Econometric study of the impact of health expenditure on economic growth in MENA countries (2000-2018)

دراسة قياسية لتأثير الإنفاق الصحي على النمو الاقتصادي في دول الشرق الأوسط وشمال إفريقيا خلال الفترة (2000–2018)

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Abstract:

This paper aim to identify the issue of the impact of health expenditure on economic growth in some MEANA's countries in the period 2000-2018, wich are : Algeria, Morocco, Tunisia, Egypt, Jordan, Saudi Arabia and Turkey, by verifying the Panel Cointegration Model And the expected causal relationship between the variables.

*This study reached the following results: Relying to the **fixed effects model**, we conclude that the government expenditure on health signal is positive and this is consistent with the economic theory, as well as from the statistical point of view, the results reached the significance of the constant with different values of the constant, from country to another, due to the specificity of each country.*

As for the logarithmic model, we note that " more government expenditure on health care increases by 1%, the GDP per capita increase by 0.71%.

Keywords: *Health expenditure, economic growth, Panel Cointegration Model, fixed effects model.*

ملخص:

تهدف هذه الدراسة الى البحث في اشكالية تأثير الإنفاق على الصحي على النمو الاقتصادي في بعض دول المينا في الفترة 2000 – 2018 وهي : الجزائر، المغرب، تونس، مصر، الاردن، السعودية وتركيا، وهذا عن طريق التحقق من التكامل المشترك *Panel Cointegration Model* والعلاقة السببية *Causality Test* المتوقعة بين المتغيرات.

توصلت هذه الدراسة الى النتائج التالية : بالاعتماد على **نموذج الآثار الثابتة** نستنتج أن إشارة معامل المتغير المستقل (الانفاق على الرعاية الصحية) موجبة وهذا ما يتفق مع النظرية الاقتصادية ،كذلك من الناحية الإحصائية فقد توصلت النتائج إلى معنوية الثابت مع اختلاف قيم الثابت من دولة لأخرى، بسبب خصوصية كل دولة.

بالنسبة للنموذج اللوغارتمي فنجد أنه كلما زاد الانفاق الحكومي على الرعاية الصحية ب 1%، كلما زاد نصيب الفرد من الناتج الداخلي الخام ب 0.71%.

كلمات مفتاحية: الانفاق الصحي، النمو الاقتصادي، نماذج بانل للتكامل المتزامن، نموذج الآثار الثابتة

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1. INTRODUCTION

Health is an essential component of human capital that supports worker productivity by enhancing physical capacity and mental capabilities. Health improvements influence the pace of income growth through many pathways: Better health directly increases labor market participation and worker productivity.

Health is one of the primary goals of social and economic development; It is one of the main requirements, and a basic right of individuals in all societies, the economic and social aspects of health care are not so simple that its importance can be ignored or simplified, because economic growth is not an end in itself, but a means to increase well-being, including improving the level of care health.

Expenditure on health care helps to prepare a healthy generation free from diseases and with high productivity due to the high level of physical, mental, and intellectual capabilities, and productive life of the human element. The state of health care for individuals in any society is related to the amount of government expenditure on treatment and investment in the health sector; As the primary goal is to improve the health status of community members by focusing on prevention and improving living conditions as well as reducing child mortality, which leads to an increase in life expectancy.

The relationship between economic growth and health expenditure is a much-discussed topic in the literature. Most of the authors argue that health expenditure has a contribution to the economic improvement so we can ask this question **what is the impact of health expenditure on economic growth in MENA countries ?**

Before arriving to answer this problematic, we suggest the following hypothesis:

- There is a relationship between economic growth and health expenditure at long-term.
- There is a causal relationship between economic growth and health expenditure.

This research started by a review of the economic literature to understand approach that examine the relationship between health and economic growth . In a second step we present an econometric study using data of health expenditure and gross domestic product **(GDP)** of some MEANA's countries applying Panel Cointegration Model , and at the end we conclude so many important results of our econometric study.

2. Literature Review

There are two approaches to estimating the effect of health on economic growth. The first is to take estimates of the effect of health from microeconomic studies. The second is to estimate the aggregate relationship directly using macroeconomic data.

2.1. Studies that examined the relationship at the micro level:

A good part of the literature on the microeconomics of health and economic outcomes examines the effects of varying health inputs on health outcomes themselves, human capital attributes that are contingent on health outcomes, and wages. Most of these studies have relied on micro-level data which focus on household and household members. Such studies include Behrman and Deolalikar (1988) and Strauss and Thomas (1998) (strauss & thomas, 1998, pp. 766-817).

In many studies, more than one variable is examined. For example, Alderman et al (2006) examined the long-run effects of childhood nutrition, using a variety of natural and manmade experiments that provide exogenous variation in nutrition and found that better nutrition leads to improvements in school completion, intelligent quotient (IQ), height, and wages **(harold, jere R, & john, 2006, p. 169)**.

Similarly, Thomas et al. (2004) found positive effects of adult nutrition on labor input and wages. Another branch of the literature also attempted to answer the question how much do differences in health contribute to differences in income by focusing on health outcomes rather than health inputs, and conducting a macroeconomic analysis rather than individual level **(B.H.thomas, D.ciliska,**

M.robbins, & S.micuccia, 2004, pp. 176-184).

An alternative approach is to calibrate the model using microeconomic evidence for parameter values The potential advantage of estimation over calibration is that the microeconomic evidence measures the effect of improvements in an individual's human capital on own earnings, ignoring the additional effects it might have on other individuals or on society as a whole. These additional effects, that is, externalities, might arise because peopleís productivity depends on the productivity of their coworkers. When workers obtain more schooling, their earnings rise, but those of their coworkers may rise as well **(David E, David, & Jaypee, 2001, p. 04)**.

