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Determinants of Human Development in Arab Countries: The Impact of Economic Growth, Capital Formation, Trade Openness, and Political Stability Using Panel Data for the Period 2000–2024

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Abstract. *This study aims to identify the main determinants of human development in a group of Arab countries over the period 2000–2024 by examining the effects of economic growth, gross capital formation, trade openness, and political stability. To achieve this objective, the study employs panel data and applies the Panel ARDL approach using the Pooled Mean Group (PMG) estimator to investigate both short- and long-run relationships among the variables. The results reveal a positive and statistically significant effect of GDP per capita on human development in both the short and long run, with a long-run coefficient of 0.244873. Gross capital formation has a positive and statistically significant effect in the short run, whereas its long-run effect is statistically insignificant. The findings also indicate that political stability has a positive and statistically significant effect on human development in the long run, with a coefficient of 0.535452, while its short-run effect is negative and statistically significant. Trade openness likewise exhibits a positive and statistically significant long-run effect, with a coefficient of 0.175670, whereas its short-run effect is statistically insignificant. The error-correction coefficient, estimated at −0.229904, confirms the existence of a long-run equilibrium relationship, with approximately 22.99% of short-run deviations from equilibrium being corrected within one period. Overall, the findings highlight the importance of economic growth, political stability, and trade openness in promoting human development in Arab countries, while emphasizing the need to direct investment toward areas that contribute to human capital development.*

Keywords: *human development, economic growth, gross capital formation, trade openness, political stability, panel data, panel ardl, pooled mean group (pmg), arab countries*

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Ərəb ölkələrində insan inkişafını müəyyən edən amillər: 2000–2024-cü illər üzrə panel məlumatlarından istifadə etməklə iqtisadi artım, kapital formalaşması, ticarət açıqlığı və siyasi sabitliyin təsiri

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Xülasə. *Bu tədqiqatın məqsədi 2000-2024-cü illər ərzində bir qrup ərəb ölkəsində insan inkişafının əsas determinantlarını iqtisadi artım, ümumi kapital formalaşması, ticarət açıqlığı və siyasi sabitliyin təsirlərini araşdırmaqla müəyyən etməkdir. Bu məqsədə çatmaq üçün tədqiqat panel məlumatlarından istifadə edir və dəyişənlər arasında həm qısa, həm də uzunmüddətli əlaqələri araşdırmaq üçün Birləşdirilmiş Orta Qrup (PMG) qiymətləndiricisindən istifadə edərək Panel ARDL yanaşmasını tətbiq edir. Nəticələr adambaşına düşən ÜDM-in həm qısa, həm də uzunmüddətli dövrdə insan inkişafına müsbət və statistik cəhətdən əhəmiyyətli təsirini göstərir, uzunmüddətli əmsalı 0,244873-dür. Ümumi kapital formalaşması qısa müddətdə müsbət və statistik cəhətdən əhəmiyyətli təsir göstərir, uzunmüddətli təsiri isə statistik cəhətdən əhəmiyyətsizdir. Nəticələr həmçinin göstərir ki, siyasi sabitlik uzunmüddətli dövrdə insan inkişafına müsbət və statistik cəhətdən əhəmiyyətli təsir göstərir, əmsalı isə 0,535452, qısamüddətli təsiri isə mənfi və statistik cəhətdən əhəmiyyətlidir. Ticarət açıqlığı da 0,175670 əmsalı ilə müsbət və statistik cəhətdən əhəmiyyətli uzunmüddətli təsir göstərir, qısamüddətli təsiri isə statistik cəhətdən əhəmiyyətsizdir. −0,229904 olaraq qiymətləndirilən səhv korreksiyası əmsalı, tarazlıqdan qısamüddətli sapmaların təxminən 22,99%-nin bir müddət ərzində düzəldilməsi ilə uzunmüddətli tarazlıq əlaqəsinin mövcudluğunu təsdiqləyir. Ümumilikdə, tapıntılar ərəb ölkələrində insan inkişafının təşviqində iqtisadi artımın, siyasi sabitliyin və ticarət açıqlığının əhəmiyyətini vurğulayır, eyni zamanda insan kapitalının inkişafına töhfə verən sahələrə investisiyaların yönəldilməsinin vacibliyini vurğulayır.*

Açar sözlər: *insan inkişafı, iqtisadi artım, ümumi kapital formalaşması, ticarət açıqlığı, siyasi sabitlik, panel məlumatlar, panel ARDL, birləşdirilmiş orta qrup (PMG), ərəb ölkələri*

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Introduction

Human development is one of the most important concepts that has received increasing attention in contemporary economic thought, as it goes beyond the narrow concept of economic growth to encompass improvements in the quality of human life and the expansion of individuals' capabilities and opportunities across various fields. Accordingly, assessing the level of development in countries is no longer based solely on output and income indicators, but also incorporates fundamental dimensions, including health, education, and standards of living. These dimensions are reflected in the Human Development Index (HDI), developed by the United Nations Development Programme (UNDP) as a more comprehensive tool for measuring human well-being and societal progress (Yin, 2021, pp. 269 –282).

The issue of human development is particularly important in Arab countries, given the considerable disparities in their levels of economic, social, and institutional development, despite sharing many

economic, geographical, and historical characteristics. Over the past decades, the Arab region has experienced significant economic transformations, including varying rates of economic growth (Soussou, 2026, pp. 1–14), developments in investment and capital formation, as well as the increasing integration of many of its economies into international trade. Nevertheless, these developments have not translated into comparable improvements in human development across all countries, raising questions about the nature of the factors that determine human development and the extent to which economic growth, investment, and trade openness can contribute to improving human well-being (Radmehr, 2022, p. 14023).

Economic growth is considered one of the fundamental factors that can contribute to enhancing human development by increasing the resources available to individuals and governments and creating greater opportunities for spending on education, healthcare, infrastructure, and social services (Bloom, 2020, pp. 377–409). However, an increase in gross domestic product does not necessarily lead automatically to improvements in human development, as this depends on how the benefits of growth are distributed, the efficiency of public policies, and the capacity of institutions to direct resources toward sectors that have a direct impact on human well-being (Wu, 2022, p. 2).

Capital formation also represents an important element in the development process because of its role in increasing productive capacity, improving infrastructure, creating employment opportunities, and enhancing productivity. Investments in physical capital can affect human development both directly and indirectly by improving basic services and creating an economic environment that is more capable of generating income and employment opportunities. At the same time (Valiyev, 2024), trade openness has become an important variable in Arab economies, as it enhances countries' integration into the global economy and enables them to expand markets and benefit from flows of goods, services, technology, and investment. However, the impact of trade openness on human development may vary from one country to another depending on the structure of the economy, trade policies, and the capacity of domestic economies to capitalize on the opportunities arising from international integration (Hamdi, 2021, pp. 219–238).

Institutional factors are no less important than economic factors in explaining differences in human development levels, with political stability being one of the most prominent among them. Political stability provides a more favorable environment for investment and economic growth, enables governments to implement long-term public policies, and reduces uncertainty that may adversely affect economic activity, investment, and social services. Conversely, political instability can disrupt economic activity, weaken institutions, and divert resources away from social and productive sectors, thereby negatively affecting the trajectory of human development (Dzihhy, 2023, pp. 349–411).

