

Full length research paper

# Knowledge economy, governance and FDI: Case of Tunisia

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**This paper seeks to detect and analyze the interaction of FDI attractiveness factors and the role of ICT, specifically telecommunications, as a factor in the increase of FDI flows. In this paper we are interested in the contribution of the theory of the knowledge economy and the theory of New Institutional Economics. It focuses on the detection of factors affecting attractiveness of FDI and the mechanisms through which ICT will attract more foreign investors. The method used is a method to estimate ordinary least square (OLS), for the period 1990-2010. Our regression model is established on Tunisia. Our investigation found that the component of institutional quality that attracts FDI is the control of corruption in Tunisia. We observe that institutional quality affects FDI positively, through human capital for the case of Tunisia.**

**Keywords:** FDI, performance of telecommunication, quality institutional, human capita.

## INTRODUCTION

Institutional economics and new comparative economics ( Djankov and Shleifer , 2003) were one of the most vibrant political economy systems over the last decade. This field, which examines the relationship between political governance and economic performance, has set up " issues of governance " (Kaufmann et al.,1999b), or "the rule of institutions" (Rodrik et al., 2004) . Initiatives such as the strategy to fight against corruption (World Bank, 1997), " Convention on the fight against corruption" (OECD, 1999) and " against the treaty corruption" ( UN, 2003) , show that governance issues are key to policy makers .

Empirical academic research has been stimulated by the availability of measures of institutional quality. Previous studies have found the impact of governance on total income, measured either by the growth of per capita income (Mauro, 1998) or by the level of income (Knack, 2003) and is the level per capita income.

Research is now focused on the establishment of channels through which institutions affect income. Indeed, in works such as Mauro (1995) and Knack (2003), the total investment was analyzed as a channel through which institutional quality affect economic growth. Other studies have focused on the quantity and quality of public investment.

However, the case of foreign direct investment is more interesting for the crucial role of FDI (Foreign Direct investment) in stimulating economic growth. Institutional conditions and local policies have always been considered by foreign companies requiring care and the existence of rating agencies on political risk.

Despite the reforms established investment codes, which aim to make them more consistent with the expectations of foreign investors on the improvement of the business climate, FDI towards the Mediterranean countries remains poor. Improving the business climate must be accompanied by a good quality workmanship, confirmed by the quality of education and improvement of education system of the Maghreb countries and macro-institutional environment (Adiil and Fatima, 2002) . This paper seeks to detect and analyze the interaction of FDI attractiveness factors and the role of ICT, specifically telecommunications, as a factor in the increase of FDI flows. In this paper we are interested in the contribution of the theory of the knowledge economy and the theory of New Institutional Economics.

In our study, we will examine the relevance of such expectations for the MENA region. We will identify and analyze the interaction of FDI attractiveness factors and the role of ICT (Information and Communication

Technology), specifically the Telecommunications as a key factor in the increase of FDI flows.

The first section deals with the relationship between ICT, Knowledge Economy, institutional quality and FDI, discussing the contribution of the knowledge economy and the contribution of institutional economics.

In the second section, the econometric study will be established for Tunisia. With a step by step estimate, our work falls under the greater weight of institutional quality and economy of knowledge in attracting FDI to the Tunisian economy.

### **ICT, Knowledge Economy, institutional quality and FDI: Theoretical overview**

Among developing countries, some countries such as China, Indonesia, Egypt and Colombia have succeeded in attracting FDI. According to the World Bank (2011), China, Indonesia and Egypt have received more than \$ 100 billion, which was nearly 31 % of total FDI paid to developing countries in 2010. While some developing countries, such as Bolivia and Yemen face the problem of a negative FDI flows. However, these first countries recorded strong growth in terms of information and communications that go along with major FDI Technologies. For the MENA region, there has been a significant increase in FDI inflows relative to GDP (Figure 1), a take-off since 1990, from 0 to 45% of GDP to about 5% in 2006. However, since that time, we noticed deterioration in FDI flows to 2.8 in 2010, largely explained by deterioration in the business environment. So, the issues are inevitable, of why FDI flows are directed only to some countries? What are the determinants of the latter? And to what extent the performance of telecommunications affect FDI?

