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The impact of digital economy indicators on foreign direct investment in over the period of (2000-2022): Standard study using a model NARDL

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Abstract

This study aims to clarify the impact of digital economy indicators on foreign direct investment in Algeria during the period 2000-2022, In order to study the statistical relationship between the study variables, foreign direct investment was relied upon as a dependent variable and digital economy indicators as independent variables (mobile phone users, internet users , cell phone subscriptions) based on the NARDL nonlinear distributed time-gap autoregressive model, Implications for theory and practice: The results have proven the existence of an asymmetric effect in the changes of positive and negative indicators of the digital economy on foreign direct investment, and after estimating the model, it became clear that there is symmetry in the short and long-term impact of the independent variables on the dependent variable. and in the end the study recommended the need to strengthen the methods and mechanisms of applying the digital economy in Algeria By improving the quality of Internet services and expanding their scope, especially in remote areas, in addition to spreading awareness among society and individuals of the new technology and opening the way for them to carry out their services based on the applications of the digital economy.

1. Introduction

Digital technologies are transforming the way we live, work, consume and produce goods and services. Examples include cloud computing, the Internet of Things, advanced robotics, advanced analytics (including big data, artificial intelligence (AI) and machine learning), biotechnology, social media, three-dimensional (3D) printing, augmented and virtual reality, broadband Internet and wireless mobility Broadband Internet and wireless mobility are not new. However, their widespread adoption and improved bandwidth provide essential virtual connectivity for the digital economy just as energy, transport and analog communications networks provided essential physical connectivity for the development of the industrial economy. (Chris D'Souza and David Williams, 2017)

The digital economy is a recently-emerging phenomenon of increasing importance given estimates of double-digit annual growth around the world , The driving forces behind this emergence are economic and political, but they of course also have roots in technological innovation (itself shaped by wider forces). In the 1990s, economic changes were associated mainly with emergence of the Internet, and this remains a foundation for growth of the digital economy. But during the 2000s and 2010s a succession of new information and communication technologies (ICTs) has diffused and underpinned economic change. This includes the embedding of connected sensors into more and more objects (the Internet of things); new enduser devices (mobile phones, smartphones, tablets, netbooks, laptops, 3D printers); new digital models (cloud computing, digital platforms, digital services); growing intensity of data usage through spread of big data, data analytics and algorithmic decision-making; and new automation and robotics technologies (OECD, 2015)

Arising from these technologies is a set of digital affordances: potential actions an individual or organisation with a purpose can undertake with a digital system within the context of the environment within which they function (R, 2017) ,These include datafication (an expansion of the phenomena about which data are held), digitisation (conversion of all parts of the information value chain from analogue to digital), virtualisation (physical disembedding of processes), and generativity (use of data and technologies in ways not planned at their origination through reprogramming and recombination) (Heeks, 2016)

The rise of the New Digital Economy, defined as the combination of mobile technology, ubiquitous access to the internet, and the shift toward storage, analysis, and development of new applications in the cloud, is unquestionably altering the dynamics of economic growth. For example, over the past 15 years, business spending on digital services including cloud computing, data analysis, and other information services in major advanced economies (Ark, 2016)

The digital economy is now here to stay. The new technologies and modes of business it has created add immensely to speed, convenience, productivity, and transparency, boosting trade and GDP. This digital economy is fundamentally transforming the global economy and unleashing a Fourth Industrial Revolution that will disrupt the existing economic order. This disruption will both drive – and be driven – by shifts in global patterns of FDI as MNEs all over the world take to digital technology and modes of organization to compete. The digital economy is also driving sustainable development through more resource-efficient products, technological inclusivity, and new green technologies, speeding up global progress in meeting the goals of the 2030 Agenda for Sustainable Development. (Satyanand, 2021)

The digital revolution has brought about fundamental changes at the economy level and attempted to introduce a new term in the digital economy that was the result of the use of ICT, e-commerce and e-business that led to the development of the financial and banking sector and contributed to the development of many areas, including investment and thus an important indicator in order to attract foreign direct investment.

The world has seen a great development in the digital field by expanding the Internet and improving its quality while providing the necessary facilities for people's participation while providing appropriate services from education, e-marketing and others, so through this study we will try to clarify the statistical relationship between digital economy indicators (mobile phone users, internet users, cell phone subscriptions) and FDI by dropping them on Algeria's experience. based on the above can be raised the following main problem:

What is the nature of the relationship to the impact of digital economy indicators on FDI in Algeria?

