The Impact of Government Debt on Economic Growth: An Empirical Investigation of the Lebanese Market

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The accumulation of the Lebanese public debt since 1990 is becoming the most critical and serious risk in the country's future economic growth and stability. This paper investigates the impact of the Lebanese government debt on its economic growth through an econometric analysis using data for about 26 years starting in 1989. The research data is from the Lebanese central bank, the International Monetary Funds and the World Development Indicators then it is regressed in basic time series analysis taking into consideration the different variables that have an influence on the economic growth. After testing its robustness and illustrated through ARMAX, the results show a statistically significant impact of public debt to GDP on the Lebanese economic *growth but vary in sign based on a threshold of 128.8%.*

Key words: Lebanese public debt, economic growth, public debt threshold, time series analysis

INTRODUCTION

The Lebanon public debt is becoming critical in determining the Lebanese economic growth, due to the sizable accumulation of government debts, since the early 1990s. Several factors in the Lebanese economy lead to increase in the total public debt to GDP about 183 per cent in 2006 and 134 per cent in 2014. Since 1990, the accumulation for the heavy Lebanese public debt was mainly due to the continues Lebanese budget deficits due to the heavy public debt service, high government expenditures on infrastructure, and the inadequate taxes collection and policies. The Lebanese budget deficit increases lead to increases in interest rates in local currency, which attract investment in Lebanese Treasury Bills as the main source for the Lebanese public debt. Beside the Lebanese high public debt, the Lebanese economy characterized by substantial trade deficits with regular imports high level.

The macro financial risk due to high public debt affect the country's long-term economic growth and stability around the world. For example, at the end of 2011, the highest debt to GDP ratio among the world's developed countries was the Japanese public debt to GDP of 233% while the US Debt to GDP ratio reached 102%, and in Europe, the major risk was in Greece with a 165.3% debt to GDP ratio (IMF, 2015). In the Middle East region, the Lebanese economy is facing a major risk due to the high public debt that reached almost 180% of its GDP in 2006. An important question that arises from this observation is whether this high level of public debt have a negative impact on the Lebanese economic growth. Another question is about the Lebanese public debt threshold that starts the negative effect on the economic growth. In other words, is the negative effect is observed only above a certain level of debt.

Reinhart and Rogoff (2010) using simple descriptive statistics showed that high public debt and economic growth have strong negative correlation. They stated that the negative impact of the public debt on the economic growth started considerably after a threshold of 90% of public debt-to-GDP ratio. In the same vein, some econometric studies for a similar set of countries confirmed that the public debt to GDP ratio affected

the economic growth negatively is about 90% of GDP for OECD countries (Cecchetti et al. 2011; Padoan et al. 2012) and for euro area countries (Checherita and Baum et al. 2013). Among these, Panizza and Presbitero (2012) reject the hypothesis that high debt causes lower growth. In spite of the importance of the Lebanese public debt as the highest as the public debtor country in the Middle East, there is a very limited empirical studies (Neaime 2010; Saad 2012) examining the impact of public debt on the economic growth.

The objective of this study is to test the impact of Lebanese public debt on the Lebanese economic growth and its threshold that turn its effect to negative. Accordingly, the study use time series data to test the impact of Lebanese public debt and real economic growth rate for the period 1989–2014. The study conducts within a period of increased public debt rate to GDP on Lebanon. The research main independent variable is the public debt to GDP and its square to check the threshold beside other economic control variables. After we check the model robustness mainly through ARMAX model, we test the public debt threshold that start affecting the Lebanese economic growth. We start the study by introducing the subject then by analyzing the economic situation in Lebanon. The third section presents the literature review of the relationship between Public debt and the economic growth before presenting the research methodology. We end up with main conclusions for the study.

