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# Contribution of official development assistance to improve health: Empirical validation from a panel of five countries in the South Shore of the Mediterranean

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**ABSTRACT:** We try in this article to see how can help bring health outcomes, particularly on improving life expectancy. The purpose of this paper is to study the contribution of GDP rate of literacy, health expenditure and aid allocated to health on improving life expectancy for 5 countries of the southern shore Mediterranean using econometric techniques given in panel unit root test, cointegration test, and causality test during the period 1992-2010. We note that the variable aid allocated to health contributes positively to the improvement of life expectancy.

**KEYWORDS:** allocated to health; gross domestic product; human capital; economic efficiency; life expectancy; cointegration test; unit root test; panel data.

## 1 INTRODUCTION

The emphasis today in health economics is crucial because of the awareness of the international community of the strong relationship between economic development and health. Indeed, of the eight Millennium Development Goals (MDGs), three focus on improvements in health by 2015: to reduce infant mortality, reduce maternal mortality and slow the spread of HIV/AIDS, malaria and tuberculosis.

The International assistance could consist of a proposed means of achieving these objectives, and thus, to reduce child mortality. The international community has pledged to double the share it pays to help developing countries, part of the aid with the aim of improving their health systems. This increases in the amounts necessary for the development of these countries. But to what extent public aid affects development on health?

At the macroeconomic level, many empirical studies have investigated the impact of the International aid on economic growth. But few studies have investigated its impact on the health of beneficiaries.

The FDA[1] is led by the Development Assistance Committee (DAC), which deals with issues relating to cooperation with countries in developing the Organization for Economic Cooperation and Development.

The economic literature offers several definitions of FDA, including that of the OECD DAC, characterizing it as “gifts (not involving a legal obligation for the recipient), and loans (however, the resulting refund of the amount transferred), preferential budgeted and transferred from rich countries to developing countries”.

It is in this context that the AFD proposes to define DDA as a public tool whose ultimate goal is to advance economic development mainly the least developed countries (LDCs) through increased funding some considered crucial sectors such as

[1] *French Development Agency*

education, health , infrastructure, but also in some cases, civil wars (through weapons), and thus achieve a higher standard of living. In other words, it is a financial transfer from one country considered "developed" to another State then called “underdeveloped” theory to promote its long-term development.

International aid varies from one period to another. After a rise in the 80s, we see a recovery. It had been a significant drop in real terms in the 1990s, partly due to the decline in strategic motivation after the end of the Cold War. Since 2000 there has been a resumption of FDA to rise, reaching over $ 120 billion in 2005 before declining to $ 110 billion in 2007.

International aid devoted to health has been a steady and significant increase since the early 1990s. Thus, according to the Institute of Health Metrics and Evaluation (IHME), international aid flows, public and non-public, allocated to health, have quadrupled since 1990, and amounted in 2007 to more than $ 20 billion. Of these, a large proportion comes from civil society through non-governmental organizations and private foundations. According to data from the IHME (2009), in 2007, about one-third of foreign aid to health came from U.S. private sector. We note that in recent years, civil society has increasingly shown to improve the health of populations by lack of resources. For this reason, the public wants more justice in the world, at least in terms of health.

Global health partnerships such as GAVI and GFATM are also very popular, and, as of 2007, 13% of international flows allocated to health. Most aid flows to health is still public source. According to IHME in 2007, more than a third of health assistance comes from bilateral development agencies, the rest from the United Nations (15%), the World Bank (5%) of European Commission (2%) and the Regional Development Banks (2%). Finally, according to IHME, more than 60 % of aid flows to the health of financial flows. The other match of in-kind assistance: donations of medicines and goods or technical assistance services, management and research.

## 2 REVIEW OF THE LITERATURE ON THE MACROECONOMIC EFFECTIVENESS OF HEALTH AID

One of the most recent topics is to discuss the effectiveness of aid allocated to health on health. However, very few works have been published. Two studies published HAVE 2T2 those of Bokhari et al. (2007) and Wolf (2007), but they are imperfect and questionable. The first focuses more specifically on the effectiveness of public health spending on the health of individuals, while taking account of the aid allocated to health, to monitor the effect of health projects from outside. A cross-sectional data for 127 countries in 2000, the effect of the aid is estimated to be insignificant, regardless of the selected health indicator (infant and child mortality, maternal and or life expectancy). However, this estimate is not perfect due to non treatment of potential endogeneity of aid.

