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The Optimal Threshold of Tax Revenue for Economic Growth: An Investigation into the ASEAN 5+1 Countries

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Abstract:

Purpose: *This paper aims to test how tax revenue affects Indonesia, Malaysia, Thailand, Singapore, the Philippines, and Vietnam.*
Design/Methodology/Approach: *The dependent variable is the annual percentage growth rate of gross domestic product (GDP). The independent variable is the government's total tax revenue to gross domestic product (TAX). The control variable is the total government expenditure to gross domestic product (GOV) with the panel data collected over the period 2008-2017 and analyzed according to the Generalized Method of Moment (GMM). Next, based on the theoretical framework of the nonlinear relationship between tax revenue and economic growth, the researchers conducted the derivation of the quadratic equation based on TAX's variable to determine the extreme point (the optimal threshold of tax revenue).*
Findings: *The research results show that tax revenue has a positive impact on the economic growth in the selected countries, while government expenditure harms these countries' economic growth. Moreover, the optimal threshold of tax revenue found in this study is 15.33%, through which tax revenue harms economic growth. This new finding of this paper will add more empirical evidence to help the ASEAN 5+1 countries plan to develop and adjust tax policies in the coming period to ensure that tax policies have a positive impact on economic growth.*
Practical Implications: *The research results bring practical and meaningful value to the ASEAN-5 countries and Vietnam.*
Originality/Value: *The paper shows that tax revenue has a nonlinear impact on economic growth. Thereby, the researchers determined the optimal threshold of tax revenue of 15.33%.*

Keywords: *ASEAN 5+1, economic growth, GMM, optimal threshold, tax revenue.*

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1. Introduction

Economic growth has always been the most important macroeconomic target of governments. Todaro and Smith (2015) have stated that economic growth is a stable process by which the economy's productive capacity increases overtime to bring about an increase in national output and income. In most countries worldwide, governments have a desire to increase tax revenue and upsurge economic growth.

However, Gale *et al.* (2015) have found that tax revenue does not have a stable impact on economic growth in different periods and even reverses the impact's direction in different stages. On the other hand, according to the theory of the nonlinear impact of fiscal policy on economic growth proposed by Barro (1990), the research results show that tax increases will reduce economic growth (Barro, 1990). Barro's theory was further developed in the studies by Rahn and Fox (1996), Armey and Armey (1995), and Scully (1996, 2003). These researchers contribute empirical arguments, models, and evidence to prove that government size can exist at a threshold at which economic growth reaches its maximum.

Overall, both theories and empirical studies show a nonlinear relationship between taxation and economic growth. The issuea raised for countries are how to formulate tax policies, implement tax policies to ensure the revenue for expenditure according to each nation's plan, and promote economic growth, how much tax revenue is the optimal level of economic development. The researchers studied "the optimal threshold of tax revenue for economic growth: an investigation into the ASEAN 5+1 countries" to address these issues. The researchers choose the ASEAN 5+1 countries because these countries (except for Singapore) are developing countries with the budget depending greatly on tax revenue, accounting for over 80% of the total revenue.

Accordingly, the question is whether the great tax revenue exceeds the threshold at which tax revenue has a positive impact on economic growth or not. In the coming time, is it possible for tax policy to be adjusted to increase the budget further? The authors' research results will be empirical evidence to provide the governments with more scientific foundations to make decisions on adjusting tax policy in the coming period. This is a new point in the study because, until the present time, there have been many studies of the optimal threshold of government expenditure on economic growth; however, there is no empirical study of the optimal threshold of tax revenue in the ASEAN 5+1 countries.

Therefore, the researchers expect that the research results will add the evidence to the theory of the nonlinear relationship between tax revenue and economic growth and have practical implications for the ASEAN 5+1 countries to adjust tax policy by the context of global integration.

