarity condition is satisfied. Table 2 indicates that the ADF test results suggest that the dependent variable (GHGE), GDP per capita (GDPC), and public expenditure (PUBE) are stationary after first differentiation I(1) at the 1% significance level. While the other variables, household final consumption expenditure (HFCE) and interest rate (IR), are integrated of order zero I(0) at the 1% level of significance. These results are confirmed by the PP test; the main difference is that HFCE is still stationary at level I(0), but only at the 5% level of significance. As a result, the ARDL approach can be applied to investigate the relationship between greenhouse gas emissions represented by CO₂ emissions and the explanatory variables: IR, PUBE, GDPC, and HFCE in Algeria.

Table (2): Results of the ADF and PP unit root test

UNIT ROOT TEST TABLE (ADF)						
	<u>At Level</u>	GDPC	GHGE	HFCE	IR	PUBS
With Constant	t-Statistic	-0.3648	-0.2416	-3.6620	-3.7088	-2.3430
	Prob.	0.9045	0.9236	0.0093	0.0083	0.1649
	n0	n0	n0	***	***	n0
With Constant & Trend	t-Statistic	-1.4423	-2.0068	-3.7422	-3.7736	-2.4207
	Prob.	0.8301	0.5775	0.0324	0.0302	0.3632
	n0	n0	n0	**	**	n0
Without Constant & Trend	t-Statistic	1.9694	3.0809	-2.4158	-3.7723	0.2959
	Prob.	0.9866	0.9991	0.0172	0.0004	0.7659
	n0	n0	n0	**	***	n0
	<u>At First Difference</u>	d(GDPC)	d(GHGE)	d(HFCE)	d(IR)	d(PUBS)
With Constant	t-Statistic	-4.2689	-7.2756	-10.0517	-5.1813	-6.6641
	Prob.	0.0020	0.0000	0.0000	0.0002	0.0000
	n0	***	***	***	***	***
With Constant & Trend	t-Statistic	-4.1963	-7.1764	-10.1809	-5.3109	-6.6046
	Prob.	0.0115	0.0000	0.0000	0.0008	0.0000
	n0	**	***	***	***	***
Without Constant & Trend	t-Statistic	-3.8276	-5.4859	-10.0521	-5.2487	-6.7304
	Prob.	0.0004	0.0000	0.0000	0.0000	0.0000
	n0	***	***	***	***	***
UNIT ROOT TEST TABLE (PP)						
	<u>At Level</u>	GDPC	GHGE	HFCE	IR	PUBS
With Constant	t-Statistic	-0.5671	-0.1114	-3.5860	-3.5227	-2.3035
	Prob.	0.8653	0.9404	0.0112	0.0132	0.1765
	n0	n0	n0	**	**	n0
With Constant & Trend	t-Statistic	-1.9448	-1.9106	-3.7843	-3.5854	-2.5073
	Prob.	0.6100	0.6278	0.0295	0.0458	0.3229
	n0	n0	n0	**	**	n0
Without Constant & Trend	t-Statistic	1.4309	4.0149	-2.3006	-3.6034	0.4326
	Prob.	0.9593	0.9999	0.0226	0.0007	0.8020
	n0	n0	n0	**	***	n0
	<u>At First Difference</u>	d(GDPC)	d(GHGE)	d(HFCE)	d(IR)	d(PUBS)
With Constant	t-Statistic	-4.2420	-7.3165	-10.8034	-10.2611	-6.8941
	Prob.	0.0021	0.0000	0.0000	0.0000	0.0000
	n0	***	***	***	***	***
With Constant & Trend	t-Statistic	-4.1636	-7.2361	-11.7589	-13.2948	-6.8299
	Prob.	0.0124	0.0000	0.0000	0.0000	0.0000
	n0	**	***	***	***	***
Without Constant & Trend	t-Statistic	-3.8597	-5.6874	-10.7274	-8.8985	-6.9155
	Prob.	0.0003	0.0000	0.0000	0.0000	0.0000
	n0	***	***	***	***	***

Note :

(*) significant at 10%,
 (**) significant at 5%,
 (***) significant at 1%.
 n0: non-stationary

Source: Authors' output from Eviews

4-5- Cointegration analysis using the ARDL (Auto Regression Distributed Lag) modeling approach

The results of the stationarity test make it possible to investigate the presence or absence of cointegration between the dependent variable and explanatory variables using the ARDL model.

