The relationship amongst public debt and economic growth in developing country case of Tunisia

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***Abstract*—this study examined the impact of public debt on economic growth of Tunisia using annual time series data spanning 1987 to 2017. The study employed the Augmented Dickey-Fuller test, Johansen co-integration test, Error Correction Model (ECM) and the Granger Causality test. The Johansen co-integration test results revealed there is no long-run relationship among the variables; external debt stock, domestic debt stock, external debt servicing, domestic debt servicing and economic development (proxied with GDP per capita) in Tunisia. The ECM results revealed that external debt stock has not an impact on economic development; however, domestic debt stock has a direct and significant relationship with economic growth while domestic debt service payment and external debt service payment are significant but inversely related to economic development. The lagged error correction terms in ECM 1 equation is not statistically significant.**

***Keywords*—Economic growth; external debt; domestic debt; error correction method; external debt servicing; domestic debt servicing**

I. INTRODUCTION

The issue of the state's debt is a major issue in the economy. For centuries already, one of the dominant questions of the macro economy has been that of the effects of public debt on the economy and hence on the different macroeconomic aggregates. For several decades, the debt problem of developing countries has become one of the major problems in international relations, and is now seen as a dominant subject in international forums. In fact, like all other variables of the conjuncture, it is undeniable that the indebtedness acts on the economic growth of the countries, on the human well-being.

In recent years, the specificity of the debt problems of African countries has received official attention, particularly from developing countries such as Tunisia. Tunisia is a middle-income, non-oil-rich country, with little natural resources, fully open to external trade, increasingly facing structural financial, commercial and economic imbalances.

There are two major sources of debts in Tunisia the internal and external sources: the internal sources include development stocks, treasury bills, treasury certificate, treasury bonds and ways and means of advances, while external debt sources include bilateral and multilateral sources such as world bank, International monetary fund (IMF),

The objective of this study was therefore to examine the impact of public debt on economic development of Tunisia by assessing the individual effects of the country's domestic and external debt stocks and service payments on economic development (proxied with GDP per capita) of Tunisia. This study will serve as a tool in revamping government policies towards loan procurement and debt servicing in Tunisia, and may also serve as a yardstick for further research and documentation on Tunisian's debt situation.

This paper is organized into five sections: Introduction, literature review, empirical strategy, result presentation and analysis and finally conclusion.

II. LITERATURE REVIEW

Debt- cum - growth model

The debate about economic growth and indebtedness is relatively old, dating back to Cairnes (1874) and the theories of endogenous growth. In the main, two approaches were advanced the theory of growth and indebtedness, namely Keynesians and Neoclassical. For the Keynesians, the main idea is that debt does not incur burdens for present and future generations, because of the investments it generates. From this approach debt raises demand, the effect and accelerator of an increase in investment leads to an increase in production. On the other hand, the classics consider the debt as a future tax the State. According to them, public debt has a negative impact on the accumulation of capital and the consumption of future and present generations.

Most empirical work considers public debt as a brake on growth. It reduces available savings, raises interest rates or calls for a reduction in productive public spending and raises taxes. In this context, Kumar and Woo (2010) have shown that economic expansion reduces the debt-to-GDP ratio. Thus, Ferreira (2009) found evidence of two-way causality between the two variables and the unstable dynamics of public debt, which plummeted as well as increased. An explanation for these empirical difficulties is that public debt can have a non-linear effect on economic growth (Pattillo et al., 2002 and Clements et al., 2003). In developed countries, the relationship is more difficult to establish. Schclarek (2004) finds no statistically significant relationship. In more recent studies, such as Checherita and Rother (2010), public debt in the euro area is detrimental to growth above a threshold of 90-100% of GDP. This characteristic is confirmed by Minea and Villieu (2009), where a sign change in the effect of deficits on public investment takes place only in the neighbourhood of a public debt ratio of 120% of GDP. More controversial work has resulted in a turning point in the relationship between public debt and growth, which is around 90% of GDP (Reinhart and Rogoff, 2010). Following Herndon's criticisms, Ash, Pollin

(2013), Reinhart and Rogoff (2013) are still basing their initial conclusions, which in turn could lead to a slowdown in economic growth.

III. EMPIRICAL STRATEGY

III.1 Data Types and Sources

In examining the impact of public debt on economic development of Tunisia for the period of 1987-2017, this work solely relied on secondary type of data collection, which was gotten from the Central Bank of Tunisia statistical bulletin and annual reports.