2. Literature Review

2.1 The Theoretical Framework of the Non-Linear Relationship Between Tax Revenue and Economic Growth

The impact of tax revenue on a country's economic growth has been explained and demonstrated in many previous studies, theoretically and empirically. The economic growth model is analyzed by two schools: exogenous growth and endogenous growth. Solow (1956) argued that economic growth is formed from exogenous factors, including capital and labor. In contrast, neoclassical economists such as Romer (1986) and Lucas (1988) have stated that innovative business activities constantly motivate a nation's internal economic development. Tax policies continually influence entrepreneurial spirit and technological innovation. In agreement with this view, Dackehag and Hansson (2012) asserted that corporate income taxes harm technological innovation and the attraction of foreign direct investment; meanwhile, personal income taxes affect investments in human resources, including personal expenditures on education and laborers' motivation.

However, the empirical evidence of the relationship between tax policy and growth seems to be inconsistent in the conclusions on the impact of taxation on economic growth. Most previous studies have pointed out the negative impact of taxation on economic growth, especially income taxes. Lee and Gordon (2005), as well as Arnold *et al.* (2011), have demonstrated that taxation harms economic growth, although Arnold *et al.* (2011) have also argued that property taxes have a positive impact on economic growth. Meanwhile, Ojede and Yamarik's (2012) study based on the data in the United States suggested that the increase in property taxes and sales taxes will reduce economic growth, but income taxes have no impact on growth (Liapis *et al.*, 2020; Thalassinos *et al.*, 2015).

In contrast, much evidence shows that taxation has a positive impact on growth in different research contexts. Specifically, Romero-Avila and Strauch (2008) found empirical evidence for this positive effect when using the data from 15 EU countries, while Takumah (2014) and Ayuba (2014) also reached similar conclusions with the research data in African countries, namely Ghana and Nigeria. Moreover, Gale *et al.* (2015) found that tax revenue and income tax rates do not have a stable impact on per capita income growth in different periods, and even reverse the impact at different stages. The empirical research results are contradictory throughout history, in many countries with different development levels, suggesting a nonlinear relationship between taxation and economic growth.

The nonlinear relationship between economic growth and macroeconomic factors such as fiscal policy, inflation, public debt, etc. has been proved in many previous studies. Plummer and Martin (2003), based on the empirical data in 83 countries, have demonstrated that the economy's level of democracy has a nonlinear effect on economic growth and government expenditure. In Southeast Asia, Thanh (2015)

argued that inflation has a nonlinear effect on five ASEAN countries' GDP growth rate. A study by Alaabed and Masih (2016), within a country of Malaysia, concluded that the impact of the level of financial development, which is measured by the ratio of domestic credit to gross national product (GDP), on economic growth would change when the ratio of domestic credit to GDP exceeds the threshold of 24.45%. Previous studies have concluded that economic growth will not be linearly affected by macroeconomic factors in the long run through different approaches. This leads to policy implications in favor of the thresholds of inflation, financial development levels, or institutional quality, at which economic growth reaches an optimal level. Among the policies aimed at optimizing economic growth, fiscal policy is indispensable, especially government expenditure and tax policy.

The BARS curve is the fundamental theoretical basis for the authors to develop their research, focusing on the nonlinear effect of tax revenue on economic growth. Although previous studies mostly used government expenditure to represent government size, the researchers in this paper believe that government expenditure depends on the revenues for the budget, including tax revenue and foreign debt. The nonlinear effect of public debt on economic growth has been demonstrated by Checherita-Westphal and Rother (2010) with the scope of the study comprising the countries in the European Union (EU). Scully (1996; 2003) approached the BARS curve from the tax revenue perspective. From the formula of the Cobb-Douglas production function in the case of taxes, he argued that there is an optimal threshold of tax revenue, creating an inverted U-shaped relationship between tax revenue to GDP and economic growth. Scully (1996; 2003) provided much empirical evidence to support his theoretical speculations in different research contexts such as New Zealand (Scully, 1996) or the United States (Scully, 2003).

