An Indicative Study of the Impact of ICT on FDI Flows in Tunisia and Algeria for the Period (2000-2020)

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Abstract:

This study aimed to measure the impact of ICT on the flow of foreign direct investment in Tunisia and Algeria through an econometric study for the period 2000-2020, and in order to achieve the goal, the **EVIEWS** program was used, based on the independent variables that represent ICT indicators based on ITU data, and the dependent variable, which is foreign direct investment based on World Bank data..

Through the analysis, it was found that information and communication technology has a significant and positive impact in the previous period on the flow of foreign direct investment in the study sample.

Keywords: FDI, ICT, Indicators, Tunisia, Algeria.

List abbreviation:

ICT : Information and communication technology

FDI : foreign direct investment

ITU : International Telecommunication Union

IT : Information Technology

IMF : International Monetary Fund

1-Introduction:

Foreign direct investment is one of the most important engines of development in the world's economies, as it contributes to raising productive capacities, increasing growth and employment rates, as well as transferring modern technology, its flows have varied greatly in terms of size and type, and we see that some governments are struggling to find ways to attract foreign capital to fill the investment gap in them.

Decision-makers in developing countries seek to adopt the necessary measures and procedures to prepare and create a suitable business environment to attract foreign investment. It should be noted that the relative importance of FDI determinants has changed over time. While traditional determinants such as market search factors, natural resources, low costs and favorable investment conditions are no longer of sufficient importance, the

technological revolution that the world is currently witnessing has become new and of greater importance and influencing the direction of foreign direct investment.

Both Tunisia and Algeria have realized the importance of attracting foreign direct investment for the development process and integration into the global economy, through the modification of the economic structure and the adoption of modern technologies, especially information and communication technology, as a mechanism to attract foreign investors.

Through the foregoing, this research paper came in order to answer the following problem:

To what extent is ICT affecting FDI flows in Tunisia and Algeria?

To answer the problem of the study, we ask the following sub-questions:

- What is the concept of information and communication technology?
- What is the concept of FDI?
- Is there a relationship between ICT and FDI in Tunisia and Algeria?

Hypotheses of the study:

- There is no correlation between the study variables.
- The existence of a positive and significant impact of ICT indicators on FDI in Tunisia and Algeria?
- The existence of a negative and insignificant impact of ICT indicators on FDI in Tunisia and Algeria.

Limitations of the study:

- **Time limits:** The study included available time series on variables during the years from 2000 to 2020.
- **Spatial boundaries:** The study is conducted in Tunisia and Algeria, using data at the quantitative economic level.

Study Methodology:

To address this topic, the descriptive approach was used in the theoretical aspect related to the concept of information and communication technology and foreign direct investment, as well as the deductive approach (elicitation of results), and the inductive method, which represents statistical data processing and as a tool for observing economic conditions.

Structure of the study:

To achieve the desired purpose of the research, we divided the study into the following axes:

First: Theoretical framework and previous studies.

Second: The relationship of information and communication technology with foreign direct investment.

Third: An econometric study of the impact of ICT on foreign direct investment in Algeria during the period 2000-2020.

Previous studies:

- Study (Amany Fakher 2016)**:** This study examines the impact of ICT investment on FDI and thus on economic development in Egypt, during the period 1995-2013, the results indicate a small positive relationship between ICT investments and FDI, and the result could be related

to poor IT infrastructure. And telecommunications in Egypt, which makes technology at this, stage a consequence of investment rather than a cause of it.

- **Study (GulRukhBangash, Wangpeizhi):** This paper analyzes the impact of the availability of ICT infrastructure on FDI flows in D8 countries (Bangladesh, Indonesia, Iran, Egypt, Nigeria, Malaysia, Pakistan and Turkey). The panel data for 1997-2018 was used and the analysis was performed using the repair effect model proposed by the. Hausman The result shows a positive and significant impact between ICT infrastructure and FDI flows, along with other dominant variables such as market size and trade openness, in the case of a macroeconomic variable representing the exchange rate having a negative but significant impact on FDI inflows.

- **Study (Bin Hajj Jalul Nassira, Hamdani Najat):** The study aims to understand the impact of ICT as a determining factor for short-term FDI flows in the MENA region, compared to traditional and institutional determinants during the period 2007-2018, using static data panels, where the study showed that ICT has a significant negative impact on FDI flows in the sample countries, where The nature of the flow of foreign investment is insensitive to the level of impact of infrastructure on ICTs, which is characterized as an ICT carrier rather than a seeker of investment.

What is noticeable in these studies is that they relied on statistical and standard analysis tools in the analysis, and we find a difference in the samples and periods used in the study, as well as in the results obtained.

2. Conceptual framework of the study
2.1. The concept of information and communication technology:
There are many concepts presented by intellectuals and international organizations for the term information and communication technology, as follows:

(P.Musso1999) explained that the concept of information and communication technology appeared twenty years ago.

A year ago, first through the development and marriage of three technical fields: telecommunications, audio

Visual and informatics then meet in multimedia. [1]

ICT is the combination of written and spoken word, still and moving image, and telecommunications, terrestrial or satellite, then storing data, analyzing its contents and making it available in the desired form, in a timely manner, and at the necessary speed. [2]

Information and communication technology is defined as all forms of technology used to create, record, exchange, display and use information in various forms (data, sounds, images).[3]

2.2. Advantages of ICT
- Raising productivity and efficiency of operational processes.
- Develop the ability to create, create and innovate.
- Facing external challenges.
- Provide appropriate information at the right time.

- Support and improve decision-making processes.
- Improving and activating the communication traffic in the facility.
- Formulate and implement the organization's strategies.

