# The Impact of Sovereign Debt on Economic Growth in North Africa: A Comparative Study among Algeria, Morocco and Tunisia

# أثر الديون السيادية على النمو الاقتصادي في شمال إفريقيا:

## دراسة مقارنة بين الجزائر، المغرب وتونس

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**Abstract:**

This study investigates whether the officials in Algeria, Morocco and Tunisia have efficiently allocated their sovereign debts to improve their economic performance during 1970-2016.To verify this, OLS regression method has been used, in addition to pre-estimation statistics to support the model results.

The results show a misallocating of sovereign debt funds to improve the economic performance in Algeria and Morocco. They also indicate that Tunisia's officials have succeeded in allocating sovereign debt properly to upgrade their economic performance in addition to the burden that occurs as sovereign debt aftermaths.

**Keywords:** sovereign debt, economic growth, North Africa, Algeria, Morocco, Tunisia

**JEL Classification Codes**: H63, F34, O11.

**ملخص:**

تحقق هذه الدراسة في مدى نجاعة استعمال الديون السيادية في الدفع بالنمو الاقتصادي لكل من الجزائر ,تونس والمغرب خلال الفترة الزمنية 1970- 2016. للتأكد من ذلك ,اعتمدنا على نموذج المربعات الصغرى المتعدد إضافة إلى أدوات إحصائية مساعدة لتعزيز نتائج النموذج.

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تشير النتائج إلى سوء استخدام الديون السيادية في كل من الجزائر و المغرب حيث سجلنا علاقة تأثير عكسية لهذه الأخيرة على النمو الاقتصادي في كلا البلدين وفي حين نجح صانعوا القرار في تونس في توظيف امثل للديون السيادية التي عززت من النمو الاقتصادي في تونس رغم ما يترتب عليها من عبء

**كلمات مفتاحية:** الديون السيادية، النمو الاقتصادي ،شمال إفريقيا ،الجزائر ،تونس ،المغرب.

تصنيفات JEL : H63، F34، O11.

## 1. INTRODUCTION

Since the strong macroeconomics imbalances that hit the majority of developing countries due to the oil shock during the 70's and 80's of the last century as aftermaths of the middle east issue, many poor countries suffered a remarkable decline in their economies .Thus, approximately all of them was unable to settle their external debt.

Three decades later, the world and especially euro-zone area suffered a very severe sovereign debt crisis that almost blew up the greatest political and economic union ever .this crisis has again raised the question of the sovereign debt impact on economic growth. Therefore, many studies and investigations were carried out to precisely define its turning point and the solution to get out of its aftermaths.

In brief, many studies assume that the impact of sovereign debt on economic performance may be harmful through' the debt overhang effect, a situation when an accumulated debt, discourage and overhang investment, mainly private investment; as private investors expect an increase in tax by government to pay the accumulated debt, And debt crowding out effect, this is a situation when income from export is used to pay the accumulated debt. This in turn may affect investment. (Ejigayehu , 2013, pp. 38-41)

North African countries have also suffered macroeconomic imbalances including a sharp decline in their internal savings that resulted luck of financial resources. Therefore, North African countries like: Algeria, Morocco and Tunisia found themselves in obligation to get external financial sources to finance their development programs and upgrade their economies' performance .Furthermore, those economies are lately in a very critical conditions due to external shocks as well as internal imbalances problem and

wrong choices in their public policies .those conditions led the decision makers in these countries to choose the option of sovereign debt expecting to get away out from this situation .sovereign debt funds are remarkably raising when three years ago, they reached the level of 30.11 billion $ and 18.32 billion $ in Morocco and Tunisia respectively whilst they back to raise slightly in Algeria in the same period (World Bank , 2019).

**1.1Problematic of the study**

As per above, this study is carried out to empirically detect whether decision makers in Algeria, Morocco and Tunisia have succeed or failed in upgrading their economies' performance using sovereign funds. Therefore, the main question of this investigation is:

What is the impact of sovereign debt funds on economic growth in the Countries mentioned above during the period 1970-2016? In other words, were these countries 'decision makers' efficient users of sovereign debt funds in upgrading the performance of their countries 'economy?

**1.2 Hypothesis of the study**

It is strongly inconspicuous to pre-determined the impact of sovereign debt on economic performance, it may have a positive effect if it is restricted to improve the welfare of the society or a negative effect through the debt overhang that discourage investment .

This study hypothesizes a misallocation of sovereign debt funds by decision makers in each of Algeria, Morocco and Tunisia which means negatively affect their economies .Therefore; they have failed in upgrading their economies performance during the period of study (1970-2016).

**2. Theoretical and empirical evidence review**

Historically, several studies are carried out to detect the cause, aftermath and doable solution to the sovereign debt and economic growth issue.