In this part of the work, on the one hand, we try to understand the advancement of literature to the impact of ICT and the Knowledge Economy on FDI; on the other hand, the rule of institutional quality on FDI.

### **ICT, Knowledge Economy and FDI**

ICT is central to the development of knowledge-based economies, as they provide economic agents a new range and unprecedented "instrument of knowledge" (Dominique, 2009). These first is a set of tools facilitating knowledge generation, creative interactions between product designers, suppliers and customers. Several studies have examined the impact of ICT on productivity and economic growth (CNUCED, 2008) and could have worked on the impact of ICT on FDI. However, the current area, with the failure of the business environment, the limited reform of investment codes, the poor institutional quality, and an obvious concern that arises is to attract more FDI.

The knowledge economy is characterized by an increase in the proportion of highly skilled workers as measured by the employment of university graduates relative to total employment (Dominique, 2009). According to the hypothesis of technological bias, ICT generates a growing demand for highly skilled labor at the expense of unskilled labor. This request is based primarily on the skills, knowledge and appropriate training induced by strengthening the education system and research (Clévenot and David 2008). Human capital is important for economic development as it brings positive externalities (Lucas, 1988) that explain the financial efforts of States in favor of education in the world (Mankiw, 2000).

A paper prepared by the CNUCED (2011) argued the benefits of ICT , " a dynamic and diversified private sector, well functioning and socially responsible is a valuable accelerator investment , trade , employment and innovation, and thereby contribute to economic growth and poverty reduction and an engine of industrialization and structural transformation. The private sector is one of the keys to sustainable economic growth , inclusive and equitable and sustainable development in the least developed countries " (Rapport, 2011).

In addition, a work established by Psacharopoulos (1994) analyzes the nuances to the new theory, has shown that the impact of education varies according to the level of development in poor countries. It is counterproductive to invest in secondary and higher education.

In addition, there are two analyses of human capita, micro and macro approaches. The first approach is apprehended by the impact on the individual and the company. In fact, human capita gives a privileged role to foster innovation and facilitate the use and dissemination of new technologies, especially informations and communications. In the human capita theory, education is seen as an investment, which an individual makes to be a productive capita. The theoretical background on the returns to education is "Mincer equation» (Mincer, 1974), linking wages to three groups of variables: variables describing the initial training, the variables describing the experience , and a third heterogeneous group.

In a macroeconomic approach, the education - related economic growth is at the heart of the analysis. Economic efforts to train individuals have a positive impact on the economy. The model of Romer ( 1990) based on the approach of Nelson and Phelps (1966) highlighted the role of technology in education. Education not only improves labor productivity, but it improves the ability to adopt new technologies and creating new ideas. In this approach, human capita is considered as the stock of knowledge available to the individual, being used either in imitation of existing ideas or in search of news. Some models from the theories of endogenous growth no longer see education as a factor of production, but as a

driver of innovation. They show that "the accumulation of physical capita and the increase of labor could only explain a small part of the growth" (Gurgand, 2005). The human capita approach is to consider education as an investment creating benefits to individuals, businesses and society.

Other models emphasizes that education increases productivity less than the capacity of individuals to adapt to changes in the economic environment. This approach moves to a more "dynamic" view of the role of education in economic growth, which had been advocated with a standard way by Nelson and Phelps (1966). The level of education affects the long-term growth through its effects on the rate of adaptation to technological change (Aghion, 2009).

In developing countries, lack of education, skills remains a major impediments to economic growth and the low stock of human capital affects economic growth. The accumulation of human capita in poor countries promotes the attractiveness of foreign direct investment (FDI) and accelerates the process of catching up.

In addition, we are called to focus on additional changes to the information technology and communications to attract foreign investors. This complementarity can be approximated or indexed by the institutional quality of a country.

