IDENTIFY THRESHOLD IN THE RELATIONSHIP BETWEEN PUBLIC DEBT AND ECONOMIC GROWTH: THE CASE OF DEVELOPING COUNTRIES

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ABSTRACT:

The paper empirically explores the relationship of public debt and economic growth in the developing countries. Especially, this study aims to examine the turning point of public debt and evaluate the impact of levels of indebtedness on current economic growth for a panel dataset of 15 developing countries. The evaluation is a vital understanding on the current indebtedness situation by determining the threshold values for the sample of countries. The results confirm the general theoretical assumption that the impact on economic growth is positive at the low levels of public debt, whereas beyond a certain debt turning point a negative effect on growth prevails. Furthermore, this study identifies the debt to GDP turning point, where the positive effect of accumulated public debt inverts into a negative effect, is roughly between 13 % and 39 % for the developing economies.

Keywords: *public debt, economic growth, panel analysis, turning points, developing countries.*

1. INTRODUCTION

Government debt has been considered as an important resource for financing the economic growth in the less developed or developing countries. In the recent years, foreign debt problem, however, has become one of the basic problems in the developing countries. The debt crisis which occurred in the early 1980s destabilized the economy of many developing countries with low income. Many policymakers do seem to think that government debt relieve the bad impact of high borrowing on economic development.

In the related literature, there are many arguments about the way of impact of the government debt on the economic growth. There are findings indicating that government debt can affect the economic growth either positively or negatively depending on the level of debt. A number of

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researches suggest that high public debt affects negatively GDP growth. Most of the studies pointed the negative impact of government on the growth performance of the developing countries in medium-term and long term. The negative non-linear correlation between public debt and economic growth in advanced and emerging market economies is shown by an increasing empirical literature (Reinhart and Rogoff, 2009, 2010a,b; Reinhart et al., 2012; Kumar and Woo, 2010; Cecchetti et al., 2011; Checherita-Westphal and Rother, 2012; Furceri and Zdzienicka, 2012). Reinhart and Rogoff (2010) pointed out that economic growth becomes slow-down when the public debt-to-GDP ratio is over 90%. Supporting the study, many studies confirmed that the turning point beyond which economic growth gradually decreases is around 90% of GDP (Mencinger et al, 2015).

However, recent econometric studies also pointed out that a country coverage matters substantially for the threshold effect. According to Elmeskov and Sutherland (2012), the threshold is 66% for a narrow sample of OECD countries. And Caner et al. (2010) estimated the tipping point is 77% when they analyzed a larger set of developing and emerging economies. Other researchers could not identify a robust negative nonlinear relationship between public debt and growth (Minea and Parent, 2012; Baglan and Yoldas, 2013; Eberhardt and Presbitero, 2013; and Pescatori et al., 2014). Finally, in a recent contribution, Panizza and Presbitero (2014) show that a negative correlation between debt and growth does not imply causality, as lower growth can result in a higher public debt to GDP ratio.

In the research we will take account of the factor of public debt which considerably changes the mechanism transmitting fiscal policy effects to levels of economic activity in the short run. The paper empirically examines and assesses the direct impact of high debt levels in the public sector on economic growth for developing countries. This paper seeks to contribute to the literature aimed at analyzing the existence of threshold effects. We first formally test the thresholds proposed for central government debt and then seek to identify the thresholds endogenously on the basis of the testing procedure for the period 1991–2014.

The paper is organized as follows: first, we provide a literature review on the connection between public debt and economic growth. Then methodology and data from different sources were applied to examine the effects of public debt on economic growth. The next section shows the results of the panel analysis and presents the threshold debt-to-GDP values for a subgroup of countries. In the end of paper, the main findings are presented and discussed.

2. LITERATURE REVIEW

2.1. The relationship between public debt and economic growth

The literature review aim attention at equivalence between public debt and economic growth. In particular, the purpose of this study is exploring the critical turning point which the excessive public debt levels to have a positive or negative impact on economic movement. Furthermore, due to the beginning of economic crisis over the world, most empirical scholars researches the causal relationship between the indebtedness and economic growth by applying a non-linear and concave connection pattern.

Classical economists, such as Smith (1776), Ricardo (1951), and Mill (1845) considered that the public debt effect destructively a country's economic. The Ricardian Equivalence theory noted that the financing of public expenditure via taxation and borrowing is equal. Governments can finance their expenditures either through taxes or by issuing bonds. Since bonds are loans, they must eventually be repaid—presumably by raising taxes in the future. Suppose that the government finances some extra spending through deficits. According to the hypothesis, taxpayers will anticipate that they will have to pay higher taxes in future. As a result, they will increase their savings to pay the future tax increase; they could reduce their current consumption to do so. The effect on aggregate demand would be the same as if the government had chosen to tax now. Therefore, there is neutral effect of public debt on economic growth.

