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PAPER

Governance and Health Systems in the MENA Countries: A Panel Causality Framework

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Abstract A substantial body of research has been carried out to analyze the health system's determinants, considering a wide range of variables related to economic performance, monetary policy, telecommunication, and demographic statistics. Nevertheless, little is known about the impact of governance on the health system. This paper aims to overcome this shortcoming and to investigate the causality nexus of the health system and governance in short and the long run, using a panel data set for 14 MENA countries over the period 1996-2019. The proposed methodology is based on calculating a Governance Composite Index (*GCI*) by aggregating several indicators related to good governance. Next, we will try to measure the effects on the health system of selected factors. Finally, a causality analysis is made based on the Engle-Granger two-step approach. Empirical analysis shows that good governance contributes significantly to the health system in the long run but not in the short run. Based on a simulation analysis, we measure the additional rate in the annual growth in good governance that is sufficient to make its short-run effect significant.

Keywords: Governance, health system, composite index, causality.

JEL Classification C58, G3, I18

1. Introduction

The quality of public management in MENA countries has recently been at the heart of many social issues. It conditions the level of economic development and, at the same time, reflects the degree of political and administrative maturity of the elite brought to the helm of the nation's affairs. Therefore, the discourse on the governance theme has enameled political, academic, and even populist debates.

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Over the years, health systems have been in a state of constant flux. Similarly, "the role of ministries of health has changed, progressively shifting from direct provision of health services to overall stewardship of the health sector, including financing and oversight of private providers" (Bigeldi et al., 2020, p.1). Government investment in favor of the health system has allowed coping with certain constraints and significantly improved the population's health status, as evidenced by the decline in infant mortality and the increase in life expectancy at birth. In addition, in terms of health coverage, public and private care provision have developed remarkably, and monitoring of the system through the different profiles of health professionals has gradually improved in quantity and quality.

However, these developments remain inadequate mainly given the ills facing health systems, primarily including the difficulties of accessing care services with regional and urban-rural disparities. Secondly, the inadequate financial and human resources, and thirdly the problem of public hospitals' status, their organization, and management.

According to international institutions (WHO, UNDP), the resolution of these dysfunctions depends on the adoption of the virtues of good governance, which is vital for the health of populations, and that is why major donors and international financial institutions make their aid and loans increasingly conditional upon reforms that ensure good governance.

In this context, abundant literature has been developed to analyze the determinants of a health system, considering a wide range of variables. Particular attention has been devoted to the impact of economic growth, demographic variable, and inflation. Other factors, such as health system input and dependency ratio, are also considered. Nevertheless, little is known about governance behavior's role and impact on health system output.

Indeed, despite its importance, the analysis of the eventual impact of governance is neglected in the literature. To this end, the main goal of this paper is to investigate the causal relationship between health system output and governance using a panel data set for 14 MENA countries over the period 1996-2019. Statistical and econometric methods such as Granger causality and Engle-Granger's two-step approaches will be applied to analyze the existence of eventual effects for the short and the long run. The study we propose is thus important given that it may give policymakers additional alternatives to developing health systems, particularly in MENA countries where governance is susceptible to be relatively higher and may generate better impact. Thus, this paper is organized as follows. Section 2 provides a comprehensive literature review of the previous studies on the health system. In section 3, a description of the proposed methodology will be presented concerning the Governance Composite Index calculation method (*GCI*) and the used econometric methods. Section 4 provides empirical validation using panel data of 14 MENA countries, with exhaustive interpretation, while section 5 concludes the paper.

2. Literature Review

Health system output has gained growing importance in many studies over recent years due to mounting pressures on health care resources. These studies have mainly focused on analyzing the impact of economic health system input factors in order to understand the phenomenon and to contribute to its development. Nevertheless, little is known about the sensitivity of health system output to governance achievements, which may have important implications in practice. This study raises this shortcoming by investigating the causal nexus between health system output and governance. For that, appropriate statistical and econometric methods are applied to calculate a Governance Composite Index (*GCI*) and to analyze the short and the long-run causal relationship.

