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# DISENTANGLING THE ASSOCIATION BETWEEN GOVERNMENT DEBT AND ECONOMIC GROWTH: A GRANGER CAUSALITY APPROACH FROM INDONESIA

Rosdiana Sijabat

**ABSTRACT:**

This paper aims to examine the possible Granger-causality relationship between public debt and economic growth in Indonesia between 1998 and 2018. To accomplish this aim, a time series regression approach as well as diagnostic tests such as the Augment Dickey–Fuller test and Johansen cointegration test (which provides evidence of a long-term relationship between external debt and economic growth) were conducted. A VECM Granger causality approach was chosen to investigate the causal link between government and economic growth. The VECM estimation provides new evidence that, over the long term, domestic debt has significantly and positively affected economic growth; at the same time, external debt has significantly and negatively affected economic growth. Meanwhile, Granger-causality analysis shows that economic growth has a unidirectional causal relationship with external public debt, but does not have such a relationship with domestic public debt. For this study, a series of 20 data points per variable were analyzed, covering 1998 through 2018. This sample size is rather small, and as such its findings are not perfect. The use of a much larger data set would enhance any similar studies in the future. Nonetheless, this study illuminates the role of government debt in the economy by highlighting the importance of domestic markets as sources of public debt to promote economic growth in Indonesia, and recommends that the government do so.

**Keywords:** Economic growth; Government debt; Johansen Cointegration; Granger causality.

**ABSTRAK:**

Penelitian ini menguji kemungkinan adanya *Granger-causality* antara hutang pemerintah dan pertumbuhan ekonomi Indonesia dari tahun 1998 hingga 2018. Dengan pendekatan *time series regression*, *diagnostic tests* seperti uji *Augment Dickey–Fuller* dan uji *Johansen cointegration*, lalu ditetapkan pendekatan VECM *Granger causality* untuk meneliti hubungan kausalitas hutang pemerintah dan pertumbuhan ekonomi. Hasil uji kointegrasi Johansen memberikan bukti adanya hubungan jangka panjang antara hutang luar negeri (eksternal) dan pertumbuhan ekonomi. Selanjutnya, dari analisis VECM ditemukan bahwa dalam jangka panjang, hutang domestik berpengaruh signifikan dan positif terhadap pertumbuhan ekonomi. Berdasarkan analisis *Granger-causality*, pertumbuhan ekonomi memiliki *unidirectional causality* dengan hutang eksternal pemerintah, namun tidak memiliki hubungan kausalitas dengan hutang domestik pemerintah. Implikasi kebijakan dari studi ini adalah pentingnya memanfaatkan sumber-sumber hutang pemerintah dari pasar domestik dan lebih berhati-hati dalam melakukan hutang pemerintah dari sumber eksternal, jika hutang pemerintahan menjadi bagian dari strategi mendorong pertumbuhan ekonomi. Faktor ketersediaan data menyebabkan data runtut waktu yang dianalisis hanya 20 titik waktu per variabel mulai tahun 1998 hingga 2018, jumlah ini relatif kecil, sehingga temuan dalam studi ini tidak sepenuhnya sempurna. Periode waktu yang lebih panjang untuk penelitian serupa di masa mendatang dapat bermanfaat.

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## INTRODUCTION

Theoretical and practical debate on the association between public debt and economic growth is ongoing ([Eberhardt & Presbitero, 2015](#); [Bökemeier & Greiner 2015](#)). Public debt is understood as resulting from limited fiscal responsibility within public policy ([Pečarić, Slišković, & Kusanović, 2018](#)). At the same time, however, public debt can help promote economic growth and development ([Pegkas, 2018](#); [Korkmaz, 2015](#)). This is particularly true in developing nations where economic growth is constrained by limited financial resources, such as Indonesia ([Barrett, 2018](#); [Muhdi & Sasaki, 2009](#)).

The policy foundation on the structure of government debt in Indonesia is regulated in Law number 17 of 2003 concerning State Finance. Article 12 paragraph 3 stipulates that the amount of debt is limited to a maximum of 60 percent of GDP and a budget deficit that is allowed a maximum of 3 percent of GDP. This law adopts one of the classifications regarding budget deficit limits and debt limits that are used as an international reference, the Maastricht Treaty. According to the Directorate General of Financing and Risk Management (DJPPR), the Ministry of Finance of the Indonesian Government, the government incurred debt because the government made the debt as one source of financing in the context of development and improving the welfare of the people in Indonesia.

Debt is such an instrument pursued by the government to meet shortages of government spending in the current fiscal year. Another argument from the Indonesian government that tends to have to do debt is because the ratio of government revenue, especially domestic income, is tax which is still not optimal. For example in 2018, Indonesia's tax ratio<sup>1</sup> was only 11.5% of GDP, this ratio is relatively low compared to some neighboring countries such as Malaysia (15%), the Philippines (14.6%), and Singapore (13.6%) (Ministry of Finance of the Indonesian Government, 2018). The government revenue from tax which is still relatively low is partly due to the level of tax compliance<sup>2</sup> in Indonesia which only reached an average of 60.1% over the last 10 years (2010-2018), where the government is aiming to reach the level of tax compliance at 80% every year.

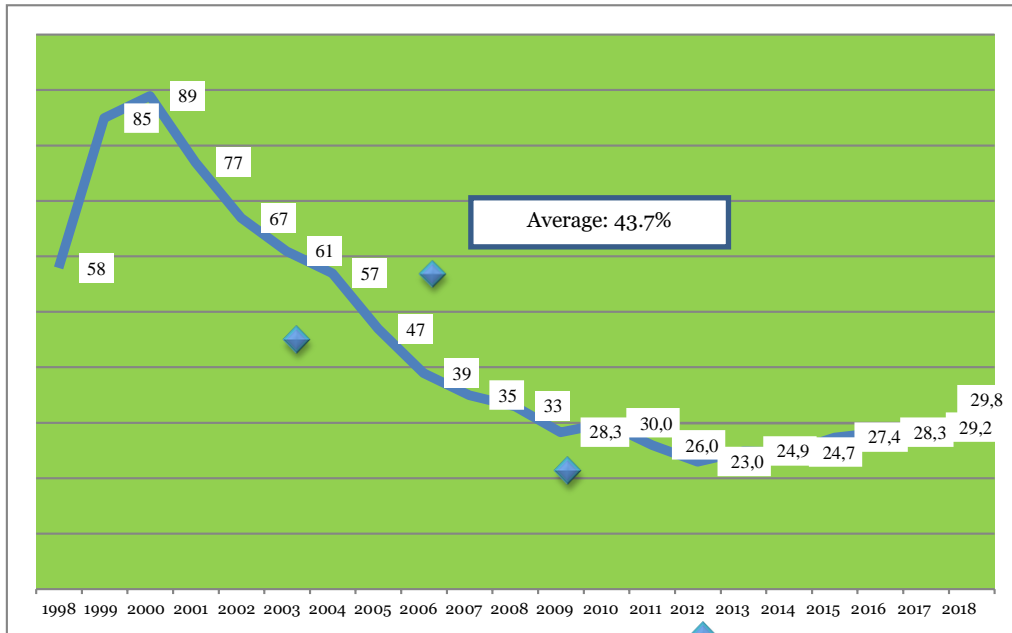
Indonesia has maintained a high level of public debt over the past twenty years, maintaining an average debt–GDP ratio of 43.7% between 1998 and 2018. Public debt has grown annually as deficits have occurred in the national budget. As Figure 1 depicts, between 1998 and 2004, Indonesia's public debt was always more than 50% of its GDP. Since 2011, the debt–GDP ratio has remained below 30%, reaching an all-time low (23%) in 2012.