Against this background, this study seeks to analyze the determinants of human development in a group of Arab countries over the period 2000–2024 by examining the effects of economic growth, capital formation, trade openness, and political stability on the Human Development Index. To achieve this objective, the study employs a panel data methodology, which makes it possible to exploit both the temporal and cross-sectional dimensions of the data and provides an appropriate framework for analyzing differences across countries and changes over time within a unified econometric framework.

The significance of this study lies in its attempt to provide econometric evidence on the nature of the relationship between economic and institutional variables and human development in Arab countries, thereby contributing to a better understanding of the factors most closely associated with improvements in human development. The findings may also provide useful policy implications regarding the importance of achieving more inclusive economic growth, strengthening investment and capital formation, developing trade policies capable of maximizing the social benefits of

openness, and supporting political and institutional stability as a fundamental condition for sustaining the human development process.

Accordingly, the study is centered on the following main research question:
To what extent do economic growth, capital formation, trade openness, and political stability contribute to explaining human development levels in Arab countries over the period 2000–2024?

Research Hypotheses
Based on the research problem formulated above, the following hypotheses can be formulated:

- *First Hypothesis:*
  There is a cointegration relationship between economic growth, capital formation, trade openness, and political stability, and human development in the Arab countries during the period 2000–2024.
- *Second Hypothesis:*
  There are statistically significant effects, both in the short run and in the long run, of economic growth, capital formation, trade openness, and political stability on human development in the Arab countries during the period 2000–2024.

Literature Review
The economic and development literature has addressed the determinants of human development from multiple perspectives, given the multidimensional nature of the Human Development Index (HDI), which combines income, health, and education dimensions. Previous studies have differed in terms of geographical scope, time periods, units of analysis, explanatory variables, and econometric methodologies employed. Nevertheless, they have generally agreed that human development is influenced by an interconnected set of economic, social, health, and institutional factors.

In this context, the (Binder, 2010)study entitled *Determinants of Human Development: Insights from State-Dependent Panel Models* examined the process of economic development in a sample of 84 countries over the period 1970–2005, with particular emphasis on comparing development when measured by Gross Domestic Product (GDP) and when measured by the Human Development Index. The study employed a dynamic panel data model that accounted for both the cross-sectional and temporal characteristics of countries, while also allowing the effects of economic policies to vary according to countries' persistent characteristics, particularly institutions and social norms. The findings showed that macroeconomic policies affect development as measured by GDP over a shorter time horizon compared with their effects on HDI, while their impact on human development emerges over a longer period and is relatively weaker. The study also demonstrated that institutional characteristics can alter the magnitude and direction of the long-run effects of economic policies. The importance of this study lies in its confirmation that human development cannot be explained solely by economic indicators; rather, the institutional environment within which economic policies operate must also be taken into account.

In a different context (Sangaji, 2016)), in the study entitled *The Determinants of Human Development Index in Several Buddhist Countries*, examined the determinants of HDI in eight Asian countries over the period 2010–2014: Japan, Sri Lanka, Thailand, Vietnam, Bhutan, Laos, Cambodia, and Myanmar. The study employed panel data using a Random Effects Model (REM) and examined the effects of GDP per capita, inflation, life expectancy at birth, and the fertility rate. The results indicated statistically significant effects of the explanatory variables on the Human Development Index, confirming the importance of economic, demographic, and health-related factors in explaining differences in human development levels across countries.

Similarly (Abdillah, 2023), in their study entitled *Analysis of Determinants Human Development Index in ASEAN Countries*, investigated the determinants of HDI in 11 ASEAN countries over the period 2018–2021 using panel data regression. The study focused on economic growth, foreign direct investment (FDI), and the unemployment rate. The findings revealed that economic growth and foreign direct investment had positive and statistically significant effects on HDI, whereas the unemployment rate did not have a statistically significant effect. These findings highlight the importance of economic performance and investment in improving human development. The study also recommended strengthening investment and creating employment opportunities in order to contribute to higher output and improved human development levels. This study is particularly relevant to the present research because it directly examines the relationship between economic growth and HDI within a panel data framework.

On the other hand, (Girum, 2018)), in their study entitled *Determinants of Life Expectancy in Low and Medium Human Development Index Countries*, focused on one of the core components of human development, namely life expectancy. The study covered 83 countries with low and medium levels of human development and relied on data from the World Health Organization (WHO), the World Bank, the United Nations Development Programme (UNDP), and UNICEF. The study employed a range of social, economic, and health indicators, as well as morbidity indicators, to explain differences in life expectancy. The results revealed statistically significant relationships between life expectancy and several social, economic, and health factors. Life expectancy was negatively associated with the young-age dependency ratio, fertility rate, and infant mortality rate, while it was positively associated with the Human Development Index, adult literacy rate, and several other indicators. These findings confirm the multidimensional nature of human development and demonstrate that improvements in the health dimension are associated with a broad range of economic, social, and demographic determinants.

In a recent study (Naveed, 2026), in their paper entitled *Human Development Disparities and Their Determinants: Evidence from Household-Level Data*, examined disparities in human development and their determinants at the household level in the Punjab region of Pakistan. The study relied on data from 38,405 households distributed across 36 districts and constructed a composite household-level human development index incorporating dimensions of assets, education, and health. Quantile regression and Ordinary Least Squares (OLS) regression were employed to analyze the effects of a range of economic, social, demographic, and technological factors. The results revealed substantial disparities in human development levels across regions. Education, financial services, the number of employed household members, and quality of life were found to be important factors explaining differences in human development, particularly among households with low HDI levels. The study is particularly distinctive in demonstrating that the magnitude of the effects of human development determinants may vary according to the level of development, with more disadvantaged households potentially responding more strongly to certain economic and social factors.

A comparison of these studies indicates that the existing literature provides substantial evidence of the importance of economic factors in explaining human development. The UNDP (2010) study confirmed that the effects of economic policies on HDI differ from their effects on GDP and that institutions can modify the long-run effects of economic policies. Similarly, Sangaji (2016) demonstrated the importance of income as well as demographic and health factors in explaining HDI. Abdillah et al. (2023) further supported the positive effects of economic growth and foreign direct investment on human development. Meanwhile, Girum et al. (2018) showed that one of the core dimensions of HDI, namely life expectancy, is influenced by a broad range of social, economic, and health factors. Finally, Naveed and Shah (2026) highlighted the importance of education, economic conditions, and access to financial services in explaining disparities in human development at the household level.

Despite the importance of these studies, they also reveal several aspects that require further investigation. On the one hand, some studies have focused on a limited set of economic determinants, such as income or economic growth, whereas others have concentrated on health and demographic determinants or household-level and social factors. On the other hand, the studies reviewed have not directly combined economic growth, capital formation, trade openness, and political stability within a single model to explain the Human Development Index. Furthermore, most of these studies do not specifically focus on Arab countries over a recent and extended period that would allow for an analysis of changes both across countries and over time.

Accordingly, the present study seeks to address this research gap by analyzing the determinants of human development in a group of Arab countries over the period 2000–2024 using panel data and incorporating four key determinants: economic growth, capital formation, trade openness, and political stability. This framework combines economic and institutional determinants within a single analytical model, thereby providing more comprehensive empirical evidence on the factors explaining changes in human development levels in Arab countries while accounting for cross-country differences and variations over time.

