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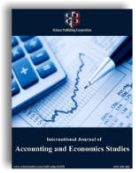

Economic Growth Effects of Health and Education Expenditures: Does Corruption Matter in The MENA Region?

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Abstract

This study analyzes the impact of health and education expenditures on economic growth in the MENA region, focusing particularly on the role of corruption in these outcomes. Using panel data from 2012 to 2023, we assess the impact of public investment in these sectors on GDP under varying levels of corruption. The CPI rankings are used to categorize corruption levels, analyze the impact of differences in these levels, and assess the moderating impact of corruption levels on the effectiveness of health and education spending in promoting GDP growth. Our main findings demonstrate that health and education spending positively impact economic growth ($10.30 billion and $54.25 billion, respectively), but this effect is significantly moderated by the degree of corruption. It shows a much stronger negative impact on education spending ($61.25 billion) than on health ($8.26 billion). While both are affected, the success of education investment is far more sensitive to corruption levels. Additionally, each additional point in the CPI World ranking is associated with a decrease in GDP of $565.44 million. The second level of corruption ($25 \leq CPI \leq 50$) leads to a decrease in GDP of $46.16 billion, while the first level of corruption ($CPI < 25$) leads to a loss of $107.44 billion. These findings can help policymakers to design and implement targeted reforms that improve governance structures and optimize the allocation of public resources through a rigorous combat against corruption.

Keywords: *Corruption CPI Index; Economic Growth; Health and Education Expenditures; MENA Region; Panel Models.*

1. Introduction

Economic growth is a central objective for governments around the world, as it is often associated with social progress, poverty reduction, and improved general well-being. Among the many determinants of economic growth, spending on health and education plays a key role as an investment in human capital. Becker (1994) was among the first to formalize this idea, demonstrating that improving health and education enhances people's skills and productivity, which in turn boosts gross domestic product (GDP).

International organizations corroborate this relationship. The World Health Organization indicates that "emphasizes that investments in health generate substantial economic returns" (WHO, 2019). Empirical studies confirm this positive impact, as was demonstrated by Kaur (2023) and Qehaja et al. (2022) in their respective studies concerning India and the Western Balkans countries. Similarly, education is an essential pillar of economic development. According to the World Bank (2018), "education is one of the best investments a country can make to boost economic growth". In this context, Mukhtarov et al. (2020) found that long-term economic growth is positively and statistically significantly impacted by government spending on education. These findings are reinforced by studies conducted by Gheraia et al. (2021) for Saudi Arabia and Barro & Lee (2013) for developing countries. However, the effectiveness of these investments varies considerably depending on the context. Baldacci et al. (2008) show that the quality of governance and institutions is essential to maximize the benefits of governments' investments in healthcare and education services for their economic development.

In this context, corruption emerges as a key factor likely to alter this dynamic. Defined as "the abuse of power for personal gain, corruption undermines the efficient allocation of resources, reduces the quality of public services and erodes citizens' trust in institutions" (Mauro, 1995; Tanzi & Davoodi, 1998). Corruption in the health and education sectors can exacerbate existing inefficiencies and limit the economic returns expected from such spending.

The relationship between investment in health, education, and economic growth has been explored across various regions, but research specific to the MENA region remains limited. More importantly, existing studies have largely overlooked the moderating role of corruption in this relationship. This research is the first to systematically analyze how different corruption levels influence the effectiveness of public expenditures on health and education in driving economic growth. By investigating this interaction, our study fills a critical gap in the literature, providing empirical insights into the extent to which corruption distorts the expected economic benefits of these investments. Unlike previous works that treat public spending as a direct driver of growth, this study highlights the conditions under which such spending becomes less effective due to institutional corruption.

This study offers a comprehensive theoretical and empirical analysis by quantifying the economic impact of public spending and the monetary losses attributable to corruption. The findings present robust evidence of the profound effects of corruption on public investment and economic growth. Furthermore, by introducing varying corruption levels - Corruption Level-I to Corruption Level-IV, this research provides a novel perspective on how differing levels of corruption influence economic outcomes in distinct ways. The paper contributes significantly to the academic discourse on corruption, public finance, and economic growth by delivering policy-relevant insights. It underscores the critical importance of implementing anti-corruption measures to enhance the efficiency of public spending, particularly in sectors where resource misallocation yields the most severe consequences. Policymakers can use these findings to design and implement targeted reforms that improve governance structures, maximize the developmental impact of public investments in key sectors such as healthcare and education services, and foster sustainable economic development through the effective allocation of public resources through a rigorous combat against corruption.

2. Literature review

2.1. The impact of health and education spending on economic growth

Investments in health and education are widely recognized for their crucial role in enhancing economic growth by improving the quality of human capital and consequently enhancing labor productivity and earnings. According to Noronha et al. (2010), "health expenditure affects economic growth directly through individual earnings, and indirectly, by influencing education levels and physical capital investments". Education impacts economic growth by improving labor productivity and innovation (Nezhnikova, 2020; Ragoobur & Narsoo, 2022).