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<sup>1</sup>Tax ratio is the nation's tax revenue relative to its gross domestic product (GDP) which is used as an indicator to assess the performance of tax revenue. Such ratio indicates the government's ability to collect taxes from the total economy (GDP) (Ministry of Finance of the Republic of Indonesia, [www.kemenkeu.go.id](http://www.kemenkeu.go.id), 24/03/2019).

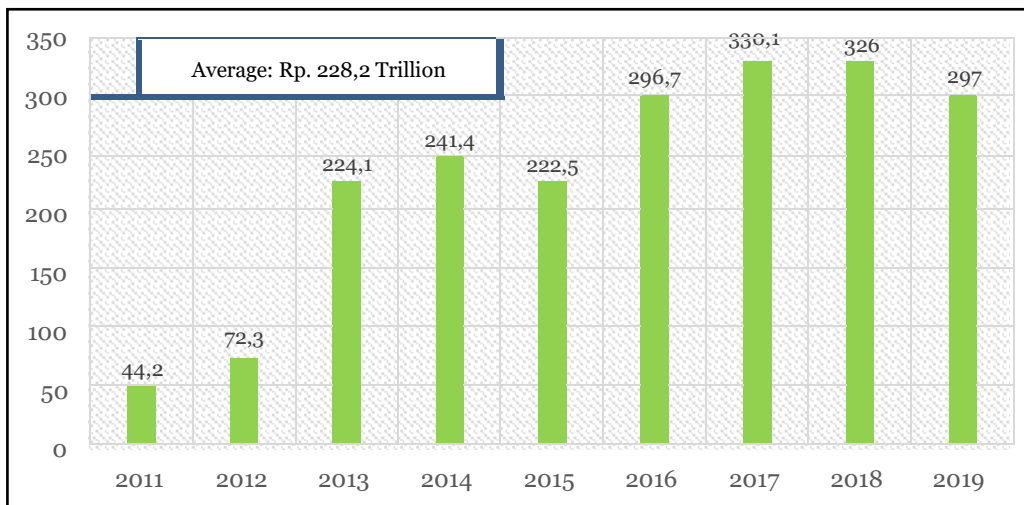
<sup>2</sup>Tax compliance refers to the fulfillment of all tax obligations as determined by applicable law which includes tax returns within a specified period, correctly declaring income and deductions, paying taxes assessed at the due date and paying taxes collected (Doran, 2009).

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**Figure 1.** Total debt-to-GDP Ratios in Indonesia, 1998-2018 (%)  
**Source:** illustrated by the author based on data from the Ministry of Finance of Indonesia.

Figure 2 shows that, over the past nine years, Indonesia has experienced an average deficit of 228.2 trillion rupiah, with the highest deficit (330.1 trillion rupiah) occurring in 2017.



**Figure 2.** State Budget Deficit (Trillion Rupiah)  
**Source:** illustrated by the author based on data from the Ministry of Finance of Indonesia.

Owing to the continued government debt and budget deficits in Indonesia, as elaborated above, this paper investigates association between public debt and economic growth. First, it is important to understand whether public debt has had a positive effect on economic growth in Indonesia. Second, to design flexible economic policy, it is paramount to determine whether

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maintaining public debt is sound fiscal policy. Third, this study offers a real answer to recent criticism of the government's fiscal policies as well as the rapid increase in public debt these have precipitated. As such, the significance of this study lies in its understanding of the relationship between public debt and economic growth in Indonesia. To do so, this study employs a VECM Granger causality test, with its results providing several novel contributions. First, empirical analysis is conducted by using the Granger causality test to understand two related phenomena: the association between domestic public debt and economic growth and the link between external public debt and economic growth. Second, analysis was conducted utilizing the most recent available data on public debt and economic growth, covering the period between 1998 and 2018. Third, it is hoped that this analysis of the Indonesian government's fiscal policy and reliance on public debt can contribute a new means of evaluating such debt's importance in the Indonesian economy.

## LITERATURE REVIEW

Public debt occurs as a result of budget deficits (Das, 2016), which may be caused by numerous factors, including investment in major infrastructure and development projects, war financing, natural disasters, economic crises, and increased government expenditures ([Aybarc, 2019](#)). All of these can cause fiscal gaps, in which the government budget is incapable of covering its expenditures ([Kiminyei, 2018](#); [Kharusi & Ada, 2018](#)). When responding to such fiscal gaps and budget deficits, governments often utilize public debt ([Thilanka & Ranjith, 2018](#)). As such, public debt is an important fiscal resource and strategy through which governments can fund their projects and make up for any shortcomings in their budgets ([Kiminyei, 2018](#)).

Public debt is defined as direct government fixed-term contractual obligations towards third parties that are not covered by foreign currency reserves or non-stock securities ([Aybarc, 2019](#)). Such debt may be categorized as external or domestic. According to Aybarc (2019), external public debt refers to the money borrowed by governments, companies, and individuals from foreign banks, governments, or financial institutions. Meanwhile, Avdjiev, Binder, and Sousa (2017) define external debt as debt owed to non-citizens that is paid in foreign currency. Domestic public debt, meanwhile, refers to government obligations to local money lenders ([Avdjiev, Binder & Sousa, 2017](#); [Shkolnyk & Koilo, 2018](#)) or markets ([Bua, Pradelli, & Presbitero, 2014](#)). A government may choose to fund its public debt through domestic means for three reasons: to cover budget deficits, to implement monetary policies through open market operations, or to develop the domestic financial market ([Alison, 2003](#)).

