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FDI, Information and Communication Technology, and Economic Growth: Empirical Evidence from Morocco

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Abstract

The document analyzes the relationship between FDI (Foreign Direct Investment), ICT (Information and Communication Technology), and economic growth in Morocco for the period from 1990 to 2021 using the ARDL model. Three models have been evaluated, with economic growth, FDI, and ICT as dependent variables in each respective model. In model (1), the results indicate that in the short term, economic growth is not positively related to FDI and ICT. However, in the long term, FDI positively contributes to economic growth, while ICT negatively affects it. A controlled inflation rate has a positive short-term effect, and the level of education shows a positive relationship in both the short and long term. In Model (2), economic growth and government spending have a significant short-term effect on FDI, while ICT has no effect. In the long term, economic performance and inflation remain important for FDI. Model (3) confirms a significant short-term relationship between FDI and ICT, with a negative impact. However, ICT is positively influenced by the inflation rate and the level of education. In the long term, FDI, demographic changes, and education have favorable and significant effects, while economic growth has a negative impact. Regarding the Granger causality test by Toda-Yamamoto, the cause-and-effect relationship between ICT and economic growth is strong and unidirectional, while economic growth influences the level of ICT development. On the other hand, the causality between FDI and ICT concerning economic growth is indirect and depends on factors such as population growth, education level, and inflation rate.

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1. Introduction

Over the last few decades, technological advances in information and communication technologies (ICT) and foreign direct investment (FDI) have become increasingly important as determining factors in the economic growth of countries around the world. Morocco, a developing country, has so far followed this trend. In recent years, FDI has seen remarkable growth in the country. In fact, FDI in Morocco increased by 52% compared to the previous year, positioning it among the top investment destinations in the region, according to UNCTAD's latest World Investment Report 2022. Thanks to the rapid expansion of Internet connectivity and increased investment in information and communication technology (ICT) infrastructure, the country has made significant progress in the adoption and use of these technologies. ICT has made significant advances, and its application now encompasses all sectors of activity (Sagna, 2006). The development of ICT infrastructure makes it easier for managers to monitor and control businesses, which is crucial for economic progress. ICT also aims to help improve competitiveness, reduce poverty, and enhance the transparency and efficiency of public sector management (Sassi & Goaied, 2013). According to the International Telecommunications Union (ITU), mobile telecommunications is currently the fastest-growing sector in the world. The increase in mobile subscriptions has outstripped that of fixed lines by more than 1,000%. In Africa, over 51.8 million people own a mobile phone (Alzouma, 2008). Advances in digital technologies have had a profound impact on businesses, changing the way they operate and produce. ICT has encouraged the automation of processes, real-time access to information, and remote collaboration. These changes have enabled businesses to optimize their operational efficiency, accelerate the development of new products and services, and respond more quickly to market demands (Chabossou, 2018).

It is crucial to determine whether factors such as FDI and ICT have actually contributed to Morocco's economic growth. The role of ICT in influencing FDI and its impact on economic growth and development is of great importance (Dunne & Masiyandima, 2017). Economic growth depends on multiple factors, among which FDI and ICT play a key role. Studies have shown that these elements are particularly beneficial for stimulating economic growth in developing countries (Boamah, 2017; Dunne & Masiyandima, 2017; Fanta & Makina, 2017; Hassan, 2005). Although FDI has played a predominant role in the economic growth of developing countries, ICT has emerged as a key driver of economic growth in these nations.

As a complementary and increasingly crucial driver, they have helped to accelerate innovation, improve productivity, promote access to information, and foster digital inclusion (S. A. Asongu & Odhiambo, 2020; S. Asongu & Boateng, 2018). ICT (information and communication technologies) can be used in all areas of the economy. The actual influence of ICT on productivity and economic growth is still a matter of debate (Veeramacheneni et al., 2008) . ICT is an essential element in fostering a country's economic prosperity, as it enhances productive capacity in many economic sectors (Hong, 2017).

This study aims to examine the correlation between foreign direct investment (FDI), ICT, and economic growth in Morocco, using empirical evidence from available economic data. By analyzing the relationship between FDI, ICT, and economic growth in Morocco, the aim of this study is to provide answers to the following questions: What mechanism underlies the impact of FDI on economic growth in Morocco? This analysis could provide valuable information for policymakers, investors, and researchers interested in Morocco's economic development and the guidelines to be put in place to promote sustainable and inclusive growth. The study seeks to draw attention to the links between FDI, information and communication technologies, and Morocco's economic growth. By doing so, we will be able to understand the economic dynamics and quickly identify the policies and measures needed to boost the nation's growth potential. With this in mind, the study aims to provide an in-depth, empirically-based analysis of the relationships between these key factors, with the aim of enriching the economic debate in Morocco.

The research is organized under four headings. The first section provides a brief overview of the literature review analyzing the relationship between foreign direct investment (FDI), information and communication technologies (ICT), and economic growth. The second section presents in detail the study data and the methodological approach adopted. The third section presents the main results of the study and the discussions. Finally, the research concludes with implications and future directions in the fourth section.

2. Literature review

2.1 Definitions of key concepts

In this section, we will provide brief definitions of the three key concepts in our study: Foreign Direct Investment (FDI), Information and Communication Technologies (ICT), and Economic Growth.

2.1.1 Foreign direct investment (FDI)

According to (Farrell, 2008), definition of FDI, in order to operate in a foreign market and supply goods and services, a company must possess a mix of capital, technology, management, and entrepreneurship. FDI is defined as the ownership or control of 10% or more of the voting shares or similar interest in an unincorporated business, according to (Griffin & Pustay, 2007). A direct investment relationship that holds 10% or more of a company's ordinary or voting shares is referred to as FDI, according to the IMF. On the other hand, a transaction involving a smaller stake is considered a portfolio investment. FDI can be categorized into two families: horizontal and vertical. Horizontal FDI is used by Japanese MNEs (Multinational Enterprises) to expand their expertise and reduce risk by investing in sectors similar to their home country for local markets with few exports (Almfraji & Almsafir, 2014).

2.1.2 Information and communication technology (ICT)

The expression "information and communication technologies" (abbreviated to "ICT") is becoming increasingly common. Within scientific communities, this acronym is gaining popularity. To emphasize the novelty of the term, the word "ICT" refers to a number of researchers who use ICT and have added the mechanism (N) (Mastafi, 2016). Information and communication technologies are all proposed as means of transmitting immaterial communications (such as images, sounds, and strings of characters), according to (Dieuzeide, 1994), one of the many researchers who have given definitions of the term ICT. He divides ICT into three groups: telecommunications, computers, and audiovisuals. The word "ICT" is also defined by (Beheton, 2010) as a set of technologies for sharing, generating, sending, storing, and exchanging information. Information and communication technologies are defined by UNESCO (2004, p. 13) as "the set of technological tools and resources for transmitting, recording, creating, sharing, or exchanging information." (Mastafi, 2016). The term "information and communication technologies (ICT)" is also defined by the European Commission as "all the technical means used to process information and facilitate communication" in its glossary. The term "ICT" was first coined by (Mastafi, 2016). According to him, information and communication technologies (ICT) are a set of technologies that mainly include computing (hardware and software) for analyzing and storing information, microelectronics, telecommunications, advanced multimedia, and audiovisual technologies combined with telecommunications. These technologies enable communication, with networks, in particular, making it possible to exchange, share, and transmit information.

