

หนี้สาธารณะกับอัตราการเจริญเติบโตทางเศรษฐกิจ: ผลการศึกษาของประเทศไทย

PUBLIC DEBT AND ECONOMIC GROWTH THE EMPIRICAL RESULT OF THAILAND

ภัศราภา ตั้งกาญจนภาสัน¹ เรวัต ธรรมาภิรมย์² และ ศิวพงศ์ อีรอำพน³

Passarapa Tangkanjanapas¹ Rewat Thamma-Apirom² and Siwapong Dheera-aumpon³

Received 1 June 2020

Revised 20 September 2020

Accepted 15 December 2020

บทคัดย่อ

การศึกษาในครั้งนี้เป็นการศึกษาผลกระทบของหนี้สาธารณะที่มีต่ออัตราการเจริญเติบโตทางเศรษฐกิจ ข้อมูลที่ใช้ในการศึกษาเป็นข้อมูลอนุกรมเวลา โดยใช้ข้อมูลของประเทศไทย ตั้งแต่ปี พ.ศ. 2541 ถึง พ.ศ. 2560 ซึ่งวิธีการที่ใช้ในการศึกษา คือ วิธีกำลังสองน้อยที่สุด 2 ชั้น (Two State Least Square estimators : 2SLS) จากการศึกษา พบว่า หนี้สาธารณะและอัตราการเจริญเติบโตทางเศรษฐกิจมีความสัมพันธ์ไม่เป็นเส้นตรงโดยมีความสัมพันธ์เป็นลบ คือ ความสัมพันธ์ระหว่างหนี้สาธารณะต่อผลิตภัณฑ์มวลรวมในประเทศ (Gross Domestic Product: GDP) กับอัตราการเจริญเติบโตทางเศรษฐกิจเป็นบวก และความสัมพันธ์ระหว่างหนี้สาธารณะต่อ GDP ยกกำลังสองกับอัตราการเจริญเติบโตทางเศรษฐกิจเป็นลบ และจุดวกกลับหรือจุดที่สูงที่สุด (Turning point) เท่ากับร้อยละ 48 แสดงให้เห็นว่า เมื่อหนี้สาธารณะต่อ GDP มากเกินกว่าร้อยละ 48 ความสัมพันธ์ระหว่างหนี้สาธารณะต่อ GDP กับอัตราการเจริญเติบโตทางเศรษฐกิจจะเปลี่ยนจากความสัมพันธ์เชิงบวก เป็นความสัมพันธ์เชิงลบ

คำสำคัญ: หนี้สาธารณะ อัตราการเจริญเติบโตทางเศรษฐกิจ จุดวกกลับ

¹ นิสิตปริญญาเอก ภาควิชาเศรษฐศาสตร์ คณะเศรษฐศาสตร์ มหาวิทยาลัยเกษตรศาสตร์

Ph.D. Candidate, Department of Economics, Faculty of Economics, Kasetsart University.

² รองศาสตราจารย์ ดร., ภาควิชาเศรษฐศาสตร์ คณะเศรษฐศาสตร์ มหาวิทยาลัยเกษตรศาสตร์

Associate Professor Dr., Department of Economic, Faculty of Economics, Kasetsart University.

³ ผู้ช่วยศาสตราจารย์ ดร., ภาควิชาเศรษฐศาสตร์ คณะเศรษฐศาสตร์ มหาวิทยาลัยเกษตรศาสตร์

Assistant Professor Dr., Department of Economic, Faculty of Economics, Kasetsart University.

Corresponding Author Email: pangyound@yahoo.com, fecoret@ku.ac.th, fecospd@ku.ac.th

Abstract

This paper aims to study the effect of public debt to economic growth in Thailand using Two Stage Least Square estimators (2SLS). This study uses of time series quarterly data from 1998 to 2017. The regression results conclude that the relationship between public debt to GDP ratio and economic growth is non-linear and negative. The relationship between public to GDP ratio and economic growth is positive. The relationship between public to the square of GDP ratio and economic growth is negative. The highest turning point is at 48 Percent an inverted U-shaped. If debt exceeds this point, the relationship between GDP growth and public debt will change from positive to negative relationship.

Keywords: Debt Public, Economic Growth, Turning Point

Introduction

Government uses debt to offset the deficit caused by restructuring public debt, economic stabilisation, or funds in projects such as infrastructure, education, and public health. The advantage of public debt is that it provides investment for new projects and technology as well as innovation from foreign countries to promote economic development. The disadvantage of public debt is the tax burden involved in repaying the principal sum and interest.

Thailand's public debt has increased continuously from 5,430,560.04 million baht in 2013 to 6,901,801.55 million baht in 2019 (Public Debt Management Office, 2019). Thailand's public debt figure is likely to increase continuously in the future. This increase in public debt is caused by government expenditure on infrastructure, education, public health, and offsetting the deficit. Consequently, increased public debt causes a lack of public confidence in the fiscal position, and may lead to decreased consumption or investment delay, resulting in fewer innovation opportunities and less investment in mega-projects.

The tax burden is also likely to decrease because the government would not need to use the revenue generated to service its principal loans and interest payments, and could use the funds to increase economic growth. On the other hand, the tax burden may increase due to high level of government borrowing for its projects, offsetting the deficit and restructuring public debt in response to economic growth. The data of public debt and GDP growth are shown in Figure 1.

