# An empirical approach to economic growth and financial development: Case of Algeria

## مقاربة تجريبية للعلاقة بين النمو الاقتصادي والتنمية المالية: حالة الجزائر

**Dr. Omar HEMCHE**
*Higher School of Management-Tlemcen, Algeria*
*hemche_o@hotmail.com*

**Dr. Omar DJAFRI**[1]
*University of Ain Temouchent, Algeria*
*Omar.djafri@univ-temouchent.edu.dz*

*Received: 11/12/2022* *Accepted: 05/05/2023* *Published: 11/06/2023*

**Abstract:**

*In our study, we focus on short-term and long-term relationship between economic growth and financial development. We use a multi-step methodology, namely the Autoregressive Distributed Lag (ARDL) approach and the Vector Error Correction Model (VECM) approach to evaluate this relationship in Algeria from 1980 to 2020. Our results show that there is a bidirectional causal relationship, long-term and short-term, of the type: validated but degenerate cointegration relationship, between the GDP per capita and the financial development index in Algeria. Our study is different in that it investigates the nature of the long-term relationship between economic growth and the financial development index over a 40-year period.*

**Key words:** *Economic growth, Financial development, ARDL, Cointegration, Habitual and degenerate relationship.*

**ملخص:**

يهدف هذا المقال بشكل أساسي إلى دراسة العلاقة قصيرة وطويلة المدى بين النمو الاقتصادي والتنمية المالية. استخدمنا منهجية متعددة الخطوات، باستعمال نموذج الانحدار الذاتي للإبطاء الموزع (ARDL) بالإضافة إلى نموذج تصحيح الخطأ المتجه (VECM) لاختبار هذه العلاقة في الجزائر من سنة 1980 إلى 2020. أظهرت نتائج الدراسة أن هناك سببية ثنائية الاتجاه طويلة المدى وقصيرة المدى، علاقة تكامل مشتركة لكنها متدهورة وذلك، بين نصيب الفرد من الناتج المحلي الإجمالي ومؤشر التنمية المالية في الجزائر. تختلف دراستنا من حيث أنها تبحث في طبيعة العلاقة طويلة الأمد بين النمو الاقتصادي ومؤشر التنمية المالية على مدى 40 سنة.

**الكلمات المفتاحية:** النمو الاقتصادي، التنمية المالية، نموذج ARDL، الاندماج المشترك، العلاقة المعتادة والمتدهورة.

[1]- *Corresponding author: Dr. Omar DJAFRI, omar.djafri@univ-temouchent.edu.dz*

## 1. INTRODUCTION

The world is currently facing critical social, environmental and economic problems. Reducing poverty, managing climate change, reducing economic inequality and, most recently, mitigating the danger of pandemics all require enormous financial resources and expenditure (Pizzi et al, 2021; United Nations, 2017).

Alongside threats to sustainability, the COVID-19 pandemic has worsened the situation for economies around the world by increasing financial constraints. Containment and isolation measures have increased uncertainty about economic output and outcomes, while a large gap in sustainable financial policies continues to pose a critical challenge (Iqbal et al, 2021). Consequently, it is crucial to assess the contribution of financial development (FD), on the one hand, and a range of socio-economic factors, on the other, to economic growth.

Although the mixed impact of financial development (FD) on economic growth has been extensively studied in the literature and, despite some counter-arguments, the finance-growth link has been widely accepted. In fact, the financial sector is the main contributor to long-term growth, influencing savings rates, investment decisions and technological innovation (Levine, 2005). Financial development triggers economic development through banks or stock markets (Beck and Levine, 2004) by collecting and pooling savings and allocating resources to industries that are expected to bring positive economic results. Convergently, micro-prudential and macro-prudential regulations are crucial for economic growth by allocating funds to structural transformation for enterprises. Given the importance of policies and regulations on growth, some studies have critically assessed the role of financial development through monetary transmission channels (Dafermos et al., 2018; Ishiwata and Yokomatsu, 2018) Shobande and Shodipe (2019) and Nabeeh et al. (2021) has identified sustainable development as well as fiscal policy and credit as key factors promoting sustainable development. Finally, financial regulation is effective in controlling the distortion of physical resources and preventing any negative impact on SED (Venables, 2016).

## 2. LITERATURE REVIEW

The financial sector plays an important role in economic growth and development of the global economy. The financial operations of firms seem to depend on financial institutions. Firms in developing countries are usually fueled by capital from bank financing, while their counterparts in developed countries often obtain financial resources from financial markets (Ang, 2008a). Since the 1990s, various empirical studies have investigated the relationship between economic growth and financial development, following the seminal work of King and Levine (1993). However, the theory of financial growth was developed in the 1950s.

Schumpeter (1911), one of the first researchers, examined the critical role of credit markets in economic growth and development. Schumpeter saw banks as a key player in facilitating and intermediating savings, leading to capital accumulation and supporting economic growth. Various researchers have supported this argument (Gurley and Shaw, 1955; Goldsmith, 1969 and Hicks, 1969). In particular, the significant contribution of financial development to economic growth has been highlighted in the studies by McKinnon (1973) and Shaw (1973).

However, Schumpeter's argument has been challenged by many scholars. Robinson (1979) presents a different view of the finance-growth link, arguing that developments in the financial sectors are essential for economic growth. He finds that banks and financial markets respond to economic growth and are not "inputs" to economic growth. Recently, endogenous financial development and the growth model have been discussed by researchers. They consider, on the one hand, that increased growth will require more financial products/services. On the other hand, the growth of financial institutions will facilitate capital accumulation, leading to higher economic growth.

Various empirical studies have examined the relationship between financial development and economic growth at the cross-country or national level. Using the system generalized method of moments (SGMM), Ibrahim and Alagidede (2018) present the effect of financial development on economic growth in 29 sub-Saharan African countries between 1980 and 2014. Similarly, Asteriou and Spanos (2019) find similar results in 26 European countries over the period 1990-2016. In contrast, using GMM, Cheng, Chien and Lee (2020) conclude that financial development has a negative effect on economic growth in 72 countries over the period 2000-2015. At the country level, Abu-Bader and Abu-Qarn (2008) confirm a two-way causality between financial development and growth in Egypt from 1960 to 2001. Uddin, Sj¨o and Shahbaz (2013) confirm the positive effect of financial development on growth in Kenya in the long run using the autoregressive distributed lags (ARDL) approach. This finding is consistent with Samargandi, Fidrmuc and Ghosh (2014) in Saudi Arabia. On another paper, Wolde-Rufael (2009) conclude that there is a bidirectional causality between growth and financial development in Kenya. Hao, Wang and Lee (2018) find unidirectional causality between economic growth and financial development in China.