A second study published the Wolf (2007), is more interested in profits sectoral support, both on health, water and sanitation, and education. A cross-sectional data from 110 countries for 2002, economist shows that aid allocated to health significantly reduces child mortality (but not mortality). However, the estimated model does not control for the level of income of the population or to the level of education, which are nevertheless recognized variables. The effect of aid and assessed is probably part. Consequently the result is biased, since ignores the endogeneity problem here help.

Mishra and Newhouse (2007) conducted a much more thorough study on the effects of aid allocated to health on health. From a panel of 118 countries between 1973 and 2004, the authors find that aid allocated to health has a positive and significant effect on the reduction of infant mortality, but its effect is rather small: doubling the health aid per capita is associated with a 2% reduction in infant mortality. Economists correct the endogeneity problem through the GMM estimator.

Gyimah et al. (2008) also use GMM estimates on a panel of 90 countries with 3-year averages over the period 1990-2004, and find a negative but significant effect of aid allocated to health on mortality infant. Finally, Gubert and Somps (2008), using data for 98 countries from 1987 to 2004, show that aid allocated to health is effective in reducing child mortality and it affects more in the poorest countries. This latest study uses instrumental variables, which effectively corrects the endogeneity of aid.

In general and as other research, these studies have limitations, and require improvements. Note first that while the quality of aid data they use is not good is questionable. Indeed, sectoral aid data are reliable only from 1995.

The study should focus on a recent period (i.e. from 1995) and therefore cannot in 1973. Then sectoral aid allocated to water supply, sanitation, family planning, but also must have a direct effect on health. Indeed, if the quality of the health care system is important to ensure good health for the population (whether to cure or prevent) the quality of the water, sanitary environment is very important and prevents diseases. Finally, flows provided by foundations such as the Bill and Melinda Gates and the many NGOs are not put into consideration when their participation is increasingly important.

This paper represents an attempt to test whether the ODA contributes to improving health or not, for a given sample in panel 5 countries on the southern shore of the Mediterranean over the period 1992-2010.

## 3 MODELS

In this section we will look at a public aid indicator development ADP and know the effect of this variable on improving health. So our model regresses as follows: a variable that is explained by the following variables:

❖ **Dependent variable**

- *Life expectancy at birth (**EV**):* The number of years a newborn infant would live if normal mortality at birth should be the same throughout his life.

❖ **Explicative variables**

- *Gross Domestic Product per capita (**GDP**):* is an economic indicator used to measure production in a given country. It is defined as the total value of the production of wealth (value of goods and services created - value of goods and services destroyed or transformed during the production process) in a given country during a given year resident economic agents within the national territory. It is also the measure of income from production in a given country.

- *Enrollment (**TA**):* what is the ratio of total enrollment (regardless of age) in the population age group that officially corresponds to the level of education considered. Enrollment is considered in the primary, secondary and higher education.

- *Health expenditure per capita (current U.S. $) **(DS)**:* total health expenditure is the sum of expenditures on public and private health as a ratio of the entire population. It covers the provision of health services (preventive and curative), family planning activities, activities related to nutrition and emergency health assistance reserved but excludes the provision of water services and hygiene.

- *The aid allocated to health "broad sense" **(ADP)**:* is defined as assistance to affected areas of health, water and sanitation and population (according to the type of CAD). It is assumed that the activities improving access to clean water, sanitation or quality family planning permit, as well as aid allocated to the health sector, to directly and significantly improve health in poor countries.