2.3. Foreign Direct Investment

2.3.1. IMF definition: Foreign investment as direct if the foreign investor owns a minimum of 10% of the nominal capital to grant the foreign investor the right to vote on administrative decisions, and this percentage may vary according to the policy of the host country.[4]

2.3.2. OECD: defines foreign investment as the employment of non-national foreign funds in fixed capital assets in certain host countries and involves a long-term relationship that reflects a benefit to the foreign investor, who may be an individual, company or institution and who has the right to manage his assets from his country or country of residence. [5]

2.3.3. Rymandbernard definition: Foreign investment is a means of transferring real resources, capital from one country to another by contributing the capital of one company to another company, where a branch is established abroad or its capital is increased, or a new foreign enterprise is established with foreign partners in another country. [6]

2.4. Determinants of FDI

The most important determinants of foreign direct investment are the following: [7]

A. Political environment: The foreign investor makes a decision to accept or reject the project, based on the degree of stability of the political system in the country, investors prefer democratic systems because they are stable and other systems are subject to change.

B. In Economic factors: The greater the economic power of a country, the more it makes it a desirable location by investors.

C. Legal and legislative environment: Investments depend mainly on the existence of laws and legislations that guarantee the investor incentives and customs and tax exemptions, in addition to guarantees against non-economic risks such as: the risks of nationalization and confiscation, in addition to the investor's right to transfer his profits to any country at any moment.

D. Administrative Environment: The most important aspects of the administrative environment are the existence of government agencies based on the administrative process in a way that reduces the time required to obtain a license to establish the project for investment, as this requires reducing or eliminating the bureaucracy of the government apparatus, and combating financial and administrative corruption in government agencies.

2.5. Characteristics of FDI

FDI has unique structural and technical characteristics that distinguish it from other investments, namely: [8]

- The long length of time he stays.
- Subject to international conventions.
- Not to trade it in international liquidity markets.
- The ability to contribute effectively to management by the investor.

2.6. Relationship of ICT to FDI

Research suggests that the increased use of new ICT tools such as Internet and mobile users can attract more FDI by reducing production costs under increased competition and leading to increased productivity.

The world is rapidly moving towards the economic systems necessary to provide information on a broad and sustainable basis, and recent developments in ICT are an important factor in making it one of the main new determinants of attracting foreign direct investment.

The availability of modern technologies has increased the ability of countries to efficiently provide goods and services in global markets and free them from all obstacles, and has led to remarkable changes in the nature of international relations and the creation of competitive advantages and alternative opportunities for the economic and social development of these countries. Therefore, they must pay attention to the development of ICT infrastructure to enhance and support their transition to the global economy and increase their chances of success.

For developing countries, modern telecommunications infrastructure is essential for economic development and is a prerequisite for participation in the global market, and is considered one of the important means of attracting foreign direct investment, as the latter reduces transaction costs, facilitates access to trade and political information that was not previously available, and provides information on investment opportunities available in different economies. [9]

2.7. Evolution of the use of information and communication technologies

The development experienced by the economies of most countries of the world is due to the development of the information and communication technology sector, as this sector works to increase their economic growth, and the figure below shows the development of information and communication technology indicators in Tunisia and Algeria during the period 2000-2020.

Figure N° (01): ICT indicators in Tunisia and Algeria during the period 2000-2020
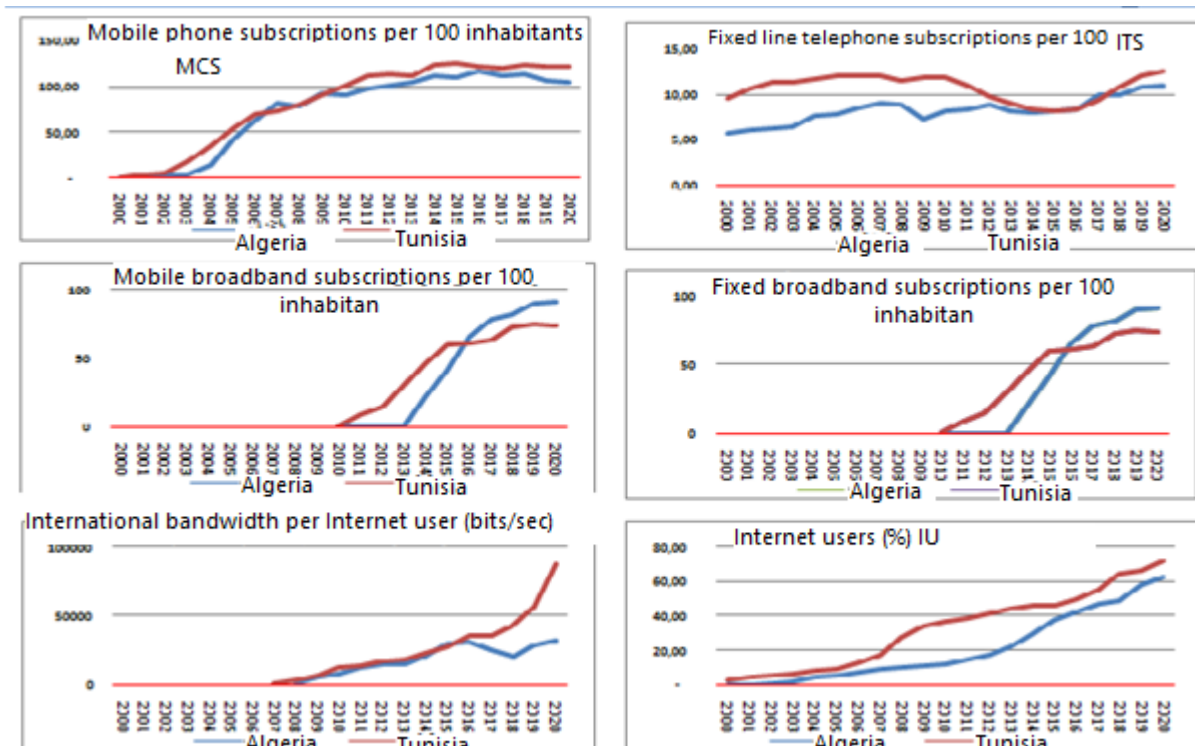
Source: Prepared by researchers based on:
ITU(2022): Country ICT Data Indicator (Indicator), Committed to connecting the world, https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx, on 26/10/2022 at 18:40.

