The impact of ease of doing business and technological infrastructure on economic growth in the Arab world

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ABSTRACT

Purpose: This paper examines the effects of technological infrastructure and a business-friendly environment on economic growth in the Arab world from 2004 to 2021 using a detailed panel data analysis approach.

Design/Methodology/Approach: The study chooses the fixed effect model based on the Hausman test with additional diagnostic tests confirming the absence of serial correlation and heteroscedasticity employing fixed and random effect models on data from thirteen Arab countries.

Findings: Findings reveal a negative relationship between ease of doing business and GDP growth (Gross Domestic Product) suggesting that improvements in the business environment paradoxically decrease economic growth. Conversely, a positive relationship exists between the human development index and economic growth underscoring the significance of human capital. Notably, no significant relationship is detected between technological infrastructure and economic growth.

Conclusion: The study concludes that regulatory reforms and human capital investment are pivotal for economic growth in the Arab world challenging the assumed positive impact of ease of doing business on economic expansion. It underscores the need for a strategic focus on developing human resources and technological infrastructure to foster sustainable economic growth.

Contribution to the Literature: This research contributes to the economic literature by highlighting the nuanced effects of the ease of doing business and the essential role of human capital in driving economic growth within the Arab region offering new insights for policymakers.

Keywords: *Arab world, Ease of doing business, Economic growth, Endogenous growth theory, Foreign direct investment, Technology.*

1. INTRODUCTION

Difficult economic conditions are one of the several problems that the Arab world is experiencing. The low labour force participation rate of women in this region coupled with the continuing Palestinian conflict that has forced numerous people to migrate around the Middle East is a contributing factor to political instability. The Arab government authorities see entrepreneurship as a critical strategy for creating jobs and reducing unemployment. Diversifying their economies through export-led growth and inclusively addressing development challenges are the traditional methods of creating jobs.

Therefore, entrepreneurship is defined as introducing new items or services to the market and taking measured risks to open new possibilities.

Young unemployment is a major problem in the Arab world where it is more than twice the global average and the example set by successful entrepreneurs around the world serves as inspiration for new businesses to launch which in turn increases productivity (Abukumail, Alrashidi, & Atta, 2018). Thus, Kuwait, Jordan, Saudi Arabia, and Bahrain are the four countries that ranked in the top 10 worldwide for reform. These countries were responsible for almost 50% of the changes that took place in the area. Maintaining its remarkable performance, the United Arab Emirates ranked 16th out of 190 nations in the category of ease of doing business (EDB) (Felsenthal & Al-

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Saeed, 2020). New Zealand, Singapore, Hong Kong, Denmark and Korea are ranked best in terms of ease of doing business out of 190 countries according to the 2019 World Bank study.

This is especially true considering the political and economic crisis that the Arab world is currently experiencing. Everything that has been said has been proven by the rise of civic demonstrations since the beginning of 2018. Due to economic advancements in the Arab world, it is very rare. Here, we examine how several variables affect GDP growth. Thus, to boost investment and economic development, the region must encourage more innovation and entrepreneurship.

This study seeks to understand the impact of business friendliness and technology infrastructure on economic development by taking into account endogenous growth theory components such as innovation, human capital with e-government and governance in the Arab world.

Therefore, it is crucial to investigate how technological advancements and business-friendly policies interact with each other and with other variables that influence GDP growth using endogenous growth theory as a framework. Most Arab countries lack effective governance and an atmosphere that is favorable to business as shown by the results which has a detrimental effect on economic development.

2. THEORETICAL BACKGROUND

This study primarily focuses on the endogenous theory of growth. Human capital-based theory (Lucas Jr, 1988) intellectual capital-based theory (Romer, 1986) and Schumpeter (1942) are the three foundational theories of endogenous growth (Chirwa & Odhiambo, 2018). Therefore, there are three factors capital stock, human resources and natural resources that contribute to economic progress. Economic expansion is a byproduct of both rising populations and advanced technologies. Solow (1957) further supports this argument by arguing that technological progress is necessary for every manufacturing process to achieve long-term economic development (Nawawi, Hanif, & Sholihah, 2022).

2.1. Economic Growth

Internal factors that regulate the economy and promote technical improvement drive the growth rate of total factor productivity (TFP) which is a long-term indicator of economic growth according to the endogenous growth hypothesis.

The opposite is true for economic growth which is defined exogenously according to the work of Solow (1956) and is hence unaffected by factors outside of the economy (Chandra, 2022).

Another version of Romer's theory of economic development which emphasizes the endogeneity of productivity is detailed in his works from 1986 to 1990. The innovation-based endogenous growth model examines how the private sector of research and development (R&D) drives technical breakthroughs that create long-term endogenous growth.