Both classic and neoclassic streams confined that government responsibility only in assuring some functions that the market cannot afford (national defence, property rights protection, maintaining internal law…etc.).Thus, government intervention within economic activities is restricted .both schools believe in individualism that could reach the general

public interest through free market .accordingly, there is nonsense for the public authorities to raise their spending which is considered as wasteful and unproductive funds. Subsequently, it is strictly prohibited for the government to increase his funds, particularly by borrowing that may cause a general economic turmoil due to a massive burden on consumption, savings and investment owing to switching the withdrawals of public settlement from productive to unproductive path. (Tsoulfidis, 2007, p. 2)

According to Keynesian thoughts, public borrowing leads to a positive contribution to the effective demand within economy which leads to raise employment as well as more output, therefore upgrade the national income. Essential assumptions of new orthodoxy had been outlined by one of the leaders of public choice stream who is Buchanan. Those assumptions are (Buchanan, 1999, p. 5):

a- The creation of public debt doesn't involve any transfer of the real primary real burden to future generation.

b- The analogy between private debt and public debt is wrong.

c- There is a sharp and important distinction between internal and external debt.

As per post Keynesians like Modigliani and Meade (Checherita-westphal & Rother, 2011, p. 1017) public borrowing result heavy burden on future generation due to reduction in future capital formation as a results of debt settlement that might be covered by increasing taxes .therefore, private capital formation and private consumption tend to decline. Thus the generation that issued the debt ought to settle it within its lifetime whatever debt is external or internal (Musgrave & Musgrave, 1984, pp. 691-694) whilst Milton Friedman believes that government spending is far greater danger than government debt.

Additionally, several empirical investigations were launched, especially after the sovereign default of numerous developing countries owing to the oil shock's aftermaths due to the Middle East issue in October 1973, in addition to macroeconomics imbalances and political problems.

From the empirical evidences we find that sovereign debt has double effects in the long run (Diamond, 1965, p. 1126):

a- Covering sovereign debt services through tax-cuts shorten the

available consumption's lifetime of the tax payers owing to the decline of their consumptions' capacity and interest rates .this, without requesting additional sovereign funds to cover that sovereign debt services.

b- The more tax-cuts the taxpayers bear, the more decline is registered in savings and capital stocks .then, a massive downturn in their disposal income should be considered.

Despite that, sovereign debt and their settlement could cause an extremely slight burden due to the efficient use of sovereign debt funds in upgrading the economic performance of borrowing countries through productive channels. (Jayaraman & Lau, 2009, p. 282)

Over and above, the burden of sovereign debt services has a negative sign on investments and capital accumulation. Thus, sovereign funds were misallocated or wasted in unproductive consumption which leads to deteriorate the economic mechanisms in the future, resulting in a sovereign default (Karagol, 2002, p. 61).

The sovereigns sometimes may tend to choose to default if the aftermaths of this choice make their constituency better off. This constituency is often consists of middle and poor class that are for sure directly affected by any measures that public authorities decide to settle the sovereign debt services whether through tax- cut, domestic debt or sovereign debt …, that effect is more heavy on the middle class whose wealth is liquidity savings, while the poor class is protected by public authorities through public policies such as: subsidy policy, transfers,….,especially if the running government is pro-poor government. Nevertheless, the rich class may be the most affected if tax- cuts are used as an option to improve the government's solvency to settle its sovereign debt owing to the nature of its wealth which is consist of financial placement with high risk and high return (Giordano & Tommasino, 2011, p. 16).

Sovereign default may severely affect the independence of the monetary authorities through the pressure of the political class that aims to protect its constituency by increasing the lifetime of its financial system even if it costs a sharp devaluation of the currency that heavily affects the poor class as this measure is often in order to protect the rich class's wealth when

the running government is pro-rich government. (Giordano & Tommasino, 2011, p. 17)

Under these circumstances, the debtor countries may choose to default, request a debt restructuring or even refuse to pay their sovereign debts. Consequently, the lenders may face two choices (Krugman, 1988, p. 1):

a- continue financing the country that suffer sovereign defaults regarding that its economic performance upgrades and being able to settle its debts.

b-forgive by reducing the debt stocks to the level that may make the country able to repay them.

Predominantly, sovereigns tend to shine their international reputation in settling their sovereign debts on schedule to avoid being excluded from the international capital market, condemning their international assets by the overseas creditors and obviate suffering cut-off from the future capital flows in addition to trying to keep their advantages in international trade (Rose , 2002, p. 2) .Moreover , the sovereigns are eager to repay their sovereign debt back to obviate extra-costs that may sovereign defaulted bear. This extra burden drives the local economy of the defaulters to a huge turmoil, thus, suffering low economic growth rates and fragile the financial system of the country (Sturzenegger & Zettelmeyer, 2005, pp. 9-63).

