The Threshold of External Debt Ratio in Indonesia

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Abstract

Since New Order[1] regime, external debt has becoe one of the reliable capital sources in Indonesia. In 2017, World Bank was incorporating Indonesia to the top ten middle income country borrowers so it is necessary to analyze the effect of external debt ratio on economic growth. Using debt Laffer curve theory, the authors determine the threshold of the external debt ratio. The method of analysis is quadratic regression. The research results indicate that there exists a nonlinier relationship between external debt ratio and economic growth in Indonesia. On the other hand, research results have found the threshold of external debt ratio in Indonesia is 48 percent to Gross Domestic Product (GDP). The external debt ratio less than 48 percent of GDP does not affect on economic growth, but it will has a negative effect on economic growth when the ratio is more than 48 percent of GDP.

Key words: *external debt ratio, threshold, quadratic regression*

1. INTRODUCTION

The main source of financing development in Indonesia comes from the tax revenues. However, when the tax revenues are insufficient to cover government spending, it causes the government budget deficit (*fiscal gap*). It is proved by the proportion of the tax revenue in the state's budget of 2017 amount to 85,6 percent (Ministry of Finance, 2016).

When revenues are not sufficient to cover the budget deficit, one policy applied by the government is using external debt. In this globalization era, ease of cross-border transactions happens as well as in the terms of lending development funds. From year to year, Indonesia's external debt continued to increase. Reflecting from the last decade, in 2007 the government's external debt by 76,9 billion dollars then recorded until 2016 the government's external debt rose to 154,9 billion dollars.

The central bank also has an external debt to keep the balance of payments. It is because of the balance of payments deficit (*external-exchange gap*) that happen when external exchange earned

from exports was not enough to be used to pay imports. The External debt of central bank in 2007 amounted to 3,7 billion dollars then to be 3,4 billion dollars in 2016.

Furthermore, private sector also has an external debt that is used as investment capital due to insufficiency of domestic savings (*investment gap*). The growth of private external debt is higher than the growth of government and the central bank external debt. The External debt of private sector in 2007 amounted to 60,6 billion dollars then rose to 159,5 billion dollars in 2016 (Central Bank of Indonesia, 2017).

When the total external debt viewed over the last decade, recorded that Indonesian external debt in 2007 amounted to 141,2 billion dollars then rose to 317,8

billion dollars in 2016. If the number of external debts charged to 261,1 million people in Indonesia, then each resident will have a debt about 1.217 dollar. Total of the external debt had made Indonesia into the top ten middle income country borrowers based on current external debt in 2015 (World Bank, 2017). With the amount of Indonesia's external debt, it is important to do the research based on the effects of external debt on economic growth.

By knowing the threshold of the external debt, it will get the safe limit external debt ratio to economic growth so it can avoid the negative effects of external debt that could retard economic growth. It is important to make analysis about threshold of Indonesia's external debt ratio with the latest data.
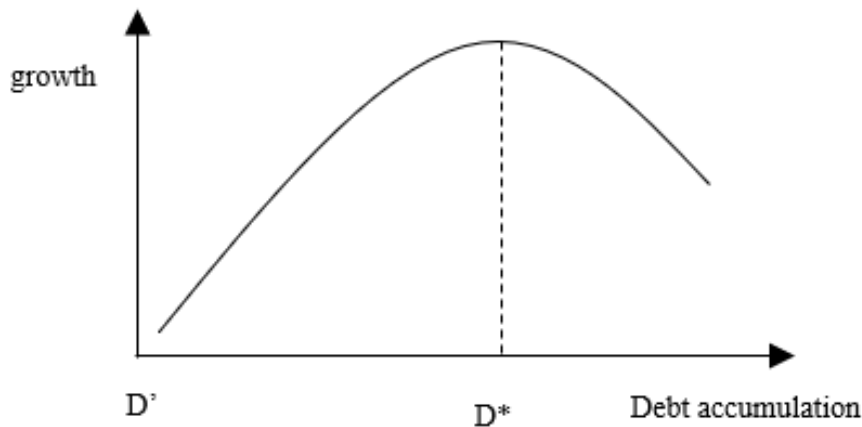
Source: Elbadawi, 1997

