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The Structure of Public Expenditure and the Dynamics of Local Investment in Algeria (2000–2023): An ARDL Approach

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ABSTRACT

This study aims to analyze the impact of public expenditure structure, both current and investment, on domestic investment in Algeria over the period 2000–2023. The ARDL model was employed to capture both short-run and long-run relationships among the variables. The results reveal a long-run equilibrium relationship between public expenditure and domestic investment; however, the coefficients of both current and investment expenditure were found to be statistically insignificant in the long run. This outcome reflects the limited effectiveness of fiscal policy in fostering domestic investment, mainly due to the rentier nature of the Algerian economy and institutional inefficiencies. In contrast, the short-run estimates show significant and positive effects of both investment and current expenditure on domestic investment, where the former stimulates productive activities through infrastructure projects and development programs, while the latter drives the economic cycle via wages, subsidies, and social spending.. ..

1. INTRODUCTION

Since the beginning of the third millennium, the Algerian economy has undergone profound financial and structural transformations, characterized by an unprecedented rise in the volume of public expenditure as a result of the oil boom. This development positioned the state as the central actor in financing economic growth and supporting local investment ((wordbank, 2024); (BMI, 2025). This was embodied in major economic recovery programs directed toward infrastructure, education, health, and housing, as well as the expansion of social spending and wage support .

However, this trajectory revealed a striking paradox: while the volume of public expenditure increased, the dynamics of local investment remained weak and unbalanced, with current expenditures dominating the budget at the expense of investment spending ((Bouktir) & (Mecheri, 2019). This raises questions regarding the efficiency of such spending in stimulating productive investment and supporting sustainable growth.

Global economic literature has addressed this issue from different angles. Keynes (1936) argued that increased government.

spending, especially during periods of recession, creates effective demand that stimulates private investment. Musgrave (1989), on the other hand, emphasized that public expenditure has multiple dimensions (distributive, stabilizing, and developmental) where investment spending plays a decisive role in boosting economic activity. Conversely, Barro (1991) warned that unproductive government expenditures may crowd out private investment and hinder growth. Similarly, Devarajan et al (1996) and Tanzi & Schuknecht (2000) showed that excessive current spending, particularly of a consumptive nature, reduces the efficiency of resource allocation and weakens its impact on investment

In the Algerian context, several studies have confirmed that fiscal policy has remained hostage to fluctuations in oil prices, which has affected the sustainability and effectiveness of public investment. For example, Siraj & Wahiba (2018) pointed out that the dominance of current expenditures limited the role of public finance in supporting growth. Benessallah (2024) concluded that the weak efficiency in directing investment resources diminished the stimulative impact of public spending on local investment. Similarly, Meskini & Boulenouar (2025) argued that the absence of economic diversification has made the relationship between public expenditure and investment dynamics fragile.

Based on these considerations, the central research problem of this study revolves around the following question:

To what extent has the structure of public expenditure (current and investment) affected the dynamics of local investment in Algeria during the period 2000–2023?

Accordingly, this study seeks to:

Analyse the evolution of the structure of public expenditure in Algeria over the past two decades.

Highlight its implications for local investment.

Test the relationship between them using the ARDL approach, which allows for studying both short- and long-term linkages between variables.

Research Hypotheses

Main Hypothesis: There is a positive and significant impact of public expenditure on domestic investment in Algeria during the study period.

1. **Sub-Hypothesis 1 (H_1):** Capital expenditure contributes directly and positively to the acceleration of domestic investment.
2. **Sub-Hypothesis 2 (H_2):** Current expenditure does not directly contribute to the enhancement of domestic investment

The significance of this research lies in the fact that it combines descriptive and econometric analysis for offering a more precise understanding of the role of fiscal policy in directing local investment. This, in turn, is for assisting policymakers in adopting more effective strategies for rationalizing expenditures and achieving sustainable economic growth.

Methodology and Data

Study Methodology

This study relies on a quantitative econometric approach to measure the impact of the structure of public expenditure on the dynamics of local investment in Algeria during the period (2000–2023). The Autoregressive Distributed Lag (ARDL) model, proposed by Pesaran, Shin & Smith (2001), was selected due to its flexibility and ability to analyse both short- and long-term relationships even when the time series variables have mixed orders of integration (I(0) or I(1)).