In this order, some studies have examined, separately or jointly, the impact of health and education expenditures on economic growth, revealing a complex and multifaceted relationship. Most of these studies show a significant positive relationship between these variables. Implementing maintenance strategies based on modern techniques promotes the training of mechanics, operators, and supervisors, enhancing the technical skills of the workforce and driving economic growth. For instance, in OECD countries, higher public investment in health and education is associated with increased economic growth (Bernaldo et al., 2009). Similarly, in Turkey, higher spending on health and education has been linked to positive long-term impacts on economic growth (Eryigit et al., 2012).

Improved health generally contributes to economic growth, as healthier populations tend to be more productive (Penghui, 2022; Qehaja et al., 2022). This connection is supported by evidence showing that better health outcomes lead to higher labor productivity and workforce participation rates (Noronha et al., 2010). Nations that achieve significant health improvements often witness higher growth rates (Jamison et al., 2010). Multiple studies support these findings. Indeed, Atilgan et al. (2017) and Esen & Çelik Keçili (2022) confirm that increased health spending leads to direct and sustained economic growth. Likewise, research focusing on the ECOWAS region demonstrates that health expenditure stimulates growth and productivity (Oche & Mah, 2020). In Turkey, it was found that compulsory health expenditures did not have an asymmetric causal effect on economic growth. This suggests that not all health-related expenditures contribute equally to economic growth (Machová & Kotlán, 2014).

The objective of this project is to promote collective health through occupational therapy. The proposal aims to address the needs of the country based on its income level. Higher levels of education tend to contribute more significantly to GDP in the long term, particularly in higher-income countries (Beraldo et al., 2009; Chaabouni & Mbarek, 2024; Jamison et al., 2010; Monterubbianesi et al., 2021). Education enhances skills and knowledge, which are crucial for economic development (Beraldo et al., 2009; Dhrifi et al., 2021).

In addition, Gheraia et al. (2021) and Mukhtarov et al. (2020) show a significant long-term contribution of education spending to economic growth. Likewise, findings from Bangladesh confirm that per capita education expenditure positively influences GDP in the short and long term (Rahman & Anis, 2023).

However, some studies reveal mixed or limited impacts, influenced by institutional quality, governance, and regional contexts. For instance, in the MENA region, health expenditures did not directly contribute to economic growth in certain cases. In Afro-Mediterranean countries, health spending combined with demographic aging had a negative effect on growth (Ed-dib et al., 2021). Similarly, excessive public health spending beyond a certain threshold can hinder growth, as observed in sub-Saharan Africa (Sirag et al., 2016).

Education expenditures also face challenges in certain regions. In North Macedonia, public spending on education did not contribute to economic growth (Kocevska, 2020). In Indonesia, the impact of education spending on growth was found to be insignificant due to economic and institutional constraints (Suwandaru et al., 2021). Similarly, Villela & Paredes (2022) found no correlation between these variables in Honduras. A study on OECD countries revealed that expenditures on education and health, typically considered productive, might hurt growth when R&D expenditures are excluded. This indicates that the classification of expenditures significantly affects their perceived impact on economic growth (Erdogan & Erdogan, 2023). In the MENA region, government expenditures had a positive impact on economic growth in oil-rich countries but not in non-oil countries in the short run. This highlights that the effectiveness of government spending can vary significantly based on the economic structure of the country (Alshammary et al., 2022).

When considering the combined effect of health and education expenditures, their joint role in enhancing human capital and productivity becomes evident. For example, combined health and education spending has significant long-term effects on economic growth (Khan et al., 2016). A triangular relationship between the three variables has been identified, and these expenditures demonstrate a bidirectional relationship with GDP, highlighting their joint role in enhancing human capital and productivity (Dahal, 2016; Hassan & Kalim, 2012). However, investments may face constraints or become less effective when external economic shocks occur, such as energy and price shocks (El Kadri & El-Khodary, 2025).

Other factors such as governance, inflation control, and private investment also play a role in maximizing the benefits of health and education spending on economic growth (Baldacci et al., 2008; Truong, 2021). Effective management and strategic allocation of resources are essential to ensure that these expenditures translate into tangible economic benefits (Huang et al., 2015).

The extent and type of this impact vary depending on the institutions, the efficiency of public policies, and the regional environment. In certain instances, this effect may be limited or even reversed due to structural or demographic issues. However, the benefits of investing in health and education vary within a triangular relationship between the three variables. Investment in health often has more obvious immediate effects than investment in education, which is necessary for sustained long-term growth (Azeem et al., 2013; Beraldo et al., 2009; Monterubbianesi et al., 2021).