III.2 Method of Data Analysis

To avoid spurious regression due to the problem of non-stationarity of data, the Augmented Dickey Fuller test was used to check for the presence of a unit root in the variables whether the variables are stationary or not and to what degree. After testing for the stationarity of the variables, the next step was to test for cointegration. This test was used to check if long-run relationship exists among the variables in the model and was carried out using the Johansen technique. In the short-run, deviations from the long-run relationship established could occur due to shocks to any of the variables. In addition, the dynamics governing the short-run behaviour of the model are different from those in the long-run. Due to this difference, the short-run interactions and the adjustments to long-run equilibrium are important because of the policy implications. The Error Correction Model (ECM) was therefore used to correct or eliminate the discrepancy that occurs in the short-run. It was used to test the speed of adjustment from short run to long-run equilibrium. The coefficient of error-correction variable gives the percentage of the discrepancy between the variables that can be eliminated in the next time period. The apriori expectation is that the ECM coefficient must be negative and significant. Finally, the granger causality test was used to check for causality between the variables. That is to test if the past of the explanatory variables contains information that can be used to predict the future of the dependent variable.

III.3 Model Specification

GDPpc = f (EDS, DDS, ESP, DSP)

The stochastic form of the model is:

$GDPpc = \beta_0 + \beta_1 EDS + \beta_2 DDS + \beta_3 ESP + \beta 4 DSP + \mu$

Where;

GDP = Gross domestic product per capita

EDS = External debt stock

DDS = Domestic debt stock

ESP = External debt service payment

DSP = Domestic debt service payment

μ = Error term

β_0 = intercept

$\beta_1, \beta_2, \beta_3, \beta_4,$ = slope of the regression equation our apriori expectations are:

β_1 and $\beta_2 > 0$, & β_3 and $\beta_4 < 0$.

IV.4 Justification of Chosen Variables and Measurement

Gross domestic product is a measure that reflects the value of goods and services produced per individual in the economy in a given year and are measured in millions of dollars. It is used to capture economic growth and development in this study because it is captures the total output produced by each individual in the country.

External debt stock is used as a proxy for capturing total external debt of the economy in a given period. It is measured in millions of dollars..

Domestic debt stock is used as a proxy for capturing total domestic debt of the economy in a given period. It is measured in millions of dollars.

External debt service payment is used to capture the total amount of money expended by the government on debt payment abroad and is measured in millions of dollars. This is characterized by channelling domestic resources abroad for servicing debt and will reduce the money available for domestic investment and consumption, hence reduce the GDP per capita.

Domestic debt service payment is used to capture the total amount of money expended by the government on debt payment within the country and is measured in millions of dollars. When government embark on servicing domestic debt, the government expenditure component of aggregate demand falls resulting to a multiple decrease in output and employment.

All variables are taking in logarithmic form.

IV. RESULT PRESENTATION AND ANALYSIS

IV.1 The Unit Root Test Results

Non-stationary data produces spurious regression; hence the result may be misleading. Therefore, it was cognizant to establish the stationarity of data. The test results of the Augmented Dickey-Fuller and Perron Person statistics for all the time series variables used in the estimation are presented in **Table 1**.

The presence of unit root indicates that the variables are non-stationary at level. The result of the ADF and PP test statistics showed that the five variables; GDP_{PC}, EDS, DDS, ESP and DSP were not stationary in their level form, but were stationary after the first difference. The null hypothesis of the presence of unit root in the series was rejected as indicated by their probability values which were less than 0.05 and the values of their calculated ADF and PP. In this sens, we say that their series are integrated of the same order I (1).

Table 1: Test for stationarity

	In level		In 1est deference	
	ADF	**PP**	**ADF**	**PP**
LEDS	0.06(0.68)	0.766(0.869)	-9.65(0.00)	-9.087(0.00)
LDDS	-2.61(0.1)	-2.34(0.17)	-4.95(0.00)	-4.95(0.0001)
LESP	-2.29(0.4)	-2.37(0.16)	-3.14(0.04)	-3.14(0.04)
LDSP	-2.3(0.17)	-2.18(0.1)	-4.3(0.005)	-4.84(0.002)
LGDP	-0.26(0.9)	-2.6(0.98)	-3.9(0.03)	-3.98(0.034)

Source: Author's computation from unit root test (ADF)

IV.2 Johansen Co-integration Test

Having confirmed the stationarity of the variables, we proceeded to examine the presence or non presence of co-integration among the variables. The co-integration test was carried out using the Johansen technique and it produced the following results:

The Trace statistic and the Max-Eigen statistic **(Tables 2 & 3)** indicated one cointegrating equations at the 0.05 level. The results of the Johansen Co-integration tests above strongly rejected the null hypothesis of no co-integration.. This implies that there is a relationship between the dependent variable and the explanatory variables.