1.1.Objectives of the study**:**

Our study seeks to achieve a set of objectives:

•Clarification of theoretical concepts regarding study variables.

•Measuring the non-linear relationship between digital economy indicators and FDI changes in Algeria.

•Measuring the impact of digital economy indicators on FDI.

1.2. Previous studies**:**

After examining the most important research and studies on the subject of our study, a series of studies were discussed:

- Shirin Muharram Ali Tuni :This study aims to study the relationship between the indicators of the digital economy and the volume of foreign investment in Egypt by presenting the theoretical framework that clarifies the basic concepts of the relationship between the variables of the study. After the statistical study, the results demonstrate a positive correlation between the two sides of the study, although they differ in strength and influence from one indicator to another.
- Yasmine Fakri Yassin Al-Khudari: The main objective of the research was to study the reality of Egypt's digital economy and identifying the most important indicators of the digital economy, the relevance and impact of the digital economy on Egypt's economic growth The study used the descriptive curriculum to learn the most important foundations and indicators of the digital economy, and to study Egypt's position on the digital economy compared to some other Arab countries The study relied on the standard method using the self-regression methodology of time gaps distributed to study the impact of the digital economy on Egypt's economic growth. The study found that both the number of Internet subscribers and the number of mobile phone subscribers representing the most important mechanisms of the digital economy have an unilateral impact on Egypt's short-term and long-term GDP according to the ARDL test, which means that the digital economy has an exponential impact on Egypt's economic growth.
- Xiangyu Tian: This study aims to discuss the impact of the digital economy on China's green financial investment through OLS fixed panel and threshold model method and the results showed that the digital economy could improve China's overall green finance efficiency, The development of the digital economy has improved the efficiency of investment in green finance in all provinces of China. In addition, through our research, we found that the application of the digital economy in green finance can reduce the imbalance in regional economic development. China must also strengthen green audit oversight to promote the development of new green financial formulas.
- Premila Nazareth Satyanand :This study aims to demonstrate how FDI is used to build and expand into countries' digital economies, by highlighting investment promotion agencies (IPAs) as well as how to attract FDI in the digital economy by focusing on: digital infrastructure, digital business development and broader digital accreditation. Investment promotion agencies and policymakers must work closely to develop a FDI strategy that promotes and facilitates investment.

2.Literature review

2.1. The digital economy

In the view of Brynjolfasson, Kahin, the digital economy indicates the shift of all economic sectors to digitizing information using the Internet. (Saleh, 2021)The "digital" economy has the greatest place to occupy by increasing productivity: the more customers the more "productive" the company, meaning it is able to provide better service at the same price that attracts new customers. (Colin, 2015)

It is defined as the continuous interaction, complementarity and coordination between information and communications technology on the one hand and the sectoral and international national economy on the other, in order to achieve transparency and productive immediate all economic indicators supportive of all economic, commercial and financial decisions in the State at some point. (Al-Khudari, 2023)Thus, the digital economy is reconfiguring manufacturing worldwide, while enhancing IT-based knowledge, promoting the digitization of traditional industries and providing new motivations to create new service industries. (LI, 2020) where many researchers believe that the digital economy has an impact on the industrial structure. Based on three dimensions: digital infrastructure, digital manufacturing, and industrial digitization, they create a comprehensive catalogue system for the development of the digital economy, and measure the level of development of the digital economy using the global key component analysis chronology method. This measurement method reflects the level of development of the digital economy from the perspective of quantitative indicators. (Tian, 2022) It is also defined as the digital economy of all international information networks (Internet), Intranet of Information, Computers and everything related to information technology. (Moussaoui Sa 'ad, 2023)

2.2. Indicators for measuring the digital economy:

In 1995, the concept of digital economy was introduced by Canadian economist Don Trapscott, a delegation that was after the beginning of the spread of the Internet as a global network. More than 20 years later, the latter became familiar with a tremendous development in the innovation of many technologies such as smartphones

and their applications, interactive sites, social networks and cloud computing, as well as economic development (ESCWA, 2018). After the widespread spread and controversy caused by the digital economy, a major problem arose over the development of specific indicators. and because its measurement is subject to many difficulties and has been highly controversial, as some market research organizations consider it necessary to distinguish between the direct and indirect digital economy. a direct contribution is economic activity related to exclusive online business activities, while indirect contribution is linked to the digital activity of mixed business. (lambin, 2014)