This study investigates the impact of monetary and budgetary policy on the CO₂ emissions, considering additional control variables such as GDP per capita and household final consumption expenditure. Hence, an ARDL model is estimated using the following linear specification:

$$GHGE = F (IR, PUBE, GDPC, HFCE)$$

From the linear correlation matrix and the results of the stationarity test, the cointegrated ARDL specification is formulated as the following error correction model:

The impact of monetary and fiscal policies on CO₂ emissions in Algeria during the period (1990-2025)

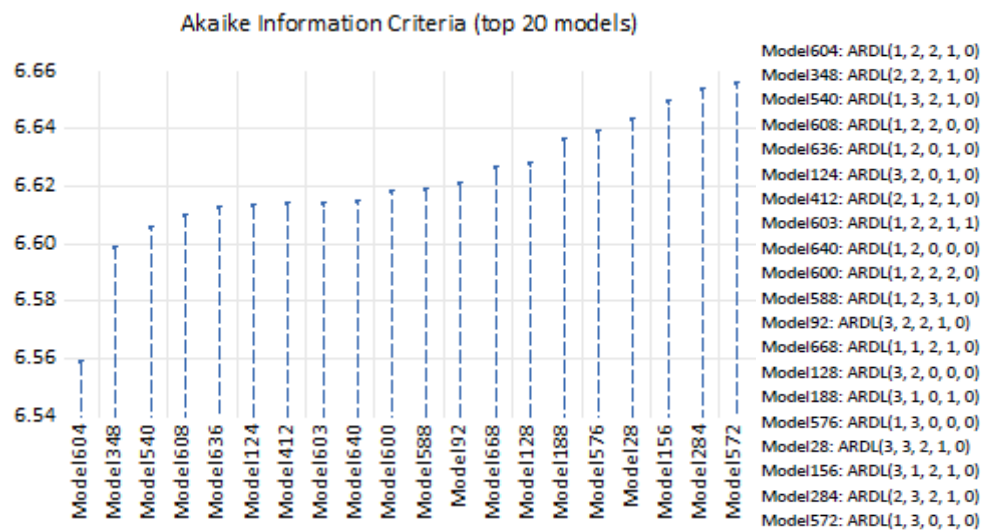
$$\Delta(\text{GHGE}) = C + \beta_1(\text{GHGE}_{t-1}) + \beta_2(\text{IR}_{t-1}) + \beta_3(\text{PUB}_{t-1}) + \beta_4(\text{GDPC}_{t-1}) + \beta_5(\text{HFC}_{t-1}) + \sum \alpha_j \Delta(\text{GHGE}_{t-j}) + \sum \alpha_k \Delta(\text{IR}_{t-k}) + \sum \alpha_l \Delta(\text{PUB}_{t-l}) + \sum \alpha_r \Delta(\text{GDPC}_{t-r}) + \sum \alpha_p \Delta(\text{HFC}_{t-p}) + \text{Uit}$$

In this equation, Δ represents the first difference operator, C represents the constant, Uit represents the error term, α_1 - α_5 represent the short-run dynamics of the model, while the β parameters reflect the long-run dynamics. The cointegration relationship is tested using the bounds test developed by Pesaran et al, (2001). To apply the Pesaran test of cointegration, two steps must be followed:

- Select the optimal lag length (AIC);
- Application of diagnostic tests to ensure the statistical validity of the model and examine cointegration between variables.

To select the optimal ARDL model, the Akaike Information Criterion (AIC) will be used, which provides statistically significant results. As can be observed in Figure 5, the ARDL (1, 2, 2, 1, 0) model is the most optimal among the other models estimated, which provides the minimum AIC value.

Fig (5): Akaike Information Criteria



Source: Authors' illustration generated by EVIEWS

After selecting the most optimal ARDL model (1, 2, 2, 1, 0), we proceed to its estimation. Table 3 reports the estimated results; the model is globally significant with an F-statistic of 233.64 (P-value= 0.0000), indicating that explanatory variables collectively influence CO₂ emissions. The model explains around 99% of GHGE variation ($R^2 = 0.9903$; Adjusted $R^2 = 0.9860$). The statistically significant and positive coefficients of greenhouse gas emissions GHGE (-1) (0.78, p-value=0.0000) suggest strong persistence of GHGE over time in Algeria, meaning that past emission levels exert a strong influence on current emissions. The result of GDP per capita shows that economic growth has a positive and significant effect; it increases GHGE in the short term (0.06, p-value = 0.0015), its first lag becomes negative and significant

(-0.06, p-value = 0.006), showing a potential reversal or decrease of this effect over time. For HFCE, its coefficient is negative but statistically insignificant (-0.73, p-value = 0.26); similarly, in the first lag, while the second lag of HFCE has a negative and significant effect (-0.84, p-value = 0.04), suggesting that HFCE can reduce GHGE after a two-year delay.