Figure 1. The Debt Laffer Curve of Elbadawi

Nonlinear model between external debt and economic growth described by Elbadawi, Ndulu, and Ndung'u (1997) as *Debt Laffer Curve*, as follows

There is an external debt ratio limit in Indonesia set by Bappenas (National

Development Planning Agency). One of the indicators set by Bappenas in maintaining a safe limit Indonesia's external debt is when the ratio of external debt does not exceed 40 percent of GDP. The safe limit that set by Bappenas is important to assess compliance

with Indonesia's external debt ratio threshold. If the limit set by Bappenas still below the threshold then it will safe to avoid the negative effects of external debt on economic growth.

There are various studies about the effect of the external debt on economic growth. The first study proves that the external debt has positive effect on economic growth. It caused the external debt will cover the lack of funds and provide stimulus for the growth of domestic savings. In addition, the external debt will also open access to modern technology, skills, and ease of access to the world market (Chenery, 1967; Hatemi & Irandoust, 2005).

Second study shows that the external debt has a negative affect on economic growth. It caused the external debt is only used for consumption rather to complement domestic resource shortage that needed for investment. In addition, the principal and interest payment of external debt will burden the budgets that will be allocated for debt repayment which make obstacles in development of finance. It is burdensome when the recipient countries have weak exchange rates so the debt will swell and force the recipient countries owe more to pay the mortgage debt (debt trap) (Griffin, 1970).

Some of the recent study using a model that combines two influences. The model explains that the external debt has a nonlinear effect on economic growth. Until a certain debt level or called threshold, the debt has a positive impact on economic growth. However, economic growth then slows as debt levels continue to rise

above the threshold. The threshold of each study is different. Elbadawi, Ndulu, and Ndung'u (1997), which examine 32 developing countries in the Sub-Saharan Africa get a safe debt limit of 97 percent of GDP; Pattillo, Poirson, and Ricci (2002) which examine 93 developing countries get a threshold of 35-40 percent of GDP; Kumara and Cooray (2013) get threshold in Sri Lanka amount to 59,42 percent of GDP; while Reinhart and Rogoff (2013) get a weak relationship between debt and economic growth when it is in the normal ratio then if it has passed the 90 percent of the economic growth. It is become lower one percent.

2. METHODOLOGY

The data use in this research is secondary data that is processed from the publication of the World Bank and Bank Indonesia. The dependent variable used is GDP growth. While the independent variable is the ratio of external debt to GDP. The data uses in the form of time series data from 1970 to 2016.

The method of analysis in this research are descriptive and inferential analysis. The descriptive analysis use graph and plot data. While inferential analysis use polynomial linear regression.

Linear Correlation

One of the requirements of time series data is stationary modeling. Therefore, it is necessary to perform the stationary test. Regressing data that is not stationary in the level will make risk spurious regression. Equation that indicated spurious regression will be meaningfull when there

are cointegration. When the dependent and independent variables are cointegrated, they have long-term relationships. The existence of cointegration characterize by two variables are not stationary at level but stationary in the same difference. In addition, the error term of the long-term equation has been stationary in level (Enders, 2010).

Long term equation can be modeled as follows:

$$growth_t = \beta_0 + \beta_1 \, debtratio_t + e_t \quad (1)$$

After that, a test of the linearity of the data is made using Ramsey's RESET (Regression Specification Error Test). Then the regression will be tested whether the addition of variable squares would raise R^2 significantly or not. If the addition is significant then the use of the linear model would be misspesificied. The null hypothesis of this test is linear model, while the alternative hypothesis is non-linear models.