2.2. Studies that examined the relationship at the macro level:

The literature on the relationship between income/growth and health at the macro level is generally inconclusive .In a study of 15 states from India for the period 1973/74, 1977/78, 1983, 1987/88, 1993/94, 1999/2000, Gupta and Mitra (2003) show that per capita public health expenditure positively influence heath status, that poverty declines with better health, and that growth and health have a positive two-way relationship **(Gupta & Mitra, 2004, pp. 193-206)**.

Also, in a study of India, the World Bank (2004) examines the impact of per capita GDP, per capita health expenditure and female literacy on infant mortality using state-level data over the period 1980-99. The study observes that both per capita public spending on health and per capita GDP are inversely related to infant mortality rate.

But the results were observed not to be very robust to alternative specification. By using the adult survival rate as an indicator of health status, Bhargava find positive relationship between adult survival rate and economic growth. Results remains similar when adult survival rate is replaced by life expectancy. However, fertility rate have a negative relationship with economic growth. Due to the fact that life expectancy is highly influenced by the child mortality, growth in workforce is mostly lower than population growth. Consequently, high fertility rate reduces the economic growth by putting extra burden on scare resources **(Bhargava, Jamison, Lau, & Murray, 2021, pp. 423-440)**.

Somewhat in between these two types of studies are contributions that estimate the effects of health interventions at the macro level on income of individuals at the micro level. The most prominent example is the work by Bleakley (2007) analyzing the long-run benefits of campaigns to eradicate hookworm infections in the South of the United States. He finds that hookworm infections explain 22 percent of the income gap between the North and the South of the United States in 1900, which is consistent with macro-based and micro-based studies from a qualitative point of view. Other prominent studies show that the eradication or treatment of diseases, such as malaria, hookworm infections, and nutritional deficiencies, raises educational attainment, improves educational outcomes, and reduces fertility **(Bloom, Canning, Kotschy, Prettner, & Schunemann, 2019, p. 05)**.

3. Econometric study :

Panel data models began to appear since the publication of the outstanding article by tow researchers « BALESTA » and « NORLOVE » on the dynamic modeling of natural gas demand in the United States of America in 1966, which was published in the journal ECONOMETRICA.

Panel models have gained great interest, especially in economic and medical studies, because they take into account the effect of change in time as well as the effect of change in cross-sectional observations.

Panel data can be defined as cross-sectional observations measured at specific time intervals. **(ARAUJO, BRUN, & COMBES, 2004, pp. 157-160)**

3.1. Data

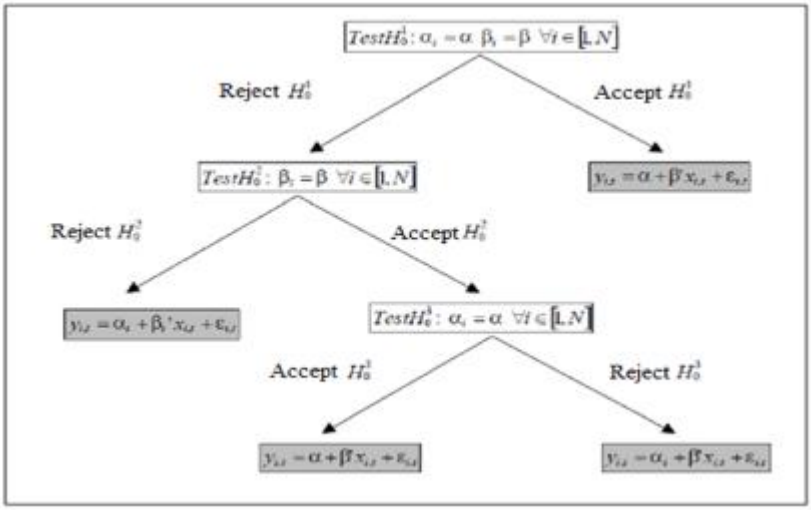
A data set on the 07 MENA countries, namely Algeria, Morocco, Tunisia, Egypt, Jordan, Saudi Arabia and Turkey, has been used in this paper to explore the linkage between health expenditure

and economic growth. Annual data for 2000-2018 periods has been gathered from the World Bank dataset and world health organisation, where the variable *GDPC* denote *Gross Domestic Product per capita* and *GGHE* indicate the *Domestic General Government health Expenditure per capita*. The variables are employed in natural logarithm forms : *LGDPC, LGGHE*.

3.2. Methods for choosing the appropriate form of panel data: To pool or not to pool?

In general, we can use Hsiao's strategy to test homogeneity or heterogeneity as follows:

Figure 01: Hsiao's (1986) strategy



Sources : Hsiao. C, Analysis of panel data, Cambridge University Press, 1986.

We will use The homogeneity test of Hsiao, **(HSIAO, third editon 2014, p. 17)** and the following table summarizes the results obtained.

Table n 01: Hsiao's (1986) strategy

H1 = Null Hypothesis : panel is homogeneous vs Alternative Hypothesis : H2
H2 = Null Hypothesis : H3 vs Alternative Hypothesis : panel is heterogeneous
H3 = Null Hypothesis : panel is homogeneous vs Alternative Hypothesis : panel is partially homogeneous

Hypotheses	F-Stat	P-Value	Decision
H1	10.79316	3.09E-14	Reject
H2	1.710125	0.124415	Accept
H3	19.22103	8.81E-16	Reject

Sources : Eviews output

According to the above table, we reject the first hypothesis wich mean that the model is completely homogeneous, and we accept the second hypothesis wich mean that the coefficients β_i are homogeneous, meaning that they are homogeneous for all countries, and finally we reject the third hypothesis wich mean that the constants α_i are not homogeneous for all countries, and therefore the model used is **the model of the constant effects**.