The importance of good governance for the health of populations has hardly been researched; Klomb and Jacob (2008), for example, have analyzed the role of governance in improving the health of individuals using a cross-sectional analysis for 101 countries over the period 2000-2005. Instead of focusing on one particular indicator of population health like most previous studies, the authors employ 18 and six indicators of government governance. Testing the hypothesis that good governance positively impacts individuals' health, the authors' results show that government governance is not directly related to the health of individuals once economic and demographic control variables are included. Indirectly, however, governance influences health via its positive impact on income and the quality of the health care sector. Using an autoregressive distributed lag with Bounds ARDL cointegration framework for 1984 to 2009, the results of Riayati and Junaidah (2016) for Malaysia show that public health expenditure and corruption affect long and short-run health outcomes.

Zechariah and Ponlapat (2020) examine the effect of governance and health expenditure on infant mortality with panel data of 32 sub-Saharan African (SSA) countries from 2000 to 2015. The evidence from the system generalized method of moment reveals that health expenditure and governance do not directly influence infant mortality. However, the coefficient of the interaction between government effectiveness and health expenditure is significant and shows a negative relationship with infant mortality, implying that the effectiveness of health expenditure may be explained by the administrative capacity of countries in SSA.

3. Health System and Governance: Causality, Short and Long Run Analysis

This section describes our proposed methodology concerning the Governance Composite Index calculation method (*GCI*) and the used econometric methods.

3.1 Data and selected variables

We use for empirical validation annual time series from the World Development Indicators (WDI) database (World Bank) for 14 MENA countries from 1996-2019.

Note that the period has been chosen based on the availability of all data series. Thus, the observed Countries are Yemen, United Arab Emirates, Tunisia, Saudi Arabia, Oman, Morocco, Malta, Lebanon, Kuwait, Jordan, Iran, Bahrain, Algeria, and Egypt.
As dependent variables, infant mortality rate *IMR* and life expectancy at birth *LEB* are respectively measured as the total number of deaths to children under the age of one year for every 1000 live births and the median age at death for a particular population group. At the same time, the primary explanatory variable is governance. The domestic general government health expenditure *DGGHE* (% of general government expenditure) reflects inputs health system, per capita gross domestic product *PCGDP*, mobile cellular subscriptions *MCS* (per 100 people), dependency ratio *DR* and inflation *INF* (consumer prices, annual %) are introduced as control variables.
Note that governance presents more difficulties in its measurement, given that it depends on several multidimensional indicators related to corruption, political stability, regulatory quality, and so on. For that, we propose adopting the "Human Development Index" (United Nations, 2010) to reduce the number of these indicators by aggregating them into a single composite index, i.e., the Governance Composite Index (*GCI)*. All the variables chosen here are thus related to the governance process outcomes, following previous works of the World Bank Institute and OECD.

Thus, classical main broad categories related to governance are included in the Governance composite index as knowing control of corruption, political stability, absence of violence/terrorism, regulatory quality, government effectiveness, the rule of law, and voice and accountability. Finally, six key governance indicators are selected under the constraint of data availability.

All these dimensions are considered good proxies of governance in the literature. Indeed, the government's effectiveness "combines into a single grouping of responses on the quality of public service provision, the quality of the bureaucracy, the competence of civil servants, the independence of the civil service from political pressure and the credibility of the government's commitment to policies. The main focus of this index is on inputs required for the government to be able to produce and implement good policies and deliver public goods" (Kaufmann et al., 2004, p.255). The control of corruption reflects perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as the capture of the state by elites and private interests (Kaufmann, 2010). The political stability and absence of violence/terrorism measure perceptions of the likelihood of political instability and politically motivated violence, including terrorism. The regulatory quality allowed appreciation of the government's ability to formulate and implement sound policies and regulations that permit and promote private sector development. The voice and accountability specify the perceptions of the extent to which a country's citizens can participate in selecting their government, as well as freedom of expression, freedom of association, and free media. The rule of law is also a fundamentally classical indicator of governance.