### Institutional Quality and FDI

The first theoretical analysis of the multi-nationalization of the firm, like the theory of internalization, began late 50s focusing on the structures of imperfect competition and oligopoly. A new, more relevant current explaining FDI is manifested in the 70s by the OLI paradigm (Dunning, 1993). This phenomenon explains the current implementation of MNCs in developed and developments economies and advance the firm, having a specific advantage like a technological advantage and know-how, decided to invest in an attractive country to exploit this advantage and internalize its production costs. Axaroglou (2005) noted that the determinants of attractiveness are labor productivity. The per capita expenditure devoted to higher education and social stability. Governance is a term carrier sense multiple and evolving. We distinguish between "corporate governance", which is oriented to the governance of a company, global governance, national governance and finally local governance. The World Bank (1992) defines "governance as the way power is exercised in the management of economic and social resources of a country, the good governance for the World Bank is a healthy development management." However, Kaufmann et al. (1999) advanced a limitations in this definition, that doesn't take into account the nature of political regimes. The definition they propose is the following "Governance is the traditions and institutions by which

authority in a country is exercised for the common good. This includes the process by which governments are selected, monitored and replaced, the government's ability to formulate and implement sound policies and the respect of citizens and state institutions that govern economic and social interactions". This definition covers several aspects, namely: The democratic political institutions, political instability and violence, government effectiveness, the weight of regulations and finally the fight against corruption.

The concept of good governance emerged in the early nineties in the work of the World Bank (2003), the applicant submits that "A good governance is one that meets two dimensions of development that is well-be tangible and intangible" (World Bank, 2004).

The World Bank provides a database named World Wide Governance Indicators Research, also known by the names of its authors Kauffman et al. (2006) are the following (Arndt and Oman, 2006):

**Control of corruption (CC):** This indicator measures the use of the prerogatives of power for personal gain, particularly the enrichment of individuals with a position of power.

**The effectiveness of public action (GE):** This is a measure of the competence of the state bureaucracy and the quality of public services.

**Political stability (PS):** This indicator measures the probability of violent changes of regime or government, as well as serious threats to public order, including terrorism.

**The quality of legal procedures (RL):** This indicator measures the quality of respect for legal contracts by the judicial system, taking into account the use of private violence and its repression.

**The regulatory quality (RQ):** This indicator measures the regulatory barriers to functioning markets.

**The claim- capacity and expression (VA):** "Voice and Accountability": This indicator measures the political and individual rights enjoyed by citizens.

These indicators are called composite or aggregate because they are developed from the results of surveys and expert rating on corruption and other aspects of governance. These indicators are more extensive than those established by other economists. They can be grouped into three sets: the first related to the political, the second related to economic governance and the third related to corporate governance. Established by the Kaufman et al. (2006), since 1996 indicators can be classified into three types of governance. Political governance is measured by two indicators namely voice

and accountability and political stability. Economic governance is measured by two indicators of regulatory quality, as measured by regulatory obstacles to the functioning of markets and government efficiency, as measured by the competence of the bureaucracy and the quality of public services.

Finally, corporate governance is measured by two indicators namely, respect for rules and laws and the control of corruption. Most synthesis of the empirical literature (Lim, 2001; Benassy et al., 2005) emphasize the importance of political stability for investors.

### Econometric Analysis for Tunisia

We add to the original specification advocated by Sekkat and Varoudakis (2000) a set of performance indicators telecommunications as explanatory variables and indicators of the quality of the macro-institutional environment. The estimation is performed on Tunisia and Morocco, to make a comparison of appropriate policies.

The series of GDP per capital GDP, inflation, government expenditure per student enrollment in higher education are taken from World Development Indicators in the world. The observation period is from 1990 to 2010. The indicators telecommunications are from the International Telecommunication Union (2010), and human capital indicators are from Ministry of Technology and Higher Education for Tunisia and Morocco teaching.