Furthermore, new growth theories and innovation as an endogenous factor emerged later although they were still based on the equilibrium principle. Both Schumpeterian and Neo-Schumpeterian theories view innovation as endogenous to the economy. Moreover, Schumpeter has made significant contributions to theories of economic development by raising awareness of the importance that innovation plays in these theories. The way that economic growth was considered experienced a significant shift as a result of Schumpeter's contributions (Eggink, 2013).

This paper will examine the business climate in the Arab world, the resources available to facilitate commercial dealings there, the governance and e-government structure, the human development index and the impact of business-friendly policies and technological advancements on GDP growth.

2.2. Ease of Doing Business

The ease of doing business index established by the World Bank serves as a gauge for assessing a country's business climate and its potential for economic achievement. Elevated scores on this index reflect an environment conducive to business activities. Countries including Malaysia, Singapore, Vietnam, the Philippines and Thailand have demonstrated marked economic progress, a portion of which can be attributed to their favorable positions on this index. This tool offers a comparative evaluation of regulatory impacts on businesses across nations, emphasizing essential operational aspects such as business initiation, procurement of construction permits,

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electrical setup, property registration, credit acquisition, investor protection, tax compliance, facilitation of international trade, contract enforcement and insolvency processes. These factors play a pivotal role in cultivating a thriving business ecosystem and propelling economic growth. Enhancements in these regulatory areas have yielded significant economic advancements in these nations, underscoring the vital influence of an accommodating regulatory backdrop on economic development (Rina & Suhadak, 2018). These countries have implemented reforms to streamline processes, reduce bureaucracy and enhance the overall business environment leading to increased investment, job creation and economic development. Improvements in the ease of doing business can have several benefits for an economy. A more business-friendly environment attracts domestic and foreign investment, encourages entrepreneurship and stimulates innovation. It also leads to higher productivity, increased competitiveness and sustainable economic growth.

However, achieving a high score on the ease of doing business index requires continuous effort and commitment from governments. Reforms in areas such as regulatory transparency, contract enforcement, property rights protection and tax administration are essential to create a conducive business environment.

2.3. *Technology Infrastructure*

The potential of an economy to attract FDI and spur growth is strongly related to the quality of its technical infrastructure. A well-established technological ecosystem provides a safe and modern setting in which international companies can operate (Shkabatur, Bar-El, & Schwartz, 2022). Low transaction costs made possible by modern communication systems, lightning-fast Internet connections and efficient transportation networks make investment more appealing (Austin, Devin, & Sullivan, 2012). Foreign investment is drawn to Arabian small and medium-sized firms (SMEs) due to their advanced technology which makes them more competitive. Two factors that promote economic progress and efficient technological infrastructure are crucial to attract foreign direct investment (FDI) and facilitate commercial transactions.

The influence of information and communication technology on GDP growth for 18 Arab countries from 1995 to 2013 was examined using panel data analysis, the fixed effects model, random effects and the Hausman test. The results show that technological advancements have a favorable effect on economic development leading to an increase of 0.261 (Hodrab, Maitah, & Smutka, 2016). The potential of an economy to attract foreign direct investment (FDI) and drive growth is closely linked to the quality of its technical infrastructure. A well-developed technological ecosystem provides a secure and modern environment for international companies to operate in. Modern communication systems, fast internet connections and efficient transportation networks reduce transaction costs making investment more attractive (Austin et al., 2012). Arabian small and medium-sized firms (SMEs) are particularly attractive to foreign investors due to their advanced technology which enhances their competitiveness. It is crucial to have a conducive environment that supports economic progress and efficient technological infrastructure to attract FDI and facilitate commercial transactions.

2.4. Other Variables

A key measure of human capital, the human development index (HDI) also offers data on the performance and developmental status of different countries and is one of the additional factors. A high Human Development Index (HDI) which incorporates improvements in health and education with adjusted real income per capita is an indication of a country's capacity to efficiently manage organizational and technical resources to foster economic development (Ramirez, Ranis, & Stewart, 1998). Innovation contributes to economic development. It is a major component of economic development. Several studies have shown that it has a positive impact on enhancing economic performance. According to Solow (1956) external factors drive innovation which drives gradual changes in the economic system. These changes have increased growth and competitiveness through education. In addition, in the business world, information access is critical particularly for small and medium-sized enterprises (SMEs) that depend on the Internet for competitive and market research. Therefore, e-government is essential. Several countries have found that e-government is essential for reducing costs, facilitating online service access for small and medium-sized businesses (SMEs) and attracting foreign direct investment (FDI) by making information easily available.

Furthermore, achieving business friendliness and subsequent economic development depends on a good administration. The development, longevity and functioning of small and medium-sized businesses (SMEs) are

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substantially impacted by the way they are governed. SMEs must employ strong governance systems to ensure long-term success and encourage economic growth. Structures, processes and methods for decision- making, resource distribution and accountability are all part of good governance in SMEs providing operational efficiency and openness. Foreign direct investment (FDI) has had a significant impact on the economic development and global integration of several nations in the contemporary era. This in-depth study promotes economic development, technological progress, innovation, job creation, market expansion and the intricacies of its management and allure. FDI or foreign direct investment is a must-have for every thriving economy. Capital may accelerate economic diversification, industrialization and the enhancement of productive capacity by injecting resources into recipient economies across international boundaries. Foreign direct investment (FDI) enhances domestic companies by providing finance, advanced technology, skilled management and industry-leading practices.