2.2.1. Knowledge Economy Index: UNDP's Knowledge Economy Index is based on the following pillars:

- Innovation**:** an effective system of business linkages with academic institutions and other organizations that can keep pace with the growing knowledge revolution and try to adapt it to local needs.
- Education**:** A basic need for economic productivity and competitiveness, where Governments must provide labour or human capital capable of integrating modern technology into work as well as creative skills into educational curricula.
- Information and communications technology infrastructure**:** facilitates the dissemination and processing of information and knowledge and the extent to which it is adapted to local needs, to support economic activity and stimulate projects to produce high value added.
- Good governance**:** Based on strong economic foundations that can provide legal and policy frameworks aimed at increasing productivity and growth, these policies aim at making ICT more accessible and accessible, while reducing tariffs on technology products and increasing the competitiveness of SMEs.

2.2.2. ICT Development Index**:**

The IDI contains indicators of the potential of countries influencing society's ability to use ICT efficiently. The ICT Development Index is designed to directly reflect progress in countries. On three main indicators include: (Tuniza Teño, 2019)

- Access: assesses the readiness of communications and information technology and the availability of infrastructure and access.
- Usage: Assesses the intensity of the use of communications and information technology.
- Skills: Assesses the skills and potential necessary and capable of using communications and information technology with high efficiency.

Table 1: Information and Communications Technology Development Index

Access to ICT 40%
-The number of subscriptions to the fixed telephone service per 100nometer. -The number of subscriptions to the cellular service per 100 breezes. - Display the Internet's international range for each Internet user. - Percentage of families with computers. - Percentage of families with Internet access.
-Use of ICT 40%
- Percentage of individuals using the Internet. -The number of subscriptions to the fixed broadband service per 100nometer. -The number of subscriptions to the wireless broadband service per 100 breezes.
-ICT Skills20%
- Adult literacy rate. - Gross secondary school enrolment rate. - Gross enrolment rate in higher education institutions.

Source: (International Telecommunication Union, 2015)

2.2.3. Digital Development Index: This indicator was released by Feltcher College The Fletcher Schools Institute, which identifies the progress that countries are making in developing their digital economy and ensures the following indicators: (Mastercard, 2017)

- Demand conditions: Know the extent of consumers' ability to integrate into the digital system by determining the availability of the means and tools needed by consumers to integrate into the digital economy.
- Display Terms: Shows the infrastructure that facilitates digital interactions and features, where this type measures the quality of the digital structure.
- Institutional environment: In addition to direct investment in infrastructure, actions and government policies play a key role in supporting the distribution of digital technologies.
- Innovation and change: Innovation is used to find new solutions to all challenges, and through its changes it contributes to change in driving the limits of the digital system,

2.2.4. Global Innovation Index**:** This indicator is a sophisticated and renewable project, including recent data and surveys of the latest research on the measurement of innovation. This indicator is based on two sub-indicators: innovation inputs consisting of institutions, human capital and research, greeting environment, market development and business development. The second indicator is innovation outputs consisting of two pillars: technological and knowledge outputs or creative outputs (Daoudi, 2017)

2.2.5Mesh readiness indicator**:**

The Network Readiness Index shows states' willingness to use ICT effectively by dividing four axes, including: (Economic, 2016)

- ICT infrastructure and the cost of accessing it with the necessary skills to ensure optimal use.
- The readiness of the three poles of society, individuals, companies and governments, to use ICT and how to benefit from it.
- Business environment, innovation and political and regulatory framework.
- Economic and social implications of ICT.

3. Foreign Investment Direct:

Foreign Investment Direct has received considerable attention from the international community because it is a long-term movement of capital and a form of external alternative financing of loans (BAMHAMMED, 2021), where the International Monetary Fund (IMF) defined FDI as having lasting benefits in an enterprise whose activities in the economic field are outside the field of the investor in order to have the capacity to make actual decisions in the enterprise's management. (Mimouni Yassine, 2019)

3 .1. The importance of Foreign Investment**:**

Foreign Investment Direct contributes to: (Tuni, 2022)

- Provide a renewable source and concessional conditions for obtaining foreign currencies or capital to finance development programmes.

- FDI contributes to the creation of complementary relationships between aspects of economic activity, through which domestic investors are incentivized to create complementary enterprises with foreign companies and thus increase national enterprises.

- Improving the efficiency of the work component and raising its productivity by developing and training human resources and qualifying them to deal with production, management and marketing systems.