2.2. The direct and indirect impact of corruption on economic growth

Numerous studies have shown that substantial investment in these areas is crucial to boosting economic growth. However, it is crucial to assess how factors such as corruption influence the effectiveness of such spending. In countries with high levels of corruption, the positive impact of health and education spending on economic growth is significantly weakened due to inefficiency and misallocation of resources (De Mendonça and Baca, 2018; Nguyen and Bui, 2022). Indeed, corruption reduces the productivity of public spending, thereby hampering economic growth (Dzhumashev, 2014; Ghosh & Neanidis, 2017).

Moreover, the connection between corruption and an economy's development isn't linearly proportional. At low levels, corruption can even promote growth by simplifying bureaucratic procedures; However, as corruption increases, it becomes detrimental (Méndez & Sepúlveda, 2006; Trabelsi, 2024). This means that while moderate levels of corruption may not significantly hinder the positive impact of health and education spending on economic growth, high levels of corruption can significantly weaken these effects.

Research shows that increased government spending in low-income economies is often associated with increased corruption and rent-seeking, leading to slower economic growth (Dzhumashev, 2014). The interaction between corruption and government spending varies depending on the level of corruption. In highly corrupt environments, government spending tends to be less effective, reducing its positive impact on economic growth (Fiorino et al., 2012; Ibrahim, 2021). Conversely, in environments with better anti-corruption measures, government spending may have a more positive impact on economic growth (Nguyen & Bui, 2022). Moreover, there is a threshold effect: moderate levels of corruption do not significantly hinder economic growth, but above a certain level, its negative impact becomes more pronounced (Nguyen & Bui, 2022; Trabelsi, 2024).

Governance reforms are essential for the economic development of the MENA zone. Key government metrics, such as voice and accountability, government efficiency, and control of corruption, have significant impacts on economic performance (Mehanna et al., 2010). Furthermore, improvements in governance and regulatory quality are essential for the economy's performance in the countries of the MENA group (El-khodary et al., 2025). However, the region continues to face challenges such as corruption and inefficient governance, which hinder sustainable growth (Kandil, 2009). The allocation of government spending matters as well: investments in education, health, and social services generally have a positive effect on economic growth (Gunarto et al., 2018).

Effective governance and anti-corruption measures are essential for maximizing the positive impact of health and education expenditures on economic growth. Policies aimed at reducing corruption -such as improving transparency and accountability- are crucial (Dzhumashev, 2014; Nurjannah et al., 2023). Sector-specific strategies may also be necessary to ensure that mandatory minimum expenditures on health and education mitigate some negative effects of corruption (Caldas et al., 2016; Galvis-Ciro & Hincapié-Vélez, 2022). Furthermore, higher wages for public officials and improved political accountability can help reduce corruption levels and enhance economic growth (Méndez & Sepúlveda, 2006; Trabelsi, 2024).

In conclusion, while moderate levels of corruption might not severely impact economic growth, high levels can significantly undermine the effectiveness of public spending in the areas of health and education, which can negatively impact their effect on economic growth. Put differently, a significant degree of corruption may negatively affect the connection between economic growth and education and health expenditures.

3. Methodology

3.1. Study description

Using panel data that extends the period between 2012 and 2023, the empirical analysis will give a better understanding of the mechanisms underlying these intricate relationships by quantifying the impact of health and education expenditures on economic growth in MENA countries and evaluating the moderating role of corruption on this relationship.

The data is collected from the "World Bank Development Indicators", the "World Health Organization Statistics", and the "Transparency International Corruption Reports".

This approach makes it possible to analyze how investments in health and education influence economic performance, while assessing the moderating impact of corruption on these relationships.

Table 1: Variables' Description

Variable	Title	Description	Unit
GDP	GDP	GDP represents the total economic output of a country.	USD
Education Expenditures	Public education expenditures	Measure the government's financial commitment to education relative to the overall economy.	% of GDP
Health Expenditures	Current health expenditure	Current health expenditure reflects the government and private sector's total spending on health care services and goods relative to the country's economic output.	% of GDP
CPI Rank	Corruption Perception Index Rank	The Corruption Perceptions Index (CPI) measures the perception of corruption in the public sector. The ranking is usually expressed on a scale from 1 (very corrupt) to 180 (very little corrupt).	Rank (1 to 180)
CPI Score	Corruption Perception Index Score	The CPI score is a rating given to each country on a scale from 0 to 100. This score is based on surveys and expert assessments of public sector corruption.	Score (0 to 100)
Corruption	Corruption Indicator	Variable to discover whether corruption is present or absent (1,0). Countries with a CPI score above the world median (40) are considered corrupt (1).	Binary (0, 1)
Corruption Level	Corruption Level	Corruption levels are based on CPI scores as follows: level IV representing a very low or no corruption (CPI > 75), level III representing low corruption (CPI 50-75), level II representing moderate corruption (CPI 25-50), and level I associated with high corruption (CPI < 25).	Level (I, II, III, IV)