Over the past two decades, the conventional relationship between financial development and economic growth appears to be well examined. For example, Edward (1999) and Harwood, Litan and Pomerleano (1999) discuss the different effects of the financial crisis in emerging countries, particularly in Southeast Asian countries, from 1993 to 1997, which were reflected in their current account deficits. Malaysia was the most affected country in the region, with a current account deficit of -4.9% of gross domestic product (GDP) in 1997, while Singapore had a current account surplus equivalent to 15.4% of GDP in the same year. Since then, the effect of financial development on economic growth in emerging markets has been neglected. Empirical studies have focused on the effects of financial development on macroeconomic stability (Kim & Wu, 2008), environmental impacts (Cetin & Bakirtas, 2020; Durusu- Ciftci, Soytas, & Nazlioglu, 2020; Sadorsky, 2010), social contributions (Nguyen, Vu, Vo, & Ha, 2019), and many other topics. Krishnan (2011) discusses the role of financial development in India.

Tran, Walle and Herwartz (2020) take a sample of over 40,000 Vietnamese firms to study the impact of local financial development on firm growth, which depends on corruption, using the empirical GMM method and various proxies on financial development. Their results confirm the impact of financial development on growth. Nguyen, Brown and Skully (2019) argue that stock and bond markets support economic growth in middle-income countries. Their findings also show a positive effect of bond markets on economic growth in high-income countries. Ang (2008b) studies

the link between financial development and economic growth in Malaysia for the period 1960-2003. The results confirm a positive long-term impact of financial development on economic growth. Finally, Yang (2019) also confirms the important contributions of financial development to economic growth in middle- and high-income countries.

The model of endogenous financial development and economic growth has been widely discussed. This model assumes that a higher level of economic growth requires financial products/services that provide increased access to financial markets and promote economic growth. Various empirical studies have been conducted in this direction, using the endogenous model of financial development and economic growth. For example, Shahbaz, Khan and Tahir (2013) investigate the dynamic links between economic growth and energy consumption, financial development and trade using multivariate framework analysis. Their results confirm a long-run relationship between these variables using the ARDL bounds test, and bidirectional causality between financial development and economic growth. Furthermore, Wolde-Rufael (2009) finds a bidirectional Granger causality between economic growth and the financial sector using the Toda and Yamamoto test. Finally, Pradhan, Arvin, Nair, Bennett and Hall (2018) show bidirectional causality between economic growth and financial development for a sample of 35 countries over the period: 1961-2015. The study by d'Egbetunde and Akinlo (2015) shows evidence of long-run causality from economic growth to financial globalisation, while those by Walle (2014) clearly show the opposite. However, an earlier study on sub-Saharan African countries finds bidirectional causality between financial development and economic growth (Fowowe, 2011).

Other studies have also indirectly examined the effect of financial development on economic growth. Alfaro, Chanda, Kalemli-Ozcan and Sayek (2004) discuss the key roles of finance in different ways. Their findings indicate that financial development plays a vital role in showing the important contribution of foreign direct investment (FDI) to economic growth.

Kutan, Samargandi and Sohag (2017), on the other hand, examine the finance-growth nexus by focusing on the important roles of FDI and institutional quality in Middle Eastern and North African (MENA) countries. The findings of their paper confirm a positive contribution of financial development to economic growth in these countries. Finally, Slesman, Baharumshah and Wohar (2015) find inconsistent effects of capital flows on economic growth resulting from the level of institutional quality. They conclude that institutional quality is important for the effective use of foreign capital flows to support economic growth in middle-income countries and also to avoid the middle-income trap. However, the empirical results on this relationship are mixed and differ across studies depending on the country sample, the study period and the empirical technique used.

## 3. DATA

Our dependent variable in this study is financial development. It is measured by the Financial Development Index (FDI). The data on the measurement of financial development is the International Monetary Fund's (IMF) "New General Index of Financial Development" (Sahay et al, 2015).

The main independent variable on which our study is based is measured by real per capita

gross domestic product (GDP) growth as an annual percentage. We also include the real sector (trade openness, government spending, foreign direct investment and inflation) in the set of independent variables. The data used are the World Bank's economic development indicators for Algeria.

The data set consists of annual data for Algeria for the period 1980-2020. Table 1 presents the definition and description of the variables used in this paper.

**Table 1.**Data description

| Variable | Description |
|---|---|
| **GDPPC** | Annual growth rate (%) |
| **FDI** | the index varies from 0 to 1 (0=low to 1=high) |
| **INFL** | Consumer price inflation |

***Source:****realized by the authors*

- ***Model specification and methodology:***

The basic model used to carry out the study can be written as follows:

$$y_t = \alpha + \beta Z_t + \varepsilon_t$$

$y_t$ : Financial development indicator;

$Z_t$ : A set of explanatory variables related to gross domestic product per capita and other real sector variables;

$\varepsilon_t$ : is the stochastic error term.

In this study, we are mainly interested in the short- and long-term causal relationship between economic growth and financial development. The latter as follow:

$$FDI = f(GDP)$$

Where FDI is the financial development indicator and GDP is the real gross domestic product per capita measuring economic growth.

We used a multi-step methodology to test this relationship. First, we used the Augmented Dickey-Fuller (ADF) (1979, 1981) and Phillips and Perron (1988) tests to test the unit root hypothesis among the series.

In the second step, we applied the ARDL: Autoregressive Distributed Lag approach to cointegration (bound Testing methodology) developed by Pesaran et al. (2001) in order to check both short-run and long-run phenomena. The general equation of the ARDL is as follows:

$$\Delta FDI = \gamma_0 + \gamma_1 FDI_{t-1} + \gamma_2 GDPP_{t-1} + \gamma_3 X_{t-1} + \sum_{i=1}^{n} \tau_{1i} \Delta FDI_{t-i} + \sum_{i=0}^{m} \tau_{2i} \Delta GDPP_{t-1} + \sum_{i=0}^{p} \tau_{3i} \Delta X_{t-i} + \varepsilon_t \quad (1)$$

Where, FDI is the financial development index, GDPP is real GDP per capita and X represents

a vector of additional variables used as a proxy for the real sector.

Before estimating the ARDL model to apply the bound Testing methodology. We need to determine the DGP condition: ARDL specification test.

Here, it is also important to note that Pesaran et al (2001) propose five alternative interpretations of the CEC (ARDL) model, distinguished according to the determination of the terms that fit into the error correction term. When deterministic terms contribute to the error correction term, they are implicitly projected onto the range of the cointegrating vector. In other words, β and α of the VAR(p) model are restricted to a linear combination of the elements in the cointegrating vector.

Next we check whether the series represent an autocorrelation of the residuals and whether the error variance is homogeneous. For this, we apply, respectively, the tests: (residual autocorrelation test, heteroscedasticity test).