Thus, let $X_{kit}(k = 1,...,6)$ be a key indicator of governance for country $i(i= 1,...,14)$ at year $t(t=1996, ...,2019)$, the governance composite index for country i at year t is calculated based on the following formula:

$$GCI_{it} = \frac{1}{6}\sum_{k=1}^{6} \frac{X_{kit} - X\min_{ki}}{X\max_{ki} - X\min_{ki}} * 100 \quad (1)$$

Where $Xmin_{ki}$ and $Xmax_{ki}$ are the minimum and the maximum values of the variable k for country i respectively over time. Thus, each variable that enters the index is normalized to be between 0 and 100 whatever the measurement unit.

Note that this aggregation method assumes that all introduced variables have the same direction of importance level, i.e., the bigger the variable value, the better the situation is ($Xmax$ indicates a better situation than $Xmin$). This does not pose any difficulties for our variables because they do not decrease due to the improvement of governance, even if they sometimes take negative values.

3.2 Methodology for causality analysis

The proposed procedure to analyze the causal relationship between governance and health system outputs is mainly based on estimating a Vector Error Correction Model following the Engle-Granger two-step approach. This procedure allows testing the existence of an eventual relationship between variables for the short and the long run. Nevertheless, this procedure needs the running of preliminary tests as knowing the stationarity and cointegration tests. Note that all variables are transformed by taking the natural logarithm for all causality analysis procedures, as commonly recommended with macroeconomic variables.

In order to test the stationarity of variables retained in the model, we propose to use two different tests to summarize the wide range of stationarity test statistics for panel data developed in the literature. The first is the Levin, Lin and Chu (2002) test, which assumes a common unit root process and considers the null hypothesis that panels contain unit roots against the alternative of panels are stationary. While the second is the Im-Pesaran-Shin (2003) test, which allows for individual unit root processes and considers the same null hypothesis as Levin, Lin, and Chu. For the cointegration test, it is common practice if the series have the same order of integration I(1) to use Pedroni's Cointegration (1999, 2004) test.

After running all preliminary tests of stationarity and cointegration, Granger's (1969) causality test may be applied to find an eventual long-run causal relationship between governance and health system outputs. Next, a Vector Error Correction Model may be estimated to analyze the existence of eventual short and long-run causality nexus. Note that these procedures required that all variables should be integrated in the same order I(1). If this condition is not satisfied, an Autoregressive Distributed Lag (ARDL) estimation will be more suitable.

The principle of Granger causality is based on two assumptions: (i) Future cannot cause the past, it is the past and present that causes the future, and (ii) Causal relationship can be detected only between two stochastic variables. Thus, causality in the Granger sense assumes the significance of past effects of two stochastic time series, i.e., given two stationary time series *Y* and *Z, Z* is said to be Granger-caused by *Y* if *Y* helps significantly in the prediction of *Z*.

In our case, we propose to estimate the following models to test the causal relationship between governance and health system outputs in Granger sense. Note that we consider only the direction of causality from governance to health system outputs, i.e., the opposite direction does not have an interpretable meaning.

$$X_{it} = \delta_0 + \sum_{k=1}^{K} \delta_k X_{i(t-k)} + \sum_{j=1}^{J} \alpha_j GCI_{i(t-j)} + \varepsilon_{it};\ i = 1,\ldots,14;\ t = 1996,\ldots,2019 \qquad (2)$$

where *X* represent *IMR* and *LEB* which are the health system outputs variables, *GCI* is the governance composite Index, δ_k and α_j ($k = 1,...,K$ *and* $j = 1,...,J$) are the models' coefficients to be estimated considering *K* and *J* as the maximum lags order of running variables (determined according to the Akaike Information Criterion (AIC)). ε_{it} are the models' errors.

Thus, considering only one direction, from governance to health.

H_0: $\alpha_1 = \alpha_2 = ... = \alpha_J = 0$

H_1: *At least* $\alpha_1 = \alpha_2 = ... = \alpha_J = 0$ (3)

Note that the Granger procedure only tests for long-run causality between two variables. To test the short-run association, Engle and Granger (1987) extended the precedent method to a two-step procedure to simultaneously test the short- and long-term association between variables. The procedure is based on a dynamic system with the characteristic that the deviation of the current state from its long-run relationship will be fed into its short-run dynamics.