Methods

This section presents the empirical methodology adopted to examine the determinants of human development in the selected Arab countries. It describes the data, econometric procedures, and estimation strategy used to investigate both the short-run and long-run relationships among the study variables.

Empirical Analysis

First, the study identifies the data sources and describes the nature of the variables included in the econometric model, along with their descriptive statistical characteristics. Subsequently, cross-sectional dependence tests are conducted to determine whether there is dependence among the cross-sectional units. The results of these tests are then used to identify the appropriate econometric tests to be employed in the subsequent stages of the analysis.

Based on the results of the cross-sectional dependence tests, appropriate unit root tests are selected. In particular, second-generation unit root tests are employed when cross-sectional dependence is detected among the units, in order to determine the order of integration of the study variables and assess their stationarity properties.

After determining the time-series properties and integration orders of the variables, a second-generation cointegration test is conducted to examine whether a long-run equilibrium relationship exists between the Human Development Index and its determinants, namely economic growth, capital formation, trade openness, and political stability.

If the existence of a cointegration relationship among the study variables is confirmed, the Panel ARDL model using the Pooled Mean Group (PMG) estimator is subsequently estimated to assess both short-run and long-run effects. This methodology allows the short-run coefficients and dynamics to differ across the countries under study while imposing homogeneity on the long-run coefficients, making it suitable for analyzing the determinants of human development within a panel-data framework.

Data Sources and Study Sample

The study analyzes the determinants of human development using a balanced panel dataset covering nine Arab countries: Algeria, Egypt, Iraq, Jordan, Morocco, Qatar, Saudi Arabia, Sudan, and Tunisia,

over the period from 2000 to 2024. These countries were selected based on the availability, consistency, and comparability of data related to the study variables across countries and over time. The dataset consists of 9 cross-sectional units (N = 9) and 25 time periods (T = 25), resulting in a total of 225 country-year observations (N × T = 9 × 25 = 225). This structure makes it possible to exploit both the cross-sectional and time-series dimensions of the data in estimating the economic relationships under investigation.

The study variables include the Human Development Index (HDI) as the dependent variable, along with GDP per capita (GDPpc), Gross Capital Formation (GCF), Political Stability (PS), and Trade Openness (TO) as explanatory variables. GDP per capita reflects the level of income and economic well-being, while gross capital formation captures the volume of investment in physical capital and the productive capacity of the economy. Trade openness measures the degree of integration of the countries under study into the global economy, whereas the political stability indicator reflects the institutional and political environment, including the extent of stability and the absence of violence and terrorism. The Human Development Index is used to measure the overall level of human development through its main dimensions related to health, education, and standard of living.

Data on GDP per capita, gross capital formation, and trade openness were obtained from the World Development Indicators (WDI) database of the World Bank. Data on political stability and absence of violence/terrorism were obtained from the Worldwide Governance Indicators (WGI) database, also provided by the World Bank. HDI data were obtained from the Human Development Reports and database of the United Nations Development Programme (UNDP). Reliance on these internationally recognized sources ensures a high degree of data consistency, reliability, and cross-country comparability, thereby supporting the validity of the econometric analysis of the relationships between human development and its economic and institutional determinants in the selected Arab countries over the period 2000–2024.

Table1
Research variables

Variable Name	Symbol	Variable Type	Data Source
Human Development Index	HDI	Dependent Variable	United Nations Development Programme (UNDP) – Human Development Reports
GDP per Capita	GDPpc	Independent Variable	World Bank – World Development Indicators (WDI)
Gross Capital Formation	GCF	Independent Variable	World Bank – World Development Indicators (WDI)
Political Stability	PS	Independent Variable	World Bank – Worldwide Governance Indicators (WGI)
Trade Openness	TO	Independent Variable	World Bank – World Development Indicators (WDI)

Source. Prepared by the researcher.

Descriptive Statistics
The descriptive statistics of the study variables, presented in Table (…), based on 225 observations representing nine Arab countries over the period 2000–2024, indicate considerable differences across countries in terms of their economic, developmental, and institutional characteristics. The Human Development Index (HDI) recorded a mean value of approximately 0.6947, with values ranging from 0.424 to 0.882 and a standard deviation of 0.1068. This indicates noticeable differences in the levels of human development among the countries included in the sample.

Regarding GDP per capita (GDPPC), the mean value was approximately 18,119.20, with a minimum of 1,678.979 and a maximum of 73,493.27, while the standard deviation reached 23,897.87. This indicates a high degree of variation in per capita income across the sample countries. As for Trade Openness (TRADE), its mean value was 71.1053%, ranging from 0.7569% to 154.2345%, with a standard deviation of 29.8304. These figures reflect differences in the degree of integration of the Arab economies under study into international trade.

With regard to the Political Stability (POLSTABILITY) index, the mean value was 3.2147, with a minimum of 0.8196 and a maximum of 5.2236, while the standard deviation was 0.9899. This indicates substantial variation in the levels of political and institutional stability across the countries during the study period.

As for Gross Capital Formation (GCF), the mean value reached 1.38×10^{15}, while the median was 2.98×10^{10}. Its values ranged from 1.89×10^{9} to 2.34×10^{16}, with a standard deviation of 5.02×10^{15}. The variable also recorded a skewness coefficient of 3.4592 and a kurtosis coefficient of 13.2162, indicating a high degree of asymmetry and the presence of extreme values in its distribution. This is also reflected in the substantial difference between its mean and median values.

Furthermore, the Jarque–Bera test rejects the null hypothesis of normality for GCF, GDPPC, and HDI, whereas the null hypothesis of normality is not rejected for TRADE and POLSTABILITY at conventional significance levels. These results indicate differences in the distributional characteristics of the variables within the sample, particularly for those variables characterized by a high degree of dispersion and extreme observations.
Overall, the descriptive statistics reveal considerable economic, developmental, and institutional heterogeneity among the Arab countries included in the study. This heterogeneity highlights the importance of employing panel data methodologies, which account for both cross-sectional differences among countries and temporal variations when estimating the economic relationships under investigation.

Table 2
Descriptive statistics of the study variables for the period 2000–2024

Statistic	GCF	GDPPC	HDI	TRADE	POLSTABILITY
Mean	1.38E+15	18,119.20	0.694720	71.10530	3.214698
Median	2.98E+10	4,057.766	0.709000	71.12015	3.394109
Maximum	2.34E+16	73,493.27	0.882000	154.2345	5.223599
Minimum	1.89E+09	1,678.979	0.424000	0.756876	0.819648
Std. Dev.	5.02E+15	23,897.87	0.106786	29.83039	0.989898
Skewness	3.459235	1.273439	-0.473736	-0.150209	-0.103469
Kurtosis	13.21615	2.841929	2.895311	3.349380	2.574510
Jarque-Bera	1,427.203	61.04599	8.518705	1.990474	2.098732
Probability	0.000000	0.000000	0.014131	0.369636	0.350160
Sum	3.11E+17	4,076,819	156.3120	15,998.69	723.3070
Sum Sq. Dev.	5.65E+33	1.28E+11	2.554345	199,326.9	219.4972
Observations	225	225	225	225	225

Source. Author's calculations based on EViews outputs and the study dataset for the period 2000–2024.