Through the figure above, the fixed telephone penetration rate in the countries under study remains generally low, as we note that there is a large variation in fixed telephone subscriptions per 100 people during the years 2000-2020, due to a weakness in the fixed telephone infrastructure compared to the global average, as this weakness appears significantly in these low-income countries.

We also note that the increasing trend towards mobile phones in Tunisia and Algeria may be due to the privileged services, such as the short communication service "MMS", the Internet service and the public packet radio service "GPRS", as the latter constitutes an essential part of the Internet and ICT infrastructure.

Tunisia and Algeria have made progress and development in mobile phone subscriptions, exceeding global penetration rates despite relative differences, mainly related to market size and the ability to cover all consumer segments. The growth of these services accelerated in parallel with the development and spread of third and fourth generation services. It should also be noted that there was a significant increase in the penetration rate of mobile phone services during the period from 2002-2013, as a result of the liberalization of the mobile communications sector and thus the increased levels of competition between companies operating in this sector, but the latter witnessed a decrease in mobile phone subscriptions in 2014-2016, and this is due to the deterioration of the security situation and mismanagement.

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The number of mobile cellular subscriptions as controlling its costs made it affordable to use, but Tunisia outperformed Algeria in mobile cellular subscriptions during the study period.

As we can see from the above figure, the continuous development of Tunisia and Algeria in fixed and mobile broadband subscriptions, but Tunisia was the first in fixed and mobile broadband subscriptions from 2010 to 2015, but since 2016 Algeria began to excel in this field and this comes as a result of the large investment in the continuous deployment and improvement of fixed and mobile broadband infrastructure.

It is also clear that both Tunisia and Algeria are characterized by a continuous increase in Internet access. It is worth mentioning that Algeria at the end of 2013 witnessed the launch of third-generation services, and then adopted fourth-generation services to be marketed, which increased by 83.28% in 2016, [10] and Tunisia was a pioneer in this, which improves the volume of e-commerce.

2.8. Evolution of FDI flows to Tunisia and Algeria (2000-2020)

All Tunisia and Algeria have many advantages that make their climate attractive for foreign direct investment.

However, their flows changed differently during the period 2000-2020.

Figure N° (02): Volume of foreign direct investment, net inflows to Tunisia and Algeria for the period (2000-2020) estimated at one million dollars
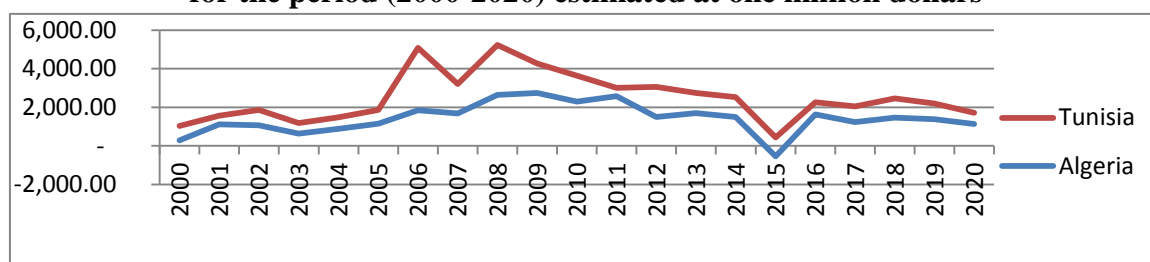
Source: Prepared by researchers based on
https://data.albankaldawli.org/indicator/BX.KLT.DINV.CD.WD
on 26/10/2022 at 18:40.

The figure above shows that inward foreign direct investment in Tunisia increased from 750.72 $ million in 2000 to 3239.9 $ million in 2006, due to privatization operations that affected many economic sectors, especially the telecommunications sector, but recorded a free fall in 2011 reaching 432.67 million dollars, due to the deteriorating political and security situation in Tunisia.

Investment inflows to Tunisia also witnessed continuous declines to reach 622.57 $ million in 2016, due to the Tunisian economy's link to global markets for goods and services..

In 2020, foreign investment reached a low value of 592.17 $ million, as a result of the economic recession caused by the Corona pandemic.

As for Algeria, it is noteworthy that the bulk of this foreign direct investment is based on the energy sector and does not contribute to national economic diversification, as it recorded a continuous increase since 2000 by 280.10 $ million to a value of 2571.24 $ million in 2011, and then gradually decreased from 1500.40 $ million in 2012 to $ 1126.71million in 2020,

even recorded divestment in 2015 After the oil shock in 2014, many investments in hydrocarbons declined.

3. Study the standard by adopting the EVIEWS program

Based on the standard study steps, **for the EVIEWS** program, which are as follows:

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These variables reflect the level of:

DFI: Foreign direct investment, net inflows (balance of payments, current US dollars).