- Increased national income as a result of the creation of nutritious industries for foreign investments

4.Methodology

In this section we will try to measure the impact of digital economy indicators (mobile users, internet users, cell phone subscriptions) on FDI in Algeria during 2000-2022 by introducing the methodology and variables of the study.

4.1.Entrance to the NARDL model:

The NARDL Non-linear Distributed Time Gap Self Regression Model is one of the latest econometric technologies by which asymmetric analysis (Asymetric) is combined with ARDL methodology, taking into

account the linear relationship in the impact of the independent variable on the long-term and short-term dependent variable. (Lahiani, 2014)

Using the NARDL model in practice requires the following:

- Test the stability of the time series in the study model.

- Estimate the self-degradation model of non-linear distributed time slowing:

The NARDL methodology is based on the tolerance of long-term parameter asymmetry relationships by launching from ARDL linear to non-linear by fragmenting the variable into negative and positive values as follows:

$xt = x0 + xt^{+} + xt^{-}$

The function of joint integration becomes as follows:

$yt = \alpha + \beta^{+} xt^{+} + \beta^{-} xt^{-} + \varepsilon t$

εt : Limit the line in the random model.

β : Asymmetric transactions in the long term and transactions are calculated according to the following equations

$xt + = \sum \Delta xj + = \sum \max(\Delta xj , 0)$

$xt - = \sum \Delta xj - = \sum \min(\Delta xj , 0)$

From the above, the NARDL model can be formulated according to the following:

$\Delta yt = u - Pyt{-}1 + \theta + xt{-}1 + + \theta - xt{-}1 - + \sum j{=}1\ p{-}1\ aj\Delta yt{-}j + \sum j{=}0\ \ q{-}1\ (\pi j + \Delta xt{-}j - + \pi j - \Delta xt{-}j -) + \varepsilon$

$\theta -$،$\theta +$: Long-term parameters of asymmetric relationship.

$\pi -$،$\pi +$: represent asymmetric short-term capabilities.

Compared to classic co-integration models, NARDL models offer some advantages:

- Detection of the joint integration relationship of small samples. (Romilly, 2001)

- Modeling is applied regardless of whether the time series is stable from the level or at the first difference, as it cannot be applied if it is stable at the second difference. (Ibrahim, 2015)

4.2. Submission of study form:

$FDIt = \beta 0 + \beta 1FLSt + \beta 2INt + \beta 3MPt + et$ …

FDI : Foreign Investments

FLS, IN, MP: Digital Economy Indicators (Mobile Users, Internet Users, Cell Phone Subscriptions)

At the outset we determine the general shape of the long-term asymmetric regression equation of the gap model:

$\boldsymbol{Ut\ A = \alpha + B + Yt\ c + + \beta - Yt\ c - + D1 + D2 + \varepsilon t}$…

Where:

Yt c+ $+ Yt\ c -$ reflect the positive and negative change in the digital economy's indicators as follows:

$\boldsymbol{Yt\ c = Y}$o $\boldsymbol{c + Yt\ c + + Yt\ c -}$…

The independent variables consist of Yt c constant primary values Yo c, positive changes Yt c +, or negative Yt c −

The non-linear line correction model takes the following form:

$\Delta(\boldsymbol{Ut\ A}) = \boldsymbol{\alpha + \delta Ut{-}1\ A + B + Yt\ c + + \beta - Yt\ c - + \sum i{=}1\ p{-}1\ \rho i\Delta(Ut{-}i\ A}) + \sum \boldsymbol{i{=}0\ q{-}1\ (\gamma i + \Delta Yt{-}i\ c + + \gamma i - \Delta Yt{-}i\ c -) + D1 + D2 + \varepsilon t}$…

Where:

$\sum \boldsymbol{i{=}0\ q{-}1\ (\gamma i +})$: Measures the positive effects of the independent variable (digital economy indicators) on FDI

$\sum_{i=0}^{q-1} (\gamma_i$ -) : - Measure the negative effects of the independent variable (digital economy indicators) on FDI

4.3 .Descriptive analysis of study variables:

We conduct a descriptive analysis of the study variables in order to study the statistical tests of the time series in question, according to the following table:

Table 2: Results of descriptive analysis of study variables

	MP	**IN**	**FLS**	**FDI**
Mean	860189.7	726792.3	3273197	1.029787
Median	68608.00	730851.0	3069140	0.939901
Maximum	14324579	740716.0	6003267.	2.033266
Minimum	1698.000	707475.0	1761327.	-0.324012
Std. Dev.	2955464.	10320.42	1086589.	0.550508
Skewness	4.379159	-0.669928	0.806651	-0.036810
Kurtosis	20.47484	1.994368	3.119635	3.226867
Jarque-Bera	366.1582	2.689573	2.508015	0.054518
Probability	0.000000	0.260595	0.285359	0.973109
Sum	19784363	16716223	75283520	23.68511
Sum Sq. Dev.	1.92E+14	2.34E+09	2.60E+13	6.667297
Observations	23	23	23	23

Source : Prepared by the author using Eviews12.