This model is characterized by its ability to:

Test for long-term equilibrium relationships using the Bounds Test.

Measure short-term dynamic effects through the Error Correction Model (ECM).

Deal with relatively short time series, as is the case in this study (2000–2023).

Variables

Dependent variable

Local investment (INV), statistically represented by the ratio of gross fixed capital formation to gross domestic product GDP.

Independent variables

Current expenditure (LEXGCO), expressed as a percentage of GDP.

Investment expenditure (EXGINV), expressed as a percentage of GDP.

Data Sources

The study relies on official data issued by:

World Bank (World Development Indicators, 2024).

Reports of the Algerian Public Treasury.

Statistics of the Bank of Algeria (reports 2000–2024).

International Monetary Fund (IMF Country Reports, 2024).

Temporal and Spatial Boundaries

Temporal boundaries: The study period (2000–2023) was chosen because it encompasses two distinct economic phases:

The period of financial abundance and expansionary programs (2000–2014).

The period following the oil price crisis and the accompanying austerity measures (2015–2023).

Spatial boundaries: The study is limited to the Algerian case.

Statistical Tools

Stationarity tests: ADF (Dickey & Fuller, 1979), PP (Phillips & Perron, 1988), and KPSS.

Bounds Test for detecting cointegration.

ARDL model to estimate short- and long-term relationships.

ECM model to measure the speed of adjustment toward equilibrium.

Model diagnostic tests: Breusch-Godfrey, ARCH, Jarque-Bera, and Ramsey RESET.

6.Results

Summary of Previous Studies on Public Expenditure

No.	Author(s) & Year	Title of the Study	Scope / Methodology	Main Findings	Key Recommendations / Conclusions
1	Gemmell, N. et al. (2014)	Does the Composition of Government Expenditure Matter for Long-Run GDP Levels?	OECD countries; Econometric time-series and cross-sectional analysis	Reallocating spending toward infrastructure and education raises long-run income levels, while higher welfare spending reduces GDP slightly.	Encourage investment in infrastructure and education to foster sustainable growth.
2	Tanzi, Vito & Schuknecht, Ludger (2000)	Public Spending in the Twentieth Century: A Global Perspective	Industrialized countries; Historical analytical study	The welfare state's expansion yielded limited additional welfare despite huge spending increases.	Governments should reduce unproductive expenditures and focus on regulatory roles.
3	Patience C. Orikara & Charity E. Uremadu (2019)	Testing Relationship between Government Current Expenditures and Economic Growth in Nigeria	Nigeria (1999–2016); Regression analysis	Administrative and debt service expenditures positively affect growth; transfers have weak impact.	Maintain recurrent spending on administration and debt servicing while minimizing financial leakages.

4	Felice, G. (2016)	Size and Composition of Public Investment, Sectoral Composition and Growth	Cross-sectoral analysis; Endogenous growth model	Productive public spending enhances growth directly via factor productivity and indirectly by altering labor composition.	Prioritize productive public investments to boost sectoral productivity.
5	Siradj, Wahiba (2018)	Analytical Study of Public Expenditure Policy in Algeria (1990–2016)	Algeria; Descriptive analysis of fiscal data	Continuous rise in total public expenditure, dominated by current spending over investment.	Rebalance government expenditure toward capital and productive investments.
6	Bouketir, Djebar & Mecheri, Merim (2019)	Public Expenditure and Economic Growth in Algeria: Analytical Study of Wagner's Law (2000–2016)	Algeria; Econometric test of Wagner's Law	Public expenditure grows faster than GDP, rejecting Wagner's Law for Algeria.	Adjust spending growth to match GDP evolution for fiscal sustainability.
7	Meskini & Boulenouar, I. (2025)	The Impact of Government Spending on Algerian Economic Growth (1999–2022): An Econometric Analysis	Algeria; Econometric time-series analysis (1999–2022)	Positive correlation between government spending and economic growth, showing effective expansionary fiscal policy.	Continue targeted public investment to improve living standards and reduce social disparities.