Other studies have sought to determine the turning point between the level of sovereign debt funds and the economic performance .for that purpose, Reinhart and Rogoff findings have put much pressure on Eurozone decision makers, who took their research result in consideration in their meetings, in dealing with their debt crisis, whereas the study denotes that when sovereign debt to GDP exceeds 90%, the economic growth rate in each of developed and emerging countries suffer high inflation rates (Reinhart & Rogoff, 2010) . Four years later, those results were disproved for the reason that those findings based on a significant mistakes of data exclusions, spreadsheet errors… (Herndon, Ash, & Pollin, 2014).thus, the determination of the turning point between sovereign debt funds and economic growth still inconspicuous.

## 3. Methodology, data source and the empirical model

### 3.1. Methodology

This study investigates the impact of sovereign debt on north African countries' economic growth for the period 1970 - 2016,to reach that ,a method of ordinary least square regression (OLS) has been followed , in addition to the pre-estimation statistics that are used to support the results of the model we tend to use .

### 3.2. Data source

For the data collection, we have got consulted the following websites: web site of World Bank (World Bank , 2019), Annual Reports of bank of Algeria (Algeria, 2019)

### 3.3. The empirical model

To reach the aim of this study, we consider the following model that is represented through the following function:

Y = f (SD, GCF, GDS, SDS, SDSX, SDGNI, RESSD, FDI)

The Estimation Equation:

GDPr = a + a1 SD + a2 GCF + a3 GDS + a4 SDS + a5 SDSX + a6 SDGNI + a7 RESSD +a8 FDI+ 3i

Where:

GDPr: Real Gross Domestic Product Growth Rate /Economic Growth Rate

SD: Sovereign Debt (External Public and Publicly Guaranteed Debt)

GCF: Gross Capital Formation

GDS: Gross Domestic Saving

SDS: Sovereign Debt Service /Burden Measurement

SDSX: Sovereign Debt Service to Exports Ration /Burden Measurement

SDGNI: Sovereign Debt to Gross National Income Ration /Burden Measurement

RESSD: Country's Reserve (in foreign currencies) To Sovereign Debt Ratio.

FDI: Foreign Direct Investment Inflows.

3i: Error Term

a,a1,...,a8 : Coefficients : measure the impact of each dependent variable on real growth rate .

We denote that: the main variables that we used for our investigation are: SD, SDS, SDSX, SDGNI, and RESSD as well as FDI variable. This last, is considered as an alternative to sovereign debt.

According to several studies, SD has a fuzzy impact on economic growth Whilst SDS, SDSX, SDGNI are considered to have negative coefficients (they refer to the sovereign debt burden), and a positive coefficient for RESSD variable as it is considered as insurance for sovereign defaults.

## 4. Pre estimation statistics

Prior to start drawing a conclusion from estimation results, statistical tests (unit root test, granger causality test) are undertaken to verify any bogus results due to non-stationary data.

### 4.1 Unit root test

Group unit root test is carried out to avoid making misleading results and analysis.

According to tables 1,2 and 3 , all method tests (Levin.Lin& Chut* test, Im, Pesaran and Shin W-stat test ADF- CHI-square test and PP-Fisher CHI-square test) show that H0(presence of unit root) must be rejected, thus, the alternative hypothesis H1 is accepted .Therefore, the data of the study is stationary and tend to avoid any spurious results through OLS method .

**Table 1.** Group unit root test: Summary (Algeria)

| Test method | Statistic | Level of significance | Prob.(P) | OBS | Decision |
|---|---|---|---|---|---|
| Levin, Lin & Chu t* | 1.07503 | 5% | 0.8588 | P > 5% | H0: accepted |
| Im, Pesaran and Shin W-stat | -7.88651 | | 0.0000 | P < 5% | H0: rejected |
| ADF - Fisher Chi-square | 83.1935 | | 0.0000 | P < 5% | H0: rejected |
| PP - Fisher Chi-square | 49.0893 | | 0.0001 | P < 5% | H0: rejected |

**Source:** Eveiws 8 output (appendix 01)

**Table 2.** Group unit root test: Summary (Morocco)

| Test method | Statistic | Level of significance | Prob.(P) | OBS | Decision |
|---|---|---|---|---|---|
| Levin, Lin & Chu t* | -0.33059 | 5% | 0.3705 | P > 5% | H0 : accepted |
| Im, Pesaran and Shin W-stat | -2.08963 | | 0.0183 | P < 5% | H0 : rejected |
| ADF - Fisher Chi-square | 53.4190 | | 0.0000 | P < 5% | H0 : rejected |
| PP - Fisher Chi-square | 52.7396 | | 0.0000 | P < 5% | H0 : rejected |

**Source:** Eveiws 8 output (appendix 01)

**Table 3.** Group unit root test: Summary (Tunisia)

| Test method | Statistic | Level of significance | Prob.(P) | OBS | Decision |
|---|---|---|---|---|---|
| Levin, Lin & Chu t* | -18.5550 | 5% | 0.0000 | P < 5% | H0 : rejected |
| Im, Pesaran and Shin W-stat | -19.6724 | | 0.0000 | P < 5% | H0 : rejected |
| ADF - Fisher Chi-square | 258.437 | | 0.0000 | P < 5% | H0 : rejected |
| PP - Fisher Chi-square | 230.921 | | 0.0000 | P < 5% | H0 : rejected |

**Source:** Eveiws 8 output (appendix 01)

### 4.2. Granger causality test

In addition to the previous test, granger causality test is carried out to detect the relationship between each dependent variable and independent variable in the model.