An estimation method will be used to MCO estimate equation (A).

$$\ln(FDI)_{it} = I_0 + I_1 \ln(GDP)_{it} + I_2 GDPGR_{it} + I_3 R_{cpi}_{it} + I_4 LFEM_{it} + I_5 NAM_{it} + I_7 INTER_{it} + I_8 GE_{it} + I_9 PS_{it} + I_{10} Crpt_{it} + I_{11} RL_{it} + I_{12} RQ_{it} + I_{13} VA_{it} + I_{14} DP_{it} + I_{15} SUP_{it} \quad (A)$$

With: FDI = Inflows of FDI; GDP<sub>i</sub> = Gross Domestic Product; GDPGR<sub>i</sub> = annual growth rate of GDP per capital; LFEM = main lines per employee (number of main lines / total employment); NAM = Number of mobile subscribers / Jobs Mobile; INTER = Number of internet users per 100 inhabitants; R<sub>cp</sub> = The inflation rate in the host country; GE = The effectiveness of public action; PS = political stability; CC = Control of Corruption; RL = quality of legal procedures; RQ = regulatory quality; VA = The immediate demands capacity and expression "Voice and Accountability"; Second = enrollment in higher education (% of total); DP = expenditure per student in higher education

However, this equation may suffer the problem of simultaneity bias. This is probably because the performance of telecommunications attracts FDI, but FDI flows also affect the performance of telecommunications. Same work established for institutional quality. She is able to attract FDI, and they also affect institutional

quality. Thus, we also consider an estimate of the causal between FDI and these two components.

From the JB test performed on Eviews, it was noted that the majority of variables follow a normal distribution, which allows the estimation by OLS. The first step in this work is to establish the time series properties of the variables used in the analysis, it is to test the non-stationarity of the variables and their order of integration using the Dickey Fuller test increased. We used the test of Dicky-Fuller augmented, that allows detected the statistic "t" of explanatory variable, the differential of order 1 passed of variable which must be compared in critical variable (Mc Kinnon Value)

If «t» is most little, we can 'not reject the no-stationary assumption. For all our variables, the t of student is superior at 2 on level or difference. All our variables are stationary with one order.

Our variables offer a greater dispersion of variability (Table 1). Certainly, spending per student provides an average of 8.578 and a variability of 3 (standard deviation), the variable rate of enrollment in higher education has an average of 2.08 and a variability of 0.956. Variables reflecting the performance of telecommunications, citing the main lines per employee, number of mobile subscribers and number of internet users have an average and variability. The second and third had an average of 15 and a high variability of 2.9 and 2.7.

For variables representing institutional quality, there has been a better result, the effectiveness of public action, has an average of 1.19 and a low variability of 0.15. The variable has a different political stability variability averaged 1.16 and 0.08 low variability. While control of corruption has a low average of 0.76 and a low variability of 0.28. The same goes for the quality of regulation. However, the variables of the macro institutional environment have a strong divergence of variability. Immediate demands and capacities of expression has an average of 0.97 and a low variability of 0.25.

The variable rate of economic growth that reflects the dynamism of the country has an average of 3.357746 and a high variability of 1.74. The inflation rate has an average of 4 and variability of 1.58.

Based on the results found in table 2, the effectiveness of public action has an impact on the number of mobile subscribers. Certainly, the efficiency of public services has a significant effect on the number of mobile subscribers. It was noted that the number of mobile subscribers is on the quality of regulation. Indeed, a large number of users of mobile telephony including private or national or international investors require good regulation in their favor. Certainly, the emergence of number of subscribers in the mobile caused the reform of the telecommunications market in Tunisia. The implementation of the Telecommunications Code of 2001 was facilitated by the publication of various texts

