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IMPACT OF THE DIGITAL DIVIDE ON ECONOMIC GROWTH IN MENA COUNTRIES EVIDENCE FROM PANEL ARDL MODELS 2000-2018

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ABSTRACT: The study of the relationship between ICT and economic growth is important as it provides crucial information for policy decisions. In this study, we seek to determine whether there is a digital divide between 15 MENA countries and to investigate its impact in the short and long-run on economic growth using Panel ARDL models. The panel data take the period of 2000-2018. The PMG and DFE estimations are applied in this analysis, the Hausman Test is conducted to decide between them; as result, PMG estimator is more efficient. We found that there exists a big digital divide among MENA countries. Furthermore, The PMG estimator results indicate the existence of a strong relationship between economic growth and ICT indicators in MENA countries, in the long-run, while the relationship in the short-run is insignificant.

Keywords : Digital divide; Economic growth ;MENA region; Panel ARDL

JEL Classification: R58 ; O33 ; C33

1. INTRODUCTION:

The last three decades have seen a revolution of Information and Communication Technologies (ICT), its utilization has been proliferating greatly. The development in hardware and software have resulted in new application areas of ICT. ICT can be used in most sectors and whose benefits may extend everywhere, including business transactions and communications, daily routines and lifestyles, politics, and the e-economy, e-government, e-health, e-learning, e-commerce, e-banking, e-finance. Furthermore, ICT are increasingly determining the ability of individuals, firms, and countries to remain competitive and to do things in a more effective and efficient way. Thus, ICT have been recognized as a major contributor in social and economic development (OECD, 2004). Therefore, the inequalities detected in their diffusion may have serious implications for

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economic growth, human development, and the creation of wealth (ITU, 2006). For this reason, the so-called digital divide has become a major issue on both international and national forums (ITU & UNCTAD, 2007).

Both American and European recovery plans have considered ICT as part of their strategic actions, while in developing countries as the MENA region, such initiatives from the political level is rare to find. (Fontenay & Beltran, 2008) argued that such societies have not been able to take advantage of the ICT resources they could muster, hence have fallen short of their growth potential; therefore, it is necessary to examine the status of digital divide among MENA countries and uncover the impact of digital divide on the economic growth. Although several authors have focused on understanding and measuring the digital divide all around the world. Considering the importance that the policy makers gives to a homogeneous digital development, the first step to take toward this development is to assess the current situation within the MENA countries. The current research helps to do this and sheds light on the issue in order that efficient policies may be deployed. We therefore intend to provide an updated analysis of digital asymmetries within 15 MENA country. We therefore seek to answer the following research question; whether there is a digital divide between MENA countries; and if such divide exists, what is its impact on the economic growth?

Our study has two goals. The first is to uncovering digital divide among MENA countries. The second is to identify the long-run association between ICT variables and economic growth as well as their short term impact.

The literature is rich in studies in which the main findings, especially those offering empirical evidence, show how close the link is between disparities in ICT diffusion and economic development. (Carloss, 2004) studied the effects of ICT in the economy, comparing the potential of these technologies to the so-called general-purpose technologies (GPTs) which in the past revolutionized the economy, such as the transportation and communications technologies in the 19th century, the Corliss steam engine, and the electric motor. He concluded that ICT appears to have an even greater impact on the economy since Bit affects the service industries (e.g., health care, government, and financial services) even more profoundly than the goods-producing industries, and these service sectors represent over 75% of GDP. (Jalava & Pohjola, 2008) showed that the contribution of ICT to Finland's GDP between 1990 and 2004 was three times greater than the contribution of electricity between 1920 to 1938. Hence, some authors consider digital divide to be a new expression of the traditional technological dualism between rich and poor countries (Billon, Ezcurra, & Lera-Lopez, 2008). (Zhao , Collier, & Deng, 2014) report that, surprisingly GDP per capita was not a significant predictor of the digital divide in their investigation, whereas most studies present the opposite conclusion (Dewan & Riggins, 2005). (Cruz-Jesus, Oliveira , & Bacao, 2012) has argued that digital divide exists among European countries as well.