Finally, the Granger causality of the vector error correction model (VECM) is applied in this study. The VECM is useful for estimating the coefficients of both short-run and long-run relationships between financial development indicators and economic growth. The VECM equations are modelled as follows:

$$\Delta Y = \omega_0 + \sum_{i=1}^{d} \omega_{1i} \Delta Y_{t-i} + \sum_{i=0}^{e} \omega_{2i} \Delta FDI_{t-i} + \sum_{i=0}^{f} \omega_{3i} \Delta X_{t-i} + \lambda_1 ECT_{t-1} + \varepsilon_t \quad (2)$$

$$\Delta FDI = \theta_0 + \sum_{i=1}^{d} \theta_{1i} \Delta FDI_{t-i} + \sum_{i=0}^{e} \theta_{2i} \Delta Y_{t-i} + \sum_{i=0}^{f} \theta_{3i} \Delta X_{t-i} + \lambda_2 ECT_{t-1} + \varepsilon_t \quad (3)$$

$\lambda_1$, $\lambda_2$: Are the coefficients of the Error Correction Term (ECT).

## 4. RESULTS AND DISCUSSION

After presenting the results, we will evaluate and interpret their implications, particularly in relation to the initial hypotheses.

### *A. Stationarity test*

**Table 2.**Augmented Dickey‑Fuller, Phillips and Perron

| | Augmented Dickey-Fuller | | | | Phillips-Perro | | | |
|---|---|---|---|---|---|---|---|---|
| | Level | | First difference | | level | | First difference | |
| Variable | Constant | Constant & Trend | Constant | Constant & Trend | Constant | Constant & Trend | Constant | Constant & Trend |
| GDPPC | (0.045)** -2.981 | (0.171) -2.905 | (0.000)*** -7.655 | (0.000)*** -5.816 | (0.030)** -3.159 | (0.121) -3.094 | (0.000)*** -7.655 | (0.000)*** -7.700 |
| IDE | (0.120) -2.513 | (0.0775) -3.320 | (0.000)*** -6.850 | (0.000)*** -5.816 | (0.148) -2.400 | (0.069)* -3.373 | (0.000)*** -9.843 | (0.000)*** -10.075 |
| FDI | (0.368) -1.814 | (0.8867) -1.244 | (0.000)*** -8.172 | (0.000)*** -8.096 | (0.363) -1.825 | (0.687) -1.796 | (0.0000)*** -8.083 | (0.000)*** -8.029 |
| INFL | (0.365) -1.819 | (0.4804) -2.192 | (0.000)*** -5.771 | (0.000)*** -5.682 | (0.311) -1.940 | (0.410) -2.326 | (0.000)*** -5.766 | (0.000)*** -5.676 |
| TRAD_OPEN | (0.548) -1.449 | (0.8000) -1.535 | (0.000)*** -4.814 | (0.002)*** -4.746 | (0.548) -1.449 | (0.800) -1.535 | (0.000)** -4.712 | (0.003)** -4.635 |
| GOV | (0.902) -0.383 | (0.890) -1.228 | (0.000)*** -4.820 | (0.000)*** -4.460 | (0.842) -0.672 | (0.780) -1.587 | (0.000)*** -4.972 | (0.000)*** -4.914 |

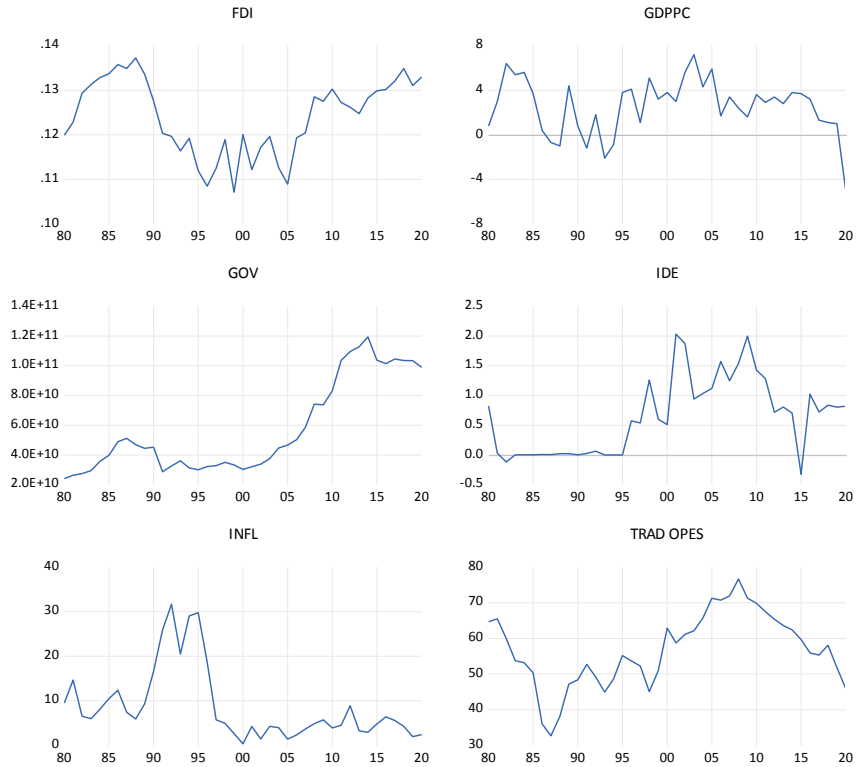
***Sources:*** *calculated by the authors using eviews 12*

(***), (**), (*): Stationarity of variables at the 1%, 5%, and 10% significance levels. The values in brackets are the probabilities.

From the results in table (02), the statistics are above the critical values at the thresholds of : 1%, 5% and 10% for both Augmented Dickey-Fuller and Phillips-Perro tests. We therefore accept the null hypothesis of unit root and reject the alternative hypothesis of no unit root, i.e. all the variables are integrated of order I and are therefore stationary. This allows us to estimate the method: ARDL.

### *B. Specification of the ARDL model*

**Fig.1.**Graphical presentation of the sample variables




***Sources:*** *calculated by the authors using eviews 12*

The Algerian economy outlines Algeria's structural and cyclical economic situation. Since its independence in 1962, Algeria has established a solid industrial base by launching major economic projects. However, despite the significant achievements (committed roads, motorways, hospitals, housing, metro and tramway, etc.) the Algerian economy has experienced various stages of turbulence.

In the 1980s, the Algerian economy encountered major obstacles. Indeed, the oil counter-shock of 1986 had a negative effect on the Algerian economy, which is considered to be entirely rentier, and this was the period of the economic and stabilization plans. In the early 1990s, Algeria employed structural reforms to facilitate the transition to a market economy. In 2012, the Algerian economy has not managed to develop a real industrialization that is competitive with foreign countries and varies in many areas, as it remains strongly linked to oil revenues, which are considered its only source of income.