***Table 1: Descriptive statistics***

| Variables | Statistics | | | |
|---|---|---|---|---|
| EV | Mean | Median | Min | Max |
| | 69,947 | 70,000 | 62,000 | 76,000 |
| | Sd.Div | C.V. | Skewness | Kurtosis |
| | 2,922 | 0,0417 | -0,549 | 0,0062 |
| GDP | Mean | Median | Min | Max |
| | 2814,29 | 1825,00 | 626,000 | 14802,0 |
| | Sd.Div | C.V. | Skewness | Kurtosis |
| | 2444,46 | 0,868589 | 2,29986 | 6,41483 |
| DS | Mean | Median | Min | Max |
| | 228,442 | 207,000 | 66,0000 | 525,000 |
| | Sd.Div | C.V. | Skewness | Kurtosis |
| | 116,091 | 0,508185 | 0,923332 | 0,243860 |
| ADP | Mean | Median | Min | Max |
| | 7,11149e+008 | 3,52570e+008 | 2,87000e+006 | 6,06520e+009 |
| | Sd.Div | C.V. | Skewness | Kurtosis |
| | 1,01793e+009 | 1,43139 | 3,06630 | 11,4300 |
| TA | Mean | Median | Min | Max |
| | 73,9789 | 81,0000 | 42,0000 | 86,0000 |
| | Sd.Div | C.V. | Skewness | Kurtosis |
| | 13,7524 | 0,185895 | -1,30311 | 0,0551570 |

## 4 ECONOMETRIC SPECIFICATIONS

We constructed a regression specification of infant and child mortality rates. We introduce the indicator aid allocated to health. We try to use the following template:

$$\boldsymbol{LogEV_{it}} = \boldsymbol{logGDP_{it}} + \boldsymbol{Logs_{it}} + \boldsymbol{logDS_{it}} + \boldsymbol{logADS_{it}} + \boldsymbol{\varepsilon_{it}} \quad \textbf{(1)}$$

Where,

- SIJ: infant and child survival in for thousands. It is obtained from the infant mortality rate (SIJ = 1 - MIJ).
- GDP: GDP per capita expressed in international dollars, i.e. parity purchasing power.
- S: The rate of adult literacy.
- DS: Public health expenditure per capita in constant dollars, i.e. parity purchasing power.
- ADS: Wide health aid per capita. Amount of aid disbursements in the areas of health.

### 4.1 RESULTS OF ESTIMATION

In this part we estimate the model represented in equation (1) using different methods. We offer classical estimators in the context of panel data models such as fixed or random effects.

*Table 2: Health impact of aid on on the health state of health fixed effects*

| Variables | *Coefficient* | *Std.div* | *t-Student* | *p. critique* | |
|---|---|---|---|---|---|
| **Const** | 3.501634 | 0.1570506 | 22.30 | 0.000 | *** |
| **LPIB** | 0.0124324 | 0.0063069 | 1.97 | 0.052 | ** |
| **LTA** | 0.0964399 | 0.0368734 | 2.62 | 0.011 | ** |
| **LDS** | 0.0667877 | 0.0052377 | 12.75 | 0.000 | *** |
| **LADS** | 0.0061005 | 0.0024659 | 2.47 | 0.015 | ** |

* Indicates significance at 10% risk

** significance at 5% risk

*** Significance at 1% risk

*Table 3: Impact of aid on the health state of health random effects*

| Variables | *Coefficient* | *Std.div* | *t-Student* | *p.critical* | |
|---|---|---|---|---|---|
| **Const** | 4.011377 | 0.0720305 | 55.69 | 0.000 | *** |
| **LPIB** | -0.0021201 | 0.0057224 | -0.37 | 0.711 | |
| **LTA** | -0.0466142 | 0.0097034 | -4.80 | 0.000 | ** |
| **LDS** | 0.0866006 | 0.005775 | 15.00 | 0.000 | *** |
| **LADS** | -0.0004077 | 0.0015424 | -0.26 | 0.792 | |

* Indicates significance at 10% risk

** significance at 5% risk

*** Significance at 1% risk

### 4.2 TEST OF HAUSMAN

Null hypothesis: GCM estimators are unbiased.

Asymptotic test statistic: Chi-square (7) = 190.258 with p. critical = (0.0000)

We must now choose the test we will choose the all based on the Hausman test that compares between the fixed effects and random effects with 7 degrees of freedom. It is to test the null hypothesis of independence between errors and explanatory variables in order to see which test you will choose.

And since Prob> $X^2$ (4) = (0.0024) <5%, we should reject the null hypothesis. I.e. the errors dependes explanatory variables. And therefore we will choose the test fixed effect is to say that all countries have the same individual effect.