Source: Prepared by The authors

2.Descriptive Analysis

The structure of public expenditure in Algeria during the period (2000–2023) witnessed notable changes reflecting the alternation between expansionary and austerity fiscal policies. During this period, there was a significant rise in public spending owing to the oil boom, with the government focusing on economic recovery programs directed mainly toward infrastructure, housing, education, and health (see Table 1).

Table 1. Public expenditure as a percentage of GDP for the period 2000–2023

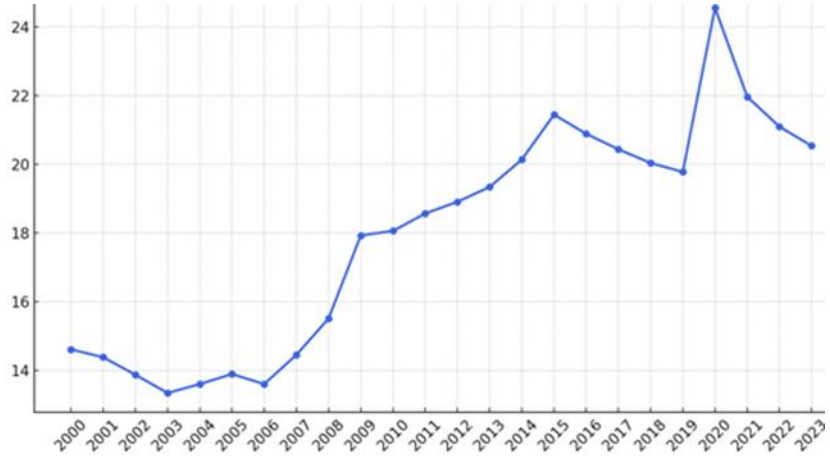
Year	Percentage	Year	Percentage	Year	Percentage
2000	**14.61**	**2009**	**17.93**	**2018**	**20.04**
2001	**14.38**	**2010**	**18.06**	**2019**	**19.78**
2002	**13.87**	**2011**	**18.57**	**2020**	**24.56**
2003	**13.34**	**2012**	**18.91**	**2021**	**21.97**
2004	**13.60**	**2013**	**19.34**	**2022**	**21.10**

2005	**13.89**	**2014**	**20.14**	**2023**	**20.54**
2006	**13.60**	**2015**	**21.45**		
2007	**14.45**	**2016**	**20.89**		
2008	**15.51**	**2017**	**20.44**		

Source: Prepared by The authors based on World Bank data.

From the table, it is evident that public expenditure ratios have shown a continuous increase, recording around 14.61% of GDP in 2000 and reaching 20.14% in 2014. However, after the oil crisis of 2014, the government attempted to lean somewhat toward austerity, maintaining expenditure levels around 20%. The only notable rise occurred during the COVID-19 crisis, when expenditure ratios climbed to 24.56% (see Figure 1).

Figure 1. Evolution of public expenditure in Algeria during the period 2000–2023



Source: Prepared by The authors based on World Bank reports and reports of the Bank of Algeria (2024).

2.1.Current Expenditure (LEXGCO):

Current expenditure represented the largest share of the public budget, rising continuously as a result of wage bill inflation and the expansion of the subsidy and social transfer system. The analysis shows that this type of spending accounted for more than 60% of total public expenditure in most years, reflecting the dominance of the social and political dimensions of fiscal policy.

2.2.Investment Expenditure (EXGINV):

Despite the considerable levels recorded during the financial boom period (2001–2014), its contribution remained below expectations, and it declined significantly after the 2014 oil price crisis. Moreover, its economic returns were subject to debate due to project delays, weak efficiency in management, and competition from current expenditure (see Table 2).

Table 2. Shares of both investment expenditure and current expenditure in Algeria's total public expenditure during the period 2000–2023