The remainder of the paper is organized as follows: In Section 2 we describe the digital divide, its types and its measurements; in Section 3 we present the methods and materials; Section 4 assesses the results and discussion; while Section 5 presents the conclusion.

2. THE DIGITAL DIVIDE:

2.1. Definition and types of the digital divide :

According to the (OECD, 2001) ‘‘the term digital divide refers to the gap between individuals, households, businesses and geographic areas at different socio-economic levels with regard both to their opportunities to access information and communication technologies and to their use of the Internet for a wide variety of activities’’.

From the above definitions, world can be divided into people who have and who do not have access to or capability to use modern artifacts, such as telephone, television, or the Internet; digital divide exists between those in cities and rural areas, educated and uneducated, economically well off and deprived classes; developed, developing and least developed countries. The other observations that further help in explaining digital divide are: differences based on race, gender, geography, economic status and physical ability; in access to information, the Internet and other information technologies; in skills, knowledge and ability to use information and other technologies. Further, the stress is on access, knowledge and content. Thus any endeavor to reduce digital divide should take care of these three aspects together. Further, digital divide can be categorized as global, regional or national digital divide. (Siriginidi, 2005, p. 363)

2.2. Measuring the digital divide :

According to the recommendations of the (OCDE, 2009), the variables those should be used to measure the digital divide vary with the goals of the research. Thus, if the researcher wishes to measure the internal or domestic digital divide he should ‘drill down’ the ICT level indicators by groups such as gender, age, income, education, geographical place, and so on, which are more likely to uncover the disparities between categories. However, to measure the digital divide among countries, the indicators should refer to the aggregated national reality. Since the objective of this study is uncovering the digital divide within the MENA countries and to determine its impact on the economic growth, it follows the second recommendation.

2.3. The impact of ICT on output :

The channels through which ICT can affect economic activity are numerous as revealed by many studies. A first, "direct" macroeconomic impact of ICT is engendered by investments in/expansions of the ICT infrastructure (Tsang, et al., 2011).

On the supply side, the use of ICT is likely to raise labor productivity and foster innovation. It can also lead to efficiency gains induced by the appearance of new business models, redesign of supply chain management, and greater access to input and output markets available to firms (Tsang, et al., 2011). ICT induced changes in management models can be emulated across several sectors, leading to positive spillovers (Basu & Fernaldm, 2007). On the demand side, the diffusion of ICT should induce a reduction in transactional costs incurred by consumers (Lee, Levendis, & Gutierrez, 2012).

The anticipated positive economic impact of ICT was largely confirmed by empirical investigation (Czernich, Falck, Kretschmer, & Woessmann, 2011). This "stylized fact" has been nuanced by many researchers; in particular, three findings are worth expanding upon.

First, an abundance of literature has stressed and explored the nature and effects of ICT as a "general-purpose technology" (GPT), chiefly in the context of the Organization for Economic Cooperation and Development (OECD) member countries (Basu & Fernaldm, 2007), (Ceccobelli, Gitto, & Mancuso, 2012) (Liao, Wang, Li, & Weyman-Jones, 2016). 2016). One key lesson from this literature is that the beneficial economic effect of ICT seems to be conditional on much-needed firm-level and industry-level "complementary investments": it is only when appropriate organizational adjustments and reallocation of resources are made and combined with the widespread use of ICT capital that the latter starts significantly impacting productivity and output. Prior to that, ICT capital can entail an adverse effect on productivity. A corollary to this finding is that a substantial time lag is needed before ICT investments translate into productivity growth.

Second, there is evidence that the economic effect of ICT is positively associated with the competitiveness of the ICT sector: a number of papers have empirically documented the adverse impact of restrictive measures on foreign direct investment (FDI) inflows in the telecom sector (Borchert, Gootiiz, & Mattoo, 2012) , and the positive effects of opening up the latter to foreign service suppliers (Rossotto, Sekkat, & Varoudakis, 2003). In particular (Borchert, Gootiiz, & Mattoo, 2012) et (Rossotto, Sekkat, & Varoudakis, 2003) demonstrated that telecommunication investments are likely to yield low returns in the absence of measures enhancing competition among service providers.