4.4.Stable Time Series:

In order to determine the appropriate method and model of study data, we use the Dickie-Fuller test, which examines the stability of time chains or not. In order to view this test, we begin with the following random traffic model, which is written according to the following:

$yt = yt-1 + \varepsilon t$

Through the regression coefficient we note that it was equal to one, which means that we may have a unitary root problem that means counting the stability of time chain data. Dickie Fuller's test has traditionally been used in several formulas:

$\nabla yt = (\emptyset - 1)yt-1 + \varepsilon t \cdots \cdots (1)$

$\nabla yt = (\emptyset - 1)yt-1 + c + \varepsilon t \cdots \cdots (2)$

$\nabla yt = (\emptyset - 1)yt-1 + c + bt + \varepsilon t \cdots \cdots (3)$

Based on the results of Dickie-Fuller's test, the following were reached:

Table 3: Unit Root Teste Results Using ADF

Order of integration	Fuler Dicckey Augmentez)			Varibls
	First Diffrence			
	None	Trend And Intercept	Intercept	
I (1)	-7.275270 0.0000	-6.893046 0.0001	-7.178721 0.0000	FDI
I (1)	-4.884334 0.0000	-4.647719 0.0070	-4.776321 0.0011	IN
I (1)	-2.270871 0.0255	-3.944739 0.0282	-3.491894 0.0188	FLS
I (1)	1.303815- 0.1715	-2.569609 0.2956	-2.392684 0.1555	MP
I (1)	-4.730788 0.0001	-4.625490 0.0078	-4.707387 0.0015	DMP

Source : Prepared by the author using Eviews12.

Based on the results of the unit root test for the time series shown in the table above, and depending on the ADF test. Fuler Dickey Augmented found that: all time series (FDI, FLS IN, stable and integrated first class except MP series did not stabilize until after the first differences were made, after which the series settled at level I.

4.5..Determine the optimal delay period of the study model:

In order to determine optimal slowing periods, Akaike's standard was used to arrive at the optimal model, through the results shown in the next format:

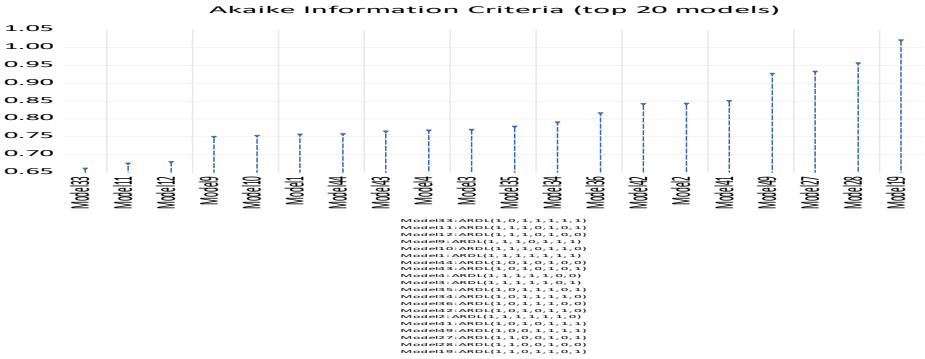

Figure1: Model Delay Results

Source : Prepared by the author using Eviews12.