Threshold

Indication of existence threshold be made by the polynomial regression. The polynomial model is a model in which the right side is an independent variable of different rank. Both of Polynomial model with the highest rank called quadratic model. Long-term quadratic model can be used to found the threshold ratio of the external debt to the economic growth. Quadratic model can be written as follows:

$$growth_t = \beta_0 + \beta_1 \, debtratio_t + \beta_2 \left(debtratio_t^2\right) + \varepsilon_t$$
(2)

When all variables are significant, it means that two variables have nonlinear correlation. When the coefficient of debt ratio variable is positive and the coefficient of debt ratio square variable is negative so the model is quadratic or U-shaped curve. When the model is U curve so the value of threshold can be estimated by makes derivative model from quadratic model with independent variables. Equation (2) can be derived with the ratio of external debt to obtain the value of the maximum external debt ratio.

$$d(growth)/d(debtratio) = 0 \quad (3)$$

Based on the maximum and minimum theorem, one of the conditions that make an extreme point is stationary function that can be known if first derivative equals to zero. Later to determine whether the extreme point is maximum or minimum can be known from the value of the second derivative. When the value is less than zero then the curve opens down so that the extreme point is the maximum point, whereas the value is more than zero so the curve shape is open up that means the extreme point is the minimum point.

3. RESULT

Economic Growth in Indonesia

Economic growth is one of the indicators of the nation welfare. Therefore, economic growth becomes the main focus of the government in implementing economic development. Economic growth in Indonesia fluctuated since 1970 to 2016. Economic growth in indonesia before the

crisis is relatively high, fluctuated between five to ten percent, except in 1982 due to a large current account deficits as well as the world recession and in 1985 due to the sharp drop in oil prices.

Rapid growth during the New Order regime was because of a large scale in the infrastructure development, promoted agricultural technology in order to create self-sufficiency in food, industrial development and higher income from oil becaused of an oil boom. In The New Order, Indonesia ever got into the group of countries in Asia with high performance (high performing Asian economies). Then


Source: Indonesian Bureau of Statistic BPS, 2017
Figure 2. Economic Growth 1970-2016 (%)

drastically the economic growth slowed negative when the economic crisis triggered by the bath crisis in Thailand. After crisis, economic growth grew up again and stabilized around 5 percent except in 2009 after exports and imports are declined.

The Development of Indonesia's External Debt Ratio

As a developing country, Indonesia needs assistance in the form of external debt as a supplement to the lack of
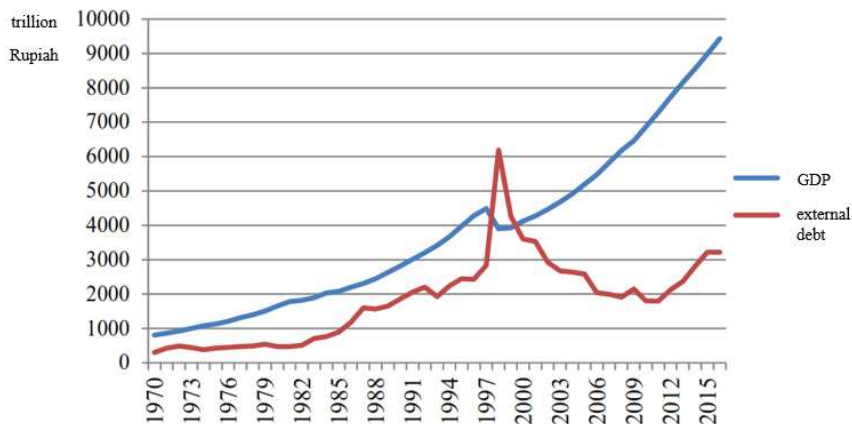

Source: Badan Pusat Statistik and World Bank, 2017
Figure 3. Gross Domestic Product and External Debt in Indonesia, 1970-2016

domestic funds. From 1970 to 1985, the ratio of external debt was dominant under 50 percent. Then it rose to peak during crisis to 158 percent of GDP. This high ratio is due to high inflation that lower GDP, weakness of rupiah that swollen the external debt and the addition of loans. The ratio of external debt then decreased to the smallest in 2011 amounted to 24,6 percent of GDP. Then the ratio of external debt crept up as a consequence of the government's infrastructure development focus but still below the threshold set by Bappenas is less than 40 percent.