Although many empirical studies have examined the effect of public debt on economic growth, the association between public debt and economic growth (both in developed and developing nations) remains widely debated. Studies have shown that public debt may have a positive or negative effect on economic growth ([Dombi & Dedák, 2019](#)). Some have suggested that, while public debt can promote short-term economic growth, over time these positive effects become increasingly deleterious ([Shkolnyk & Koilo, 2018](#); [Aybarc, 2019](#)).

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## The Negative Association between Government Debt and Economic Growth

In 2002, Patillo, Helene, and Luka examined the link between public debt and economic growth in 93 developing countries between 1969 and 1998. Employing panel data analysis, they found evidence that a non-linear Laffer curve explained the association between public debt and economic growth. They also found that the influence of public debt on economic growth extent is informed by its extent, concluding that external debt has a deleterious effect on economic growth when its amount surpasses 35–40% of the GDP and 160–170% of exports.

Reinhart and Rogoff (2010) examined the association between high public debt, economic growth, and inflation in 44 countries (both developing and developed). They found that, when public debt is higher than 90% of the GDP, it has a negative effect on the national economy. This finding was supported by Blake (2015), who found that public debt exceeding 100% of the GDP (with more than 55% coming from foreign sources) has a deleterious effect on the economy. Blake reached this conclusion by analyzing quarterly data from Jamaica that covered the period between 1990 and 2014 using an autoregressive distributed-lag (ADRL) model to identify public debt's short- and long-term effects on the economy.

Shah and Pervin (2012) analyzed the short- and long-term effects of public debt on economic growth in Bangladesh between 1974 and 2010, finding that external public debt has had deleterious effects in the period studied. They showed that Bangladesh has experienced a debt overhang, wherein the state accumulated a significant amount of debt but lacked the ability to repay said debt. Shah and Pervin also found that this external debt has had a crowding-out effect, wherein private investment became less common owing to the extent of government borrowing. Meanwhile, Puente-Ajovin and Sanso-Navarro (2014) employed a Granger causality test to examine the effect of public debt in OECD countries between 1980 and 2009, finding that economic growth is negatively affected by public debt. Woo and Kumar (2015) similarly showed that, in developed countries, public debt has had a deleterious effect on economic growth, concluding that a 10% increase in public debt would reduce economic growth by 0.2%. Gómez-Puig and Sosvilla-Rivero (2016) investigated members of the European Economic and Monetary Union (EEMU) using a data time series spanning from 1960 through 2012 to analyze the short- and long-term effects of public debt on economic growth, finding that such debt has deleterious consequences over the long term. More recently, Kharusi and Ada (2018) examined the link between government external borrowing and economic growth in Oman using a data time series covering the period from 1990 to 2015. Employing an ADRL cointegration approach, they investigated the short-term dynamics of external debt and economic growth, finding that such debt has had a negative effect on Oman's economic growth.

In Pakistan, another developing country, Butt and Hassan (2008) used ARDL and cointegration analysis to investigate the association between external public debt and economic growth between 1975 and 2005. They found that public debt has had no effect on Pakistan's short- and long-term economic growth. Another recent study, conducted by Kum and Öktem (2018), employed autoregressive (AR<sup>3</sup>) panel data analysis to understand the link between economic

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<sup>3</sup> The autoregressive (AR) model is a form of stationary time series model, the  $p$ -ordered AR model states that the value of the  $t$  observation depends on the values of the observation over the previous  $p$  period. In

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growth and public debt in 15 EU member states between 2000 and 2016. They found that increases in these countries' GDPs reduced public debt over the short term, but increased it over the long term. They thus found a negative correlation between public debt and long-term GDP growth, which they attributed to public debt's negative effects on economic growth.

Public debt may negatively affect economic growth owing to the crowding-out effect (see, [Picarelli, Vanlaer, & Marneffe, 2019](#); [Huang, Panizza & Varghese, 2018](#)), in which private investment is reduced owing to high levels of government borrowing in the domestic market. As the government experiences high levels of fiscal deficits and public debt, the repayment of this debt absorbs available capital resources and increases interest rates (Picarelli, Vanlaer & Marneffe, 2019). The crowding-out effect occurs when public debts redirect national savings that could otherwise be used for investment. This is exacerbated by the fact that increased interest rates reduce private actors' willingness to borrow money, thereby limiting their investments. According to Picarelli, Vanlaer and Marneffe (2019), external debt can cause the appreciation of domestic currency, which can reduce competitiveness, stymie investments, and hinder economic growth ([Buaa, Pradelli & Presbitero, 2014](#); [Picarelli, Vanlaer & Marneffe, 2019](#)).

## The Positive Association between Government Debt and Economic Growth

On the other hand, some empirical studies present a positive association between government debt and economic growth. Al-Zeaud (2014) employed an Ordinary Least Squares (OLS) approach to investigate the link between public debt and economic growth in Jordan between 1991 and 2010, finding that public debt has had a positive effect on the national economy. Meanwhile, Spilioti and Vamvoukas (2015) examined public debt in Greece between 1970 and 2009, finding that it has had positively affected economic growth. More broadly, Karagoz and Caglar (2016) employed a panel data model to investigate the effect of public debt in 17 OECD member states, concluding that public debt and economic growth were positively correlated in these countries. Thao (2018) examined the effects of public debt on economic growth in six ASEAN countries (Indonesia, Malaysia, Filipina, Singapura, Thailand, and Vietnam) between 1995 and 2015 by employing a General Method of Moments (GMM) approach and considering Foreign Direct Investment (FDI), with gross fixed capital and real exchange rates as variables. Thao found that public debt has a significant positive effect on GDP per capita in these countries, which could be attributed in part to their governments' effective use of investments to promote long-term economic growth.

Meanwhile, Daud (2016) analyzed the direct link between federal public debt, capital accumulation, and investment levels in Malaysia, finding a positive correlation between public debt and economic growth. This study took investment as representative of economic growth, federal public debt as a proxy for increased productivity, and degree of openness as illustrative of government policy. Employing OLS estimation and an ARDL cointegration bound test, Daud (2016) concluded that the accumulation of federal public debts has been positively correlated with

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the concept of AR, an event is not always influenced by factors that occur at the same time, but also previously known as lag (time difference). AR model is written:  $Z_t = \phi_1 Z_{t-1} + \phi_2 Z_{t-2} + \dots + \phi_p Z_{t-p} + a_t$  (Greene, 2018).