However, Kennedy (2000) and Hill (2008) have argued that Scully's model ignores the fact that the capital generated from the previous periods' production activities will not be fully depreciated and can be reused for subsequent production cycles. Nevertheless, as Scully (2000) explained, the capital accumulated in the previous production periods, together with technological advancement, has been shown in his model through the reduction in production in later years. Therefore, the production factor does not change the estimation results from the Scully model for the optimal tax rate. From the above arguments, the researchers have the basis for building a research model to prove the Scully curve or the BARS curve and use tax revenue as a measure of government size with the scope of the study comprising the countries in Southeast Asia.

2.2 The Empirical Evidence of the Non-Linear Relationship Between Economics and the Quadratic Function

The quadratic function is a classical mathematical model and is often applied to express the nonlinear relationship between two variables. This tool helps researchers easily identify the optimal point through the problem of finding the extreme value.

Therefore, it can be applied in economic research to find optimal thresholds in economic relationships, helping policymakers develop appropriate solutions.

Herath (2012), based on Armey's (1995) theoretical background, used a quadratic function model to determine the optimal threshold of government expenditure in Sri Lanka. According to the author's estimation, government expenditure should be 27% to achieve the maximum growth rate.

Nasreddine and Mensi (2016) testified the existence of the theory proposed by Greenwood and Jovanovic (1990) based on the idea of the Kuznets (1955) curve and in this case, they verified the inverted U-shaped relationship between financial development and inequality level. The authors used the data from 138 countries over the period 1980-2012 to analyze the linear regression relationship between the dependent variable of the Gini coefficient measuring the level of inequality and the independent variable of the ratio of bank credit to the private sector, the size of the stock market capitalization and the square of these variables. The estimation results show that the slope of the variable of the bank credit ratio and the square of market capitalization are statistically significant, proving that the impact of financial development factors on the Gini coefficient measuring inequality is a quadratic function.

The U-shaped curve was also discovered by Garcia and Haldenwang (2016) when studying the impact of democracy on tax revenue based on the data collected from 131 countries in the period 1990-2008. Accordingly, the countries with high autocracy and the countries considered to be the most democratic have a higher tax revenue ratio than the countries between these two extremes. Therefore, this paper's research results also suggest that policy options will not always yield a unique result, and the direction can be reversed when the value of the impact variable exceeds the threshold defined by the formula for finding the extreme value of a quadratic function.

In Tunisia, with the data from 1966 to 2015, Chokri and Ali (2018) used a quadratic function model to estimate the optimal ratio of tax revenue to GDP for economic growth. According to the estimation results, the authors conclude that Tunisia's tax revenue ratio to GDP should be 19.6% to reach the maximum growth rate of 4.93%.

A study by Milasi and Waldmann (2018) on the nonlinear impact of tax policy on economic growth employed a different approach. The two authors used the top marginal tax rates on personal income to measure tax policy's impact on economic growth in OECD countries. This study also found statistical evidence favoring the existence of the optimal tax rate of personal income tax, at which the economic growth rate reached its maximum.

Based on the theoretical framework of the nonlinear relationship between tax revenue and economic growth and the empirical evidence found in several countries

and country groupings, the researchers suggest applying a similar research model to determine the optimal tax revenue threshold in ASEAN countries. There has been no study directly estimating the optimal threshold of tax revenue for economic growth in these countries to the best of the researchers' knowledge. Therefore, this study will help fill the research gap and provide policy implications for the countries in the study's scope to propose policies that best serve the growth targets.

3. Data and Methodology

3.1 Data Collection

The research data was collected from the World Bank in the period 2008-2017. The countries selected in the study include ASEAN-5 countries (Indonesia, Malaysia, Thailand, Singapore, and the Philippines) and Vietnam. The collected data includes the annual percentage growth rate of gross domestic product (GDP), the government's total tax revenue to gross domestic product (TAX), and the total government expenditure to gross domestic product (GOV).

3.2 Methodology

With the panel data collected from the ASEAN-5 countries and Vietnam in 2008-2017, the researchers used the Generalized Method of Moment (GMM) for data analysis. The GMM method can control the autocorrelation phenomenon between errors and heteroscedasticity (Blundell and Bond, 1998). Simultaneously, the GMM method also solves the potential endogenous problem in the research model (Doytch and Uctum, 2011).