Relationship between Economic Growth and External Debt Ratio in Indonesia

Mubarik (2005) provides an example in plotting the data to see the relationship patterns of two variables. The first step is making all observations into groups by choosing numbers that can represent the group. In this study, the external debt ratio less than 30 percent is represented by a value of 30, the ratio more than 30 percent and less than 40 percent is represented by a ratio of 40, and so on. Next making the average of economic growth variable of each group. So, the plot is generated between the
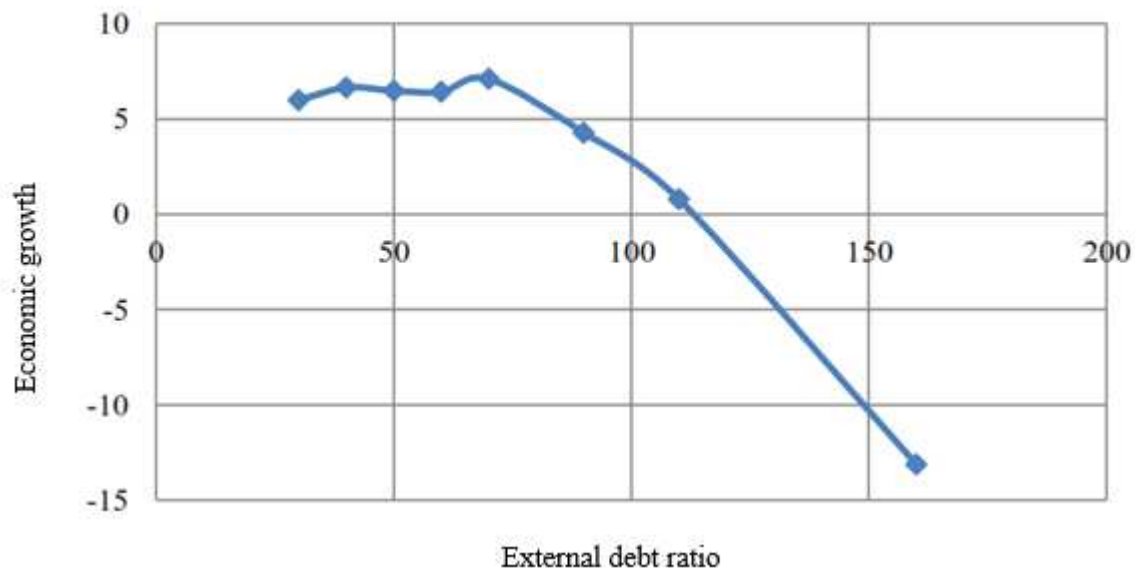
Source: Author

Figure 4. The Plot between Economic Growth and External Debt Ratio

average economic growth with the value of external debt ratio that represents each group.

Based on figure 4, it is seen that the first relationship between ratio of external debt slightly fluctuated from negative and positive. However, there is a change in the direction of the original positive

relationship to be negative at higher ratio. Thus, there is an indication that the pattern of the relationship between the ratio of external debt to economic growth is nonlinear. This is because there is a structural break point which is marked by changes in direction of the relationship between the two variables. With

the structural break point then there is a possibility that the relationship between the ratio of external debt and economic growth have a threshold.

Stationarity Test

The use of data plot is a nonformal test. Therefore, it has to do a formal testing to determine how the effects of external debt ratio on economic growth. Before making the model, requirement of time series data is stasionarity.

With a significance level of 5 percent it can be concluded that both variables are not stationary at level as it contains a unit root. Regressing data that has not stationary in levels will have a spurious regression risk. However, spurious regression will be meaningfull regression when cointegration occurs. From the test results, it shows that the economic growth data and the ratio of external debt have been stationary at the first derivation and the residuals of the long-term equation have stationary at that level so between the two variables occur

Table 1. Result of Unit Root Test

Variabel	Condition	ADF Test	
		p-value	Conclusion
Growth	Level	0.0598	accept H_0
	First difference	0.0000	reject H_0
Debt Ratio	Level	0.3170	accept H_0
	First difference	0.0000	reject H_0
error	Level	0,0001	reject H_0

cointegration so that equation becomes meaningfull which means both have a long-term balance.

