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ICT INVESTMENT AND ECONOMIC GROWTH IN KSA AND BAHRAIN

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Abstract

Investment in ICT is an important source of Economic Growth. However, countries do not benefit in the same way from these technologies and a digital divide arises between countries and regions. The purpose of this paper is to study by descriptive and econometric analysis the contribution of ICTs to economic growth in Saudi Arabia and Bahrain. We use panel data over 1981-2016 period. Our descriptive analysis shows that Saudi Arabia and Bahrain have made significant investments to benefit from ICT and are well ranked in the region and the world in the areas of these technologies. Our econometric analysis shows that ICTs have a positive and significant impact on economic growth in these two countries.

Keywords: ICT, Productivity, Economic Growth, KSA, Bahrain, Digital Divide, Panel Data

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INTRODUCTION

Since the 1990s, ICTs have brought about major economic and social changes and occupy an important place at the national and international level. These technologies concern all sectors of the economy and have transformed all areas. The importance of ICT effects on economic growth and productivity are comparable to those generated by the major technological waves of industrial revolutions. Then, the search of ICT-led growth has become a priority goal in all countries. Indeed, several studies (Adel Ben Yousef and Mhanni H. (2004) Colecchia and Schreyer (2001), Jorgenson and Stiroh (2000), OECD (2003), etc. have shown that ICTs increase the productivity and efficiency and lead to sustainable and faster economic growth. The major challenge for each country is to integrate into the global information society where economic growth seems to be driven by the knowledge accumulation. ICTs are an important factor in the transfer of knowledge and contribute directly and indirectly to the process of the economic growth. ICT investments in all sectors contribute to capital intensification and increased labor productivity. In fact, in a global economy characterized by strong technological change, access to ICT is likely to improve factor productivities, create new jobs, change, strengthen and boost the comparative advantage of each country.

One of the main reasons for interest in ICTs is certainly their effect on economic growth. Indeed, ICTs are considered among the most important factors that affect the process of economic growth especially because they influence the economy, governance, education, health etc. ICTs trigger the need for a developed information and communication infrastructure. Thus, we can say that there is a causal relationship between ICT and economic growth. We are interested in this study only in the effects of ICT on economic growth.

Thus, purpose of this paper is to study theoretically and empirically the effects of ICTs on economic growth in Saudi Arabia and Bahrain by using panel data over 1981-2016 period.

This paper is organized as follows: in the first section we try through a theoretical analysis to highlight the relationship between ICT and economic growth: we explain the main mechanisms by which ICTs affect the process of economic growth. In the second section, we are interested in the experiences of KSA and Bahrain in terms of ICT. In the third section, we test the relationship between ICT and economic growth through an empirical model. The last section is devoted to the conclusion and the necessary recommendations.

EFFECTS OF ICT ON ECONOMIC GROWTH: A LITERATURE REVIEW

According to the theoretical literature, there are several reasons that explain the importance of ICT in economic growth. Indeed, investment in ICT increases the capital stock available to workers and therefore contributes to improving labor productivity. Also, the ICT sector plays an

important role because it is characterized by rapid technological progress and very high demand. In addition, the use of ICT can increase overall efficiency by combining labor and capital and hence multifactor productivity. The use of ICT can also accentuate network effects, such as reducing transaction costs and accelerating innovation, and thus improving TFP.

Economists distinguish several channels for transmitting the positive effects of ICTs on economic growth. Among these channels we can indicate:

- Massive investment in ICT is an important component of overall investment and generates a growth effect through the Keynesian multiplier. In a study on the effects of ICTs on the Tunisian economy, Ben Youssef Adel and Hatem Mhenni (2004) proved the existence of a multiplier effect of investment in ICT. According to these authors, the ICT multiplier is larger than the non-ICT investment multiplier. In 2008, the OECD estimated the multiplier effects of ICT in order to study their contribution to the total GDP and economic growth over 2001 -2006 period. The results of this study show that, on average, ICTs accounted for 2.1 percentage points of the annual growth in total output of the countries observed.