The Human Development Index (HDI) is a key measure of human capital that combines indicators of health, education and income to assess the development status of different countries. A high HDI indicates a country's capacity to efficiently manage resources and foster economic development. According to Ramirez et al. (1998) a high HDI reflects improvements in health and education which are essential for economic progress.

Innovation is crucial for economic development as it drives improvements in economic performance. Solow (1956) suggests that external factors drive innovation leading to gradual changes in the economic system that enhance growth and competitiveness through education.

Access to information is vital for businesses especially for small and medium-sized enterprises (SMEs) that rely on the internet for market research and competitive analysis. E-government has become essential for providing online services to SMEs, saving costs and attracting foreign direct investment (FDI) by providing accessible information.

Achieving business friendliness and economic development requires good governance. SMEs benefit from strong governance systems that ensure long-term success and encourage economic growth. Good governance involves effective decision-making, resource distribution and accountability, enhancing operational efficiency and transparency.

FDI plays a significant role in economic development and global integration. It promotes technological progress, innovation, job creation and market expansion. FDI injects resources into economies, accelerating economic diversification, industrialization and enhancing productive capacity. It also improves local businesses by introducing advanced technology, management skills and industry best practices.

3. LITERATURE REVIEW

According to Elshaiekh, Al-Hijji, Shehata, and Alrashdi (2023) countries that have developed advanced technical infrastructure tend to have more favorable economic environments which attract foreign direct investment. Multinational corporations find simpler to establish stores in areas with advanced electricity, communication, transportation and internet infrastructure. Foreign investors are drawn to a country's outstanding technological infrastructure because it boosts efficiency and production which in turn increases profitability and competitiveness (Mani & Goniewicz, 2023). Foreign direct investment (FDI) is anticipated to increase if a nation's technical infrastructure expands. According to Elshaiekh et al. (2023), a nation's technological infrastructure has a significant impact on foreign direct investment. Businesses and industries flourish when appropriate technical frameworks are in place. Companies seek countries with strong technological infrastructure so that they can run their business efficiently and remain competitive (Li, Rim, & An, 2023). Strong technical infrastructure is necessary for a country to progress. This may boost economic development, innovation and job prospects. According to Chabane, Komljenovic, and Abdul-Nour (2023), a country's technological infrastructure may either help or hurt its ability to thrive and attract international investments. Companies may be hesitant to put money into nations that lack the necessary infrastructure for technology because they fear that it will affect their bottom line. There is a strong correlation between highly developed technical infrastructure and Foreign Direct Investment (FDI).There is a strong correlation between the two.

The integration of a country's technology infrastructure and human resources is essential for its economy to prosper. Today's educational programs rely on improved communication infrastructure including high-speed Internet to prepare students for the global economy. Companies and investors are drawn to countries with high levels of human capital and skilled workers (Dovletmurzaeva, 2023). Conversely, a country's technological

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infrastructure may be propelled by the aspirations and engagement of educated and talented people in technological innovation. According to Zhang and Meng (2023), a positive feedback loop may encourage the growth of both human resources and technology infrastructure. A company's success depends on several factors including people and technology. The care and improvement of technological infrastructure have the potential to increase human capital. Developing and deploying new technical infrastructure may be made easier by competent and well-trained staff which might lead to more innovation and development (Hamidu, Mensah, Issau, & Asafo-Adjei, 2023). Businesses must invest in technical infrastructure and human resources to maintain a competitive edge, boost efficiency and ensure continuous success (Tang & Zhao, 2023). Human capital development and technological infrastructure go hand in hand. Well-developed technological infrastructures and pools of competent workers are potentially helpful to economic growth.

There is a two-way street of influence between the two domains of influence, technical infrastructure and government. According to Grzesiak and Sulich (2023) technological infrastructure has the potential to influence governance by making data-gathering and analysis easier and more transparent. This has the potential to help businesses make better choices, enhance service delivery and use most of their resources. Establishing rules for the creation and execution of technological infrastructure is one way in which governance may affect this sector (Sovacool, 2023). If this is the case, technology can promote ethical and responsible behaviour while also improving the protection of the company's data and intellectual property. Good governance practices have the potential to reduce cybersecurity risks and technological obsolescence. Businesses may reap the benefits of Information technology (IT) infrastructure with a well-organized governance framework in place (Chen, 2023). The administrative team in charge of the organization's IT infrastructure is crucial to its success. Organizations may better manage their technological infrastructure by implementing efficient governance procedures. According to Song et al. (2023) this will help firms achieve their strategic goals and meet the expectations of their stakeholders. Technological infrastructure can improve governance by fostering openness, accountability and teamwork. Businesses can operate more efficiently and successfully if they have access to technology infrastructure that offers resources for improved communication, data management and decision-making. Participating in collecting and analyzing information may increase decision-making transparency and accountability (Hu, Chen, & Lin, 2023). Organizations may be better able to manage risks to their cyber security and the potential for technology obsolescence by implementing policies and processes. Organizations can benefit from good governance by maintaining secure, up-to-date and morally related IT systems for their primary goals.