3.3. Stationary and cointegration

Before using the cross-sectional time series data, it is necessary to ensure the stationary of the time series used in the model, by studying the unit root. **(BANERJEE, 1999, pp. 607-630)**

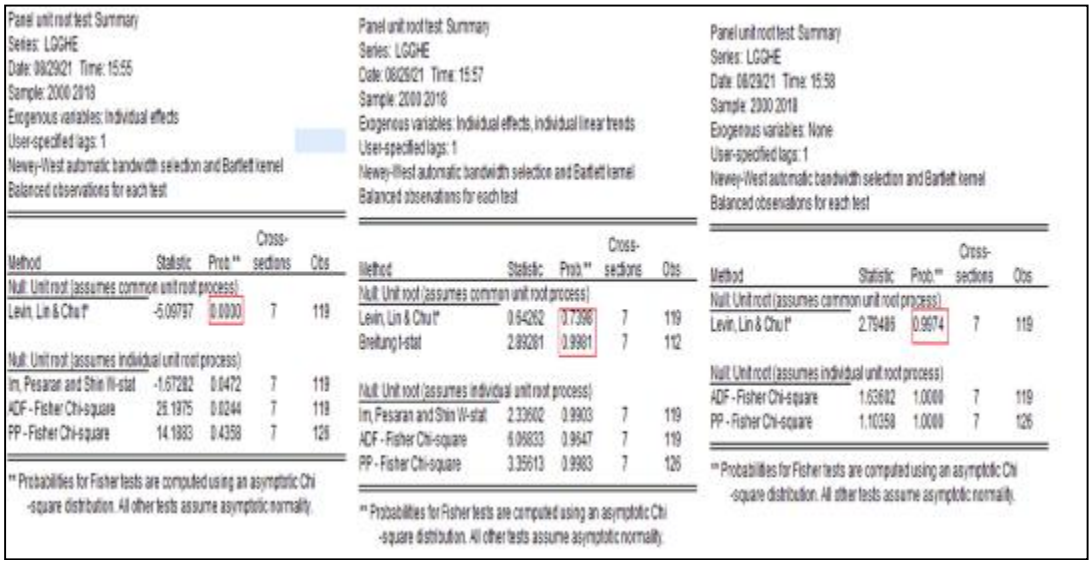
3.3.1. Unit root tests for panel data

We check the stationarity properties of the variables by employing panel unit root tests. Panel unit root test results are presented in figures 2 to 5The outcomes clearly demonstrate that the order of integration of *lgghe* and *lgdpc* is not I(0). At the first difference are I(1).

These results allowed us to perform the Pedroni and Kao panel cointegration tests to check whether there is a cointegration equation among the variables or not.

Through the following figures, we note that the variables became stationary after making the first difference I(1).

Figure 02: LGGHE series on the level



Panel unit root test: Summary
Series: LGGHE
Date: 08/29/21 Time: 15:55
Sample: 2000 2018
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-5.09797	0.0000	7	119
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-1.67282	0.0472	7	119
ADF - Fisher Chi-square	25.1975	0.0244	7	119
PP - Fisher Chi-square	14.1883	0.4358	7	126

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: LGGHE
Date: 08/29/21 Time: 15:57
Sample: 2000 2018
Exogenous variables: Individual effects, individual linear trends
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	0.64262	0.7398	7	119
Breitung t-stat	2.89281	0.9981	7	112
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	2.33602	0.9903	7	119
ADF - Fisher Chi-square	6.09833	0.9647	7	119
PP - Fisher Chi-square	3.35613	0.9983	7	126

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

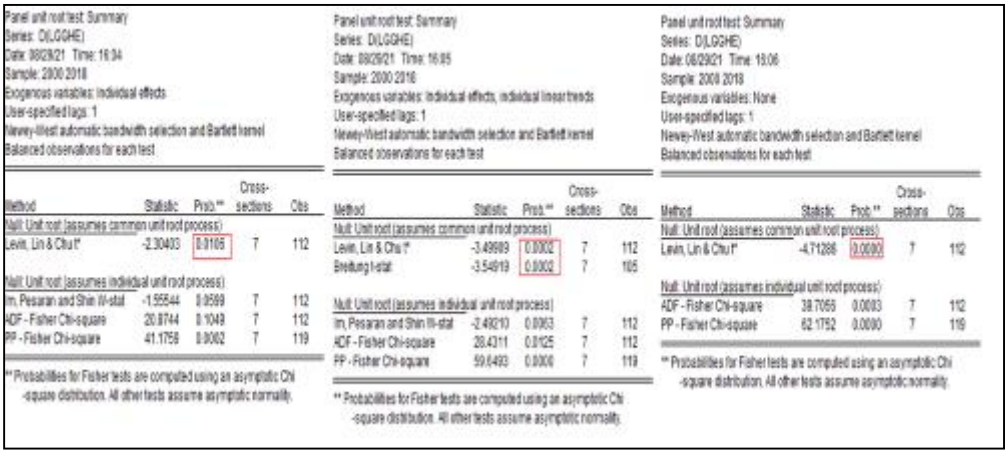
Panel unit root test: Summary
Series: LGGHE
Date: 08/29/21 Time: 15:58
Sample: 2000 2018
Exogenous variables: None
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	2.76486	0.9974	7	119
Null: Unit root (assumes individual unit root process)				
ADF - Fisher Chi-square	1.63692	1.0000	7	119
PP - Fisher Chi-square	1.10359	1.0000	7	126