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economic growth in the country. Importantly, this study indicates that there is an optimal level of public debt for economic growth. Only if this level of debt is exceeded will economic growth be stymied.

The positive impact of public debt on a country's economic growth can occur if the increase in external debt or total outstanding debt is less than the interest rate on the total debt accumulation (Todaro & Smith, 2015; Dombi & Dedák, 2019). This concept is known as basic transfer, which is the difference between foreign exchange inflow and foreign exchange outflow at international borrowing or is the calculation of the difference between capital inflow minus capital outflow against interest payments on the accumulation of external debt (Islamov, 2011). This basic transfer concept can be written as follows:  $BT = dD - rD = (d-r) D$ . BT is the basic transfer value,  $r$  is the interest payment for external debt accumulation,  $rD$  is the total interest payment per year,  $d$  is the amount of increase in external debt, and  $dD$  is the total external debt outstanding. If  $d > r$ , then basic transfers will be positive, meaning that countries that have external debt experience economic growth as a result of external debt. Conversely, if  $r > d$ , it means that a country that has external debt loses foreign exchange. Government debt, especially foreign debt if allocated to productive investment will encourage economic growth, because productive investment has a rate of return  $> r$ .

## Government Debt and Economic Growth in Indonesia

Within an Indonesian context, studies of the link between public debt and economic growth have had mixed results. Swastika, Ginanjar, and Masih (2013) combined a Wavelet Coherence (WTC) approach, Maximal Overlap Discrete Wavelet Transform (MODWT), and multivariate non-linear regression technique of Hansen Threshold (2000). Wavelet analysis was used to examine co-movement and causality, while the Hansen Threshold was employed to investigate non-linearity in the debt-economic growth ratio. This study, which focused on the period between 2003 and 2012, found a complex and dynamic lead-lag relationship between the external debt-GDP ratio and economic growth in Indonesia. It also suggested that public debt is inversely related with short-term economic growth, while contributing minimally to long-term economic growth.

Another study was conducted by Cholifihani (2008), who analyzed the short- and long-term effect of external public debt on GDP growth between 1980 and 2005, finding a negative correlation in which every 1% increase in public debt reduced the GDP by 0.13%. Muhdi and Sasaki (2009) investigated the effects of government borrowing on Indonesia's macroeconomy to determine whether the crowding-out effect was occurring in the country. They found that, although external public debt has promoted investment and economic growth in Indonesia, it has also caused the rupiah to depreciate as the government has had to repay its debts. This has been particularly prominent since the Southeast Asian financial crisis of 1997, when the Indonesian government accumulated significant domestic debts. Ultimately, they find that external public debt has resulted in a crowding-out effect.

A relatively recent study was conducted by Djulius (2018), who examined the role of FDI, foreign borrowings, and domestic savings in short- and long-term economic development. Using data from the World Bank and Bank Indonesia, this study used an error correction model (ECM)

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to investigate the link between several variables and economic growth. Djulius found that external debt and domestic savings have significantly influenced Indonesia's short-term economic growth; however, over the long-term, FDI has a significant negative effect on economic growth. Meanwhile, although foreign borrowings have negatively affected Indonesia's short-term economic growth, they do not significantly affect growth over the long term.

**Table 1.** Association of Public Debt and Economic Growth

Author	Sample	Result
Al-Zeaud (2014)	Jordan	There is a positive role for government debt to the economy.
Blake (2015)	Jamaica	If the ratio of government debt to GDP > 100%, and external debt > 55% of GDP, government debt will have a negative impact on the economy
Butt & Hassan (2008)	Pakistan	Government debt has no impact on economic growth both in the short term and long term.
Cholifihani (2008)	Indonesia	There is a negative relationship between external debt and GDP.
Daud (2016)	Malaysia	If the government debt does not exceed the optimal debt limit, the debt will have a positive impact on the economy, conversely if the debt exceeds the optimal level, it will have a negative impact on the Malaysian economy.
Djulius (2018)	Indonesia	In the long run, foreign debt will not significantly affect economic growth.
Gómez-Puig & Sosvilla-Rivero (2016)	European Union Countries	Government debt has a negative impact on the economic performance of EU countries in the long run.
Karagoz & Caglar (2016)	17 OECD countries	There is a positive relationship between government debt and economic growth.
Kharusi & Ada (2018)	Oman	External debt has a negative impact on economic growth.
Kum & Öktem (2018)	15 European Union Countries	There is a negative correlation between government debt and GDP growth in the long run.
Muhdi & Sasaki (2009)	Indonesia	External debt has a positive effect on investment and economic growth in Indonesia.
Patillo, Helene, & Luka (2002)	93 Developing Countries	External debt has a negative association with economic growth.
Puente-Ajovin & Sanso-Navarro (2014)	OECD Countries	Economic growth and government debt are negatively correlated.
Reinhart & Rogoff (2010)	44 countries	If the ratio of government debt to GDP exceeds 90%, then government debt will have a negative impact on the economy.
Shah & Pervin (2012)	Bangladesh	The accumulation of large amounts of debt with weak ability to pay causes a crowding out effect.
Spilioti & Vamvoukas (2015)	Greek	Government debt has a positive impact on economic growth.
Swastika, Ginanjar & Masih (2013)	Indonesia	There is an inverse relationship between debt and economic growth in the short run and the contribution of debt to the Indonesian economy is relatively small in the long run.



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Thao (2018)	6 countries ASEAN	There is a positive and significant impact of public debt on GDP growth per capita.
Woo & Kumar (2015)	38 advanced and emerging economies	An increase in government debt will has deteriorate economic growth.

**Source:** Author's summary based on existing literature.

## RESEARCH METHOD

### Model Specification

This study takes public debt, both external and domestic, and real GDP growth. For this, it employs a data time series covering 1998 through 2018. Data regarding Indonesia's GDP and debts were obtained from the Indonesian Ministry of Finance. To determine whether a causal relationship exists between public debt and economic growth, a bivariate model of public debt and economic growth was examined, as written in the following equation:

$$GDP_t = \alpha_0 + \alpha_1 GDD_t + \alpha_2 GED_t + \mu_t \quad (1)$$

In this equation,  $\alpha_0$  is the constant,  $\alpha_1$  and  $\alpha_2$  are the estimated parameters,  $t = 1, 2 \dots 20$  are indices of the years covered by this study (1998 through 2018), and  $\mu$  is the stochastic error term. Meanwhile, GDP refers to Indonesia's economic growth (as indicated by real GDP), GDD refers to gross domestic debt, and GED refers to its gross external (foreign) debt. To understand Indonesia's economic growth, data were collected regarding its real economic growth; meanwhile, to understand its public debts, data were collected regarding its outstanding domestic and external debts. Descriptive analysis was employed to examine the distribution of observed data and avoid biased results (Greene, 2018). The Jarque–Bera normality test was further used to examine the normality of the data time-series, with the zero hypothesis that data would be normally distributed. Statistical testing referred to Jarque (2011):

$$JB = n \left[ \frac{S^2}{6} + \frac{(K - 3)^2}{24} \right] \quad (2)$$

Where:

JB = amount of observations; n = amount of data; S = skewness; K = kurtosis

To ensure the normality of the data, Gross Domestic Debt (GDD) and Gross External Debt (GED) were converted to logarithmic values.