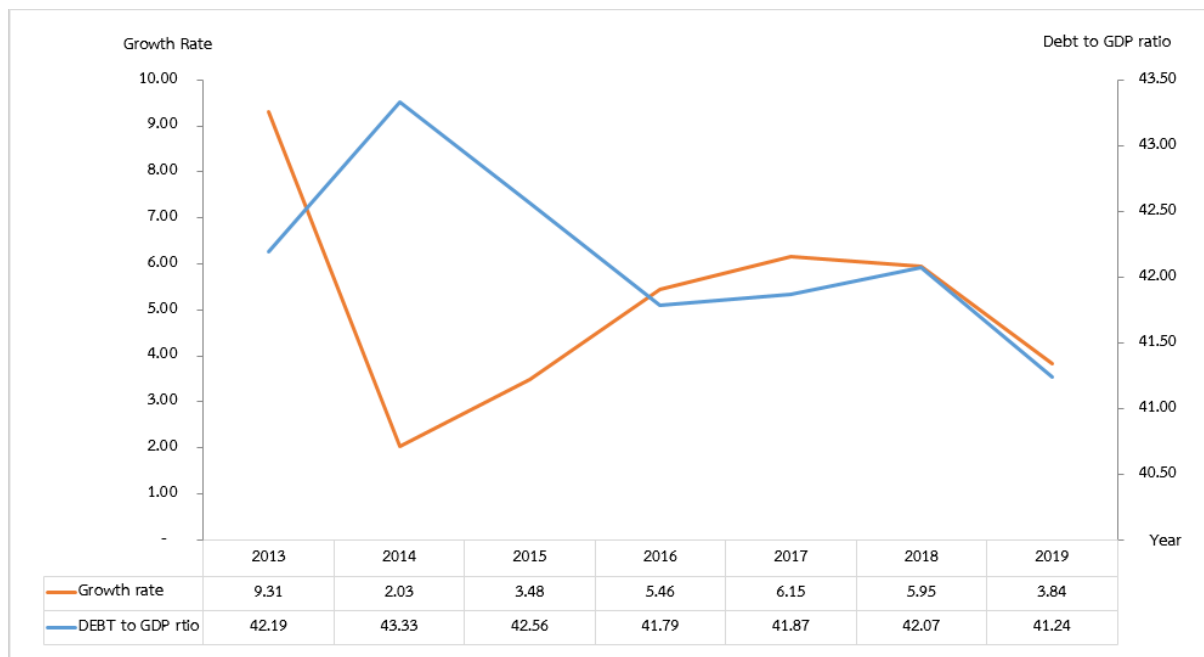


Figure 1 Relationship between public debt and economic growth

Source: Public Debt Management Office (2019)

This paper attempts to study the relationship between public debt and economic growth for Thailand over the period of 1998 to 2017. Moreover, this paper also finds the turning point where public debt has a negative impact on GDP growth.

Literature Review

1. The relationship between debt and growth

Ali Abbas and Christensen (2007) suggested that there were many reasons for the effect of public debt on economic growth in the context of adverse European and international developments. For instance, there was the lack of comparable datasets for a large number of countries which considered public debt mainly as an endogenous variable rather than exogenous, with size affecting macroeconomic outcomes; in addition, until recently, the size of public debt had not been assessed as a problem in most developed countries where most research efforts focused. Studies the effect of public debt on economic growth has two categories that are developing and developed countries. The effect of public debt on economic growth is a negative, positive and bidirectional relationship.

The premise of the nonlinear effect of public debt on economic growth was found by Smyth and Hsing (1995), Reinhart and Rogoff (2010a, 2010b), Checherita and Rother (2010), Baum, Checherita-Westpha and Rother (2012) and Greenidge, Craigwell, Chrystol and Drakes (2012). The result of the United States studied from 1980 to 1990, shared a nonlinear relationship between two indicators that is the same result as optimal public debt ratio almost 50 percent of GDP. Pattillo, Poirson and Ricci (2002), using a sample of 93 developing countries

from 1969 to 1998, found a nonlinear relationship between external debt and economic growth, while Pattillo, Poirson and Ricci. (2004) estimated that increasing external debt inhibited growth to approximately 35 – 40 percent of GDP. Clements, Bhattacharya and Nguyen (2003) used the data from 55 low-income countries from 1970 to 1999 to identify the critical threshold of external debt was 50 percent of GDP. The results of the research by Weeks (2000) on a group of 18 Latin America countries indicated that a 1 percent increase in external debt service in the long run produced a 1.6 percent lower economic growth rate. This was similar to the finding of Scott (1995) and Karagol (2002) on developing countries. Pattillo et al. (2002) found that external debt had a negative impact on GDP growth per capita when the net present value of debt was above 35 percent – 40 percent of GDP. Clements et al. (2003) examined the same relationship and found the net present value of external debt to be around 20 percent – 25 percent of GDP. Moreover, Schclarek (2004) examined the same relationship between public debt and GDP growth and found that foreign debt had a negative impact on the growth rate of GDP per capita. Hepp (2008) considered the existence of a positive impact from public debt on economic growth with external debt reduction beginning in the 90s in developing countries and found that such an impact was almost non-existent, although countries benefitting from higher incomes provided more consistent results.