The 2017 report on Algeria by the Oxford Business Group (OGB), a consultancy and economic intelligence firm, stresses the efforts made by Algeria to solidify and diversify its economy in order to cope with the fall in oil prices. The report emphasizes the role of the private sector in GDP, in particular that of small and medium-sized enterprises (SMEs) supported by new measures; as well as the financial services sector, which has seen an accentuated development such as the introduction of online payments.

We note that the Algerian economy has gone through various stages of turbulence. Therefore, we have to take into consideration all the changes in order to choose among the five different DGP specifications, the best specification suitable for our study. By analyzing the graphical representation of the latter.

The selection of an appropriate model to fit the data is both an art and a science. Nevertheless, there are some guidelines. Any model in which the series are not centred on zero will generally require the case three: constant, while any model in which the series exhibit a trend will generally have a better fit so that the trend term is incorporated.

Our series are not increasing, they do not evolve and decrease with time. So there is no trend, we will not choose the model: Trend. Also, the series are not centred on zero. This leads us to choose case 03, to estimate the ARDL model: Unrestricted Constant and No Trend.

### *C. Residual autocorrelation test (LM test):*

**Table 3.**Test d'autocorrélation des résidus

| | | | |
|---|---|---|---|
| F-statistic | 0.220205 | Prob. F(1,7) | 0,6531 |
| Obs*R-squared | 1.128441 | Prob. Chi-Square(2) | 0.2881 |

***Sources:*** *calculated by the authors using eviews 12*

The P value of the statistical value F (0.220205): 0.651 is greater than the 10% threshold. This leads to the acceptance of the null hypothesis: no serial correlation of the residuals. We therefore conclude that we do not have a problem with serial correlation.

### *D. Heteroscedasticity test:*

**Table 4.** Heteroscedastic test

| | | | |
|---|---|---|---|
| F-statistic | 0.677488 | Prob. F (27,9) | 0.7931 |
| Obs*R-squared | 24.79870 | Prob. Chi-Square (27) | 0.5857 |
| Scaled explained SS | 1.068139 | Prob. Chi-Square (27) | 1.0000 |

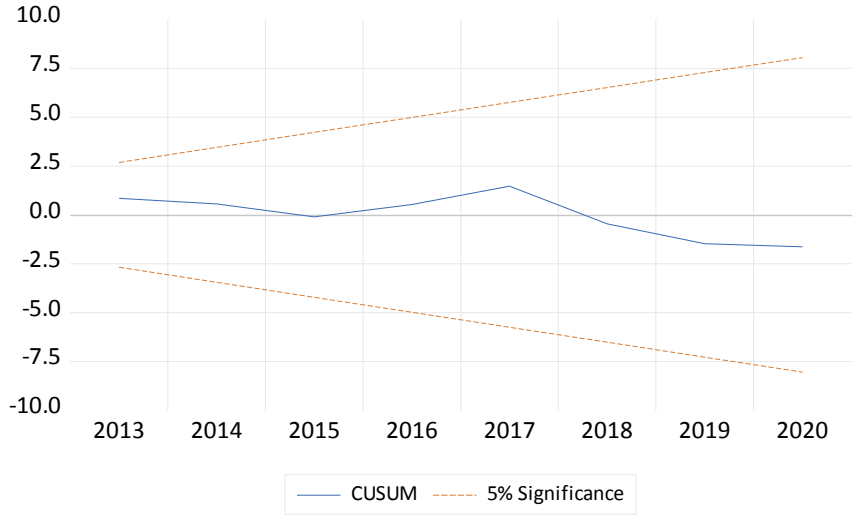
***Sources:*** *calculated by the authors using eviews 12*

The P value of the statistical value F (0.7931): 0.677488 is higher than the 10% threshold. This leads to the acceptance of the null hypothesis: the residuals are homoscedastic. We therefore conclude that the residuals are homoscedastic at the 10% significance level.

### *E. Test for stabilization of variables:*

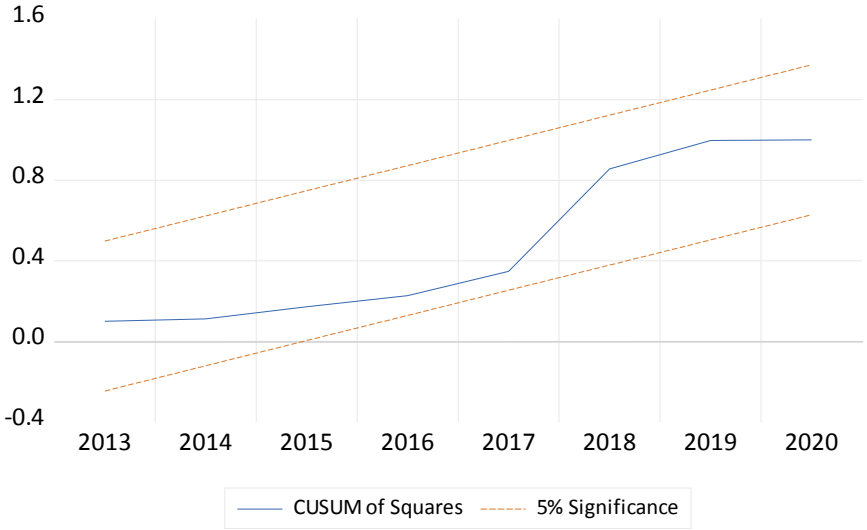
The sum of the errors is between the two confidence levels on the two graphs below, which means that the value of the model parameters is constant over time. This means that the variables are stationary.

**Fig.2.**Graph of the cumulative set




***Sources:*** *calculated by the authors using eviews 12*

**Fig.3.**Cumulative sum of squares graph




***Sources:*** *calculated by the authors using eviews 12*

### *F. ARDL Long Run Form and Bounds Test:*

$$\begin{cases} H_0: \text{Abcence of a co} - \text{integration relationship} \\ H_1: \text{Co} - \text{integration relationship} \end{cases}$$

**Table 5.** F-Bounds Test

| **Statistical test** | **Value** | **Signif.** | **I(0)** | **I(1)** |
|---|---|---|---|---|
| | | | **asymptotic n=1000** | |
| F-statistic | 6.3373 | 10% | 2.26 | 3.35 |
| K | 5 | 5% | 2.62 | 3.79 |
| | | 2.5% | 2.96 | 4.18 |
| | | 1% | 3.41 | 4.68 |
| Sample size | 37 | | Final sample: n=40 | |
| | | 10% | 2.483 | 3.708 |
| | | 5% | 2.962 | 4.338 |
| | | 1% | 4.045 | 5.898 |

***Sources:*** *calculated by the authors using eviews 12*

The result of the F-Bournds test is presented in Table 5. The calculated F-statistic 6.3373 is above the critical value limit I(1) at the 1% threshold. This result indicates that we reject the null hypothesis H_0 that there is no balancing relationship. And to say that there is evidence of a co-integration relationship between the variables. An important conclusion that can be drawn here is that there is a long-run relationship between economic growth and financial development in Algeria.

$$\begin{cases} \mathrm{H}_{1_0}: \text{Nonsense cointegration relation} \\ \mathrm{H}_{1_1}: \text{Cointegration relationship of the usual type} \\ H_{1_2}: Valid\ but\ degenerate\ cointegration\ relationship) \end{cases}$$

Since we rejected the null hypothesis and did not include a constant or trend in the cointegrating relationship, we use the critical values of the t-bounds test to determine which alternative hypothesis emerges. So we use the critical values of the t-bounds test to determine which alternative hypothesis emerges.