2.1.3 Economic growth

The debate on the foundations of economic growth remains very broad, and the notion of economic growth itself is complex. The measurement tools associated with it also have a long history, which continues to give rise to debate about their effectiveness and relevance. Indeed, several researchers have defined growth as "an increase in output over a long period." It can be described as "a sustained increase, over one or more extended periods, in a dimensional indicator; for a country, this is net world product in real terms." (PERROUX, 1999). As far as the concept of economic growth per capita is concerned, this is mainly attributed to productivity growth, which is also known as "economic prosperity." The process of increasing productivity implies that the same resources and factors of production (labour, capital, energy, and technical progress) generate more goods and services. Thus, growth is generally assessed using the real approach, where the term "economic growth" refers to the production of goods and services (Almfraji & Almsafir, 2014).

2.2 Literature on the link between FDI, ICT, and economic growth

The aim of this section is to examine the theoretical foundations underlying the correlation between Foreign Direct Investment (FDI), Information and Communication Technologies (ICT), and economic growth, highlighting the links and interactions between these elements. The link between FDI, economic growth, and ICT is the subject of lively debate among researchers. Indeed, studies by (Hassan, 2005) have suggested a positive theoretical relationship between FDI, ICT, and economic prosperity, and these beneficial effects can propagate through different channels, of which ICT stands out as a notable example. The positive spillovers associated with FDI can take different forms and be conveyed through various channels, such as ICT. A study carried out by (Bouras et al., 2014) examines the interaction between factors attracting foreign direct investment (FDI) and the role of ICT, particularly in the telecommunications sector between Morocco and Tunisia. This study reveals that better quality infrastructure has a positive effect on FDI flows. In addition, research has shown that a growing number of Internet users have a considerable and positive impact on the attractiveness of foreign direct investment (FDI), regarding the effects of ICT and FDI on economic growth, several studies have been conducted using various econometric methods. These studies aim to assess the impact of these factors on economic growth and analyze the mechanisms by which they interact. However, a study by (Okafor et al., 2017) presents different results. This study explores the determinants of FDI in a sample of 20 Sub-Saharan African (SSA) and 11 MENA countries over the period 2000–2012. According to this study, FDI inflows in these regions are influenced by gross domestic product (GDP) per capita, highlighting its crucial role in attracting foreign investment. In addition, this research finds a negative effect of inflation on FDI inflows, indicating that high inflation rates can deter foreign investors from locating in these areas. Research findings indicate that the influence of FDI on economic growth varies according to a country's stage of development. In developed countries, FDI tends to be beneficial for economic growth, whereas in developing countries, other factors, such as GDP per capita, may play a more important role. In addition, macroeconomic considerations such as inflation may also influence FDI inflows in certain regions. Furthermore, in a study conducted by (S. A. Asongu & Odhiambo, 2020) which aims to demonstrate how ICT modulates the effect of foreign direct investment (FDI) on economic growth dynamics in 25 sub-Saharan African countries over the period 1980–2014, it was found that internet penetration and mobile phone penetration play a massive role in modulating the effect of FDI to induce positive net effects on all three economic growth dynamics. Other research studies have also explored the link between FDI and economic growth, found a positive and significant correlation between FDI and economic growth (Arain et al., 2020; Khaliq, 2007; Nguyen, 2020; Odhiambo, 2022; Rakhmatillo et al., 2021; Saidi et al., 2020; Shittu et al., 2020; Wang & Wang, 2021; Zeng & Zhou, 2021). However, (Mpira, 2022) found that FDI had no significant impact on growth in Canada. Information and communication technologies (ICT) have a positive impact on economic growth, according to a study by (Youssef, 2003), who highlighted in their study that the development of the Tunisian economy based on ICT depends to a large extent on taking the deflator effect into account. Similarly, (Choi & Hoon Yi, 2009) found that the Internet has a positive and significant impact on economic growth in their research. However, (Maurseth, 2018) challenges these results by replicating the work of Choi and Hoon Yi and concluding that the effect of the Internet on economic growth is negative and significant. Additionally, (Vu, 2019) found that the effect of Internet penetration on a country's economic growth increases as the size of its Internet network grows. In another study,(Vu, 2011) examined the hypothesis that ICT penetration has positive effects on economic growth. According to this study, the marginal effect of the penetration of Internet users is greater than that of mobile phones, which is itself greater than that of personal computers, for an average country. However, the marginal effect of ICT penetration decreases as penetration increases. A study by (Veeramacheneni et al., 2008) examined the relationship between ICT investment and foreign direct investment (FDI) in India, with reference to their implications for economic growth. The researchers found that developing countries are seeking to improve their ICT investments in order to benefit from expected increases in economic activity. It is often assumed that there is a causal relationship between FDI and investment in information and communication technologies (ICT). Similarly, a study by (Sassi & Goaied, 2013) examined the impact of information and communication technologies on economic growth while taking into account the level of financial development. The authors found that there is a positive and significant direct effect of ICT indicators on economic growth. In another study, (Khalili et al., 2014) found that in the long run, there is a unidirectional causality between the contribution of ICT and economic growth. However, in the short run, the contribution of ICT does not show a robust causal relationship. Research conducted by (Hong, 2017) demonstrated that investment in ICT is driven by economic growth. (Efobi et al., 2018) examined how improved ICT enhances women’s economic participation. Their results showed that improvement occurs particularly in the context of higher mobile penetration, internet penetration, and fixed broadband subscriptions. In addition, (Belloumi, 2014) examined the relationship between foreign direct investment (FDI), trade openness, and economic growth in host countries. The results revealed that there was no significant Granger causality between FDI and economic growth. On the other hand, (Balasubramanyam et al., 1996) found that the beneficial effect of FDI on improving economic growth was greater in countries that adopted an outward-oriented trade policy.

3. Data, methodology, and specification of the empirical model

3.1 Data

The variables studied include GDP per capita, which measures the level of economic growth in current US dollars and has been used as an indicator of variation in economic output. This choice of GDP per capita measure is appropriate for capturing economic growth, as suggested by renowned researchers such as Solow (1956), Romer (1986), and Lucas (1988), according to Beck & Levine (2004) and Andersen (2003), GDP per capita is an indicator of the level of economic development (Gakpa, 2019). In this study, we have selected relevant variables that enable us to achieve our main objective. The variables selected are as follows: Foreign Direct Investment (FDI): Measured in millions of US dollars, this indicator represents stock inflows of FDI, Information and Technology (ICT): This variable includes different measures such as fixed telephone subscriptions, broadband access, mobile telephone subscriptions, and internet usage. In addition to these specific variables, we also included some general contextual elements in line with the contemporary literature on economic development. These include population, inflation, public expenditure, and education. These factors were deemed relevant to capture the relationship between ICT, FDI, and economic growth based on previous studies conducted by (Anyanwu, 2011; S. A. Asongu, 2015; S. A. Asongu & Odhiambo, 2020; Barro, 2003; Elu & Price, 2010; Fosu, 2015; Kreuser & Newman, 2018; Maryam & Jehan, 2018; Nyasha & Odhiambo, 2015; Sahoo et al., 2010). The control variables selected for this study are justified by their importance as relevant factors in understanding how FDI can boost a country's economic performance. The population variable is considered relevant because population growth is positively associated with output and economic activity. This variable is expressed as an annual percentage to reflect population growth (Headey & Hodge, 2009). The inflation variable, in percent annualized, indicates the variation in the prices of goods and services. According to (S. A. Asongu & Odhiambo, 2020), low and stable inflation is conducive to economic prosperity, while high inflation may indicate an economic environment characterized by uncertainty and limited investment and economic activity. Government expenditure, expressed as %GDP, represents the proportion of final consumption expenditure made by the government. It plays a crucial role in stimulating economic activity, productivity, and output. It is primarily designed to achieve macroeconomic objectives such as investment, employment, and economic growth. Finally, education, as measured by gross school enrolment, is seen as a driver for improved economic activity. According to (Ssozi & Asongu, 2016), education or human capital is necessary to boost economic productivity. This variable assesses the education system and the quality of training of the population, which plays a crucial role in economic development (S. Asongu & Odhiambo, 2018). The variables are chosen as relevant factors to understand how FDI can boost a country's economic performance. By including them in our analysis, we hope to better understand the underlying mechanisms and impact of ICT, FDI, and contextual factors on economic growth in Morocco. Table 1 presents the variables of the study, their definitions, and the main sources collected.