- ICTs are characterized by a decline in their prices. This leads to lower production costs and increased profit and investment in all sectors. Indeed, technological progress and the intensification of competition have led to lower prices for ICT goods and services. This has involved the substitution of other forms of capital and labor by computer equipment (Jorgenson, 2001). Given these effects, ICT positively influence productivity and economic growth. In addition, at the macroeconomic level, lower ICT prices reduce overall inflation, improve purchasing power, and increase effective demand, which favors economic growth through an indirect Keynesian multiplier effect.

- The use of ICT makes the production process more intensive in ICT capital as a result of substitution effects (David (2001), Jorgensen (2001)). This substitution in favor of ICT capital is explained by the improvement of their quality, their productive performance and the continuous decrease of their prices in relation to other investment goods and labor. In these conditions, the growth process favors the accumulation of capital. For example, according to Gordon (2001) two-thirds of the USA productivity acceleration during 1996-2001 is due to the substitution effects. Also, according to Jorgenson and Stiroh (2000), technical progress and the substitution effect that it induces are the main factors explaining the acceleration of output growth in several countries in recent years.

- ICTs are also characterized by significant changes in variety and quality levels. This creates a production and distribution process that is richer in knowledge and information. ICTs that are becoming more efficient, developed and effective contribute to high quality goods. The

permanent improvement of ICT quality implies dynamic gains and thereby promotes economic growth.

ICTs are a source of positive externalities because they allow to benefit from network externalities (Cohen. D and Debonneil M (2000)). Thus, ICTs enable more collective and interactive production of knowledge and skills. The exchange and sharing of different information generates positive externalities for all actors. These externalities lead to economies of scale and improve overall factor productivity (TFP) and thus promote the process of economic growth.

At the national level, the massive use of ICTs brings about a structural change in the production process as production relies more on the high-tech sectors than on traditional sectors or natural resources. This structural change improves productivity and growth because ICT-based sectors have greater added value.

At the international level, the use of ICTs allows some countries to gain market share and benefit more from productivity gains than other countries. In addition, the use of ICT makes it possible to expand product varieties and better respond to the evolution of aggregate demand. The consequence is that ICTs are a source of dynamic comparative advantages and gaps between countries and regions because the contribution of ICTs to economic growth is generally positive, but at different rates between countries and regions (Pohjola M (1998, 2000, 2002), etc.,). Countries with low ICT capacity and unable to overcome their gaps in ICT, risk to be excluded from integration to the world information society due to lack of skills and infrastructures. These gaps can be explained by differences between countries in terms of size, international specialization, initial factor endowments, the regulatory environment, adequate qualifications (human capital), the cost of access to ICT, other investments complementary to ICT, etc. It is not enough to have ICTs to achieve significant economic growth. As a result, countries with equivalent levels of ICT diffusion will not necessarily achieve the same economic performance.

Several empirical studies have shown the importance of several socio-economic factors and local absorption capacity to access and benefit from ICTs. Indeed, by using panel data covering 17 African countries, Osman Birba and Abdoulaye Diagne (2012) show that, the human capital, urbanization and the spread of Internet infrastructures play an important role in the adoption of ICTs technology. The positive effect of human capital is also confirmed by Thierry Penard et al (2012) who show that high level of education and computer skills play an important role in ICT adoption. Figuera C. (1999) studied the key factors of uneven internet diffusion by using data relative to 29 OECD countries during 1990-1997 period. The results of Figuera show that the income, the human capital, the telecommunications infrastructures, are

main determiners of ICTs diffusion. Dewan S., Ganley D. and Kraemer K. L. (2005) treated the uneven ICTs diffusion by using panel data for a sample of 40 countries during 1985-2001 period. This study shows that the access to ICTs is positively correlated to the GDP per head, the human capital and with the opening. In addition, according to this study the costs of telecommunications and urban population size inhibit ICTs diffusion. Hargittai E. (1999) used 18 OECD countries to explain the differences in Internet connections during 1994 - 1996 period. The author showed that the existence of monopoly in the telecommunications sector reduces Internet diffusion. It would be then necessary to encourage competition between all operators of Internet services to generalize this technology in the various geographical zones.