BACKGROUND OF THE LEBANESE ECONOMY

One of the major problems in the Lebanese economy is its huge accumulated public debt to GDP that reached in 2006 180%. Studying the impact of the Lebanese public debt on its economic growth from 1989 to 2014 is the main target of this paper. In achieving this objective, we examine the impact of Lebanese government debt to GDP ratio on the Lebanese economic growth including other macroeconomic and debt variables as mentioned earlier.
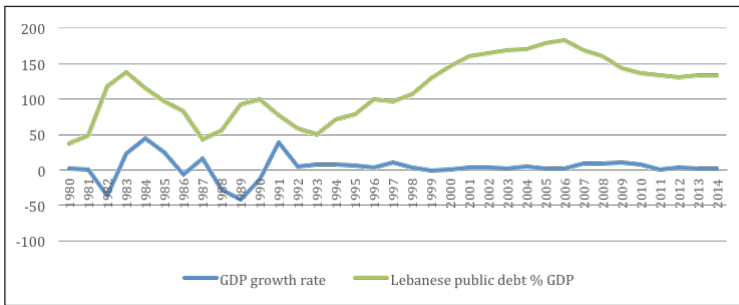
Since 1975 the beginning of the Lebanese civil war, the Lebanese economic situation faced many difficulties due to

several internal and external political instability that caused economic growth fluctuation. After the end of the Lebanese civil war in 1989, the Lebanese economic recovery started to take place to push the economic growth to rise but very slowly with respect to the huge increase in the Lebanese public debt ratio. However, several Lebanese political and security instability beside the continuous budget deficit created unfavorable conditions for investment. These circumstances lead to increase the gap between the economic growth and its public debt to GDP growth.

After the end of the Lebanese civil war in 1989, the Lebanese government used to cover its budget deficits by issuing the treasury bonds as the main source of financing its deficit. The heavy Lebanese government expenditures mainly on infrastructure coupled with corruption and the weak government revenue due to the inadequate collection of taxes led to increase the Lebanese public debt. Another reason in the increase of the Lebanese public debt was its heavy debt service burden. By the end of 2014, total public debt was about 134 per cent of GDP although it reached its highest level 183 % between 2005 and 2006 (see figure 1).

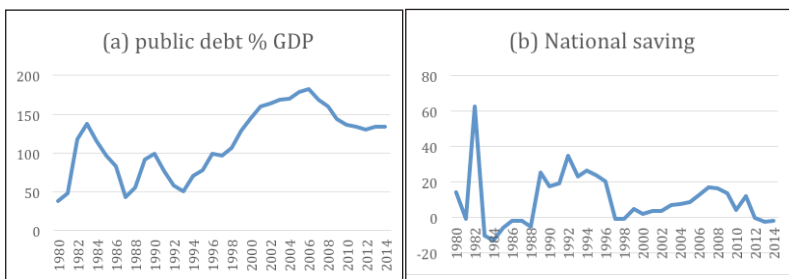Figure 1: Lebanese economic growth versus public debt change 1980–2014

Source: Author estimation based on Lebanese Ministry of Finance and the World Bank's World Development Indicators 2015.
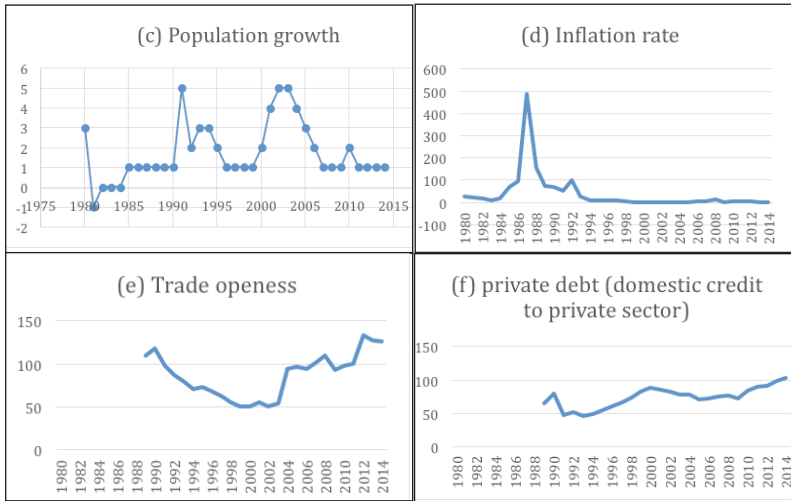
During the Lebanese civil war from 1975 to 1990, the Lebanese government revenue was very weak mainly due to