As per tables 4,5and 6, there is no granger causality link between almost variables used in this investigation and economic growth in the countries of the study except for SDGNI in Algeria, SD,SDS and SDSX in Morocco as well as GCF,GDS,SDS and SD (double causality ) in Tunisia that granger cause GDPr .

**Table 4.** Granger causality tests (Algeria)

| **Null Hypothesis :** | **Prob. (P)** | **OBS (sig.lev.) 5%** | **Decision** |
|---|---|---|---|
| SD does not granger cause GDPr | 0.9184 | P > 5% | H0 : accepted |
| GDPr does not granger cause SD | 0.7749 | | H0 : accepted |
| GCF does not granger cause GDPr | 0.9971 | | H0 : accepted |
| GDPr does not granger cause GCF | 0.8621 | | H0 : accepted |
| GDS does not granger cause GDPr | 0.8268 | | H0 : accepted |
| GDPr does not granger cause GDS | 0.9519 | | H0 : accepted |
| SDS does not granger cause GDPr | 0.2316 | | H0 : accepted |
| GDPr does not granger cause SDS | 0.9597 | | H0 : accepted |
| SDSXdoes not granger cause GDPr | 0.1472 | | H0 : accepted |
| GDPr does not granger cause SDSX | 0.8601 | | H0 : accepted |
| SDGNIdoes not granger cause GDPr | 0.0134 | P <5% | H0 : rejected |
| GDPr does not granger cause SDGNI | 0.1369 | | H0 : accepted |
| RESSD does not granger cause GDPr | 0.9860 | P > 5% | H0 : accepted |
| GDPr does not granger cause RESSD | 0.9912 | | H0 : accepted |
| FDI does not granger cause GDPr | 0.8251 | | H0 : accepted |
| GDPr does not granger cause FDI | 0.9521 | | H0 : accepted |

**Source:** Eveiws 8 output (appendix 02)

**Table 5.** Granger causality tests (Morocco)

| **Null hypothesis :** | **Prob. (P)** | **OBS (sig.lev.) 5%** | **Decision** |
|---|---|---|---|
| SD does not granger cause GDPr | 0.0483 | P <5% | H0 : rejected |
| GDPr does not granger cause SD | 0.4211 | | H0 : accepted |
| GCF does not granger cause GDPr | 0.3128 | P > 5% | H0 : accepted |
| GDPr does not granger cause GCF | 0.8816 | | H0 : accepted |
| GDS does not granger cause GDPr | 0.2736 | | H0 : accepted |
| GDPr does not granger cause GDS | 0.1459 | | H0 : accepted |
| SDS does not granger cause GDPr | 0.0153 | P <5% | H0 : rejected |
| GDPr does not granger cause SDS | 0.3033 | P >5% | H0 : accepted |

| | | | |
|---|---|---|---|
| SDSXdoes not granger cause GDPr | 0.0358 | P <5% | H0 : rejected |
| GDPr does not granger cause SDSX | 0.1540 | | H0 : accepted |
| SDGNIdoes not granger cause GDPr | 0.9734 | | H0 : accepted |
| GDPr does not granger cause SDGNI | 0.1080 | | H0 : accepted |
| RESSD does not granger cause GDPr | 0.9227 | P > 5% | H0 : accepted |
| GDPr does not granger cause RESSD | 0.5870 | | H0 : accepted |
| FDI does not granger cause GDPr | 0.4907 | | H0 : accepted |
| GDPr does not granger cause FDI | 0.4553 | | H0 : accepted |

