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FISCAL SUSTAINABILITY ANALYSIS IN MANAGING STATE DEBT

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ABSTRACT

To maintain fiscal sustainability when the state budget is in deficit, the government issues debt, which has the potential to burden the state budget. This study examines fiscal sustainability as observed through debt management, which is represented by the primary balance/GDP ratio and the debt to GDP ratio, which is influenced by macroeconomic variables such as interest rates, economic growth, inflation, and exchange rate changes. The results of the variance decomposition show that the condition of the primary balance/GDP ratio is a factor that determines changes in the debt to GDP ratio. The results of the impulse response function show that fiscal sustainability occurs when the primary balance/GDP ratio is in surplus so that it can reduce the debt to GDP ratio. Conversely, increasing the debt to GDP ratio can support the primary balance/GDP ratio to achieve a surplus or reduce a deficit. Based on the VAR estimation results, to maintain fiscal sustainability, the government needs to pay attention to four aspects that could affect relative costs, such as economic growth, interest rates, inflation, and changes in exchange rates. Macroeconomic developments need attention because this variable can affect spending quality and debt management in the state budget.

Keywords:
Debt, Deficit Budget, Fiscal Sustainability, Macroeconomic Variable

JEL Classification:
H63, H62, E62, B22

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1. INTRODUCTION

The increase in state debt during a crisis challenges the state's ability to maintain fiscal sustainability. After the Asian financial crisis that occurred in 1997–1998, Indonesia prioritizes fiscal sustainability because of the large-scale increase in state debt. The crisis was marked by increased government spending, mainly due to the costs of overcoming the impact of the crisis. With the crisis, government debt has increased significantly to cover the state budget deficit.

The 2003 State Finance Law Number 17 Clause, Paragraph 3, stipulated a debtto GDP ratio limit of 60% and a budget/GDP deficit of 3% (Ikhsan & Virananda, 2021). For the sake of brevity, the term fiscal sustainability use throughout this paper refers to managing the government's budget as a whole in terms of revenue, spending, and budget deficit financing. The Ministry of Finance (2018) states three pillars of fiscal sustainability: 1) optimal state revenue; 2) quality government spending; 3) sustainable financing management.

Hubbard et al. (2014) define "fiscal sustainability" as the government's ability to maintain state spending without defaulting on its obligations or debts in the future. Therefore, a fiscal condition is said to be sustainable if it can fund all state expenditures for an unlimited period. The state's inability to balance the expenditure burdens of state revenues will seriously jeopardize the ability of the state budget to repay debts (or fiscal solvency). Fiscal solvency can be maintained if the state budget has a surplus. If the state budget is in deficit, it will threaten fiscal solvency (Chalk & Hemming, 2000). Then, all state spending must be financed for an unlimited period so that fiscal policy can be sustainable (Langenus, 2006; Levy-Yeyati & Sturzenegger, 2007; Kuncoro, 2011).

In recent years, Indonesia's fiscal condition has continued to go through a budget deficit, as evidenced by state revenues being smaller than state expenditures (see Chart 1). To cover its budget deficit, Indonesia needs other funding sources to support state revenues from taxes. If it is insufficient, the government will need another funding source through debt issuance. In Chart 1, a significant increase in Indonesia's debt occurred in 2000–2002, namely the debt/GDP ratio, which exceeded 60%.