Based on empirical studies, the researchers built a model to examine the impact of tax revenue on economic growth. The dependent variable is economic growth (GDP), and the independent variable is tax revenue (TAX). Simultaneously, the researchers added the independent variable of the square of tax revenue (TAX2) to the research model to test the nonlinear impact of tax revenue on economic growth. Thereby, the study had a basis for determining the optimal threshold of tax revenue.

In this study, the researchers also added the control variable of government expenditure (GOV) to the research model because the empirical studies showed that government expenditure impacts economic growth. Specifically, the studies by Chobanov and Mladenova (2009) or Herath (2012) used government expenditure as a measure, which represents government size and has been proved to have a nonlinear impact on economic growth form of a reverted U-shaped curve. However, this study used tax rates as the representative of government size. This can lead to endogenous phenomena due to the omission of variables because government size depends on non-tax revenues. To avoid the endogenous phenomena in the model, the researchers used the GOV variable, which represents the government expenditure to GDP and controls the potential endogenous phenomena in the model.

Accordingly, the suggested research model has the equation as follows with the variables presented in Table 1:

$$GDP_{it} = \beta_0 + \beta_1 TAX_{it} + \beta_2 TAX^2_{it} + \beta_3 GOV_{it} + \varepsilon_{it}$$

Table 1. *The variables in the research model*

Variable name	Code	Measurement	Previous studies
Dependent variable			
Economic growth	GDP	Annual percentage growth rate of gross domestic product	Scully (2003), Chobanov and Mladenova (2009), Herath (2012), Alaabed and Masih (2016), Milasi and Waldmann (2018)
Independent variable			
Tax revenue	TAX	Government's total tax revenue to gross domestic product	Scully (2003), Chokri and Ali (2018)
Square of tax revenue	TAX^2	(Government's total tax revenue to gross domestic product)^2	Chokri and Ali (2018)
Control variable			
Government expenditure	GOV	Total government expenditure to gross domestic product	Chobanov and Mladenova (2009), Herath (2012)

Source: *Own study.*

4. Empirical Results and Discussion

4.1 Descriptive Statistics

The research data collected from the World Bank for the ASEAN-5 countries and Vietnam in the period 2008-2017 is described in Table 2 below:

Table 2. *Descriptive statistics of variables*

Variable	Minimum	Mean	Maximum	Standard Deviation (Std. Dev.)
GDP	-0.015	0.049	0.152	0.025
TAX	0.099	0.145	0.220	0.028
GOV	0.056	0.109	0.171	0.032

Source: *Own study.*

Table 2 shows that Malaysia had the lowest economic growth (GDP) in 2009 (-1.5%). Meanwhile, Singapore achieved the highest economic growth (GDP) in 2010 (15.2%). For tax revenue (TAX), Indonesia achieved the lowest tax revenue in 2017 (9.9%), and Vietnam achieved the highest tax revenue in 2008 (22%). Simultaneously, Vietnam was the country with the lowest government expenditure (GOV) in 2008 (5.6%), and Thailand was the country with the highest government expenditure in 2015 (17.1%).

4.2 Empirical Results

Table 3 shows that tax revenue (TAX) is positively correlated with economic growth (GDP). Meanwhile, government expenditure (GOV) is negatively correlated with economic growth (GDP).

Table 3. *Correlation matrix*

	GDP	TAX	GOV
GDP	1.000		
TAX	0.003	1.000	
GOV	-0.336	-0.198	1.000

Source: *Own study.*

Table 4 shows that the research model has no autocorrelation phenomenon between errors. However, the research model has heteroscedasticity at the 1% significance level. Therefore, the researchers used the GMM method to analyze the impact of tax revenue on economic growth. This is because the GMM method can control heteroscedasticity (Blundell and Bond, 1998) and the research model's potential endogenous phenomenon (Doytch and Uctum, 2011).