Ferreira (2009) studied the relationship with GDP per capita growth in OECD countries from 1998 to 2001, based on VAR method and Granger causality test. The results confirmed a bidirectional relationship between public debt and growth; a higher growth rate reduced public debt while at the same time increased the latter's negative effect on economic growth. Misztal (2010) used the same methodology as Ferreira (2009) to study European countries from 2000 to 2010 and found that an increase in public debt of 1 percent, created a reduction in GDP of 1 percent, while a 1 percent growth in GDP resulted in a public debt reduction of 40 percent on average. The most important factor was the dynamics of GDP which had an impact on the size of public debt. Kumar and Woo (2010) used data on advanced economies from 1970 to 2007 and used BE and SGMM estimators. The results indicated a nonlinear relation, meaning that higher levels of debt had a proportionately larger effect on subsequent economic growth. Moreover, they found that a 10 percent increase in the debt to GDP ratio was associated with a slowdown in 15 percent of economic growth. This indicated the nonlinearity; i.e., the higher levels of initial debt had a proportionately greater negative effect on subsequent economic growth. The reason for the inverse relationship was that an increase in public debt was associated with lower investment and a reduction in the rate of capital accumulation. Reinhart and Rogoff (2010a, 2010b) applied the optimal growth-maximising public debt threshold using data from 44 countries and found a negative relationship between public debt and economic growth over the period of 1790 to 2009. The results showed that economic growth was around 4 percent higher in advanced countries with a public debt to GDP ratio less than 30 percent. The analysis by Herndon, Ash and Pollin.

(2013) found the error that significantly changes the results obtained by Reinhart and Rogoff (2010a, 2010b).

Caner, Grennes and Koechler-Geib (2010) evaluated the optimal growth-maximising public debt by using annual data from 77 countries for the period from 1980 to 2009. The results indicated that a growth-maximising public debt level of developed countries was 77 percent and 64 percent in developing economies. Checherita-Westphal and Rother (2010) demonstrated the impact of external debt and debt restructuring on growth, applying a panel data analysis of public debt using data from 12 European countries. The estimated optimal growth-maximising public debt was around 90 percent which was similar to the finding of Reinhart and Rogoff (2010a, 2010 b). The results showed that the relationship between public debt ratios and economic growth to be concave, non-linear and U-shaped. Greiner (2012) indicated that the results presented by Checherita-Westphal and Rother (2010) were influenced by their assumption that the shortage was equal to public investment at each point in time. Presbitero (2010) used data on low-income countries from 1990 to 2007 and found that public debt had a negative impact on economic growth up to a threshold of 90 percent of GDP. Balassone, Francese and Pace (2011) studied the case of Italy and found public debt had a negative impact on economic growth. The effect was stronger once public debt exceeds 100 percent of GDP, and stronger in the case of foreign debt compared to domestic debt mainly through reduced investment. Panizza and Presbitero (2014) used an instrument variable approach to analyse OECD countries and found that public debt had a negative effect on economic growth. Dinca and Dinca (2015) analysed 10 former communist countries from 1999 to 2010 by applying a quadratic equation. The results indicated that a significant negative nonlinear relationship existed between the government debt to GDP ratio and per capita growth rate at a turning point around 50 percent. Bilan and Ihnatov (2015) analysed 33 European countries from 1990 to 2011 and found a U-shaped relationship between public debt and economic growth at a maximum threshold of about 94 percent of GDP.

On the other hand, there was evidence supporting the positive effect of public debt on economic growth (Ali Abbas & Christensen, 2007). Moore and Chrystol (2010) used meta-analysis in the case of developing countries to demonstrate the positive impact of external indebtedness on economic growth, concluding that the use of external resources could increase the productive capacity of a nation. Baum et al. (2012) identified a positive short-term impact from a public debt ratio at 67 percent of GDP on economic growth. The effect was insignificant afterwards and even became a negative beyond 95 percent of GDP. Greenidge et al. (2012) analysed developing countries in the Caribbean and found that the public debt had a positive effect on economic growth only with a much smaller threshold of about 55 percent – 56 percent of GDP, and becoming even weaker once public debt exceeded 30 percent of GDP. Pescatori, Sandri and Simon (2014) found that no evidence of a public

debt threshold in the medium-term growth prospects are deemed as a significantly disadvantage.

2. Growth-maximizing public debt threshold

Growth-maximizing public debt threshold is often referred to as the Debt Laffer Curve (Sachs, 1989), which means that the level of debt is inclined to be higher with less probability of debt services. It was introduced through the idea of “debt overhang hypothesis” whereby high debt levels cause a loss in efficiency (Sachs, 1989). Figure 2 shows the Growth-maximising public debt threshold. The theoretical turning point (d^*) indicates that public debt has a negative effect on economic growth. At this point, an increase in public debt would slow down economic growth, considered to be the growth-maximising public debt threshold. The literature on debt overhang confirms that higher stocks of public debt are predicted to result in lower economic growth rates and a reduced investment channel.