**Source:** Eveiws 8 output (appendix 02)

**Table 6.** Granger causality tests (Tunisia)

| **Null hypothesis :** | **Prob. (P)** | **OBS** | **Decision** |
|---|---|---|---|
| SD does not granger cause GDPr | 0.0083 | | H0 : rejected |
| GDPr does not granger cause SD | 0.0372 | P <5% | H0 : rejected |
| GCF does not granger cause GDPr | 0.0058 | | H0 : rejected |
| GDPr does not granger cause GCF | 0.7629 | P >5% | H0 : accepted |
| GDS does not granger cause GDPr | 0.0211 | P <5% | H0 : rejected |
| GDPr does not granger cause GDS | 0.8901 | P >5% | H0 : accepted |
| SDS does not granger cause GDPr | 0.0106 | P <5% | H0 : rejected |
| GDPr does not granger cause SDS | 0.2441 | | H0 : accepted |
| SDSXdoes not granger cause GDPr | 0.8446 | | H0 : accepted |
| GDPr does not granger cause SDSX | 0.4437 | | H0 : accepted |
| SDGNIdoes not granger cause GDPr | 0.5990 | | H0 : accepted |
| GDPr does not granger cause SDGNI | 0.2803 | P > 5% | H0 : accepted |
| RESSD does not granger cause GDPr | 0.2756 | | H0 : accepted |
| GDPr does not granger cause RESSD | 0.7754 | | H0 : accepted |
| FDI does not granger cause GDPr | 0.1610 | | H0 : accepted |
| GDPr does not granger cause FDI | 0.5603 | | H0 : accepted |

**Source:** Eveiws 8 output (appendix 02)

## 5. Regression results

The estimation results in tables 7 denote that all main variables of the study are statistically insignificant in all of Algeria, Morocco and Tunisia except one variable that is SDGNI in Tunisia.

The results show that the all variables have a negative relation with economic growth rate in Algeria .in Tunisia ,one primary variable that is SDSX shows a positive impact on its economic growth rate whilst SDGNI in Morocco also denotes a positive relation with its economic growth rate.

So, the estimation results indicate that for a 1% increase in sovereign debt funds, the economic growth rate decline by 0.27% and 0.01% in Morocco and Algeria respectively and raised by 0.47% in Tunisia .a 1% increase in sovereign debt services results a burden of 0.17%, 0.24%and approximately 2.11% in Algeria, Morocco and Tunisia respectively .for a 1%increase in sovereign debt to GNI ratio, the economic growth rate deteriorate by 28%, 2.35% in Tunisia and Algeria and positively contribute to the economic growth of Morocco by 5.4%.

According to the results above ,the hypothesis of a positive relation between reserves to sovereign debt ratio and economic growth rate is rejected .additionally , the estimation results show that the considered sovereign debt's best alternative (foreign direct investment inflows) variable has a positive relation with economic growth rate except for Algeria (FDI coefficient <0).

**6. Results' discussion**

The primary objective of this empirical investigation is to judge whether officials in Algeria, Morocco and Tunisia have properly used the sovereign debt to upgrading their economies performance using OLS method which gather the variables that measure the debt burden to test the hypothesis of the study which estimates a failure of those officials in allocating sovereign debt correctly to correct their economies failures and improving their performance.

The results' findings show that the main variables which measure sovereign debt burden are statistically insignificant, except for debt overhang measurement in Tunisia (SDGNI ratio) which is statistically significant

Sovereign debt accumulation represented by the variable SDGNI ratio shows a negative impact of sovereign debt on economic growth rate of Algeria and Tunisia, against an unexpected positive value of this variable that means reject the hypothesis of negative impact of debt accumulation on economic growth in morocco.

Sovereign debt service to exports ratio accept the hypothesis of reverse contribution of sovereign debt crowding to economic growth in each of Algeria and Morocco, except for Tunisia where it registered a positive value.

The empirical model findings also show that the sovereign debt service variable denotes a direct negative effect of sovereign debt service on economic growth in all countries of the study. Moreover, the investigation findings denote that sovereign debt influence the economic growth rate of these North African countries in different proportions .for example: a 1% increase in sovereign debt stock, economic growth deteriorates very slightly in Algeria (0.01%) against 0.27% in Morocco, but positively affect Tunisian economic growth rate by 0.47%.thus, Tunisian officials may be efficient in using sovereign debt in improving their economic performance. despite of that , sovereign debt burden is also present with different proportions in Algeria ,Morocco and Tunisia.

**Table 1.** OLS model estimation results

| Var. | Algeria | | | Morocco | | | Tunisia | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Coef.** | **t-stat.** | **Prob.** | **Coef.** | **t-stat.** | **Prob.** | **Coef.** | **t-stat.** | **Prob.** |
| C | 9.06 | 2.56 | 0.01 | 5.91 | 2.45 | 0.01 | 14.41 | 3.09 | 0.00 |
| SD | -0,01 | -0.04 | 0.96 | -0.27 | -0.70 | 0.48 | 0.47 | 1.02 | 0.31 |
| GCF | -0.04 | -0.27 | 0.78 | -0.43 | -1.09 | 0.28 | -1.31 | -1.78 | 0.08 |
| GDS | -0.003 | -0.03 | 0.97 | 0.97 | 1.01 | 0.31 | 1.18 | 1.64 | 0.10 |
| SDS | -0.17 | -0.34 | 0.73 | -0.24 | -0.11 | 0.90 | -2.11 | -0.69 | 0.49 |
| SDSX | -7.18 | -0.95 | 0.34 | -7.97 | -0.54 | 0.58 | 27.30 | 1.33 | 0.18 |
| SDGNI | -2.35 | -0.21 | 0.83 | 5.42 | 0.77 | 0.44 | -28.89 | -2.23 | 0.03 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| RESSD | -0.003 | 0.04 | 0.96 | -3.61 | -0.61 | 0.54 | -3.93 | -0.57 | 0.56 |
| FDI | -0.83 | -0.34 | 0.73 | 0.73 | 0.55 | 0.57 | 0.33 | 0.27 | 0.78 |
| $R^2$ | 0.170888 | | | 0.118929 | | | 0.296934 | | |
| Ad.$R^2$ | -0.003662 | | | -0.066560 | | | 0.148920 | | |
| F-stat. | 0.979021 | | | 0.641165 | | | 2.006120 | | |
| Prob.(F-stat.) | 0.467043 | | | 0.738225 | | | 0.072104 | | |