Time Trends of the Study Variables:
As shown in the figure below, GCF exhibits a generally increasing trend over the period 2000–2024, rising from approximately 12 billion at the beginning of the period to more than 55 billion by the end

of the period, with particularly noticeable growth during 2004–2014. This development reflects an expansion in the volume of investment and capital formation, which may indicate an improvement in productive capacity and the expansion of infrastructure and economic assets. However, the variable experienced some declines and fluctuations in subsequent years, reflecting the sensitivity of investment to economic fluctuations, domestic conditions, and external shocks.

The GDPpc variable exhibits noticeable fluctuations throughout the study period. It increased from approximately 15,500 at the beginning of the period to more than 20,000 during 2010–2012, before following a gradual downward trend, reaching approximately 17,500 in 2020. Since then, the indicator has experienced a gradual recovery, reaching approximately 18,600 in 2024. This trajectory reflects the sensitivity of GDP per capita to changes in economic activity and various shocks, and indicates that improvements in income levels were not sustained throughout the entire study period. The HDI is characterized by a relatively stable upward trend compared with the other study variables, increasing from approximately 0.63 in 2000 to around 0.73 in 2024. This development indicates a gradual and sustained improvement in human development, encompassing the dimensions of education, health, and standard of living. Moreover, the persistence of the upward trend in the index despite some declines in GDPpc confirms the cumulative nature of human development, which is not necessarily affected immediately by short-term fluctuations in economic performance.

The Political Stability index exhibited a downward trend during most of the study period, declining from approximately 3.6 in 2000 to around 3.0 in the middle of the second decade, before gradually improving to approximately 3.2 in 2024. From an economic perspective, a decline in political stability may increase uncertainty and investment-related risks, potentially affecting investors' decisions and economic activity. Conversely, the gradual improvement in political stability in recent years may contribute to creating a more favorable environment for investment and promoting economic activity and development. The Trade variable shows considerable fluctuations over the period 2000–2024. It increased from approximately 74% in 2000 to more than 85% during the middle of the first decade, before declining significantly, particularly after 2012, reaching approximately 55% in 2020. It then recorded a slight improvement in the subsequent years, reaching approximately 58% in 2024. This trajectory reflects changes in the degree of economic integration into international markets and indicates the influence of domestic and international economic conditions, as well as changes in commodity prices and external demand, on trade activity.

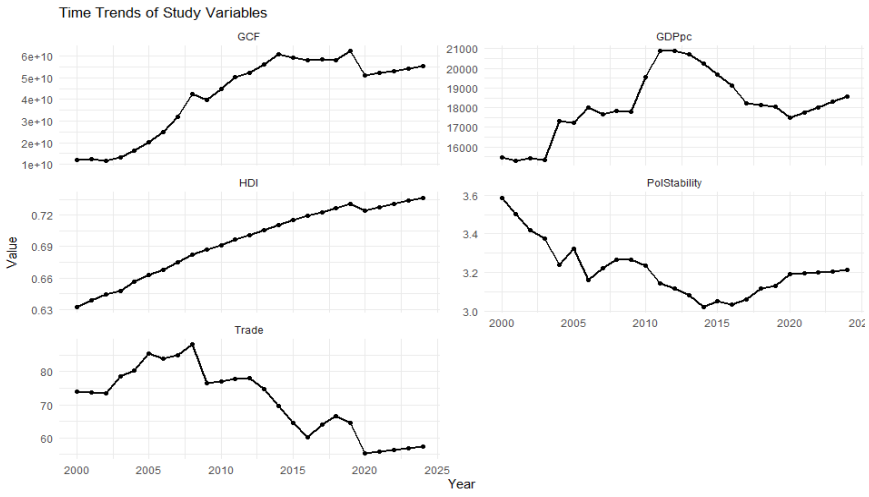


Figure 1
Time trends of the study variables

Source. Author's calculations based on R version 4.6.0.

Temporal Relationships between the Explanatory Variables and Human Development
The figure illustrates the bivariate relationships between the Human Development Index (HDI) and the explanatory variables, namely Gross Capital Formation (GCF), GDP per capita (GDPpc), Political Stability (PolStability), and Trade Openness (Trade). The descriptive results reveal a clear positive relationship between GCF and HDI, whereby higher levels of gross capital formation are associated with improvements in human development. This relationship can be explained by the role of investment in expanding infrastructure, enhancing productive capacity, and improving the provision of basic services.

The relationship between PolStability and HDI also exhibits a positive association, suggesting that improvements in political stability may contribute to creating a more favorable institutional environment for the provision of social services, investment, and human development. Similarly, the relationship between Trade and HDI displays a positive trend, reflecting the potential contribution of trade openness to human development through expanded access to markets, technology transfer, and improved economic efficiency.

In contrast, the relationship between GDPpc and HDI appears to be relatively weak, as there is no clear positive linear trend. This may suggest that increases in per capita income do not necessarily translate directly into comparable improvements in human development, particularly given differences in income distribution and the efficiency of public expenditure across countries.
Overall, these preliminary findings highlight the potential importance of investment, political stability, and trade openness in explaining differences in human development levels. However, it should be emphasized that these relationships are descriptive in nature and do not establish causality. Therefore, their validity and statistical significance need to be further examined using appropriate econometric models and formal statistical tests.

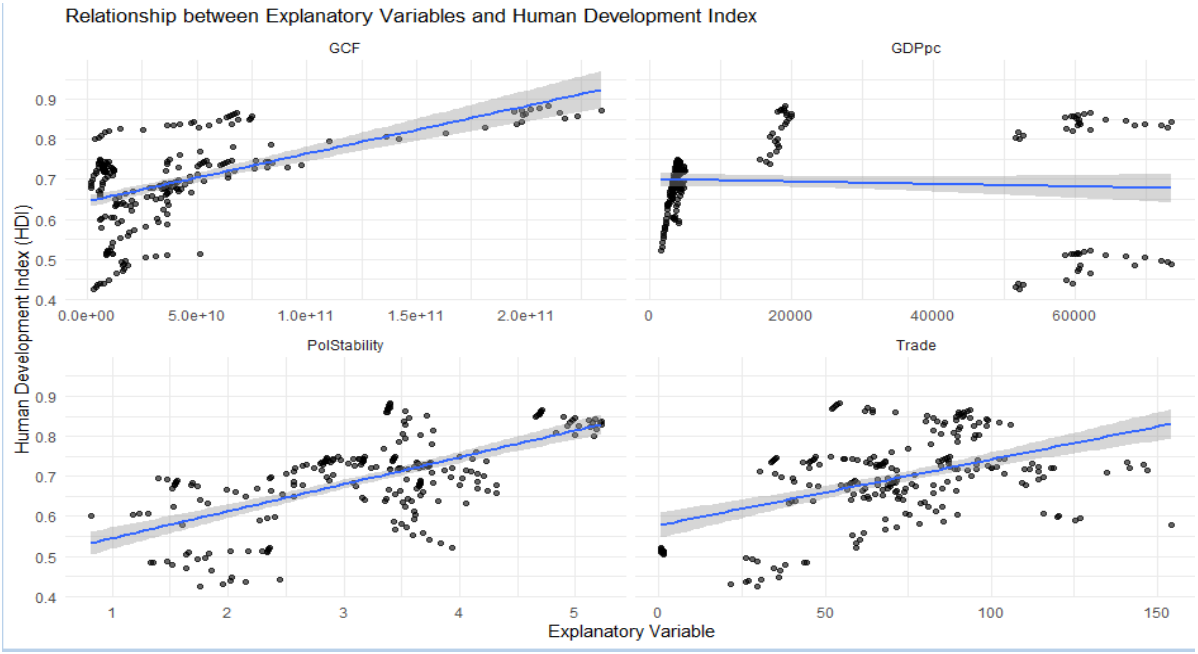


Figure
Relationship between the explanatory variables and the human development index

Source. Author's calculations based on R version 4.6.0.