Thus, the first step consists of running the traditional Granger causality (1969) test and then estimating a Vector Error Correction Model for each variable as follows:

$$\begin{aligned}\Delta X_{it} = {} & \delta_0 + \sum_{k=1}^{K} \delta_k \Delta X_{i(t-k)} + \sum_{j=1}^{J} \alpha_j \Delta GCI_{i(t-j)} + \sum_{l=1}^{L} \theta_l DGGHE_{i(t-l)} + \sum_{p=1}^{P} \phi_p PCGDP_{i(t-p)} \\ & + \sum_{q=1}^{Q} \gamma_q MCS_{i(t-q)} + \sum_{r=1}^{R} \omega_r DR_{i(t-r)} + \sum_{s=1}^{S} \lambda_s INF_{i(t-s)} + EC_{i(t-1)} + \mu_{it}\end{aligned} \qquad (4)$$

Where Δ is the first difference operator, $\delta_k, \alpha_j, \theta_l, \phi_p, \gamma_q, \omega_r$, and λ_s are the models' estimators with lags level *K,J,P,Q,R* and *S* respectively. *EC* is the lagged error-correction term obtained from the long-run cointegrating causality in Model (2) and μ_{it} are the models' errors. Note that it is possible to investigate the opposite directions of causality. However, in our case, we only focus on the causality direction considering health system outputs as the dependent variable. Thus, the final hypotheses to test the short-run causal relationships from governance to health system outputs are as follows:

$H_0: \alpha_j = 0 \; for \; j = 1,..., J$

$H_0: \alpha_j \neq 0 \; for \; at \; least \; one \; j$ (5)

According to Engle and Granger (1987), the long-run causality effect may be tested according to the significance of the *EC* term in model (4).

4. Results and discussion

The governance composite index *GCI* is calculated following the previously described procedure. Table 1 presents descriptive statistics of the considered governance indicators and the variables that will be used for the causality analysis, which are the governance composite index (*GCI*), the infant mortality rate, the life expectancy at birth, the gross domestic product per capita, the domestic general government health expenditure, the mobile cellular subscriptions, the dependency ratio, and the inflation. Also, Table 1A in the Appendix presents more details on descriptive statistics by countries of the main variables, i.e., health system outputs and governance composite index.

Table 1. Descriptive statistics of used variables for all panels

Variables	Mean	Std. Dev.	Min	Max
Control of corruption	-0.1	0.63	-1.68	1.28
Government effectiveness	-0.004	0.62	-2.28	1.51
Political stability and absence of violence/terrorism	-0.33	0.96	-2.99	1.60
Regulatory quality	-0.06	0.72	-1.72	1.43
Rule of law	-0.023	0.70	-1.79	1.63
Voice and accountability	-0.76	0.68	-1.91	1.37
Governance composite index	51.05	19.31	2.36	100
Infant mortality rate	19.31	13.84	5.69	78.1
Life expectancy at birth	73.62	4.04	59.096	82.6
Domestic general government health expenditure	9.32	3.76	2.01	22.94
Per capita gross domestic product	14160.53	14859.41	631.49	64864.72
Mobile cellular subscription	72.61	57.76	0.012	212.39
Dependency ratio	7.82	5.24	0.796	32.098
Inflation	5.003	6.23	-3.75	39.91

The causal relationships between governance and health system outputs are studied based on panel data. Consequently, as indicated previously, some preliminary tests, such as unit root and cointegration analysis, are required to reveal these relations. Table 2 reports the results of the Levin, Lin, and Chu and the Im-Pesaran-Shin unit root tests, including a trend and a constant. Lags are selected according to the Akaike Information Criteria (AIC). According to the tests' results, each panel has a unit root in the level forms, and this panel becomes stationary as a result of the first difference taking. This indicates that all variables are stationary at I(1) rather than I(0), which is a necessary condition to apply the proposed causality analysis procedure.