Andrès L. and al (2010) chow by using panel data of 199 countries during 1990 – 2004 period that competition between suppliers of Internet plays an important role in the ICT diffusion between countries.

Regarding the effects of ICTs on economic growth, we can say that several empirical studies have been interested in this relationship, especially in developed countries and mainly in the USA and some OECD countries. The results of these studies vary according to the estimation techniques used, the sample, the estimation period and the data used. These studies allow us to highlight two important points. First, the problems of measuring ICTs because ICT sector data are unreliable and not fully available over long periods. Second, the sources of productivity gains are not the same for developing and developed countries. The effects of ICT on economic growth seem less important in developing countries than in developed ones. In developing countries, productivity gains come mainly from the ICT sector, rather than the use of ICT. The opposite has been observed for developed countries (UNCTAD, (2007)).

Most empirical work at the macroeconomic level has generally shown a positive relationship between ICT investment and GDP growth. Harchaoui and Tarkhani (2004) compared the contribution of ICT to labor productivity in Canada and in the USA. These authors show that the rise in USA labor productivity is attributable to ICTs, but in Canada, ICTs were only one factor among others. Harchaoui and Tarkhani explain this result by the fact that the ICT-producing industries have a higher weight in GDP in the USA than in Canada, In addition, investments in ICT-using industries are higher in the USA than in Canada. Tang et al. (2004) who tested the effects of ICTs on economic growth and employment in Canada in the second half of the 1990s, showed that ICTs led to rapid growth in output, employment and productivity.

Daveri (2000) and Colecchia and Schreyer (2001) have estimated in two different studies the effects of ICTs on economic growth in OECD countries during the 1990s. Both studies concluded that ICTs have an important contribution to economic growth in OECD

countries. According to the study of Colecchia and Schreyer, the contribution of ICT varies in these countries between 20 and 50%.

Schreyer (2000) estimated the effects of ICT on the economies of the G7 countries during 1980-1996 period. The author has shown that ICT has a positive contribution in all countries, but this contribution is higher in the USA than in other countries. According to Jorgenson and Stiroh (2000), the improvement in labor productivity and TFP in the USA can be explained by ICT. Indeed, the authors showed that labor productivity and TFP reached levels during the 1990s, which have not been reached since 1960.

Christine Zhen-Wei Qiang and al (2009) estimated the effects of ICTs on economic growth using a sample of 120 countries over 1980-2006 period. The results of this study show that the impacts for developing countries were slightly higher than those for developed countries. This result is also confirmed by the ITU report of 2005 on the effects of ICTs on GDP growth in the different regions. This report showed that during the period 1989-2003, the G7 countries benefited the most from ICTs. In developing countries, ICT has a relatively lower impact. Vuong (2008) studied the impacts of ICTs on economic growth for a set of developing countries. He showed that ICT has positive effects only in the long run and with the markets liberalization. In the short term, the impacts of ICTs on economic growth are absent for certain countries.

To conclude, we can say that countries do not benefit in the same way from ICTs due to several socioeconomic factors. The income, the educational level, the high costs, etc., are variables which explain the differences in the contribution of ICTs to economic growth.