Table 1: Definition of study variables

Variable	Code	Definition	Source
Economic Growth	GDPpc	GDP per capita (current US$)	WDI
Foreign Direct Investment	FDI	Foreign direct investment stock (US dollars) at current prices in millions)	UNCTAD
Information and communication technology	ICT	Fixed-line telephone subscriptions (per 100 inhabitants); Subscriptions to fixed-line broadband access services (per 100 inhabitants); Mobile telephone subscriptions (per 100 inhabitants); Internet users (% of population) (per 100 inhabitants)	WDI
Population	POP	Population growth (annual %)	WDI
Inflation	CPI	Consumer price index (annual %)	WDI
Education	EDUC	School enrolment, higher education (% gross); School enrolment, secondary (% gross); School enrolment, primary (% gross)	WDI
Expenditure on governments	GFCE	Government final consumption expenditure (% of GDP)	WDI

Source: Compiled by the Author

3.2 Epistemological foundation and methodological approach to research

In our research, we postulate that economic growth is inherent to the intrinsic characteristics of the Moroccan economy, independently of actors such as private investments, including FDI and ICT. Thus, knowledge about economic growth is considered to be objective. Consequently, we choose to take scientific realism as our epistemological foundation, while opting for the hypothetico-deductive methodological approach in our research (Gavard-Perret et al., 2012). In order to achieve our objective of analyzing the relationship between FDI, ICT, and growth in Morocco over the period from 1980 to 2021, we adopt a methodology that is based on the relevant economic literature. Our basic models are formulated in a general form, which allows us to examine the links between FDI, ICT, and economic growth in Morocco.

$$GDPpc = f\ (FDI, ICT, GFCE, EDUC, CPI, POP) \quad (1)$$

$$FDI = f\ (GDPpc, ICT, GFCE, EDUC, CPI, POP) \quad (2)$$

$$ICT = f\ (GDPpc, FDI, GFCE, EDUC, CPI, POP) \quad (3)$$

In our study, we developed three models. The first model uses GDP per capita (GDP) as the dependent variable, together with FDI, ICT, and four other variables relevant to our study. The second model focuses on FDI as the variable to be explained, while the third model focuses on ICT as the dependent variable. To correctly specify the models used in our study, we proceeded to analyze the stationarity of the variables to determine their order of integration. We used the ADF (Augmented Dickey-Fuller) and PP (Phillips-Perron) tests to assess the stationarity of the variables. It is important to note that the stationarity of the variables is an essential prerequisite for using many econometric models. The results in Table 2 show the stationarity or not of each series of data studied. The variables LnFDI, LnICT, and LnEDUC were found to be stationary after being differentiated once, indicating that they are of integration order I (1). On the other hand, the variables LnGDPpc, LnGFCE, LnCPI, and LnPOP are stationary without requiring differentiation, which implies that they are of integration order I (0).

Table 2: Stationarity tests

Variable	ADF test	PP test	Specification	Order
LnGDPpc	-3.583968(0.0437) **	-3.683574 (0.0349)**	Ct +trend	I(0)
LnFDI	-5.254400 (0.0006) ***	-5.546347 (0.0003) ***	Ct +trend	I(1)
LnICT	-2.957085 (0.0478) **	-2.910091 (0.0530)*	Constant	I(1)
LnGFCE	-5.577170 (0.0002) ***	-3.526349 (0.0497) **	Ct +trend	I(0)
LnEDUC	-4.860716 (0.0019) ***	-6.319702 (0.0000) ***	Ct +trend	I(1)
LnCPI	-5.788458 (0.0001) ***	-5.783999 (0.0001) ***	Ct +trend	I(0)
LnPOP	-3.277947 (0.0017) ***	-4.108634 (0.0001) ***	None	I(0)

Note: () indicates probability, ***, **,* at significance level 1%, 5% and 10% respectively.
Source: Calculations of the Author.

To complete our analysis, we also performed a cointegration test. Several tests are available in the literature, such as the Engle and Granger (1987) test, which is relevant for two integrated variables of the same order but less effective for multivariate models. Johansen's Trace test (1988, 1991) is valid for models based on the VECM (Vector Error Correction Model) and when all the variables are integrated in the same order, which is not the case here. To determine the long-term relationship, we used the "boundary cointegration test," according to Pesaran et al. (2001). This test is applicable when the variables studied have different orders of integration (I (0); I (1)), which is the case in our study (Pesaran et al., 2001). The application of this test is based on two steps: the determination of the optimal lag on the basis of the criteria (AIC, SIC, and HQ) and the verification of the hypotheses using the Fisher test. The boundary cointegration test is based on a comparison of the Fisher values with the critical values (lower and upper bounds). The aim is to test two statistical hypotheses. The first null hypothesis (H0) postulates that $\boldsymbol{\Omega}1=\boldsymbol{\Omega}2=\boldsymbol{\Omega}3=... \boldsymbol{\Omega}7=0$, which would indicate the presence of a cointegrating relations.

In contrast, the alternative hypothesis (H1) assumes that $\boldsymbol{\Omega}1\#\boldsymbol{\Omega}2\#\boldsymbol{\Omega}3\# ... \#\boldsymbol{\Omega}7\#0$, suggesting no cointegration. The full results of the test are shown in Table 3.

Table 3: Results of the cointegration test at the bounds

Model (1)			**Model (2)**			**Model (3)**		
LnGDPpc: dependent variable			***LnFDI: dependent variable***			***LnICT: dependent variable***		
F- statistics	**8.094**		F- statistics	**6.757**		F- statistics	**25.343**	
level	I(0)	I(1)	level	I(0)	I(1)	level	I(0)	I(1)
10%	2.254	3.888	10%	2.254	3.888	10%	2.254	3.888
5%	2.685	6.960	5%	2.685	6.960	5%	2.685	6.960
1%	3.713	5.326	1%	3.713	5.326	1%	3.713	5.326
Cointegrated			Cointegrated			Cointegrated		

Note: I (0) indicate the lower limit while I (1) is the upper limit.
Source: The Author.