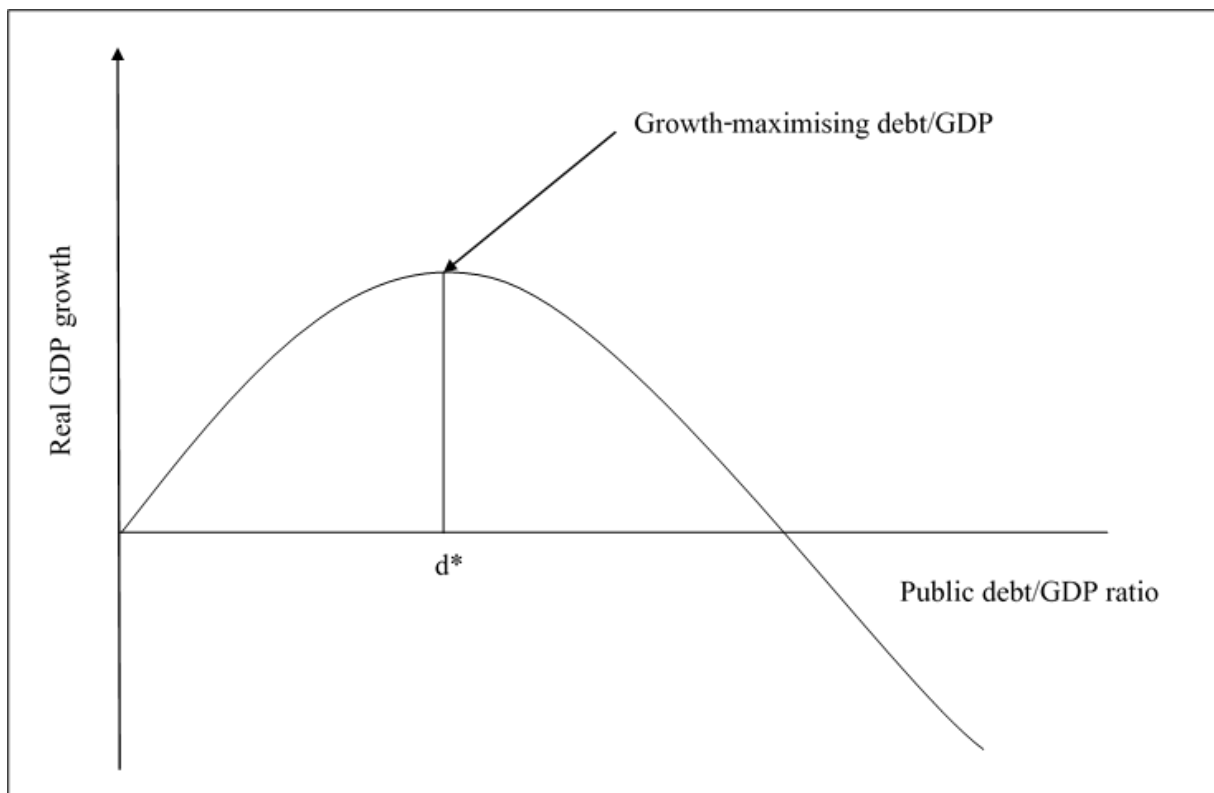


Figure 2 Growth-maximising public debt threshold

Source: Adapted from Pattillo, Poirson, and Ricci (2002) and Mupunga and Roux (2015)

3. Two Stage Least Squares (2SLS) (Nagler, 1999)

The basic description of 2SLS contains three elements.

3.1) The endogeneity problem, and the bias of Ordinary Least Squares (OLS).

As a general rule, when a variable is endogenous, it correlates with the disturbance term, hence violating the basic OLS assumptions and making OLS estimates biased

or lead to a relationship loop between dependent variable and independent variables. The following is an example of two equations where Y and X_1 are both endogenous.

$$Y_i = \alpha_{10} + \beta_{11}X_{1i} + \beta_{12}X_{2i} + \beta_{13}X_{3i} + \dots + \beta_{1k}X_{ki} + \mu_i \quad (1)$$

$$X_{1i} = \alpha_{20} + \beta_{21}Y_i + \beta_{22}Z_{2i} + \beta_{23}X_{3i} + \dots + \beta_{2k}X_{ki} + \nu_i \quad (2)$$

Then substitute (1) into (2)

$$X_{1i} = \alpha_{20} + \beta_{21}(\alpha_{10} + \beta_{11}X_{1i} + \beta_{12}X_{2i} + \beta_{13}X_{3i} + \dots + \beta_{1k}X_{ki} + \mu_i) + \beta_{22}Z_{2i} + \beta_{23}X_{3i} + \dots + \beta_{2k}X_{ki} + \nu_i \quad (3)$$

where, Z_i is a proxy of X_i and u_i is an error term

X_1 is shown as a linear function of μ_i and hence will be correlated with μ_i

3.2) The consistency property of 2SLS.

If the sample size increases, it is unbiased that means it does not violate the basic assumption of the OLS estimation ($\text{Cov}(X, \mu_i) = 0$).

3.3) The mechanics of the solution.

The goal is to find a proxy for X, that will not be correlated with the error term. The first stage of 2SLS is to generate the proxy while the second stage is to simply substitute the proxy for X, and then the OLS estimation is performed.