ICT INVESTMENT IN KSA AND BAHRAIN

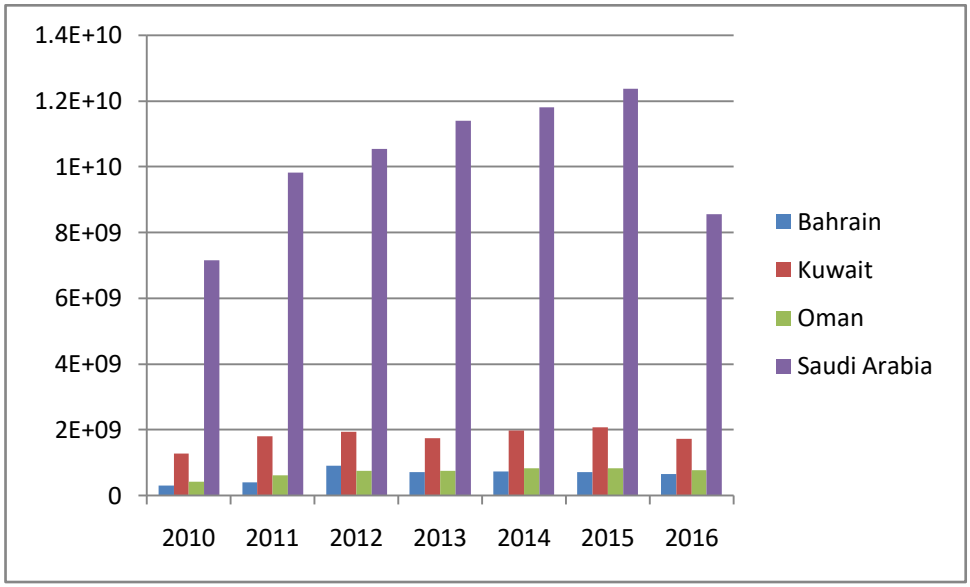
Saudi Arabia and Bahrain recognize that investment in ICTs is an important factor for economic growth. For this reason, the two countries have adopted several policies to encourage investment in communication and information technologies and to develop digital infrastructure by using advanced technologies, especially high-speed broadband technologies. These policies have enabled Saudi Arabia and Bahrain to make significant advances in the use of communication technologies in various fields such as e-government services, e-learning, e-commerce, health, etc.

In its development strategy, Saudi Arabia has given a major importance to ICTs in the public and private sectors and in civil society. Saudi Arabia has embarked on a major ICT investment program to achieve widespread adoption of ICT in its households and businesses and to be a "knowledge economy" and a regional technological powerhouse in the Middle East. ICT investments in Saudi Arabia have registered a rapid growth trajectory and Saudi Arabia has

become the largest ICT investor and the largest ICT market in Middle East. Indeed, the telecommunications and information technology industries in Saudi Arabia account for more than 55% and 51% respectively of the total Middle East market. These important investments in the ICT sector are due to the Kingdom's significant financial capabilities such as the Public Investment Fund, which makes it able to invest and make good use of communication and information technologies. In the last few years, Saudi Arabia has taken several measures to develop and modernize the IT infrastructure such as e-government, the liberalization of the telecommunications sector to create competition in the ICT sector and the strong commitment to e-commerce and e-governance initiatives (including protection of intellectual property).

In order to measure and understand the importance of the telecommunication sector in each country, economists use three indicators: spending on the ICT sector, telecommunications and ICT investments, and the total value added of the ICT sector. For the KSA, these three indicators indicate a vital and important role of the telecommunications sector and its place in the policies and strategies of the Kingdom compared too many other countries. According to the CITC, the kingdom's ICT spending in 2014 was 111.98 billion riyals and was larger than the rest of the CCG countries in the same sector. According to the same report, the value of investments in the ICT sector amounted to 17.83 billion riyals in the same year. Concerning the value added of the telecommunications sector, the data indicate that its contribution was in the range of 26.57 billion riyals in 2014. According to statistics, ICT spending in Saudi Arabia has increased by 6% in 2017, reaching more than 36 billion $ USA and 40 billion $ USA in 2018.

Figure 1: Imports of ICT goods (2010-2016)



Saudi Arabia's ICT sector plays an important role in the Kingdom's economy. According to the Commission for Information and Communication Technologies, this sector accounts for 6% of GDP and 10% of non-oil GDP in 2016. Spending in this sector exceeded 130 billion riyals (34.7 billion $) in 2016 and was in the order of 138 billion riyals (36.8 billion $) in 2017. Revenues from telecommunication services also amounted about 70 billion riyals (18.66 billion$) in 2017.