Table 1. Descriptive statistics

	C1	C2	S2	S3	T1	T2	T3	X1	X2	X3	X4	X5	X6
Mean	8.598020	11.04173	2.431107	3.066570	20.52384	21.17378	2.058126	0.088405	0.427695	0.034326	0.210174	9.814599	1.688448
Median	8.199880	10.79821	3.638344	2.753113	12.40000	10.13845	1.160793	0.011570	0.057674	0.158336	0.179445	5.161107	1.741569
Maximum	11.08538	13.21557	10.57687	7.986166	49.00000	62.50605	5.700000	0.503467	0.788418	0.538291	0.051417	9.64508	1.305445
Minimum	7.586655	9.159090	7.998930	0.619802	9.000000	4.739429	0.002223	0.260801	1.987424	0.401103	0.428957	450338.0	1.960072
Std. Dev.	1.008033	1.090571	4.616468	2.248681	16.97509	21.44367	2.333236	0.280451	0.906048	0.303081	0.117916	2.456708	0.227792
Skewness	0.198648	0.416431	0.550214	0.720662	0.622061	0.632693	0.605544	0.236037	0.340579	0.422407	0.436779	2.862378	0.403987
Kurtosis	2.686906	2.802308	2.891094	2.292364	1.819043	2.016486	1.655812	1.433945	1.689385	1.737043	2.078636	9.737032	1.740573
Jarque-Bera	0.223887	0.641149	1.069950	2.255892	2.574689	2.247437	2.864378	2.340960	1.908976	2.020176	1.410514	68.39039	1.772524
Probability	0.894095	0.725732	0.585684	0.323697	0.276003	0.325069	0.238786	0.310218	0.385009	0.364187	0.493982	0.000000	0.412194
Sum	1860.558	231.8763	51.05324	64.39797	4211.000	4446.494	432.2066	1.856515	8.981592	0.720847	4.413660	2.066809	32.08052
Sum Sq. Dev.	2032.262	23.78690	426.2355	101.1313	576307.2	919661.7	10887.98	1.573057	16.41847	1.837157	0.278083	1.209918	0.934004
Observations	21	21	21	21	21	21	21	21	21	21	21	21	21

Table 2. Test of causality

Null Hypothesis:	Obs	F-Statistic	Probability
T2 does not Granger Cause Y	17	4.22781	0.03952
Y does not Granger Cause T2		2.15719	0.16476
Y does not Granger Cause T3	17	0.58174	0.68474
T3 does not Granger Cause Y		9.70585	0.00368
Y does not Granger Cause X3	15	52.1138	0.01895
X3 does not Granger Cause Y		0.18068	0.04657
Y does not Granger Cause X4	15	31.9713	0.03064
X4 does not Granger Cause Y		0.38261	0.84737
<u>causality between institutionel quality and TIC</u>			
X1 does not Granger Cause T2	19	7.20598	0.00705
T2 does not Granger Cause X1		0.73146	0.49872
X5 does not Granger Cause T2	19	1.54918	0.24673
T2 does not Granger Cause X5		6.54328	0.00985

Table 2. Cont.

<u>causality between performance of télécommunications and humain capita</u>			
T3 does not Granger Cause C1	19	0.47608	0.63091
C1 does not Granger Cause T3		4.28582	0.03531
T2 does not Granger Cause C2	19	2.40009	0.12699
C2 does not Granger Cause T2		8.00247	0.00481
T3 does not Granger Cause C2	19	4.36377	0.03365
C2 does not Granger Cause T3		6.92307	0.00812

applications in a spirit of reform; the Code was amended in 2008.

Technical and regulatory framework was also enacted in 2008 to modernize and diversify the services of telephony through Voice over IP (Decree No. 2008-2638 establishing the conditions of service provision telephony over Internet Protocol). Other decrees detailing the implementation of the 2008 Act were enacted in the same year. By analyzing the causal link between the performance of telecommunications and human capital, it was noted that, in Tunisia, the investment effort in higher education has a positive impact on the number of internet users per 100 inhabitants.

Certainly, the Internet offers tremendous potential for Tunisian enterprises by facilitating access to information, facilitating relationships between customers and suppliers and improving dialogue with the government.

Therefore, in order to achieve these objectives, whether national or foreign private company, will need internet connection at an affordable price and the knowledge and skills to operate. The growth of Internet use in countries marked development is explained by the increase in devices that offer the ability to connect to the internet.

With our results of causality, we also detected that the rate of enrollment in higher education has an impact on the number of mobile subscribers (a lower probability of 5 %). Indeed, the spread of mobile telephony continues to transform the ICT landscape and have important implications for private sector development. However, the ICT landscape is expanding the range of mobile applications; text messaging to financial transactions requires skills and high qualification to increase services for the development of foreign and domestic private sector. Appendix 1 presents the regression models estimated to explain the determinants of FDI in the case of Tunisia. To identify the determinants of FDI and see the weight of each component.