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Source: Eviews output

Figure 03: LGGHE series at first diference



Panel unit root test: Summary
Series: D(LGGHE)
Date: 08/29/21 Time: 16:04
Sample: 2000 2018
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-2.30403	0.0106	7	112
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-1.55544	0.0599	7	112
ADF - Fisher Chi-square	20.8744	0.1049	7	112
PP - Fisher Chi-square	41.1758	0.0002	7	119

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: D(LGGHE)
Date: 08/29/21 Time: 16:05
Sample: 2000 2018
Exogenous variables: Individual effects, individual linear trends
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-3.49989	0.0002	7	112
Breitung t-stat	-3.54919	0.0002	7	105
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-2.49210	0.0063	7	112
ADF - Fisher Chi-square	28.4311	0.0125	7	112
PP - Fisher Chi-square	59.6493	0.0000	7	119

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

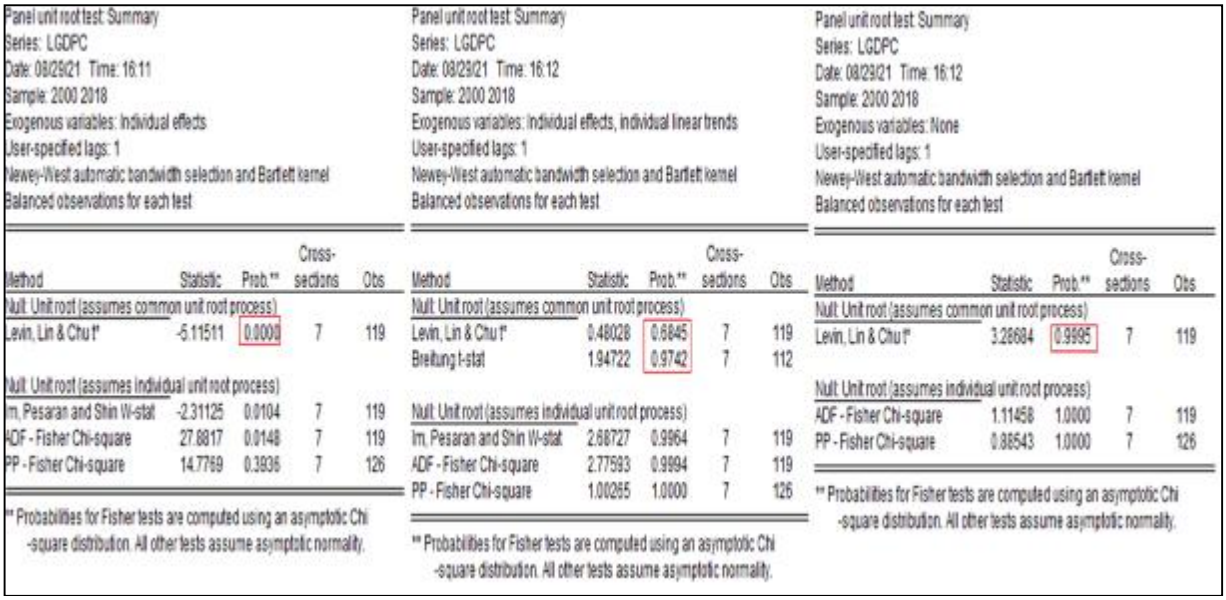
Panel unit root test: Summary
Series: D(LGGHE)
Date: 08/29/21 Time: 16:06
Sample: 2000 2018
Exogenous variables: None
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-4.71286	0.0000	7	112
Null: Unit root (assumes individual unit root process)				
ADF - Fisher Chi-square	38.7055	0.0003	7	112
PP - Fisher Chi-square	62.1752	0.0000	7	119

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Source: Eviews output

Figure 04: LGDPC series on the level



Panel unit root test: Summary
Series: LGDPC
Date: 08/29/21 Time: 16:11
Sample: 2000 2018
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-5.11511	0.0000	7	119
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-2.31125	0.0104	7	119
ADF - Fisher Chi-square	27.6817	0.0148	7	119
PP - Fisher Chi-square	14.7769	0.3936	7	126

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: LGDPC
Date: 08/29/21 Time: 16:12
Sample: 2000 2018
Exogenous variables: Individual effects, individual linear trends
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	0.48028	0.6845	7	119
Breitung t-stat	1.94722	0.9742	7	112
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	2.68727	0.9964	7	119
ADF - Fisher Chi-square	2.77593	0.9994	7	119
PP - Fisher Chi-square	1.00265	1.0000	7	126