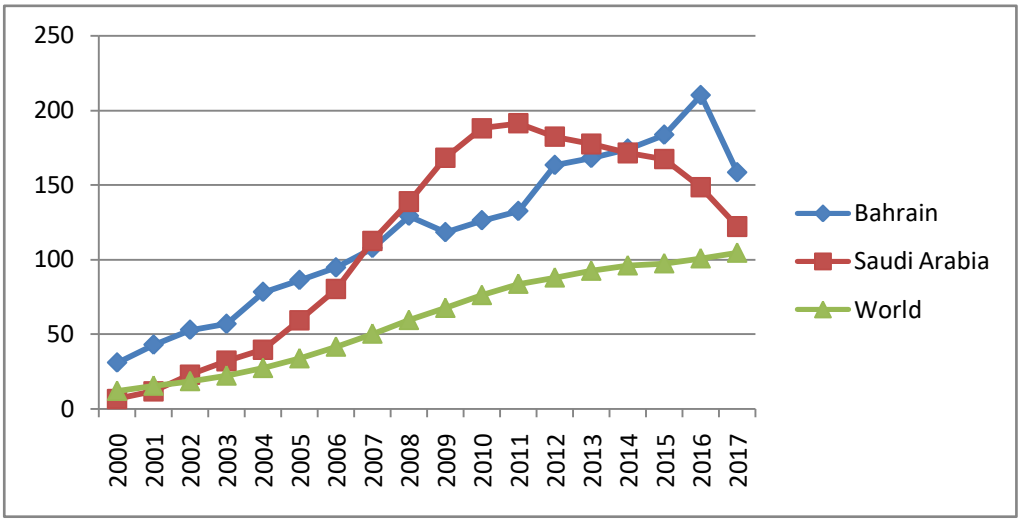
In the future, ICTs will be an important catalyst for the 2030 vision of KSA to develop the country's digital infrastructure Vision 2030 aims to invest in major international companies and emerging technology companies in all countries of the world. This vision aims to achieve the creation of one million jobs in the telecommunications sector in the coming years. Vision 2030 aims also to provide quick government services in all ministries and other departments, reduce delays in implementing these services, simplify administrative procedures, diversify channels of communication, expand in electronic services and improve their quality to cover all fields such as health and education. ICT will also play a central role in achieving the goals of the 2020 National Transformation program. Indeed, this program identifies several digital platforms and initiatives for key sectors of the Saudi economy.

For the case of Bahrain, we can say that recognized as an engine of growth, economic diversification and social cohesion, the ICT sector in Bahrain has played an important role in economic development while serving as a catalyst for other public and private sectors. Indeed, Bahrain has a well-developed telecommunications sector in the Middle East region and has invested heavily in the ICT sector. Bahrain has adopted several strategies to develop the ICT sector such as the e-government strategy and a cybersecurity strategy. Bahrain has also encouraged FDI in this sector. According to the Bahrain Information and Online Administration (IGA), the ICT sector accounts for 7.1% of total GDP in the fourth quarter of 2017. In 2016, telecommunications sector revenues reached 430 million BD (1.1 billion USD) and represent almost 4% of GDP. According to the report of Department of Social and Economic Affairs of Bahrain of 2018, Bahrain ranks fourth out of 193 in the World Telecommunication Infrastructure Index. Similarly, according to the ITU (2017), Bahrain is ranked 31 out of 176 countries (and first among the Arab country) in the ICT Development Index. The telecommunications sector in Bahrain is supervised daily by the Telecommunications Regulatory Authority (TRA) and several measures are being taken in the telecommunications sector to make it more competitive.