Table 2. Unit root test results

Variables	**Level**		**First difference**	
	LLC	**IPS**	**LLC**	**IPS**
Infant mortality rate	-1.23(0.11)	-0.67(0.25)	-4.6[a] (0.0)	-3.27[a] (0.0005)
Life expectancy at birth	3.84(0.99)	-1.35(0.089)	-13.42[a] (0.0)	-14.13[a] (0.0)
Governance composite index	0.55(0.71)	-036(0.36)	-7.29[a] (0.0)	-10.71[a] (0.0)
Domestic general government health expenditure	0.037(0.51)	-0.84(0.20)	-15.82[a] (0.0)	-14.31[a] (0.0)
Per capita gross domestic product	0.005(0.50)	1.99(0.98)	-3.12[a] (0.0)	-3.96[a] (0.0)
Mobile cellular subscription	1.75(0.96)	1.36(0.91)	-4.43[a] (0.0)	-2.73[a] (0.003)
Dependency ratio	3.42(0.99)	-0.74(0.23)	-1.96[a] (0.03)	-5.99[a] (0.0)
Inflation	1.59(0.94)	-0.94(0.18)	-4.006[a](0.0)	-4.89[a] (0.0)

Note: Values between parentheses are the P-values. [a] 99% levels are significant.

Next, the cointegration test is performed using Pedroni's Cointegration test. Results are presented in Table 3, which suggests the rejection of the null hypothesis, indicating that there must be effectively a long-run causal relationship between variables at the 5% level.

Table 3. Pedroni's cointegration test results (IMR as dependent variable)

Statistic Test	Panel	P-Value
V	34.86	0.0000
ADF	-1.93	0.0266

Pedroni's cointegration test results (LEB as dependent variable)

Statistic Test	Panel	P-value
V	-2.05	0.02
ADF	-3.57	0.0002

Also, focusing on the direction of the causal relationship from governance to health system outputs, the Granger causality test is performed to test the existence of long-run causality based on Model (2). The result is presented in Table 4. The Granger causality test suggests rejecting the null hypothesis at the 5% level, indicating that statistically, there is a significant long-run causality running from governance to health system outputs. This result shows the importance of the governance factor in developing health system outputs and thus the importance of giving more consideration to this fact for health system policy design.

Table 4. Granger causality test results: From GCI to IMR

	Z-bar
Statistic	3.8334
P-value	0.0001

Granger causality test results: From GCI to LEB

	Z-bar
Statistic	5.8213
P-value	0.0000

It is also essential to test the existence of eventual short-run causal relation between governance, health system inputs, and health system outputs. For that, a Vector Error Correction Model (*VECM*) is estimated according to the model (4). Results are presented in Table 5.

Table 5. Vector error correction model: Dependent variable ΔIMR

Explicative variables	Coefficient	P-value
EC	-0.136	0.0268
$\Delta GCI(-1)$	0.095	0.5981
$\Delta DGGHE(-1)$	0.312	0.0369
$\Delta PCGDP(-1)$	0.254	0.0456
$\Delta MCS(-1)$	0.053	0.1245
$\Delta DR(-1)$	0.154	0.0952
$\Delta INF(-1)$	-0.068	0.0856
Constant	5.126	0.0037

Vector error correction model: Dependent variable ΔLEB

Explicative variables	Coefficient	P-value
EC	-0.163	0.0315
$\Delta GCI(-1)$	0.142	0.4574
$\Delta DGGHE(-1)$	0.266	0.0852
$\Delta PCGDP(-1)$	0.135	0.0765
$\Delta MCS(-1)$	0.092	0.1186
$\Delta DR(-1)$	0.079	0.1058
$\Delta INF(-1)$	-0.159	0.0943
Constant	4.256	0.0021

Note that the lagged error-correction terms EC is well negative, which is a necessary condition to reach the long-run equilibrium. Note also that the short-run effect is detected according to the significance of the coefficient of the first difference-lagged variable $GCI(\Delta GCI(-1))$. Thus, the result shows that the P-value associated with $\Delta GCI(-1)$ is equal to *0.5981 OR 0.4574*, greater than 5%, indicating that governance did not contribute significantly to the development of health system outputs in the short run.