Consequently, Equation (1) may be written as:

$$LGDP_t = \alpha_0 + \alpha_1 LGDD_t + \alpha_2 LGED_t + \mu_t \quad (3)$$

As seen in Table 2, before the variable GDP was converted to logarithmic form, it did not meet the Jarque–Bera criteria for normality,  $129.03 > \text{Prob. } 0.00$  (Jarque, 2011; Abdellatif, Moutaouakil & Satori, 2018; Jarque, 2011)—and thus regression produced biased results. Given this finding, GDP was converted to logarithmic form, then it is named as LGDP, producing the results  $0.46 < \text{Prob. } 0.79$ . This indicated that normal distribution was achieved through LGDP. As such, bias in regression results was minimal (Jarque, 2011; Mantalos, 2010).

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**Table 2.** Summary Statistics

Description		Description (After converting GDP to logarithmic form)	
Mean	4,86E-16	Mean	2,75E-15
Median	0,800865	Median	0,168612
Maximum	3,031828	Maximum	4,245945
Minimum	-15,31601	Minimum	-4,981990
Std. Deviation	3,840424	Std. Deviation	2,027994
Skewness	-3,171624	Skewness	-0,260217
Kurtosis	13,35519	Kurtosis	3,506524
Jarque-Bera	129,0335	Jarque-Bera	0,461491
Probability	0,000000	Probability	0,793942

**Source:** Authors' calculation using EViews 10.

## RESULT AND DISCUSSION

### Unit Root: Augmented Dickey–Fuller Stationarity Test

When conducting time series analysis, it is necessary to ensure that the time series being analyzed is stationary, i.e. is consistent and constant. The most widely used method for checking stationary of data is the Augmented Dickey–Fuller (ADF) test ([Dickey & Fuller, 1981](#); [Paparoditis & Politis, 2018](#); [Salles et al., 2019](#)). This test utilizes unit root tests to determine whether the analyzed time series is stationary, thereby avoiding spurious regression. ADF testing employs the following equation:

$$\Delta Y_t = a_0 + zt + a_1 Y_{t-1} + \sum_{i=1}^p a_i \Delta Y_{t-i} + \varepsilon_t \quad (4)$$

with  $a_0$  being the constant and  $t$  being the deterministic trend. If the autoregressive (AR) representation  $Y_t$  contains a unit root, the t-ratio for  $a_1$  must be consistent with the hypothesis  $a_1 = 0$  (MacKinnon, 2010). According to this test, if the p-value > 5%, it may be determined that the analyzed variable includes a unit root; conversely, if the p-value < 5%, no unit root exists. Afterwards, the best lag duration for the variable was chosen to enable a Granger causality analysis of public debt and economic growth. As this approach examines the association between variables, it requires the lagged value of the variable being analyzed to be linked with the values of other independent variables. For time series with  $n$  iterations, the analysis follows the equation  $y_t = (y_{1t}, y_{2t}, y_{3t}, \dots, y_{nt})$ .

The degree of  $\rho$  (VAR ( $\rho$ )) was determined through the following equation:

$$y_t = A_0 + A_1 y_{t-1} + A_2 y_{t-2} + \dots + A_p y_{t-p} + \quad (5)$$

With  $\rho$  being the lag amount,  $n$  being the number of variables,  $y_t$  being the vector ( $n,1$ ) of in the VAR model;  $A_0$  being the vector ( $n,1$ ) of the intercept;  $A_1$  being the vector ( $n,n$ ) of the coefficient matrix, and  $\varepsilon_t$  being the vector ( $n,1$ ) of the error terms.

As shown in Table 3, the ADF test shows that two variables are not stationary at the 5% level, namely domestic public debt (LGDD) and external public debt (LGED). Meanwhile, the variable GDP was stationary, with a t-statistic value of -2.342166. ADF testing was thus conducted at the first difference (Kulaksizoglu, 2015; Paparoditis & Politis, 2018). At the first difference, the

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variable LGDD was not stationary at the 5% level, while LGDP and LGED were stationary, with t-statistic values of -12.45130 and -4.319236 (Table 3). ADF testing was thus conducted at the second difference, a higher level of integration. This test found that LGDP was stationary, with a t-statistic value of -9.609003; LGDD was stationary, with a t-statistic value of -6.424901; and LGED was stationary, with a t-statistic value of -4.440034. As such, all variables were determined to be stationary at the second difference.

**Table 3.** The Augmented Dickey Fuller Test

Variables	ADF t-statistics: Level Values	ADF t-statistics: first- order difference	ADF t-statistics: second- order difference
LGDP	-2.342166 (0.02190)	-12,45130 (0.0001)	-9.60900 (0.0000)
LGDD	1.756847 (0.97520)	-0.0694642 (0.3999)	-6.424901 (0.000)
LGED	2.181299 (0.9902)	-4.3019236 (0.0002)	-4.440034 (0.0002)

Notes: the null hypothesis: GDP; LGDD; LGED has a unit root.  
Number in brackets are *p* value, the significance value of 5%.

**Source:** Authors' calculation using EVIEWS 10.

Further analysis of the time series required the application of a VAR or VECM model (Rothe & Sibbertsen, 2006; Kim & Choi, 2017). To determine which model was appropriate, a cointegration test was conducted. If cointegration was found, the VECM model would be used. Conversely, if no cointegration was found, the VAR model would be employed. The model was chosen after the stability of the model and the optimal lag length were determined (Jian et al., 2019).