A third interesting result pinpointed by the literature is that, at the aggregate level, a certain threshold of diffusion of the latter technologies has to be reached before their reverberations fully unveil. This so-called "critical mass" level, where the diffusion of ICT becomes self-sustainable (Gajek & Kretschmer, 2012).

2.4. ICT in MENA region:

Since the beginning of the 21^{st} century, MENA countries began the planning and developing of strategies to reach certain levels in terms of the deployment and the provision of online Arabic, English and other contents. MENA countries represented by public and private institutes tried to simulate the developed countries in the adoption of internet and ICT applications in various economic, social and scientific activities. In the light of the rapid and successive developments in ICTs and their robust positive impact in economic and social fields, the involvement of MENA region in the information society has become essential.

In 2018, mobile technologies and services generated 4.5% of GDP in the MENA region a contribution that amounted to $191 billion of economic value added. The mobile ecosystem also supported 1 million jobs (directly and indirectly) and made a substantial contribution to the funding of the public sector, with just over $18 billion raised through taxation. By 2023, mobile’s contribution will reach just over $220 billion as countries increasingly benefit from the improvements in productivity and efficiency brought about by the increased take-up of mobile services. (GSMA, 2019)

The MENA region has some of the most penetrated mobile markets in the world. By the end of 2018, nearly half of the 25 countries in the region had unique subscriber penetration rates of 70% or more. For context, the global average at the end of the same period was 66%. In the more mature markets of the region, subscriber growth has slowed to below 2% annually. However, there are still significant growth opportunities in frontier markets in the region, where subscriber penetration rates remain below 50%. (GSMA, 2019)

3. METHODS AND MATERIALS:

Our data set contains panel data from 2000 to 2018 for 15 MENA countries (Middle East and North Africa) which are strongly balanced. As a response variable, we use Gross Domestic Product per capita (GDPPCAP) (2010 PPA $), as a proxy for the economic development as this is perhaps the most popular and accurate single indicator of the economic development of a country. As following the recommendations from the OECD, we employ three ICT indicators, to investigate the subject matter of interest. The explanatory variables considered have been the following: cell subscriber (per 100 people), internet user (% of population), and telephone line user (per 100 people). All data are drawn from the World Telecommunication/ICT Indicators Database and the World Development Indicators Database.

For the choice of our methodology, first, we have employed descriptive statistics to answer the question whether the digital divide exist amongst the MENA countries. Second, in order to identify the long-run and association between ICT and economic growth as well as their short term impact, we referred largely to the technique autoregressive distributed lag ARDL introduced by (Pesaran & smith, 1995), this method is the more appropriate in studying this type of question.

In this section, we briefly review the general framework for the dynamic heterogonous panel regression using the ARDL approaches, we discuss, in terms of efficiency and consistency the three estimators: the mean group (MG) of (Pesaran & smith, 1995), pooled mean group (PMG), and dynamic fixed effect (DFE) estimators developed by (Pesaran, Shin, & Smith, 1999). All three estimators consider the long-run equilibrium and the heterogeneity of the dynamic adjustment process. (Demetriades & Law, 2006)

Based on (Pesaran, Shin, & Smith, 1999), the dynamic heterogeneous panel regression can be incorporated into the error correction model using the autoregressive distributed lag ARDL (p,q) technique and stated as follows (Loayza & Rancière, 2006).

$$\Delta(Y_i)_t = \sum_{j=1}^{p-1} \gamma_j^i \, \Delta(y_i)_{t-j} + \sum_{j=0}^{q-1} \delta_j^i \, \Delta(X_i)_{t-j} + \varphi^i [(y_i)_{t-1}] - \{\beta_0^i + \beta_1^i \ (X_i)_{t-1}\} \epsilon_{it}$$

Where is the GDP per capita, is a set of independent variables including the ICT indicators, and represent the short-run coefficients of lagged dependent and independents variables respectively, β are the long-run coefficients, and is the coefficient of speed of adjustment to the long run- equilibrium. The subscripts i and t represent country and time, respectively. the term in the square brackets contains the long-run growth regression.