The long-term model is formed with the rate of economic growth as the dependent variable and the external debt ratio as the independent variable. The long-term equations obtained are as follows:

$$\widehat{growth}_t = 10{,}21^* - 0{,}09 \; debtrasio_t^* \quad (4)$$

description: *) significant at á = 5%

From the result of the long-term equation as in Equation 4, it shows that the ratio of external debt negatively affects economic growth. When the debt ratio rose one percent point to GDP then economic growth will fall by 0,09 percent point.

Linearity test of data is important to do. So, the long-term equation can be used. The linearity of data can be tested using Ramsey RESET test. The result of the test gets the F count of 67,7 and p-value equal to 0,00. It means that with a significance level of 5

percent there is a sufficient evidence to reject the null hypothesis. It means the good model is nonlinear so the threshold can be found.

Threshold Estimation

Analysis of external debt threshold uses quadratic model or polynomial regression with the highest rank is two. Polynomial regression can show nonlinear patterns in the data. When the independent variable of rank one and rank two are significant affect on economic growth, it means nonlinear patterns occurs on the data. Then when the coefficients of quadratic variable is negative, it means the curve U inverted and the maximum value is known.

The quadratic equation is as follows:

$$\widehat{growth_t} = 2{,}856034^* + 0{,}152854\, debtratio_t^* - 0{,}001592 \left(debtratio_t^2\right)^*$$

From the model's estimation result, it was found that the debt ratio variable rank one and rank two are significant. The coefficient of the debt ratio is positive and the coefficient of the squared debt ratio is negative. This means that the model of the relationship between the two variables can be illustrated with an inverted U-curve so the maximum point can be searched. Furthermore, to get threshold value can be used the derivation of the quadratic equation to obtain the maximum debt ratio.

The derivation of equation quadratic model as follows:

Table 2. Estimation Result from The Model with The Ratio Less than or Equal to 48 Percent

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6,652416	2,487252	2,674605	0,0135
debtless	-0,015637	0,072604	-0,215375	0,8314
R^2 = 0,002013; F-stat = 0.046387; prob(F-stat) = 0.831373				

Table 3. Estimation Result from The Model with Ratio More than 48 Percent

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	16,40545	1,201111	13,65856	0,0000
debtmore	-0,165496	0,016473	-10,04643	0,0000
R^2 = 0,834; F-stat = 100,93; prob(F-stat) = 0,000				

$$growth_t$$
$$= 2,856034 + 0,152854\ debtrasio - 0.001592\ debtratio^2$$

$$d(growth)/d(debtratio)$$
$$= 0,152854 - 2(0.001592)debtratio = 0$$

$$= 0,152854 - 0,003184\ debtrasio = 0$$

$$debtratio$$
$$= 0,152854/0,003184$$

While the result of the second derivation are as follow

From the first derivation, the threshold of Indonesia's external debt ratio is 48 percent of GDP. From the results of the second derivation, the value is less than zero means that the curve is concave downward or inverted U-curve so that the first derivative of a quadratic function is the maximum value.

The appropriateness of the relationship of the external debt ratio to growth after the discovery of the threshold can be proved with cutting the data. It will prove the effect of external debt ratio before passing the threshold and after passing the threshold. The Model estimates were performed with debt ratio is less than or equal to 48 percent and model estimates with the ratio more than 48 percent.

From cutting the models, there are two models that can explain the different relationships of the external debt ratio to economic growth. The estimation results that when the ratio of external debt below 48 percent, external debt does not significantly affect the economic growth. Meanwhile, when the ratio of external debt is more than 48 percent, the ratio of external debt has a negative and significant impact on economic growth.

Classic Assumption Test of Polynomial Equations

Normality test

This normality test uses the Jarque-Bera test. The p-value is 0.527. That is with a significance level of 5 percent there is not enough evidence to reject the null hypothesis so that the decision receives H0 and it can be concluded that the residual is normally distributed.

Homoscedasticity Test

Homoskedasticity test using ARCH test. In making the decision, it can be seen from p-value Chi-square obtained that is equal to 0,5585. That is with a significance level of 5 percent it can be concluded that the residual meets the assumption of homoscedasticity or has a constant variance.