Table 3 shows the results of the cointegration test for three variables: LnGDPpc, LnFDI, and LnICT, which are all dependent variables. For the variable LnGDPpc, the cointegration test indicates an F-statistic of 8.094. The threshold corresponding to a lower limit of cointegration (I (0)) is 2.254 at the 10% confidence level, 2.685 at the 5% confidence level, and 3.713 at the 1% confidence level. These results suggest that LnGDPpc is cointegrated, i.e., that there is a cointegrating relationship between the underlying variables. For the LnFDI variable, the F-statistic is 6.757. The corresponding thresholds are 2.218 at the 10% confidence level, 2.618 at the 5% confidence level, and 3.505 at the 1% confidence level. These results also indicate cointegration for LnFDI. Finally, for the variable LnICT, the F-statistic is 25.343. The corresponding thresholds are 2.254 at the 10% confidence level, 2.685 at the 5% confidence level and 3.713 at the 1% confidence level. These results strongly suggest cointegration for LnICT. In summary, the results of the cointegration test indicate that the variables LnGDPpc, LnFDI, and LnICT are all cointegrated, suggesting the existence of long-term relationships between these variables.

3.3 The empirical model

In order to achieve our objective, we have adopted the ARDL (AutoRegressive Distributed Lag) approach. The choice of this model is not arbitrary; it is based on justifications and reasons from the economic literature. Firstly, the ARDL model is suitable for limited sample sizes, which is applicable in our case. Secondly, the model is valid for integrated variables of orders I(0) and I(1), but not for integrated variables of order I(2). Our study of the stationarity of the variables revealed a mix of order I(0) and I(1), which confirms the appropriateness of choosing the ARDL model. Additionally, the ARDL model requires the existence of cointegration among the variables, which is consistent with our case. To determine the presence of a long-term relationship, we performed the "boundary cointegration test" based on Pesaran et al. (2001). This test is applicable when the variables studied have different orders of integration (I(0) and I(1)), which is consistent with our case. There are several tests in the literature, such as the Engel and Granger (1987) test, but they are only suitable for two integrated variables of the same order and are considered less effective for multivariate models. The Trace test (Johansen, 1988; 1991) is valid for models based on the VECM (Vector Error Correction Model) and when all the variables have the same order of integration, which does not apply to our case. The general formula of the ARDL model is as follows(Pesaran, 1998):

$$Y(t) = \alpha + \beta_0 X(t) + \beta_1 X(t-1) + ... + \beta p X(t-p) + \delta_1 Y(t-1) + ... + \delta_r Y(t-r) + \varepsilon(t) \quad (4)$$

Where Y (t) represents the dependent variable at time t. X (t), X (t-1),..., X(t-p) are the explanatory variables at time t and in past periods. Y (t-1), Y (t-r) are the lagged values of the dependent variable. α is the intercept. β_0, β_1, ..., βp are the coefficients associated with the explanatory variables. δ_1, ..., δ_r are the coefficients associated with the lagged values of the dependent variable. ε(t) is the error term. If we wish to determine the short-run and long-run impacts of the explanatory variables on economic growth, equations (1, 2 and 3) of the ARDL representation will be as follows, respectively:

$$\Delta LnGDPpc(t) = \alpha_0 + \sum_{i=1}^{p} \beta 1i \Delta LnGDPpc(t-i) + \sum_{i=1}^{p} \beta 2i \Delta LnFDI(t-i) + \sum_{i=1}^{p} \beta 3i \Delta LnICT(t-i) + \sum_{i=1}^{p} \beta 4i \Delta LnGFCE(t-i) + \sum_{i=1}^{p} \beta 5i \Delta LnEDUC(t-i) + \sum_{i=1}^{p} \beta 6i \Delta LnCPI(t-i) + \sum_{i=1}^{p} \beta 7i \Delta LnPOP(t-i) + \boldsymbol{\Omega}_1 LnGDPpc_{t-1} + \boldsymbol{\Omega}_2 LnFDI_{t-1} + \boldsymbol{\Omega}_3 LnICT_{t-1} + \boldsymbol{\Omega}_4 LnGFCE_{t-1} + \boldsymbol{\Omega}_5 LnEDUC_{t-1} + \boldsymbol{\Omega}_6 LnCPI_{t-1} + \boldsymbol{\Omega}_7 LnPOP_{t-1} + \varepsilon(t) \quad (5)$$

$$\Delta LnFDI(t) = \alpha_0 + \sum_{i=1}^{p} \beta 1i \Delta LnFDI(t-I) + \sum_{i=1}^{p} \beta 2i \Delta LnGDPpc(t-I) + \sum_{i=1}^{p} \beta 3i \Delta LnICT(t-I) + \sum_{i=1}^{p} \beta 4i \Delta LnGFCE(t-I) + \sum_{i=1}^{p} \beta 5i \Delta LnEDUC(t-I) + \sum_{i=1}^{p} \beta 6i \Delta LnCPI(t-i) + \sum_{i=1}^{p} \beta 7i \Delta LnPOP(t-I) + \boldsymbol{\Omega}_1 LnFDI_{t-1} + \boldsymbol{\Omega}_2 LnGDPpc_{t-1} + \boldsymbol{\Omega}_3 LnICT_{t-1} + \boldsymbol{\Omega}_4 LnGFCE_{t-1} + \boldsymbol{\Omega}_5 LnEDUC_{t-1} + \boldsymbol{\Omega}_6 LnCPI_{t-1} + \boldsymbol{\Omega}_7 LnPOP_{t-1} + \varepsilon(t) \quad (6)$$

$$\Delta LnICT(t) = \alpha_0 + \sum_{i=1}^{p} \beta 1i \Delta LnICT(t-i) + \sum_{i=1}^{p} \beta 2i \Delta LnGDPpc(t-I) + \sum_{i=1}^{p} \beta 3i \Delta LnFDI(t-i) + \sum_{i=1}^{p} \beta 4i \Delta LnGFCE(t-i) + + \sum_{i=1}^{p} \beta 6i \Delta LnCPI(t-i) + \sum_{i=1}^{p} \beta 7i \Delta LnPOP(t-I) + \boldsymbol{\Omega}_1 LnICT_{t-1} + \boldsymbol{\Omega}_2 LnGDPpc_{t1} + \boldsymbol{\Omega}_3 LnFDI_{t-1} + \boldsymbol{\Omega}_4 LnGFCE_{t-1} + \boldsymbol{\Omega}_5 LnEDUC_{t-1} + \boldsymbol{\Omega}_6 LnCPI_{t-1} + \boldsymbol{\Omega}_7 LnPOP_{t-1} + \varepsilon(t) \quad (7)$$