$$\ln(FDI) = 0.36 \ln(GDP) - 0.18GDPG - (0.16) \quad (-1.66)$$

$$0.23Rcp - 0.003LFEM + 0.008NAM + (1.15) \quad (-0.38) \quad (1.8) \\ 0.007INTER + 4.28GE + 2.73PS+ (0.13) \quad (1.49) \quad (1.37) \\ 1.53Crpt - 6.95RL - 3.49RQ - 1.77VA (2.04) \quad (-2.36) \quad (-1.84) \quad (-1.32) \\ - 0.06DP - 0.42SUP (-1.92) \quad (-2.13)$$

The estimated model 1 (including three variables of economic activities only see appendix 1 model 1) indicates that only the GDP is significant, a 10% increase in GDP leads to an increase of 9.01% of FDI. Thus, in Tunisia, the inflation rate does not attract FDI. Adding variables that identifies the ICT namely the number of mainlines / total employment, number of subscribers to mobile / mobile job and the number of Internet user per 100 inhabitants, we estimate the model 2 (see appendix 1) . However, Tunisia foreign investors are indifferent of information and telecommunication technologies, and FDI located in Tunisia are not able to develop ICT.

This result is explained by the find made the performance of telecommunications is limited in Tunisia in terms of quality, price and productivity and not having a significant weight on FDI. It can also be explained by the made that much of them in manufacturing low value added. While Tunisia has initiated efforts reforms only in 2001, it was noted that Tunisia has a small market does not have a significant effect on the attractiveness of FDI (lim, 2001). The objective of our work is to see the interaction between the two components (ICT and institutional quality ) simultaneously and their impact on FDI , so a model 3 is established to meet this goal. The estimated model shows that institutional quality advocated by the political, economic and corporate governance, accompanied by the telecommunications services is not statistically significant. Indeed, taking into consideration only those variables, it is concluded that the effectiveness of public policy, political stability, quality of Procedure Law, the voice of expressions and control of corruption has no impact on attractiveness of FDI. Also

an interaction between institutional quality and performance of telecommunications has no significant impact on FDI. These results demonstrate the poor institutional quality in Tunisia, and suggests the introduction of other variables in the knowledge economy other than ICT can generate a robust model and attract FDI. In estimating the model 4, including public expenditure per student enrollment in higher education, there is a dramatic improvement of the model ( $R^2 = 0.88$ ). However, unlike in Morocco, several variables explain the attractiveness of FDI, like inflation, the control of corruption, the quality of law and procedure quality regulations, spending on higher education and rate enrollments. By adding these two variables, institutional quality is significant and positive for the control of corruption and significant and negative for the quality of regulations and procedures of law. A 10% increase in inflation leads to an increase of 3.4 IDE. Indeed, a weak currency can have negative consequences on the economy of a country, explained by the inflation risk out of a depreciation of the currency risk that directly affects the consumer. Indeed, a weak currency attracts investors and external demand to swell, which can lead to inflation, but also play on domestic demand, a weak currency will raise prices. However, weak currency inflation may be inducing growth factor. Indeed, it attracts investors and direct investment (FDI), which can afford to sell more goods and services to a company or to innovate and thus increase its profit and why not lower its prices.

A control corruption induced by a 10% increase in procedures and inspections in the field of FDI increased 14.5%, a very significant impact on the attractiveness. On corporate governance, it is also detected by the quality procedures law. An increase of 10% of the latter indicator generates a negative cash flow of 70% of FDI. Moreover, this latter contradicts some theoretical contributions, but calls other work. Moreover, thanks to the 4th model sets, we detected that the investment effort and the rate of enrollment in higher education have a direct and indirect effect on the attractiveness of FDI. The first effect is detected by the made a 10% increase in spending in the higher education leads to a decrease of 0.7% of FDI. This is not consistent with the economic literature suggests that a good qualification is an attractive factor for FDI, the results can be explained either by the IDE made that require mainly of unskilled labor to the detriment the skilled, is made by that work for unproductive public investments that result in inefficiency of public institutions and slowing the accumulation of human capital, defective institutions indirectly hinder the attractiveness of foreign investment.