Referring to some ICT indicators published each year by the ITU, data show that mobile-cellular telephone subscriptions per 100 inhabitants in KSA and Bahrain recorded an impressive increase during the period 2000-2017 and has exceeded 100% in both countries since 2007. In Bahrain for example, there were 2.36 million mobile subscriptions in 2017.This growth of cellular mobile telephony is the result of several factors such as the introduction of the competition in

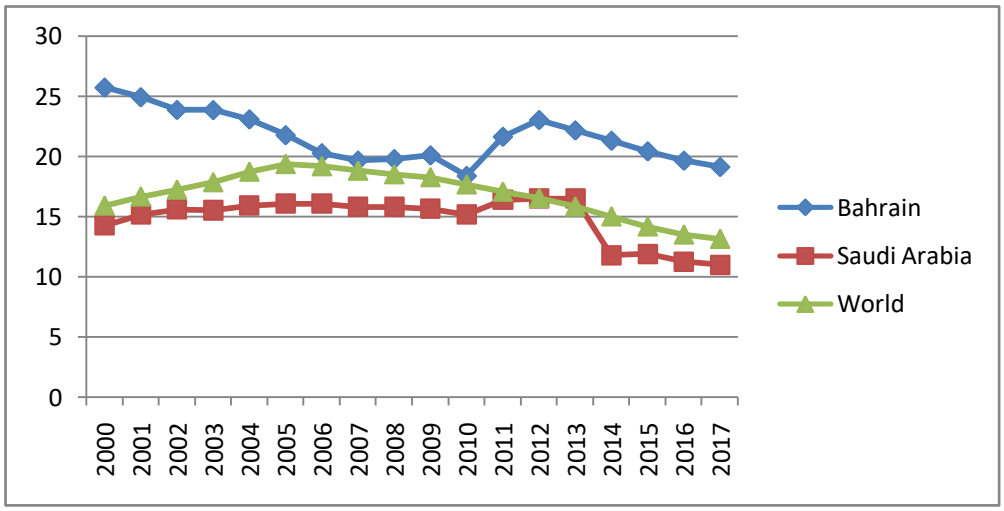
the mobile communications market and the strong reduction of prices, the innovations of product and marketing (in particular the prepaid card), etc. These factors facilitated the access to ICTs in particular for the rural zones. The data also show that the evolution of mobile-cellular telephone subscriptions per 100 inhabitants is higher than the average in the world (figure 2). This reflects the efforts made by these two countries to benefit from ICTs and especially to reduce the digital divide with the advanced countries.

Figure 2: Mobile-cellular suscriptions per 100 inhabitants, 2000-2017



Source: World Development Indicators (2018)

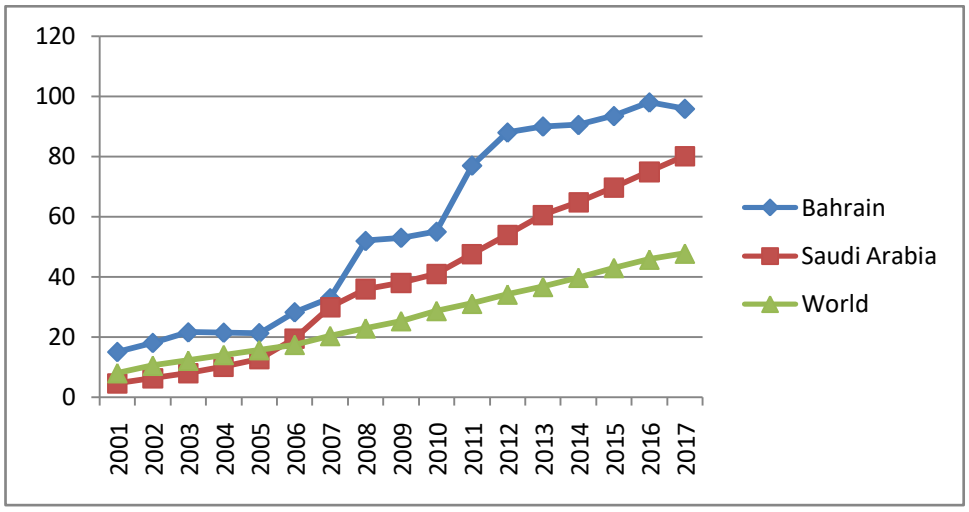
Figure 3: Fixed-telephone subscriptions per 100 inhabitants, 2000-2017



Source: Source: World Development Indicators (2018)

According to the ITU data (2018), Individuals using the Internet per 100 inhabitants in KSA and Bahrain exceeds 40 % at the end of 2010, while in the World, this number is less than 30 % (Figure 4). According to the ITU (2017), 95.88% of residents of Bahrain and 81% of residents of Saudi Arabia used the Internet. This places these two countries in advanced ranks in the world ranking.