FLS : Fixed line subscriptions 100 people

MCS : Mobile cellular subscriptions per 100 inhabitants

UI : Internet users (%)

IBPIU: International bandwidth per Internet user (bits/sec)

AMBS: Active mobile broadband subscriptions per 100 inhabitants

FBS: Fixed broadband subscriptions per 100 inhabitants

Estimating the equation

Estimating the gravitational equation through what has been mentioned; we will try to put the desired mathematical equation estimate as part of our case study according to the list of variables we assume, which are as follows:

$$\text{Log} \ (DFI_{it}) = \beta_0 + \beta_1 \log (FLS_{it}) + \beta_2 \log (MCS_{it}) + \beta_3 \log (UI_{it}) + \beta_4 \log (IBPIU_{it}) + \beta_5 \log (AMBS_{it}) + \beta_6 \log (FBS_{it}).$$

Standard Study Results and Projections

Using an **EVIEWS** program, and after data entry, we obtained the results presented in the table below, which we will discuss in detail by analyzing these data.

Standard study results using the EVIEWS programme

Table N° (01): The results of the standard study of the first model using the **EVIEWS** programme

Dependent Variable: DFI
Method: Least Squares
Date: 11/18/22   Time: 10:00
Sample: 2000 2020
Included observations: 21

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	9.610359	0.999422	9.615919	0.0000
FBS	0.029703	0.062454	0.475602	0.6417
FLS	-1.421531	1.170935	-1.214014	0.2448
IBPIU	-0.112670	0.116913	-0.963712	0.3515
IU	1.253450	1.043992	1.200633	0.2498
MCS	-0.159857	0.348036	-0.459311	0.6531
AMBS	-0.365457	0.153708	-2.377613	0.0322

R-squared	0.429049	Mean dependent var	8.972832
Adjusted R-squared	0.184355	S.D. dependent var	0.231362
S.E. of regression	0.208950	Akaike info criterion	-0.032240
Sumsquaredresid	0.611242	Schwarz criterion	0.315934
Log likelihood	7.338524	Hannan-Quinn criter.	0.043322
F-statistic	1.753412	Durbin-Watson stat	1.730779
Prob(F-statistic)	0.181125		

Source: Prepared by the author with the assistance of Eviews

The results of the estimation of the model parameters are as follows, based on the following data:

```
 Estimation Command:
=========================
LS DFI C AMBS FBS FLS IBPIU IU MCS


Estimation Equation:
=========================
DFI = C(1) + C(2)*AMBS + C(3)*FBS + C(4)*FLS + C(5)*IBPIU + C(6)*IU + C(7)*MCS


Substituted Coefficients:
=========================
DFI = 9.61035936637 - 0.365457114722*AMBS + 0.0297032144651*FBS -
1.42153147085*FLS - 0.112670326883*IBPIU + 1.2534504914*IU -
0.159856578501*MCS.
```

Source: Prepared by the author with the assistance of Eviews

Evaluation of the first model
From an economic point of view
We note through the formula of the multiple linear regression model that the impact relationship of information and communication technologies on foreign direct investment for Tunisia with each of them such as fixed broadband subscriptions per 100 inhabitants and Internet users (%), is a direct relationship and this is consistent with the gravity model. But its relationship of mobile cellular subscriptions per 100 inhabitants, international bandwidth per Internet user (bits/sec), active mobile broadband subscriptions per 100 inhabitants, and finally the fixed line subscription 100 people is an inverse relationship, which is inconsistent with the model under study. Because we notice from the regression formula that the value of the fixed parameter, which represents the amount (9.61035936637) of intra- trade, which is independent of the explanatory external variables, has a positive sign, and this in turn is acceptable from an economic point of view, so this model is rejected from an economic point of view and does not need to pass for a standard study.

Second model

And after making several attempts by deleting each time for a negative or insignificant variable. We got a model in the last one where we removed the mobile cellular subscription index per 100 inhabitants and the index of active mobile broadband subscriptions per 100 inhabitants. To obtain the formula of a four-variable linear regression model that explains the impact of information and communication technologies on foreign direct investment for Tunisia in terms of such as international bandwidth per Internet user (bits/sec), active mobile broadband subscriptions per 100 inhabitants, fixed line subscriptions 100 people and finally the fixed broadband subscription per 100 inhabitants, and this model can be expressed mathematically as follows:

$$\text{Log}\ (DFI_{it}) = \beta_0 + \beta_1 \log (FLS_{it}) + \beta_2 \log (UI_{it}) + \beta_3 \log (IBPIU_{it}) + \beta_4 \log (FBS_{it}).$$

Result

The results of the evaluation are presented in the following table:

Table N° (02): The results of the standard study of the second model using the **EVIEWS** programme

Dependent Variable: DFI
Method: Least Squares
Date: 11/18/22   Time: 10:12
Sample: 2000 2020
Included observations: 21

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	8.117756	1.015510	7.993776	0.0002
FBS	0.036342	0.073086	2.497246	0.0258
IU	0.203084	0.411069	2.494037	0.0280
FLS	0.660613	0.996567	3.662889	0.0168
IBPIU	0.035381	0.095203	2.371638	0.0150

R-squared	0.820787	Mean dependent var	8.972832
Adjusted R-squared	0.146516	S.D. dependent var	0.231362
S.E. of regression	0.247732	Akaike info criterion	0.251319
Sumsquaredresid	0.981939	Schwarz criterion	0.500015
Log likelihood	2.361152	Hannan-Quinn criter.	0.305292
F-statistic	56.361038	Durbin-Watson stat	1.500318
Prob(F-statistic)	0.832664		