The correlation matrix

The correlation matrix presented in Figure (X) illustrates the nature and strength of the linear relationships between the Human Development Index (HDI) and the explanatory variables, namely GDP per capita (GDPpc), Gross Capital Formation (GCF), Trade Openness (TRADE), and Political Stability (POLSTABILITY). The results indicate that the strongest correlation with the Human Development Index is observed for political stability, followed by gross capital formation and trade openness, whereas the correlation between HDI and GDP per capita is very weak and close to zero.

Regarding the relationship between HDI and GDPpc, the correlation coefficient is −0.07, indicating a very weak negative correlation that is close to zero. This result suggests the absence of a strong linear relationship between per capita income and human development within the sample. From an economic perspective, this may indicate that increases in per capita income do not necessarily translate into proportional improvements in human development, particularly when countries differ in terms of income distribution, the efficiency of public expenditure, and the extent to which economic resources are converted into improvements in education, health, and living standards.

The correlation coefficient between HDI and GCF is 0.56, indicating a moderate positive relationship. This finding suggests that higher levels of gross capital formation are generally associated with higher levels of human development. Economically, this relationship may be explained by the role of investment in expanding productive capacity and developing physical infrastructure and economic and social services, which can contribute to improving access to education, healthcare, and other basic services, thereby supporting improvements in human development.

The correlation between HDI and TRADE is approximately 0.46, indicating a moderate positive relationship. This result suggests that greater trade openness is associated with higher levels of human development in the sample. Such an association may be explained by the contribution of international trade to market expansion, technology and knowledge transfer, increased access to goods and services, and improvements in economic efficiency, which may ultimately contribute to higher living standards.

The strongest correlation is observed between HDI and POLSTABILITY, with a coefficient of 0.62, indicating a moderately strong positive relationship. This finding suggests that countries characterized by higher levels of political stability tend to exhibit higher levels of human development. From an economic perspective, greater political stability may reduce uncertainty and investment risks, improve the institutional and investment environment, and enhance the continuity and effectiveness of public policies. These conditions may facilitate the allocation of resources toward education, healthcare, infrastructure, and social services, thereby supporting human development.

Overall, the correlation analysis provides preliminary evidence of positive associations between HDI, GCF, TRADE, and POLSTABILITY, while the relationship between HDI and GDPpc appears to be negligible. Nevertheless, these coefficients reflect linear associations only and should not be interpreted as evidence of causality. Moreover, the correlation matrix does not control for country-specific effects, omitted variables, or other sources of heterogeneity. Therefore, the statistical significance and causal direction of these relationships should be assessed through the subsequent panel-data econometric analysis.

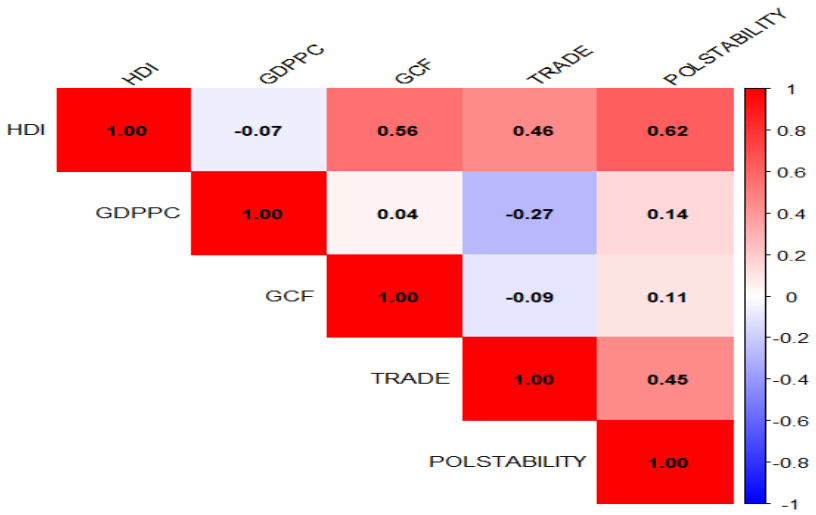


Figure 3

Correlation matrix of the study variables

Source. Author's calculations based on R version 4.6.0.

Results

This section presents the empirical results of the study and discusses the main econometric findings regarding the determinants of human development in the selected Arab countries over the period 2000–2024. The analysis begins with the specification of the econometric model, followed by the relevant diagnostic and estimation tests.

Econometric Model Specification

To examine the determinants of human development in a group of Arab countries over the period 2000–2024, this study employs an econometric model based on panel data. The Human Development Index (HDI) is specified as the dependent variable, while a set of economic and institutional variables are included as explanatory variables, namely economic growth, measured by GDP per capita (GDPpc), gross capital formation (GCF), trade openness (TO), and political stability (PS). To improve the statistical properties of the time-series data and reduce the variance and differences in scale across variables, the natural logarithmic transformation is applied to the positive quantitative variables. This transformation also allows the coefficients of these variables to be interpreted in terms of elasticities. Accordingly, the baseline model of the study is specified as follows:

$$\boldsymbol{lHDI_{i,t}} = \boldsymbol{a} + \boldsymbol{\beta_1 GlDPPC_{i,t}} + \boldsymbol{\beta_2} l\text{GCF}_{\boldsymbol{i,t}} + + \boldsymbol{\beta_3 lTO_{i,t}} + \boldsymbol{\beta_4 lPs_{i,t}} + \boldsymbol{\varepsilon_{i,t}}$$

- ✓ $\boldsymbol{HDI_{i,t}}$: Human Development Index of country (i) in period (t), representing the dependent variable.
- ✓ $\boldsymbol{GDPPC_{i,t}}$: Gross Domestic Product per capita of country (i) in period (t), reflecting the level of income and economic activity per capita.
- ✓ $\mathbf{GCF}_{\boldsymbol{i,t}}$: Gross Fixed Capital Formation of country (i) in period (t), reflecting the level of investment in capital assets and the productive capacity of the economy.
- ✓ $\boldsymbol{TO_{i,t}}$: Trade Openness of country (i) in period (t), measuring the degree of integration of the economy into international trade. It can generally be measured as the ratio of the sum of exports and imports to GDP.
- ✓ $\boldsymbol{Ps_{i,t}}$: Political Stability of country (i) in period (t), reflecting the degree of political stability and the likelihood of political instability or violence.
- ✓ **εit**:Random Error Term.

Cross-Sectional Dependence Test Among the Study Variables

The cross-sectional dependence test aims to determine the extent to which the cross-sectional units in the study sample are independent by examining the possibility of interdependence among countries resulting from common economic and political shocks or developments. The results of the tests indicate the presence of cross-sectional dependence among the countries in the sample for most of the study variables, suggesting that developments in a particular country cannot be considered completely independent of developments in the other countries.