The relationship between business friendliness, technical infrastructure and GDP development has been the subject of several studies. Since quarterly data demonstrate that the ease of doing business contributes to economic development, empirical research was carried out in Indonesia in 2022 using multiple regression analysis with 10 years of observations (Li et al., 2023).

According to another study carried out in Asian countries, including South, Southern, and East Asia, economic development is aided by commercial ease. Research has shown that having the world's greatest and easiest business climate contributes to economic development. Ani (2015) stated that Singapore has gained a reputation as an exceptionally inventive country.

Additionally, research on the index of ease of doing business using the Fully Modified Ordinary Least Squares (FMOLS) approach showed that ease of doing business had a negative and significant influence on income inequality by 19%. This study included panel data from 16 countries in the Middle East and North Africa (MENA) from 2010 to 2020. Therefore, the country has to improve its infrastructure to foster an environment conducive to business. Additionally, this study shows that GDP and easy access to businesses can reduce income disparity in the MENA region (Mousavi, Samdaliri, Mohammadi, & Ramezanpour, 2022). Quarterly studies of Indonesia in 2022 using multiple regression analysis over a 10-year observation period found that the HDI positively influences GDP growth. According to Nawawi et al. (2022) a 1% rise in the human development index results in a substantial 14.9% boost in economic growth.

A study of panel data for the MENA region from 2000 to 2016 using the panel-corrected standard error technique (PCSE) and six countries found that R&D spending which is frequently used as a substitute for innovation is positively and significantly related to economic growth. The investigation was based on the Cobb-Douglas production function (Omar, 2019).

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Furthermore, empirical research examining the correlation between e-government and GDP growth reveals that e-government enhances GDP by 0.35% using panel data with fixed effects spanning 2003–2010 and 154 countries worldwide (Majeed & Malik, 2017).
According to a GMM applied to industrialized countries from 2002 to 2018, governance has both direct and indirect effects on economic development (Zhuo, Almalki, Muhammad, & Khan, 2021).
Foreign direct investment (FDI) plays a pivotal role in a country's economic climate by developing robust company connections. A study that examined the relationship between FDI and GDP in Eastern Africa from 1980 to 2013 found that FDI has a beneficial impact on economic development. The study employed panel data analysis using the generalized method of moments (GMM) model (Zekarias, 2016).
Consequently, this study has a favorable effect on the expansion of economic variables such as e-government, administration, technological infrastructure, FDI, innovation, human development index and business-friendliness.

4. METHODOLOGY

This study investigates the impact of ease of doing business and technological change on economic growth, including other factors. Balanced secondary data were used in this study. This index started in the Arab World in 2004. The data are extracted from the World Bank, the International Telecommunication Union (ITU) and the United Nations Development Program (UNDP) from 2004 to 2022 for the following countries: Lebanon, Algeria, Oman, Jordan, Saudi Arabia, Tunisia, Qatar, Egypt, Morocco, Iraq, Kuwait, the United Arab Emirates and Mauritania.
The ease of doing business in the Arab World from 2004 to 2022 was the study's time frame for using balanced and secondary panel data.
Reputable organizations such as the World Bank, the International Telecommunication Union (ITU) and the United Nations Development Program (UNDP) provided data.
Previous studies indicate a positive relationship between ease of doing business (EDB) and economic growth, such as a panel for 155 countries over the years 2006-2016 which indicates an insignificant effect of ease of doing business on economic growth. However, hypothetical predicted growth suggests the importance of ease of doing business across groups of countries which suggests the necessity of improving this indicator (Adepoju, 2017).
The econometric approach used in this study is a panel-data model. Every country represents a panel and every year is the time variable. Panel data involve sampling the same cross-sectional units at many periods. The "strongly balanced" strategy guarantees that data for all years is available for all nations. This method has significant advantages compared with standard cross-sectional and time-series data studies (Hsiao, 2007).
The first step is to pool time series and cross-section data which is known as "pooling" and then estimate parameters using ordinary least squares (OLS). Pooled OLS is a linear regression without fixed or random effects in which all coefficients including slopes and intercepts are constants and the error term () is constant across groups and time periods. According to Sayrs (1989) the adherence to the static coefficient model suggests that the link between X and Y is stable across all nations. On the other hand, overlooking country and time-specific features may generate variability in model specifications potentially leading to non-sensical and inconsistent parameter estimations (Hsiao, 2007).
Two basic techniques for dealing with panel data are better suited to handle possible country heterogeneity: the Fixed Effects (FE) and Random Effects (RE) models. These models include mechanisms for accounting for changes in unique characteristics associated with individual nations providing more robust and meaningful parameter estimations than the simple assumptions of pooled OLS.
The Fixed Effects (FE) model is used to exclude not only country-specific effects but also the impact of time-invariant components (Kennedy, 2008). This approach is especially effective for evaluating variables that vary over time and in attempting to determine the link between the predictor and outcome variables within a country. The FE model posits that specific features within a particular nation may impact or skew the predictor or outcome variables necessitating control over these elements. The adoption of the FE model efficiently mitigated the impact of time-constant features allowing for a focused examination of the net effect of predictors on the outcome variable. Each nation has its point of intersection guaranteeing that its error term and constant are unconnected to those of other countries. It is important to emphasize that the FE model might not be the best tool for analysis and could lead to incorrect findings if the error term and constant are linked to those of other countries.