### 4.3 TEST OF STATIONARITY

Before testing the significance of each variable in health and its impact on economic growth, it is very important to test the stationarity ie if it varies around its mean over time. Thus, it will do two stationarity tests namely Levin-Lin-Chu test (LLC) and Im-Pesaran-Shin (IPS).

The standard approach to test for the existence or not of a unit root is the regression Augmented Duckey-Fuller (ADF):

$$\Delta \boldsymbol{y_{it}} = \boldsymbol{\delta_i} + \boldsymbol{\alpha_i t} + \boldsymbol{\beta_{it}} + \boldsymbol{y_{it-1}} + \sum_{j=1}^{p_i} \boldsymbol{\rho_{ij}} \Delta \boldsymbol{y_{it-j}} + \boldsymbol{\varepsilon_{it}}$$

i= 1,…, N

t= 1,…, T

Where, $\Delta y_{it}$=$y_{it}$-$y_{it-1}$

t : Linear trend

p : number of delay

***a- Test of Levin-Lin-Chu (LLC) :***

Among the unit root tests that we apply in this study included testing Levin et al (2002) which is an extension of Levin and Lin (1993) and test (IPS) Im et al (1997 and 2003) .

The structure of the LLC test assumes that each individual unit in the panel shares the same coefficient AR (1), but takes into account the individual effects, time effects and the possibility of a trend over time.

$$\Delta y_{it} = \delta_i + \theta_t + \alpha_{it} + \beta_i y_{it-1} + \sum_{j=1}^{p_i} \rho_{ij} \Delta y_{it-j} + \varepsilon_{it}$$

The null hypothesis $H_0$ : $\beta_i$=0 for all (i).

The delays of the dependent variable are presented to reflect the correlation in the periodic errors.

The statistics of this LLC test is given by:

$$t^*_{\beta} = t_{\beta=0} - N\tilde{T}\,\hat{S}_{NT}\,\hat{\sigma}_{\varepsilon}^{-2} RSE\,(\widehat{\beta})\alpha_{\bar{t}} \;/\; \sigma_{\bar{T}}$$

Where $t_{\beta=0}$ is the statistical associated $\hat{\beta}_i$ under the null hypothesis $\beta_i = 0$.

$$\tilde{T} = (T - \bar{p} - 1) \text{ et } \quad \bar{p} = N^{-1} \sum_{i=1}^{N} P_i$$

$\widehat{s_{NT}^2}$ is the standard variance of $y_{it}$

$\widehat{\sigma_{NT}^2}$ is the variance of the residual

RSE ($\hat{\beta}$) is the standard residue estimating $\hat{\beta}_i$

Under the null hypothesis that ($\beta i = 0$), the test panel $t_\beta$* is distributed as normal.

***b- Test of Im-Pesaran-Shin (IPS):***

Another test of Im et al (1997 and 2003) called test (IPS) was performed to further confirm the results found in the test (LLC). This test represents an extension and generalization of the test (LLC). This model is represented by the following equation:

$$\Delta y_{it} = \delta_i + \theta_t + \alpha_{it} + \beta_i y_{it-1} + \sum_{j=1}^{p_i} \rho_{ij} \Delta y_{it-j} + \varepsilon_{it}$$

The null hypothesis $H_0$ : $\beta_i$=0 for all i is tested against the alternative hypothesis $H_1$ : $\beta_i$< 0 for i test that takes into account the heterogeneity des $\beta_i$ without losing sight of the objectives of Pesaran and Smith (1995) on use of panel estimators pooled. So the test IPS proposes the use of statistical t-bar:

$$Z_i = N^{\frac{1}{2}}(\bar{t}\ NT - E(\bar{t}\ \mathbf{NT}))/(\mathbf{var}\ (\bar{t}\ \mathbf{NT}))^{\frac{1}{2}}$$

Where,

$$\bar{t}\ NT(\rho_i) = \frac{1}{N} \sum_{i=1}^{N} t_{iT}\ (\rho_i)$$

And $t_{iT}$ ($p_i$) is the t-statistic to test individual $\beta_i$ =0 for all (i).

While E ($\overline{T_{NT}}$) and var($\overline{T_{NT}}$) are obtained by stochastic simulation.