## Estimation of Vector Autoregressive (VAR)

Autocorrelation is most commonly a problem in VAR systems, and as such determining the optimal lag length was necessary (Greene, 2018). There are many methods that can determine the optimal lag period for the VAR model, among other is to see the polynomial AR roots, including by inspecting the AR roots polynomial value (Jian et al., 2019; Lutkepohl, 2017; Morano, 2012). If the value of the AR roots polynomial < 1, the model may be identified as stable. As reported in Table 4, through the third lag no value was higher than one; as such, the model was declared stable.

**Table 4.** Root of Characteristic Polynomial Lag 3

Root	Modulus
0,944489 – 0,159699i	0,957895
0,944489 + 0,159699i	0,957895
-0,734370	0,734370
-0,239267 – 0,653343i	0,695777
-0,239267 + 0,653343i	0,695777
0,656430	0,656430
0,272507 – 0,456090i	0,531299
0,272507 + 0,456090i	0,531299
0,275579	0,275579

**Source:** Authors' calculation using EVIEWS 10.

To determine the optimal lag length within the VAR or VECM model, the lowest value of the Akaike Information Criterion (AIC), Final Prediction Error (FPE), Schwarz Information

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Criterion (SIC), and Hannan-Quinn Criterion (HQ) were sought, as was the highest LR value (Cernat-Cernat, 2009; Muruganandan, 2017; Niedzwiecki & Ciolek, 2017). As seen in Table 4, lag one was optimal, as it had the lowest FPE and SIC values as well as the highest LR value. This indicated that the variables within the model are not only mutually influential in the current period but were also mutually influential in the previous period. The VAR lag order results also showed that lag one was most appropriate for cointegration, VAR, VECM, and Granger causality testing. The decision to use lag one was further supported by the fact that LR had a statistical value of 38.33275 and FPE had a value of 2.07e-06, as seen in Table 5 (see, Niedzwiecki & Ciolek, 2017), as well as the fact that the SIC had a statistical value of -4.012209 and HQ value of -4.541896 (both significant at the 5% level).

**Table 5.** Vector Autoregressive Criteria Lag Order

Lag	Logl	LR	FPE	AIC	SC	HG
0	26,03933	NA	1,34e-05	-2,710509	-2,563472	-2,695894
1	51,10305	38,33275*	2,07e-06*	-4,600359*	-4,012209*	-4,541896*
2	55,67869	5,383099	3,97e-06	-4,079846	-3,050582	-3,977535
3	65,20070	7,841658	5,37e-06	-4,141259	-2,670882	-3,995101

Notes: \* significant at 5% significance level.

**Source:** Authors' calculation using EViews 10.

## Cointegration Test

A Johansen cointegration test was conducted to ascertain the long-term correlation of the values being analyzed, a necessary precursor for employing the vector error correction model (VECM) (Menegaki, 2019; Jian et al., 2019; Zou, 2018). The Johansen cointegration test involves two stages. First, the VAR order is determined, then the cointegration vector is tested, with the null hypothesis being that no cointegration exists. This null hypothesis may be rejected after maximum eigenvalue and trace testing, both of which are conducted with the null hypothesis that no cointegration exists. The Johansen test was conducted by checking  $\pi$ , with  $\pi = \alpha\beta'$  (with  $\alpha$  being the amount of cointegration vectors within the VECM equation and  $\beta$  being the cointegration vector). To test the cointegration of the variables being analyzed, their rank within  $\pi$  was examined through their eigenvalues (Menegaki, 2019).

Different null hypotheses were used in eigenvalue and trace testing. For the trace test, the null hypothesis that the amount of cointegration vectors  $\leq r$ . Meanwhile, for the maximum eigenvalue test, a separate test was used for individual eigenvalues, with the null hypothesis being that the number of cointegration vectors was  $r$ , with the alternative being  $(r + 1)$ . The following equations were used for the maximum eigenvalue test and for the trace test:

$$\lambda_{Trace}(r) = -T \sum_{i=r+1}^k \ln(1 - \hat{\lambda}_i) \quad (6)$$

$$\lambda_{Max}(r, r + 1) = -T \ln(1 - \hat{\lambda}_{r+1}) \quad (7)$$

As shown in Table 6, the Johansen cointegration test resulted in a trace statistic value of 47.52813 > critical value 29.79707 and a maximum eigenvalue of 31.03284 > critical value 21.13162. As this indicated that the analyzed variables were stably cointegrated over the long term, further analysis

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was conducted using the vector error correction model (VECM) ([Jian et al., 2019](#); [Liang & Schienle, 2019](#)).

**Table 6.** Johansen Test for Cointegration

### Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0,05 Critical Value	Prob.**
None*	0,804717	47,52813	29,79707	0,0002
At most 1*	0,536756	16,49529	15,49471	0,0352
At most 2	0,093961	1,874776	3,841466	0,1709

### Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Stat.	0,05 Critical Value	Prob.**
None*	0,804717	31,03284	21,13162	0,0015
At most 1*	0,536756	14,62051	14,26460	0,0439
At most 2	0,093961	1,874776	1,874776	0,1709

**Source:** Authors' calculation using EViews 10.

To confirm the relevance of the VECM, the stationarity of the residual ( $e$ ) at the level through ADF is assessed. As shown in Table 6, the residual ( $e$ ) is stationary at the level, with lag one not containing any unit roots. It may thus be concluded that cointegration was found amongst all the model's variables, and as such VECM analysis was appropriate.

**Table 7.** ADF Test for the Residual

Variable	ADF t- statistics	Critical Value			Conclusion
		1 %	5%	10%	
e	-2,923095	-2,685718	-1,959071	-1,607458	Stationary

**Source:** Authors' calculation using EViews 10.

## VECM Estimation and Granger Causality

As alluded earlier, after determining that all the variables investigated contained cointegration, it was possible to employ VECM Estimation and Granger causality. The equations used for VECM analysis are presented below:

$$\Delta LGDP_t = A_1 \sum_{i=1}^{k-1} B_{1i} \Delta LGDP_{t-1} + \sum_{i=1}^{k-1} C_{1i} \Delta LGDD_{t-1} + \sum_{i=1}^{k-1} D_{1i} \Delta LGED_{t-1} + \mu_1 ECT_{t-1} + e_t \quad (8)$$

$$\Delta LGDD_t = A_2 \sum_{i=1}^{k-1} B_{2i} \Delta LGDP_{t-1} + \sum_{i=1}^{k-1} C_{2i} \Delta LGDD_{t-1} + \sum_{i=1}^{k-1} D_{2i} \Delta LGED_{t-1} + \mu_2 ECT_{t-1} + e_t \quad (9)$$

$$\Delta LGED_t = A_3 \sum_{i=1}^{k-1} B_{3i} \Delta LGDP_{t-1} + \sum_{i=1}^{k-1} C_{3i} \Delta LGDD_{t-1} + \sum_{i=1}^{k-1} D_{3i} \Delta LGED_{t-1} + \mu_3 ECT_{t-1} + e_t \quad (10)$$

As discussed above, cointegration testing was used to show the long-term association between economic growth and government debt. To determine causality, meanwhile, it was necessary to employ VECM Estimation ([Ahad & Dar, 2018](#); [Zou, 2018](#)). If the economic growth variable (LGDP) is predictive of changes in government debt (LGDD, LGED), regression can be shown through these two variables. If this occurs, economic growth may be identified as the Granger cause of changes in government debt. Conversely, if this is not the case, it may be concluded that no Granger causality exists ([Menegaki, 2019](#); [Jian et al., 2019](#)).