weak tax collection and thus the national saving was fluctuating (Figure 2b). The inflation rate registered its highest levels in 1987 at 488 per cent then it started to decrease but increased again after the civil war to reach 100 per cent in 1992 (Figure 2d). The population growth rate was not recording big difference during all the tested period (Figure 2c). The Lebanese trade indicate active developments in importing between 1989 and 1992 then showed high rates between 2006 and 2014 where an international trade agreement has been established like The Lebanese-European Union Association agreement (Figure 2e). The Lebanese-European Union Association agreement worked intensively on trade liberalization. With helped to make The European Union is the first trading partner for Lebanon with more than 34 % of Lebanese trade as of 2012. Under the agreement framework, the European Union member states with the Mediterranean partners intended to promote socio-political stability, economic and financial cooperation. In addition, this agreement encourages the Mediterranean countries intra-regional cooperation that would lead to better economic growth and sociopolitical stability (Havrylyshyn 1997)

Figure 2: *Evolution of Lebanon's Macroeconomic Fundamentals, 1980–2014*[12]

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12   Evolution of Lebanon's Macroeconomic Fundamentals, 1980–2014. (a) GDP per capita growth rate, (b) Public debt % of GDP, (c) Gross national saving (% of GDP), (d) population growth rate, (e) inflation rates, (f) current account balance (% of GDP), (g) trade openness (trade % of GDP), (h) private debt (domestic credit to private sector.

(c) Population growth

(d) Inflation rate

(e) Trade openess

(f) private debt (domestic credit to private sector)

Source: Author estimation based on International Monetary Fund's (IMF), Lebanese Ministry of Finance, World Development Indicators WDI (2015).

LITERATURE REVIEW

The theoretical literature supports a negative relationship between public debt and economic growth. The results of many empirical studies show the existence of a negative correlation between public debt and GDP growth (see Diamond 1965; Saint Paul 1992; Schclarek 2004; Adam and Bevan 2005; Aizenman et al. 2007). Most empirical literature on this topic examine the impact of external debt on economic growth mainly in developing countries.

Diamond (1965) tested the taxes effect on capital stock by differentiating between public internal and external debt. He noticed that, due to the taxes impact needed to finance the public debt interest payments, both external and internal public debt minimize the tax payers purchasing power, their savings, and then the capital stock. Moreover, he concludes that additional reduction in the capital stock due to the difference between government debt and physical capital in individual portfolios has produced by internal debt. Saint Paul (1992) finds a negative relation between public debt and growth rate through analyzing

the impact of fiscal policy using the neoclassical growth model. More specifically, he shows that an increase in public debt reduces the growth rate, so there will always be a burden on a future generation. In addition, Aizenman (2007) evaluate the fiscal policy and the optimal public investment for limited tax and debt capacities countries. They studying an endogenous growth model where public expenditure has considered as an input in the production process and they find a negative relation between the public debt and the growth rate although the flow of public expenditures raises productivity.

Krugman (1988) studies the creditors' trade-offs for a country with high debt such levels that cannot attract voluntary new lending. In case a country is unable to meet its debt service requirements from its current income, the creditors have either to finance the country by lending with a great loss hopping that the country will be able to repay its debt, or to write off debt to a level that the country can repay. In the same vain, the IMF and the US post-1983 debt strategy has mainly relied on financing, with debt reform call for forgiveness instead. More precisely, he shows that the choice between forgiveness and financing represents a trade-off. In this context, Schclarek (2004) studies the relationship between growth and debt for a number of developing and developed/industrial economies and covers the period 1970–2002. He finds that higher growth rates are associated with lower external debt levels, and mainly this relationship is not by private external debt but by public external debt for developing countries. However, he does not find any significant relationship between government debt and economic growth for industrial countries.