Concerning public expenditure (PUBE) has a negative immediate effect but is statistically insignificant (-0.17, p-value = 0.66). Its lagged value is positive and marginally significant at the 10% level (0.67, p-value = 0.10), indicating a lagged positive impact on emissions, with weak significance. Interest rate (IR) has a negative impact in the short run and is marginally significant at the 10% level (-0.25, p-value = 0.0789), indicating that IR may contribute to reducing GHGE, maybe by delaying investment and economic activity. Overall, the findings suggest that GDPC is a key determinant of CO₂ emissions in Algeria, while HFCE and the variable that represents monetary policy (IR) exert a moderating effect on environmental degradation over time.

Table (3) : ARDL model estimation (1, 2, 2, 1, 0)

Dependent variable GHGE			
Variable	Coefficient	t-Statistic	Prob.
GHGE(-1)	0.781690	11.16593	0.0000
GDPC	0.060175	3.615254	0.0015
GDPC(-1)	-0.067706	-3.021560	0.0061
GDPC(-2)	0.027778	1.802882	0.0845
HFCE	-0.733766	-1.149137	0.2623
HFCE(-1)	-0.104295	-0.212707	0.8334
HFCE(-2)	-0.843475	-2.113741	0.0456
PUBE	-0.176837	-0.444320	0.6610
PUBE(-1)	0.672735	1.681998	0.1061
IR	-0.251120	-1.838714	0.0789
C	-47.57341	-3.259837	0.0034
R-squared	0.990252	F-statistic	233.6409
Adjusted R-squared	0.986013	Prob(F-statistic)	0.000000
		Durbin-Watson stat	2.150788

Source: Authors' output from Eviews

Following the estimation of the optimal ARDL model, Table 4 summarizes the diagnostic test results for the estimated specification. The results suggest the absence of autocorrelation and heteroskedasticity, follow a normal distribution, and that the model is properly specified. Hence, the model can be considered statistically valid.

The impact of monetary and fiscal policies on CO₂ emissions in Algeria during the period (1990-2025)

Table (4): Diagnostic tests

Test hypothesis	Tests	Value (probability)
Autocorrelation	Breusch-Godfrey	0.46 (0.64)
Heteroskedasticity	Breusch-Pagan-Godfrey	0.72 (0.70)
Normality	Jarque Bera	0.66 (0.44)
Specification	Ramsey RESET	0.18 (0.68)

Source : Authors' output from Eviews

4-6- Bound test

After testing for the existence of a long-run relationship between the variables, the bounds test cointegration results are reported in the **table.5** indicates that the F statistic (4.65) is higher than the upper bound critical values at the 10%, 5%, 2.5%, and 1% significance values. Consequently, the null hypothesis of no long-run relationship is rejected, confirming the existence of a long-run relationship between GHGE and the explanatory variables in Algeria.

Table (5) : Bounds test cointegration

Variables	ghge, ir, pube, hfce, gdpc	
F statistic	4.65	
Critical value		
Signification	Lower Bound	Upper Bound
10%	2.2	3.09
5%	2.56	3.49
2.5%	2.88	3.87
1%	3.29	4.37

Source :Authors' output fromEviews

4-7- Long-run and short-run effects

In this section, we examine the short-term and the long-term estimation results obtained for Algeria. Table 6 summarizes the short-run dynamic; this table shows that the adjustment coefficient is statistically significant and negative (-0.22, P=0.0000) at the 1% level, confirming the presence of an error correction mechanism, and the existence of the long-run relationship between variables. In other words, more than 22% of short-run disequilibria are adjusted annually to return to the long-run equilibrium. Also, the results show that GDP per capita has a positive and highly significant effect in the short term (0.06, P= 0.0000); this suggests that an increase in economic growth of 1% in Algeria contributes to environmental degradation by 0.06%. This finding can be explained by the structure of economic growth in Algeria, which is largely driven by energy-intensive sectors, including transport, hydrocarbons, public

infrastructure, and industry. Rising income per capita typically leads to higher energy use, fuel use, electricity demand, and industrial production. However, it lagged difference has a significant and negative impact (-0.03, $p=0.02$), indicating that the initially positive effect of economic growth on Algeria's emissions decreases over time. This effect persists over time and remains negative **Table 7**.

Household final consumption expenditure (HFCE) has a negative coefficient and is marginally significant at 10% (-0.73, $p=0.07$), suggesting that an increase of 1% in HFCE may contribute to reducing Algeria's CO₂ emissions by 0.73%; after one period, the effect becomes positive and significant (0.84, $p=0.013$). This impact is the same in the long run as the table of long-run estimation results (-7.7, $p=0.018$). Hence, the environmental effect of HFCE appears with a time lag.