On the contrary, in the Investment Saving-Liquidity Preference Money Supply (IS-LM) model, Keynesian economists pointed out that an increase in government debt, which induced by deficit-financed fiscal policy, will improve the level of income, the transaction demand for money and prices. Keynesian economists often argue that private sector decisions sometimes lead to inefficient macroeconomic outcomes which require active policy responses by the public sector, in particular, monetary policy actions by the central bank and fiscal policy actions by the government, in order to stabilize output over the business cycle.

Supporting this theory, several studies have found the significantly positive relationship between debt amount and economic growth (Bakar and Hassan, 2008; Umutlu et al, 2011; Çiçek et al., 2010; Cohen, 1991). Pattillo et al (2002) applied various methodologies such as OLS, instrumental variables, fixed effects and GMM to analyze 93 developing Sub-Saharan African countries and Latin American and Middle-Eastern Countries from 1969 to 1998. Their research

declared that the positive relation ship between suitable debt level and economic growth, while high indebtedness may be detrimental to growth. According to the study of Schclarek and Ramon- Ballester (2005), the data of 20 Latin American and Caribbean nations in five years during 1970 – 2002 were separated seven periods which includes every five years. The results was found critical and negative relationship of the total indebtedness and economic growth level. Chen (2006) claimed the low GDP growth lead to an increase in foreign debt in comparison with the previous periods, meanwhile foreign debt may decline when GDP increases in the following periods. Consequently, due to the low GDP level, economic capacity and capital accumulation, Philippines need more foreign debt.

In the published paper of Mariano and Villanueva (2006), the results dedicated that the positive impact of the growth in GDP and export lead the burden of debt from foreign to decline. Moreover, the study also argued that the impact of external debt on growth is linear with interest rates but non-linear with capital accumulation way. For the case of six Pacific countries from 1988 to 2004, Jayaraman and Lau (2009) used panel data for empirical analysis. The results expressed the external public debt coefficients and openness coefficients are positive and statistically critical. However, the budget deficit variable is negatively significant. In a published paper by Panizza and Presbitero (2014), there is a threshold at which the relationship between public debt and growth will turn from positive to negative.

According to Schclarek and Ramon-Ballester (2005), the relationship between the total external debt and economic growth level is significant and negative. They use data for seven periods, each of which consisting of five years between 1970 and 2002 (like 1970–74; 1975–1979) for 20 Latin American and Caribbean countries. Although the total external debt includes private external debt and public debt, it is concluded that the negative relationship between the foreign borrowing and economic growth is the results from the public debt and not from the private debt. The study shows the high level of public external borrowing is relevant with low economic growth.

In a related study, Ferreira (2009) analyzed the possible presence of causality between real GPD per capita growth and public debt. The author used the panel data approach from Erdil, Türkcan and Yetkiner (2009) to 20 OECD countries during 1988–2001, and found evidence of the presence of a bi-directional causal relationship between growth and public debt. Lof and Malinen (2014) used panel vector auto-regressions with data for 20 developed countries from 1954 to

2008. They found that the negative correlation between sovereign debt and growth is due to a negative reverse effect of growth on debt. On the contrary, Panizza and Presbitero (2014) used a similar sample to the study of Erdil and Yetkiner (2009) ; but the results was not shown the same. These authors adopted an instrumental variable approach that captures valuation effects caused by the interaction between foreign currency debt and exchange rate volatility.

2.2. Threshold of public debt in the relation with economic growth

In a sample of 38 developed and emerging countries, Kumar and Woo (2010) conclude that a high level of indebtedness have negative influence on economic growth of these countries in the period of 5 years. Because of the negative impact on capital accumulation and indebtedness, the economic activity result is less effective. The negative relationship between high continuous public debt and economic growth makes development ratios of labor output decline. Consequently, investment and capital stock is reduced too.

Nersisyan and Wray (2010) concluded that the detrimental impact of high indebtedness levels on economic growth build upon absolute threshold. This conclusion brought about controversy among scholars. As stated in practical results, the span of public debt values is from 85% to 100% toward advanced economies and from 40% to 70% toward emerging countries in long term. (Kumar & Woo 2010; Checherita & Rother, 2010; Ceccheti et al., 2011)

In the other side, regarding to the effect of public debt on growth in the short run, the supposed threshold of public debt on GDP value ranges between 50-60% for recent EU countries and between 90-100% for old member states of the EU (Baum et al., 2013; Mencinger et al., 2014).