Reinhart and Rogoff (2010) (henceforth R&R) in a sample of 44 countries over a large period between 1790 and 2009 studies the economic growth and inflation at different levels of government and external debt. They find that there is a weak relationship between real GDP growth and government debt for countries with a threshold of less than 90% debt to GDP ratios. While, the average growth rates considerably greater and the median growth rates decrease by one percent, for countries with debt to GDP ratio above 90%. In addition, they noticed that this public

debt threshold is almost the same in advanced and emerging economies. In the same vein, Kumar and Woo (2010) find a similar GDP growth behavioral change in relation to the debt ratio. Based on a panel of emerging and advanced economies for about four decades, they study the high public debt impact on long run economic growth taking into account various economic growth factors. Among these, Panizza and Presbitero (2012) reject the hypothesis that high debt causes lower growth. Pescatori. et al (2014) found that there is no simple threshold for debt ratios in affecting the economic growth. Although they found an evidence for the trajectory of debt influence on the country's economic growth. In other words, the country with high debt but declining levels proved to have a fast growth as its peers.

Empirically, the results show an inverse relationship between subsequent growth and initial debt. However, controlling other determinants of growth and realize that a 10%-point increase in the initial debt to GDP ratio on average is accompanied with a decrease in annual real per capital GDP growth of around 0.2% points per year, while the impact is somehow smaller in advanced economies. In literature, public debt proved to have a positive impact on economic growth until it reaches certain level (Chudik et. al 2015). The risk is for countries with too high debt levels facing difficulties to refinance it, decreasing economic growth and even they can reach a level of default. For the Lebanese economy, the empirical studies on the impact for the Lebanese public debt on its economic growth is still very limited (Neaime 2014; Saad 2012).

METHODOLOGY

This research test used data from the Lebanese central bank, Lebanese ministry of finance, International Monetary and fund, and World Bank statistics from 1989 to 2014 as secondary time series. These data included public and private debt, inflation, population growth, trade openness and national saving. The research used multilinear regression equation using Ordinary Least Squares method. The research testing will start with the baseline-estimated regression before we run other robustness

regression checking. In order to check the fitness of the model through autoregressive along with moving average terms for the disturbance in the model we run the ARMAX. We end up with checking the public debt threshold that turns its impact on the Lebanese economic growth to negative.

In testing the impact of the Lebanese public debt on its economic growth, we compose the dataset focusing on the debt variables, such as public debt and its square in order to check later the public debt to GDP threshold. Based on the variables used by Cecchetti et al. (2011), some explanatory variables included in the model like the private debt, trade openness, national saving, Population growth rate, and the inflation rate. Respecting the nature of the Lebanese economy structure, not all variables used by Cecchetti et al are used here due to the availability of data. Data set in this research has collected from year 1989 until year 2014– in total 26 yearly observations it is limited due to the availability of data.

This research model based on multiple linear regression equation, it composes of one dependent and six independent variables during the time period t equivalent to 26 periods. The model equation is as follows:

$$g.GDP_t = \alpha + \beta_1 PDBT_t + \beta_2 (PDBT)2_t + \beta_3 PD_t + \beta_4 LN(GDP/Cap)_t + \beta_5 PP_t + \beta_6 OPN_t + \beta_7 INF_t + \beta_8 NSAV_t + \varepsilon_t$$

According to the model equation, we consider the following: α is a constant variable; β is the regression coefficients; εt is the error term. The model dependent variable is the growth rate for the gross domestic product used as annual percentage growth rate of real GDP. The model independent variables are: Annual General government gross debt to GDP; private debt is the domestic credit to private sector as percentage of GDP; the natural logarithm for annual GDP per capita; population annual growth rate; trade openness is the total trade of goods and services to GDP; inflation rate is the percentage change in the annual CPI; and national saving is total national saving to GDP. The main hypothesis is that the variability of the GDP growth rate explained by the variability of the government debt different levels.