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The fundamental idea behind the Random Effects (RE) model is that the variance across countries is considered random and unrelated to the predictor or independent variables of the model in contrast to the fixed-effects model. The RE model is distinguished by its ability to accommodate time-invariant variables that are absorbed by the intercept in the FE model. This model allows results to be generalized beyond the individual sample under consideration. On the other hand, missing variables caused by the lack of some entity-level properties may cause bias in the model. The use of time-invariant variables is predicated on the premise that a country's error term in the RE model is not consistently related to independent variables (Greene, 2012).

Panel regression models with both fixed and random effects were used for the panel data. The Hausman test is used to assess whether to use the FE or RE model whether the coefficients are consistent across the methods or whether there is a systematic difference. The chi-square probability test is used to detect whether a fixed or random impact exists (Hausman & Taylor, 1981). If the error terms are interrelated, the use of fixed effects may lead to incorrect findings. In such circumstances, it is advisable to create a link using random effects.

4.1. Variables

This study investigates the impact of control variables such as e-government, governance, technology, innovation, foreign direct investment, human capital index and ease of doing business on economic growth which is the gross domestic product.

This study examines the relationship between the independent and dependent variables using the control variable gross domestic product (GDP) which measures economic growth. The following variables were collected from UNDP: e-government, governance, technology, innovation, foreign direct investment net inflows (FDI) and the human capital index (HDI).

The literature review embodied the endogenous theory of growth which is related to variables such as the human development index, foreign direct investment, governance, technology infrastructure and innovation that affect economic growth.

This study investigates how economic growth from either structure occurs using an econometric model that is widely used in different studies on the subject matter. Solow (1956) stated that this model's explanatory variables are based on the determinants of growth. The below model is derived from Mathenge and Nikolaidou (2018).

The proposed model aims to analyze the factors influencing GDP growth in a given country over time. It includes several independent variables, each representing a different aspect of the economy.

Foreign Direct Investment (FDI): This variable represents the inflow of foreign capital into the country which can stimulate economic growth through investments in infrastructure, technology and job creation. A positive coefficient for FDI (β1) would indicate that an increase in foreign direct investment leads to higher GDP growth reflecting the positive impact of foreign capital inflows on the economy.

Innovation: Innovation is a key driver of economic growth as it leads to the development of new products, processes and industries. The variable innovation represents the level of innovation in the country with a positive coefficient (β2) indicating that higher levels of innovation are associated with higher GDP growth.

Government Spending: Government spending can stimulate economic activity and create demand in the economy. The variable GOV represents government spending with a positive coefficient (β3) suggesting that an increase in government spending leads to higher GDP growth.

Technological Infrastructure: Technological infrastructure such as high-speed internet and digital communication networks can improve productivity and efficiency in the economy. The variable technology represents the level of technological infrastructure in the country with a positive coefficient (β4) indicating that better technological infrastructure is associated with higher GDP growth.

Human Development Index: The Human Development Index (HDI) reflects the overall level of human development in a country including factors such as education, health and income. A positive coefficient for HDI (β5) would suggest that higher levels of human development are associated with higher GDP growth.

Ease of Government: The variable ease of government represents the ease of government regulations and bureaucracy with a negative coefficient (β6) indicating that more streamlined government processes are associated with higher GDP growth.

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Ease of Doing Business: Ease of doing business reflects the overall ease of starting and operating a business in a country. A negative coefficient for EDB1 (β7) would suggest that a more business-friendly environment is associated with higher GDP growth.

Model specification:

$$GDP_{it} = \beta_0 + \beta_1 FDI_{it} + \beta_2 INNOV_{it} + \beta_3 GOV_{it} + \beta_4 LNTECH_{it} + \beta_5 HDI_{it} + \beta_6 EGOVL_{it} + \beta_7 EDB1_{it} + \varepsilon t$$

α is the intercept

β_1, β_2, β_3, β_4, β_5, β_6, β_7, and β_8 are the coefficients of the independent variables.