Following the studies of Barro (1979), Eisner (1992), Smyth and Hsing (1995) analyzed the impact of debt on the economic growth and test whether an optimal debt rate will maximize the economic growth rate or not. It is found that the threshold value will be 38.4% and debt rate above this threshold will have a negative impact on economic growth, when public borrowing is used in the analysis of maximum debt rate of economic growth.

Clements and Krolzig (2012) supported previous studies in their empirical estimates by prove that external borrowing influences growth in low-income countries. They argued that the per capita income is related to low growth rate when the high external borrowing is beyond a definite threshold. Depending on the variables used in the estimation method, they found the threshold value of 30–37% of GDP and 115–120% of export. According to recent researches, results

explain the correlation between external borrowing and growth rate on the developing countries. High borrowing rate decreases the economic growth in the low-income countries.

In their research, Reinhart and Rogoff (2010) argued that the crucial public debt-to-GDP ratio is 90%, beyond which the growth slows down considerably. The data was used to examine a group of selected advanced countries for the period from 1946 to 2009. Their results are shown to prove this claim: average and median annual GDP growth rates are relative to the level of the central government debt-to-GDP ratio average GDP growth drops from around 3% to below 2% as public debt passes the threshold of 90% of GDP. When the growth is measured in terms of the median, the decrease is more serious than the average: a public debt-to-GDP ratio higher than 90% is associated with zero GDP growth.

Mencinger et al. (2015) used data of two subgroups included the developed countries (period 1980 - 2010) and emerging countries (period 1995 - 2010) to explores which factors of public debt considerably changes the effect of transmits fiscal policy to economic activity in the short term. The results shows that the impact of public debt at low levels on growth is positive, it becomes negative when the debt is beyond a certain debt turning point. The authors calculated that the debt-to-GDP turning point, where the positive effect of accumulated public debt inverts into a negative effect, is roughly between 44 % and 45 % for emerging economies. The debt-to-GDP turning point is higher, between 90 % and 94 % for developed countries.

3. METHODOLOGY AND DATA

3.1. Methodology

Extending our previous research (Mencinger *et al.*, 2014) and using the estimation strategy by (Checherita & Rother, 2010), we aim to identify the turning point beyond which the debt-to-GDP ratio has deleterious effects on growth. Assuming a non-linear and concave relationship between government debt and growth, the model is augmented with the quadratic equation in debt. The estimation process suffers from the problem of heterogeneity and endogeneity. However, we assume that there are 2 threshold points in the relationship between public debt and economic growth (positive point and negative point).

The first, the positive threshold point is identified on the following formula:

$$\Delta GDP_{it} = \beta_0 + \beta_1 DUt\ (DEBT_{it} - k) + \beta_2 X_{it} + \varepsilon_{tt} \quad (1)$$

$$\begin{cases} DU_t = 1 \text{ if } DEB_t > k \\ DU_t = 0 \text{ if } DEB_t \leq k \end{cases}$$

The second, the negative threshold point also is identified on the following formula:

$$\Delta GDP_{it} = \beta_0 + \beta_1 DUt \ (DEBT_{it} - k) + \beta_2 X_{it} + \varepsilon_{tt} \quad (2)$$

$$\begin{cases} DU_t = 1 \text{ if } DEB_t < k \\ DU_t = 0 \text{ if } DEB_t \geq k \end{cases}$$

In equation (1), ΔGDP denotes growth of real GDP which represents economic growth; DEBT denotes initial public debt as a share of GDP. X is a matric of explanatory variables including: DINF is inflation which is calculated by GDP deflator; PINV is Gross Private Investment; GE denotes government expenditure; SAVING is saving as a share of GDP Trade and *et* is the error term. Parameter *k* represents the public debt threshold level in the relationship between public debt and economic growth. DU is a dummy variable, and equals to one when public debt level is higher than *k* percent and zero vice versa in the equation (1). But, DU equals to one when public debt level is smaller than *k* percent and zero vice versa in the equation (2). The equation (1) could be estimated to identify public debt threshold by using the Ordinary Least Squares (OLS) method, and then Two-Stages Least Squares (2-SLS) and Generalized Method of Moments (GMM) techniques were applied to deal with endogeneity. In addition, the results from 2-SLS and GMM methods were then compared with estimated result from OLS. Threshold levels used for calculation range from *k~* to averaged k.

Continuously, the optimal threshold *k** will be chosen to capture the smallest sum of squared residuals (RSS) value or the public debt threshold is the level that maximizes R square. The minimization of RSS is found via using the following formula:

$$k^* = \arg\min_{k} \left\{ S_1(k), k = \tilde{k}, ..., \bar{k} \right\}$$

$$(3)$$

Where, S1(*k*) is the sum of squared residuals from estimating equation (1). At the defined public debt threshold of *k**, the relationship between public debt and economic growth is interpreted as follows: (i) β₁ at the public debt rates equal to or lower than the threshold level and ; (ii) Sum of β₁ and β₂ at the public debt rates higher than the threshold level. Naturally, the β₁ value is significantly positive but the sum of β₁ and β₂ value is negative.

