

The Impact of Digital Development on Economic Growth: Empirical Evidence from Selected Arab Countries

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Abstract

Objectives: The main objective of this paper is to evaluate the primary determinants of real economic growth in the Arab region, with a particular emphasis on the role of digital development.

Methods: The study examines the key determinants of economic growth in eight selected countries from the Arab region, using panel data comprising 160 observations from the World Bank database. The data covers the period 2000-2020. An econometric model is utilized to achieve the study objectives by employing economic theory. Advanced econometric estimation methods (FMOLS, panel generalized method of moments GMM, and panel EGLS) are employed to estimate the model parameters. Additionally, as the sum of the elasticity coefficients is less than one, the selected Arab economies exhibit decreasing returns to scale (DRS), necessitating concerted efforts to enhance the productivity of all factors of production and reduce production costs in the long run.

Results: The study's estimation results indicate significant effects of all classical factors of production in promoting economic growth in the selected Arab countries. Specifically, the empirical analysis identifies the main contributors to real economic growth in the Arab region (arranged according to their importance): trade openness, labor productivity, investment (rate of capital accumulation), digital development, and technological progress.

Conclusions: Based on the results, the policy recommendation is that to boost real economic growth, Arab countries should adopt a balanced policy mix designed to promote trade liberalization, investment, labor productivity, and digital development, respectively.

Keywords: Economic Growth, FMOLS, GMM, Digital Development, Arab countries.

تأثير التنمية الرقمية على النمو الاقتصادي: أدلة تجريبية من بلدان عربية مختارة

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ملخص

الأهداف: الهدف الرئيسي للدراسة تحديد عوامل النمو الاقتصادي الحقيقي في المنطقة العربية مع التركيز على دور التطور الرقمي.

المنهجية: تستخدم الدراسة عينة زمنية مقطعية (160 مشاهدة) تغطي ثمان دول عربية ممن يتوفر عنها بيانات لكامل فترة الدراسة 2000-2020 مأخوذة من مصدر واحد هو قاعدة بيانات البنك الدولي. وتستخدم الدراسة نموذجاً قياسياً تم اختيار متغيراته استناداً الى نظرية النمو الكلاسيكي المحدثة ومدعوماً بالدراسات التطبيقية السابقة في هذا المجال. وفي ضوء اختبارات السكون والتكامل المشترك تم تقدير معاملات النموذج بثلاث طرق بديلة هي طريقة العزم المعممة، وطريقة المربعات الصغرى المصححة كلياً، وطريقة المربعات الصغرى العامة القابلة للتقدير.

النتائج: توصلت الدراسة إلى أن عوامل الإنتاج التقليدية تؤثر على معدلات النمو الاقتصادي في دول العينة المختارة وهذا التأثير ذو دلالة إحصائية، وفيما يلي نشير للعوامل المؤثرة وهي مرتبة حسب فعالية وقوة العلاقة: الانفتاح التجاري، إنتاجية العمل، الاستثمار، التقدم الرقمي، والتقدم التكنولوجي على التوالي. وفي ضوء أن مجموع المعاملات (المرونات) المقدرة يقل عن واحد صحيح يستنتج أن الإنتاج الكلي في هذه الدول يخضع لظاهرة تزايد التكاليف أو ما يعرف بوفورات الحجم المتناقصة في الأجل الطويل. الخلاصة: في ضوء النتائج ولتعظيم النمو الاقتصادي الحقيقي توصي الدراسة صانعي القرار في الدول العربية باتباع مزيج من السياسات المتوازنة المحفزة للاستثمار والتحرير التجاري والإنتاجية والتطور الرقمي على التوالي.

الكلمات الدالة: النمو الاقتصادي، التطور الرقمي، المربعات الصغرى المصححة كلياً، العزم العامة، دول عربية.



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1. INTRODUCTION

After the COVID-19 pandemic, digital development and the digitization of the economy have assumed heightened importance as a dynamic factor facilitating all types of economic activities while boosting real economic growth. The main impact channels are through fostering industrial structure upgrades, economizing time and costs of economic activities, and curbing the spread of corruption (UNCTAD, 2022). Moreover, digital development can augment the efficiency of classic factors of production such as capital and labor.

The Economic Research Forum revealed that even though 56% of females and 68% of males in Arab countries utilize the internet, these nations lag behind others in digitalizing public services and adopting new technology by businesses and financial institutions. This suggests that the impact of digital development on economic growth remains limited (Shahrokh and Nabli, 2023). However, the nature and intensity of the relationship between digital development and economic growth concerning a specific region can only be evaluated empirically.