Based on the results obtained from the Akaike standard, we conclude that optimal slows were: (NARDL) 1,0,1,1

5.6..NARDL model rating:

The NARDL model is estimated according to the following table:

Table 4: NARDL Model Rating Results

Dependent Variable: D(FDI) Method: Least Squares Sample (adjusted): 2002 2022 Included observations: 21 after adjustments				
Prob.*	t-Statistic	Std. Error	Coefficient	Variable
0.0519	2.282343	0.423504	0.966582	C
0.0116	-3.258540	0.214296	-0.698293	FDI(-1)
0.7217	-0.369039	3.85E-07	-1.42E-07	FLS_POS
0.3862	0.916583	7.09E-07	6.50E-07	FLS_NEG(-1)
0.4397	0.813166	0.000157	0.000128	IN_POS(-1)
0.0849	-1.965434	1.65E-05	-3.25E-05	IN_NEG(-1)
0.2051	-1.379551	1.78E-06	-2.45E-06	MP_POS(-1)
0.6455	0.477887	5.15E-06	2.46E-06	MP_NEG(-1)
0.3948	-0.899276	7.95E-07	-7.15E-07	D(FLS_NEG)
0.1427	-1.625453	0.000147	-0.000240	D(IN_POS)
0.0288	2.660785	1.71E-05	4.54E-05	D(IN_NEG)
0.3226	1.054165	6.17E-08	6.51E-08	D(MP_POS)
0.1416	1.630869	6.64E-06	1.08E-05	D(MP_NEG)
R-squared		0.865807	Mean dependent var	-0.074294
Adjusted R-squared		0.664519	S.D. dependent var	0.507162
S.E. of regression		0.293752	Akaike info criterion	0.660852
Sum squared resid		0.690321	Schwarz criterion	1.307461
Log likelihood		6.061056	Hannan-Quinn criter.	0.801183
F-statistic		4.301320	Durbin-Watson stat	2.718143
Prob(F-statistic)		0.023300		

Source : Prepared by the author using Eviews12.

Based on the results of the NARDL model assessment, we note:

- Coefficient value of 0.86 R 2 =, i.e. independent variables explain the dependent variable by 86%.

- The probability value of Fisher P (F-Statistic) = 0, 0223300, i.e. the study model is moral and statistically significant and this confirms the overall morale of the model.

-The Durdin -watson procedure = 2,718,143 indicates the absence of error associations.

5.7 .Test the non-linear relationship in the long and short term:

Based on the Wald test, the non-linear relationship is tested in the long and short term according to the following:

5.7.1 Short Term Symmetry Test:

Table 5: Short Term Symmetry Test Results

Wald Test			
Test Statistic	**Value**	**df**	**Probability**
t-statistic	0.315796	8	0.7602
F-statistic	0.099727	(1, 8)	0.7602
Chi-square	0.099727	1	0.7522

Source : Prepared by the author using Eviews12.

From the long-term symmetry test we note that: the corresponding statistical probability is t-statistic F-statistic Chi-square calculated is greater than 0.05 at a 5% morale level, so we accept the nowhere hypothesis and reject the alternative hypothesis and so it can be said that there is a short-term effect of autonomous variables on the dependent variable.

5.7. 2 Longitudinal Symmetry Test:

Table 6: Long-Term Symmetry Test Results

Wald Test			
Test Statistic	**Value**	**df**	**Probability**
t-statistic	-0.844153	8	0.4231
F-statistic	0.712595	(1, 8)	0.4231
Chi-square	0.712595	1	0.3986

Source : Prepared by the author using Eviews12.

From the long-term symmetry test we note that: the corresponding statistical probability is t-statistic F-statistic

Chi-square calculated is greater than 0.05 at a 5% morale level, so we accept the nowhere hypothesis and reject the alternative hypothesis and so it can be said that there is a symmetry in the long-term impact of autonomous variables on the dependent variable.

5.8.2. BOUNDS Test :

According to the boundary test, joint integration is done by estimating the unrestricted error correction model, which is prepared as a method to test the extent to which the balanced relationship between the study variables is achieved, through the following two hypotheses (Pesraan, 2001)

$H1: \lambda 0 = \lambda 1 = \cdots = \lambda K = 0$

$H0: \lambda 0 \neq \lambda 1 \neq \cdots \neq \lambda k \neq 0$

Table 7: Boundary Test Results BOUNDS Test

Resultat	**calculated value** **F=4,761**		Model critical value
A long-term common integration relationship	minimum	maximum	
	2,88	3,99	1% At a moral level
	2,27	3,28	At a moral level %5
	1,99	2,94	10% At a moral level

Source : Prepared by the author using Eviews12.

By the results obtained it is clear that: the calculated value of F is greater than the values of the upper limit of critical values at morale levels of 1%, 5%, 10%) We therefore reject the non-existent hypothesis that there is no common complementarity between the study's variables, accept the alternative hypothesis and thus a long-term balance between the dependent variable and the autonomous variables, i.e., a common complementarity between digital economy indicators and FDI.