This finding is particularly evident from the results of the Breusch–Pagan LM, Pesaran Scaled LM, and Bias-corrected Scaled LM tests. The p-values were approximately 0.00 for all study variables, leading to the rejection of the null hypothesis of no cross-sectional dependence and supporting the alternative hypothesis of the existence of cross-sectional dependence (Baltagi, 2007).

Regarding the Pesaran CD test, the results were more heterogeneous across the variables. Cross-sectional dependence was not statistically significant for HDI, with a p-value of 0.20, nor for GDPpc at the 5% significance level, with a p-value of 0.06. In contrast, the test revealed statistically significant cross-sectional dependence for GCF, PolStability, and Trade Openness at the 1% significance level. Despite the differences observed in the Pesaran CD results for some variables, the overall evidence, particularly that provided by the first three tests, supports the presence of cross-sectional dependence in the study data.

This finding can be economically explained by the interconnectedness among the economies of the countries included in the sample, particularly through foreign trade, investment and capital flows, regional economic integration, common economic developments, as well as political and institutional shocks. Accordingly, the occurrence of an economic or political shock in one country may transmit its effects, directly or indirectly, to the other countries in the sample. This makes the assumption of complete independence across cross-sectional units less appropriate for the data under consideration. This result also has important methodological implications for the selection of subsequent econometric tests and estimation techniques. The presence of cross-sectional dependence implies that researchers should not rely exclusively on first-generation panel unit root tests, which generally assume cross-sectional independence. Instead, second-generation panel unit root tests should be employed because they account for cross-sectional dependence among countries. After determining the integration order of the variables and ensuring that none of the variables is integrated of order I(2), the analysis can proceed to cointegration testing and the estimation of a Panel ARDL model using the Pooled Mean Group (PMG) approach, which is consistent with the characteristics and structure of the study data.

The following table presents the results of the cross-sectional dependence tests for the study variables.

Table 3

Results of the cross-sectional dependence tests for the study variables

Variable	Breusch–Pagan LM	Pesaran Scaled LM	Bias-Corrected Scaled LM	Pesaran CD
Dependent variable				
LHDI	761.09	85.09	85.26	27.42
	(0.00)	(0.00)	(0.00)	(0.20)
Independent variables				
LGDPpc	387.74	41.45	41.26	17.57
	(0.00)	(0.00)	(0.00)	(0.06)
LGCF	555.89	60.79 (0.00)	60.61	22.66
	(0.00)		(0.00)	(0.00)

LPolStability	153.79 (0.00)	13.88 (0.00)	13.69 (0.00)	2.17 (0.00)
LTrade Openness	286.34 (0.00)	29.50 (0.00)	29.31 (0.00)	12.59 (0.00)

Source. Prepared by the researcher based on the outputs of EViews 13**.**

Estimation of the Dynamic Panel Model in the Short and Long Run
Stationarity of the Time Series and Panel Unit Root Tests
A sound econometric methodology requires the researcher, prior to the estimation process and before investigating the existence of a cointegrating relationship among the study variables, to first verify the stationarity of the time series. The problem of non-stationary time series may lead to spurious regression results, resulting in unreliable or biased estimates and misleading statistical inferences (Banerjee, 2017).

Given the presence of cross-sectional dependence among the countries in the sample, as established by the preceding tests, this study relies on second-generation panel unit root tests, which account for cross-sectional dependence among the cross-sectional units. In particular, the analysis employs the Cross-Sectionally Augmented IPS (CIPS) framework and its associated statistics to determine the order of integration of the study variables (Gengenbach, 2009, pp. 111–145).

The results reported in the following table indicate that the variables are generally non-stationary in levels but become stationary after first differencing. Accordingly, all variables are integrated of order one, I(1). Importantly, none of the variables is integrated of order two, I(2), which satisfies an essential condition for proceeding with the Panel ARDL estimation and the Pooled Mean Group (PMG) approach (Hashem, 2007, p. 22).

Table 4
Results of the second-generation panel unit root tests

Variable	t-bar at Level	t-bar at First Difference	Z[t-bar]	P-value	CIPS at Level	CIPS at First Difference	Decision
LGDP per capita	-2.529	-3.084	-2.496	0.006	-1.772	-3.497	I(1)
LGCF	-1.234	-2.779	-1.514	0.065	-1.548	-4.229	I(1)
LPolitical Stability	-2.356	-3.609	-4.190	0.000	-2.569	-4.438*	I(1)
LTrade Openness	-2.660	-2.989	-2.191	0.014	-2.535	-4.378	I(1)
LHDI	-2.214	-2.545	-0.758	0.224	-1.444	-3.289	I(1)

Source. Prepared by the researcher based on the outputs of R 4.6

The results of the panel unit root tests, using the CIPS and Z [t-bar] tests, indicate that the study variables are non-stationary in levels but become stationary after first differencing. The CIPS test results show that the calculated statistics at level do not exceed the critical values at the conventional significance levels, indicating that the null hypothesis of a unit root cannot be rejected. After first differencing, the CIPS statistics for all variables became more negative than the corresponding critical values, reaching –3.497 for LGDP per capita, –4.229 for LGCF, –4.438 for Political Stability, –4.378 for Trade Openness, and –3.289 for HDI. These results confirm the stationarity of the series after first differencing.

The Z[t-bar] results are generally consistent with these findings, showing a clear improvement in the stationarity of the variables after first differencing. Accordingly, the model variables are classified as integrated of order one, I(1), with no variable being integrated of order two, I(2). This finding has important econometric implications, as it confirms the suitability of the study data for applying the Panel ARDL–PMG methodology, which allows for the estimation of dynamic short and long-run relationships among the variables while allowing short-run dynamics to differ across cross-sectional units and imposing homogeneity on the long-run coefficients.

Cointegration Relationship

After verifying the time-series properties of the study variables, the analysis proceeded to test for the existence of a long-run equilibrium relationship among them using second-generation panel cointegration tests. These tests are particularly important for panel data because they account for cross-sectional dependence among the units under investigation, making them more appropriate in cases where countries or cross-sectional units are affected by common economic shocks.

The Westerlund cointegration test was employed to examine the existence of a long-run cointegrating relationship among the model variables. The null hypothesis of the test assumes that there is no cointegration relationship among the variables. When the p-value is lower than the conventional significance levels (10%, 5%, or 1%), the null hypothesis is rejected in favor of the alternative hypothesis of cointegration. This indicates that, although the study variables may be non-stationary in levels, they move together according to a stable long-run equilibrium relationship.

The results of the Westerlund test indicate mixed evidence across the four test statistics. The Group-alpha (Ga) statistic is statistically significant at the 1% level (p = 0.000), providing evidence in favor of cointegration. In contrast, the Group-t (Gt) and Panel-alpha (Pa) statistics do not reject the null hypothesis of no cointegration, with p-values of 1.000 and 0.999, respectively. The Panel-t (Pt) statistic is significant at the 5% level (p = 0.043), indicating evidence of cointegration at the panel level (Westerlund, 2006).

Overall, the results provide evidence supporting the existence of a long-run cointegrating relationship among the study variables, particularly based on the Group-alpha (Ga) and Panel-t (Pt) statistics. Accordingly, the existence of cointegration justifies proceeding to the estimation of the short- and long-run coefficients using appropriate panel-data techniques, particularly the Panel ARDL–PMG approach, while taking into account the heterogeneous short-run dynamics across countries and the homogeneity of the long-run coefficients.