ε is the error term, i is the country and t is the year.

4.2. Descriptive Statistics

Descriptive statistics were used to calculate the mean and standard deviation and to summarize the number of observations (Holcomb, 2016).

Table 1. Descriptive statistics.

Variables	Mean	SD	Min.	Max.
GDP	124	71.446	1	247
LNHDI	-0.317	0.140	-0.721	-0.083
FDI	118.668	70.433	1	241
EDB	55.344	12.953	23.441	85.616
GOV	51.810	40.403	0	200.32
LNEGOV	-0.811	0.473	-4.080	-0.104
LNTECH	4.559	0.630	1.227	5.410
INNOV	497.498	421.158	47.504	1989.5

Table 1 explains the descriptive statistics. It shows that GDP is the dependent variable has the largest mean compared with the other variables. Its mean exceeds its standard deviation by a factor of 124 (71.44695). This shows that there was a concentration of data around the mean. Additionally, every independent variable's mean value was higher than its corresponding standard deviation value suggesting that the data were centered on the mean. The data points appear to be distributed from the mean because only the human development index (HDI) and EGOV show mean values lower than their standard deviation values (-0.316 < 0.14400 and -0.811 < 0.4734) respectively .

In addition, the maximum value for the dependent variable was 247 whereas the minimum value was 1. The maximum value in the independent variables which is innovation is 1989.5 while the minimum value in the independent variables is the human development index (HDI) which is -0.721.

5. RESULTS

The results of the correlation matrix, random and fixed effects and diagnostic tests were as follows:

5.1. Correlation Matrix

The degree of these interactions can be seen by examining the correlation matrix which is used to analyze the association between the independent variables and the dependent variable as well as between the independent variables (Senthilnathan, 2019).

Table 2 explains the correlation matrix. It shows that the dependent variable which is the gross domestic product and the independent factors have a weak, significant negative connection (GDP) specifically, the human development index (HDI) (r = -0.1498). A similar pattern is also shown with technology and ease of doing business which show that a rise in either of these variables is associated with a decrease in GDP (correlation coefficients: -0.2720, -0.1667, and HDI, respectively). However, with a correlation value of 0.1358, the correlation matrix shows a positive, weak and significant association between GDP and foreign direct investment (FDI) indicating that an increase in FDI corresponds to an increase in GDP.

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Table 2. Pearson.

Variables	1	2	3	4	5	6	7	8
GDP	1							
FDI	0.1358*	1						
EDB	-0.1667*	-0.0477	1					
GOV	-0.08670	-0.1630*	0.2869*	1				
INNOV	-0.0712	0.1082	0.4966*	-0.1770*	1			
LNHDI	-0.1498*	-0.1119	0.5509*	0.5115*	0.1999*	1		
LNTECH	-0.2720*	-0.1597*	0.6622*	0.3394*	0.1623*	0.3912*	1	
LNEGOV	-0.1122	-0.1962*	0.4895*	0.2534*	0.4020*	0.5479*	0.3974*	1

Note: *, denotes 0.1% respectively.

There is no strong relationship between the variables when the coefficient of correlation is less than 0.7(see Table 2). The highest correlation is between economic growth and technology where the coefficient of correlation is 0.6622 which indicates that when technology installation increases in the country, economic growth increases. This can be explained by the transformation of most Arab regions that have developed their strategies by implementing digital technology.

5.2. Regression Outcomes

5.2.1. Fixed and Random Effects

The intercept parameter in the fixed-effects model captures individual differences. The random effects model examines heterogeneity across variables which regulates disparities between individuals for all time-invariant data (Ceesay & Moussa, 2022).

Table 3. Fixed effects.

Fixed effects			
Variables	**Coefficient**	**Standard error**	**P-value**
LNHDI	443.466	256.56	0.086
LNEGOV	-55.827	47.943	0.246
FDI	0.060	0.108	0.578
EDB	-2.976	0.878	0.001*
GOV	0.420	0.705	0.553
LNTECH	-24.215	17.049	0.158
INNOV	0.005	0.022	0.811
Constant	452.89	143.710	0.002**

Note: *, ** denote 5% and 0.1% respectively.

Table 3 exhibits the fixed effects model. It indicates that economic growth and ease of doing business have a negative and significant relationship. Economic growth decreased by 2.976 units for every unit increase in the ease of doing business ($p = 0.001 < \alpha = 0.05$).

The model's constant which represents the adjustment rate is negative and significant which means that 452.893 is required for the model to reach equilibrium ($p = 0.001 < \alpha = 0.05$).

Table 4. Random effects.