With: Δ represents the first difference; α0: indicates the constant; β_1.....β_7: represent the effects in the short term; $\boldsymbol{\Omega}_1$..... $\boldsymbol{\Omega}_7$: are the parameters that indicate the long-term dynamics and finally, ε(t): this is the error term (white noise). The form of the error correction model, which allows us to validate the principle of cointegration or not, will have the following form for the case of our study:

$$\Delta LnGDPpc(t) = \alpha_0 + \sum_{i=1}^{p} \beta 1i\Delta LnGDPpc(t-i) + \sum_{i=1}^{p} \beta 2i\Delta LnFDI(t-I) + \sum_{i=1}^{p} \beta 3i\Delta LnICT(t-i) + \sum_{i=1}^{p} \beta 4i\Delta LnGFCE(t-i) + \sum_{i=1}^{p} \beta 5i\Delta LnEDUC(t-i) + \sum_{i=1}^{p} \beta 6i\Delta LnCPI(t-i) + \sum_{i=1}^{p} \beta 7i\Delta LnPOP(t-I) + \Theta u_{t-1} + \varepsilon(t) \quad (8)$$

$$\Delta LnFDI(t) = \alpha + \sum_{i=1}^{p} \beta 1i\Delta LnFDI(t-i) + \sum_{i=1}^{p} \beta 2i\Delta LnGDPpc(t-I) + \sum_{i=1}^{p} \beta 3i\Delta LnICT(t-I) + \sum_{i=1}^{p} \beta 4i\Delta LnGFCE(t-i) + \sum_{i=1}^{p} \beta 5i\Delta LnEDUC(t-I) + \sum_{i=1}^{p} \beta 6i\Delta LnCPI(t-i) + \sum_{i=1}^{p} \beta 7i\Delta LnPOP(t-I) + \Theta u_{t-1} + \varepsilon(t) \quad (9)$$

$$\Delta LnICT(t) = \alpha_0 + \sum_{i=1}^{p} \beta 1i\Delta LnICT(t-i) + \sum_{i=1}^{p} \beta 2i\Delta LnGDPpc(t-I) + \sum_{i=1}^{p} \beta 3i\Delta LnFDI(t-i) + \sum_{i=1}^{p} \beta 4i\Delta LnGFCE(t-i) + \sum_{i=1}^{p} \beta 5i\Delta LnEDUC(t-I) + \sum_{i=1}^{p} \beta 6i\Delta LnCPI(t-i) + \sum_{i=1}^{p} \beta 7i\Delta LnPOP(t-i) + \Theta u_{t-1} + \varepsilon(t) \quad (10)$$

The study aims to estimate relationships (5 to 7). The estimation results will be presented in the Results and Discussion section, showing both short-term and long-term impacts in Tables 6 and 7, respectively. Additionally, Table 8 will present the diagnostic tests of the estimated models. To verify Granger causality, equations (8 to 10) will be estimated using the Toda and Yamamoto (1995) approach applied to a standard VAR model (Toda & Yamamoto, 1995). The results of this analysis will be presented in Table 9.

4. Results and discussion

Table 4 presents descriptive statistics highlighting economic behavior. The measures of centrality (mean and median) indicate the values around which observations cluster. For example, LnGDPpc has a mean of 7.44, reflecting an average level of this variable, while the median of the log of FDI is 9.22, showing that half of the observations are below this value. The standard deviation assesses the variability of the data in relation to the mean; a high standard deviation, as for LnFDI (1.28), indicates a wide variation in values. The Jarque-Bera test assesses the normality of the distribution; a high value, as for LnPOP (5.55), suggests a deviation from a normal distribution. Table 5 shows the correlation matrix, enabling us to understand the linear relationships between the variables studied.

Table 4: Descriptive statistics

Variable	LnGDPpc	LnFDI	LnICT	LnPOP	LnCPI	LnGFCE	LnEDUC
Mean	7.446038	9.382268	2.748399	0.413880	0.862777	2.871310	4.975007
Median	7.298163	9.225120	2.853459	0.299360	0.788231	2.882809	4.903822
Maximum	8.241540	11.19741	5.473934	0.977108	2.525131	2.988604	5.482904
Minimum	6.502364	7.733304	-0.179824	0.042661	-1.192749	2.745591	4.567388
Std. Dev.	0.524561	1.288998	2.170691	0.268263	0.970765	0.058685	0.255469
JarqueBera	2.722488	4.686208	4.842585	5.552565	1.469865	1.002018	3.589489
Probability	0.256342	0.096029	0.088807	0.062270	0.479538	0.605919	0.166170

Source: The Author

Table 5: Correlation matrix

Variable	LnGDPpc	LnFDI	LnICT	LnPOP	LnCPI	LnGFCE	LnEDUC
LnGDPpc	1.0						
	0.966	1.0					
LnFDI	23.709	-----					
	0.000	-----					
	0.960	0.995	1.0				
LnICT	21.713	66.154	-----				
	0.000	0.000	-----				
	-0.864	-0.857	-0.870	1.0			
LnPOP	-10.891	-10.549	-11.193	-----			
	0.000	0.000	0.000	-----			
	-0.736	-0.764	-0.767	0.798	1.0		
LnCPI	-6.889	-7.497	-7.569	8.384	-----		
	0.000	0.000	0.000	0.000	-----		
	0.526	0.570	0.575	-0.345	-0.484	1.0	
LnGFCE	3.915	4.395	4.452	-2.325	-3.501	-----	
	0.000	0.0001	0.0001	0.025	0.001	-----	
	0.807	0.872	0.859	-0.779	-0.702	0.470	1.0
LnEDUC	8.650	11.319	10.633	-7.870	-6.238	3.371	-----
	0.000	0.000	0.000	0.000	0.000	0.001	-----

Source: The Author

According to this matrix, significant positive correlations are observed between GDP per capita (GDPpc) and foreign direct investment (FDI), as well as between GDP per capita and information and communication technologies (ICT). These results suggest that increased foreign and technological investment is associated with higher economic growth. On the other hand, there was a significant negative correlation between population (POP) and inflation (CPI), suggesting that a larger population may be associated with lower economic stability. As for the other variables, there is a significant positive correlation between public spending (GFCE) and the level of education (EDUC), as well as between public spending and GDP per capita. This indicates that countries that invest more in education tend to have higher public spending, which can stimulate economic growth.

The objective of our study is to determine the relationship that exists between FDI, information and communication technologies, and economic growth in Morocco. Table 6 presents the short-run estimates of the three models, while Table 7 presents the results of the long-run coefficients.