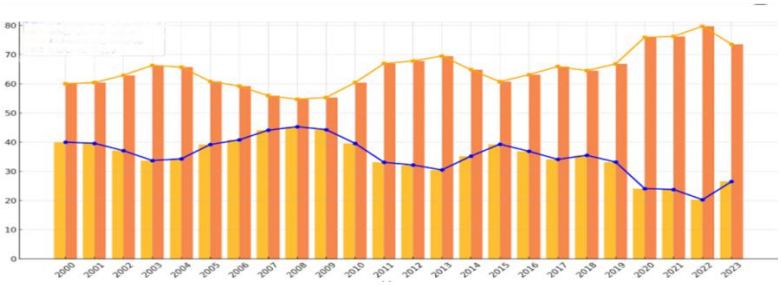
Year	% of investment expenditure from total public expenditure	% of current expenditure from total public expenditure	Year	% of investment expenditure from total public expenditure	% of current expenditure from total public expenditure	السنة	% of investment expenditure from total public expenditure	% of current expenditure from total public expenditure
2000	40	60	2009	44,3	55,3	2018	35,5	64.5
2001	39.6	60.40	2010	39,6	60,4	2019	33,2	66.8
2002	37.1	62.90	2011	33,1	66,9	2020	24,1	75.9

2003	33.7	66.3	2012	32,2	67,8	2021	23,8	76.2
2004	34.3	65,7	2013	30,5	69,5	2022	20,3	79.7
2005	39,2	60,8	2014	35.2	64,8	2023	26,50	73.5
2006	40,8	59,2	2015	39.3	60,7			
2007	44,1	55.9	2016	36,9	63.1			
2008	45,3	54.7	2017	34,1	65,9			

Source: Prepared by The authors based on reports of the Algerian Central Bank (2008–2024) and the World Bank.

The data in the table show a clear disparity between the rates of investment expenditure and current expenditure during the study period. Current expenditure experienced a marked increase from one period to another, ranging between 60% and 73.5%, while investment expenditure ranged between 40% and 26.5%. This reflects the government's prioritization of current spending in order to improve social conditions. By contrast, investment expenditure was constrained following the oil crisis and the COVID crisis, which is a phase of attempts to rationalize public spending (Figure 2).

Figure 2. % of current expenditure and % of investment expenditure from total public expenditure for the period 2000–2023



_ investment expenditure __ current expenditure

Source: Prepared by The authors

2.3.Local Investment (INV)

Local investment was subject to numerous fluctuations primarily linked to financial circumstances. It increased during periods of expansionary policies based on public spending, while it declined during periods of austerity. Nevertheless, it failed to establish a stable dynamic, reflecting its dependence on public expenditure and its inability to generate a self-sustaining investment cycle (Table 3).

Table 3. % of local investment from GDP

year	٪	year	٪	year	٪
2000	23,56	**2009**	46,06	**2018**	46,45
2001	29,40	**2010**	43,28	**2019**	44,62
2002	32,42	**2011**	39,75	**2020**	42,94
2003	32,08	**2012**	40,28	**2021**	39,14
2004	32,85	**2013**	44,58	**2022**	35,08
2005	31,17	**2014**	46,89	**2023**	37,72
2006	30,36	**2015**	51,77		
2007	33,57	**2016**	51,64		
2008	35,53	**2017**	48,26		

Figure 3. % of local investment from GDP

Source: Prepared byThe authors based on data from the international bank (2000-2024)

The results of the table show the continuous rise in the share of local investment from GDP, which recorded 23.56% in 2000, continued to increase until it reached 51.64% in 2016, and then declined again, reaching 37.72%.

Studies have highlighted that these high rates are primarily due to large public investments financed by oil surpluses during the first phase (2000–2014), particularly in infrastructure, housing, and social facilities, within the framework of the five-year plans (2001–2004, 2005–2009, 2010–2014), which were allocated more than 800 billion USD (National Investment Program, 2014, p. 22).

Algeria has attempted to address many imbalances through the issuance of the new Investment Law of 2022, which included a set of incentives for local investors, such as exemption from profit tax for up to ten years, reduction of customs duties on production equipment, and the allocation of industrial land under favourable conditions. The "Algerian Investment Promotion Agency" (AAPI) was established to be the body responsible for assisting local investors through a "one-stop shop" system (UNCTAD, Investment Policy Monitor, 2023, p. 3).

Despite these reforms, economic performance indicators still show that local investment remains concentrated in activities with low added value, such as the services sector, while its contribution to vital sectors like technology and agro-processing remains limited. This is confirmed by the most recent report of the Algerian Ministry of Industry, which showed that more than 60% of local projects declared in 2023 were in the commercial services sector (Ministry of Industry, Report 2023, p. 18).