However, (Pesaran & smith, 1995), (Pesaran M. , 1997) and (Pesaran, Shin, & Smith, 1999) present the (ARDL) model in error correction form as a relatively new cointegration test. While (Johansen, 1995) and (Philips & Bruce , 1990) argue that the long-run relationships exist only in the context of cointegration among variables with the same order of integration, (Pesaran, Shin, & Smith, 1999) argue that panel ARDL can be used even with variables with different order of integration irrespective of whether the variables under study are I (0) or I (1). In addition, the ARDL model provides consistent coefficients despite the possible presence of endogeneity because it includes lags of dependent and independent variables (Pesaran, Shin, & Smith, 1999). For further understanding of the key features of the three different estimators in the dynamic panel formwork, we present the assumptions relating to each estimator.

- **Pooled Mean Group (PMG)** :

The main characteristic of PMG is that it allows short-run coefficients, including the speed of adjustment and the intercepts, to the long-run equilibrium values, and error variances to be heterogeneous country by country, while the long-run slope coefficients are restricted to be homogeneous across countries. This is particularly useful when there are reasons to expect that the long-run equilibrium relationship between the variables is similar across countries or, at least, a sub-set of them. However, there are several requirements for the efficiency of this methodology. First, the relative size of T and N is crucial, since when both of them are large this allows us to use the dynamic panel technique, which helps to avoid the bias in the average estimators. Second, an important assumption for the consistency of the ARDL model is that the resulting residual of the error-correction model be serially uncorrelated and the explanatory variables can be treated as exogenous. Such conditions can be fulfilled by including the ARDL (p,q) lags for the dependent (p) and independent variables (q) in error correction form using some consistent information criterion . Third, the existence of a long-run relationship among the variables of interest requires the coefficient on the error–correction term to be negative and larger than -2.

- **Mean Group (MG):**

The MG technique estimate separate regressions for each country and calculate the coefficients as unweighted means of the estimated coefficients for the individual countries. This does not impose any restrictions; it allows for all coefficients to vary and be heterogeneous in the long-run and short-run. Nevertheless, the necessary condition for the validity of this approach is to have a sufficiently large time-series dimension of the data; and the cross-country dimension should also be large (about 20 to 30 countries), With short time series data this model however may give misleading result, thus we will not use it in the estimation of our data since our cross-country dimension is about 15 countries.

- **Dynamic Fixed Effects (DFE):**

the DFE estimator is very similar to the PMG estimator and imposes restrictions on the slope coefficient and error variances to be equal across all countries in the long run. The DFE model further restricts the speed of adjustment coefficient and the short-run coefficient to be equal too; nonetheless, the model features country-specific intercepts. However, (Baltagi, Griffin, & Xiong, 2000) point out that this model is subject to a simultaneous equation bias due to the endogeneity between the error term and the lagged dependent variable in case of small sample size.

- **PMG or MG or DFE?**

To identify the choice among the PMG, MG and DFE methods, the Hausman test developed by (Hausman , 1978) , is used to test whether there is a significant difference between these estimators. If the null hypothesis is not rejected, the PMG estimator is recommended since it is efficient. The PMG will be used if the P-value is insignificant at the 5% level; and it happens to have a significant P-value, then the use of a MG or DFE estimator is appropriate.

Since the ARDL model is not applicable for series exceeding an order of integration equals 2, we apply a unit root test to make sure that series is I (0) or I (1) (Pesaran & smith, 1995) and (Pesaran, Shin, & Smith, 1999). There are different types of unit root tests, as our data are strongly balanced we apply the LLC test; (Levin, Lin, & Chu, 2002) introduced different panel unit root tests having different specifications dependent upon the assumption about entity specific intercepts terms and time trends. LLC test inflicts homogeneousness on the autoregressive coefficient (intercept and trend may vary across individual series) which shows the presence or nonexistence of unit root.