A variable may be understood as significantly influential if its t statistics < t table. In the model used, the t tables were 2.10092 (5%) and 1.73406 (10%). Meanwhile, with the degree of

freedom being 1. This model had a degree of freedom of 21. The 7% level. As such, it

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was concluded that domestic government debt (LGDD) and external government debt (LGED) have significant long-term effects on economic growth (LGDP), as shown by the t-statistics being 2.08297 and 4.48951. Domestic debt is positively correlated with economic growth, while external debt is negatively correlated.

Based on Table 8, the cointegration equation may be written:

$$GDP_{t-1} = 99,407667 + 7,074042GDD_{t-1} - 14,60334GED_{t-1}$$

It was found that every percentage point increase in domestic government debt was followed by a 7.074042 percentage point increase in economic growth; conversely, every 1 percentage point increase in external government debt reduced economic growth by 14.6033 percentage points. This outcome highlights the long-run inverse relationship between external debt and economic growth in Indonesia.

**Table 8.** Estimation Results of Cointegration Equation

Cointegrating Eq:	CoitEq1
LGDP(-1)	1,000000
LGDD(-1)	7,074042 (2,08297*) [3,39613]
LGED(-1)	-14,60334 (4,48951*) [-3,25277]
C	99,40766

Notes: numbers in square brackets and in parenthesis are the corresponding standard errors and the t-statistics respectively.

**Source:** Authors' calculation using EVIEWS 10.

VECM estimation results are summarized in the table below, showing that the VECM model had a relative goodness of fit model except for Equation (10), as the R<sup>2</sup> value > 0.8 and the AIC and SIC were relatively low. For Equation (8), ECT<sub>t-1</sub> was negative and statistically significant at the 5% level. The short-term VECM outcome indicates that changes in domestic debt (LGDD) in one to two previous time periods did not significantly influence changes in economic growth (LGDP) as evidenced by the respective t-values, namely [1.24105] and [-0, 56581] < t-table 2.10092. On the other hand, changes in external debt (LGED) in one to two previous time periods have a significant effect on changes in economic growth (LGDP), this is shown by the respective t-values, namely [-4,36217] and [-2,35555] > t-table 2.10092. The LGED coefficient value (-1) of -9.295100 explains that when there is an increase in changes in external debt in the previous period of 1 unit, then the change in economic growth (LGDP) will decrease by -9.295100 percent.

Furthermore, the LGED coefficient (LGED (-2)) of -4.468089 explains that when there is an increase in external debt changes in the previous two periods of 1 unit, the change in LGDP economic growth will decrease by -4.468089 percent. Based on the value of Adj. R-squared in the short-term VECM equation, changes in the domestic government debt (LGDD) and external government debt (LGED) are able to explain variations in changes in the economic growth (LGDP) of 0.702621 or 70.26 percent, while the remaining 29.74 percent explained by changes in other variables outside the VECM being estimated.

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**Table 8.** Estimation Results of VECM: Short Run Estimation

Error Correction:	D(LGDP)	D(LGDD)	D(LGED)
CointEq1	-0,441880 (0,15209) [-2,90544]	0,027797 (0,00709) [3,91980]	0,056320 (0,03083) [1,82703]
D(LGDP(-1))	-0,116651 (0,22536) [-0,51763]	0,007063 (0,01051) [0,67218]	-0,039686 (0,04568) [-0,86884]
D(LGDP(-2))	0,110138 (0,14499) [0,75963]	-0,010809 (0,00676) [-1,59883]	-0,035735 (0,02939) [-1,21601]
D(LGDD(-1))	5,136255 (4,13862) [1,24105]	0,584710 (0,19298) [3,02997]	-0,524458 (0,83884) [-0,62522]
D(LGDD(-2))	-1,007766 (1,78111) [-0,56581]	-0,049512 (0,08305) [-0,59617]	0,483000 (0,36101) [1,33793]
D(LGED(-1))	-9,295100 (2,13084) [-4,36217]	0,154685 (0,09936) [1,55686]	0,015508 (0,43189) [0,03591]
D(LGED(-2))	-4,468089 (1,89684) [-2,35555]	0,270916 (0,08845) [3,06308]	-0,166922 (0,38446) [-0,43417]
C	0,366087 (0,21800) [1,67926]	0,026643 (0,01017) [2,62102]	0,062809 (0,04419) [1,42146]
R-squared	0,825071	0,943989	0,556897
Adj. R-squared	0,702621	0,904781	0,246725
F-statistics	6,738029	24,07642	1,795446
Akaike information criterion	1,396101	-4,735008	-1,796091
Schwarz criterion	1,791822	-4,229287	-1,400370

Notes: Number in parentheses are the standard errors; Number in square bracket are the t-statistics.

**Source:** Authors' calculation using EViews 10.

From the results of the VECM estimation in the table above, the following VECM is generated:

$$\begin{aligned}
 \Delta GDP_t &= -0,441880 \Delta GDP_{t-1} - 0,116651 \Delta GDP_{t-2} + 0,007063 \Delta LGDD_{t-1} - 0,039686 \Delta LGDD_{t-2} + 0,056320 \Delta LGED_{t-1} \\
 &+ 0,110138 \Delta LGED_{t-2} - 1,007766 \Delta LGDD_{t-2} - 4,468089 \Delta LGED_{t-2} + 0,027797 \Delta LGDD_{t-1} + 5,136255 \Delta LGDD_{t-1} - 0,524458 \Delta LGDD_{t-1} \\
 &+ 0,154685 \Delta LGED_{t-1} + 0,015508 \Delta LGED_{t-1}
 \end{aligned}$$