Table 2: Test for Johansen co-integration using trace statistic

Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	Prob.
None *	0.769503	86.55086	69.81889	0.0013
At most 1	0.529508	45.46041	47.85613	0.0825
At most 2	0.461369	24.34907	29.79707	0.1861
At most 3	0.137593	7.024802	15.49471	0.5748
At most 4	0.097745	2.880014	3.841466	0.0897

Trace test indicates 1 cointegrating equation (s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
Source: Author's computation from E-views 9

Table 3: Test for Johansen co-integration using max-Eigen value

Hypothesized No. of CE(s)	Eigen value	Max-Eigen Statistic	0.05 Critical Value	Prob.
None *	0.769503	41.09044	33.87687	0.0058
At most 1	0.529508	21.11135	27.58434	0.2695
At most 2	0.461369	17.32427	21.13162	0.1572
At most 3	0.137593	4.144788	14.26460	0.8438
At most 4	0.097745	2.880014	3.841466	0.0897

Max-Eigen value test indicates 1 cointegrating equation(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
Source: Author's computation from E-views9

IV.3 Error Correction Estimates

Table 4: test of Error Correction Estimates

Dependent Variable: D(LGDP)

D(LGDP) = C(1)*(LGDP(-1) + 0.0809627642607*LEDS(-1) - 1.09155471332*LDDS(-1) + 0.327379077259*LESP(-1) + 0.593652247928*LDSP(-1) - 2.96018947727) + C(2)*D(LGDP(-1)) + C(3)*D(LGDP(-2)) + C(4)*D(LEDS(-1)) + C(5)*D(LEDS(-2)) + C(6) *D (LDDS (-1)) + C(7)*D(LDDS(-2)) + C(8)*D(LESP(-1)) + C(9)* D(LESP(-2)) + C(10)*D(LDSP(-1)) + C(11)*D(LDSP(-2)) + C(12)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.376581	0.194803	1.933141	0.0723
C(2)	-0.586413	0.436528	-1.343358	0.1991
C(3)	-0.450145	0.285034	-1.579267	0.1351
C(4)	-0.022609	0.018626	-1.213869	0.2436
C(5)	-0.009634	0.023025	-0.418391	0.6816
C(6)	0.339874	0.181403	1.873586	0.0806
C(7)	-0.002214	0.020699	-0.106944	0.9163
C(8)	-0.130997	0.073307	-1.786974	0.0942
C(9)	0.067614	0.057491	1.176081	0.2579
C(10)	-0.142937	0.070632	-2.023678	0.0612
C(11)	-0.045582	0.056435	-0.807689	0.4319
C(12)	0.031876	0.010714	2.975112	0.0094

R-squared	0.434324	**Mean dependent var**	0.018296
Adjusted R-squared	0.019496	**S.D. dependent var**	0.018734
S.E. of regression	0.018550	**Akaike info criterion**	-4.835577
Sum squared resid	0.005162	**Schwarz criterion**	-4.259650
Log likelihood	77.28029	**Hannan-Quinn criter.**	-4.664324
F-statistic	1.046997	**Durbin-Watson stat**	2.379183
Prob (F-statistic)	0.456435		

Source: Author's computation from E-views 9

The coefficient of the explanatory variables in the error correction model measures the short-run relationship of the dependent variable and the explanatory variables

The result in **Table 4** indicated that most of the variables and their lags are not significant. This is expected possibly because of multicolinearity. The R^2 presented above however indicated that all the explanatory variables in the model accounts for 43.43% of the systematic variation in GDPPC. The f-statistical value of 1.046 with the probability value of 0.45 indicated that the whole model is not significant. The error correction term i.e. ECM(-1) is positive and statistically

not significant at the 5% level. So there is not an equilibrium in the long run.