Table 6: Short-term estimates

Variable	Coefficients (probabilities)		
	Model (1)	Model (2)	Model (3)
Δ (LnGDPpc)	----	0.565116 (0.0015) ***	- 0.681365 (0.0001) ***
Δ (LnGDPpc (-1))	----	- 0.304770 (0.0101) ***	- 0.446810 (0.0010) ***
Δ (LnGDPpc (-2))	----	0.384500 (0.0054) ***	- 0.158089 (0.0941)*
Δ (LnGDPpc (-3))	----	0.619398 (0.0000) ***	0.222476 (0.0120) **
Δ (LnFDI)	-0.069702 (0.3877)	----	- 0.425942 (0.0038) ***
Δ (LnFDI (-1))	-0.922486 (0.0002) ***	----	-1.706614 (0.0000) ***
Δ (LnFDI (-2))	-0.788342 (0.0002) ***	----	-1.359215 (0.0000) ***
Δ (LnFDI (-3))	-0.273348 (0.0092) ***	----	0.702168 (0.0002) ***
Δ (LnICT)	-0.654638 (0.0000) ***	-0.051550 (0.4422)	----
Δ (LnICT (-1))	0.030569 (0.5758)	0.182122 (0.0188) **	----
Δ (LnICT (-2))	-0.446547 (0.0001) ***	-0.191711 (0.0231) **	----
Δ (LnICT (-3))	-0.250249 (0.0199) **	0.170164 (0.0661)*	----
Δ (LnPOP)	-0.734417 (0.0283) **	-3.299399 (0.0000) ***	-3.848625 (0.0000) ***
Δ (LnPOP (-1))	-0.183502 (0.6771)	2.335409 (0.0009) ***	0.430766 (0.3318)
Δ (LnPOP (-2))	-0.497315 (0.0766)*	0.490149 (0.3093)	-0.388597 (0.3069)
Δ (LnPOP (-3))	----	-1.144806 (0.0067) ***	-1.314874 (0.0036) ***
Δ (LnCPI)	0.073489 (0.0005) ***	-0.012331 (0.4487)	0.057214 (0.0012) ***
Δ (LnCPI (-1))	0.272806 (0.0000) ***	-0.013321 (0.4107)	0.386489 (0.0000) ***
Δ (LnCPI (-2))	0.207034 (0.0001) ***	-0.062369 (0.0021) ***	0.298618 (0.0000) ***
Δ (LnCPI (-3))	0.111624 (0.0007) ***	-0.152263 (0.0000) ***	0.077690 (0.0025) ***
Δ (LnGFCE)	-1.089383 (0.0001) ***	0.849241 (0.0003) ***	-0.282464 (0.0362) **
Δ (LnGFCE (-1))	2.299444 (0.0000) ***	----	3.381634 (0.0000) ***
Δ (LnGFCE (-2))	2.095038 (0.0001) ***	----	2.978156 (0.0000) ***
Δ (LnGFCE (-3))	1.050553 (0.0012) ***	----	2.377784 (0.0000) ***
Δ (LnEDUC)	0.320068 (0.0002) ***	-0.135280 (0.0497) **	0.096187 (0.0290) **
Δ (LnEDUC (-1))	-0.477853 (0.0001) ***	0.672128 (0.0000) ***	----
Δ (LnEDUC (-2))	-0.054389 (0.2546)	0.071005 (0.2765)	----
Δ (LnEDUC (-3))	-0.069789 (0.1272)	0.146273 (0.0600)*	----
CointEq (-1)	-1.045743 (0.0000) ***	-0.780547 (0.0000) ***	-0.963504 (0.0000) ***
R^2	0.986	0.973	0.992
R^2-Adjusted	0.963	0.936	0.978
F-statistics	7.737	5.788	28.639
Probability-F-stat	0.008	0.007	0.000
Durbin-Watson	3.023	3.163	2.883

Note: ***, **,* indicate significance levels at 1%, 5% and 10% respectively.
Source: Calculations of the Author

According to table (6), this represents the estimate of the short-term regression. We can clearly see that for all three models (1, 2, and 3), the lagged error correction terms (coefficient equilibrium adjustment coefficient) are all significant and have a negative sign. This coefficient, also known as the restoring force, has a range of absolute values from 0 to 1. This characteristic guarantees an error correction mechanism, allowing the establishment of a long-term relationship (cointegration) between the variables in the three models studied. In model (1), the restoring force is -1.04, which means that there is a very high speed of adjustment towards long-term equilibrium. For models (2) and (3), the adjustment coefficients are still quite fast but less so than for the first model (1). The short-term estimation results, presented in Table 4, reveal important information about model (1). Firstly, the dynamics of the variable (FDI) show a significant decrease relative to the baseline and previous periods. Secondly, the variable (ICT) is statistically significant but has a negative impact on GDP per capita. This is indicated by the negative coefficients. In summary, in the short term, ICT has a significant and negative influence on GDP per capita. This result can be explained by several reasons: Substitution effects; the adoption of information and communication technologies can lead to increased automation of production processes, which reduces the demand for labor and may result in job losses. This can negatively affect workers' income and, consequently, GDP, Disintermediation effects; information and communication technologies can reduce dependence on traditional intermediaries in commercial transactions. This can lead to a fall in revenues for businesses and intermediary sectors, which is also reflected in GDP per capita, Inequalities; the negative impact of the ICT indicator on GDP per capita may be linked to inequalities in income and access to technology. If the adoption of ICT mainly favors certain companies or groups of people, this may exacerbate economic inequalities and reduce the average GDP per capita. In addition, population growth is significant in two periods, but always has negative coefficients that impact GDP per capita. This can be explained by the pressure on available economic resources, which can negatively affect GDP per capita. If population growth is not followed by a proportional increase in economic output, this can lead to a reduction in the average standard of living. In other words, if population growth is not accompanied by equivalent growth in the economy, this could lead to a fall in the average standard of living of individuals. Regarding variable government expenditure (GFCE), generally speaking, there are significant relationships between variations in public expenditure and GDP per capita. An increase in government spending can be associated with a decrease in GDP per capita, but also with an increase in GDP per capita depending on the time context. Possible economic explanations include factors such as whether public resources are allocated efficiently. The impact of public investment on economic activity and the cumulative or delayed effects of public policies are important aspects to consider. Regarding the education variable, the results suggest a correlation between an increase in the level of education and a rise in GDP per capita. This relationship can be explained by the fact that education enhances the skills and productivity of the workforce, which in turn promotes economic growth and leads to an improvement in the average standard of living. However, the results also indicate significantly negative values for past periods. This observation can be explained by the fact that rapid growth in education can put pressure on the labor market, potentially leading to high unemployment or a mismatch between available skills and labor market needs. These factors could negatively impact GDP per capita. On the other hand, for the variable (CPI) that measures inflation, the results suggest a significant relationship between CPI and GDP per capita. An increase in CPI is associated with a significant rise in GDP per capita, which can be explained by the stimulating effect of moderate inflation on demand, investment, and overall economic growth. Thus, the performance indicators for model (1) are also provided; the coefficient of determination R2 indicates that the model is globally significant; moreover, it explains a large part of the variation in GDP per capita with a high value. Similarly, the adjusted R2 indicates that the model is well-fitted. Finally, the value of DW means that there is an absence of self-creation in the residuals. In model (2), the results suggest that the current level of GDP per capita has a positive effect on FDI. However, negative changes in GDP per capita relative to previous periods may have a negative effect on FDI. This may be explained by the fact that foreign investors are attracted to growing economies with high living standards and business opportunities, while negative changes in GDP per capita may indicate economic instability and fewer investment opportunities. As for the ICT variable, the results show a complex relationship between ICT and FDI. A recent increase in ICT may favor FDI by offering technological infrastructures that are attractive to foreign companies. However, variations in ICT over earlier periods may have different effects. With regard to population, the results indicate that the impact of population on FDI depends on the temporal context. A higher population may offer a larger market and business opportunities, which may encourage FDI. However, negative changes in population compared to previous periods may indicate demographic or economic changes that could influence foreign investment decisions. The CPI variable measures inflation and the results suggest that recent changes in the CPI do not have a significant impact on FDI. However, variations in the CPI over older periods (two times earlier and three times earlier) show a significant negative relationship with FDI. This can be explained by the fact that high levels of inflation can create economic uncertainty and risks for foreign investors. High inflation can cause higher production costs, reduced business competitiveness, and economic instability, all of which are likely to deter foreign investment. Regarding the education variable, the results suggest a significant positive relationship between education and FDI. An increase in education can encourage FDI by providing a skilled workforce and a greater capacity for innovation in the country. Foreign investors may be attracted by a pool of educated workers, which could stimulate direct investment. The negative change in education compared to the previous period may indicate different scenarios. For example, it could be the result of a decline in the level of education among the working population or a mismatch between workers' skills and the requirements of the labor market, with negative consequences for Foreign Direct Investment (FDI). However, changes in education relative to earlier periods are not statistically significant in explaining FDI. This may indicate that the effects of education on FDI are more relevant in the short term, or that there are other economic, political, or institutional factors that have a greater influence on foreign investment decisions. On the other hand, government expenditure has a positive impact on FDI, i.e., an increase of 1 unit in the logarithm of government expenditure is associated with an increase of 0.85 units in FDI. This relationship is statistically significant. This can be explained by a number of factors: the infrastructure that can be used to develop the necessary facilities, such as roads, ports, airports, telecommunications, and so on. These high-quality, well-maintained infrastructures can attract foreign direct investment, as they facilitate business activities and reduce logistical costs; economic incentives can use public spending to implement economic incentive policies, such as subsidies, tax breaks, or trade advantages, which encourage FDI; stability and confidence in key sectors such as education, health, security, and justice can contribute to a country's social and economic stability; and regional development can be used to promote regional economic growth and reduce economic disparities. This can encourage FDI into less developed regions, providing economic opportunities and promoting a more equitable distribution of economic activities. For the performance indicators, they are generally similar to model (1) and show high and statistically significant values. In model (3), we can clearly see that a 1% increase in growth in gross domestic product per capita (GDPpc) leads to a 0.69% decrease in ICT. This can be explained by the fact that when the economy grows, companies invest less in information and communication technologies, as they may prefer to use their resources for other purposes and that generally, from a statistical point of view, the relationship between GDPpc and ICT is significant. Similarly, for the (FDI) variable, the results are significant but have negative coefficients, suggesting that ICT does not affect FDI. Alternatively, foreign companies investing in other sectors of the economy may neglect investment in ICT, for the population variable (POP), the relationship is significant and negative, in other words, faster population growth may require additional investment in areas such as infrastructure and social services, to the detriment of ICT investment. In contrast, the relationship between ICT and inflation is positive and highly significant. This suggests that inflation may have a slightly positive effect on ICT investment. Consequently, an increase in inflation may be associated with an increase in investment in this sector. On the other hand, government spending has a significant negative impact on ICT. This indicates that when the government allocates more resources to other priority sectors, the funds available for investment in ICT decrease. On the other hand, the results indicate that past public spending has had a significant positive impact on ICT investment in the short term. This suggests that an increase in public spending in this area may stimulate investment in the short term. Finally, for the education variable, the results are significant at the 5% level, indicating a statistically significant correlation between education and ICT. In other words, investment in education can encourage the adoption and use of ICT. A more educated and skilled workforce can use technology more efficiently and productively, which can stimulate the development of ICT. In sum, model (3) presents very significant performance indicators, as do the first two models, highlighting the important relationships between ICT, inflation, government spending, and education. These findings underline the extent to which these factors play an essential role in the progression and advancement of information and communication technologies.