Under the null hypothesis of non-stationarity $H_0$, the $Z_{\overline{T}}$-statistic converges to a normal distribution $Z_T \rightarrow$ N (0,1).

*Table 4: Test of unit root in panel*

| Variables | IPS | | Levin lin | | Stationarity |
|---|---|---|---|---|---|
| | Coef | p- value | Coef | p- value | |
| **LEV** | 2.1563 | 0.9845 | -2.2201 | 0.3356 | Stationary in first differences |
| **ΔLEV** | -1.571 | 0,043 | -3.7829 | 0.0632 | |
| **LPIB** | - 1.144 | 0.126 | -1.388 | 0.085* | Stationary level |
| **ΔLPIB** | -1.484 | 0.068 | -1.728 | 0.041** | |
| **LS** | -1.763 | 0,0225 | -1.842 | 0,0327** | Stationary level |
| **LDS** | -1.3382 | 0,067 | -2.726 | 0,003** | Stationary level |
| **LADS** | 0.237 | 0,594 | -4.3470 | 0.0377 | Stationary in first differences |
| **ΔLADS** | -1.366 | 0.042 | -1.578 | 0.050** | |
| * Indicates significance at 10% risk<br>** significance at 5% risk<br>*** Significance at 1% risk | | | | | |

### 4.4 TEST OF COINTEGRATION IN PANEL

Given the results of the test panel unit root, we proceed to test for panel cointegration, we find that, overall, all variables are integrated order.1 . Cointegration fear is defined as a systematic co- movement in the long term between two or more economic variables (Yoo 2006). Testing Granger (1981) and Johansen (1988) are based on time series and do not include panel data. Several tests are developed in the framework of panels: The cointegration panel data proposed by Pedroni (1995, 1997, 1999, 2004), Kao (1999) and Bai and Ng (2001) tests are similar residual tests the proposed by Engle and Granger (1987) in the context of time series tests.

In addition, Pedroni (1995, 1997) gave various cointegration tests in two steps to apprehend the null hypothesis of absence of intra-individual cointegration for both homogeneous and heterogeneous panels in the presence of a single regressor in cointegrating relationships , Pedroni (1999, 2004). It offers an extension to the case where cointegration relationships include more than two variables and develops seven (7) tests based on the estimated residuals of the model in the long term. Pedroni tests take into account the heterogeneous by using parameters which are different among individuals. Thus, under the alternative hypothesis, there is a cointegration relationship for each individual, and the parameters of the cointegrating relationship are not necessarily the same for each individual panel (Hurlin and Mignon 2007). In addition, Kao (1999) also proposed testing the null hypothesis of no cointegration: type test Dickey -Fuller test type and Augmented Dickey-Fuller.

The tests of Pedroni based on the estimation of the long-term relationship of heterogeneity model coefficients following slope:

$$\boldsymbol{y_{it} = \alpha_i + \delta_{it} + \beta_{1i} x_{1,it} + \beta_{2i} x_{2,it} + \cdots \beta_{mi} x_{m,it} + e_{it}}$$

Where i = 1, ..., N denotes the individual, t = 1, ....., T (time), and m = 1 ..... M index (slope coefficients)

From this model Pedroni has developed seven (07) test statistics, four are based on the Within dimension (intra) and three on the Between dimension (inter). Both types of tests based on the null hypothesis of no cointegration (H0: ρi = 1 whatever i). The parameter ρi is the autoregressive coefficient estimated residuals under the alternative hypothesis as

$$\hat{e}_{i,t} = \boldsymbol{\rho_i}\ \hat{e}_{i,t} + \boldsymbol{\mu_{i,t}}$$

The distinction between the two categories of tests lies in the specification of the alternative hypothesis ($H_1$):

- For tests based on intra dimension, the alternative hypothesis is written:

$$\rho_i = \rho < 1 \quad \text{whatever i}$$

- For-based international dimension tests, the alternative hypothesis is written:

$$\rho_i < 1 \text{ whatever i}$$

It is thus seen that the test based on the international dimension is more general in that it allows the presence of heterogeneity among individuals under the alternative hypothesis.