5.9.Study the validity of the NARDL model :

In order to study the validity of the NARDL model, we conduct a series of tests:

5.9.1 Personal Tests:

-Test Godfrey-Breusch

Test Godfrey-Breusch is one of the tests for studying and detecting the problem of self-association, by trying to test the following hypothesis:

H_0**: $P_1 = P_2 = \cdots P_P = 0$**

If the H0 non-hypothesis is rejected, this means there is a self-correlation problem for 1 = P errors

Table 8: Results of serial correlation test for errors

Test Godfrey-Breusch			
F-statistic	1.319023	**Prob. F(12,8)**	0.3556

Source : Prepared by the author using Eviews12.

Through the results of the Test Godfrey-Breusch test shown in the table above, the probability value of Prob. F is immoral and therefore we accept the non-existent hypothesis that there is no problem of self-association of errors (there is no serial link to the retention).

-Test ARCH Error Variability Test.

Table (9): ARCH Test Results

Test ARCH			
F-statistic	3.194097	**Prob. F(12,8)**	0.0908

Source : Prepared by the author using Eviews12.

Through Test ARCH error variability test results.) shown in the table above shows that: Prob. F probability value is immoral and therefore we accept the hypothesis of nowhere that there is no ARCH effect in the model.

-The normal distribution test (Bera-Jarque):

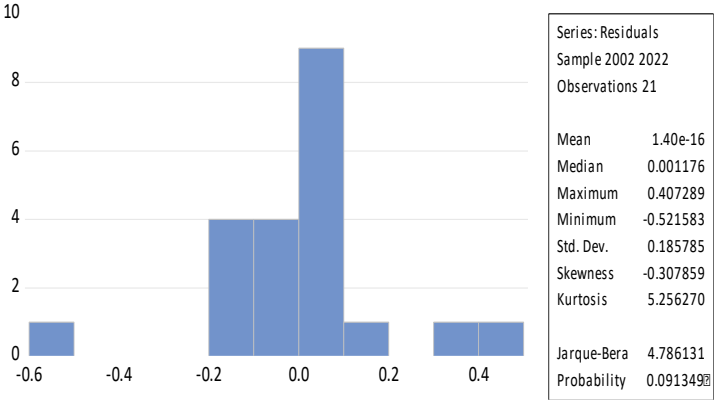

Figure 2: Natural distribution test results

Source : Prepared by the author using Eviews12.

Through the results of the natural distribution test (Bera-Jarque) shown in the table above, it is shown that: probability value Prob. F is immoral and therefore we accept the hypothesis of nowhere that the retention chain follows natural distribution.

5.10. Stability Model Parameters:

In order to ensure that the study data are free of any structural changes, the cumulative total test of CUSUM parcels must be used, in addition to the cumulative total test of the CUSUM of Square oblast boxes, through which the extent of any structural change in the data and the stability of the long-term and short parameters is explained.

The structural stability of the estimated parameters of the error correction formula of the self-degradation model of non-linear distributed deceleration is achieved, if the graphic form of the CUSUM and CUSUM of Square tests falls within critical boundaries at a morale level of 5% i.e. the curve is within the field, we accept the hypothesis of nowhere that the parameters are stable during the study period. Which can be explained by the following two forms:

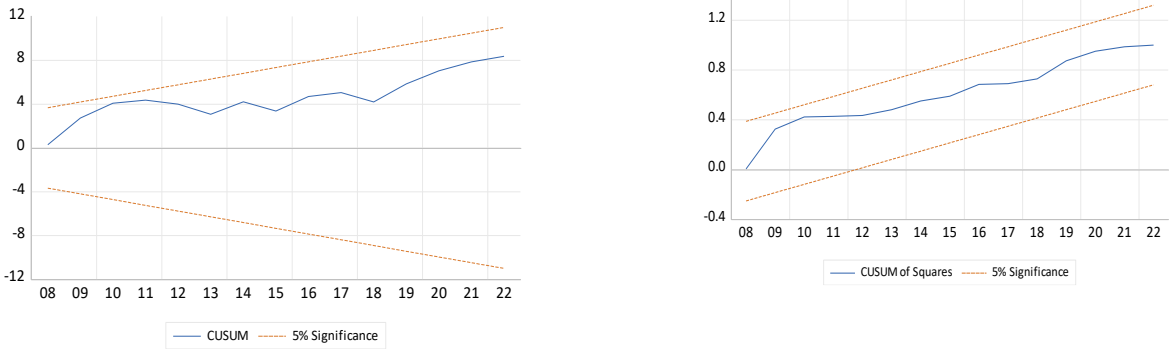

Figure (3): Stability of model parameters

Source : Prepared by the author using Eviews12.