In Conclusion

The structural composition of expenditure has clearly leaned toward current expenditures at the expense of investment expenditures of a productive nature.

The fluctuating ratios of local investment reflect the dependence of fiscal policy on fuel revenues.

The continuous rise in current expenditure has created constraints on the state's ability to allocate sufficient resources to support productive investment.

3.Econometric Analysis

3.1.Stationarity Tests

The stationarity properties of the time series were verified using three tests: Phillips–Perron (PP), Augmented Dickey–Fuller (ADF), and KPSS (Appendices 1–3). The results showed that all variables (INV, EXGINV, LEXGCO) are non-stationary at level but become stationary at first difference. Accordingly, the series are classified as I(1), which allows for the use of the ARDL approach.

3.2.Cointegration Test (F-Bounds Test)

The results of the Bounds Test (Appendix 4) revealed that the F-statistic value (6.84) exceeds the upper critical bounds at conventional significance levels (1%, 5%, 10%). Based on this, the null hypothesis is rejected and the alternative hypothesis of a long-run equilibrium relationship between the variables is accepted.

3.3.Estimation of the ARDL Model

The ARDL(4,3,1) model was estimated (Appendix 5). The results highlighted that:

Public investment expenditure (EXGINV), in its current level, has a positive and significant effect on local investment.

Current expenditure (LEXGCO) did not appear significant at the present level, but recorded a negative effect at lagged periods.

The dependent variable INV(-1) was positive and significant, which confirms the persistence of local investment dynamics.

Model fit results indicated that the adjusted coefficient of determination (R^2) reached 0.99 and the F-test was significant at 1%, while the Durbin–Watson statistic (2.34) pointed to the absence of autocorrelation.

3.4.Error Correction Model (ECM)

The ECM equation derived from the ARDL was estimated (Appendix 6). The error-correction term (CointEq(-1)) showed a negative sign as expected, reflecting the presence of a mechanism for adjustment toward long-run equilibrium, although its statistical significance varied. In the short run, investment expenditure was positive and highly significant, while current expenditure displayed a lagged and limited effect.

3.5.Model Validity Tests

Breusch–Godfrey test (Appendix 9): did not reveal autocorrelation of residuals.

ARCH test (Appendix 10): confirmed the absence of heteroskedasticity.

Accordingly, the estimated econometric model is highly reliable and appropriate for analysing the short- and long-run relationship between the structure of public expenditure and local investment in Algeria.

4.Discussion

The results of the analysis show that the relationship between the structure of public expenditure and local investment in Algeria was marked by significant variability during the period 2000–2023. The econometric estimation using the ARDL approach confirmed that investment expenditure had a positive and significant effect, both in the short and long term. This finding is consistent with Barro (1991) and Gemmell et al. (2016), who highlighted the vital role of capital spending in stimulating growth and investment.

In contrast, current expenditure did not show a significant impact on local investment, whether in the short or long term. This reflects its more consumptive than productive character. This result aligns with the conclusions of Devarajan (1996) and Tanzi & Schuknecht (2000), who argued that inflated current expenditure can generate fiscal burdens without clear productive returns.

When compared with local studies, the results converge with those of Siraj (2018) and Bouketir & Mecheri (2019), who confirmed that the dominance of current expenditure in the budget constrained the capacity of fiscal policy to stimulate investment growth. Similarly, Meskini & Boulenouar (2025) showed that economic recovery programs had a positive impact on growth thanks to investment spending directed toward infrastructure.

From the economic perspective, these results reflect the limitations of Algeria's rentier model, which relies heavily on fluctuations in oil prices. During periods of financial abundance, investment expenditures rose and supported local investment, while during crises the government reduced them, maintaining high levels of current spending for social and political reasons. Thus, the relationship between public expenditure and local investment is not determined solely by the type of spending, but also by the efficiency of institutions in directing resources and by the degree of fiscal flexibility available to the state.

5.Conclusion

This study aimed to analyse the effect of the structure of public expenditure, both current and investment, on the dynamics of local investment in Algeria during the period 2000–2023, using an econometric approach based on the ARDL model. It responded to the central question of whether public spending has been effective in stimulating productive investment and supporting sustainable growth.