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

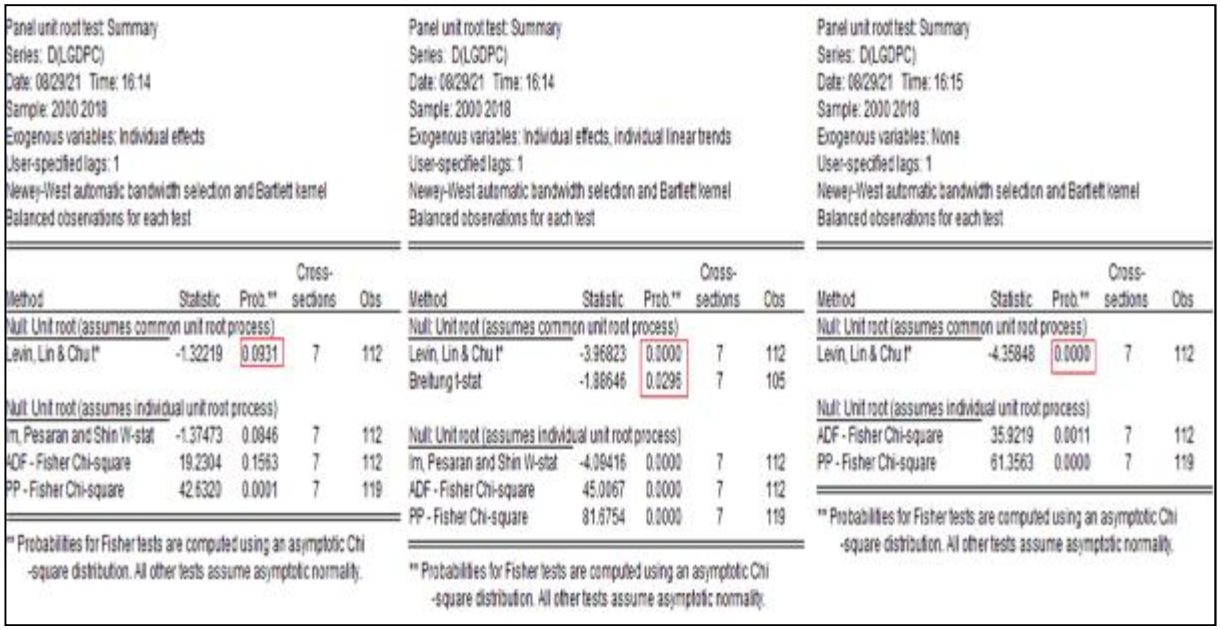
Panel unit root test: Summary
Series: LGDPC
Date: 08/29/21 Time: 16:12
Sample: 2000 2018
Exogenous variables: None
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	3.26684	0.9995	7	119
Null: Unit root (assumes individual unit root process)				
ADF - Fisher Chi-square	1.11458	1.0000	7	119
PP - Fisher Chi-square	0.88543	1.0000	7	126

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Source: Eviews output

Figure 05: LGDPC series at first diference



Panel unit root test: Summary
Series: D(LGDPC)
Date: 08/29/21 Time: 16:14
Sample: 2000 2018
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-1.32219	0.0931	7	112
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-1.37473	0.0846	7	112
ADF - Fisher Chi-square	19.2304	0.1563	7	112
PP - Fisher Chi-square	42.6320	0.0001	7	119

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: D(LGDPC)
Date: 08/29/21 Time: 16:14
Sample: 2000 2018
Exogenous variables: Individual effects, individual linear trends
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-3.96823	0.0000	7	112
Breitung t-stat	-1.88646	0.0296	7	105
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-4.09416	0.0000	7	112
ADF - Fisher Chi-square	45.0067	0.0000	7	112
PP - Fisher Chi-square	81.6754	0.0000	7	119

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: D(LGDPC)
Date: 08/29/21 Time: 16:15
Sample: 2000 2018
Exogenous variables: None
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-4.35848	0.0000	7	112
Null: Unit root (assumes individual unit root process)				
ADF - Fisher Chi-square	35.9219	0.0011	7	112
PP - Fisher Chi-square	61.3563	0.0000	7	119

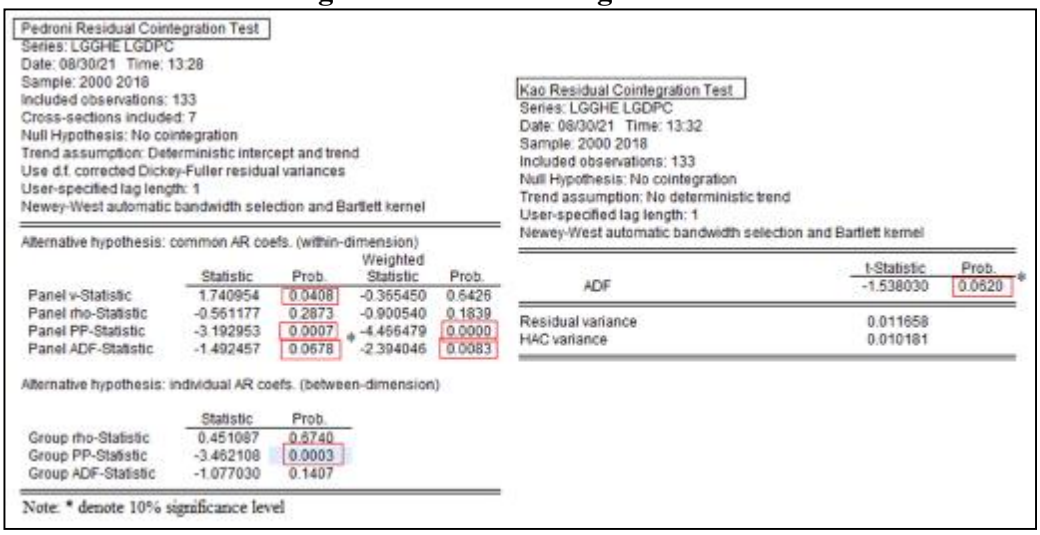
** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Source: Eviews output output