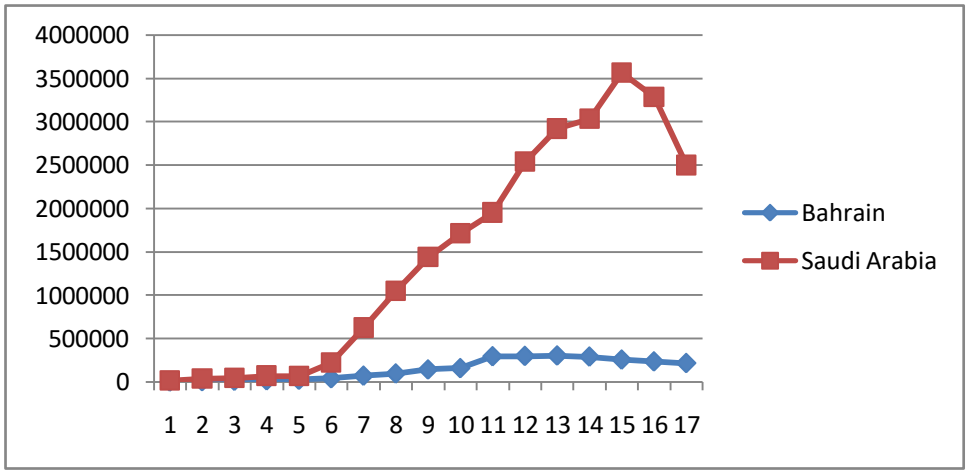
Figure 4: Individuals using the Internet per 100 inhabitants, 2001-2017



Source: Source: World Development Indicators (2018)

The number of fixed broadband subscriptions is important in both countries. Indeed, this number has increased 181 times in Bahrain and 177 times in KSA during the period 2001-2017.

Figure 5: Fixed broadband subscriptions 2001-2017



Source: World Development Indicators (2018)

From this analysis, we can conclude that concerning all ICTs indicators KSA and Bahrain register a higher rate of penetration compared with the world level.

EFFECT OF ICT ON ECONOMIC GROWTH IN KSA AND BAHRAIN: EMPIRICAL ANALYSIS

In this section, we empirically estimate the effect of ICT on economic growth in KSA and Bahrain by using panel data over 2000-2016 period then we draw the necessary recommendations in terms of economic policies. The choice of this period is explained by the availability of data. The choice of panel data is necessary in this study to take into account the variation over time and the variation between the two countries.

METHODOLOGY

Empirical model and data

We use the following empirical model

$$GDPC_{it} = f\left(KICT_{it}, FDI_{it}, Open_{it}\right) \quad (1)$$

Where:

- $GDPC$ is the GDP per capita, PPP (constant 2011 international $) which used as an indicator of economic growth. Data are from the World Development Indicators (2018).
- FDI is the stock of FDI flows in KSA and Bahrain. Data are from UNCTAD (2017).
- The index t and i refer to the year t and country i

$Open$ is a measure of the openness approximated by the share of imports in GDP. We use openness as an explanatory variable because it is an important channel for access to ICTs, in particular for countries that do not produce these technologies due to their production costs.