The descriptive analysis revealed that current expenditure constituted the largest share of the state budget, exceeding 60% of total spending, driven by wage bill inflation and the expansion of social transfers. By contrast, although investment expenditure increased during the oil boom years (2000–2014), it declined significantly after the 2014 oil price crisis, negatively affecting local investment dynamics.

At the econometric level, stationarity tests showed that all variables were integrated of order one, allowing for the use of ARDL. The bounds test confirmed the existence of a long-term equilibrium relationship among the variables. The ARDL estimation indicated that local investment is strongly influenced by investment spending in the short run, while current expenditure showed no significant impact except in lagged form and with a negative sign. The ECM confirmed the existence of an adjustment mechanism toward long-term equilibrium, although the speed of adjustment was relatively weak. Model validation tests (Breusch–Godfrey, ARCH) reinforced the credibility of these results.

Based on this, the relationship between the structure of public expenditure and local investment in Algeria has a dual character:

In the short run: investment spending has a direct and positive impact on local investment, while the effect of current spending remains limited and unsustainable.

In the long run: neither type of expenditure shows a significant effect, reflecting the fragility of Algeria's economic structure, its continued dependence on oil price fluctuations, and the weakness of institutional effectiveness in managing public resources.

Accordingly, merely increasing the volume of public spending is insufficient to guarantee the stimulation of local investment unless accompanied by thorough structural reforms aimed at improving efficiency and transparency in expenditure management.

Recommendations

Rationalize current expenditure: review wage policy and curb the excessive growth of recurrent spending.

Strengthen productive investment spending: prioritize developmental projects with high added value, particularly in industry, agro-industry, and renewable energy.

Monitor the implementation of development projects: establish effective mechanisms to track execution.

Appendices

Table 1. Phillips–Perron (PP) Unit Root Test

Var.	C (t, p)	C&T (t, p)	None (t, p)	Result
Level				
INV	−2.68 (0.09)	−1.72 (0.71)	0.88 (0.89)	n■
EXGINV	−2.35 (0.17)	−1.39 (0.84)	0.86 (0.89)	n■
LEXGCO	−1.36 (0.58)	−2.00 (0.57)	0.15 (0.72)	n■
1st Diff.				
ΔINV	−4.00 (0.01)	−3.95 (0.03)	−4.08 (0.00)	***
ΔEXGINV	−3.73 (0.01)	−3.60 (0.05)	−3.80 (0.00)	***
ΔLEXGCO	−4.23 (0.00)	−4.17 (0.02)	−4.34 (0.00)	***

Note: n■ = non-stationary; *, **, *** = significance at 10%, 5%, 1%.

Table 2. Augmented Dickey–Fuller (ADF) Unit Root Test

Var.	C (t, p)	C&T (t, p)	None (t, p)	Result
Level				
INV	−2.77 (0.08)	−1.59 (0.77)	0.88 (0.89)	n■
EXGINV	−2.35 (0.17)	−1.89 (0.62)	0.86 (0.89)	n■
LEXGCO	−1.36 (0.58)	−1.95 (0.60)	0.15 (0.72)	n■
1st Diff.				
ΔINV	−4.00 (0.01)	−3.98 (0.03)	−4.08 (0.00)	***
ΔEXGINV	−3.73 (0.01)	−3.62 (0.05)	−3.80 (0.00)	***
ΔLEXGCO	−4.23 (0.00)	−4.19 (0.02)	−4.34 (0.00)	***

Note: n■ = non-stationary; *, **, *** = significance at 10%, 5%, 1%. MacKinnon (1996) one-sided p-values.

Table 3. KPSS Unit Root Test Results

Var.	C (t, prob)	C&T (t, prob)	None (t, prob)	Result
Level				
INV	0.4761 (**)	0.1653 (**)	——	**
EXGINV	0.5247 (**)	0.1662 (**)	——	**
LEXGCO	0.3419 (n■)	0.1196 (*)	——	*
1st Diff.				
ΔINV	0.4395 (*)	0.0525 (n■)	——	*
ΔEXGINV	0.3359 (n■)	0.0545 (n■)	——	n■
ΔLEXGCO	0.1209 (n■)	0.0949 (n■)	——	n■

Note: n■ = not significant; *, ** = stationarity at 10% and 5% levels respectively. Null hypothesis: the variable is stationary.