Source : Préparé par l'auteur avec l'aide d'Eviews

```
Estimation Command:
=========================
LS DFI C FBS IU FLS IBPIU


Estimation Equation:
=========================
DFI = C(1) + C(2)*FBS + C(3)*IU + C(4)*FLS + C(5)*IBPIU


Substituted Coefficients:
=========================
DFI  =  8.11775577282  +  0.0363415851942*FBS  +  0.203083599388*IU  +
0.660613010788*FLS                    +                    0.035380965696*IBPIU
```

Source : Préparé par l'auteur avec l'aide d'Eviews

$$\text{Log } (DFI_{it}) = \beta_0 + \beta_1 \log (FLS_{it}) + \beta_2 \log (UI_{it}) + \beta_3 \log (IBPIU_{it}) + \beta_4 \log (FBS_{it}).$$

A. Model Evaluation

- **From an economic point of view**

We note through the simple linear regression formula for the impact of information and communication technologies on foreign direct investment for Tunisia in terms of as international bandwidth per Internet user (bits/sec), active mobile broadband subscriptions per 100 inhabitants, fixed line subscriptions for 100 people and finally the fixed broadband subscription for 100 inhabitants, that there is a direct relationship between them, and this is consistent with the economic model.

In addition, the constant parameter which represents the international bandwidth per Internet user (bits/sec), active mobile broadband subscriptions per 100 inhabitants, fixed line subscriptions 100 people and finally the fixed broadband subscription per 100 inhabitants. It has a positive value (8.11775577282**).** This is also in line with economic theory, so it is necessary to study this model from a standard point of view.

C. From an economic point of view

C.1 The coefficient of determination

Based on the estimation results presented in Table N° 2, this model is explained. By 82.07% and it is within acceptable moral limits, because it explains more than 50% of the economic phenomenon.

C.2 Probability value for interpreted variables

According to the results presented in the same table N°2, we statistically accept the capacity of the FBS parameter, because its probability is less than 5%. And we also accept each of the IU variables because its probability is less than 5%, the FLS carsa probability is value (0.0168), IBPIU indicator of value (0.0150).

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C.3 Statistical significance of model parameter estimators (Student's test):

Student's test: Statistical inference is the part of statistics that, unlike descriptive statistics, does not simply describe observations, but extrapolates the findings to a larger set and allows hypotheses to be tested about that set and decisions to be made. A statistical test is a mechanism that makes it possible to decide between two hypotheses in view of the results of a sample. Let H0 and H1 be two hypotheses (H0 is called null hypothesis, H1 alternative hypothesis), one of which is true. The decision is to retain H0 or H1. [11]

- (C) Constant parameter: Where we make the following two assumptions

: C=0

: C>0

The preference is made on the basis of a comparison between **Student**, arithmetic and tabular values.

And we have (n=2) and a level of significance (α=5%) the tabular value of Student is (4.3027) As for the arithmetic value of **Student** according to Table No. 2 it is (7.993776) and it is greater than the tabular value, so H_1 we accept and reject H_0 that is to say that C to statistical significance is statistically acceptable.

C.4 Capability of the FBS parameter

The arithmetic value of the **Student** value of the capacity of the FBS parameter (2.497246) as shown in Table N° 2 is greater than the tabular value of **Student** (2.0796) Therefore, we accept H_1 and reject H_0 that is, and the capacity of the FBS parameter is statistically acceptable.

C.5 The capacity of the UI parameter

The arithmetic value of the Student value of the capacity of the IU parameter (2.494037) as shown in Table 2 is greater than the tabular value of Student (2.0796) Therefore, we accept H_1 and reject H_0 that is, and the capacity of the UI parameter is statistically acceptable.

C.6 The capability of the FLS parameter

The arithmetic value of the Student value of the capacity of the FLS parameter (3.662889) as shown in Table 2 is greater than the tabular value of Student (2.0796) Therefore, we acceptH_1 and reject H_0 that is, and the capacity of the FLS parameter is statistically acceptable.

C.7 The capacity of the IBPIU parameter

The arithmetic value of the Student value of the capacity of the IBPIU parameter (2.371638) as shown in Table N° 2 is greater than the tabular value of Student (2.0796) Therefore, we accept H_1 and reject H_0 that is, the capacity of the IBPIU parameter is statistically acceptable.

C.8 The global significance test of the model (Fisher test)

Fisher test: This is a statistical test, to compare the dispersion of two samples or two sets of measures (at the mathematical level: their variance). We calculate the ratio of this dispersion, and then we check if it exceeds a certain theoretical value, which we look for in the Fisher table. If the calculated ratio is larger than the theoretical value, then one can definitively reject the hypothesis of equality of the two dispersions. But if it is lower, we cannot come to a conclusion: the two dispersions may be identical, but it is also possible that we lack values to see the difference. [12]We have at the significance level α=5% and n=21 then the Fisher table value is (4.381) [13] ($F\ n-2, K-1 = F\ 22-2, 2-1 = 4.381$ and the Table N°2 equal to (56.361038). And we extract the Fisher arithmetic value which is (56.361038) which is greater than the tabular value, and therefore at least one of the simple linear regression parameters is estimated to be nonzero.

Where and comparing (F_0) the favoritism with the value (F_t) tabular, it emerges from table (F) is equal to (4.381). And just as $F_t < F_0$ it means that the assumed relationship in our model is significant and that there is a positive effect of one or more independent variables on the dependent variable (Y) which here represents the level of impact of information and communication technologies on foreign direct investment for Tunisia. It should be noted that the basic data we used to estimate the parameters of the model.

And we will differentiate in poverty from the conclusions of the study, the conclusions based on the results of the standard assessment, for the model from which we have departed.