Accordingly, we deduce that governance is important and contributes significantly to the increase in the health system outputs. Nevertheless, its effect is reached only in the long run, i.e., the growth rate of governance in the observed countries is not enough to contribute to the increase of the growth rate of health system outputs in the short run. It seems thus that there is a need for additional awareness efforts targeting the governance and the conscience degree of individuals to reach a short-run effect.

To this end, an important question arises: what is the additional needed governance growth rate to make its short-run effect on health system outputs significant?

In order to respond to this question, we propose to apply an original procedure based on the simulation technique by generating from 1% to 10% additional annual rate in the *GCI* while keeping all other variables unchanged. Thus, the new series GCI^k with an additional annual growth rate $k(k = 1,...,10)$ for country $i(i = 1,...,14)$ and year $t(t = 1996,...,2019)$ is calculated as follows:

$$GCI_{it}^{k} = (1 + r + k)\,GCI_{i(t-1)} \tag{6}$$

Where r is the observed *GCI* growth rate: $r = (GCI_{it} - GCI_{i(t-1)}) / GCI_{i(t-1)}$. Note that the first observation of *GCI* when $t=1996$ remain the same whatever the value of k i.e.,

$$GCI_{i1996}^{k} = GCI_{i1996} \quad \forall k \tag{7}$$

It is essential also to note that given that variables are transformed in the logarithm form, the interpretation of results will be based on the relative change (growth rate) of variables for analyzing their relationship according to the principle of elasticity.

For each value of *k*, we estimate the model (4) using the new series GCI^k it instead of the observed one. Considering the estimation results, we focus mainly on two indicators. The first is the *EC* coefficient, which indicates the speed of adjustment toward long-run equilibrium, in order to evaluate the effect of the additional simulated annual growth rate on the speed of adjustment in the long run, i.e., the bigger the *EC* coefficient, the faster the adjustment towards long-run equilibrium is.

The second indicator is the P-value of the $\Delta GCI(-1)$ term to analyze the effect of the additional simulated annual growth rate on the significance of the short-run causal relationship from governance to health system outputs. This allows us to determine the additional needed governance growth rate to make its short-run relative effect on health system outputs significant.

Table 6 presents the simulation analysis results. In addition, figure 1 illustrates the evolution of the P-value according to the simulated additional mean growth rate k in the observed governance.

Table 6. Simulation analysis results: Dependent variable ΔIMR

Simulate rate	***EC***	**Δ*GCI***
		P-Value
0%	-0.136	0.5981
1%	-0.116	0.3957
2%	-0.114	0.2768
3%	-0.111	0.1531
4%	-0.113	0.0952
5%	**-0.114**	**0.0496**
6%	-0.115	0.0398
7%	-0.112	0.0258
8%	-0.113	0.0118
9%	-0.113	0.0195
10%	-0.114	0.0133

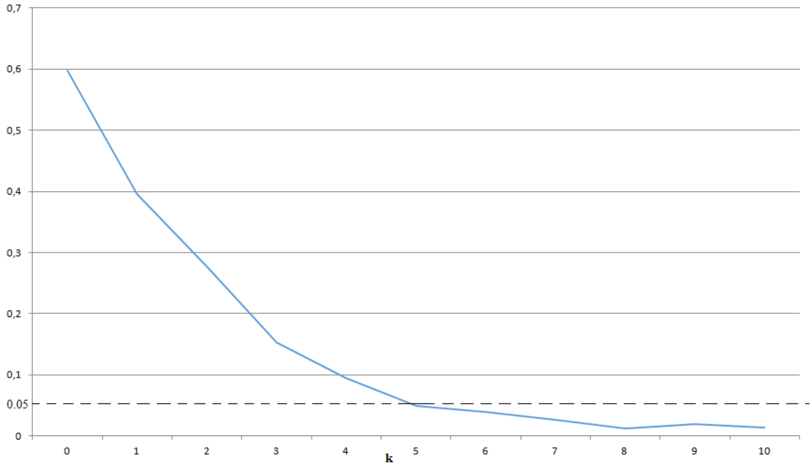
Simulation analysis results**:** Dependent variable ΔLEB

Simulate rate	***EC***	**Δ*GCI***
		P-Value
0%	-0.163	0.4574
1%	-0.137	0.3745
2%	-0.132	0.2259
3%	-0.129	0.1486
4%	**-0.133**	**0.0478**
5%	-0.135	0.0415
6%	-0.136	0.0357
7%	-0.139	0.0268
8%	-0.141	0.0219
9%	-0.138	0.0159
10%	-0.137	0.0112

According to the P-values in Table 6 obtained from the simulation analysis results, we deduce that there is a need for an additional between 4% and 5% annual growth rate in governance (at the 5% level of significance) to make its short-run effect on health system outputs significant. This indicates that extra policies targeting the modernization of governance and the conscience of countries toward health systems will significantly impact the short run.