Variables	Coefficient	Standard error	P-value
LNHDI	-96.473	91.254	0.290
LNEGOV	-30.309	41.776	0.468
FDI	0.183	0.090	0.043*
EDB	-1.609	0.650	0.013*
GOV	0.139	0.162	0.391
LNTECH	2.952	13.303	0.824
INNOV	0.016	0.153	0.285
Constant	109.723	66.678	0.100

Note: * denotes 0.1% respectively.

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Table 4 exhibits the random effects model where the estimation of the random effects model denotes a significant and positive impact of foreign direct investment (FDI) on economic growth (GDP) where an increase in foreign direct investment at 1-point leads to an increase of 0.183 points in economic growth (GDP).
In contrast, there is a negative and significant impact of the ease of doing business (EDB) on economic growth (GDP) where an increase in ease of doing business (EDB) in 1 point leads to a decrease in 1.609 points in economic growth (GDP).

5.2.2. Hausman Test

This test is used to choose between the fixed- and random-effects models where the hypothesis is as follows:
H_0: The appropriate model is the random effect model.
H_1: The appropriate model is the fixed effect model.
The results of the Hausman test are as follows:
Chi2(7) =18.51
Prob>chi2=0.0051
The fixed effects model is the proper model. The null hypothesis is rejected and the alternative hypothesis is accepted as indicated by the Hausman test result in the preceding table which is p-value =0.0051<α=0.05.
Selecting the fixed-effects model indicates that there are specific characteristics connected to the dependent variable. It also indicates that most of the Arab World has interrelated elements that are known as "segmented market economies" owing to the low dynamism of low-to mid-income countries such as cultural, geographic, etc. Economies outside the oil-rich Gulf share several characteristics that distinguish them from many other emerging nations. In addition, many Arab countries share similar conditions which contributes to the explanation of many of their unique development issues, such as the division of labor and business between formal and informal marketplaces because of the limited capacity of governments categorized as underdeveloped economies (Hertog, 2022).

5.2.3. Diagnostics

We used the following method to evaluate the diagnostics: Wooldridge for serial correlation which shows a p-value of 0.4481>α=0.05. Consequently, the alternative hypothesis which states that there is no autocorrelation is rejected and the null hypothesis is accepted (Born & Breitung, 2016).
The heteroskedasticity of the data was tested using the Breusch-Pagan Lagrange multiplier which showed a p-value of 0.044<α=0.05. Consequently, the alternative hypothesis is accepted and the null hypothesis is rejected (Halunga, Orme, & Yamagata, 2017).

6. DISCUSSION AND CONCLUSION

The findings of the econometric model reveal that the fixed-effects model is the one selected. As a result, the endogenous theory of growth states that innovation, technology and human capital are crucial to attain economic growth. However, the ease of doing business has a negative influence on GDP growth and the endogenous theory of growth does not support this because other factors do not have any effect on GDP growth. Therefore, we can infer that GDP growth is impossible to achieve.
Additionally, the assumption that there is a positive relationship between business-friendly policies and GDP growth is not supported by the data. The result obtained suggests a negative relationship which contradicts this finding. Several factors contribute to this, including the fact that businesses face inefficiencies due to insufficient allocation and challenges in acquiring licenses as seen in Lebanon. In addition, the lack of legal safeguards and increased regulatory requirements in the informal sector reduce the positive impact that ease of doing business may have on GDP development. Brain drain is another negative aspect linked to the ease of doing business because of the high rates of immigration among entrepreneurs and qualified workers.
Political instability, regional wars, an unwelcoming investment environment and ineffective state management systems have contributed to a decline in output throughout the Arab world which explains the current situation (Meliantsev & Amirov, 2018). Thus, the impacts of technology, innovation, e-government, FDI and governance reduce the capacity of the Arab world to undergo economic expansion. This may explain why these factors do not contribute to GDP growth.

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Consequently, it is of utmost importance to tackle the technological development issues facing the Arab world as both information and technology are foundational to making knowledge accessible. Stability in government and sound policies are prerequisites for attracting FDI which upgrades the infrastructure and simplifies business processes.

Every Arab country has to adopt nationwide e-government policies and work to improve critical areas such as their political climate, political stability and taxation systems. We need to take these measures to attract FDI and make conducting business easier. Therefore, we cannot rule out the possibility that the Human Development Index has a positive effect on GDP growth but we cannot rule out the possibility that business accessibility has a negative link with GDP growth. The other correlations were not significant (Meliantsev & Amirov, 2018). Finally, the ease of doing business in the Arab world is problematic for a number of reasons including high taxes, poor governance, political instability which discourages FDI, a lack of banking facilities, the immigration of skilled human capital, complicated regulations which can lead to an informal economy and business and the negative effects of ease of doing business.