Conclusions and projections

The results of the estimate show a positive relationship between the indicators of ICT and FDI in Tunisia, this means that the availability of good infrastructure such as fixed telephone subscriptions of 100 inhabitants, Internet users, international bandwidth per Internet user (bits/second), active mobile broadband subscriptions per 100 inhabitants, improves the climate and business environment and works to attract such investments by reducing costs and saving time as well as allowing direct connection between customers. and producers, thereby increasing the level of productivity and attracting FDI flows in this state.

Algeria

Estimating the equation

Estimating the gravitational equation through what has been mentioned; we will try to put the desired mathematical equation estimate as part of our case study according to the list of variables we assume, which are as follows:

Log (DFI_{it}) = β_0+$\beta_1$log (FLS_{it}) +$\beta_2$log (MCS_{it}) +β_3 log (UI_{it}) +β_4 log ($IBPIU_{it}$) +β_5 log ($AMBS_{it}$) +β_6 log (FBS_{it}).

Standard Study Results and Projections

Using an **EVIEWS** program, and after data entry, we obtained the results presented in the table below, which we will discuss in detail by analyzing these data.

Standard study results using the EVIEWS programme

Table N° (03): The results of the standard study of the first model using the **EVIEWS** programme

Dependent Variable: DFI
Method: Least Squares
Date: 11/18/22   Time: 13:01
Sample: 2000 2020
Included observations: 20

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	9.076730	1.000511	9.072090	0.0000
AMBS	-0.082655	0.137306	-0.601980	0.5575
FBS	0.177784	0.126301	1.407627	0.1827
FLS	-0.225790	1.256996	-0.179627	0.8602
IBPIU	0.000114	0.053780	0.002126	0.9983
IU	-0.250293	0.564679	-0.443249	0.6649
MCS	0.344540	0.244802	1.407427	0.1828

R-squared	0.707103	Mean dependent var		9.135193
Adjusted R-squared	0.571920	S.D. dependent var		0.229104
S.E. of regression	0.149898	Akaike info criterion		-0.688512
Sumsquaredresid	0.292101	Schwarz criterion		-0.340005
Log likelihood	13.88512	Hannan-Quinn criter.		-0.620480
F-statistic	5.230706	Durbin-Watson stat		2.065351
Prob(F-statistic)	0.006077			

Source: Prepared by the author with the assistance of Eviews

The results of the estimation of the model parameters are as follows, based on the following data:

```
Estimation Command:
=========================
LS DFI C AMBS FBS FLS IBPIU IU MCS


Estimation Equation:
=========================
DFI = C(1) + C(2)*AMBS + C(3)*FBS + C(4)*FLS + C(5)*IBPIU + C(6)*IU +
C(7)*MCS


Substituted Coefficients:
=========================
DFI = 9.07673005507 - 0.0826553950746*AMBS + 0.177784485363*FBS -
0.225790050671*FLS + 0.00011433467771*IBPIU - 0.250293103246*IU +
0.344540302284*MCS
```

Source: Prepared by the author with the assistance of Eviews

Evaluation of the first model
From an economic point of view
We note through the formula of the multiple linear regression model that the impact relationship of information and communication technologies on foreign direct investment for Algeria with each of them such as fixed broadband subscriptions per 100 inhabitants and mobile cellular subscriptions per 100 inhabitants, The international bandwidth per Internet user (bits/sec) is a direct relationship and this is consistent with the gravity model. But its relationship of active mobile broadband subscriptions per 100 inhabitants, Internet users (%), and finally the fixed line subscription 100 people is an inverse relationship and this is inconsistent with the model under study. Because we notice from the regression formula that the value of the fixed parameter, which represents the amount (9.07673005507) of intra-trade, which is independent of the explanatory external variables, has a positive sign, and this in turn is acceptable from an economic point of view, so this model is rejected from an economic point of view and does not need to pass for a standard study.

Second model
And after making several attempts by deleting each time for a negative or insignificant variable. We obtained a model in the last one where we removed the index of active mobile broadband subscriptions per 100 inhabitants, the index of Internet users (%), and finally the index of fixed line subscription 100 people. To obtain the formula of a three-variable linear regression model that explains the impact of information and communication technologies on foreign direct investment for Algeria in terms of such as fixed broadband subscriptions per

100 inhabitants, mobile cellular subscriptions per 100 inhabitants, and international bandwidth per Internet user (bits/sec), and this model can be expressed mathematically as follows:

$$Log\ (DFI_{it}) = \beta_0 + \beta_1 log\ (FLS_{it}) + \beta_2 log\ (MCS_{it}) + \beta_3 log\ (FBS_{it}).$$

Result

The results of the evaluation are presented in Table N° 4 below:

Dependent Variable: DFI
Method: Least Squares
Date: 11/18/22   Time: 13:09
Sample: 2000 2020
Included observations: 20

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	10.09362	0.735096	13.73101	0.0001
FBS	0.059616	0.074672	4.798374	0.0363
MCS	0.291712	0.077595	3.759425	0.0017
FLS	1.553079	0.910955	7.704890	0.0076

R-squared	0.597411	Mean dependent var		9.135193
Adjusted R-squared	0.521925	S.D. dependent var		0.229104
S.E. of regression	0.158409	Akaike info criterion		-0.670415
Sum squared resid	0.401495	Schwarz criterion		-0.471268
Log likelihood	10.70415	Hannan-Quinn criter.		-0.631539
F-statistic	76.914239	Durbin-Watson stat		1.715116
Prob(F-statistic)	0.001845			