4. RESULTS AND DISCUSSION:

4.1. Descriptive statistics:

Before proceeding to any estimation, we apply descriptive statistic to determine whether the digital divide exist among MENA countries or not.

Table N°1: descriptive statistics of all variables

variable		Mean	Std. Dev.	Min	Max
GDPPCAP	overall	16783.12	18807.94	667.95	69679.09
	between		19157.18	1112.66	64483.65
	within		3162.47	4288.83	33647.05
Cell subscriber	overall	83.56242	52.92	0.18	212.64
	between		28.92	33.91	133.13
	within		44.91	-22.412	175.66
Internet user	overall	36.07693	28.54	0.083	100
	between		14.78	11.46	63.24
	within		24.69	-13,36	89.63
Telephone line user	overall	15.20904	8.42	1.99	38.82
	between		7.85	4.082	31.64
	within		3.62	-1,97	26.49

Source: Author's own elaboration using STATA results

Table 01 represents the descriptive statistics of all the variables. First of all, we notice that the income inequality is high between MENA countries, since the standard deviation of GDPPAC is excessive. The standard deviation is high overall, between and within countries on the basis of all ICT indicators, thus we can assume that there is a big digital divide among MENA countries.

Table N °2. descriptive statistics of ICT indicators of MENA countries (2000-2018)

Countries	Variables	Mean	Std.Dev	Min	Max
United Arab Emirates	Cell subscriber (per 100 people)	133,13	52,70	45,57	212,64
	Internet user (% population)	63,24	26,73	23,63	98,45
	Telephone line user (per 100 people)	24,98	4,35	17,30	32,55
Bahrain	Cell subscriber (per 100 people)	118,32	51,20	30,95	210,05
	Internet user (% population)	55,59	34,08	6,15	98,64
	Telephone line user (per 100 people)	21,47	2,14	18,37	25,73
Algeria	Cell subscriber (per 100 people)	70,38	44,87	0,28	121,93
	Internet user (% population)	17,88	17,61	0,49	59,58
	Telephone line user (per 100 people)	7,95	1,20	5,67	9,91
Egypt	Cell subscriber (per 100 people)	60,64	44,11	1,98	112,78
	Internet user (% population)	21,50	14,73	0,64	46,92
	Telephone line user (per 100 people)	10,40	2,87	6,48	14,88
Iran	Cell subscriber (per 100 people)	54,71	40,17	1,47	108,46
	Internet user (% population)	22,80	21,46	0,93	70,00
	Telephone line user (per 100 people)	31,64	8,23	14,46	38,82
Jordan	Cell subscriber (per 100 people)	76,62	40,49	7,59	148,90
	Internet user (% population)	30,34	22,31	2,62	71,28
	Telephone line user (per 100 people)	7,72	3,46	3,20	12,68
Kuwait	Cell subscriber (per 100 people)	113,81	63,42	23,27	205,91
	Internet user (% population)	50,26	30,28	6,73	100,00
	Telephone line user (per 100 people)	18,17	4,09	12,46	22,84
Lebanon	Cell subscriber (per 100 people)	44,04	22,39	18,13	71,30
	Internet user (% population)	39,17	29,56	6,78	80,25
	Telephone line user (per 100 people)	15,77	2,96	13,03	27,05
Morocco	Cell subscriber (per 100 people)	78,03	44,23	8,13	129,02
	Internet user (% population)	34,65	23,75	0,69	64,80
	Telephone line user (per 100 people)	6,87	2,65	3,83	11,59
Oman	Cell subscriber (per 100 people)	100,85	57,59	7,14	155,76
	Internet user (% population)	37,02	30,66	3,52	83,53
	Telephone line user (per 100 people)	10,03	0,78	8,71	11,60
Qatar	Cell subscriber (per 100 people)	100,11	40,76	20,40	146,38
	Internet user (% population)	53,60	34,19	4,86	99,65
	Telephone line user (per 100 people)	20,35	4,52	14,54	27,54
Saudi Arabia	Cell subscriber (per 100 people)	112,63	65,52	6,66	191,03
	Internet user (% population)	39,75	28,86	2,21	93,31
	Telephone line user (per 100 people)	15,38	1,24	11,81	16,47
Tunisia	Cell subscriber (per 100 people)	81,10	47,07	1,23	130,55
	Internet user (% population)	29,50	20,58	2,75	64,19
	Telephone line user (per 100 people)	10,88	1,41	8,44	12,44
Turkey	Cell subscriber (per 100 people)	75,16	24,96	25,51	97,30
	Internet user (% population)	34,39	20,69	3,76	71,04
	Telephone line user (per 100 people)	22,45	5,96	13,88	29,45
Yemen	Cell subscriber (per 100 people)	33,91	25,01	0,18	66,98
	Internet user (% population)	11,46	10,53	0,08	28,86
	Telephone line user (per 100 people)	4,08	0,79	1,99	4,80