3.2. Model specification

Analyzing the nexus between education and health expenditures, economic growth, and corruption in the MENA region involves a multi-faceted approach that considers the intricate interactions among these variables. Our study focuses on how health and education expenditures, along with levels of corruption, impact economic growth across various countries within the countries of MENA group.
This study employs econometric techniques tailored for panel data analysis. This method is particularly effective in handling datasets characterized by two dimensions (Kadri et al., 2024): a temporal dimension, covering the years from 2012 to 2023, and a cross-sectional dimension, encompassing multiple countries in the MENA region. By utilizing panel data, we can analyze how public spending on education and health influences economic growth and the effect of corruption on this relationship over time while controlling for both country-specific and time-specific effects.
The panel data model enables us to explore the dynamics of GDP in relation to the independent variables, specifically health expenditure, education expenditure, and corruption. The model will be illustrated by the following equation:

Equation 1:

$$GDP_{it} = \alpha i + \beta_1 HealthExpenditure_{it} + \beta_2 EducationExpenditure_{it} + \beta_3 Corruption_{it} + \beta_4 (HealthExpenditure \times Corruption)_{it} + \beta_5 (EducationExpenditure \times Corruption)_{it} + \mu_{it}$$

In equation 1, GDP_{it} represents the GDP of country i at time t_i, while α_i captures the country-specific effects that account for unobserved heterogeneity. The coefficients (β_1, β_2, β_3, β_4, β_5) quantify the relationships between public expenditures, corruption, and GDP, allowing us to determine how each independent variable contributes to economic growth.
In addition to the primary model, we examine the relationship between corruption and GDP through the Corruption Perceptions Index (CPI) ranking and the three defined levels of corruption. These levels are categorized as follows:

$$\text{Corruption Level} \begin{cases} \text{Level\_IV} & \text{if CPI Score } > 75 \\ \text{Level\_III} & \text{if } 50 < \text{CPI Score } \leq 75 \\ \text{Level\_II} & \text{if } 25 \leq \text{CPI Score } \leq 50 \\ \text{Level\_I} & \text{ifCPI Score } < 25 \end{cases}$$

The model specification for this analysis is as follows:

Equation 2:

$$GDP_{it} = \beta_0 + \beta_1 \cdot CPI_{Rank_{it}} + \beta_2 \cdot Corruption_{Level_{II_{it}}} + \beta_3 \cdot Corruption_{Level_{I_{it}}} + \epsilon_{it}$$

4. Results

4.1. Descriptive analysis

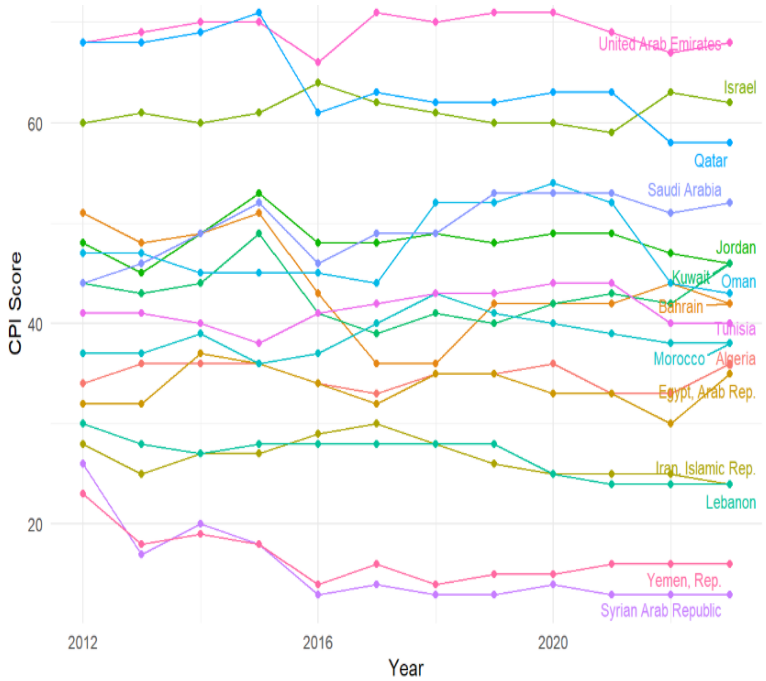

Fig. 1: CPI Score by Country over Time.

Figure 1 shows the evolution of CPI scores for each country over time. The frequency band of the CPI scale is 0 to 100. A score of 0 indicates a very high level of corruption, while a score of 100 reflects no corruption.

The United Arab Emirates and Israel exhibit high scores, indicating low perceived corruption, while Syria and Yemen are at the bottom of the ranking, reflecting very high corruption. Countries with intermediate scores, such as Jordan and Morocco, have moderate corruption, with fluctuations over time.