**Table 6.** t- Bounds Test

| **Statistical test** | **value** | **Signif.** | **I(0)** | **I(1)** |
|---|---|---|---|---|
| **t-statistic** | **-4,404683** | 10% | -2.57 | -3.86 |
| | | 5% | -2.86 | -4.19 |
| | | 2.5% | -3.13 | -4.46 |
| | | 1% | -3.43 | -4.79 |

***Sources:*** *calculated by the authors using eviews 12*

From Table 06, the absolute value of the calculated t-statistic is|-4.404683 |=4.404683 , which is higher than the absolute value of t-Bounds I(0) or I(1) at the 5% threshold. This result suggests that we should reject the null hypothesis H_(1_0 ): (cointegrating relationship without any nonsense)

from the t-Bounds test and conclude that the cointegrating relationship is either of the usual type or valid but degenerate. Nevertheless, an examination of the fit between the dependent variable and the balancing equation should lead us to believe that the relationship is indeed valid.

### *G. Estimating the speed of adjustment:*

**Table 7.** The cointegration equation

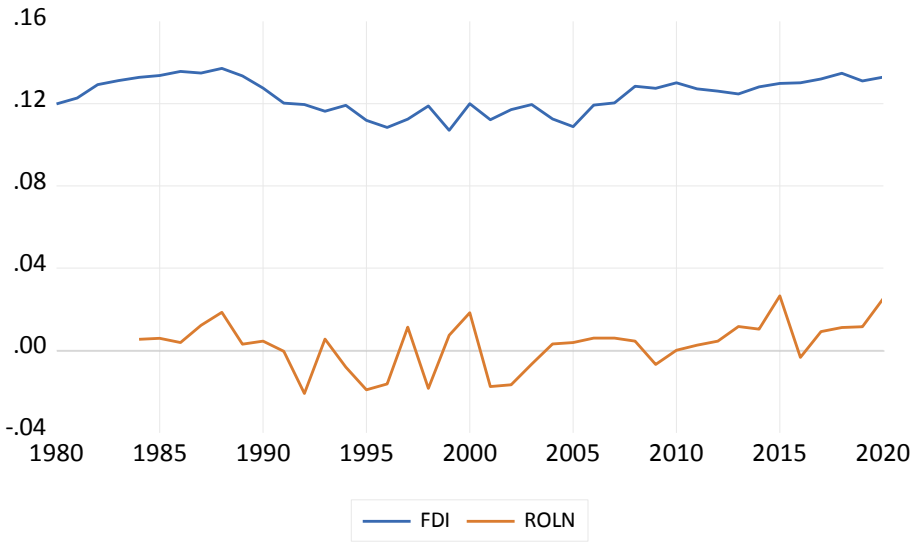
| Variable | Coefficient | Std. Error | t-Statistic | Probability |
|---|---|---|---|---|
| **CointEq(-1)*** | **-0.890350** | 0.113267 | -7.860623 | **0.0000** |

***Sources:*** *calculated by the authors using eviews 12*

As expected, the CE term, represented here by CointEq(-1), is negative with an associated coefficient estimate of -0.890350. This implies that about 89.90% of all short-run imbalance movements are corrected over a long period. Furthermore, given that t-statistics is -7.860623, we can also conclude that the coefficient is highly significant.

### *H. Determining the case of the cointegrating relationship:*

**Fig.4.**Plot of the Financial Development Index and Cointegration




***Sources:*** *calculated by the authors using eviews 12*

From the graph above we can see that this is a validated but degenerate cointegration relationship. Pesaran (2001) has pointed out a special case called the degenerate case. This can happen even if the null hypothesis of non-cointegration is rejected under the F-Bounds test. The first case he dubbed the degenerate case (1): this is the situation where only the lagged dependent variable is significant but not for the other lagged independent variables. And the second, he called the degenerate case (2). He defined as significant only for the lagged independent variables but not for the lagged dependent variable.

Looking at the lagged variables in the model, we find that the lagged dependent variable is significant but all the other independent variables are not significant. We therefore conclude that this

is a validated but degenerate cointegration relationship: case 01, between economic growth and financial development.

### *I. The cointegration equation:*

**Table 8.** The cointegration equation

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| **GDPPC** | -0.003046 | 0.000940 | -3.239879 | 0.0119 |
| **GOV** | -2.61E-15 | 4.74E-14 | -0.055036 | 0.9575 |
| **IDE** | -0.019770 | 0.004484 | -4.408970 | 0.0023 |
| **INFL** | -0.001453 | 0.000304 | -4.776259 | 0.0014 |
| **TRAD_OPES** | 0.000645 | 0.000302 | 2.134676 | 0.0653 |

***Sources:*** *calculated by the authors using eviews 12*

We find that the probabilities are zero for all variables in the model except for public expenditure. This means that the model is globally significant.

This result suggests that there is evidence of co-integration between the financial development indicator, economic growth and the other variables.

### *J. Granger Vector Error Correction Model causality test (VECM)*

**Table 9.**Granger Vector Error Correction Model causality test (VECM)

| | D(GDPPC) | D(FDI) | D(IDE) | D(GOV) | D(INFL) | D(TRAD_OPES) |
|---|---|---|---|---|---|---|
| **D(GDPPC)** | | **(0.0003)*** 18.81950** | (0.5877) 1.927165 | (0.1690) 5.037998 | (0.8529) 0.785786 | (0.7021) 1.414533 |
| **D(FDI)** | **(0.0903)* 6,484626** | | (0.2939) 3.715142 | (0.1790) 4.903670 | (0.8629) 0,743404 | (0.4856) 2.443609 |
| **D(IDE)** | (0.6214) 1.770254 | (0.0000)*** 63.61623 | | (0.6249) 1.754482 | (0.9754) 0,2135 | (0.9813) 0.176334 |
| **D(GOV)** | (0.1992) 4.650985 | (0.1790) 4.903670 | (0.6249) 1.754482 | | (0.9112) 0.534646 | (0.9986) 0.030439 |
| **D(INFL)** | (0.7046) 1.403841 | (0.0000)*** 36.44629 | (0.4113) 2.875057 | (0.1846) 4.830901 | | (0.5085) 2.321011 |
| **D(TRAD_OPES)** | (0.0027)*** 14.12691 | (0.0000)*** 22.97813 | (0.2948) 3.707711 | (0.9767) 0.205625 | (0.7483) 1.219553 | |

***Sources:*** *calculated by the authors using eviews 12*

(***), (**), (*) : Stationarity of variables at the 1%, 5%, and 10% significance levels.