Source: author's own elaboration using STATA results

Table 02 represents the descriptive statistics of the ICT indicators of MENA countries separately. This table highlighted the mean, the standard deviation the Minimum and the Maximum. From this table we see that the mean values of different variables of internet users ranges from 11.46 to 63.24, cell subscriber ranges from 133.13 to 33.91, while telephone line users ranges from 4.08 to 31.64; Yemen has the minimum values while the United Arab Emirates has the maximum values. The mean values of different indicators indicate that there is a big digital gap among countries. On another hand, we notice that the Maximum values of the cell subscriber, internet user and telephone line user are 212.64(the United Arab Emirates), 100 (Kuwait) and 38.82 (Iran) respectively; while Yemen is at the bottom of the ranking for all the variables, hence we cannot ignore the digital divide on this dimension too.

The table shows that United Arab Emirates has the highest digital facilities measured in all the dimensions considered in this study while the digital divide in mostly prevalent in Yemen.

4.2. Unit root test :

Table 3 reports the results of unit root tests, which suggest that most of the variables under consideration are stationary of order I (0) with constant and trend, while Internet user is integrated of order I (1). Due to these mixed orders of integration, panel ARDL approach rather than the traditional panel cointegration test is appropriate.

Table N°3: Panel unit root test results

LLC			
Variable	level (p-value)	First difference (p-value)	level of integragion
GDPPCAP	0.000**	/	I(0)
Cell subscriber	0.000**	/	I(0)
Internet user	0,9954**	0.000**	I(1)
Telephone line user	0.000**	/	I(0)
** refers significance at 5%			

Source: author's own elaboration using STATA results

4.3. Panel ARDL estimates :

However, before moving to the panel regression the ARDL lag structure should be determined by some consistent information criterion. Based on the Akaike Information criterion (AIC) we impose the following lag structure (1,0,0,0) for the GDPPCAP, cell subscriber, internet user and telephone line user respectively. The best combination of ARDL is chosen based on the smallest values of AIC. Thus, the estimation of the impact of the digital divide on economic growth is conducted using Autoregressive Distributed Lag model ARDL (1,0,0,0).Though cross sectional units are not that large yet the study has applied only the PMG and the DFE estimators.

Table N°4: ARDL(1,0,0,0) estimation using PMG and DFE estimators

	PMG		DFE	
Variables	Coef.	P.value	Coef.	P.value
long run coefficient				
Cell subscriber	0,2496**	0,032	0,02878	0,309
Internet user	0,7134**	0,006	-0,8375	0,125
Telephone line user	0,104**	0,003	0,4297**	0,023
short run coefficient				
Error correction coefficient	-0,01946**	0,0233	-0,1184**	0
Δ Cell subscriber	0,00027	1	-0,0157**	0,032
Δ Internet user	-0,0229	0,095	-0,0097	0,61
Δ Telephone line user	-0,02762	0,738	0,0316	0,508
intercept	-4,1818	0,223	1,392**	0,007
Hausman test	0,05	0,997		
** refers significance at 5%				

Souce: Athour's own elaboration using stata results

The table 4 reports the results of PMG and DFE estimation along with the Hausman h-test to measure the comparative efficiency and consistency among them. The results indicate that ICT indicators have a positive strongly significant impact in the long run on the economic growth according to the PMG estimator, whereas the DFE estimator suggests a positive and significant impact of telephone line user in the long run, and insignificant positive and negative impact of the cell subscriber and the internet user respectively in the long run. As expected, the Hausman test accepts the null hypothesis of the homogeneity restriction on the regressors in the long run, which indicates that PMG is more efficient estimator than DFE.