BASELINE REGRESSION ESTIMATION

In order to construct the above econometric model, we follow the methodology of general to specific in order to produce a parsimonious explanatory model. More specifically, we regress the dependent variable (the growth rate of real GDP) on the government debt on lagged values of the public debt to GDP and its square, the log of the GDP per capita and the other initial value for the explanatory variables. In this study, the impact of public debt on the Lebanese economic growth rate is analysed using regression analyse. The regression model summery is clear in Table 1. The lagged public debt coefficient of determination is positive, its lagged square coefficient of determination is negative, and both are statistically significant even at 1 per cent. The results show that most of the explanatory variables are statistically significant and have the expected sign. The public debt and its square inverted U shape coefficient results illustrate the theoretical findings of Reinhart and Rogoff (2010) changing relationship between real GDP growth and government debt based with a debt threshold.

Table 1: *OLS Public debt and economic growth in Lebanon 1989–2014*[13]

	Coefficient	Std. Error	t-ratio	p-value	
const	–17.9426	40.3741	-0.4444	0.66235	
Public debt/GDP_1	2.6288	0.897617	2.9286	0.00938	***
Public debt/GDPsqr_1	–1.02399	0.346124	-2.9584	0.00880	***
LnGDP/cap	–29.9333	16.5256	-1.8113	0.08780	*
Nsav	0.942737	0.402059	2.3448	0.03144	**
Pop	1.69223	1.14068	1.4835	0.15624	
Inf	–0.476517	0.163806	-2.9090	0.00977	***
Topen	0.203252	0.0356285	5.7047	0.00003	***
prvdebt	–0.590201	0.160529	-3.6766	0.00187	***

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13   HAC standard errors, bandwidth 2 (Bartlett kernel).
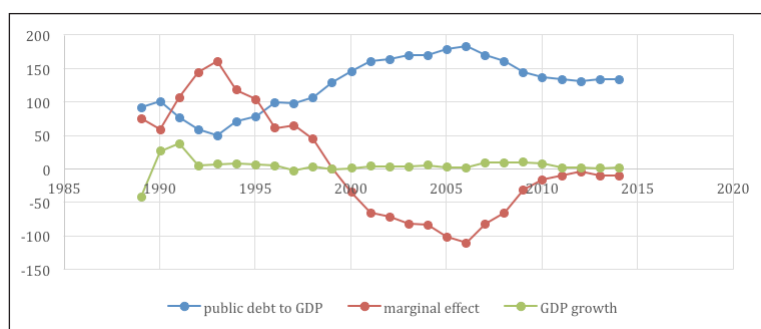
Mean dependent var	4.614853	S.D. dependent var	12.75797
Sum squared resid	1540.839	S.E. of regression	9.520379
R-squared	0.621336	Adjusted R-squared	0.443141
F(8, 17)	11.63692	P-value(F)	0.000016
Log-likelihood	–89.95822	Akaike criterion	197.9164
Schwarz criterion	209.2393	Hannan-Quinn	201.1770
rho	–0.279062	Durbin-Watson	2.206386

Source: Author calculation based on Lebanese Ministry of Finance and the World Bank's World Development Indicators 2015.

The results suggest that the Log of GDP per capita, inflation rate and private debt are statistically significant with negative impact on GDP growth. While, the gross national savings and trade openness have a positive impact on the economic growth and statistically significant. Population growth rate has a positive impact on the economic growth and statistically insignificant. These findings are on table1.

Figure 3: Lebanese public debt to GDP marginal effect to economic growth

Source: Author estimation based on Lebanese Ministry of Finance and the World Bank's World Development Indicators 2015.

Once we check the marginal effect for the public debt on the economic growth, we can notice that the Lebanese economic growth vary as per the level of the public debt. These results illustrate the need to check the public debt threshold that turns

its influence on economic growth to negative (see Figure 3). Our support R&R suggest that up to a specific percentage, the impact of government debt on GDP growth is positive before it turns to negative. Although this threshold varies from case to another. the robustness of the model should be checked before testing this threshold.