Source: Prepared by the author with the assistance of Eviews

```
Estimation Command:
=========================
LS DFI C FBS MCS FLS


Estimation Equation:
=========================
DFI = C(1) + C(2)*FBS + C(3)*MCS + C(4)*FLS


Substituted Coefficients:
=========================
DFI = 10.0936161503 + 0.0596162696719*FBS + 0.291711781183*MCS +
1.55307873635*FLS
```

Source: Prepared by the author with the assistance of Eviews

$$\text{Log } (DFI_{it}) = \beta_0 + \beta_1 \log (FLS_{it}) + \beta_2 \log (MCS_{it}) + \beta_3 \log (FBS_{it}).$$

B. Model Evaluation

- **From an economic point of view**

We note through the simple linear regression formula for the impact of information and communication technologies on foreign direct investment for Algeria in terms of such as fixed broadband subscription per 100 inhabitants, mobile cellular subscription per 100 inhabitants, and international bandwidth per Internet user (bits/sec), that there is a direct relationship between them, And this is consistent with the business model.

In addition, the constant parameter which such as fixed broadband subscription per 100 inhabitants, mobile cellular subscription per 100 inhabitants, and international bandwidth per Internet user (bits/sec). It has a positive value (10.0936161503)**.** This is also in line with economic theory, so it is necessary to study this model from a standard point of view.

C. From an economic point of view

C.1 The coefficient of determination R^2

On the basis of the estimation results presented in Table N° 4 this model is explained. By 59.74% and it is within acceptable moral limits, because it explains more than 50% of the economic phenomenon.

C.2 Probability value for interpreted variables

According to the results presented in the same table N°4, we statistically accept the capacity of the FBS parameter, because its probability is less than 5%. And we also accept each of the MCS variables because its probability is less than 5%, the FLS carsa probability is of value (0.0076).

C.3 Statistical significance of model parameter estimators (Student's test):

- (C) Constant parameter: Where we make the following two assumptions

  : C=0

  : C>0

The preference is made on the basis of a comparison between **Student**, arithmetic and tabular values.

And we have (n=2) and a level of significance (α=5%) the tabular value of Student is (4.3027) As for the arithmetic value of **Student** according to Table 4 it is (13.73101) and it is greater than the tabular value, so H_1 we accept and reject H_0 that is to say that C to statistical significance is statistically acceptable.

C.4 Capability of the FBS parameter

The arithmetic value of the **Student** value of the capacity of the FBS parameter (4.798374) as shown in Table N° 4 is greater than the tabular value of **Student** (2.0796) Therefore, we accept H_1 and reject H_0 that is, and the capacity of the FBS parameter is statistically acceptable.

C.5 The capacity of the MCS parameter

The arithmetic value of the Student value of the capacity of the FBS parameter (3.759425) as shown in Table N° 4 is greater than the tabular value of Student (2.0796) Therefore, we accept H_1 and reject H_0 that is, the capacity of the FBS parameter is statistically acceptable.

C.6 The capability of the FLS parameter

The arithmetic value of the Student value of the capacity of the FLS parameter (7.704890) as shown in Table N° 4 is greater than the tabular value of Student (2.0796) Therefore, we accept H_1 and reject H_0 that is, the capacity of the FLS parameter is statistically acceptable.

C.9 The overall significance test of the model (Fisher test)

Fisher test: This is a statistical test, to compare the dispersion of two samples or two sets of measures (at the mathematical level: their variance). We calculate the ratio of this dispersion, then we check if it exceeds a certain theoretical value, which we look for in the table of We have at the level of significance α=5% and n=21 then the value of Fisher's table is (4.381), ($F\ n - 2, K - 1 = F\ 22 - 2, 2 - 1 = 4.381$ and table N° 4 equal to (76.914239). And we extract the Fisher arithmetic value that is greater than the tabular value, and therefore at least one of the simple linear regression parameters is estimated to be nonzero.

Where and comparing (F_0) the favoritism with the value (F_t) tabular, it emerges from table (F) is equal to (4.381). And just as $F_t < F_0$ this means that the assumed relationship in our model is significant and that there is a positive effect of one or more independent variables on the dependent variable (Y) which here represents the level of impact of information and communication technologies on foreign direct investment for Algeria. It should be noted that the basic data we used to estimate the parameters of the model.

And we will differentiate in poverty from the conclusions of the study, the conclusions based on the results of the standard assessment, for the model from which we have departed.

Conclusions and projections

The results of the estimate show that there is a positive relationship between the indicators of information and communication technology and foreign direct investment in Algeria, this means that fixed telephone subscriptions per 100 inhabitants, mobile cellular subscriptions per 100 inhabitants, and active mobile broadband subscriptions per 100 inhabitants, are important indicators and drivers to attract foreign investors, in terms of facilitating activity for economic

operators by the speed of implementation of various financial transactions, such as storing and transferring funds and paying bills.

Conclusion:

The study aimed to measure the impact of information and communication technology on foreign direct investment in Tunisia and Algeria during the period: (2000-2020), and to answer the problem raised, it was based on the steps of the standard study, according to the **EVIEWS** program.

In this applied study on the impact of information and communication technology on foreign direct investment in Tunisia and Algeria, we found the following:

Both Tunisia and Algeria have paid attention to the ICT sector as an alternative option, and this is a result of the fact that the Internet has become one of the priorities that are relied upon today in all sectors, and an important factor to improve performance and increase profitability in order to attract foreign capital, as the role of foreign direct investment has increased at the global level, especially in recent decades, as it leads to the benefit of the host country and maximizing its gains.