Table 7: Long-term estimates

Variable	Coefficients (probabilities)		
	Model (1)	**Model (2)**	**Model (3)**
LnGDPpc	----	0.951571 (0.0609) *	-0.671587 (0.0304) **
LnFDI	0.841244 (0.0425) **	----	1.263971 (0.0077) ***
LnICT	-0.668644 (0.0221) **	0.316387 (0.1263)	----
LnPOP	0.678401 (0.0025) **	-0.937000 (0.0255) **	0.506292 (0.0097) ***
LnCPI	-0.235629 (0.0034) ***	0.122990 (0.0732) *	-0.328843 (0.0014) ***
LnGFCE	-2.704187 (0.0096) ***	-0.404697 (0.2889)	-4.656239 (0.0017) ***
LnEDUC	0.631088 (0.0335) **	-0.948641 (0.1438)	0.041842 (0.7347)
Constant	7.751200 (0.0101) **	1.359627 (0.2428)	13.40993 (0.0017) ***

Note: ***, **, * indicate significance levels at 1%, 5% and 10% respectively.
Source: Calculations of the Author

Table 7 presents the results of long-term estimates for three different economic models (Model 1, Model 2, and Model 3). The coefficients of the model's control variables are provided, along with their associated probabilities. In Model 1, the coefficients of the variables LnFDI, LnICT, LnPOP, LnCPI, LnGFCE, and LnEDUC are statistically significant, with probabilities below 1% and 5%. In fact, foreign direct investment, population, and education level have positive effects on GDP per capita in the long term, while information and communication technology, inflation, and government spending have negative effects on GDP per capita. In Model 2, the coefficients of the variables LnGDPpc, LnPOP, and LnCPI are statistically significant, with probabilities lower than 5% and 10%. The coefficients of the variables (ICT, GFCE, and EDUC) are not significant. Thus, we can clearly see that, in the long term, high economic growth, low inflation, and economic stability have positive coefficients on FDI. On the other hand, population growth has a negative coefficient in the long term. In Model 3, the coefficients of the LnGDPpc, LnFDI, LnPOP, LnCPI, and LnGFCE variables are statistically significant, with probabilities of less than 1% and 5%, respectively. Information and communication technology are positively affected by the presence of FDI and population growth. On the other hand, GDP per capita, inflation, and government expenditure show negative coefficients; in other words, the long-term relationship is deemed to be negative. Therefore, model (3) shows that the education system does not have a significant impact on ICT.
In order to validate our previously estimated models, several diagnostic tests were performed to validate and confirm the optimal models. Table 6 shows the results of

the diagnostic tests. We observe that for all three models, there is no autocorrelation of errors and no heteroskedasticity. The errors are normally distributed, and the models are correctly specified.

Table 8: Diagnostic tests for the estimated ARDL models

Tests	Model (1)	Model (2)	Model (3)
Autocorrelation of errors: Breusch-Godfrey LM	2.68 (0.21)	3.13 (0.18)	3.46 (0.16)
Heteroskedasticity: Breusch-Pagan-Godfrey	1.23 (0.42)	0.55 (0.88)	0.49 (1.13)
Heteroskedasticity: Arch-test	1.97 (0.11)	0.02 (0.88)	2.02 (0.13)
Normality of residues: Jarque-Bera	0.34 (0.84)	1.97 (0.37)	2.84 (0.24)
Ramsey Reset	3.35 (0.17)	7.27 (0.12)	0.84 (0.44)

Note: () indicates the probability associated with each test.
Source: The Author

The Toda-Yamamoto method (1995) is used to analyze short- and long-term causal relationships, according to Granger's concept. This method helps to determine the nature of the links between the dependent variables and the explanatory variables included in the three models. The results of the Granger tests carried out using the Toda-Yamamoto method and presented in Table 8 below reveal unidirectional causality between the variables. More specifically, we observe that economic growth is strongly influenced by inflation, which in turn has a significant impact on foreign direct investment (FDI). Additionally, FDI is influenced by economic growth, information and communication technology (ICT) with a threshold of 1%, and the level of inflation with a threshold of 5%. Government spending and the level of education also exert a relatively weak influence on FDI, with a threshold of 10%. As far as ICT is concerned; there is little unidirectional causality with economic growth. In the case of education, there is strong causality with population growth, which is itself influenced by FDI. Thus, economic growth has a weak effect on education, with a threshold of 10%. On the other hand, inflation is influenced by education, with a threshold of 5%.
In summary, the results of the study suggest that economic growth significantly influences foreign direct investment (FDI) in the short and long term (strong causality). Economic growth is also responsible, albeit insignificantly at 10%, for the development of information and communication technology (ICT), while ICT has no causal effect on economic growth. Moreover, there is a strong unidirectional causality from ICT to FDI, with a threshold of 1%, while FDI is not the cause of ICT.