6.1. Future Research

Delving deeper into a qualitative analysis of regulatory reforms involves exploring the intricacies of regulatory challenges faced by businesses in the Arab world. Researchers could conduct detailed interviews and surveys with a diverse range of stakeholders, including business leaders, policymakers, legal experts and representatives from regulatory bodies. Policymakers can tailor reforms to address these challenges effectively by understanding the specific pain points and obstacles that businesses encounter. Qualitative insights can shed light on the cultural, institutional and procedural aspects influencing the regulatory environment, facilitating the creation of more targeted and context-specific reforms. In-depth case studies should not only focus on identifying successful economic growth models but also thoroughly analyze the contextual factors that contributed to their success. Researchers could explore the historical evolution of business environments in countries that experienced substantial economic growth after implementing reforms. Examining the role of political will, stakeholder collaboration and adaptability to changing global economic trends would provide a holistic understanding. Case studies should also highlight the challenges faced during the implementation of reforms and how they were overcome. This comprehensive analysis can offer actionable insights for other countries in the region seeking to replicate successful growth models.

Researchers could assess the specific projects and initiatives undertaken by governments in the Arab world to elaborate further on the impact of technological infrastructure investment. This includes studying the development of high-speed internet networks, digital payment systems and smart city initiatives in detail. Quantitative metrics such as the increase in internet penetration rates, the adoption of digital technologies by businesses and improvements in overall connectivity can be analyzed. Additionally, qualitative assessments of the societal impact of these technological advancements such as changes in work patterns and access to information can provide a more comprehensive understanding. Evaluating the challenges and successes of these infrastructure investments will aid policymakers in formulating effective strategies for future technological development.

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Not applicable.

TRANSPARENCY

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

COMPETING INTERESTS

The authors declare that they have no competing interests.

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AUTHORS' CONTRIBUTIONS

Both authors contributed equally to the conception and design of the study. Both authors have read and agreed to the published version of the manuscript.

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Appendix A

Table 1. Multicollinearity.

Variable	VIF	1/VIF
Gov	1.94	0.516
LNEGOV	4.94	0.202
LNHDI	3.37	0.296
LNTECH	3.07	0.325
EDB	2.42	0.412
FDI	1.42	0.704
INNOV	1.51	0.663
Mean VIF	2.67	

The Table 1 exibits the multicollinearity, where the mean VIF presents a value 2.67, which is less than 10; this denotes the absence of multicollinarity between the independent variables.

Table 2. Pooled OLS- dependent variable GDP.

Variables	Coefficient	Standard error	P-value
LNHDI	-96.473	91.254	0.292
LNEGOV	-30.309	41.776	0.469
FDI	0.1832	0.090	0.045*
EDB	-1.609	0.650	0.015*
GOV	0.139	0.162	0.392
LNTECH	2.952	13.303	0.825
INNOV	0.016	0.153	0.287
Constant	109.723	66.678	0.102

Note: *, 0.1% respectively.

The Table 2 explains the Ordinary Least Squares estimation (OLS), indicates a positive and significant relationship between foreign direct investment and the economic growth (p-value=0.045<α=0.05).
In addition, there is a negative and significant relationship between the ease of doing business and the economic growth, where p-value is respectively 0.015< α=0.05.

Table 3. Wooldridge test for autocorrelation.

H_0: No first order autocorrelation	
F (1,9)	0.629
Prob>chi2	0.4481

The Table 3 explains the test of autocorrelation, the Wooldridge test indicates that p-value=0.4481>α=0.05; Therefore, the null hypothesis is accepted and the alternative hypothesis is rejected, which means the absence of autocorrelation.

Table 4. Breusch-Pagan Lagrange multiplier.

Variables fitted values: of GDP	
Chi2 (1)	4.04
Prob>chi2	0.044

The Table 4 explains the test of Breusch Pagan, it indicates that p-value=0.044<α=0.05; Therefore, the null hypothesis is rejected and the alternative hypothesis is accepted, which means that the data is heteroskedastic.

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Table 5. Robust.

Variables	Coefficient	Robust std. error	t	p>|z|
LNHDI	443.466	160.281	2.77	0.022*
LNEGOV	-55.827	37.310	-1.50	0.169
FDI	0.060	0.212	0.28	0.783
EDB	-2.976	0.746	-3.99	0.003**
GOV	0.420	0.591	0.71	0.495
LNTECH	-24.215	12.675	-1.91	0.088
INNOV	0.005	0.132	0.41	0.691
Constant	452.893	100.626	4.50	0.001**

Note: *, ** denotes 5% and 0.1% respectively.

The Table 5 exhibits the robust test, after correcting the heteroskedasticity, the corrected model indicates a positive and significant relationship between the logarithm of HDI and the economic growth; when the human development index increases 1 unit, the economic growth increases 443.46 units (p-value=0.022<α=0.05). In contrast, the relationship between the ease of doing business and economic growth is negative and significant. When the ease of doing business increase 1 unit, the economic growth decreases 2.976 units (p-value=0.003<α=0.05).

The constant is the speed of adjustment which is negative and significant, which means that the model needs 452.893 to return to its equilibrium units (p-value=0.001<α=0.05).

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