## CONCLUSION

From work, it was noted that the size of the institutional quality attractive for FDI economic governance in Tunisia

detected by the control of corruption. The estimated model shows that institutional quality advocated by the political, economic and corporate governance, accompanied by the telecommunications services is not statistically significant. Indeed, taking into consideration only those variables, it is concluded that the effectiveness of public policy, political stability, quality of Procedure Law, the voice of expressions and control of corruption has no impact on attractiveness of FDI. Also an interaction between institutional quality and performance of telecommunications has no significant impact on FDI. These results demonstrate the poor institutional quality in Tunisia, and suggest the introduction of other variables in the knowledge economy other than ICT can generate a robust model and attract FDI.

Default data availability, we took into account in our work the rate of enrollment in higher education, the most ideal is to consider the number of qualified employees. However, for Tunisia, it was noted that the effectiveness of public action has an impact on the number of mobile subscribers. Certainly, the efficiency of public services has a significant effect on the number of mobile subscribers. This result was found as advocated by the economic literature advancing a causal link between ICT and the skills of the workforce. Certainly, the assumption of technological bias, ICT generates a growing demand for highly skilled labor at the expense of unskilled labor. This request is based primarily on the skills, knowledge and appropriate training induced by strengthening the education system and the research (Clévenot and David 2008).

It was noted that the number of mobile subscribers is on the quality of regulation. Indeed, a large number of users of mobile telephony including private or national or international investors require good regulation in their favor. Certainly, the emergence of number of subscribers in the mobile caused the reform of the telecommunications market in Tunisia. The implementation of the Telecommunications Code of 2001 was facilitated by the publication of various texts applications in a spirit of reform, the Code was amended in 2008.

Technical and regulatory framework was also enacted in 2008 to modernize and diversify the services of telephony through Voice over IP (Decree No. 2008-2638 establishing the conditions of service provision telephony over Internet Protocol). Other decrees detailing the implementation of the 2008 Act were enacted in the same year.

In this paper we detected that the performance of telecommunications limited in terms of quality, price and productivity not having a significant weight on FDI. Our estimation found an insignificant and positive effect of the number of Internet users on the attractiveness of FDI, a fact justified by the poor efforts made for the development of telecommunications technologies that allowed Tunisian

companies to develop and operate a telecommunications sector in poor evolution compared to other Arab countries like Morocco and Egypt.

Regarding the second pillar of the Knowledge Economy, The effort of investment in human capital has affected FDI in the case of Tunisia, directly and indirectly acting on institutional quality. We find that institutional quality positively affects FDI through human capital.

However, in our work we are interested only in the performance of Telecommunications as a factor of ICT, however, in further work could include all the determinants of ICT and the knowledge economy, namely the number of patents deployed, the expenditure in research and development. However the lack of missing data, we did not include these variables in our work.

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**Appendix 1: Estimation OLS step by step****Modèle 1.**

Dependent Variable: LOG(Y)

Method: Least Squares

Date: 10/07/12 Time: 15:18

Sample: 1990 2010

Included observations: 21

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(S1)	3.266897	1.043130	3.131820	0.0061
S2	0.054544	0.078288	0.696707	0.4954
S3	0.524985	0.189661	2.768020	0.0132
C	-77.68274	25.86420	-3.003485	0.0080
R-squared	0.428854	Mean dependent var		4.142775
Adjusted R-squared	0.328064	S.D. dependent var		1.893352
S.E. of regression	1.552013	Akaike info criterion		3.886626
Sum squared resid	40.94866	Schwarz criterion		4.085583
Log likelihood	-36.80957	F-statistic		4.254909
Durbin-Watson stat	1.243728	Prob(F-statistic)		0.020510

**Modèle 2 :**

Dependent Variable: LOG(Y)

Method: Least Squares

Date: 10/07/12 Time: 15:21

Sample: 1990 2010

Included observations: 21

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(S1)	-4.227378	4.343714	-0.973217	0.3470
S2	0.069596	0.063453	1.096812	0.2912
S3	0.416069	0.168387	2.470902	0.0269
T1	-0.012029	0.022166	-0.542698	0.5959
T2	0.010014	0.007093	1.411741	0.1799
T3	0.130510	0.097415	2.339732	0.2017
C	103.9312	104.3342	0.996137	0.3361
R-squared	0.693332	Mean dependent var		4.142775
Adjusted R-squared	0.561903	S.D. dependent var		1.893352
S.E. of regression	1.253188	Akaike info criterion		3.550460
Sum squared resid	21.98673	Schwarz criterion		3.898634
Log likelihood	-30.27983	F-statistic		5.275338
Durbin-Watson stat	1.870605	Prob(F-statistic)		0.004926