The mechanism for generating a proxy is to find a variable that belongs in equation (2) (the one predicting X_1) but does not appear in equation (1) (the one predicting Y). This means finding a variable Z that determines X_1 but that variable does not influence Y. The technical conditions of Z are as follows: $\text{cor}(Z; u) = 0$ $\text{cor}(Z; x) \neq 0$ that is equation (1). Then the OLS estimation of the following equation is carried out.

$$X_{1i} = \alpha + \beta_1 Z_i + \beta_2 X_{2i} + \beta_3 X_{3i} + \dots + \beta_{1k} X_{ki} + \nu_i \quad (4)$$

This equation includes all the exogenous variables from the first equation on the right-hand sided, and adds Z. These estimates allow the generation of a new set values of the variable $\hat{X}_1$

$$\begin{aligned} \hat{X}_i &= \alpha + \hat{\beta}_1 Z_i + \hat{\beta}_2 X_{2i} + \hat{\beta}_3 X_{3i} + \dots + \hat{\beta}_k X_{ki}; \\ X_1 &= \hat{X}_1 + \hat{\nu} \end{aligned} \quad (5)$$

Now, $\hat{X}_1$ can be substituted for X_1 in equation (1)

$$Y_i = \alpha + \beta_1 (\hat{X}_{1i} + \hat{\nu}_i) + \beta_2 X_{2i} + \beta_3 X_{3i} + \dots + \beta_{1k} X_{ki} + \mu_i \quad (6)$$

It can be rewritten as:

$$Y_i = \alpha + \beta_1 \hat{X}_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \dots + \beta_{1k} X_{ki} + (\mu_i + \beta_1 \hat{v}_i) \quad (7)$$

Furthermore, a literature review of empirical research suggests the relationship between public debt and economic growth which can be estimated using several models and many different restricted variables. The difference in the choice of variables depends on the definition, construction of those variables, and data limitations. The variables most used for estimating the relationship between public debt and economic growth, are transformed into logs of GDP per capita, government revenue, government expenditure, gross fixed capital formation, inflation, and trade openness, etc.

A review of the relevant literature provides a clear understanding of the relationship between public and economic growth. The variables such as public debt to GDP ratio, lagged public debt to GDP ratio (1 year and 2 years), population growth, government revenue, population growth, gross fixed capital formation (total; private; and public), inflation (CCPI), exchange rate, openness and interest rate (interbank rate). To estimate the relationship between public debt and economic growth in Thailand, a model representing the relationship between GDP per capita growth and economic variables is developed and explained in the methodology section. The empirical results will express the relationship between the GDP per capita growth and economic variables through the 2SLS estimation.

Data and Methodology

This study aims to analyses the relationship between public debt and economic growth. The model in this study is applied as a non-linear quadratic growth function. The model is applied from Checherita-Westphal (2010); Mupunga and Roux (2015) and Bilan and Ihnatov (2015). This model will be analysed in two parts, 1) the relationship between public debt and economic growth, and 2) the relationship between public debt and economic growth per capita. The quadratic function is used in this study because the non-linear impact of public debt on GDP per capita growth is of interest and leads to the determination of the debt turning point. The basic model can be written in equation (8)

$$\text{growth}_t = \alpha + \beta \text{debt}_t + \gamma \text{debt}_t^2 + \text{other control variables} + \varepsilon_t \quad (8)$$

Other control are applied such as domestic saving, government consumption, openness and gross fixed capital formation.

where

growth is the GDP per capita growth rate that is a dependent variable

Debt is a public debt to GDP ratio, and

ε_t is an error term.

The empirical growth model considers the logarithm of GDP per capita growth and population growth rate as the regression model. Not only do two variables affect GDP per capita growth but also other economic variables as control variables or independent variables.

Control variables or independent variables in this study consist of debt to GDP ratio which is a set of control variables used to capture the impact of economic growth, the logarithm of GDP per capita government revenue used to study the effect of government income and the development of economic. Real government consumption is used to study the effect of government outlay. Domestic savings and Gross fixed capital formation are employed to study the impact of capital accumulation. Openness, foreign direct investment and exchange rate are applied to estimate the degree of openness impact on the economy and external competitiveness. Interest rate is used to capture its influence on investment and public debt while inflation is applied to examine the impact of fiscal policy on economic growth. The study model can therefore be written in equation (9) as

$$\begin{aligned} growth_i = & \alpha + \beta_1 Debt_i + \beta_2 Debt_i^2 + \beta_3 \ln gdpc_i + \beta_4 POP + \beta_5 saving_i + \\ & \beta_6 GOV_con_i + \beta_7 GOV_rev_i + \beta_8 GFCF_i + \beta_9 GFCF_pri_i + \\ & \beta_{10} GFCF_pub_i + \beta_{11} open_i + \beta_{12} FDI_i + \beta_{13} Exc_i + \beta_{14} INT_i + v_t + \varepsilon_{it} \end{aligned} \quad (9)$$

where

growth is GDP growth and GDP per capita growth,

Debt is the public debt to GDP ratio,

ln gdpdc is the natural logarithm of the initial of GDP per capita,

POP is population growth,

saving is a domestic saving as a share of GDP,

GOV_con is a real government consumption as a share of GDP,

GOV_rev is a government revenue as a share of GDP,

GFCF is gross fixed capital formation as a share of GDP,

GFCF_pri is Private sector of gross fixed capital formation as a share of GDP,

GFCF_pub is Public sector of gross fixed capital formation as a share of GDP,

open is trade openness that is sum of import and export as a share of GDP,

FDI is a foreign direct investment as a share of GDP,

Exc is an exchange rate,

INT is a long-term interest rate; interbank rate,

v_t is a time fixed effects,

ε_{it} is an error term.