Studies regarding the role of digital development in the real economic growth of the Arab region are scant in comparison to other world regions. Economic growth, defined as the annual percentage change in gross domestic product (GDP) at constant prices, is considered the most comprehensive available indicator of progress in economic activity, on the one hand, and the most commonly used proxy for shifts in a nation's national welfare on the other hand.

Economic theories propose that real economic growth and the subsequent rise in the level of domestic national income are contingent on the factors of production augmented by the degree of foreign trade openness. The policy of trade liberalization has grown in relevance over the past few decades owing to its critical role in combating unemployment, poverty, and the gender labor gap.

Just like other world regions, countries in the Arab region vary in resource abundance, degree of trade openness, and consequently, realized real economic growth. As illustrated in Table 1, Morocco achieved the highest growth rate in 2022 at 7.9%, followed by Tunisia at 4.3%. The lowest growth rate was reported at 2.2%, jointly achieved by both Bahrain and Jordan.

Table (1): GDP Growth (annual %) for Selected Arab Countries and Economies (2022)

Country	Algeria,	Bahrain	Egypt	Jordan	Morocco	Oman	Tunisia	Saudi Arabia	Arab region
Growth%	3.5	2.2	3.3	2.2	7.9	3.1	4.3	3.2	3.7

Source: Extracted from World Bank database.

The significance of this study lies in its distinction as one of few that scrutinize the empirical relationship between factors of production and real economic growth in select Arab countries demonstrating the highest degree of trade openness—specifically, Algeria, Bahrain, Egypt, Jordan, Morocco, Oman, Tunisia, and Saudi Arabia.

The quantitative assessment of the association between determinants of growth and real economic growth, as an indicator of economic welfare, will enable appraisal of the relative significance of each factor influencing economic growth. Consequently, this understanding can help identify policies promoting growth and enhancing the economic welfare of the researched nations.

The remainder of this paper is arranged as follows: The ensuing section offers a literature review, followed by a section outlining the methodology and econometric estimations, which also discusses the primary results. Finally, section four delivers the study's conclusions and recommendations.

2. LITERATURE REVIEW

Digital development can bolster economic growth through its impacts on both the supply side and demand side of an economy. On the supply side, digital connectivity can directly influence the productivity of firms, workers, and other inputs in the production process. Conversely, on the demand side, internet connectivity can affect sellers' and buyers' ability to access markets, facilitate the marketing of their products, and improve the availability and quality of information pertaining to traded products and services.

The digitization of both public and business activities is anticipated to positively impact real economic growth through various channels, including procedural time savings, productivity enhancements, increased transparency, and curbs on various forms of corruption.

Aligned with this study's central theme, the following literature review will hone in on the empirical relationship between digital development and real economic growth. The scope and empirical findings of the reviewed studies will be emphasized.

Sofia et al. (2022) utilized a panel data sample spanning thirty-six OECD countries from 2000 to 2019. The model was estimated using the Generalized Method of Moments (GMM). Their estimation results confirm that Information and Communication Technologies (ICTs) have a positive effect on the economic development of OECD countries.

Zhang et al. (2022) conducted an investigation into the impact of the digital economy on economic growth and development post-COVID-19 for countries along the "Belt and Road". Their results showed a modest positive contribution of the ICT-based digital economy to GDP growth. Moreover, the digital economy significantly contributed to upgrading the industrial structure and catalyzing increases in real gross domestic product.

According to Abdelbary and Benhin (2021), human capital and investment significantly impact economic growth in Arab countries. However, regulatory quality presents a major obstacle to economic growth in the sample of Arab countries they analyzed.

Yusuf (2021) scrutinized the long-term trend of digitalization advances in Arab countries and its effect on income equality. The findings of the study show that digital development doesn't seem to have greatly displaced labor in manufacturing and formal services, nor has it enhanced productivity and growth. Additionally, it does not appear to have influenced income distribution in the selected Arab nations.

In an analysis conducted by EL-Mostafa (2020), it was established that human capital is a crucial factor in boosting economic growth for a sample of twelve Arab countries, compared to a selection of non-Arab Asian developing countries. However, when juxtaposed with a sample from developed countries, the contribution of human capital to real growth significantly lags.

Alhaj Yousef and Warrad (2020) investigated growth determinants using a sample of twelve Arab countries over the period 1998-2017. They found empirical evidence supporting the classical theory of growth, specifically, the labor force, gross fixed capital formation, trade openness, economic freedom, and governance indicators which positively affected economic growth in Arab countries.