Appendix 4

Table 1. Results of ARDL(4,3,1) Model Estimation
Dependent Variable: INV (Investment) — Sample: 2004–2023 — Method: ARDL (AIC-based selection)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INV(-1)	0.794186	0.134402	5.909021	0.0002
INV(-2)	-0.180021	0.145405	-1.238066	0.2470
INV(-3)	0.281675	0.110010	2.560443	0.0307
INV(-4)	-0.095661	0.048952	-1.954166	0.0824
LEXGCO	8.212026	4.784264	1.716466	0.1202
LEXGCO(-1)	-0.545405	6.477114	-0.084205	0.9347
LEXGCO(-2)	12.80160	6.467130	1.979487	0.0791
LEXGCO(-3)	-19.39580	4.437168	-4.371211	0.0018
EXGINV	1.056214	0.114124	9.254972	0.0000
EXGINV(-1)	-1.056013	0.143853	-7.340913	0.0000
C	3.726939	8.349474	0.446368	0.6659

Model Statistics	Value	Model Statistics	Value
R-squared	0.9966	Mean dependent var	41.1026
Adjusted R-squared	0.9929	S.D. dependent var	6.5679
S.E. of regression	0.5536	Sum squared resid	2.7582
F-statistic	266.5425	Prob(F-statistic)	0.0000
Durbin–Watson stat	2.3482	Log likelihood	-8.5672
Akaike info criterion	1.9567	Schwarz criterion	2.5044
Hannan–Quinn criterion	2.0636		

Appendix 5

F-Bounds Test		**Null Hypothesis: No levels relationship**		
Test Statistic	**Value**	**Signif.**	**I(0)**	**I(1)**
F-statistic	**6.843241**	**10%**	**2.63**	**3.35**
k	**2**	**5%**	**3.1**	**3.87**
		2.5%	**3.55**	**4.38**
		1%	**4.13**	**5**

Appendix 6. ARDL Long Run Form and Bounds Test

Dependent Variable: D(INV) Selected Model: ARDL(4,3,1) Case 2: Restricted Constant and No Trend
Sample: 2000–2023 Included Observations: 20

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.726939	8.349474	0.446368	0.6659
INV(-1)*	-0.199821	0.131171	-1.523360	0.1620
LEXGCO(-1)	1.072421	2.417887	0.443536	0.6678
EXGINV(-1)	0.000202	0.169372	0.001190	0.9991
D(INV(-1))	-0.005993	0.090712	-0.066069	0.9488
D(INV(-2))	-0.186014	0.079453	-2.341191	0.0439
D(INV(-3))	0.095661	0.048952	1.954166	0.0824
D(LEXGCO)	8.212026	4.784264	1.716466	0.1202
D(LEXGCO(-1))	6.594200	4.463515	1.477356	0.1737
D(LEXGCO(-2))	19.39580	4.437168	4.371211	0.0018
D(EXGINV)	1.056214	0.114124	9.254972	0.0000

** p-value incompatible with t-Bounds distribution.*

Levels Equation Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LEXGCO	5.366912	13.04955	0.411272	0.690
EXGINV	0.001008	0.847004	0.001191	0.999
C	18.65141	41.86393	0.445525	0.666

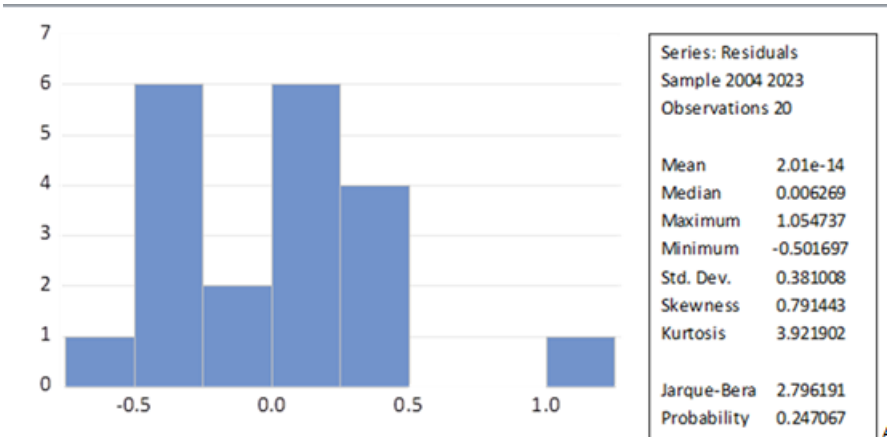
EC = INV - (5.3669 × LEXGCO + 0.0010 × EXGINV + 18.6514)