Granger causality testing is used to examine the causal association between variables. Two variables may be said to have a causal relationship if their values are mutually predictive. For example, Variable X may be identified as the Granger cause of Variable Y if its past value can be used to predict the latter's current value (see [Zou, 2018](#)). The Granger causality test may be

expressed mathematically as follows:

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$$y_t = \sum_{i=1}^p a_{11} y_{t-i} + \sum_{j=1}^p a_{12} y_{t-j} + \varepsilon_{1t}$$

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$$X_t = \sum_{j=1}^p a_{21} y_{t-j} - j \sum_{j=1}^p a_{22} y_{t-j} - j \quad \varepsilon_{2t} \quad (12)$$

With  $p$  being the maximum lag and  $a$  being the coefficient of the model. For this study, Granger causality was tested by examining the association between LGDP, LGDD and LGED as variables in the VECM. As seen in Table 10, the Granger causality test found that domestic public debt (LGDD) was not the Granger cause of economic growth (LGDP) ( $p$ -value  $> 0.05$ ); similarly, economic growth (LGDP) was not the Granger cause of domestic public debt (LGDD). However, external public debt (LGED) was statistically found to be a Granger cause of economic growth (LGDP), while economic growth (LGDP) was identified as a Granger cause of external public debt (LGED), with a  $p$ -value  $< 0.05$ .

**Table 10.** Estimation Results of VECM Granger Causality

Dependent variable: D(GDP)			
Excluded	Chi-sq	df	Prob.
D(LGDD)	2,421513	2	0,2980
D(LGED)	19,14891	2	0,0001
All	32,95436	4	0,0000
Dependent variable: D(LGDD)			
Excluded	Chi-sq	df	Prob.
D(GDP)	3,793536	2	0,1501
D(LGED)	9,400302	2	0,0091
All	13,41062	4	0,0094
Dependent variable: D(LGED)			
Excluded	Chi-sq	df	Prob.
D(GDP)	1,815510	2	0,4034
D(LGDD)	2,756232	2	0,2521
All	2,757619	4	0,5992

Notes: the null hypothesis: existence of Granger cause.

**Source:** Authors' calculation using EVIEWS 10.

## DISCUSSION

This study has examined the causal relationship between government debt (both domestic and external) and economic growth in Indonesia between 1998 and 2018. A stationary data time series was analyzed using ADF testing. At the level, economic growth (GDP) was stationary, while domestic government debt (LGDD) and external government debt (LGED) were not. At the first difference, meanwhile, government domestic debt (LGDD) was not stationary, but LGDP and LGED were stationary at the 5% level. Further ADF testing found that, at the second difference, all variables were stationary. This enabled the data time series to be analyzed using a VAR or VECM model.

To determine which analytical model was appropriate, Johansen cointegration testing was conducted. This test found a stable long-term association between economic growth (LGDP), domestic public debt (LGDD), and external public debt (LGED). External public debt was found to significantly and negatively influence economic growth, while domestic public debt had a significant and positive effect. The positive effect of public debt on economic growth supports the findings of Thao (2018), Spilioti and Vamvoukas (2015), and Daud (2016). The Granger causality test found unidirectional causality between external public debt and economic growth. This reinforces earlier findings (see Cholifihani, 2008; and Djulius, 2018) that external public debt is

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negatively associated with economic growth in Indonesia, and refutes findings (see [Muhdi and Sasaki, 2009](#)) that external debt and economic growth are negatively correlated.

This suggests that the Indonesian government should focus on domestic debt, rather than external debt, as the former is positively associated with economic growth. This reflects the findings of Buaa, Pradelli, and Presbitero (2014), who found that domestic public debt poses fewer risks to national currency, reduces vulnerability, and enables the government to implement countercyclical monetary policy to mitigate the deleterious effects of outside phenomena. To optimize its domestic sources of debt, the Indonesian government must improve its institutional frameworks and promote a healthy macroeconomy, particularly as related to the debt market and public debt management ([Abbas & Christensen, 2010](#)).

## CONCLUSION

In managing the state budget, the Indonesian government encounters one of the important challenges, namely the budget deficit, both domestic and foreign sources of income cannot meet development funding. This condition causes the government to make debt as an effort to cover the budget deficit. The average budget deficit of 330 trillion Rupiah from 2011 to 2018. Meanwhile, for 20 years from 1998 to 2018, the ratio of government debt to Indonesian GDP averaged 43.7%.

The role and impact of a country's government debt on development and economic growth remains a topic of theoretical and practical debate among academics and policymakers. Thus, this study was motivated by the theoretical and empirical discussions of the association between public debt and economic growth. It investigated the relationship between government debt and economic growth in Indonesia over the period 1998 to 2018. Data regarding public debt and economic growth from the Indonesian Ministry of Finance, covering the period 1998 and 2018.

Empirical analysis was carried out with three main procedures. First, the stationarity properties of the time series were checked, so that the stationarity test was performed using the ADF test. Results from the ADF test demonstrate that all the variable series were stationary at the second difference. Second, Johansen cointegration test is performed to check for the long run cointegration relationship between the time series. The Johansen cointegration test demonstrate that series are cointegrated based on the trace test and the maximum Eigenvalue. Cointegration test results also revealed that in the long run, domestic government and economic growth have a positive and significant association. On the other hand, government debt from external sources is negatively associated with Indonesia's economic growth. This finding corroborates the neoclassical view which posits that external debt may impede economic growth due to a crowding-out effect of government debt.

Third, based on the long-term association between government debt and economic growth, the VECM is adopted for empirical analysis purposes. Granger causality and VECM estimations were used to establish the causal relationship between government debt and economic growth. The empirical results of this analysis suggested that economic growth, domestic public debt, and external public debt are co-integrated over the long term. Testing further found that, although a causal association existed between external public debt and economic growth, no such association existed between domestic public debt and economic growth.

## IMPLICATION

This study has some policy implication to guide policymakers in the area of government debt management in Indonesia. Its findings reaffirm that domestic government debt has a

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significant and positive relationship with economic growth in Indonesia. As such it underscores the importance of such debt for economic development in Indonesia. For a policy perspective, policymakers need to be better prepared instruments for developing government debt in the country for example by providing more effective debt instruments for mobilizing debt that are attractive to the Indonesian and foreign investors.

In contrast, external debt appears to dictate long-term GDP growth; consequently, the government must be more cautious in dealing with such debt. Future studies could focus on the reason why domestic public debt positively influences economic growth while external public debt has a negative influence, as this study did not consider such issues. One could also examine the source of economic growth, such as domestics and foreign investments, export, imports and domestic interest rate.

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