The above results (Table4) show that external debt stock (EDS) has a negative but not significant relationship with gross domestic product per capita (GDPPC) inTunisia. The negatively signed coefficient of EDS is not in conformity with our apriori expectation. Domestic debt stock (DDS) has a positive and highly significant relationship with gross domestic product per capita (GDP_{PC}) in Tunisia. A unit increase in DDS will lead to 0.33 units increase in GDPPC. External debt servicing (ESP) has a negative and significant relationship with GDP_{PC}. A unit rise in ESP will cause GDPPC to decrease by 0.13 units. Also, domestic debt service payment (DSP) is highly statistically significant and negatively related to GDP_{PC}. A one per cent increase in DSP will cause GDP_{PC} to decrease by 0.14units.

The value of the coefficient of determination (R^2) of 0.43 shows that that the exogenous variables in the ECM equation, EDS, DDS, ESP and DSP explains over 43% of the systematic variations in GDP_{PC} while the remaining 57% variations in GDP are caused by factors outside the model captured in the stochastic term (μ).

Furthermore, the f-statistical value (1.046) is not highly statistically significant at the 5% level going by its probability value of 0.45. This implies that EDS, DDS, ESP and DSP taken together, have not a linear relationship with the dependent variable, GDP_{PC}. The DurbinWatson statistic of 2.37 is indicative of the presence of a low positive serial autocorrelation in the model.

IV.4 Granger Causality Test

The result of Pairwise Granger's causality between the variable under study is provided in table 5. However, our focus is on the causal relationship public debt burden and economic growth and development inTunisia.

The probabilities for our causal variables EDS and GDP_{PC} are 0.722 and 0.302. Therefore we accept the null hypothesis and conclude that there is no causal relationship between external debt and gross domestic product per capita in Tunisia. Also, the probabilities for our causal variables DDS and GDP_{PC} are 0.743 and 0.1561. Therefore we reject the null hypothesis and conclude that there is no way causal relationship between domestic debt and gross domestic product per capita in Tunisia. It is generally implied that no causal relationship exists between external debt burden and gross domestic product per capita and no way causal relationship exist between domestic debt burden and gross domestic product per capita in Tunisia, but there is one way causal between ESP and GDP_{PC} (0.02)

Table 5: Granger causality test

Pairwise Granger Causality Tests
Sample: 1987 2016
Date: 10/08/17 Time: 12:19
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
EDS does not Granger Cause GDP	28	0.33024	0.7221
GDP does not Granger Cause EDS		1.26104	0.3022
DDS does not Granger Cause GDP	28	0.29983	0.7438
GDP does not Granger Cause DDS		2.01529	0.1561
ESP does not Granger Cause GDP	28	4.62883	0.0204
GDP does not Granger Cause ESP		1.17510	0.3267
DSP does not Granger Cause GDP	28	0.11528	0.8916
GDP does not Granger Cause DSP		1.71529	0.2021
DDS does not Granger Cause EDS	28	6.15225	0.0072
EDS does not Granger Cause DDS		0.00282	0.9972
ESP does not Granger Cause EDS	28	0.76996	0.4746
EDS does not Granger Cause ESP		2.22320	0.1310
DSP does not Granger Cause EDS	28	0.13784	0.8720
EDS does not Granger Cause DSP		5.87601	0.0087
ESP does not Granger Cause DDS	28	2.62534	0.0940
DDS does not Granger Cause ESP		1.63391	0.2170
DSP does not Granger Cause DDS	28	0.10206	0.9034
DDS does not Granger Cause DSP		0.96855	0.3946
DSP does not Granger Cause ESP	28	4.75376	0.0187
ESP does not Granger Cause DSP		0.52987	0.5957

Source: Author's computation from E-views 9

V. CONCLUSION

The objective of the study was to examine the impact of public debt on economic growth of Tunisia. The study used annual time series data spanning 1987-2017. Economic growth (proxied by GDP per capita) was regressed on external debt stock (EDS), domestic debt stock (DDS), external debt service payment (ESP) and domestic debt service payment (DSP). The study employed the Augmented Dickey-Fuller test, Johansen cointegration test, Error Correction Method (ECM) and the Granger causality test.

The results of the study revealed that there is no long-run relationship between external debt stock, domestic debt stock, external debt servicing, domestic debt servicing and gross domestic product per capita in Tunisia. Also, it was discovered that external debt service payment (ESP) and domestic debt service payment (DSP) have insignificant negative relationship with gross domestic product per capita in Tunisia. However, domestic debt stock (DDS) has a positive and significant effect on gross domestic product per capita (GDP_{PC}).

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