According to the simulation analysis results, *EC* coefficients in Table 6 indicate that the speed of adjustment towards long-run equilibrium is between 11% and 13% for simulated results, i.e., the effect of additional governance on the long-run equilibrium remains similar. Nevertheless, in the short run, the results are different. Indeed, according to Figure 1, it appears as expected that the slope is decreasing as the P-values should tend to zero with additional governance. Nevertheless, the slope is steeper with the four first additional annual growth rates $k=(1,2,3,4)$, and then the curve seems to become less decreasing. This indicates that it is expected that the impact of the four first additional annual growth in governance will have a more critical impact on health system outputs in the short run than with higher levels of k .

Dependent variable ΔIMR



Dependent variable ΔLEB

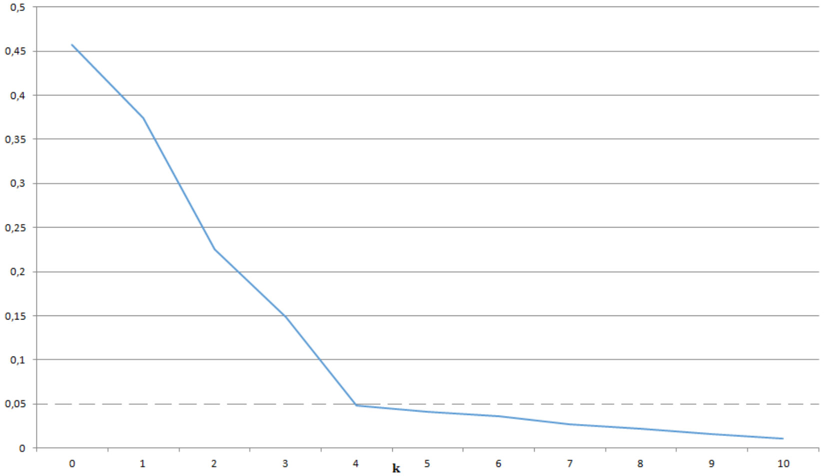


Figure 1. P-values according to the simulated additional mean growth rate k in governance

Finally, if we summarize all our results, we note that the Granger causality test suggests that statistically, there is a significant long-run causality running from governance to health system outputs. This result is important given that it shows the importance of governance and the conscience level of countries in developing the health system, a detail that has been neglected in the literature. Nevertheless, in the short run, the estimated Vector Error Correction Model (VECM) shows that governance did not contribute significantly to developing health system outputs. However, the simulation analysis shows that there is a need for an additional 4% or 5% in governance (at the 5% level of significance) to make its short-run effect on health system outputs significant and reach an optimal impact for the short and the long run. The short effect of the inputs in the health system is positive and significant for developing the outputs in the health system. Control variables contribute differently to the explanation of the outputs health system. The effect of per capita gross domestic product and dependency rate is positive and not always significant contrary to inflation. The mobile cellular subscription participation is not significant.

5. Conclusion

The health system has been studied extensively in relation to different macroeconomic variables, with little regard for the eventual contribution of governance. Consequently, little is known about the role and the impact of the degree of conscience and governance on the health system outputs. In this paper, we attempted to overcome this shortcoming by investigating the impact of governance on health system outputs for the short and the long run using panel data of 14 MENA countries observed between 1996 and 2019. In this context, a governance composite index *GCI* has been calculated based on the aggregation of six-governance well-being: control of corruption, government effectiveness, political stability and absence of violence/terrorism, regulatory quality, the rule of law, and voice and accountability. In order to test the short and long-run causal relationship between governance and health system outputs, a Vector Error Correction Model (VECM) has been estimated, considering the stationarity and cointegration of variables. The empirical analysis revealed original and interesting results. Indeed, we found that governance significantly affects the health system outputs in the long run but not in the short run. This indicates that the current governance development in the observed countries is insufficient to affect the health system outputs in the short run significantly.