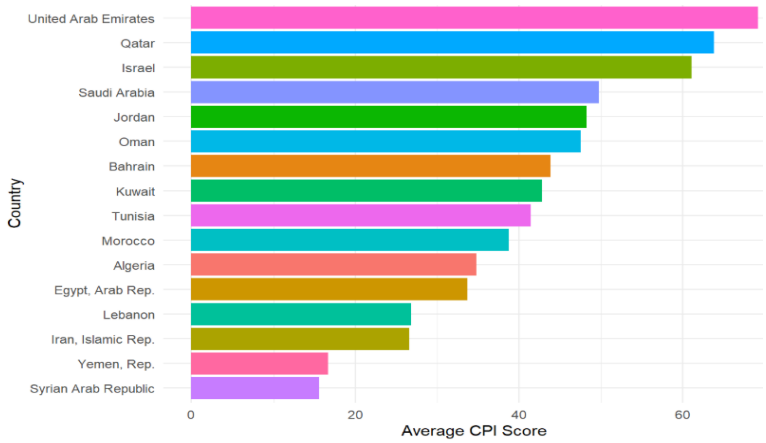

Fig. 2: Average CPI Score in MENA between 2012 and 2023.

Figure 2 illustrates the average Corruption Perception Index (CPI) scores for MENA countries between 2012 and 2023. The United Arab Emirates, Qatar, and Israel exhibit the highest CPI scores, reflecting low levels of perceived corruption and relatively effective governance. Conversely, countries such as Syria, Yemen, and Libya rank at the bottom, indicating governance environments characterized by high levels of corruption.

These results highlight significant disparities across the region, with major implications for the allocation of public resources. Countries with high CPI scores are generally better positioned to use public spending effectively, particularly in education and wellness programs. Conversely, countries with low CPI scores may face substantial challenges in translating public expenditures into economic gains due to poor governance and resource mismanagement.

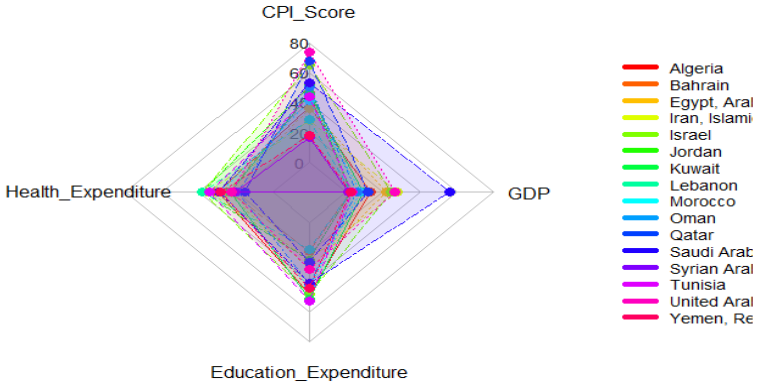

Fig. 3: CPI Score, GDP, Health, and Education Expenditures in MENA Countries.

Figure 3 illustrates Corruption Perception Index (CPI) scores, health spending, education spending, and GDP for MENA countries. There is marked heterogeneity across these countries, highlighting significant differences in governance and economic performance.

Countries with high CPI scores, like Qatar and the United Arab Emirates, are distinguished by strong economic indicators and significant investments in health and education. Conversely, countries such as Yemen and Libya, characterized by low CPI scores, have lower levels of spending in these areas, reflecting a less efficient allocation of public resources.

These findings reveal that corruption plays a key role in the effectiveness of public spending. Indeed, countries with better governance appear to be better at leveraging their investments in health and education to boost economic growth. This analysis supports the central hypothesis of our study, according to which corruption acts as a moderator influencing the impact of public spending on economic growth.

4.2. Statistics and normality results

The summary statistics presented in Table 5 provide key insights into the dataset used for this study, which focuses on the impact of health and education spending on economic growth in the MENA region, with corruption as a moderating factor. The dataset includes data from 16 MENA countries, covering the period from 2012 to 2023. Key variables in the analysis include GDP, health spending, education spending, and the CPI, which plays a crucial role as a moderating variable.

Table 2: Statistics and Normality Results

Indicator	GDP	Health Expenditure	Education Expenditure	CPI Score
Min	8.980061e+09	1.7482215	1.670000e+00	1.300000e+01
Max	1.108571e+12	10.0615444	7.963000e+00	7.100000e+01
Range	1.099591e+12	8.3133229	6.293000e+00	5.800000e+01
Sum	3.945482e+13	790.1400241	4.791599e+02	7.926000e+03
Median	1.384494e+11	5.3961902	3.984180e+00	4.150000e+01
Mean	2.144284e+11	5.4492415	4.354521e+00	4.128125e+01
SE.mean	1.612635e+10	0.1320541	1.785505e-01	1.109499e+00