Table 9: Results of Toda-Yamamoto Granger causality

Dependent variables	Causal variables (probability)						
	LnGDPpc	LnFDI	LnICT	LnGFCE	LnEDUC	LnCPI	LnPOP
LnGDPpc	-	1.26 (0.7376)	4.77 (0.1894)	3.14 (0.3694)	2.90 (0.4057)	13.82 (0.0031)***	3.72 (0.2930)
LnFDI	20.87 (0.0001)***	-	17.24 (0.0006)***	7.77 (0.0508)*	7.53 (0.0566)*	9.40 (0.0244)**	4.16 (0.2440)
LnICT	6.76 (0.0799)*	1.59 (0.6601)	-	4.69 (0.1953)	3.88 (0.2736)	5.27 (0.1529)	1.41 (0.7011)
LnGFCE	1.07 (0.7820)	2.17 (0.5360)	1.84 (0.6053)	-	0.79 (0.8495)	2.46 (0.4817)	1.57 (0.6648)
LnEDUC	6.36 (0.0938)*	5.62 (0.1313)	1.13 (0.7675)	1.71 (0.6341)	-	2.66 (0.4462)	14.53 (0.0023)***
LnCPI	5.91 (0.1161)	1.05 (0.7881)	0.47 (0.9244)	1.10 (0.7756)	9.86 (0.0198)**	-	0.87 (0.8310)
LnPOP	5.29 (0.1514)	9.81 (0.0202)**	0.64 (0.8863)	5.14 (0.1614)	3.58 (0.3101)	2.36 (0.5004)	-

Note: ***, **,* indicate significance at 1%, 5% and 10% respectively.
Source: The Author

The figure below illustrates the causal relationship between the variables

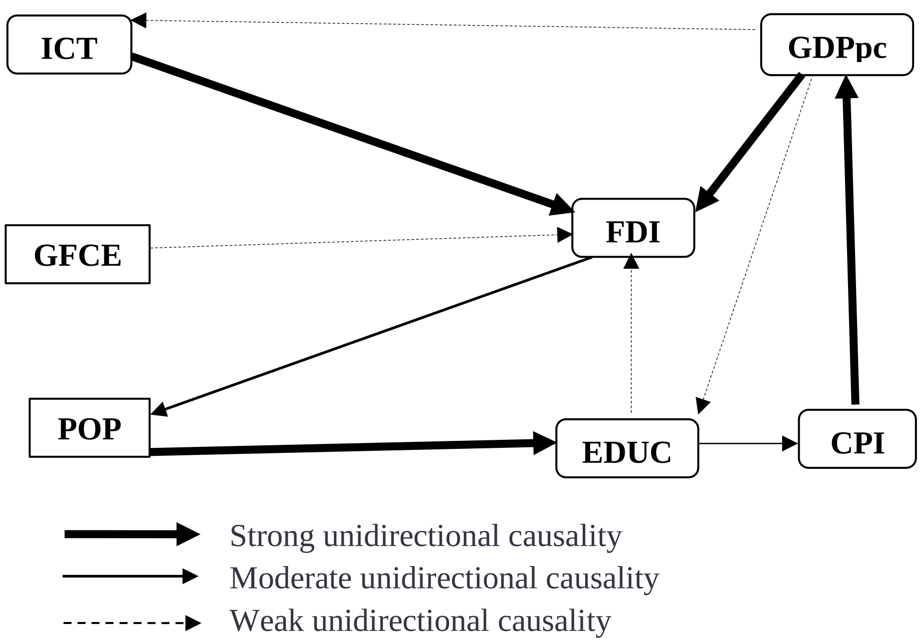

Figure 1: Causality between the variables

Source: The Author

It is clear that the causal relationship between information and communication technology (ICT) and economic growth is strong and unidirectional, with economic growth influencing the level of ICT development. On the other hand, the causality between foreign direct investment (FDI) and ICT vis-à-vis economic growth is indirect and depends on factors such as population growth, the level of education, and the inflation rate.

5. Conclusion

Over the last few decades, Foreign Direct Investment (FDI) and advances in Information and Communication Technology (ICT) have become crucial to global economic growth. Our research aims to answer this central question: What mechanism underlies the impact of FDI on economic growth in Morocco?

Our theoretical contribution is based on the literature that establishes a link between Foreign Direct Investment (FDI), economic growth, and Information and Communication Technology (ICT) intermediation. As a methodological contribution, we have opted for epistemological positioning and a hypothetico-deductive approach. To study our conceptual model, we used the ARDL model and Toda-Yamamoto causality. Our empirical contribution is based on the Moroccan economy over the period 1990–2021. We specified three models: the first model with economic growth as the dependent variable, the second model with FDI as the dependent variable, and the third model with ICT as the dependent variable. The results of our study reveal that, in the short term, there is a significant and positive relationship between FDI and economic growth. This means that Foreign Direct Investment has a positive impact on economic growth in Morocco. It is recommended that policies to attract foreign investment continue to be promoted, focusing on key sectors and creating a business-friendly environment. As regards the relationship between ICT and economic growth, the study shows a complex relationship. In the short term, Information and Communication Technologies (ICT) tend to have a negative effect on economic growth, probably due to substitution effects, disintermediation, and inequalities in technological access. However, in the long term, ICT can have a positive impact by stimulating innovation and business efficiency. It is therefore advisable to encourage the adoption and use of ICT while carefully monitoring the potential effects on employment and inequality.

The results also highlight the importance of other variables such as population, inflation, public spending, and education for economic growth. Controlled population growth, moderate inflation, efficient public spending, and investment in education can promote long-term economic growth. Policies that support these key growth factors are recommended. With regard to causality analysis in the Granger sense by Toda and Yamamoto (1995), the study identified causalities between the variables studied. The results indicate significant unidirectional causalities between certain variables. For example, inflation has a strong causal effect on economic growth, which in turn influences foreign direct investment. In addition, economic growth is also linked to information and communication technology, while education is influenced by population growth, partly caused by foreign direct investment. Thus, we deduce that economic growth is strongly influenced by FDI, suggesting that foreign investment has a positive impact on a country's economic development. At the same time, economic growth is also linked to ICT, although this relationship is less strong. In other words, an increase in FDI promotes economic growth, while the increased presence and use of ICT can also help stimulate economic growth, albeit to a lesser extent. This relationship highlights the importance of foreign investment and ICT adoption as potential drivers of economic growth.

This study suggests that FDI attraction policies should be maintained by offering incentives and improving the business climate. To encourage the adoption of ICT despite the negative short-term impact, investment in technological infrastructure, improving Internet access, and building skills are essential to having a developed infrastructure, and consequently, foreign flows will increase, leading to high economic growth. It is also important to manage controlled demographic growth by ensuring that the supply of employment is in line with the active population. Maintaining moderate inflation and economic stability is essential to foster long-term growth, which requires prudent monetary and fiscal policy as well as structural reforms. Investing in education to develop a skilled workforce and foster innovation is another key recommendation. Strengthening the education system by focusing on technical and vocational skills in line with labour market needs is essential.

As for the limitations of this study, our analysis is limited in scope and focuses only on the case of Morocco, so the study period is not very extensive due to the availability of data. As a research perspective, to go beyond the geographical limits, we plan to conduct a study on the relationship between FDI, ICT, and economic growth, or, in other words, the role that ICT plays as a modulator between FDI and growth in other countries in the MENA region, which will be addressed in a future article.

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