Through the above two formats, the CUSUM cumulative gross test curve and the CUSUM of Square cumulative total test curve are located within the boundary field (between the two critical boundaries). This shows the stability of the estimated model at a 5% morale level. Thus, it can be said that: The self-degradation model of gaps distributed in the two scales is stable.

5.11. Asymmetric Dynamic Multiplier Test :

This test is carried out to track asymmetric modification patterns occurring in the dependent variable after all positive and negative changes occurring in the autonomous variable, and also allows to know the timing of similar and asymmetric effects.

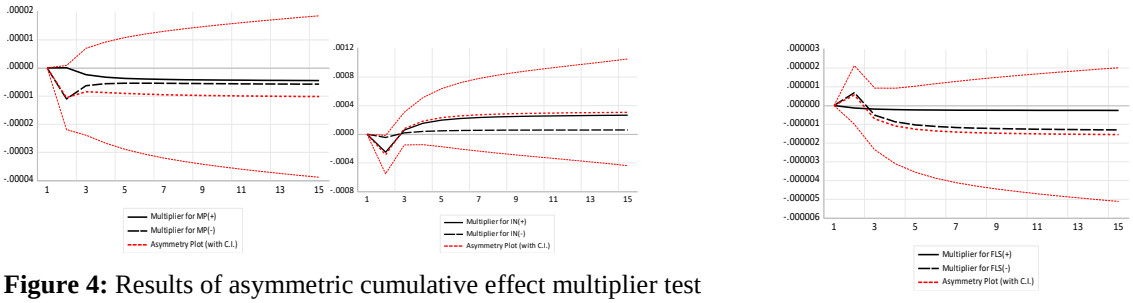

Figure 4: Results of asymmetric cumulative effect multiplier test

Source : Prepared by the author using Eviews12.

The above forms illustrate the results of testing the asymmetric dynamic cumulative effect multiplier of independent variables (FDI) divided into negative and positive values: a positive shock in digital economy indicators leads to a balance in FDI after three years, and when a negative shock results in a balance in FDI after the third year. Similarity in response between positive and negative changes in shapes is also evident through the reach of the symmetry curve to zero, i.e. a positive shock in digital economy indicators of 0.4 will lead to a balance in FDI after three years, and when a negative shock results in a balance after the second year.

6. Results and discussion

Based on the standard study obtained:

- All FDI, FLS IN time series, stable and integrated first class except MP series, stabilized only after the first discrepancies were made, after which the chain settled at level I.

- By testing the long-term and short-term non-linear relationship, there is an analogy in the short-term effect of autonomous variables on the dependent variable. The existence of a symmetry in the long-term impact of autonomous variables on the dependent variable.

- After estimating a model, a long-term balance between the dependent variable and the autonomous variables was found, i.e., a common integration of digital economy indicators and FDI.

- When studying the validity of the NARDL model and when conducting the necessary personal tests show that there is no problem of self-association of errors (there is no serial link to the parapet), there is no ARCH effect in the model and the chain of paraphernal tracking natural distribution.

- The CUSUM cumulative total test curves have shown that the self-regression model of non-linear distributed gaps is stable in the short and long term.

- Calculated the results of the asymmetric dynamic cumulative effect multiplier test between the analogous and asymmetric effects of the dependent and independent variable occurred from the first period.

7.Conclusion

Through this paper, we have tried to illustrate the impact of some indicators of the digital economy on FDI in Algeria. Thus, it can be said that the digital economy is one of the modern concepts adopted by many Governments that combines production and its processes with technology and its means. Based on innovation in delivering new outputs, its uses enable it to support technological development.

While the study's findings indicated a long-term non-linear balance relationship between digital economy indicators and FDI, this validates the first hypothesis (a relationship between digital economy indicators and FDI is non-linear).

Results following joint integration were also demonstrated by the frontier test to the glory of a long-term balanced relationship between the study's variables, and by the asymmetric impact of digital economy indicators on long-term FDI. This demonstrates the validity of the second hypothesis (positive digital economy indicator changes are not similar to the mechanism for the impact of negative digital economy indicators changes).

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