Table 4. *Result of heteroscedasticity and autocorrelation*

Heteroscedasticity test	**Autocorrelation test**
chi2 (6) = 7574.91 Prob>chi2 = 0.000***	F(1, 5) = 0.482 Prob > F = 0.518

Note: *** *indicates significance at the 1% level.*
Source: *Own study.*

After using the GMM method to control the potential endogenous problem and the heteroscedasticity, the research results (Table 5) are as follows:

Table 5. *The result of the research model*

Variable	**Coefficient**	**P>|z|**
TAX	5.245	0.043**
TAX^2	-17.108	0.041**
GOV	-0.455	0.012**
Constant	-0.289	0.111
Significance level	Wald chi2(2) = 6.37 Prob > chi2 = 0.095*	
Number of instruments	5	
Number of groups	6	
Arellano-Bond AR(2) test	Pr > z = 0.944	
Sargan test	Prob > chi2 = 0.397	

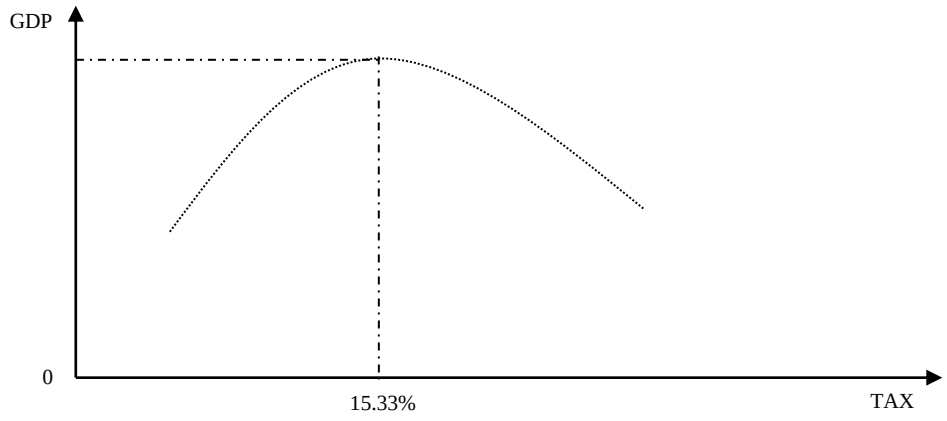
Note: ** *and* * *indicate significance at the 5% and 10% level, respectively.*
Source: *Own study.*

The research model is statistically significant at the 10% significance level. The Arellano-Bond AR (2) test gave the result that was greater than 10%, so the research model's result was quite good because there was no autocorrelation between errors. The Sargan test gave a greater than 10% result, which indicates that the instruments are used appropriately.

Overall, tax revenue (TAX) positively impacts economic growth (GDP) at the 5% significance level. According to this result, the tax collection in ASEAN 5+1 countries is suitable for their economic conditions, so the value of tax collection has stimulated economic growth; this is also consistent with reality. In particular, the tax policy introduced by developing countries is to boost the economy, and at the same time, the tax policy has another important goal of increasing budget revenue. Because when increasing budget revenue, countries will increase investment in infrastructure, attract domestic and foreign investment, increase business size, and increase jobs, leading to an increase in GDP. However, the square of tax revenue (TAX2) hurts economic growth (GDP) at the 5% significance level. This shows that tax revenue positively impacts economic growth (GDP), but to a certain threshold value, tax revenue will harm economic growth. In other words, tax revenue has a nonlinear impact on economic growth. In addition, economic growth (GDP) is negatively affected by the control variable of government expenditure (GOV) at the 5% significance level. Therefore, the result of the research model has the following equation:

$$GDP_{it} = 5.245\ TAX_{it} - 17.108\ TAX^2_{it} - 0.455\ GOV_{it} + \varepsilon_{it}$$

Figure 1. *The impact of tax revenue (TAX) on economic growth (GDP)*



Source: *Own study.*

Next, the researchers conducted the derivation of the quadratic equation based on the variable of TAX to determine the extreme point. The result shows that the optimal

threshold of tax revenue is 15.33%. In other words, if tax revenue reaches 15.33%, economic growth (GDP) will reach the optimal value (Figure 1).