Non-autocorrelation Test

To know that the model was free from autocorrelation problem then used stationary test of residual polynomial equation by using Phillips-Perron test. The result shows that the t-stastistic count of -4.74 is smaller than the t-table of -1.94 so with a significance level of 5 percent there is enough evidence to reject the null hypothesis so that the residual is stationary means it does not contain autocorrelation problems.

Assumption of Test Classical Equations with External Debt Ratio Less than 48 Percent

Normality test

This normality test using Jarque-Bera test with obtained p-value of 0.909. That is, with a significance level of 5 percent there is not enough evidence to reject the null hypothesis so that the decision receives H0. It can be concluded that the residual is normally distributed.

Homoscedasticity Test

Homoskedasticity test using ARCH test. In making the decision, it can be seen from p-value Chi-square obtained that is equal to 0.8689. That is, with a significance level of 5 percent there is not enough evidence to reject the null hypothesis so it can be concluded that the residual meets the assumption of homoscedasticity or has a constant variance.

Non-autocorrelation Test

To know that the model is free from autocorrelation problem then use Breusch-Godfrey serial correlation LM test. The results show that p-value is 0.16 so with a significance level of 5 percent there is not enough evidence to reject the null hypothesis so that residuals do not contain autocorrelation problems.

Test of Classic Assumption of Equations with External Debt Ratio Over 48 Percent

Normality test

This normality test uses Jarque-Bera test with p-value resulting from a calculation of 0.53. That is, with a significance level of 5 percent there is not enough evidence to reject the null hypothesis so that the decision

receives H0 and it can be concluded that the residual is normally distributed.

Homoscedasticity Test

Homoskedasticity test using ARCH test. In making decisions, can be seen from p-value Chi-square obtained that is equal to 0.185. That is, with a significance level of 5 percent is not enough evidence to reject the null hypothesis so it can be concluded that residuals meet the assumption of homoscedasticity or have a constant variance.

Non-autocorrelation Test

To know that the model is free from autocorrelation problem then use Breusch-Godfrey serial correlation LM test. The result shows that p-value is 0,026 so with a significance level of 5 percent there is enough evidence to reject the null hypothesis so that the residual contains an autocorrelation problem. But this is understandable because the data used a bit.

Evaluation of Estimates of Indonesia's External Debt Threshold

The estimation results show that the level of the external debt ratio below the threshold has no significant effect on economic growth. This can be explained by the absorption of external debt which is still not effective. External debt obtained is not only for financing the state budget deficit but also paying for old debt. Based on the 2016 APBN data, Indonesia's primary balance is at -105.5 trillion rupiah, which means a deficit (Ministry of Finance, 2016).

Primary balance is state income minus state expenditure not including payment of debt interest installments. positive primary balance means that funds are still available for debt interest payments. When the primary balance is zero, it is necessary to make a loan or external debt to pay the debt interest installments. So that it can be termed dig a hole close the hole. Then when the primary balance is negative then state revenues are not enough to be used to finance state expenditure. This condition requires Indonesia to make loans or external debt used to finance state expenditure and external debt repayments so that it can be said to dig a bigger hole or dig another hole. Based on this phenomenon, Indonesia has entered into a debt trap, which is carrying out external debt to repay debt so that the influence of its external debt ratio is not significant to economic growth.

For external debt ratio more than the threshold value, the debt ratio has a negative effect on economic growth. This is because the more a country borrows from another country, the more the debt burden will be, so the ability to repay the debt decreases. The results of this study are same as the results from Reinhart and Rogoff (2013) which states that the relationship between debt ratios and economic growth is weak when it is in the normal ratio. Whereas when the ratio exceeds the safe limit, it will negatively affect economic growth.

The result of the model with a ratio below the threshold has the same concept as economists of Ricardian. According to Ricardian, external debt has no effect on economic growth. That is because government external debt that used for subsidies or tax reduction will be substituted with future tax increase. Therefore, people will save their disposable income to be used to pay the more expensive taxes in the future. So, that stimulus provided by the government does not lead to increase in consumer demand. Then the increase in public saving would off set government savings. National savings which are the sum of public savings and government savings remain unchange. So that the increase of external debt has no effect on economic growth (Mankiw, 2010).