4.1. Results of the study: The proposed model for processing the study sample is the EVIEWS program, through the economic and statistical evaluation of the model, we found a positive relationship between fixed telephone subscriptions 100 inhabitants, mobile cellular subscriptions per 100 inhabitants, Internet users, international bandwidth per Internet user (bit/s), active mobile broadband subscriptions per 100 inhabitants, positively affect the attraction of foreign direct investment in the countries under study.

4.2 Recommendations:

- Improving and updating laws and legislations and making them enjoy some stability in order to support trust with the investor in the ICT sector and guarantee the rights of customers in the digital economy, in order to combat piracy in order to create credibility for the digital system.
- Increase research & development spending.
- Creating competencies capable of generating advanced technology and paying attention to the development of human capital.
- The need to develop the ICT infrastructure by opening the way for the private sector to invest in the provision of various telecommunications services.
- The government should make more efforts to move towards a digital economy and bridge the digital divide between Tunisia, Algeria and developed countries.
- Training workers in all sectors on hardware and software related to information and communication technology.

5. Marginalization list:

[1] Fidele NWAMEN, Impact of Information and Communication Technologies on Performance
commerciale des entreprises, la revue des sciences de gestion, N°218, March-April 2006, P :113.

[2] Abdslam Bendiabdellah, Djilali Benabou, **Impact of ICTs on the structures and behaviours of entreprises modern**, Revue économie et management, Université de Telemcen, N3, March 2004, p51.

[3] Chokri El Fidha, Mohamed HidiCharki, **The role of ICT in the development of customer relations Application to the bank/company relationship**, La Revue des sciences de gestion, marketing, France, 2008, p 124.

[4] **UNCTAD** word Investment Report 2004, the shift towards services, P: 345 Geneva and New York.

[5] OECD Organization, (1993), «**Detailed Benchmark Definition of Foreign Direct Investment**» Edition 1, P: 3, Paris.

[6] RYMAND Bernard, (no date of publication) ,«**Economie Financiere Intrenational**»,p.dpuf p : **,.**

[7] Dahmaninour el houda, **The Impact of Foreign Direct Investment on Economic Growth in Algeria: Econometric study for the period (2000-2017),** Al-Bashaer Economic Journal, Algeria, vol 05, N° 03, 2019, p 22.

[8] Bassem Hammadi Al-Hassan, Foreign Direct Investment, "Oil Licensing Contracts and their Impact on the Development of the Economy", Al-Halabi Human Rights Publications, Beirut 2014, p. 19.

[9] CHEIKHI Malika and others, **The relationship between Information and Communication Technology to Foreign Direct Investment in the MENA countries - An empirical study using the joint integration model for the period (2007-2017).** Journal of Economic Growth and Entrepreneurship JEGE Spatial and entrepreneurial development studies laboratory Year: 2022 Vol.5 No.3 p106.

[10] ARPT (2016): postal and telecommunications regulatory authority, Annual Report, p32, postal and telecommunications regulatory authority

[11] Course (7) of distance statistics, developed by Zarrouk Fayçal, ISSEP Ksar-Said, 2011-2012, page 1/5, http://www.issep-ks.rnu.tn/fileadmin/templates/Fcad/Test__de_Student.pdf

[12] Institut national de recherche en sciences et technologies du numérique, 2004, https://interstices.info/glossaire/test-de-fisher/

[13] $F_{n-2,K-1} = F_{22-2,2-1} = 4.381$

6. List of references:

1- Fidele NWAMEN, Impact of Information and Communication Technologies on Performance commerciale des entreprises, la revue des sciences de gestion, N°218, March-April 2006, P :113.

2- Abdslam Bendiabdellah, Djilali Benabou, **Impact of ICTs on the structures and behaviours of enterprises modern**, Revue économie et management, University of Telemcen, N3, March 2004, p51.

3-   Chokri El Fidha, Mohamed Hidi Charki, **The role of ICT in the development of customer relations Application to the bank/company relationship**, La Revue des sciences de gestion, marketing, France, 2008, p124.

4- **UNCTAD** word Investment Report 2004, The shift Towards services,P:345 Geneva and new York.

5- OECD Organization, (1993), «**Detailed Benchmark Definition of Foreign Direct investment**» Edition 1, P:3, Paris.

6-   RYMAND   Bernard,   (no   date   of   publication)   ,«**Economie   Financière International**»,p.dpuf

7- Dahmaninour el houda, **The Impact of Foreign Direct Investment on Economic Growth in Algeria: Econometric study for the period (2000-2017), Al-Bashaer** Economic Journal, Algeria, vol 05, N° 03, 2019, p 22.

8- Basem Hammadi Al-Hassan, Foreign Direct Investment, "Oil License Contracts and Their Impact on the Development of the Economy," Al-Halabi Human Rights Publications, Beirut 2014, p. 19.

9- CHEIKHI Malika and others, The relationship between Information and Communication Technology to Foreign Direct Investment in the MENA countries - An empirical study using the joint integration model for the period (2007-2017)**.** Journal of Economic Growth and Entrepreneurship JEGE Spatial and entrepreneurial development studies laboratory Year: 2022 Vol.5 No.3 p106.

10-ARPT(2016): postal and telecommunications regulatory authority, Annual Report, p32, postal and telecommunications regulatory authority

11- Course (7) of distance statistics, developed by Zarrouk Fayçal, ISSEP Ksar-Said, 2011-2012 , page 1/5, http://www.issep-ks.rnu.tn/fileadmin/templates/Fcad/Test__de_Student.pdf.

 12-ITU(2022): Country ICT Data Indicator (Indicator), Committed to connecting the world, https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx, on 26/10/2022 at 18:40.

 -:on 26/10/2022 at 18:40.

13https://data.albankaldawli.org/indicator/BX.KLT.DINV.CD.WD