The values in brackets are the probabilities.

**Tableau 10.**Hypothesis testing - Granger causality VECM Model

| ***Hypothesis*** | **Statistic** | **Probability** |
|---|---|---|
| *Economic growth does not cause financial development* | 18.81950 | (0.0003)*** |
| *Financial development does not cause economic growth* | 6,484626 | (0.0903)* |

***Sources:*** *realized by the authors*

Based on the above results, we use the Granger causality test in the VECM model to identify whether there is a causal relationship between financial development and GDP per capita in Algeria.

The results are presented in the tables. Based on these results, we conclude that there is a bidirectional causal relationship between GDP per capita and the financial development index in Algeria.

While our main conclusion that growth drives finance in Algeria, Esso (2010), (Egbetude and Mobolaji, 2010) Abu-Bader and Abu-Qarn (2008), Wolde-Rufael (2009). Kenya. Hao, Wang and Lee (2018) (Fowowe, 2011), Uddin , Sj¨o and Shahbaz (2013), Shahbaz, Khan and Tahir (2013) Walle (2014) Samargandi, Fidrmuc and Ghosh (2014), Pradhan, Arvin, Nair, Bennett and Hall (2018). Other studies have found that financial development promotes growth in the same country. Moreover, the least squares method and Wald test employed on the cointegrated equation (see Appendix) show that the relationship is both long-run and short-run.

## 5. CONCLUSION

The primary concern of this study is to define the virtues of financial development as an engine of growth. The study thus aims to contribute to the development of our country by providing new evidence from Algeria. More specifically, it analyses the relationship between financial development and economic growth in the country.

The literature on the finance-growth nexus examined in the study concludes that the relationship between finance and economic growth remains ambiguous. As long as the relationship is unidirectional or bidirectional, it may be insignificant.

The results indicate that there is a bidirectional causal relationship between GDP per capita and the financial development index in Algeria. This relationship is both long-run and short-run. Then, using the t-bounds test, we conclude that it is a validated but degenerate cointegration relationship. This result confirms the results of previous studies by Shahbaz, Khan and Tahir (2013) , Egbetunde and Akinlo (2015) and Pradhan, Arvin, Nair, Bennett and Hall (2018).

The policy implications that could arise from the findings of this study are that Algeria needs to promote and focus more on economic growth in order to have a high level of financial development.

## 6. Bibliography List:

*Abu-Bader, S., & Abu-Qarn, A. S. (2008). Financial development and economic growth: The Egyptian experience. Journal of Policy Modeling, 30(5), 887–898. https://doi.org/10.1016/j.jpolmod.2007.02.001*

*Alfaro, L. et al. (2004). FDI and economic growth: The role of local financial markets. Journal of International Economics, 64(1), 89–112.*

*Ang, J. B. (2008a). A survey of recent developments in the literature of finance and growth. Journal of Economic Surveys, 22(3), 536–576.*

*Ang, J. B. (2008b). What are the mechanisms linking financial development and economic growth in Malaysia? Economic Modelling, 25(1), 38–53. https://doi.org/10.1016/j.econmod.2007.04.006*

*Asteriou, D., & Spanos, K. (2019). The relationship between financial development and economic growth during the recent crisis: Evidence from the EU. Finance Research Letters, 28, 238–245. https://doi.org/10.1016/j.frl.2018.05.011*

*Botev, J. et al. (2019). The non-linear relationship between economic growth and financial development: Evidence from developing, emerging and advanced economies. International Economics, 160, 3–13.June.*

*Cetin, M. A., & Bakirtas, I. (2020). The long-run environmental impacts of economic growth, financial development, and energy consumption: Evidence from emerging markets. Energy & Environment, 31(4), 634–655.*

*Cheng, C. Y. et al. (2020). ICT diffusion, financial development, and economic growth: An international cross-country analysis. Economic Modelling. https://doi.org/10.1016/j.econmod.2020.02.008*

*Dong, K. et al. (2018). CO2 emissions, economic and population growth, and renewable energy: Empirical evidence across regions. Energy Economics, 75, 180–192. https://doi.org/10.1016/j.eneco.2018.08.017*

*Durusu-Ciftci, D., Soytas, U., & Nazlioglu, S. (2020). Financial development and energy consumption in emerging markets: Smooth structural shifts and causal linkages. Energy Economics, 87, 104729*

*Edwards, S. (1999). Crisis prevention: Lessons from Mexico and east Asia. National Bureau of Economic Research. Retrieved from: https://www.nber.org/papers/w7233/*

*Egbetunde, T., & Akinlo, A. E. (2015). Financial Globalization and Economic Growth in Sub‐Saharan Africa:Evidence from Panel Cointegration Tests. African Development Review, 27, 187-198.https://doi.org/10.1111/1467-8268.12140*

*Goldsmith, R. W. (1969). Financial structure and development. New Haven, CT: Yale University Press.*

*Gurley, J. G., & Shaw, E. S. (1955). Financial aspects of economic development. The American Economic Review, 45(4), 515–538.*

*Hao, Y., Wang, L. O., & Lee, C. C. (2018). Financial development, energy consumption and China's economic growth: New evidence from provincial panel data. International Review of Economics & Finance. https://doi.org/10.1016/j.iref.2018.12.006*

*Harwood, A., Litan, R. E., & Pomerleano, M. (1999). The crises in emerging financial markets: A World Bank group-brookings conference report. Brookings Institution. Retrieved from: https://www.brookings.edu/research/the-crisis-in-emerging-financial-markets-a-world-bank-group-brookingsconference-report/.*

*Hicks, J. R. (1969). A Theory of Economic History. Oxford: Oxford UniversityPress.*

*Ibrahim, M., & Alagidede, P. (2018). Effect of financial development on economic growth in sub-Saharan Africa. Journal of Policy Modeling, 40(6), 1104–1125. https://doi.org/10.1016/j.jpolmod.2018.08.001*

*Kar, M., Nazlioğlu, S¸ ., & Ağir, H. (2011). Financial development and economic growth nexus in the MENA countries: Bootstrap panel granger causality analysis. Economic Modelling, 28(1–2), 685–693. https://doi.org/10.1016/j.econmod.2010.05.015*