4.3 Discussion

The empirical results from the data on GDP growth and the percentage of tax revenue to GDP of 6 countries in Southeast Asia come up with two conclusions: (1) the ratio of tax revenue to GDP has an impact on economic growth in the selected countries between 2008 and 2017, and (2) the impact of taxation on economic growth in the selected countries changes when the ratio of tax revenue to GDP reaches a certain threshold. Specifically, the impact of taxation on economic growth is represented by the reverted U-shaped curve: at low tax rates, taxation has a positive impact on economic growth, by the research results of Romero-Avila and Strauch (2008), Takumah (2014), and Ayuba (2014).

On the other hand, when the ratio of tax revenue to GDP exceeds the optimal threshold of 15.33%, which is estimated by the researchers, the increase in tax revenue is considered to reduce the economic growth rate, by the arguments of Lee and Gordon (2005) as well as Arnold *et al.* (2011). The research results are empirical evidence favouring the theory of the BARS curve through the approach to government revenue, particularly tax revenue.

The optimal threshold of tax revenue for growth is estimated to be 15.33%, higher than the average threshold of 14.5% in the research sample; according to the research results, the tax collection of ASEAN countries 5+1 has a positive impact on economic growth. Hence, the countries under study need to revise the tax rate if it is less than 15.33%, that country can increase the tax collection rate to 15.33%. If any country has a higher tax rate than 15.33%, it will reduce the tax collection rate because increasing taxes will harm economic growth. This reflects that the countries in Southeast Asia, except Singapore, are still in the developing phase, and tax revenue plays an important role in financing resources for infrastructure innovation and human resource development, indispensable factors in economic development in general. This situation contrasts with the results presented in a similar study by Chokri and Ali (2018) in Tunisia, whereby the author estimated the optimal threshold of tax revenue to be much lower than the current ratio of tax revenue to GDP in this country.

According to the argument of Chokri and Ali (2018), the optimal threshold of tax revenue is low compared to reality, which reflects that the use of tax revenue is still ineffective, and tax revenue is not allocated to the targets by growth. Therefore, it can be inferred that the countries in the Southeast region are making good use of tax revenue to serve their growth targets, and the growth potential of this region is still being maintained. When the tax revenue to GDP reaches 15.33%, these countries will consider the adjustment by not increasing tax revenue but increasing non-tax revenues.

5. Conclusions and Implications

The paper shows that tax revenue has a nonlinear impact on economic growth. Thereby, the researchers determined the optimal threshold of tax revenue of 15.33%. Accordingly, tax revenue has a positive impact on economic growth (GDP), and when the tax revenue is greater than 15.33%, this impact will be negative. In other words, tax revenue stimulates economic growth; however, when tax revenue is too high (greater than 15.33%), tax revenue will harm economic growth. This finding is new compared to previous studies. Simultaneously, the researchers also found the negative impact of the control variable of government expenditure (GOV) on economic growth (GDP). Therefore, the research results bring practical and meaningful value to the ASEAN-5 countries and Vietnam.

From the research results, the researchers make some recommendations to the ASEAN 5+1 countries as follows:

Firstly, depending on the reality of each country, it is possible to increase the ratio of tax revenue/GDP in the coming time, which means that the countries need to review the current tax laws of each country, from which there are adjustments to expand tax bases, supplement the activities not yet governed by laws to ensure an increase in the ratio of revenue/GDP in the coming time, ensure the right and full revenue, and limit tax losses.

Secondly, the test results also show that government expenditure harms economic growth, so the countries need to control government expenditure, specifically: Limiting the spread of public investment, reforming and improving the efficiency of public investment, avoiding loss and waste, transparency in government expenditure, strictly controlling government expenditure to reduce the burden on the budget, increasing expenditures that have a greater positive impact on economic growth such as transportation, education, and training; simultaneously, reducing consumer expenditure and spending on development investment instead. However, depending on the socio-economic targets that the government is pursuing, choose an appropriate spending structure in each period.

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