The first step is to study the effect of public debt on GDP per capita growth and the effect of public debt to GDP growth in Thailand. The data are estimated using time series quarterly data for the period from 1998 to 2017. Two-stage least square (2SLS) estimator is used as an instrument variable estimation techniques to solve the problem of endogeneity specific to the economic growth model. With 2SLS estimators, lagged debt to GDP ratio is used as an instrument variable to avoid the reverse causality from economic growth on the public debt to GDP ratio. In fact, the link between economic growth and public debt suggests that low economic growth can lead to a high level of public debt (Krugman, 2010)

The second step is to find the turning point. The turning point is calculated as the growth-maximising public debt threshold using the model in equation (10). Maximising the results from equation (10), reveals turning point of optimal public debt in terms of economic growth.

$$growth = \beta_1 Debt + \beta_2 Debt^2 \quad (10)$$

Results and Discussions

The stationarity test (unit root test) is performed on all variables using the Augmented Dickey-Fuller (ADF) unit root test. The variables are used to calculate such as GDP growth, GDP growth per capita, public debt to GDP ratio, lagged public debt to GDP ratio (1 year and 2 years), GDP growth, GDP per capita growth, logarithm GDP per capita, population growth, domestic saving, government consumption, government revenue, gross fixed capital formation (total; private; public), foreign direct investment, exchange rate, openness, and interest rate. The unit root test results are applied to confirm that the variables in this study are stationary at first difference level (1) and at the statistical significance level of 0.10. The results are presented in Table 1.

Table 1 Stationary test (unit root test)

Variable	Augmented Dickey-Fuller (ADF)	
	Level	First difference
Debt/GDP ratio	-3.038900** (0.0361)	-2.632990* (0.0913)
Lagged Debt/GDP ratio (4 Lags)	-2.582311 (0.1011)	-2.930086** (0.0466)
Lagged Debt/GDP ratio (8 Lags)	-2.731647* (0.0736)	-5.306772*** (0.0000)

Table 1 (Cont.)

Variable	Augmented Dickey-Fuller (ADF)	
	Level	First difference
GDP Growth	-4.682142*** (0.0002)	-16.29689*** (0.0001)
GDP Per Capita Growth	-4.577559*** (0.0003)	-16.32638*** (0.0001)
Logarithm GDP Per Capita	-1.007095 (0.7470)	-4.350085*** (0.0008)
Population Growth	-2.974852** (0.0422)	-5.195874*** (0.0000)
Domestic Saving	-3.223875** (0.0223)	-3.940467*** (0.0028)
Government Consumption	-9.579777*** (0.0000)	-7.181033*** (0.0000)
Government Revenue	-2.158756 (0.2230)	-4.941997*** (0.0001)
Gross fixed Capital Formation (Total)	-2.465009 (0.1281)	-5.252906*** (0.0000)
Gross fixed Capital Formation (Private)	-2.834838* (0.0583)	-4.569186*** (0.0004)
Gross fixed Capital Formation (Public)	-2.892484* (0.0512)	-3.536182*** (0.0097)
Openness	-3.449791** (0.0122)	-5.026636*** (0.0001)
Foreign Direct Investment	-0.831750 (0.8036)	-4.430973*** (0.0006)
Exchange Rate	-1.162798 (0.6867)	-9.714588*** (0.0000)
Interest Rate (Interbank Rate)	-8.518698*** (0.0000)	-5.260916*** (0.0000)

Source: Author's calculation

Note: ***statistically significant at 1 percent, ** statistically significant at 5 percent,
*statistically significant at 10 percent.

A time-series regression is used through Two Stage Least Square (2SLS) method for studying the relationship between public debt to GDP ratio and economic growth. This study

follows the methodology used Checherita-Westphal (2010); Mupunga and Roux (2015) and Bilan and Ihnatov (2015). The results are presented in Table 2

Table 2 The empirical result from Two Stage Least Square estimators

Variable	GDP per capita growth		GDP growth	
	Coefficient	Std. Error	Coefficient	Std. Error
constant	-2.466358	0.420589***	-2.474675	0.423869***
Debt	5.213153	3.063483*	5.296027	3.084953*
Debt_sq	-0.056762	0.029836*	-0.057566	0.030065*
Logarithm GDP Per Capita	163.1393	18.82113***	163.6245	18.91775***
Population Growth	2.509526	1.484048*	2.650871	1.437682*
Domestic Saving	0.094576	0.950641	0.091587	0.954268
Government Consumption	0.278482	0.337050	0.276832	0.339809
Government Revenue	-2.299546	0.819624***	-2.318257	0.823996***
Gross fixed Capital Formation (Total)	117.1661	85.97044	117.9100	86.71751
Gross fixed Capital Formation (Private)	-120.8013	85.67847	-121.5292	86.42208
Gross fixed Capital Formation (Public)	-114.6634	86.04867	-115.4035	86.79762
Openness	-0.415969	0.306021	-0.420083	0.307896
Foreign Direct Investment	-1.090755	0.605498*	1.132170	0.607304*
Exchange Rate	0.835082	0.232466***	0.840842	0.233932***
Interest Rate (Interbank Rate)	-1.203217	0.187258***	-1.202160	0.188007***
turning point	48	48		

Source: Author's calculation

Note: ***statistically significant at 1 percent, ** statistically significant at 5 percent,

*statistically significant at 10 percent.

