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## **LONG-TERM EFFECTS OF PUBLIC DEBT ON ECONOMIC STABILITY AND GROWTH**

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### **ABSTRACT**

*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 public 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**

Debt is a two-edged sword. Used wisely and in moderation, it clearly improves welfare. But, when it is used imprudently and in excess, the result can be disaster. For individual households and firms, over borrowing leads to bankruptcy and financial ruin. For a country, too much debt impairs the public's ability to deliver essential services to its citizens. High and rising debt is a source of justifiable concern. We have seen this recently, as first private and now public debt have been at the centre of the crisis that began four years ago. Data bear out these concerns – and suggest a need to look comprehensively at all forms of non-financial debt: household and corporate, as well as public. Over the past 30 years, summing these three sectors together, the ratio of debt to GDP in advanced economies has risen relentlessly from 167% in 1980 to 314% today, or by an average of more than 5 percentage points of GDP per year over the last three decades. Given current policies and demographics, it is difficult to see this trend reversing any time soon. Should we be worried? What are the real consequences of such rapid increase in debt levels? When does its adverse impact bite? Finance is one of the building blocks of modern society, spurring economies to grow. Without finance and without debt, countries are poor and stay poor. When they can borrow and save, individuals can consume even without current income. With debt, businesses can invest when their sales would otherwise not allow it. And, when they are able to borrow, fiscal authorities can play their role in stabilising the macro economy. But, history teaches us that borrowing can create vulnerabilities. When debt ratios rise beyond a certain level, financial crises become both more likely and more severe. This strongly suggests that there is a sense in which debt can become excessive. But when? We take an empirical approach to this question. Using a new dataset on debt levels in 18 OECD countries from 1980 to 2010 (based primarily on flow of funds data), we examine the impact of debt on economic growth. Our data

allow us to look at the impact of household, non-financial corporate and public debt separately.<sup>1</sup> Using variation across countries and over time, we examine the impact of the movement in debt on growth.<sup>2</sup> Our results support the view that, beyond a certain level, debt is bad for growth. For public debt, the number is about 85% of GDP. For corporate debt, the threshold is closer to 90%. And for household debt, we report a threshold of around 85% of GDP, although the impact is very imprecisely estimated. Our result for public debt has the immediate implication that highly indebted publics should aim not only at stabilising their debt but also at reducing it to sufficiently low levels that do not retard growth. Prudence dictates that publics should also aim to keep their debt well below the estimated thresholds so that even extraordinary events are unlikely to push their debt to levels that become damaging to growth.

Taking a longer-term perspective, reducing debt to lower levels represents a severe test for the advanced economies. Here, the challenge is compounded by unfavourable demographics. Ageing populations and rising dependency ratios have the potential to slow growth as well, making it even more difficult to escape the negative debt dynamics that are now looming. The remainder of the paper is organised in four sections. we discuss why we believe that high levels of debt create volatility and are bad for growth. Formal models of this phenomenon are still at very early stages, so all we can offer is some intuition. We go on, to a preliminary examination of the data and the main facts about the build-up of non-financial sector debt in advanced economies. Section 4 contains our main empirical results. These are based on a series of standard growth regressions, augmented with information about debt levels. It is here that we report our estimates of the thresholds beyond which debt becomes a drag on growth. discusses these results in the context of the inescapable demographic trends.

## **Economy**

An economy is a complex system of interrelated production, consumption, and exchange activities, which ultimately determine how resources are allocated among participants. The production, consumption, and distribution of goods and services combine to fulfill the needs of those living and operating within the economy. An economy can encompass a nation, a region, a single industry, or even just one family.

## **Types of Economies**

In the modern world, few nations are purely market-based or purely command-based. But most lean toward one or the other of these models.

### **Market-Based Economies**

Market-based or "free market" economies allow people and businesses to freely exchange goods and services according to supply and demand. The United States is mostly a market economy. Producers determine what's sold and produced, and what prices to charge. If they expect to succeed, they will produce what consumers want and charge what consumers are willing to pay.

Through these decisions, the laws of supply and demand determine prices and total production. If consumer demand for a specific product increases, production tends to increase to satisfy the demand. The increased demand causes prices to rise until consumers balk and cut back on their purchases. Demand for the product will then decline and prices will decline with it.

### Command-Based Economies

Command-based economies depend on a central public that controls the production levels, pricing, and distribution of goods. In such a system, the public owns industries deemed essential on behalf of the consumers who use them. Competition among companies is discouraged or banned. Prices are controlled.

Communism requires a command-based economy. Contemporary examples include Cuba and North Korea. A command-based economy attempts to supersede the workings of supply and demand.

### Mixed Economies

Pure market economies rarely exist in the modern world since there's usually some degree of public intervention or central planning. Even the United States could be considered a mixed economy. It may not mandate production but it has ways to influence it. For example:

- In late 2021, President Joe Biden ordered 50 million gallons of oil released from the nation's Strategic Petroleum Reserves with the stated aim of forcing gasoline prices lower by increasing its supply.<sup>1</sup>
- In 2022 and 2023, the Federal Reserve imposed a series of interest rate increases on the nation's banks. The purpose was to raise interest rates throughout the economy in order to reduce demand for loans and therefore reduce inflation in the costs of goods and services.

### OBJEVTIVE

1. to study on Long-Term Effects of Public Debt on Economic Stability
2. to study on Lebanese public debt to GDP marginal effect to economic growth

### 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. 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:

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

According to the model equation, we consider the following:  $\alpha$  is a constant variable;  $\beta$  is the regression coefficients;  $\epsilon_t$  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 public 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 public debt different levels.

## RESULT

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 public 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 public debt based with a debt threshold.

Table 1: OLS Public debt and economic growth in Lebanon 1989–2014<sup>13</sup>

	Coefficien t	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	***

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 table 1.

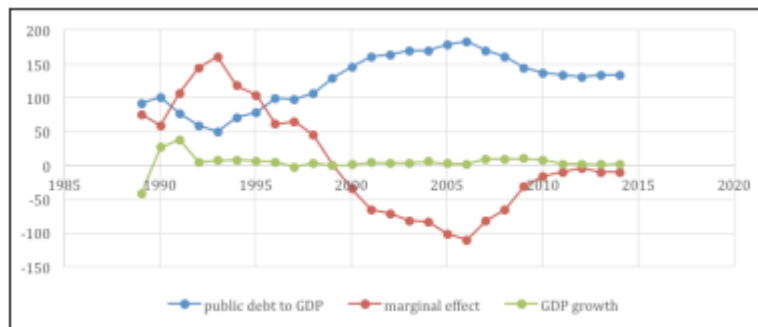


Figure 3: Lebanese public debt to GDP marginal effect to economic growth

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 public 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 Absolute 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 Absolute 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<sup>14</sup>

	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	Imagina ry	Modul us	Frequen cy
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.

### 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. 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:  $D = -\beta_1 * 100 / 2 * \beta_2$ , where D is the threshold level, while  $\beta_1$  and  $\beta_2$  are the debt and its square variable coefficients. 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 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 changing relationship between real GDP growth and public 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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