Consequently, we have tried to find the needed additional annual growth rate of governance to make its short-run effect on health system outputs significant. For that, we have simulated from 1% to 10% additional annual growth rate in the *GCI* while keeping all other variables unchanged. The obtained result showed that there is a need for a 4% or 5% additional annual growth rate of governance to make its short-run effect significant, and the highest impact is expected to be reached with the first 4% of additional governance annual growth rate. These results have important implications in practice and may consolidate the current effort toward the health system's governance. Indeed, considering that governance contributes significantly to the development of health system outputs in the long run, policymakers will have additional tools to boost the health system in the future and plan efficient, sustainable development strategies. In the short run, there is a need for additional policies targeting the modernization of governance and the stimulation of the conscience of countries toward health system, which, according to our results, will also have a significant impact.

We hope our results will open the debate on the role of good governance in the health system, given that it is not discussed enough in the literature. In this context, a sensitivity analysis of the relationship between governance and the health system may be performed to enhance our knowledge on the subject. Also, we recommend investigating this relationship by considering different factors, such as the effect of inequalities.

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Conflicts of interest

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Appendix

Table 1A. Descriptive statistics of governance composite Index (***GCI***) and health system outputs (***IMR, LEB***) by countries

Countries	Variables	Mean	Std. Dev.	Min	Max
Algeria	***GCI***	55.5	19.6	20.4	93.4
	IMR	27.1	5.6	19.9	36.1
	LEB	73.6	2.6	68.9	76.9
Bahrain	***GCI***	51.6	18.8	14.8	88.5
	IMR	8.7	2.3	5.9	14.2
	LEB	75.6	1.1	73.6	77.3
Egypt	***GCI***	54.4	23.9	17.7	86.4
	IMR	28.5	8.7	17.3	46.8
	LEB	69.9	1.4	67.3	72.0
Iran	***GCI***	46.1	19.6	11.0	70.6
	IMR	20.5	7.0	12.0	34.2
	LEB	72.9	2.6	68.8	76.7
Jordan	***GCI***	46.8	14.8	16.3	69.3
	IMR	19.4	3.8	13.4	25.6
	LEB	72.9	1.1	71.1	74.5
Kuwait	***GCI***	48.5	24.0	6.5	78.1
	IMR	9.5	1.6	6.8	12.2
	LEB	74.1	0.9	72.9	75.5
Lebanon	***GCI***	52.0	21.0	12.3	80.4
	IMR	11.7	4.8	6.2	20.9
	LEB	76.9	2.1	72.1	72.6

Malta	***GCI***	49.2	17.2	3.5	73.6
	IMR	6.4	0.6	5.9	7.9
	LEB	80.0	1.8	77.3	82.6
Morocco	***GCI***	44.7	22.9	10.8	100
	IMR	31.6	9.5	18.3	49.2
	LEB	72.5	3.2	67.2	76.7
Oman	***GCI***	52.8	17.7	27.6	88.3
	IMR	11.8	2.8	9.5	19.1
	LEB	74.6	2.3	70.3	77.9
Saudi Arabia	***GCI***	45.5	10.7	24.2	67.7
	IMR	12.9	5.5	5.69	23.4
	LEB	73.6	1.1	71.5	75.1
Tunisia	***GCI***	53.7	10.5	36.2	71.4
	IMR	19.9	6.1	14.5	33.8
	LEB	74.5	1.4	71.9	76.7
United Arab Emirates	***GCI***	54.5	10.0	32.8	75.2
	IMR	8.1	1.4	6.4	10.9
	LEB	75.8	1.4	73.4	78.0
Yemen	***GCI***	59.5	27.8	2.4	90.2
	IMR	54.1	12.4	43.2	78.1
	LEB	63.7	2.5	59.1	66.1