Debt to GDP ratio (debt) has a positive relationship with GDP per capita growth and GDP growth, and significant at 0.10. The results indicate that the coefficient of debt is around 5.21 and 5.29. The result implies that when the size of debt increases by 1 unit, GDP per capita growth and GDP growth will increase by 5.21 unit and 5.29 unit. Debt to GDP ratio square (debt²) has a negative relationship with GDP per capita growth and GDP growth, and significant at 0.10. The results indicate that debt² is around -0.06. The result implies that when the size of debt² increases by 1 unit, GDP per capita growth and GDP growth will decrease by

0.06 unit. The result confirms that there is non-linear negative relationship between public debt and GDP per capita growth. The empirical results for the non-linear negative relationship is the same as Checherita-Westphal (2010); Mupunga and Roux (2015) and Bilan and Ihnatov (2015).

The logarithm of GDP per capita has a positive relationship with GDP per capita growth and GDP growth, and significant at 0.01. The results indicate that the coefficient of the logarithm of GDP per capita is around 163.14 and 163.62 implied that when the size of the logarithm of GDP per capita increases by 1 unit, GDP per capita growth and GDP growth will increase by 163.14 unit to 163.62 unit.

Population growth has a positive relationship with GDP per capita growth and GDP growth, and significant at 0.10. The results indicate that the coefficient of population growth is around 2.51 and 2.65 implied that when the size of population growth increases by 1 unit, GDP per capita growth and GDP growth will increase by 2.51 unit and 2.65 unit.

Government revenue has a negative relationship with GDP per capita growth and GDP growth, and significant at 0.01. The results indicate that the coefficient of government revenue is around -2.30 and -2.31 implied that when the size of government revenue increases by 1 unit, GDP per capita growth and GDP growth will decrease by 2.30 unit and 2.31 unit.

Foreign direct investment has a negative relationship with GDP per capita growth and GDP growth, and significant at 0.10. The results indicate that the coefficient of foreign direct investment is around -1.09 and -1.13 implied that when the size of foreign direct investment increase by 1 unit, GDP per capita growth and GDP growth will decrease by 1.09 unit and 1.13 unit.

Exchange rate has a positive relationship with GDP per capita growth and GDP growth, and significant at 0.01. The results indicate that the coefficient of exchange rate is around 0.84 implied that when the size of exchange rate increase by 1 unit, GDP per capita growth and GDP growth will increase by 0.84 unit.

Interest rate has a negative relationship with GDP per capita growth and GDP growth, and significant at 0.01 for GDP per capita growth and GDP growth. The results indicate that the coefficient of interest rate is around -1.20 implied that when the size of interest rate increase by 1 unit, GDP per capita growth and GDP growth will decrease by 1.20 unit.

Domestic saving, government consumption, gross fixed capital formation and openness are not have a significant level to GDP per capita growth and GDP growth. It means that those variables cannot describe a significant increase or decrease in GDP per capita growth and GDP growth.

The positive coefficients of debt and negative coefficients of debt² indicated an concave inverted U-shaped relationship between GDP per growth and debt and relationship between GDP growth and debt. The turning point is 48 percent presented in Figure 3 and Figure 4. This result implies that if debt exceed this point, the relationship between GDP per

capita growth and debt and GDP growth and debt will change from positive to negative relationship.

The result suggests that Thailand has more public investment such as public health, Bangkok (Mass) Transit System Skytrain (BTS Skytrain), Metropolitan Rapid Transit (MRT) that is the reason why the government has increase public debt so the government keeps budget deficits for many years. When public debt increase, the government responds to maintaining fiscal discipline is to increase the fiscal surplus, as a result, the government must more repay the principal sum and interest. Nevertheless, the fiscal surplus has a limit, ultimately it results in a slowdown in a fiscal surplus. The government must manage by restructuring the public debt or repayment public debt. It confirms the result that public debt and economic growth is a negative relationship. If the public increase, the economic growth will decrease.