***Table 5: Results of different tests based on the size of the interior (panel cointegration statistics) and one (group mean panel cointegration statistics)***

| **Alternative hypothesis: AR coefs. Common (inner dimension)** | | |
|---|---|---|
| | Statistic | Prob |
| Panel v-Statistic | 0.174 | 0.120 |
| Panel rho-Statistic | -0.254 | 0.399 |
| Panel PP-Statistic | -5.275 | 0.000 |
| Panel ADF-Statistic | -4.656 | 0.000 |
| **Alternative hypothesis: AR coefs. Individualle (one-dimension)** | | |
| Group rho-Statistic | 0.756 | 0.775 |
| Group PP-Statistic | -9.291 | 0.000 |
| Group ADF-Statistic | -5.096 | 0.000 |

This table summarizes the results of seven (07) statistics of Pedroni cointegration. They were calculated using Eviews 7 has an appropriate program to address the data cointegration heterogeneous panels. The cointegration variables depend on the value of the statistical probability associated with each. Thus the seven statistics have four probability values below 5%. It is mainly (Panel pp-Statistic) and (Group ADF-Statistic), which proves that there is a cointegration relationship between the variables in the model.

### 4.5 TEST DE CAUSALITÉ DE GRANGER EN PANEL :

Following the results of the cointegration test, we estimate the VECM in panel to test the causality of Engel and Granger (1987). We adopt the two-step procedure by first estimating the long-term model to obtain residuals.

$$\ln EV_{it} = \alpha_{it} + \delta_t + \gamma_{1i} s_{it} + \gamma_{2i} ADS_{it} + \varepsilon_{it}$$

Delayed value of these residues is introduced as a term of VECM error correction, the dynamic correction model is estimated following error:

$$\Delta \ln EV_{it} = \alpha_{iy} + \sum_{K=1}^{q} \theta_{11ik} \Delta \ln EV_{it-k} + \sum_{K=1}^{q} \theta_{12ik} \Delta \ln S_{it-k} + \sum_{K=1}^{q} \theta_{13ik} \Delta \ln ADS_{it-k} + \Lambda_{1i} \varepsilon_{it-1} + \mu_{it}$$

$$\Delta \ln s_{it} = \alpha_{is} + \sum_{K=1}^{q} \theta_{21ik} \Delta \ln s_{it-k} + \sum_{K=1}^{q} \theta_{22ik} \Delta \ln EV_{it-k} + \sum_{K=1}^{q} \theta_{23ik} \Delta \ln ADS_{it-k} + \Lambda_{2i} \varepsilon_{it-1} + \mu_{it}$$

$$\Delta \ln ADS_{it} = \alpha_{iSE} + \sum_{K=1}^{q} \theta_{31ik} \Delta \ln ADS_{it-k} + \sum_{K=1}^{q} \theta_{32ik} \Delta \ln EV_{it-k} + \sum_{K=1}^{q} \theta_{33ik} \Delta \ln S_{it-k} + \Lambda_{3i} \varepsilon_{it-1} + \mu_{it}$$

With Δ the first difference operator, and q is the number of delays peuventt be determined by the two-step procedure suggested by Abdalla and Murinde (1997), the optimal number of delay is one that maximizes the value of $R^2$, and u is the error term.

*Table 6: The test of causality between health and variable growth economy in PRSM over the period 1992-2010*