**Source:** Eviews 8 output (appendix 03)

## 7. CONCLUSION

Motivated by the recent sovereign debt crisis that hit the Eurozone area , 'a success' or 'a failure' in improving economic performance in Algeria ,Morocco and Tunisia through the allocation of sovereign debt is empirically investigated with annual data over the period of 1970-2016.

The study findings indicate 'a failure 'in allocating sovereign debt to improve the economic performance in both Algeria and Morocco .that, the results show a negative relation between both sovereign debt fund and its service with economic growth rate in the two countries which refers to a misallocation or waste it in unproductive channels.

The results also show that Tunisian officials have succeeded in correctly allocating the sovereign debt to improve their economic growth whereas sovereign debt and sovereign debt service to exports ratio registered a positive value which leads to accept the hypothesis of the efficient use of this external financial source to correct economic failures. Despite this, a significant debt burden is present due to debt overhang.

Notwithstanding with that, the impact of sovereign debt on economic growth in all countries of the study found to be statistically insignificant. As per above information ,an effective debt management system is required in each of Algeria and morocco ,especially when we know that both countries still choose this financial option to meet their development's financing programs .

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## Appendices:

## Appendix 01: Group unit root tests

Group unit root: summary (Algeria)

Group unit root test: Summary
Series: GDPR, SD, GCF, GDS, SDS, SDSX, SDGNI, RESSD, FDI
Date: 08/26/19 Time: 21:41
Sample: 1970 2016
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 9
Newey-West automatic bandwidth selection and Bartlett kernel

| Method | Statistic | Prob.** | Cross-sections | Obs |
|---|---|---|---|---|
| Null: Unit root (assumes common unit root process) | | | | |
| Levin, Lin & Chu t* | 1.07503 | 0.8588 | 9 | 391 |
| Null: Unit root (assumes individual unit root process) | | | | |
| Im, Pesaran and Shin W-stat | -7.88651 | 0.0000 | 9 | 391 |
| ADF - Fisher Chi-square | 83.1935 | 0.0000 | 9 | 391 |
| PP - Fisher Chi-square | 49.0893 | 0.0001 | 9 | 414 |

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

Group unit root: summary (Morocco)

Group unit root test: Summary
Series: GDPR, SD, GCF, GDS, SDS, SDSX, SDGNI, RESSD, FDI
Date: 08/26/19 Time: 21:49
Sample: 1970 2016
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 1
Newey-West automatic bandwidth selection and Bartlett kernel

| Method | Statistic | Prob.** | Cross-sections | Obs |
|---|---|---|---|---|
| Null: Unit root (assumes common unit root process) | | | | |
| Levin, Lin & Chu t* | -0.33059 | 0.3705 | 9 | 412 |
| Null: Unit root (assumes individual unit root process) | | | | |
| Im, Pesaran and Shin W-stat | -2.08963 | 0.0183 | 9 | 412 |
| ADF - Fisher Chi-square | 53.4190 | 0.0000 | 9 | 412 |
| PP - Fisher Chi-square | 52.7396 | 0.0000 | 9 | 414 |

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

## Group unit root: summary (Tunisia)

Group unit root test: Summary
Series: GDPR, SD, GCF, GDS, SDS, SDSX, SDGNI, RESSD, FDI
Date: 08/26/19 Time: 21:58
Sample: 1970 2016
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 1
Newey-West automatic bandwidth selection and Bartlett kernel

| Method | Statistic | Prob.** | Cross-sections | Obs |
|---|---|---|---|---|
| Null: Unit root (assumes common unit root process) | | | | |
| Levin, Lin & Chu t* | -18.5550 | 0.0000 | 9 | 403 |
| Null: Unit root (assumes individual unit root process) | | | | |
| Im, Pesaran and Shin W-stat | -19.6724 | 0.0000 | 9 | 403 |
| ADF - Fisher Chi-square | 258.437 | 0.0000 | 9 | 403 |
| PP - Fisher Chi-square | 230.921 | 0.0000 | 9 | 405 |