Table 5

Results of the westerlund cointegration test

Westerlund Test Statistic	*Statistic*	*Z-value*	*P-value*	*Decision*
Group-t (Gt)	-2.961	-1.619	0.043	Cointegration at 5%
Group-alpha (Ga)	-1.106	4.640	1.000	No evidence
Panel-t (Pt)	-11.643	-4.798	0.000	Cointegration at 1%
Panel-alpha (Pa)	-1.159	3.224	0.999	No evidence
Final decision	—	—	—	Evidence of cointegration

Source. Prepared by the researcher based on the outputs of *R 4.6.*

The results of the Westerlund cointegration test indicate the existence of a long-run equilibrium relationship among the model variables. The Group-t (Gt) statistic recorded a value of -2.961, with a p-value of 0.043, which is lower than the 5% significance level. Therefore, the null hypothesis of no cointegration is rejected according to this statistic.

Similarly, the Group-alpha (Ga) statistic recorded a value of -11.643, with a p-value of 0.000, providing strong evidence of cointegration at the 1% significance level. In contrast, the Panel-t (Pt) and Panel-alpha (Pa) statistics were not statistically significant, with p-values of 0.999 and 1.000, respectively. Consequently, the null hypothesis of no cointegration cannot be rejected based on these two statistics.

Despite the differences across the four test statistics, the statistical significance of the Gt and Ga statistics, particularly the significance of the Group-alpha (Ga) statistic at the 1% level, provides empirical evidence supporting the existence of a cointegrating relationship among the model variables. Accordingly, it can be concluded that there is a long-run equilibrium relationship among the variables, thereby justifying the estimation of a Panel ARDL–PMG model to examine the short- and long-run relationships among the variables.

Model Estimation in the Short and Long Run

After establishing the existence of a cointegrating relationship among the study variables, the analysis proceeded to estimate a Panel ARDL model using the Pooled Mean Group (PMG) approach in order to examine the dynamic relationships in both the short and long run. This methodology allows the short-run coefficients to differ across countries while assuming homogeneity in the long-run coefficients, which is consistent with the characteristics of the study data. (Teng, 2020)

Table 6

Results of the panel ARDL–PMG estimation

Dependent Variable: D(LHDI)
Method: ARDL
Date: 09/04/26 Time: 18:17
Sample: 2002 2024
Included observations: 207
Maximum dependent lags: 2 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (2 lags, automatic): LGDPPC LGCF LPOLSTABILITY LTRADE
Fixed regressors: C
Number of models evalulated: 4
Selected Model: ARDL(2, 2, 2, 2, 2)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Long Run Equation				
LGDPPC	0.244873	0.055065	4.446979	0.0000
LGCF	0.001281	0.004870	0.263163	0.7929
LPOLSTABILITY	0.535452	0.243324	2.200572	0.0296
LTRADE	0.175670	0.084351	2.082595	0.0394
Short Run Equation				
COINTEQ01	-0.229904	0.060865	-3.777130	0.0000
D(LHDI(-1))	0.203070	0.072180	2.813522	0.0049
D(LGDPPC)	0.076918	0.027093	2.839026	0.0053
D(LGDPPC(-1))	-0.011640	0.015477	-0.752095	0.4534
D(LGCF)	0.023756	0.003488	6.811927	0.0000
D(LGCF(-1))	-0.002150	0.002344	-0.917357	0.3608
D(LPOLSTABILITY)	-0.111756	0.042793	-2.611075	0.0090
D(LPOLSTABILITY(-1))	-0.016696	0.012065	-1.383774	0.1690
D(LTRADE)	-0.004082	0.011580	-0.352494	0.7251
D(LTRADE(-1))	-0.009604	0.005233	-1.835281	0.0689
C	-0.110020	0.061503	-1.788858	0.0761

Source. Prepared by the researcher based on the outputs of EViews 13.

- *Results of the Panel ARDL–PMG Estimation*

The estimation results of the Panel ARDL model indicate a positive and statistically significant effect of GDP per capita (LGDPPC) on the Human Development Index (LHDI) in the long run. The long-run coefficient is 0.244873, with a p-value of 0.0000, confirming statistical significance at the 1% level. This finding suggests that improvements in economic activity and GDP per capita are

associated with higher levels of human development over the long run. In the short run, the coefficient of the first difference of LGDPPC is approximately 0.076918, with a p-value of 0.0053, indicating a positive and statistically significant effect at the 1% level. In contrast, the first lagged coefficient is negative, at −0.011640, and statistically insignificant (p = 0.4534), suggesting that the positive effect of economic growth on human development is mainly contemporaneous and does not persist significantly through the lagged effect.

- *Effect of Gross Capital Formation (LGCF)*

The results show that Gross Capital Formation (LGCF) has a positive but statistically insignificant effect on the Human Development Index in the long run. The long-run coefficient is 0.001281, with a p-value of 0.7929, which is above the conventional significance levels. Therefore, there is insufficient statistical evidence to establish a long-run effect of gross capital formation on human development within the model. In contrast, LGCF exhibits a highly positive and statistically significant short-run effect, with the coefficient of D(LGCF) = 0.023756 and a p-value of 0.0000, indicating that increases in capital formation contribute to improvements in human development in the short run. However, the first lagged coefficient, D(LGCF(-1)) = −0.002150, is statistically insignificant (p = 0.3608), suggesting that this positive effect does not significantly persist into the subsequent period.

Effect of Political Stability (LPOLSTABILITY)

The estimation results indicate that political stability has a positive and statistically significant effect on human development in the long run. The coefficient of LPOLSTABILITY is approximately 0.535452, with a p-value of 0.0296, making it statistically significant at the 5% level. This finding suggests that improvements in political stability are associated with higher levels of human development over the long run. This relationship may be explained by the fact that a stable political environment contributes to greater institutional efficiency and creates more favorable conditions for the provision of social services and investment in human capital.

In the short run, however, the first difference of political stability has a negative and statistically significant coefficient of −0.111756, with a p-value of 0.0090, whereas the lagged effect is statistically insignificant (p = 0.1690). This divergence between the short- and long-run effects may reflect the dynamic nature of the relationship between political stability and human development.

Effect of Trade Openness (LTRADE)

The results indicate a positive and statistically significant long-run effect of trade openness on the Human Development Index. The coefficient of LTRADE is approximately 0.175670, with a p-value of 0.0394, confirming statistical significance at the 5% level. This finding suggests that greater trade openness can contribute to improved human development over the long run by stimulating economic activity, expanding access to goods, services, and technology, and enhancing economic efficiency.
In the short run, the coefficient of the first difference is −0.004082, with a p-value of 0.7251, indicating that the short-run effect of trade openness is statistically insignificant. The lagged coefficient is −0.009604, with a p-value of 0.0689. Although this coefficient is not statistically significant at the 5% level, it is relatively close to significance at the 10% level. Therefore, the positive effect of trade openness on human development appears to be more evident and stable in the long run than in the short run.