While the result of the model with the ratio pass the threshold has the same concept of traditional economists. According to traditional concept, external debt would cause crowding-out, a condition which government's debt that used for subsidies will lead increased consumption. Increased consumption will cause saving down and interest to rise. This causes private demand for investment decreased thus reducing GDP.

In addition, excessive external debt will reduce the ability to pay the debt and debt interest. Debt will be more burdensome when the exchange rate weaken so the amount of external debt will soar and push to make more debt to pay the debt (debt trap) so that the country will continue to depend on external debt. When the portion of the budget used to pay the debt is high, it will cause a reduction the budget for development.
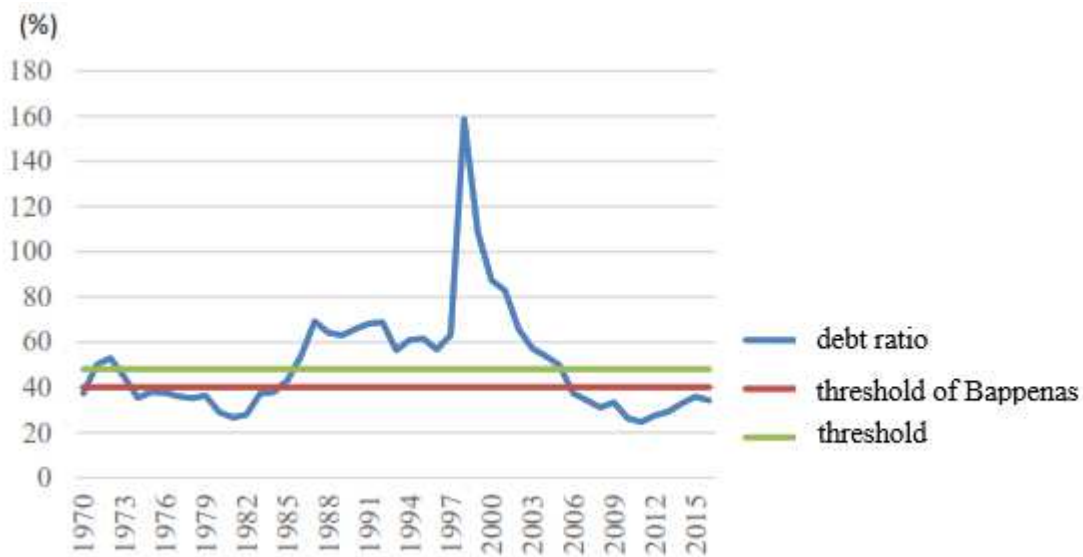
Safe Limit for Indonesia's External Debt

Bappenas (National Development Planning Agency) has provided a safe limit

policy for Indonesia's external debt ratio, which is less than or equal to 40 percent of GDP. While the IMF provides a limit of 60 percent of GDP. Compared with the safe limits that apply in Indonesia, which is set by the Bappenas at 40 percent of GDP, the safe limit is still below the threshold. This means that the established safe limits are appropriate to keep Indonesia's economic

growth from being adversely affected by external debt. While the limit set by the IMF has passed the threshold. this means that the limit set by the IMF has passed the safe limit so that external debt does not negatively affect Indonesia's economic growth.

Based on the results of the Indonesian external debt ratio threshold, if there is a

Figure 5. Threshold and external debt ratio to GDP in Indonesia, 1970-2016 (%)

possibility that Indonesia's external debt ratio will increase because of the large loan funds needed, so the limit beyond the Bappenas safe limit is up to a ratio of 48 percent to GDP. It aims to avoid the negative impact of external debt for economic growth.

4. CONCLUSION

Based on the results of research and analysis that have been described, conclusions can be drawn as follows:

1) The relationship between the ratio of external debt and economic growth in Indonesia is nonlinear.

2) Indonesia's external debt threshold is at 48 percent of GDP that still above the Bappenas's safe limit.

3) The ratio of external debt does not affect significantly on the economic growth when the ratio of external debt less than 48 percent. Meanwhile, after passing the threshold, the ratio of external debt becomes negative and

affects significantly on economic growth.

4) For further research, it can compare threshold estimates with dummy or spline models.

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