*Kim, S. J., & Wu, E. (2008). Sovereign credit ratings, capital flows and financial sector development in emerging markets. Emerging Markets Review, 9(1), 17–39.*

*King, R. G., & Levine, R. (1993). Finance and growth: Schumpeter might be right. Quarterly Journal of Economics, 108(3), 717–737. https://doi.org/10.2307/2118406*

*Krishnan, K. P. (2011). Financial development in emerging markets: The Indian experience. Asian Development Bank Institute.*

*Kutan, A. M., Samargandi, N., & Sohag, K. (2017). Does institutional quality matter for financial development and growth? Further evidence from MENA countries. Australian Economic Papers, 56(3), 228–248.*

*Lee, C. C., & Chang, C. P. (2009). FDI, financial development, and economic growth: International evidence. Journal of Applied Economics, 12(2), 249–271. https://doi.org/10.1016/S1514-0326(09)60015-5*

*McKinnon, R. I. (1973). Money and Capital in Economic Development. Washington: Brookings Institution Press.*

*Nguyen, C. T., Vu, N. T., Vo, H. D., & Ha, T. T. D. (2019). Financial development and income inequality in emerging markets: A new approach. Journal of Risk and Financial Management, 12(4), 173. https://doi.org/10.3390/jrfm12040173*

*Nguyen,Y.N., Brown, K.,&Skully,M. (2019). Impact of finance on growth: Does it vary with development levels or cyclical conditions? Journal of Policy Modeling, 41(6), 1195–1209. https://doi.org/10.1016/j.jpolmod.2019.05.006*

*Pradhan, R. P., Arvin, M. B., Nair, M., Bennett, S. E., & Hall, J. H. (2018). The dynamics between energy consumption patterns, financial sector development and economic growth in financial action task force (FATF) countries. Energy, 159, 42–53. https://doi.org/10.1016/j.energy.2018.06.094*

*Robinson, J. (1979). The generalization of the general theory. In The Generalization of the General Theory and Other Essays (p. 176). London: PalgraveMacmillan.*

*Sadorsky, P. (2010). The impact of financial development on energy consumption in emerging economies. Energy Policy, 38(5), 2528–2535.*

*Sahay, R., Čihák, M., N' Diaye, P., Barajas, A., Bi, R., Ayala, D., Gao, Y., ⋯ Yousefi, S. R. (2015). Rethinking Financial Deepening: Stability and Growth in Emerging Markets. International Monetary Fund. Staff Discussion Notes. https://doi.org/10.5089/9781498312615.006*

*Samargandi, N., Fidrmuc, J., & Ghosh, S. (2014). Financial development and economic growth in an oil-rich economy: The case of Saudi Arabia. Economic Modelling, 43, 267–278. https://doi.org/10.1016/j.econmod.2014.07.042*

*Samargandi, N., Fidrmuc, J., & Ghosh, S. (2015). Is the relationship between financial development and economic growth monotonic? Evidence from a sample of middle-income countries. World Development, 68(1), 66–81. https://doi.org/10.1016/j.worlddev.2014.11.010*

*Schumpeter, J. A. (1911). The Theory of Economic Development. Cambridge, MA: Harvard University Press.*

*Shahbaz, M., Khan, S., & Tahir, M. I. (2013). The dynamic links between energy consumption, economic growth, financial development and trade in China: Fresh evidence from multivariate framework analysis. Energy Economics, 40, 8–21. https://doi.org/10.1016/j.eneco.2013.06.006*

*Shaw, E. S. (1973). Financial Deepening in Economic Development. New York: Oxford University Press.*

*Slesman, L., Baharumshah, A. Z., & Wohar, M. E. (2015). Capital inflows and economic growth: Does the role of institutions matter? International Journal of Finance & Economics, 20(3), 253–275.*

*Tran, V. T., Walle, Y. M., & Herwartz, H. (2020). The impact of local financial development on firm growth in Vietnam : Does the level of corruption. European Journal of Political Economy, 62. https://doi.org/10.1016/j.ejpoleco.2020.101858*

*Uddin, G. S., Sj¨o, B., & Shahbaz, M. (2013). The causal nexus between financial development and economic growth in Kenya. Economic Modelling, 35, 701–707. https://doi.org/10.1016/j.econmod.2013.08.031. June 2011.*

*Walle, Y. M. (2014). Revisiting the Finance‐Growth Nexus in Sub‐Saharan Africa: Results from Error CorrectionbasedPanel Cointegration Tests. African Development Review, 26, 310-321. https://doi.org/10.1111/1467-8268.12083*

*Wolde-Rufael, Y. (2009). Re-examining the financial development and economic growth nexus in Kenya. Economic Modelling, 26(6), 1140–1146. https://doi.org/10.1016/j.econmod.2009.05.002*

*Yang, F. (2019). The impact of financial development on economic growth in middle-income countries. Journal of International Financial Markets, Institutions and Money, 59, 74–89. https://doi.org/10.1016/j.intfin.2018.11.008*

## 7. Annexes :

Dependent Variable: FDI
Method: ARDL
Date: 10/28/22 Time: 18:11
Sample (adjusted): 1984 2020
Included observations: 37 after adjustments
Maximum dependent lags: 4 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): GDPPC GOV INFL IDE TRAD_OPES
Fixed regressors: C
Number of models evalulated: 12500
Selected Model: ARDL(3, 4, 4, 4, 4, 4)