- $KICT$ is the stock of ICT capital. The stock of ICT capital data for both countries is not available. For this purpose, this stock was calculated by the permanent inventory method. According to this method, the stock of ICT capital ($KICT_t$) of each year t is equal to the sum of the capital stock ICT of the year t-1, corrected by a depreciation rate (δ) plus the investment on ICT of the year t (I_t).

$$KICT_t = I_t + (1-\delta)KICT_{t-1} \quad (2)$$

Where (I_t) is approximated by ICT imports in years t and δ is the rate of Capital ICT depreciation. Referring to some empirical work that has adopted this method, we have retained the value 33% for δ. This rate implies an average life of 3 years of ICT capital. The initial ICT

capital stock (the beginning of the period) is the ratio of the initial investment I_0 to the sum of the average annual growth rate g of the investment (I_t) during the estimation period and the depreciation rate δ.

$$K_0 = \frac{I_0}{(g+\delta)} \quad (3)$$

The logarithmic form of the previous equation is:

$$\log GDPC_{it} = c + \alpha_1 \log KTIC_{it} + \alpha_2 \log FDI_{it} + \alpha_3 \log Open_{it} + \varepsilon_{it} \quad (4)$$

ε is the error term.

RESULTS

We use Hausman test to choose between fixed effects and random effects. According to this test, random effects hypothesis is accepted. Estimation Results appears in the following table.

Table 1 : Hausman Test Results

Dependent variable: $\log GDPC$				
Explanatory variables	Coefficient	Std. Error	t-Statistic	Prob
C	9.250527	0.1899221	48.71	0.000
logKICT	0.047703	0.0163972	2.91	0.004
logFDI	0.0371973	0.0062337	5.97	0.000
Lopen	0.0016565	0.0020793	0.80	0.426
R2=, 0.5480 N =34				
Hausman test: chi2(3)= 2.68 Prob>chi2 = 0.4434				

This table shows that all explanatory variables are with expected effect on economic growth. Indeed, KICT and FDI, contribute positively to the economic growth. Their coefficients are positive and significant. The coefficient of openness is positive but no significant.

The positive contribution of ICTs to economic growth confirms the importance of these technologies and justifies the efforts, investments and reforms made by Saudi Arabia and Bahrain to benefit from ICT.

FDI contributes to economic growth, which leads us to conclude that FDI-attracting countries benefit more from ICTs. The effect of FDI is explained by certain mechanisms that generate positive externalities. First, FDI creates a competitive environment that forces

domestic firms to adopt ICTs to protect their competitiveness and their share in the local market. Then, local firms can benefit from an imitation effect or learning-by-watching effect by examining FDI production methods (technologies, organizations, management, etc.) Also, cooperation and upstream and downstream relations between local and foreign companies can strengthen communication networks and adoption of ICTs. FDI has highly skilled workers who can be a source of positive externalities by moving towards domestic firms. This positive effect of FDI shows the importance of adopting economic policies (tax systems, administrative procedures, infrastructure, etc.) to attract more FDI.

Our results are consistent with those of several empirical studies that we have already presented in the previous section and which show a positive contribution of ICTs to economic growth.

CONCLUSION

The empirical literature has, since the 1990s, identified a large number of studies on the effects of ICTs on economic growth. This work shows that ICT has greater effects in advanced countries than in developing countries. In this paper we empirically studied the relationship between ICT and economic growth using panel data for Saudi Arabia and Bahrain during the period 2000-2016. The main results and any consequent recommendations are as follows: ICTs have a positive effect on the economic growth of these two countries. We can therefore say that it is essential for them to invest in ICT. In addition, the positive and significant effect of FDI reveals the strengthening of cooperation procedures between domestic and foreign firms.

In reality, the effects of ICTs depend heavily on certain other economic factors such as human capital, openness, FDI, public infrastructure, and so on. The catalytic role of these different factors in the relationship between ICT and economic growth may be the subject of future research. The literature shows that countries that are more open to the rest of the world benefit more from ICTs. Thus, it is essential to adopt extroverted strategies and abandon all forms of protection to better benefit from ICTs.

Human capital is an important factor in taking advantage of ICTs. Thus, it is essential to make significant investments in terms of qualification of workers who are directly confronted with the use of ICT. At this level, the creation of training and scientific, technical and technological information centres is crucial. Also, the education system should focus on strengthening existing ICT skills. This is also true for all factors that can increase local absorptive capacity such as public infrastructure and the institutional environment.

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