3.3.2. Panel Cointegration

PEDRONI (1999); proposed 7 tests for co-integration, including four co-integration tests for the panel based on the inside dimension, and three co-integration tests for the panel center as a group based on the between dimension). **(PEDRONI, 1999, pp. 653-670)**

Figure 06: Panel cointegration test



Pedroni Residual Cointegration Test
Series: LGGHE LGDPC
Date: 08/30/21 Time: 13:28
Sample: 2000 2018
Included observations: 133
Cross-sections included: 7
Null Hypothesis: No cointegration
Trend assumption: Deterministic intercept and trend
Use d.f. corrected Dickey-Fuller residual variances
User-specified lag length: 1
Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	1.740954	0.0408	-0.365450	0.6426
Panel rho-Statistic	-0.561177	0.2873	-0.900540	0.1839
Panel PP-Statistic	-3.192953	0.0007 *	-4.466479	0.0000
Panel ADF-Statistic	-1.492457	0.0678	-2.394046	0.0083

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	Prob.
Group rho-Statistic	0.451087	0.6740
Group PP-Statistic	-3.462108	0.0003
Group ADF-Statistic	-1.077030	0.1407

Note: * denote 10% significance level

Kao Residual Cointegration Test
Series: LGGHE LGDPC
Date: 08/30/21 Time: 13:32
Sample: 2000 2018
Included observations: 133
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
User-specified lag length: 1
Newey-West automatic bandwidth selection and Bartlett kernel

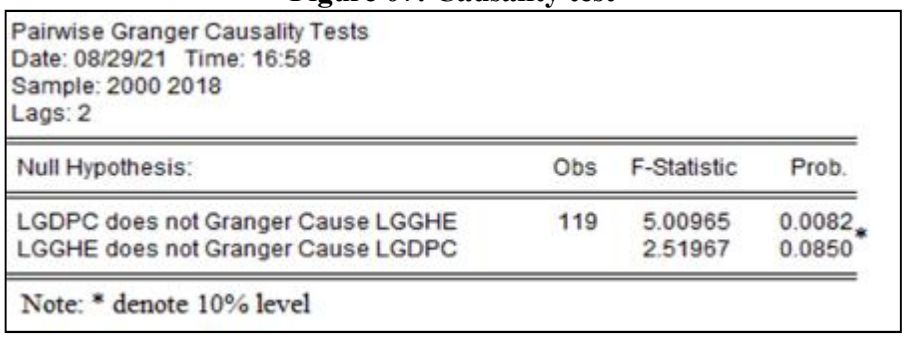
	t-Statistic	Prob.
ADF	-1.538030	0.0620 *
Residual variance	0.011658	
HAC variance	0.010181	

Source: Eviews output

As advised by **(PEDRONI, 1999, pp. 653-670)** and **(KAO, 1999, pp. 1-44)**, for the I(1) variables, Pedroni and Kao panel cointegration tests were used for the purpose of investigating the long-run relationships between the variables. The outcome of the Pedroni panel cointegration test is summarized in figure 05, which indicates that 5 out of 11 statistics are significant at the 5 % level. This suggests that no cointegration null hypothesis can be rejected. The findings from the Kao panel cointegration test for model is in line with the findings from the Pedroni panel cointegration test as shown in figure 05. Hence, both results confirm the existence of a long-run cointegration relation between **health expenditure** and economic growth.

3.3.3. Causality test

Figure 07: Causality test



Pairwise Granger Causality Tests
Date: 08/29/21 Time: 16:58
Sample: 2000 2018
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
LGDPC does not Granger Cause LGGHE	119	5.00965	0.0082 *
LGGHE does not Granger Cause LGDPC		2.51967	0.0850

Note: * denote 10% level

Source: Eviews output

Note: * 10% significance levels

Results indicate that variations in GDPC significantly lead to changes in GGHE, at the 5% level. figure 06 also reveals that changes in economic growth significantly result in variations in GGHE at the 10% level.

3.4. Panel data modeling and results

In the method of estimating the regression model using panel data can be done through three approaches, among others. **(GREENE, Fifth Edition 2003, pp. 283-320)**

3.4.1. Pooled Regression Model (PRM)

The form of panel data regression equation is similar to ordinary least square, ie:

$$y_{it} = \alpha_i + \sum_{k=1}^{K} x_{k,it}\beta_{k,i} + \varepsilon_{it} \cdots\cdots\cdots (01)$$

For i = 1, 2, ..., N and t = 1, 2, ..., T. Where N = Number of individuals or cross section and T is the number of time periods. From this model NxT can be generated equation, that is equal to T equation of cross section and as much N equation coherent time or time series
The PRM is as follows:

Figure 08 : Pooled Regression Model

Dependent Variable: LGDPC
Method: Panel Least Squares
Date: 08/29/21 Time: 13:15
Sample: 2000 2018
Periods included: 19
Cross-sections included: 7
Total panel (balanced) observations: 133

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.879099	0.122459	39.84262	0.0000
LGGHE	0.724769	0.025045	28.93907	0.0000

R-squared	0.864735	Mean dependent var	8.348504
Adjusted R-squared	0.863703	S.D. dependent var	0.780012
S.E. of regression	0.287968	Akaike info criterion	0.362992
Sum squared resid	10.86328	Schwarz criterion	0.406456
Log likelihood	-22.13895	Hannan-Quinn criter.	0.380654
F-statistic	837.4700	Durbin-Watson stat	0.102837
Prob(F-statistic)	0.000000		

Source Eviews output

According to the above output, the Summary of Regression Result Panel Data P R Model is:

- **R Square:** is the magnitude of the influence or ability of predictor variables simultaneously in describing the response variable, In this panel data regression, the R Square value is 0.8647, which means that the predictor variable is strong in explaining the response variable.
- **Prob (F-Statistics):** is the **p** value of the F test which is the significance level of the F value, that is to assess the simultaneous influence of the predictor variable to the response variable whether statistically significant or not. the value of p value is less than the critical limit eg 0.05 accepting H1. which means simultaneous influence of predictor variable to the response variable proved **statistically significant**.