Public expenditure has a negative but not significant coefficient (-0.176, $p=0.549$), suggesting that changes in PUBE in Algeria do not have a significant short-term effect on CO₂ emissions.

A considerable share of public expenditure in Algeria is allocated to public wages, transfers, social subsidies, which has no direct effect on the environment, which explain its long-term effect (2.271, $p=0.27$) **table.7**. The monetary policy represented by the interest rate (IR) at the long-run has a negative impact (-1.15, $p=0.10$), a higher IR may reduce CO₂ emissions, by discouraging investment, reducing credit consumption, and restrain economic activity. In Algeria, the impact of this policy is limited because economic activity depends on hydrocarbons and public investment.

Table (6) : Short-term estimation of the ARDL model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDPC)	0.060175	0.011772	5.111815	0.0000
D(GDPC(-1))	-0.027778	0.011247	-2.469736	0.0214
D(HFCE)	-0.733766	0.397374	-1.846536	0.0777
D(HFCE(-1))	0.843475	0.314096	2.685408	0.0132
D(PUBE)	-0.176837	0.290826	-0.608051	0.5491
CointEq(-1)*	-0.218310	0.037448	-5.829640	0.0000

Source: Authors' output from Eviews

The impact of monetary and fiscal policies on CO₂emissions in Algeria during the period (1990-2025)

Table (7): Long-run estimation result

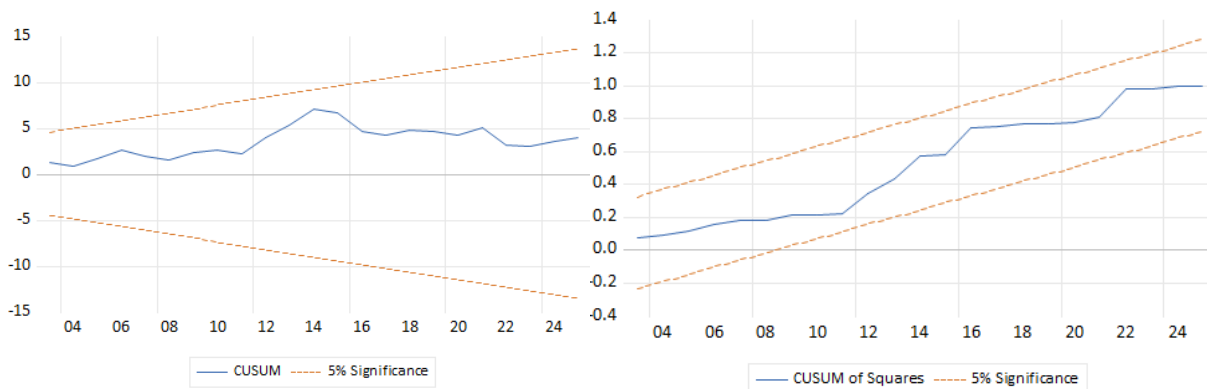
Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDPC	0.092741	0.014704	6.307110	0.0000
HFCE	-7.702506	3.042430	-2.531696	0.0186
PUBE	2.271532	2.016023	1.126739	0.2715
IR	-1.150291	0.687372	-1.673461	0.1078
C	-217.9166	49.84820	-4.371604	0.0002
EC = GHGE - (0.0927*GDPC -7.7025*HFCE + 2.2715*PUBE -1.1503*IR - 217.9166)				

Source: Authors' output from Eviews

4-8- Model stability test

As illustrated in **fig. 6**, the coefficients estimated by the ARDL model are structurally stable during the 1990-2025 period, suggesting a stable long-run relationship between the study variables, as the statistics of both tests (CUSUM and CUSUM of squares) remain within the 5% critical bounds.

Fig (6):ARDL model validity test



Source: Authors' illustration generated by EViews

Conclusion:

To conclude, Algeria's share of carbon dioxide emissions is very weak compared to the major industrialized countries such as China and the United States of America, but CO₂ emissions in Algeria during the study period are constantly increasing, so it is necessary to study this issue and address it from the economic point of view because of its importance on the future of sustainable development in Algeria, and it is also necessary to know the impact of monetary and fiscal policies on carbon dioxideemissions, where a set of variables representing the tools of the two policies were used as independent variables and CO₂ emissions as a endogenous variable.The relationship was formulated in the form of a measurable model, and thus, using the accepted methodology, we reached the necessity of measuring the model using

the ARDL approach, through which we reached a set of results, the most important of which are:

-Economic growth rates expressed in per capita income have a positive marginal impact in the short and long term on CO₂ emissions, which is consistent with economic theory.