Enda and Kyton (2020) analyzed the impact of digital technology use on economic growth, using a sample of 39 African countries between 2012 and 2016. Applying the System GMM estimator, they found that only individual usage had a positive and significant effect on economic growth.

Kofahi and Warrad (2020) examined the impact of Information and Communication Technology (ICT) on intra-Arab trade in the case of the Gulf Cooperation Council for the period 2005-2016. By implementing the Feasible Generalized Least Squares method to estimate an augmented Gravity Model, their findings pointed to a significant positive effect of

ICT variables on the volume of regional trade among the GCC countries.

Godwin et al. (2019) investigated the contribution of digitalization to economic growth in Sub-Saharan African countries compared to the more advanced economies of the Organization for Economic Cooperation and Development. They found evidence that digitalization positively contributes to economic growth in both countries. However, the effect of internet access is less significant for Sub-Saharan Africa than for OECD countries.

Moosa (2008) reviewed the applicability of Okun's law in four Arab countries: Algeria, Egypt, Morocco, and Tunisia. His primary finding was that economic growth does not necessarily reduce unemployment in these countries.

Xavier, Martin, and Elsa V. (2002) attributed the poor economic growth performance of both oil and non-oil producing countries over the last four decades to excessive reliance on public investment, low-quality financial institutions, political and social instability, and low-quality human capital.

Compared to other studies, this paper contributes to the existing research on Jordan's economic growth using the latest available data on the most liberalized Arab economies. It also provides several methods of econometric panel estimation for comparison and robustness purposes.

3. METHODOLOGY AND ECONOMETRIC ANALYSIS

3.1 Methodology and the model

To explore the relationship between real economic growth in the Arab region and its key determinants according to an augmented neoclassical growth model, time series data for the period 2000-2020 is taken from the World Bank database on eight Arab countries for which data is available and/or open to international trade including Algeria, Bahrain, Egypt, Jordan, Morocco, Oman, Tunisia, and Saudi Arabia¹. To assess the impact of digital development (among other factors), on real economic growth, a model based on the Neoclassical Growth Theory is used (Romer, 1994). It assumes that output is determined mainly by factors of production and technology. The non-linear Cobb-Douglas type production function is linearized by taking the natural logarithm of each variable of the model. The resulting econometric model is as follows:

$$LGDP_{it} = b_0 + b_1 * LCAP_{it} + b_2 * LLAB_{it} + b_3 * LOPEN_{it} + b_4 * DIGDEV_{it} + b_5 * TECH_{it} + e_{it} \quad (1)$$

The model variables are defined as follows:

L refers to the logarithm of the variable, GDP represents gross domestic product at constant US\$ prices (dependent variable), and the independent variables are defined as follows: cap denotes gross physical capital formation at constant prices, lab is the total labor force, and tech is a proxy for technological progress over time, measured simply by a linear time trend.

In addition to the classical factors of production, the model is augmented by two additional factors: trade policy of openness (Open) serves as an indicator of trade openness and is measured as the sum of the current value of exports and imports divided by nominal GDP. The variable digdev is the digital development indicator, measured by the percentage of the population using the internet. Access to the internet creates opportunities for bringing education, technological advancement, and valuable information within the reach of consumers and producers. It can significantly shorten the time needed to perform various productive activities and open up a new range of information resources. Furthermore, it opens up significant new economic opportunities for existing and new businesses.

Data limitations prevented the use of other measures/indices of digital development and/or the inclusion of more Arab

¹ Website of World Bank: [World Bank Open Data | Data](https://data.worldbank.org/)

countries. Additionally, due to data unavailability on technological progress in Arab countries covering the period 2000-2020, the independent variable tech is approximated by a simple time trend.

The model parameters b_0, \dots, b_5 are all in elasticity form. The e-term is added to account for random errors in the model specification. Noting that the model variables are taking two subscripts: one for country (i) and the second for time (t), a panel estimation technique will be chosen based on the results of panel stationarity and cointegration tests.

3.2 Empirical analysis

To assess the stationarity of the model variables, a panel unit root test is conducted. The results of the Levin, Lin and Chu test (shown in Table 2) indicate the stationarity of all model variables except for the trade openness variable, which was found to be integrated of (1) (Levin, et al., 2002).