4.3.2. Fixed Effect Model (FE)

This model assumes that differences between individuals can be accommodated from different intercept. To estimate Fixed Effects model panel data using a dummy variable technique to capture the differences between intercept countries. Nevertheless the intercept same between countries. This estimation model is often also called the technique of Least Squares Dummy Variable (LSDV).
The Fixed effect model differs from the common effect, but still uses the ordinary least square principle. The assumption of modeling that produces a constant intercept for each cross section and time is considered less realistic, so more models are needed to capture the difference. Fixed effects assume that differences between individuals (cross section) can be accommodated from different intercept. In order to estimate the Fixed Effects Model with different intercept between individuals, the dummy variable technique is used. Such estimation models are often referred to as the Least Squares Dummy Variable technique or abbreviated LSDV.
The regression equation of fixed effects model panel data is as follows: **(KAMGNIA DIA, 2007, pp. 99-114)**

$$y_{it} = \alpha_i + \sum_{k=1}^{K} x_{k,it}\beta_k + \varepsilon_{it} \cdots\cdots\cdots (02) \quad \left| \quad \begin{cases} H3: \begin{cases} \alpha_{it} = \alpha_i \\ \beta_{k,it} = \beta_k \end{cases} \\ H4: \varepsilon \sim iid\,(0, \sigma^2) \end{cases} \right.$$

After adding the dummy variables d in Equation 02, the model becomes as follows:

$$y_{it} = \alpha + \sum_{j=1}^{N} \gamma_j d_j + \sum_{k=1}^{K} x_{k,it}\beta_k + \varepsilon_{it} \cdots\cdots\cdots (03)$$

The output of fixed is as follows :

Figure 09 : Fixed Effect Model

Dependent Variable: DLGDPC
Method: Panel Least Squares
Date: 08/29/21 Time: 17:32
Sample (adjusted): 2001 2018
Periods included: 18
Cross-sections included: 7
Total panel (balanced) observations: 126

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	91.58488	90.78843	1.008773	0.3151
DLGGHE	2375.743	628.1462	3.782150	0.0002

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.160141	Mean dependent var	226.4500
Adjusted R-squared	0.110319	S.D. dependent var	993.6107
S.E. of regression	937.2027	Akaike info criterion	16.58506
Sum squared resid	1.04E+08	Schwarz criterion	16.76514
Log likelihood	-1036.859	Hannan-Quinn criter.	16.65822
F-statistic	3.214247	Durbin-Watson stat	2.105787
Prob(F-statistic)	0.003740		

Dependent Variable: LGDPC
Method: Panel Least Squares
Date: 08/29/21 Time: 17:35
Sample: 2000 2018
Periods included: 19
Cross-sections included: 7
Total panel (balanced) observations: 133

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.956614	0.135375	36.61405	0.0000
LGGHE	0.708576	0.028148	25.17305	0.0000

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.964679	Mean dependent var	8.348504
Adjusted R-squared	0.962701	S.D. dependent var	0.780012
S.E. of regression	0.150644	Akaike info criterion	-0.889529
Sum squared resid	2.836701	Schwarz criterion	-0.715674
Log likelihood	67.15370	Hannan-Quinn criter.	-0.818881
F-statistic	487.7048	Durbin-Watson stat	0.388539
Prob(F-statistic)	0.000000		

Source: Eviews output

4.3.3. Random Effect Model (RE)

In the random effect model, residuals may be interconnected between time and between individuals or cross sections. Therefore, this model assumes that there is a difference of intercept for each individual and the intercept is a random variable. So in the random effect model there are two residual components. The first is the residual as a whole where the residual is a combination of cross section and time series. The second residual is an individual residual which is a random characteristic of the i-th unit observation and remains at all times. The regression equation of panel data of random effects model is as follows:

$$y_{it} = \alpha + \sum_{k=1}^{K} x_{k,it}\beta_k + u_i + w_{it} \cdots\cdots\cdots (04) \quad \left\{ \begin{array}{l} H3: \begin{cases} \alpha_{it} = \alpha \\ \beta_{k,it} = \beta_k \end{cases} \\ H4: \begin{cases} \varepsilon_{it} = u_i + w_{it} \\ w_{it} \sim iid\,(0, {\sigma_w}^2) \\ u_i \sim iid\,(0, {\sigma_u}^2) \\ u_i \text{ et } w_{it} \text{ Indépendants} \end{cases} \end{array} \right.$$

The random effects model is sometimes called the Error Component Model because the model of Equation No. 04 contains two components of the error **(GUJARATI, 2004, p. 650)**. Output random effect example is as follows:

Figure 10 : Random Effect Model

Dependent Variable: LGDPC
Method: Panel EGLS (Cross-section random effects)
Date: 08/29/21 Time: 13:55
Sample: 2000 2018
Periods included: 19
Cross-sections included: 7
Total panel (balanced) observations: 133
Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.951796	0.171252	28.91520	0.0000
LGGHE	0.709583	0.027454	25.84582	0.0000