| Null Hypothesis: | Obs | F-Statistic | Prob. |
|---|---|---|---|
| LPIB does not Granger Cause LEV | 85 | 2.93116 | 0.0591 |
| LEV does not Granger Cause LPIB | | 1.55376 | 0.2178 |
| LDS does not Granger Cause LEV | 85 | 4.43543 | 0.0149 |
| LEV does not Granger Cause LDS | | 2.00497 | 0.1414 |
| LTA does not Granger Cause LEV | 85 | 1.38455 | 0.2564 |
| LEV does not Granger Cause LTA | | 0.46298 | 0.6311 |
| LOG_ADS does not Granger Cause LEV | 85 | 2.38568 | 0.0190 |
| LEV does not Granger Cause LOG_ADP | | 3.04671 | 0.0531 |
| LDS does not Granger Cause LPIB | 85 | 2.94956 | 0.0581 |
| LPIB does not Granger Cause LDS | | 0.70474 | 0.4973 |
| LTA does not Granger Cause LPIB | 85 | 0.30975 | 0.7345 |
| LPIB does not Granger Cause LTA | | 0.00922 | 0.9908 |
| LOG_ADP does not Granger Cause LPIB | 85 | 0.51333 | 0.6005 |
| LPIB does not Granger Cause LOG_ADP | | 3.12172 | 0.0495 |
| LTA does not Granger Cause LDS | 85 | 0.09509 | 0.9094 |
| LDS does not Granger Cause LTA | | 2.22269 | 0.1150 |
| LOG_ADP does not Granger Cause LDS | 85 | 0.70333 | 0.4980 |
| LDS does not Granger Cause LOG_ADP | | 2.88816 | 0.0615 |
| LOG_ADP does not Granger Cause LTA | 85 | 0.37568 | 0.6880 |
| LTA does not Granger Cause LOG_ADP | | 0.43645 | 0.6479 |

From the results presented in this table Granger, there:

- A bidirectional causality between aids allocated to health and life expectancy.
- A causal relationship between GDP growth and life expectancy.
- A causal relationship between health and expenditure of aid allocated to health.

***Table 7: Test of exogeneity***

| **Variables** | **LEV** | **LPIB** | **LDS** | **LADS** |
|---|---|---|---|---|
| **Restoring Forces** | -0.084 | -0.125657 | -0.011973 | -0.012819 |
| **T- statistic** | [-3.819] | [-3.85214] | [-1.9999] | [-2.32407] |
| **P value** | 0.020 | 0.0002 | 0.0485 | 0.0223 |

All explanatory variables are strongly exogenous forces as reminders are negative and significant. Thus, according to the results of the VECM estimation, we find that the force is negatively significant in relation to the logarithm of the relative life expectancy in the relationship relative to the logarithm of gross domestic product in the relationship on the logarithm of enrollment and the logarithm relation aid allocated to health. It is said that the deviation from the target converges towards equilibrium. Thus, these variables are strongly exogenous and lead to the long-term equilibrium which confirms the technique Pedroni concerning the existence of a relationship explanatory long-term evolution of life expectancy by gross domestic product, enrollment and aid allocated to health. The long-term relationship can be written as follows:

$$\mathbf{L\,EV_{it} = 0{,}10TS_{it} + 0{,}11\,LPIB_{it} + 0{,}029\,LADS_{it} + \mu_{it}}$$

Similarly, and by focusing on our main problem, we find the equation of a long-term positive and significant correlation between aid allocated to health and improved life expectancy. There is a 10% improvement of aid allocated to health contributes to an increase of 0.29% of the life expectancy. This result suggests accordance with that found by Bloom et al. (2001) and Weil (2004). These authors found that the improvement of the health of the individual helps to increase the rate of economic growth. Similarly, income and education are also two important factors of human capital accumulation. The results show the existence of a long-term relationship between adult literacy and health improvement so that a 10 % literacy rate contributes to an improvement of 1 % of hope life. Similarly an increase in GDP of 10% is associated with an increase in life expectancy of 1.1 %.

## 5 CONCLUSION

The purpose of this article is to evaluate the effectiveness of aid to improve health. The first part of this paper describes the evolution of health indicators in countries of the southern Mediterranean. In the second part we reviewed the contribution of aid allocated to health to improve life expectancy and found that external financing can improve the health of populations. In the context of this article, preliminary estimates have been made to test the effectiveness of foreign aid on health. Those conducted on health are consistent with the theoretical results.

In the countries of the southern Mediterranean, all the variables are stationary in first differences. Based on the test results panel unit root, we proceed to test for cointegration. We use the test pedroni, the results show that the variables are cointegrated of order 1. It is thus seen that there is a long-term relationship between the variable aid allocated to health and improved life expectancy.

The test causality Engel and Granger (1987) application of VECM in panel aims. The results found mention that there is bidirectional causality between external assistance and health improvement. Similarly, the estimate of long-term pattern in the countries of the southern Mediterranean shows that the 10% increase in aid allocated to health results in increased life expectancy of 0.3 %.

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