-Household consumption spending has a negative impact in the short and long term on CO₂ emissions, so Algerian households do not spend much on CO₂ emissions, such as transportation, the energy industry, buildings, etc.

-Government spending is insignificant in the short and long term; therefore, we can say that it does not affect CO₂ emissions, and this shows the government's awareness of spending on everything that is environmentally friendly and reduces CO₂ emissions.

-Real interest rates are insignificant in the short term, while in the long term, the result is in the 90% confidence range and negatively affects CO₂ emissions, as the higher the real interest rates, the higher the cost, which reduces the causative activities. CO₂ emissions.

In general, we say that monetary and fiscal policies can affect Algeria's carbon dioxide emissions, especially public expenditure under fiscal policy and real interest rates under monetary policy. However, the most important variable that affect Algeria's gas emissions during the period of study is GDP per capita, as the higher it is, the more positive it will be on CO₂ emissions, because high GDP per capita positively affects the causes of carbon dioxide emissions, such as the transport sector, the combustion of fossil fuels, and the energy industry, etc. finally, the results highlight that policymakers should adopt fiscal and monetary policies with environmental considerations. Encouraging investment in the green sector and economic diversification can play a key role in reducing carbon emissions while ensuring sustainable economic development.

The impact of monetary and fiscal policies on CO₂ emissions in Algeria during the period (1990-2025)

Bibliography List:

- AlShafeey, Mutaz, and Mohamad Ali Saleh Saleh. 2024. "Assessing Inflation and Greenhouse Gas Emissions Interplay via Neural Network Analysis: A Comparative Study of Energy Use in the USA, EU, and China." *Environmental Sciences Europe* 36 (1): 1–18.
- Amaefule, Chukwuemeka, Igwe Justice Ibeabuchi, and Akeem Shoaga. 2022. "Determinants of Greenhouse Gas Emissions." *European Journal of Sustainable Development Research* 6 (4): em0194.
- Anastasiou, Dimitris, Antonis Ballis, Assil Guizani, Christos Kallandranis, and Faten Lakhel. 2024. "Monetary Policy Impact on Sustainability: Analyzing Interest Rates and Corporate Carbon Emissions." *Journal of Environmental Management* 368 (August): 122119.
- Bletsas, Konstantinos, Georgios Oikonomou, Minas Panagiotidis, and Eleftherios Spyromitros. 2022. "Carbon Dioxide and Greenhouse Gas Emissions: The Role of Monetary Policy, Fiscal Policy, and Institutional Quality." *Energies* 15 (13): 4733.
- Chishti, Muhammad Zubair, Manzoor Ahmad, Abdul Rehman, and Muhammad Kamran Khan. 2021. "Mitigations Pathways towards Sustainable Development: Assessing the Influence of Fiscal and Monetary Policies on Carbon Emissions in BRICS Economies." *Journal of Cleaner Production* 292 (April): 126035.
- Dai, Zhifeng, and Xiaotong Zhang. 2023. "Climate Policy Uncertainty and Risks Taken by the Bank: Evidence from China." *International Review of Financial Analysis* 87 (May): 102579.
- Di Bucchianico, Stefano, Mario di Serio, Matteo Fragetta, and Giovanni Melina. 2025. "Time-Varying Impacts of Government Spending on CO₂ Emissions." *IMF Working Papers* 2025 (132): 1.
- Mahmood, Haider, Anass Hamadelneel Adow, Muzafar Abbas, Asim Iqbal, Muntasir Murshed, and Maham Furqan. 2022. "The Fiscal and Monetary Policies and Environment in GCC Countries: Analysis of Territory and Consumption-Based CO₂ Emissions." *Sustainability: Science Practice and Policy* 14 (3): 1225.
- Mbassi, Christophe Martial, Suzanne Edwige Clarisse Hyoba, and Muhammad Shahbaz. 2023. "Does Monetary Policy Really Matter for Environmental Protection? The Case of Inflation Targeting." *Research in Economics* 77 (3): 427–452.
- Qingquan, Jiang, Shoukat Iqbal Khattak, Manzoor Ahmad, and Lin Ping. 2020. "A New Approach to Environmental Sustainability: Assessing the Impact of Monetary Policy on CO₂ Emissions in Asian Economies." *Sustainable Development* 28 (5): 1331–1346.
- Ramlogan, Avinash, and Andell Nelson. 2024. "Assessing the Influence of Fiscal and Monetary Policies on Carbon Dioxide Emissions." *Latin American Journal of Central Banking* 5 (3): 100114.