CI.mean.0.95	3.181747e+10	0.2610149	3.549467e-01	2.188445e+00
Var	4.785086e+22	2.5285524	2.773586e+00	2.363498e+02
std.dev	2.187484e+11	1.5901423	1.665409e+00	1.537367e+01
coef.var	1.020147e+00	0.2918098	3.824551e-01	3.724130e-01
Skewness	1.592950e+00	-0.0531575	3.091219e-01	6.250818e-02
skew.2SE	4.446357e+00	-0.1319985	5.985319e-01	1.781709e-01
Kurtosis	2.542778e+00	-0.5219496	-1.215070e+00	-6.657275e-01
kurt.2SE	3.567299e+00	-0.6522816	-1.188699e+00	-9.535314e-01
normtest.W	8.143667e-01	0.9875651	9.344915e-01	9.738290e-01
normtest.p	4.908470e-14	0.2205654	2.687069e-04	1.159643e-03

The GDP values exhibit a significant range from a minimum of approximately $8.98 billion to a maximum of $1.11 trillion, reflecting substantial economic disparities between the countries. The mean and median values of GDP are $214.4 billion and $138.4 billion, respectively, indicating a skew towards higher GDP values. The high skewness value (1.59) further supports this observation, while the kurtosis (2.54) suggests a distribution with a peak larger than a normal distribution.

In terms of health expenditures, the range spans from $1.75 to $10.06 per capita, with a mean of $5.45 USD. This expenditure distribution shows a slight negative skew (-0.053), suggesting that most countries are clustered around the median value of $5.40, with only a few outliers spending significantly more. The normality test ($W = 0.9876$, $p = 0.221$) indicates that the data for health expenditure is approximately normally distributed.

Similarly, education expenditure ranges from $1.67 to $7.96 per capita, with a mean of $4.35 and a median of $3.98. The positive skewness (0.31) suggests a slight asymmetry with a longer right tail. However, the normality test ($W = 0.934$, $p = 0.00027$) indicates a significant deviation from normality, suggesting that the education expenditure data may not be normally distributed.

In terms of corruption (CPI Score), the values range from 13.0 to 71.0, with a mean of 41.28 and a median of 41.5. The slight positive skewness (0.06) and low kurtosis (-0.67) suggest a symmetric distribution with fewer extreme values. However, the normality test ($W = 0.974$, $p = 0.00116$) indicates that the CPI data is not normally distributed, as the low p-value signifies a significant departure from normality.

The variance and standard deviation values suggest that the data points for each variable have a considerable spread, with GDP showing the highest variability (variance = 4.78×10^{22}, standard deviation = 2.19×10^{11}). The coefficient of variation for GDP (1.02) is quite high, indicating a relatively larger spread in GDP compared to the other variables. In contrast, the CPI score exhibits the lowest coefficient of variation (0.37), suggesting more uniformity in the distribution of corruption scores across countries.

4.3. Correlation analysis

Table 3: Correlation Results

Correlation	GDP	Health Expenditure	Education Expenditure	CPI Score
GDP	1.0000000	0.2447910	0.1985456	0.1256885
Health Expenditure	0.2447910	1.0000000	0.1332679	-0.3316595
Education Expenditure	0.1985456	0.1332679	1.0000000	0.1426553
CPI Score	0.1256885	-0.3316595	0.1426553	1.0000000

Table 3 presents the correlation matrix, which highlights a positive relationship between GDP and health as well as education expenditures. These results indicate that both types of public expenditure contribute to GDP, although the effect of education expenditure is relatively weaker. Furthermore, a positive but weak correlation is observed between GDP and corruption (0.13), suggesting that reduced levels of corruption could slightly stimulate economic growth.

On the other hand, the negative relationship between health expenditure and corruption (-0.33) potentially reflects the impact of corruption on the efficiency of investments in the health sector. Finally, a weak positive relationship is observed with the CPI score, suggesting that lower levels of corruption may encourage investments in education.

4.4. Panel models

To analyze the results of panel data models, it is essential to compare the effects of different explanatory variables on GDP while considering the moderating role of corruption. Using both fixed-effects (within) and random-effects (random) models, the statistical significance of the coefficients of health and education expenditures, as well as their interactions with corruption, should be examined. Special focus should be paid to the effect of corruption on these relationships, as it could reduce the positive impact of education and health investments on economic growth.

Table 4: Impact of Health and Education Expenditures and Corruption On GDP: Fixed and Random Effects Models

		Fixed Models	Random Effects Models
Health Expenditures	coefficient values	1.1701e+10	1.0301e+10
	standard errors	1.5434e+10	1.4175e+10
	p-values	0.451	0.467
Education Expenditures	coefficient values	5.7089e+10	5.4245e+10
	standard errors	1.8337e+10	1.7368e+10
	p-values	0.002	0.001
Corruption	coefficient values	3.3037e+11	3.3235e+11
	standard errors	1.7562e+11	1.6659e+11
	p-values	0.06	0.046
I(Health Expenditure * Corruption)	coefficient values	-4.1276e+09	-8.2582e+09
	standard errors	2.5460e+10	2.4132e+10
	p-values	0.87	0.732
I(Education Expenditure * Corruption)	coefficient values	-6.6538e+10	-6.1254e+10
	standard errors	2.2631e+10	2.1143e+10
	p-values	0.004	0.003
Constant	coefficient values		-1.1083e+11

	standard errors		8.0249e+10
	p-values		0.167
Observations		81	81
	R^2	0.213	0.184
AdjuR-squared		0.046	0.130
F-Statistic		3.569 (df=5;66)	16.932
p-value		0.006	0.004
Fixed effects		TRUE	FALSE
Random effects		FALSE	TRUE