Table (2): Levin, Lin & Chu Panel unit root test

Variable	Statistic	Probability	Integration order
lgdp	-4.32620	0.0000	I(0)
llab	-6.12922	0.0000	I(0)
lcap	-4.94686	0.0000	I(0)
lopen	1.51890	0.9356	I(1)
ldigdev	-7.33538	0.0000	I(0)
tech	-	0.0000	I(0)

Source: calculated using Eviews software.

Hence, a co-integration test between the model variables is conducted and the test results are displayed in Table 3. The Kao Residual Cointegration test rejects the hypothesis of no cointegration at a better than 1% significance level, indicating the existence of a stable long-term relationship among the model variables (Orsal, 2007).

Table (3): Kao Residual Panel Cointegration Test, 2000-2020

ADF		t-statistics		
		-2.89		
Residual variance		0.000610		
HAC variance		0.000848		
Augmented Dickey-Fuller Test Equation				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID(-1)	-0.221066	0.057149	-3.868245	0.0002
D(RESID(-1))	0.301274	0.091407	3.295962	0.0012

Source: calculated using Eviews software.

3.3.1 Model Estimation

In principle, the model parameters can be estimated by Ordinary Least Squares (OLS) if the objective of the research is to provide overall predictions. However, due to the non-stationarity of the trade openness variable—which is key to this research—the model will be estimated by the Fully Modified OLS (FMOLS). This method was first suggested by Phillips and Hansen (1990) as a way to deal with both the endogeneity and simultaneity of regressors, as well as to have testable parameters estimates. Furthermore, the model will be re-estimated with the Panel Generalized Method of Moments (GMM), and the panel EGLS to compare estimates² and for robustness. The results of estimation by various methods are presented in Table (4).

Table (4): Estimation results of FMOLS, Panel GMM, FE, and Panel EGLS, 2000-2020

Variable	Panel FMOLS		Panel GMM		Panel EGLS	
	B	P-Value	β	P-Value	β	P-Value
Lcap	0.07	0.0000	0.05	0.0000	0.05	0.0021
Llab	0.11	0.0004	0.11	0.0000	0.11	0.0000
Lopen	0.15	0.0000	0.146	0.0000	0.146	0.0000
Ldigdev	0.022	0.0000	0.02	0.0000	0.02	0.0103
Tech	0.024	0.0000	0.025	0.0000	0.027	0.0000
Constant	-	-	-41.3	0.0000	-41.3	0.0000

Source: calculated using Eviews software.

The results of the estimations by the three methods are satisfactory and interestingly, they are quite similar to each other. All coefficients carry the expected positive sign and are statistically significant at 1% or better. As anticipated, the coefficient representing trade openness is positive at 0.15; although inelastic, it implies that a 1% increase in the trade openness index will enhance real economic growth by about 0.15%. However, it should be noted that the trade openness coefficient is the largest compared to other model variables, indicating that trade liberalization is a principal contributor to Arab economic growth.

After trade openness, the second main contributor to growth is labor productivity, with elasticity equal to 11%. Following labor, investment (capital accumulation) positively contributes to economic growth with an elasticity equal to 7%. Although the coefficients for both technological progress and digital development variables are highly significant, they both turned out to be inelastic, with an elasticity coefficient equaling only 2.2%.

Nevertheless, these findings harmonize with previous studies' findings where the Information and Communication Technology (ICT)-based digital development contribution to GDP growth typically ranged from 0.1 to 1.0 percentage points and tended to increase as economies progressed to higher stages of development (Khuong Vu, 2020).

² For details on these econometric methods see Greene (2012).

4. CONCLUSIONS

This study examines the effect of trade openness, digital development, and other classical factors on real economic growth for eight selected Arab countries. This is done using panel data of 160 observations from 2000 to 2020. The analysis of integration and co-integration confirms a stable long-term relationship among the model variables. The research uses a theoretically well-founded econometric model, estimated by the following competing econometric methods: Fully Modified Ordinary Least Squares (FMOLS), Panel Dynamic Ordinary Least Squares (DOLS), and Panel EGLS (both dummy and random versions).

The estimation results by all methods highlight the critical role of trade openness, technological progress, and digital development, respectively, in promoting real economic growth in the selected Arab countries. They provide empirical evidence that trade openness and, to a lesser extent, technological progress and digital development significantly promote economic growth, albeit with an inelastic effect.

In light of the research findings, the main policy recommendation is as follows: To boost real economic growth, Arab countries should pursue a balanced policy mix designed to simultaneously foster trade liberalization, investment, labor productivity, and digital development. Greater attention should be given to innovative production methods by introducing technologically advanced production methods and accelerating digital development in all economic activities.

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