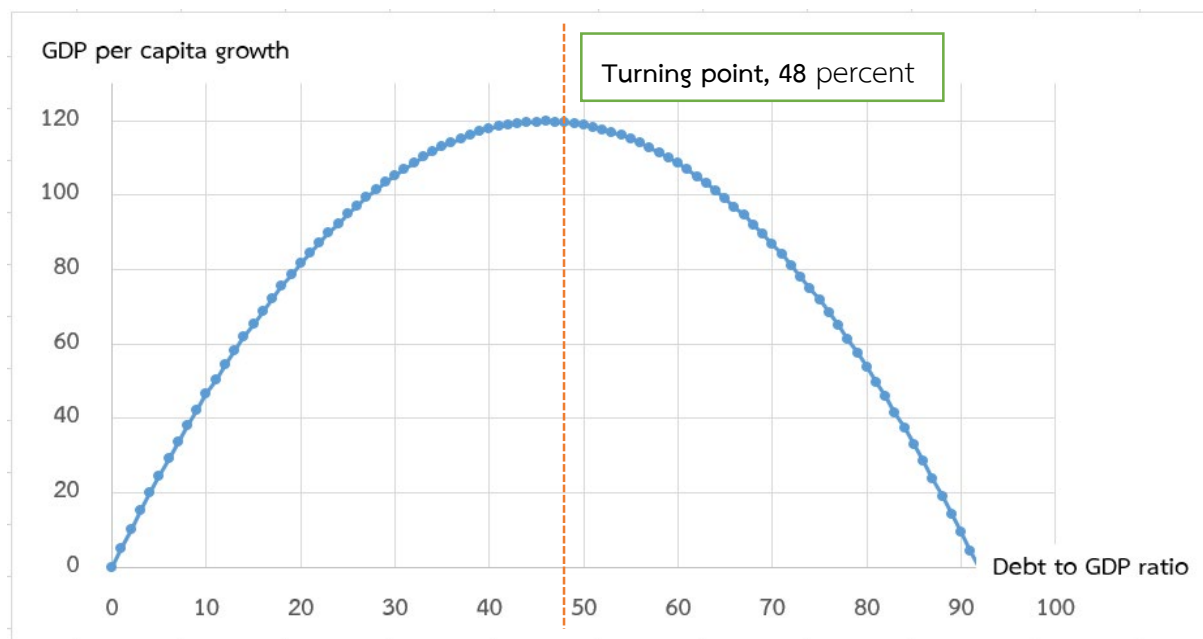


Figure 3 The empirical results between GDP per capita growth and public debt to GDP ratio
Source: Author's estimation

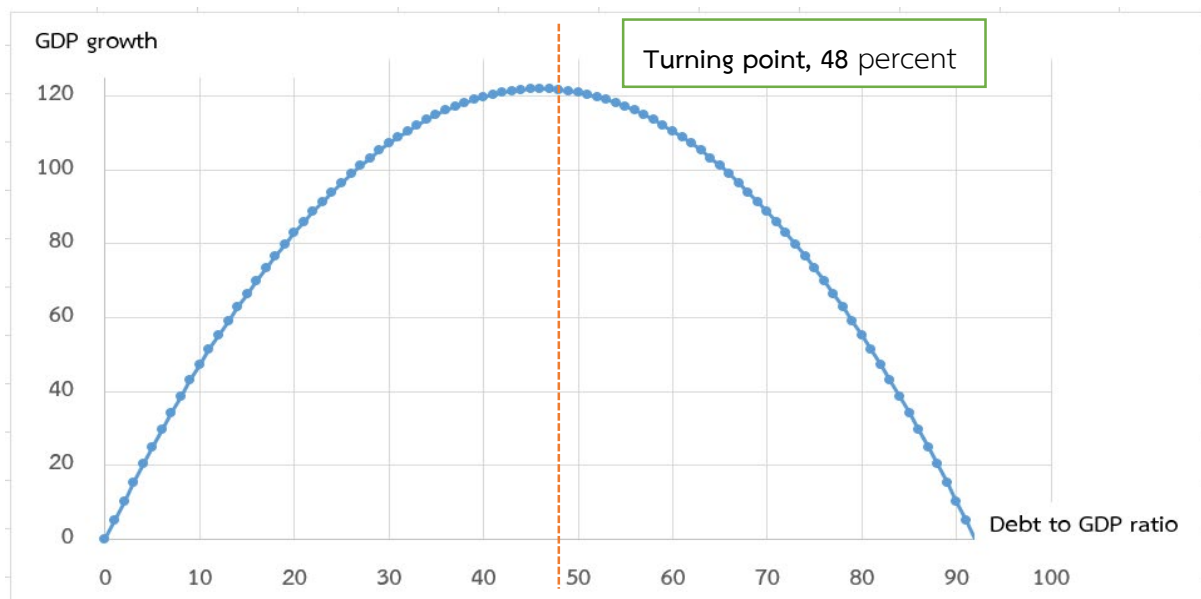


Figure 4 The empirical results between GDP growth and public debt to GDP ratio

Source: Author's estimation

Conclusions

This paper follows the methodology of Checherita-Westphal (2010); Mupunga and Roux (2015) and Bilan and Ihnatov (2015) to study the effect of public debt to economic growth for Thailand. This study uses quarterly data from 1998 to 2017. This paper is study the effect of public debt on GDP per capita growth and the effect of public debt to GDP growth in Thailand by using 2SLS estimators and find the turning point that is calculated as the growth-maximising public debt threshold.

The results from this study indicate that the relationship between public debt to GDP ratio and economic growth is non-linear and negative. The turning point is at 48 percent that is the highest point of an inverted U-shaped. The point at which the government may control the debt limit influences the debt service and thus increasing economic growth. If the public debt ratio in Thailand is exceeding 48 percent, it will be a negatively affected on economic growth.

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