**Modele 3 :**

Dependent Variable: LOG(Y)

Method: Least Squares

Date: 10/07/12 Time: 15:22

Sample (adjusted): 1990 2008

Included observations: 19 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(S1)	0.704948	7.249072	0.097247	0.9257
S2	0.030793	0.070368	0.437597	0.6770
S3	0.479722	0.405516	1.182993	0.2816
T1	-0.047514	0.030901	-1.537620	0.1751
T2	0.026842	0.013013	2.062740	0.0847
T3	0.216301	0.140419	1.540397	0.1744
X1	-3.329945	10.20213	-0.326397	0.7552
X2	-1.471805	1.727403	-0.852033	0.4269
X3	-3.938844	3.265266	-1.206286	0.2731
X4	5.449350	6.804367	0.800861	0.4537
X5	7.566470	5.162139	2.465762	0.1931
X6	5.171353	3.376993	1.531348	0.1766
C	2.101769	174.4719	0.012046	0.9908
R-squared	0.870250	Mean dependent var		4.012679
Adjusted R-squared	0.610750	S.D. dependent var		1.948206
S.E. of regression	1.215483	Akaike info criterion		3.443902
Sum squared resid	8.864398	Schwarz criterion		4.090097
Log likelihood	-19.71707	F-statistic		3.353567
Durbin-Watson stat	2.506216	Prob(F-statistic)		0.073898

**Modèle 4.**

Dependent Variable: LOG(Y)

Method: Least Squares

Date: 10/07/12 Time: 15:25

Sample (adjusted): 1990 2008

Included observations: 19 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(S1)	-6.159851	12.62790	-0.487797	0.6512
S2	0.079554	0.102204	0.778382	0.4798
S3	0.300526	0.536460	0.560203	0.6052
T1	-0.055032	0.036520	-1.506914	0.2063
T2	0.033006	0.019988	1.651267	0.1740
T3	0.399973	0.309749	1.291282	0.2662
X1	-18.87975	23.62846	-0.799026	0.4690
X2	-4.278909	4.122190	-1.038018	0.3579

X3	4.533070	11.66474	0.388613	0.7174
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**Model 4. Cont**

X4	8.497188	8.748396	0.971285	0.3864
X5	10.00797	7.506639	1.333216	0.2533
X6	7.719153	5.052008	1.527938	0.2012
C1	-0.025958	0.115254	-0.225226	0.8328
C2	-2.041288	2.773009	-0.736127	0.5025
C	199.8025	342.1543	0.583954	0.5906
R-squared	0.887526	Mean dependent var		4.012679
Adjusted R-squared	0.493868	S.D. dependent var		1.948206
S.E. of regression	1.386012	Akaike info criterion		3.511540
Sum squared resid	7.684113	Schwarz criterion		4.257150
Log likelihood	-18.35963	F-statistic		2.254558
Durbin-Watson stat	2.662199	Prob(F-statistic)		0.224700

Dependent Variable: LOG(Y)

Method: Least Squares

Date: 10/09/12 Time: 23:03

Sample: 1990 2010

Included observations: 21

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(S1)	0.901369	0.337691	2.669214	0.0162
S2	-0.077125	0.067971	-1.134687	0.2723
S3	-0.015274	0.086138	-0.177314	0.8614
C	-15.70991	8.230533	-1.908736	0.0733
R-squared	0.385976	Mean dependent var		5.501553
Adjusted R-squared	0.277619	S.D. dependent var		0.621188
S.E. of regression	0.527966	Akaike info criterion		1.730075
Sum squared resid	4.738722	Schwarz criterion		1.929031
Log likelihood	-14.16578	F-statistic		3.562069
Durbin-Watson stat	1.729482	Prob(F-statistic)		0.036412