3.2. Data

The research used annual data from 1985 to 2013 in 15 developing countries. The data is extracted from the World Development Indicators database of World Bank.

4. EMPIRICAL RESULTS

The estimation result found two thresholds which change the relationship between economic growth and the debt ratio. Firstly, it is found that the relationship of debt rate and economic growth has changed from negative to positive at the threshold – debt rate 13%. This finding has implications for developing countries if they are not in debt, it is not necessarily good for economic growth. The results prove the debt rate from 13% provides a positive relationship between the debt rate and economic growth. This demonstration claims that the countries should borrow in the range greater than or equal to 13% of GDP.

The regression results of the threshold of debt rate on GDP in the long term are presented in the following table:

Table 1. Estimation results of positive threshold

Dependent Variable: GDPG

Variables	Coefficient	T - value	P - value
C	6.421332	1.538075	0.1259
DEBT	-0.577709	-1.704574	0.0901
DU*(DEBT-12)	0.585795	1.711258	0.0889
DINF	-0.011090	-7.298473	0.0000
PINV	0.144099	2.970576	0.0034
GE	0.125213	5.323374	0.0000
SAVING	0.082811	2.783502	0.0060
R^2	0.407780	Akaike Criteria	5.256981
Adjusted R^2	0.386630	Schwarz Criteria	5.383573
F- statistic	19.27975	Hannan-Quinn Criteria	5.308330
p-value	0.000000	Durbin-Watson Statistic	1.873062

Source: Calculated from research data

However, the results seem to encourage the countries should debt more and more to boost economic growth? Does increasing debt cause anything negative? Both the theory and practice of economic activities show that if countries keep increasing the debt ratio to a certain turning point, when the debt will make economic growth slowdown and reduce. Thus, is there a threshold is indication that countries should not pass? Continued implementation of regression, the study result found a threshold in the relationship between economic growth and debt-to-GDP

ratio at which this relationship changes from positive to negative. It is shown that 39% is the debt-to-GDP turning point, where the positive effect of public debt inverts into a negative effect. So, if the ratio of debt to GDP exceed 39%, the debt ratio will drag down economic growth. Therefore, the developing countries should maintain the ratio of debt to GDP below 39%.

The regression results estimated the debt-to-GDP threshold of negative relationship are presented in the following table:

Table 2. Estimation results of negative threshold

Dependent Variable: GDPG

Variables	Coefficient	T – value	P - value
C	-2.354827	-1.777110	0.0774
DEBT	0.025057	1.671762	0.0964
DU*(DEBT-39)	-0.084118	-2.076865	0.0393
DINF	-0.010859	-7.307640	0.0000
PINV	0.141921	2.937814	0.0038
GE	0.127493	5.423580	0.0000
SAVING	0.106049	3.433785	0.0007
R^2	0.412540	Akaike Criteria	5.248911
Adjusted R^2	0.391560	Schwarz Criteria	5.375503
F- statistic	19.66284	Hannan-Quinn Criteria	5.300261
p-value	0.000000	Durbin-Watson Statistic	1.872378

Source: Calculated from research data

The regression results also support the previous studies that the inflation has negative relationship with economic growth and the private investment has a positive relationship with economic growth at statistical significance 1%. Moreover, the government spending has a positive relationship with economic growth at significance 1% (this is explained that increasing government spending increases GDP and thereby promote economic growth). Finally, the results also show there is a proportional relationship between saving and economic growth at significance 1%. It implies the increasing of the saving rate will help stimulate growth in the long term.

5. CONCLUSION

Unlike the previous studies on the public debt and economic growth nexus, a sample of 15 developing countries over the period 1985-2013 was applied in this study to examine this relationship. The results show if public debt rate bigger than 13%, the relationship will positive (the positive threshold is 13%) but if public debt rate overcomes 39%, it will be switched negative (the negative threshold is 39%). The research results complement and contribute to literature on the impact of public debt on the economy. The research findings also provide useful information about the impact direction of public debt on growth, and thenceforth the policymakers in these countries can enhance the effectiveness of planning and operating policy to identify an optimal debt for support the growth of developing countries.

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Appendix 1. List of countries used in research sample

Country	
Belarus	Bhutan
Georgia	Guatemala
India	Indonesia
Jordan	Malaysia
Maldives	Moldova
Mongolia	Philippines
Sri Lanka	Tunisia
Ukraine	