Effects Specification	S.D.	Rho
Cross-section random	0.288435	0.7857
Idiosyncratic random	0.150644	0.2143

Weighted Statistics			
R-squared	0.837066	Mean dependent var	0.993207
Adjusted R-squared	0.835823	S.D. dependent var	0.370404
S.E. of regression	0.150083	Sum squared resid	2.950765
F-statistic	673.0089	Durbin-Watson stat	0.373821
Prob(F-statistic)	0.000000		

Unweighted Statistics			
R-squared	0.864355	Mean dependent var	8.348504
Sum squared resid	10.89377	Durbin-Watson stat	0.101256

Source: Eviews output

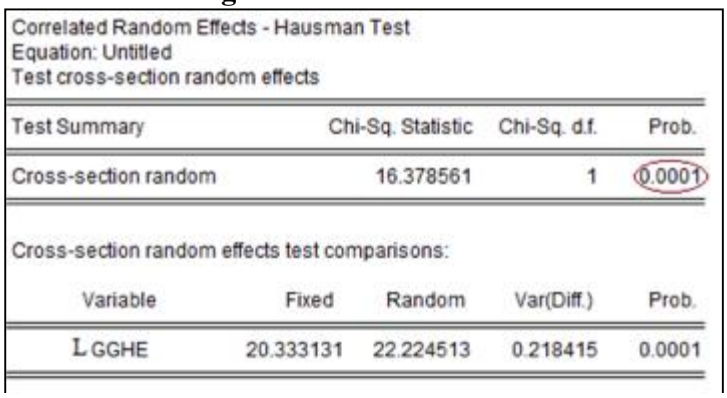
4.3.4. Model selection

To select the most appropriate model, there are several tests that can be done, such as :

- **Hausman Test**

Hausman test is a statistical test to select whether the most appropriate Fixed Effect or Random Effect model is used. (**GREENE**, Fifth Edition 2003, p. 301)
H0: Select RE ($p > 0.05$)
H1: Select FE ($p < 0.05$)
Hausman test or often referred to as Hausman Test is a test used to determine the best method between fixed effect or random effect

Figure09 : Hausman Test



Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	16.378561	1	0.0001

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
LGGHE	20.333131	22.224513	0.218415	0.0001

Source: Eviews output

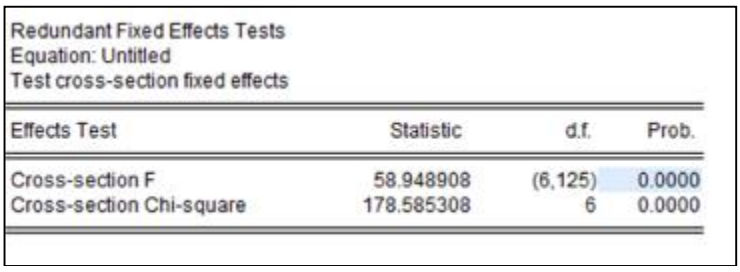
Which must be considered from the Hausman Test output with Eviews above, that is on the value that is in the red circle. The value is the p value of the test Hausman test which in this tutorial is worth 0.0000. P Value less than 0.05 then receive H1 which means **the best method that must be used is « fixed effect from the random effect ».**

- **Lagrange multiplier test (LM)** : is a test to determine whether Random Effect model is better than Common Effect (PLS) method used. **(BREUSCH & PAGAN, 1980, pp. 239-254)**

H0: Select CE (p> 0.05)
H1: Select RE (p <0.05)

Lagrange Multiplier Test, or commonly referred to as Lagrangian Multiplier Test, is an analysis performed with the aim to determine the best method in panel data regression, whether to use common effect or random effect. The Lagrange Multiplier test has a function to determine the best estimate, whether using a random effect or not.

Figure 10 : Lagrange Multiplier Test



Redundant Fixed Effects Tests
Equation: Untitled
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	58.948908	(6,125)	0.0000
Cross-section Chi-square	178.585308	6	0.0000

Source: Eviews output

Value of P Value is shown by the number below which is 0.000 where the value is less than 0.05. So the Lagrange Multiplier Test indicates that receiving H1 which mean that the best estimation method is Random Effect.

5. CONCLUSION

We have seen that Health expenditure plays a key role in the economic improvement of emerging economies. When people in these countries become healthier, they Identifying the Causality Relationship between Health Expenditure and Economic Growth. In this study, we evaluate the relationship between economic growth and health expenditure in MENA's economy.

Within this context, this relationship is examined by using Pedroni panel cointegration and panel causality analysis. For this purpose, annual data for the years between 2000 and 2018 is considered to reach this objective.

We can summarize the results obtained through this study, as follows:

1- Hsiao's homogeneity test proved that the best model is **the fixed effects model**, and we also proved that it is the best with the Hausman test.
2- Results confirm the existence of a long-run cointegration relation between GDPC and GGHE .
3- Causality test reveals a mutual relationship between GDPC and GGHE . This result supports the feedback hypothesis.
4- Through the best model (**fixed effects model**), we conclude that GGHE signal is positive, and this is consistent with economic theory. From a statistical point of view, the model is acceptable because of the Ficher statistic (prob F-stat = 000.0), and in terms of explanatory power, we find that $R^2 = 0.96$ is very high, and even when we use stationary variables, the model remains acceptable.
5- The results also indicate the significance of the constant with different values of the constant from one country to another, due to the specificity of each country.
6- As for the logarithmic model, we note that more health government expenditure increase by 1%, more GDP per capita rise by 0.71%.

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