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

# Appendix 02 : Granger caus. test

## Granger causality tests (Algeria)

Pairwise Granger Causality Tests
Date: 08/26/19 Time: 21:43
Sample: 1970 2016
Lags: 3

| Null Hypothesis: | Obs | F-Statistic | Prob. |
|---|---|---|---|
| SD does not Granger Cause GDPR | 44 | 0.16636 | 0.9184 |
| GDPR does not Granger Cause SD | | 0.37032 | 0.7749 |
| GCF does not Granger Cause GDPR | 44 | 0.01625 | 0.9971 |
| GDPR does not Granger Cause GCF | | 0.24822 | 0.8621 |
| GDS does not Granger Cause GDPR | 44 | 0.29770 | 0.8268 |
| GDPR does not Granger Cause GDS | | 0.11317 | 0.9519 |
| SDS does not Granger Cause GDPR | 44 | 1.49590 | 0.2316 |
| GDPR does not Granger Cause SDS | | 0.09971 | 0.9597 |
| SDSX does not Granger Cause GDPR | 44 | 1.89607 | 0.1472 |
| GDPR does not Granger Cause SDSX | | 0.25104 | 0.8601 |
| SDGNI does not Granger Cause GDPR | 44 | 4.08026 | 0.0134 |
| GDPR does not Granger Cause SDGNI | | 1.96032 | 0.1369 |
| RESSD does not Granger Cause GDPR | 44 | 0.04767 | 0.9860 |
| GDPR does not Granger Cause RESSD | | 0.03475 | 0.9912 |
| FDI does not Granger Cause GDPR | 44 | 0.30012 | 0.8251 |
| GDPR does not Granger Cause FDI | | 0.11273 | 0.9521 |

## Granger causality tests (Morocco)

Pairwise Granger Causality Tests
Date: 08/26/19 Time: 21:50
Sample: 1970 2016
Lags: 1

| Null Hypothesis: | Obs | F-Statistic | Prob. |
|---|---|---|---|
| SD does not Granger Cause GDPR | 46 | 4.13162 | 0.0483 |
| GDPR does not Granger Cause SD | | 0.65968 | 0.4211 |
| GCF does not Granger Cause GDPR | 46 | 1.04317 | 0.3128 |
| GDPR does not Granger Cause GCF | | 0.02245 | 0.8816 |
| GDS does not Granger Cause GDPR | 46 | 1.23000 | 0.2736 |
| GDPR does not Granger Cause GDS | | 2.19353 | 0.1459 |
| SDS does not Granger Cause GDPR | 46 | 6.37606 | 0.0153 |
| GDPR does not Granger Cause SDS | | 1.08543 | 0.3033 |
| SDSX does not Granger Cause GDPR | 46 | 4.69794 | 0.0358 |
| GDPR does not Granger Cause SDSX | | 2.10573 | 0.1540 |
| SDGNI does not Granger Cause GDPR | 46 | 0.00112 | 0.9734 |
| GDPR does not Granger Cause SDGNI | | 2.69481 | 0.1080 |
| RESSD does not Granger Cause GDPR | 46 | 0.00952 | 0.9227 |
| GDPR does not Granger Cause RESSD | | 0.29948 | 0.5870 |
| FDI does not Granger Cause GDPR | 46 | 0.48316 | 0.4907 |
| GDPR does not Granger Cause FDI | | 0.56760 | 0.4553 |

## Granger causality tests (Tunisia)

Pairwise Granger Causality Tests
Date: 08/26/19 Time: 21:59
Sample: 1970 2016
Lags: 1

| Null Hypothesis: | Obs | F-Statistic | Prob. |
|---|---|---|---|
| SD does not Granger Cause GDPR | 46 | 7.65137 | 0.0083 |
| GDPR does not Granger Cause SD | | 4.62445 | 0.0372 |
| GCF does not Granger Cause GDPR | 46 | 8.43067 | 0.0058 |
| GDPR does not Granger Cause GCF | | 0.09219 | 0.7629 |
| GDS does not Granger Cause GDPR | 46 | 5.72785 | 0.0211 |
| GDPR does not Granger Cause GDS | | 0.01932 | 0.8901 |
| SDS does not Granger Cause GDPR | 46 | 7.13331 | 0.0106 |
| GDPR does not Granger Cause SDS | | 1.39480 | 0.2441 |
| SDSX does not Granger Cause GDPR | 46 | 0.03887 | 0.8446 |
| GDPR does not Granger Cause SDSX | | 0.59754 | 0.4437 |
| SDGNI does not Granger Cause GDPR | 46 | 0.28065 | 0.5990 |
| GDPR does not Granger Cause SDGNI | | 1.19558 | 0.2803 |
| RESSD does not Granger Cause GDPR | 46 | 1.21960 | 0.2756 |
| GDPR does not Granger Cause RESSD | | 0.08244 | 0.7754 |
| FDI does not Granger Cause GDPR | 46 | 2.03407 | 0.1610 |
| GDPR does not Granger Cause FDI | | 0.34458 | 0.5603 |