As Table 4 shows, both models yield similar results, with close coefficients for the main variables, indicating that education and health spending positively affect GDP growth, suggesting that public investment stimulates the economy.
Additionally, the results show a positive impact of corruption on GDP, aligning with some studies that interpret this effect because of specific economic dynamics in certain contexts. However, corruption in the education and health sectors negatively affects GDP, with a more pronounced impact in the education sector. This underscores the critical role of corruption in determining the quality and efficiency of educational services, ultimately influencing overall economic performance.

Table 5: Results of the Hausman Test

Test	Chi-sq.	Df	p-value
Hausman Test	1.6805	5	0.8913

To choose between the fixed-effects model and the random-effects model, the Hausman test was used. The results of this test indicate a χ^2 statistic of 1.6805with a p-value of 0.8913. As the p-value is above 5%, we can't reject the null hypothesis that the random-effects model is consistent. Consequently, the random effects model is preferred for this analysis.
The best model shows that public spending on health and education boosts GDP growth by around $10.3 billion and $54.25 billion, respectively. However, the interplay between corruption and these expenditures demonstrates a negative consequence. Corruption has an $8.26 billion negative impact on healthcare costs. This shows that corruption in health-related spending hinders public investment in health, resulting in inefficiency, poor service delivery, and poor health outcomes, all of which hinder economic growth. To ensure that resources are allocated to health.
Similarly, corruption reduces the impact of education spending by an estimated $61.25 billion, emphasizing the serious impact of corruption on education, as it leads to the loss of vital resources that could be used to improve education infrastructure, teacher quality, and student achievement, all of which are vital to long-run economic progress.

Table 6: The Impact of the CPI Ranking and Different Levels of Corruption on GDP

CPI Rank	coefficient values	-5.6544e+08
	standard errors	0.011
	p-values	<0.001
Corruption level II	coefficient values	-4.6157e+10
	standard errors	0.389
	p-values	<0.001
Corruption level I	coefficient values	-1.0743+11
	standard errors	0.629
	p-values	<0.001
Constant	coefficient values	3.0322e+11
	standard errors	1.357
	p-values	<0.001
Observations		184
R^2		0.126
AdjuR-squared		0.111
F Statistic		5.53661e+22
p-values		< 2.22e-16

As shown in Table 6, for every point increase in the CPI ranking, the GDP decreases by about US$565.44 million. This suggests that corruption hinders the efficient use of public resources, especially in sectors such as health and education. This leads to misallocation of resources or inefficient management. For instance, the $565.44 million lost to corruption could have been used to significantly strengthen the public health system and expand the coverage of the quality of education.
When corruption reaches a moderate level (level 2), GDP suffers a loss of approximately $46.16 billion compared to a corruption-free scenario. This huge shortfall could have been invested in critical infrastructure, such as hospitals, health-care improvements, educational facilities, and teacher-training programs. These losses demonstrate that even moderate levels of corruption pose significant risks to investments necessary for long-term development.
Considering level I corruption, the loss of GDP is even more pronounced in the case of high levels of corruption (Level I), amounting to $107.44 billion, which far exceeds the loss in the case of a Level II corruption environment. This huge economic loss could have been invested in transformation initiatives in the health and education sectors, such as national health reforms, ensuring universal access to education, and developing state-of-the-art health and education facilities. Aggravated corruption is a serious economic loss that consumes billions of dollars over time, erodes human capital, and is a key impediment to sustainable economic growth.

5. Discussion

The results of this study revealed the complex connections between health and education spending, corruption, and economic growth in the MENA region. Drawing on empirical data covering the period 2012-2023, several key observations emerge.
First, our study confirms the positive impact of public spending on health and education on economic growth. This corroborates the findings of many previous studies, including Penghui (2022), who showed that health investments directly and indirectly increase GDP in

China, and Faruk et al. (2022), who highlight a similar effect in the MENA region. Similarly, education spending, by strengthening human capital, plays a critical role in economic growth, as demonstrated by Rahman & Anis (2023).

However, this positive relationship is strongly modulated by the level of corruption in the countries studied. Our results indicate that corruption has a significant negative effect on the efficiency of public spending in health and education. For example, interactions show that in countries with low CPI scores (indicating high corruption), the effect of spending on growth is attenuated. This finding is aligned with the work of Delavallade (2006), who also demonstrated that corruption distorts the allocation of resources and limits their positive impact. In other words, even if governments increase their budgets in these sectors, the presence of corruption can reduce the impact of these investments on economic growth.