- ✓ *Error-Correction Mechanism and Long-Run Equilibrium*

The error-correction coefficient (COINTEQ01) is −0.229904, with a p-value of 0.0000, indicating a negative and statistically significant coefficient at the 1% level. This result confirms the existence of a long-run equilibrium relationship among the model variables. It also indicates that approximately 22.99% of short-run deviations from the long-run equilibrium are corrected within one period, with

the system gradually returning to its long-run equilibrium path following a short-run shock. Thus, the error-correction coefficient confirms the dynamic nature of the model and its ability to restore equilibrium after temporary short-run disturbances.

Long-Run Results

- ✓ *First, GDP per capita (LGDPPC):*

The coefficient of LGDPPC is approximately 0.244873, positive and statistically significant at the 1% level, with a p-value of 0.0000. This result indicates a positive long-run relationship between per capita income and human development. Since the variables are expressed in logarithmic form, a 1% increase in GDP per capita is associated with an approximately 0.245% increase in the Human Development Index, ceteris paribus.

Second, Gross Capital Formation (LGCF):

The coefficient of LGCF is approximately 0.001281. Although positive, it is statistically insignificant, with a p-value of 0.7929, which is above the 10% significance level. Therefore, the results do not provide sufficient statistical evidence of a long-run effect of gross capital formation on human development in the study sample, despite the positive sign of the coefficient.

- ✓ *Third, Political Stability (LPOLSTABILITY):*

The variable LPOLSTABILITY has a positive and statistically significant effect on human development in the long run, with a coefficient of 0.535452 and a p-value of 0.0296, indicating significance at the 5% level. This implies that a 1% improvement in political stability is associated with an approximately 0.535% increase in the Human Development Index, holding other factors constant. This finding highlights the importance of a stable political environment in promoting human development and improving socioeconomic conditions.

- ✓ *Fourth, Trade Openness (LTRADE):*

The coefficient of LTRADE is approximately 0.175670, positive and statistically significant at the 5% level, with a p-value of 0.0394. This result indicates that a 1% increase in trade openness is associated, on average, with an approximately 0.176% increase in the Human Development Index in the long run, ceteris paribus. This positive relationship may be explained by the fact that greater trade integration can improve access to goods, services, technology, and investment opportunities, thereby contributing positively to human development.

Hypothesis Testing

First: Testing the First Hypothesis

H1: There is a long-run cointegration relationship between human development and its determinants, namely economic growth, gross capital formation, trade openness, and political stability in Arab countries over the period 2000–2024.

To test this hypothesis, the Westerlund cointegration test for panel data was employed. The null hypothesis assumes that there is no cointegration relationship among the variables of the model.

The results show that the Group-t (Gt) statistic is −2.961, with a p-value of 0.043, which is below the 5% significance level. In addition, the Panel-t (Pt) statistic is −11.643, with a p-value of 0.000, indicating statistical significance at the 1% level. Accordingly, the null hypothesis of no cointegration is rejected, providing statistical evidence of the existence of a long-run equilibrium relationship among the variables of the study.

Therefore, the first hypothesis (H1) is accepted, confirming the existence of a long-run cointegration relationship between the Human Development Index and its determinants in the Arab countries under study during the period 2000–2024.

Second: Testing the Second Hypothesis

The second hypothesis states:

H2: Economic growth, gross capital formation, trade openness, and political stability have statistically significant effects on human development in both the short and long run in Arab countries over the period 2000–2024.
To test this hypothesis, the results of the Panel ARDL–PMG estimation were employed by examining the long-run coefficients and short-run dynamics of each explanatory variable.

The long-run results indicate that GDP per capita (LGDPPC) has a positive and statistically significant effect on human development, with a coefficient of 0.244873 and a p-value of 0.0000. Political stability (LPOLSTABILITY) also exhibits a positive and statistically significant effect, with a coefficient of 0.535452 and a p-value of 0.0296. Similarly, trade openness (LTRADE) has a positive and statistically significant effect, with a coefficient of 0.175670 and a p-value of 0.0394. In contrast, gross capital formation (LGCF) has a positive but statistically insignificant effect, with a coefficient of 0.001281 and a p-value of 0.7929.

In the short run, GDP per capita has a positive and statistically significant effect, with the coefficient of D(LGDPPC) equal to approximately 0.076918 and a p-value of 0.0053. Gross capital formation also has a positive and statistically significant effect, with a coefficient of 0.023756 and a p-value of 0.0000. In contrast, political stability has a negative and statistically significant short-run effect, with a coefficient of −0.111756 and a p-value of 0.0090. Trade openness does not exhibit a statistically significant contemporaneous effect in the short run, as D(LTRADE) has a coefficient of −0.004082 and a p-value of 0.7251. However, its lagged effect is relatively close to statistical significance at the 10% level, with a p-value of 0.0689.

Based on these findings, the second hypothesis is partially accepted, since statistically significant effects are found for some determinants of human development in either the short or long run, whereas not all variables exhibit significant effects in both periods. Therefore, the results do not fully support the hypothesis but rather provide partial support, reflecting differences in the nature and magnitude of the effects across the short and long run.

Furthermore, the error-correction coefficient COINTEQ01 = −0.229904, with a p-value of 0.0000, is negative and statistically significant at the 1% level. This confirms the existence of an adjustment mechanism through which short-run deviations are gradually corrected and the system returns toward its long-run equilibrium path. The magnitude of the coefficient indicates that approximately 22.99% of short-run disequilibrium is corrected within each period, reflecting a moderate speed of adjustment toward long-run equilibrium.

Conclusion

- This study aimed to examine the determinants of human development in a group of Arab countries over the period 2000–2024 by investigating the effects of GDP per capita, gross capital formation, trade openness, and political stability using the Panel ARDL approach and the Pooled Mean Group (PMG) estimator. The cointegration test results confirmed the existence of a long-run equilibrium relationship among the study variables, while the estimation results revealed significant differences between short- and long-run effects.
- The findings show that GDP per capita has a positive and statistically significant effect on human development in both the short and long run, highlighting the importance of sustained improvements in income and economic activity for enhancing human well-being. Political stability and trade openness also exert positive and statistically significant effects in the long run, emphasizing the importance of a stable institutional environment and effective integration into international markets. In contrast, gross capital formation has a positive and statistically significant short-run effect, but its long-run effect is statistically insignificant, suggesting that the

developmental contribution of investment depends not only on its volume but also on its efficiency, allocation, and orientation toward human-capital-enhancing sectors.

- These findings indicate that human development in Arab countries cannot be explained by economic growth alone. Rather, it depends on the interaction between economic performance, political and institutional stability, efficient investment, and the ability to transform the benefits of trade openness into broader improvements in living standards. Accordingly, the study recommends adopting sustainable and inclusive growth strategies, directing investment toward education, health, infrastructure, and other sectors that strengthen human capital, while reinforcing institutional stability and improving competitiveness and technology transfer.
- Despite its contribution, the study has several limitations related to the selected country sample, the study period, and the variables included in the empirical model. Future research could address these limitations by incorporating additional determinants such as institutional quality, income inequality, education and health expenditure, foreign direct investment, and digital transformation. Further studies could also account more explicitly for cross-country heterogeneity and investigate potential nonlinear and asymmetric relationships between economic, institutional, and human development indicators.
- Overall, the study demonstrates that achieving sustainable human development in Arab countries requires an integrated development strategy that combines economic growth with political stability, efficient investment, and productive trade openness, ensuring that economic gains are effectively transformed into lasting improvements in human well-being and quality of life.

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