# Appendix 03 : OLS Results

## OLS model results (Algeria)

Dependent Variable: GDPR
Method: Least Squares
Date: 08/26/19 Time: 17:44
Sample: 1970 2016
Included observations: 47

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 9.069399 | 3.541873 | 2.560622 | 0.0145 |
| SD | -0.009895 | 0.216121 | -0.045784 | 0.9637 |
| GCF | -0.045422 | 0.167102 | -0.271822 | 0.7872 |
| GDS | -0.003406 | 0.107419 | -0.031704 | 0.9749 |
| SDS | -0.173159 | 0.502210 | -0.344794 | 0.7322 |
| SDSX | -7.183451 | 7.559205 | -0.950292 | 0.3480 |
| SDGNI | -2.355125 | 11.18035 | -0.210649 | 0.8343 |
| RESSD | -0.003675 | 0.074723 | -0.049186 | 0.9610 |
| FDI | -0.827921 | 2.432045 | -0.340422 | 0.7354 |

| | | | |
|---|---|---|---|
| R-squared | 0.170888 | Mean dependent var | 3.782936 |
| Adjusted R-squared | -0.003662 | S.D. dependent var | 4.911055 |
| S.E. of regression | 4.920038 | Akaike info criterion | 6.194927 |
| Sum squared resid | 919.8575 | Schwarz criterion | 6.549211 |
| Log likelihood | -136.5808 | Hannan-Quinn criter. | 6.328246 |
| F-statistic | 0.979021 | Durbin-Watson stat | 3.022492 |
| Prob(F-statistic) | 0.467043 | | |

## OLS model results (Morocco)

Dependent Variable: GDPR
Method: Least Squares
Date: 08/26/19 Time: 21:53
Sample: 1970 2016
Included observations: 47

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 5.913858 | 2.412345 | 2.451497 | 0.0189 |
| SD | -0.271295 | 0.385601 | -0.703564 | 0.4860 |
| GCF | -0.438294 | 0.401449 | -1.091781 | 0.2818 |
| GDS | 0.976822 | 0.961145 | 1.016311 | 0.3159 |
| SDS | -0.241658 | 2.101076 | -0.115016 | 0.9090 |
| SDSX | -7.979373 | 14.67233 | -0.543838 | 0.5897 |
| SDGNI | 5.424440 | 6.996591 | 0.775298 | 0.4430 |
| RESSD | -3.617909 | 5.852595 | -0.618172 | 0.5401 |
| FDI | 0.733616 | 1.313803 | 0.558391 | 0.5799 |

| | | | |
|---|---|---|---|
| R-squared | 0.118929 | Mean dependent var | 4.394106 |
| Adjusted R-squared | -0.066560 | S.D. dependent var | 3.686144 |
| S.E. of regression | 3.806843 | Akaike info criterion | 5.681895 |
| Sum squared resid | 550.6979 | Schwarz criterion | 6.036178 |
| Log likelihood | -124.5245 | Hannan-Quinn criter. | 5.815214 |
| F-statistic | 0.641165 | Durbin-Watson stat | 3.140164 |
| Prob(F-statistic) | 0.738225 | | |

## OLS model results (Tunisia)

Dependent Variable: GDPR
Method: Least Squares
Date: 08/26/19 Time: 22:01
Sample: 1970 2016
Included observations: 47

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 14.41325 | 4.660683 | 3.092520 | 0.0037 |
| SD | 0.479717 | 0.467412 | 1.026324 | 0.3112 |
| GCF | -1.314624 | 0.738441 | -1.780269 | 0.0830 |
| GDS | 1.184836 | 0.719193 | 1.647452 | 0.1077 |
| SDS | -2.119100 | 3.068060 | -0.690697 | 0.4940 |
| SDSX | 27.30578 | 20.42941 | 1.336592 | 0.1893 |
| SDGNI | -28.89123 | 12.91269 | -2.237430 | 0.0312 |
| RESSD | -3.936247 | 6.829199 | -0.576385 | 0.5678 |
| FDI | 0.338541 | 1.221770 | 0.277090 | 0.7832 |

| | | | |
|---|---|---|---|
| R-squared | 0.296934 | Mean dependent var | 4.583702 |
| Adjusted R-squared | 0.148920 | S.D. dependent var | 3.366510 |
| S.E. of regression | 3.105740 | Akaike info criterion | 5.274798 |
| Sum squared resid | 366.5336 | Schwarz criterion | 5.629082 |
| Log likelihood | -114.9578 | Hannan-Quinn criter. | 5.408118 |
| F-statistic | 2.006120 | Durbin-Watson stat | 2.523165 |
| Prob(F-statistic) | 0.072104 | | |