The study established a significant relationship between different levels of corruption and GDP. The results show that moderate levels of corruption (CPI between 25 and 50) have a negative impact, but less pronounced than high levels of corruption (CPI below 25). This highlights the urgency of improving the transparency and efficiency of governance to maximize the impact of public spending on economic development.

Data analysis also reveals that corruption tends to affect the health and education sectors differently. Our results show that in more corrupt countries, investments in education are often less effective, while health spending can be more easily diverted. This raises questions about the prioritization of public investments and how governments can ensure that resources are used optimally for the well-being of the population. This observation is consistent with the study of Delavallade (2006), who demonstrated that "public corruption distorts the structure of expenditure by reducing the share devoted to social expenditures, such as education and health".

Moreover, this relationship between corruption and public expenditure is not simply linear. As the work of De Mendonça & Baca (2018) indicates, corruption can diminish the positive impact of public spending on economic growth, highlighting the need for effective governance to maximize the benefits of investments. These complex dynamics require careful attention from policymakers, who must design tailored strategies to combat corruption while maximizing the impact of public spending.

Finally, this study highlights the importance of transparent and accountable governance to improve the effectiveness of public spending. MENA countries need to implement institutional reforms to strengthen transparency, promote accountability, and reduce opportunities for corruption. This could include measures such as improving control and audit mechanisms, promoting citizen participation in budget decision-making, and strengthening judicial institutions to combat corruption.

In conclusion, while public spending on health and education is essential to boost economic growth, its effectiveness is seriously compromised by corruption. Policymakers must therefore adopt an integrated approach that combines investments in these sectors with anti-corruption reforms to ensure that public resources are used optimally for economic progress and the population's prosperity. This research paves the way for future studies that could explore practical solutions and specific policies to improve governance and efficiency of public spending in the MENA region and beyond.

6. Conclusion

This study highlighted the impact of public spending on health and education on economic growth in MENA countries, while underlining the crucial moderating role of corruption. The results show that, although increased investment in these sectors can boost GDP, their effectiveness is severely compromised by high levels of corruption.

By reducing the efficiency and transparency of budget allocations, corruption limits the positive impact of public spending on economic well-being. The health and education sectors are affected differently: investments in education appear to be less effective in highly corrupt countries, while health spending is more exposed to misappropriation. These findings underline the urgent need for institutional reforms to maximize the effectiveness of public investment.

To ensure that resources allocated to health and education make a real contribution to economic growth, policy-makers must implement institutional reforms aimed at strengthening transparency, promoting accountability, and combating corruption. Concrete international experiences can serve as inspiration. Singapore applies one of the strictest anti-corruption legal frameworks in the world, with penalties including "imprisonment of up to seven years, fines of up to SGD 100,000, confiscation of illicit benefits under the Corruption, Drug Trafficking and Other Serious Crimes (Confiscation of Benefits) Act 1992, and mandatory payment of a penalty equivalent to the amount of bribes received" (CMS, 2024). The European Union has implemented a rule-of-law conditionality mechanism, suspending funds to member states that fail to meet governance standards. This approach ties budget allocations to performance, granting more funding to ministries or regions that demonstrate high levels of transparency and efficiency (Faruk et al., 2022).

Such examples illustrate that strong legal frameworks and conditionality mechanisms can serve as effective tools for reducing corruption and improving governance. By adopting such an integrated strategy, combining sectoral investments with robust legal sanctions and governance-based budget conditionality, MENA countries can significantly enhance the efficiency of public spending and create an environment conducive to sustainable economic growth.

In short, this research paves the way for future reflections and studies on the best practices and policies to be adopted to strengthen governance and optimize the impact of public spending on the well-being of populations and economic development in the region.

7. Limitations

While this study has provided valuable insights into the impact of corruption and public spending on health and education on economic growth in MENA countries, several limitations must be acknowledged. The analysis is based on data covering the period 2012-2023, which may not capture long-term dynamics or incorporate the specificities of the data, whose quality varies from country to country, thus introducing possible biases. In addition, the use of the Corruption Perceptions Index (CPI) as an indicator, while useful, is based on perceptions that do not always reflect the reality of local corrupt practices. Methodologically, although advanced econometric techniques have been employed, the model may not consider certain important exogenous variables, such as economic crises or conflicts, which also influence the relationships studied. These limitations invite us to consider the results presented here as part of a broader discussion, while highlighting the need for future research to delve deeper into the complex interactions between governance, corruption, and economic growth.

From a methodological perspective, the analysis does not explicitly incorporate key exogenous factors, such as economic crises, armed conflicts, and political instability that frequently characterize the MENA region and may significantly influence both governance quality and the economic outcomes under study. Recognizing these constraints, the findings should be viewed as a contribution to a larger dis-

cussion, with future research encouraged to integrate a broader set of contextual elements when examining the intricate links between governance, corruption, and economic growth.

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