| Variable | Coefficient | Std. Error | t-Statistic | Prob.* |
|---|---|---|---|---|
| FDI(-1) | -0.224351 | 0.225405 | -0.995323 | 0.3487 |
| FDI(-2) | 0.516750 | 0.152368 | 3.391460 | 0.0095 |
| FDI(-3) | -0.182748 | 0.197313 | -0.926183 | 0.3814 |
| GDPPC | -0.000236 | 0.000289 | -0.816400 | 0.4379 |
| GDPPC(-1) | -0.000883 | 0.000375 | -2.354102 | 0.0464 |
| GDPPC(-2) | -0.000554 | 0.000485 | -1.143123 | 0.2860 |
| GDPPC(-3) | -0.000595 | 0.000387 | -1.535058 | 0.1633 |
| GDPPC(-4) | -0.000444 | 0.000380 | -1.169277 | 0.2759 |
| GOV | 7.75E-14 | 1.15E-13 | 0.676050 | 0.5181 |
| GOV(-1) | 8.10E-14 | 1.41E-13 | 0.576241 | 0.5803 |
| GOV(-2) | -5.49E-14 | 1.27E-13 | -0.432994 | 0.6765 |
| GOV(-3) | 6.39E-14 | 1.46E-13 | 0.437206 | 0.6735 |
| GOV(-4) | -1.70E-13 | 1.09E-13 | -1.563367 | 0.1566 |
| INFL | -9.41E-05 | 0.000150 | -0.627993 | 0.5475 |
| INFL(-1) | -0.000470 | 0.000169 | -2.781643 | 0.0239 |
| INFL(-2) | -0.000168 | 0.000217 | -0.777959 | 0.4590 |
| INFL(-3) | -5.97E-05 | 0.000184 | -0.324691 | 0.7537 |
| INFL(-4) | -0.000501 | 0.000132 | -3.805296 | 0.0052 |
| IDE | -0.000141 | 0.001725 | -0.081887 | 0.9367 |
| IDE(-1) | -0.002578 | 0.001772 | -1.455059 | 0.1837 |
| IDE(-2) | -0.001750 | 0.001711 | -1.023183 | 0.3362 |
| IDE(-3) | -0.009402 | 0.001477 | -6.364483 | 0.0002 |
| IDE(-4) | -0.003730 | 0.001946 | -1.916461 | 0.0916 |
| TRAD_OPES | -0.000233 | 0.000141 | -1.659682 | 0.1356 |
| TRAD_OPES(-1) | 0.000362 | 0.000207 | 1.750174 | 0.1182 |
| TRAD_OPES(-2) | -0.000146 | 0.000267 | -0.547233 | 0.5991 |
| TRAD_OPES(-3) | 0.000292 | 0.000191 | 1.525599 | 0.1656 |
| TRAD_OPES(-4) | 0.000300 | 0.000171 | 1.752317 | 0.1178 |
| C | 0.106836 | 0.031021 | 3.444002 | 0.0088 |

| | | | |
|---|---|---|---|
| R-squared | 0.985418 | Mean dependent var | 0.123892 |
| Adjusted R-squared | 0.934381 | S.D. dependent var | 0.008760 |

| | | | |
|---|---|---|---|
| S.E. of regression | 0.002244 | Akaike info criterion | -9.325044 |
| Sum squared resid | 4.03E-05 | Schwarz criterion | -8.062433 |
| Log likelihood | 201.5133 | Hannan-Quinn criter. | -8.879915 |
| F-statistic | 19.30801 | Durbin-Watson stat | 2.078657 |
| Prob(F-statistic) | 0.000092 | | |

*Note: p-values and any subsequent tests do not account for model selection.

Dependent Variable: D(FDI)
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 11/06/22 Time: 00:34
Sample (adjusted): 1984 2020
Included observations: 37 after adjustments
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

D(FDI) = C(1)*( FDI(-1) + 0.0029519077792*GDPPC(-1) + 2.5348216314E -15*GOV(-1) + 0.0206377454507*IDE(-1) + 0.00149446620509*INFL( -1) - 0.000682318312716*TRAD_OPES(-1) - 0.120319318566 ) + C(2) *D(FDI(-1)) + C(3)*D(FDI(-2)) + C(4)*D(FDI(-3)) + C(5)*D(GDPPC(-1)) +
C(6)*D(GDPPC(-2)) + C(7)*D(GDPPC(-3)) + C(8)*D(GOV(-1)) + C(9) *D(GOV(-2)) + C(10)*D(GOV(-3)) + C(11)*D(IDE(-1)) + C(12)*D(IDE(-2)) + C(13)*D(IDE(-3)) + C(14)*D(INFL(-1)) + C(15)*D(INFL(-2)) + C(16) *D(INFL(-3)) + C(17)*D(TRAD_OPES(-1)) + C(18)*D(TRAD_OPES(-2)) + C(19)*D(TRAD_OPES(-3)) + C(20)

| | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C(1) | -0.898936 | 0.113164 | -7.943626 | 0.0000 |
| C(2) | -0.321887 | 0.083118 | -3.872652 | 0.0012 |
| C(3) | 0.158813 | 0.081492 | 1.948810 | 0.0680 |
| C(4) | 0.036595 | 0.109621 | 0.333831 | 0.7426 |
| C(5) | 0.001796 | 0.000487 | 3.689197 | 0.0018 |
| C(6) | 0.000937 | 0.000211 | 4.446029 | 0.0004 |
| C(7) | 0.000616 | 0.000229 | 2.685770 | 0.0156 |
| C(8) | 2.00E-13 | 5.57E-14 | 3.591373 | 0.0023 |
| C(9) | 8.80E-14 | 7.97E-14 | 1.104350 | 0.2848 |
| C(10) | 2.06E-13 | 1.22E-13 | 1.685575 | 0.1101 |
| C(11) | 0.015186 | 0.002446 | 6.208015 | 0.0000 |
| C(12) | 0.013778 | 0.001619 | 8.508537 | 0.0000 |
| C(13) | 0.004526 | 0.001112 | 4.070370 | 0.0008 |
| C(14) | 0.000680 | 0.000212 | 3.209924 | 0.0051 |
| C(15) | 0.000727 | 0.000127 | 5.714274 | 0.0000 |
| C(16) | 0.000521 | 8.19E-05 | 6.356767 | 0.0000 |
| C(17) | -0.000658 | 0.000176 | -3.739582 | 0.0016 |
| C(18) | -0.000448 | 9.87E-05 | -4.536675 | 0.0003 |
| C(19) | -0.000371 | 0.000120 | -3.081490 | 0.0068 |
| C(20) | -0.001395 | 0.000376 | -3.712813 | 0.0017 |

| | | | |
|---|---|---|---|
| R-squared | 0.910978 | Mean dependent var | 4.49E-05 |
| Adjusted R-squared | 0.811484 | S.D. dependent var | 0.005159 |
| S.E. of regression | 0.002240 | Akaike info criterion | -9.061162 |
| Sum squared resid | 8.53E-05 | Schwarz criterion | -8.190395 |
| Log likelihood | 187.6315 | Hannan-Quinn criter. | -8.754176 |
| F-statistic | 9.156052 | Durbin-Watson stat | 2.336523 |

| | | | |
|---|---|---|---|
| Prob(F-statistic) | 0.000015 | Wald F-statistic | 135.9876 |
| Prob(Wald F-statistic) | 0.000000 | | |

Wald Test:
Equation: Untitled

| Test Statistic | Value | df | Probability |
|---|---|---|---|
| F-statistic | 17.27513 | (5, 17) | 0.0000 |
| Chi-square | 86.37564 | 5 | 0.0000 |

Null Hypothesis: C(5)=0,C(8)=0,C(12)=0,C(14)=0,C(17)=0
Null Hypothesis Summary:

| Normalized Restriction (= 0) | Value | Std. Err. |
|---|---|---|
| C(5) | 0.001796 | 0.000487 |
| C(8) | 2.00E-13 | 5.57E-14 |
| C(12) | 0.013778 | 0.001619 |
| C(14) | 0.000680 | 0.000212 |
| C(17) | -0.000658 | 0.000176 |