OTHER ROBUSTNESS CHECKS

Another robustness-checking test based on Least Absolut deviation, illustrate the baseline regression estimation with respect to the public debt to GDP and its square coefficients and clearly explain its robustness (see Appendix table 3). As a second robustness checking method, we refer to robust (sandwich) standard errors. Where we notice no major change deviation for the lagged debt to GDP and its square and the other control variables (see Appendix table 4). The regression baseline estimation beside both robustness-checking results illustrate the inverted U shape for the public debt and its square coefficients with positive coefficient of the public debt and negative sign for its square.

RUNNING ARMAX

For better parsimonious description for our model, we run autoregressive–moving-average (ARMA) models based on auto regression and second moving average polynomial. The AR part involves regressing the variable on its own lagged values while The MA part involves modeling the error term as a linear combination of error terms occurring contemporaneously and at various times in the past.

The ARMAX results show very similar significant results to the ones on baseline variable coefficients. The coefficient labeled phi 1 is the estimate of the autocorrelation parameter. The root of this equation is 1/phi 1. The roots (or modulus) is greater than 1 in absolute value thus the model is stationary. The same with theta as coefficient for MA parameter with root greater than one to in Absolut value to prove it stationarity. The advantage to this

approach is that we can see that the model is stable via the root analysis. The moduli are both roots are greater than 1 and Both AR and MA are stationary. The results in table 2 show a good fit for the model.

Table 2: *ARMAX, Public debt and economic growth in Lebanon 1989–2014*[14]

	Coefficient	Std. Error	z	p-value	
const	16.9259	40.2891	0.4201	0.67440	
phi_1	–0.966907	0.0540587	-17.8863	<0.00001	***
theta_1	0.708987	0.188278	3.7656	0.00017	***
Public debt/GDP_1	2.62148	0.389507	6.7303	<0.00001	***
Public debt/GDP sqr_1	–1.02271	0.153114	-6.6794	<0.00001	***
LnGDP/cap	–36.6227	12.0609	-3.0365	0.00239	***
Nsav	0.756476	0.315473	2.3979	0.01649	**
Pop	2.06942	1.12916	1.8327	0.06685	*
Inf	–0.556694	0.130189	-4.2761	0.00002	***
Topen	0.261425	0.0634807	4.1182	0.00004	***
prvdebt	–0.752668	0.17271	-4.3580	0.00001	***

Mean dependent var	4.614853	S.D. dependent var	12.75797
Mean of innovations	–0.417763	S.D. of innovations	6.679711
Log-likelihood	–86.82672	Akaike criterion	197.6534
Schwarz criterion	212.7506	Hannan-Quinn	202.0009

		Real	Imaginary	Modulus	Frequency
AR	Root 1	-1.0342	00.0000	1.0342	.5000
MA	Root 1	-1.4105	0.0000	1.4105	0.5000

Source: Author calculation based on Lebanese Ministry of Finance and the World Bank's World Development Indicators 2015.

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14   Standard errors based on Hessian.

LOOKING FOR THRESHOLD

After we checked the robustness of the module, now we check whether there is a threshold, above which the Lebanese public debt has a negative effect on GDP growth. Reinhart and Rogoff, Cecchetti et al. (2011) do not find a clear correlation between different debt levels and GDP growth. In our case study, the regression results prove that there is an inverted U-shape relationship between the public debt to GDP and its square. The results show a positive coefficient for the debt/GDP ratio is, and negative coefficient for its square. In a simplified way to find the threshold for the Lebanese economy public debt to GDP where it starts to affect negatively its GDP growth we refer to the first derivative of the quadratic equation and equalize it to 0. The threshold level therefore is: D =- β1*100/2*β2, where D is the threshold level, while β1 and β2 are the debt and its square variable coefficients (Mkrtchyan 2016).

According to the estimations and the above equation, the level of debt overhang is 128.8%. Once we regress our equation restricting public debt results above 128.8 it has a positive coefficient of variation for public debt to GDP (3.9). However, once we test the regression restricting public debt results below our threshold we get a negative coefficient of variation for the public debt to GDP (–2.5). The test results illustrate the research and theoretical hypothesis of Rehant and Rogof (2012) but with different threshold of 128.8.