Appendix 7

ARDL Error Correction Regression				
Dependent Variable: D(INV)				
Selected Model: ARDL(4, 3, 1)				
Case 2: Restricted Constant and No Trend				
Date: 07/22/25 Time: 20:28				
Sample: 2000 2023				
Included observations: 20				
ECM Regression				
Case 2: Restricted Constant and No Trend				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
D(INV(-1))	**-0.005993**	**0.072477**	**-0.082691**	**0.9359**
D(INV(-2))	**-0.186014**	**0.066967**	**-2.777688**	**0.0215**
D(INV(-3))	**0.095661**	**0.037672**	**2.539310**	**0.0317**
D(LEXGCO)	**8.212026**	**3.476102**	**2.362423**	**0.0424**
D(LEXGCO(-1))	**6.594200**	**3.509654**	**1.878875**	**0.0930**
D(LEXGCO(-2))	**19.39580**	**3.831075**	**5.062756**	**0.0007**
D(EXGINV)	**1.056214**	**0.081501**	**12.95946**	**0.0000**

CointEq(-1)*	**-0.199821**	**0.033076**	**-6.041298**	**0.0002**
R-squared	**0.989158**	**Mean dependent var**		**0.282206**
Adjusted R-squared	**0.982834**	**S.D. dependent var**		**3.659156**
S.E. of regression	**0.479425**	**Akaike info criterion**		**1.656716**
Sum squared resid	**2.758181**	**Schwarz criterion**		**2.055009**
Log likelihood	**-8.567162**	**Hannan-Quinn criter.**		**1.734467**
Durbin-Watson stat	**2.348168**			
*** p-value incompatible with t-Bounds distribution.**				

Appendix 8

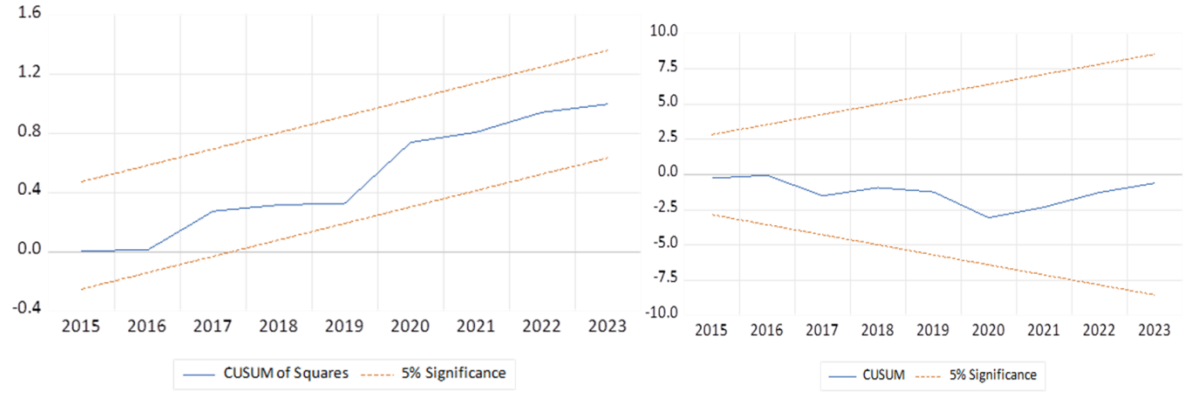


Appendix 9

Breusch-Godfrey Serial Correlation LM Test:			
Null hypothesis: No serial correlation at up to 2 lags			
F-statistic	0.417205	Prob. F(2,7)	0.6743
Obs*R-squared	2.130115	Prob. Chi-Square(2)	0.3447

Appendix 10

Heteroskedasticity Test: ARCH			
F-statistic	0.059447	Prob. F(1,17)	0.8103
Obs*R-squared	0.066209	Prob. Chi-Square(1)	0.7969



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