Thus the study only focuses on the result from PMG model in discovering the potential dynamic effect of the ICT variables on economic growth in MENA countries.

The PMG estimator results indicate the existence of a strong relationship between economic growth and ICT indicators in MENA countries, in the long-run. As one would not expect, we can notice clearly that the long-run marginal effect of all the ICT indicators on real per capita GDP growth is explosive since the long-run coefficients are very high and significant, an increase in cell subscriber, internet users and telephone line users by 1% causes an increase in GDPPCAP respectively by, 24,96%, 71,34 and 10,4%; which means that high investments in TIC leads to higher economic growth in the long-run in MENA countries. On the other hand, the impact of the ICT indicators is insignificant in the short-run. The reason behind the persistent insignificant contribution of ICT indicators to economic growth in MENA countries is evidenced by the fact that in MENA countries, the information technology sector is still under developed. in addition to this, in countries with heavy dependence on hydrocarbons and lack of economic diversification; the investments that goes to the IT sector does not accrue the expected growth potentials. Compounding this situation also are the poor ICT infrastructural facilities in MENA countries which contributes significantly in hindering the efficient and effective functioning of the IT sector to the fullest capacity to warrant them the opportunity to drive the economic growth prospects of the continents to the expected echelon. ICT in turn play important role as catalyst and pave the way for rapid economic growth by enhancing economic diversification and restricting the heavy dependence on hydrocarbons; which explain the strong significant relationship between economic growth and ICT indicators in the long-run.

The validity of this finding was supported by the coefficient of error correction term which is negative and statistically significant as well in all specifications. This estimator provides an evidence of sufficient arguments for valid speed of convergence to the long-run steady-state; this is an indication that model converges towards equilibrium. The speed of adjustment is about 1,94% in each specification.

5. CONCLUSION :

The explosive development of ICT, its applications, and the emergence of a global information society are changing the way people live, learn, work and interact. The divide between technology's haves and have-nots threatens to exacerbate the gaps between the rich and poor, within and among countries.

The study has highlighted several interesting findings. First, there exists a big digital divide among MENA countries, United Arab Emirates has the highest ICT facilities and Yemen has the poorest ICT facilities, which explain the income inequality between the two countries. We have applied the Panel Autoregressive distributed lag ARDL (PMG and DFE) to verify the short-run and long-run effects between ICT indicators and GDPPCAP. Since the Hausman test which indicates that PMG is more efficient estimator than DFE, thus the study only focuses on the result from PMG model. The PMG estimator results indicate that the long-run marginal effect of all the ICT indicators on real per capita GDP growth is explosive since the long-run coefficients are very high and significant, which means that high investments in TIC leads to higher economic growth in the long-run in MENA countries. While, the impact of the ICT indicators is insignificant in the short-run; however, in countries with heavy dependence on hydrocarbons and lack of economic diversification; the investments that goes to the IT sector does not accrue the expected growth potentials. Thus, a call for action to reduce the digital divide is very important if MENA countries wishes to unearth the fullest potential of its economic growth in the years to come.

In view of this, and for sustainable economic growth prospects of these region, we recommend proper information technology sector development through public and private sector partnership, improvement in ICT infrastructural facilities that pique production and providing an enabling investment environment for the thriving of indigenous entities and the influx of foreign direct investment. To ensure this, we emphasize for the need for complementary policies, institutional qualities and extensive technological acquisition. Finally, it should be noted that digital development alone is unlikely to promote a continued and sustainable economic growth amidst macroeconomic instability and lack of economic diversification particularly in those countries were these factors remain a crucial challenge.

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