CONCLUSIONS

This research main objective is to study the impact of Lebanon public debt on its economic growth. We tested the impact of Lebanese public debt on its economic growth using data for 26 years from 1989 to 2014. The lagged public debt coefficient of determination is positive, its lagged square coefficient of determination is negative, and both are statistically significant even at 1 per cent. The results show that most of the explanatory variables are statistically significant and have the expected sign. The public debt and its square inverted U shape coefficient results illustrate the theoretical findings of Reinhart and Rogoff

(2010) changing relationship between real GDP growth and government debt based with a debt threshold. Once we check the marginal effect for the public debt on the economic growth, we noticed that the Lebanese economic growth vary as per the level of the public debt. Another robustness-checking test based on Least Absolut deviation and (sandwich) standard errors, illustrate the baseline regression estimation with respect to the public debt to GDP and its square coefficients and clearly explain its robustness. Moreover, we ran the ARMAX model and the results show very similar significant results to the ones on baseline variable coefficients and both AR and MA are stationary which show a good fit for the model. After checking the robustness for the model, we tested the level of debt overhang is 128.8%. The test results illustrate the research and theoretical hypothesis of Rehant and Rogof but with different threshold of 128.8. The study main results are highly consistent with the public debt and the economic growth relationship empirical literature with the existence of a statistically significant relationship.

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APPENDIX

Table 3: *LAD, using observations 1989-2014 (T = 26)[15]*

	Coefficient	Std. Error	t-ratio	p-value
const	121.886	147.363	0.8271	0.41963
publicdebtGDP_1	1.60822	1.47069	1.0935	0.28942
pdbtsqr_1	−0.583512	0.57204	-1.0201	0.32200
LnGdppercap	−52.8485	48.8589	-1.0817	0.29451
Nsav	0.300542	0.68625	0.4379	0.66694
Pop	−0.226958	2.35691	-0.0963	0.92441
Inf	−0.35161	0.493	-0.7132	0.48540
Topen	0.219146	0.159767	1.3717	0.18800
prvdebt	−0.513223	0.445538	-1.1519	0.26530

Median depend. var	3.731951	S.D. dependent var	12.75797
Sum absolute resid	118.6581	Sum squared resid	2930.888
Log-likelihood	−83.49372	Akaike criterion	184.9874
Schwarz criterion	196.3103	Hannan-Quinn	188.2480

Source: Author calculation based on Lebanese Ministry of Finance and the World Bank's World Development Indicators 2015.

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15   Dependent variable: GDP growth rate.

Table 4: *Quantile estimates, using observations 1989-2014 (T = 26)[16]*

	Coefficient	Std. Error	t-ratio	p-value	
const	121.886	131.842	0.9245	0.36817	
publicdebtGDP_1	1.60822	0.638282	2.5196	0.02204	**
Public debt/GDPsqr_1	−0.583512	0.262984	-2.2188	0.04040	**
LnGdppercap	−52.8485	32.4045	-1.6309	0.12130	
Nsav	0.300542	0.461226	0.6516	0.52336	
Pop	−0.226958	1.96703	-0.1154	0.90950	
Inf	−0.35161	0.232836	-1.5101	0.14938	
Topen	0.219146	0.0684407	3.2020	0.00523	***
prvdebt	−0.513223	0.27024	-1.8991	0.07465	*

Median depend. var	3.731951	S.D. dependent var	12.75797
Sum absolute resid	118.6581	Sum squared resid	2930.888
Log-likelihood	−83.49372	Akaike criterion	184.9874
Schwarz criterion	196.3103	Hannan-Quinn	188.2480

Source: Author calculation based on Lebanese Ministry of Finance and the World Bank's World Development Indicators 2015.

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16   Dependent variable: GDP growth rate tau = 0.5.; Robust (sandwich) standard errors.