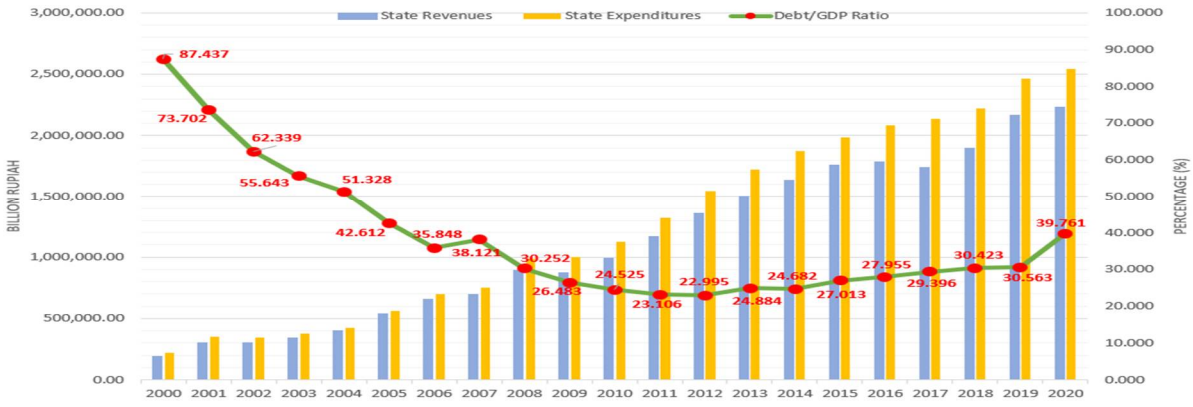
APPLICATIONS FOR PRACTICE

- The government needs to be careful in managing debt by implementing good risk management to support the state budget, which is currently in deficit.
- The government also needs to pay attention to macroeconomic developments, such as interest rates, economic growth, inflation, and exchange rate changes, because these variables can affect the quality of spending originating from the state budget and the quality of managing state debt.
- To maintain fiscal sustainability, debt management needs to be done as well as possible so that the burden on the government's budget does not get bigger or exacerbate the deficit.

Debt has risks because it can threaten fiscal sustainability if it is not managed properly. With the *Anggaran Pendapatan dan Belanja Negara* (APBN or state budget) deficit, how can Indonesia maintain its fiscal sustainability, and how can the APBN remain sustainable despite experiencing a budget deficit?

This study aims to examine fiscal sustainability in Indonesia from 2000 to 2020 through debt management (primary balance/GDP ratio and debt/GDP ratio), which are influenced by macroeconomic variables when the state budget is in deficit. We measure fiscal sustainability using the fiscal reaction function (FRF) approach. Taking into account the analysis of macroeconomic variables, it can provide input for the government to design various policies related to fiscal sustainability. In

Chart 1 Fiscal Conditions Compared to the Debt to GDP Ratio



Source: Indonesia Ministry of Finance & International Monetary Fund (IMF), processed by the author 2023

general, this research builds upon previous research and enhance the empirical studies on fiscal sustainability in Indonesia.

Research on fiscal sustainability analyzed through FRF in Indonesia, which includes macroeconomic elements, is quite rare (see Marisa, 2015; Insukindro, 2018, as a reference). In the fiscal reaction function, there are three main endogenous variables: the primary balance/GDP ratio, the debt/GDP ratio as debt management, and explanatory variables as exogenous such as macroeconomic indicators, that form the structure of the state budget (Bohn, 2007). In our research, the primary balance/GDP ratio and debt/GDP ratio will be endogenous variables to analyze the government's reaction when there is a change in these variables. Meanwhile, exogenous variables in this study are interest rates, economic growth rates, inflation rates, and changes in exchange rates because these variables are used in forming the structure of the state budget (Marisa, 2015), representing macroeconomic conditions in Indonesia.

2. LITERATURE REVIEW

Fiscal Reaction Function

Fiscal sustainability is often measured through a FRF. According to Bohn (2007), FRF is a function that determines how the government reacts to debt increases or changes that lead to debt management. Adams et al. (2010) went on to define fiscal sustainability as a situation where the government's budget can support state expenditures without leading to a precipitous rise in the government's debt. Government debt as an ever-increasing burden will certainly affect the government's budget in the future because the government's budget is also used to pay interest on government debt from the previous period. Therefore, good debt and budget deficit management are required to achieve long term fiscal sustainability.

Several researchers have analyzed financing using different methods. Fiscal policy can be sustainable, according to Alvarado et al. (2004), if the government can maintain its budget constraints. Meanwhile, according to Burnside (2005), the budget constraint equation model is represented as follows:

$$\beta_t - \beta_{t-1} = I_t - X_t - (M_t + M_{t-1}) \quad (1)$$

Where β_t is the amount of government debt at t period, β_{t-1} is the amount of government debt at $t-1$ period, I_t is interest payments at t period, X_t is the primary balance at t period, and M_t is the money supply at t period.

Equation (1) explains that the amount of government debt decreased at the end of a certain period (at t period) from the previous period (at $t-1$ period). Then the amount of government debt can be affected by interest payments, the primary balance, and the money supply. According to Burnside (2005), the current primary surplus is used to cover future government debt. This is done to ensure that the government can pay its debt on time and won't strain its future government budget. When the government can pay off the amount of debt using a budget surplus, this is referred to as fiscal sustainability.

According to Burnside (2005), the long-term government debt/GDP can be close to zero; this occurs when several factors influence government debt. In addition to government debt and primary balances, real interest rates and economic growth rates must also be considered for fiscal sustainability. The real interest rate is important because it can burden future government debt payments. Meanwhile, economic growth affects the calculation of government spending and revenue. Therefore, the government's ability to manage debt can be observed through the debt/GDP ratio. Meanwhile, the government's ability to pay for its total expenditures can be seen from the primary balance/GDP ratio.

A state's fiscal sustainability may be examined using the FRF approach by observing its primary balance/GDP ratio, changes in the government debt/GDP ratio, and its macroeconomic circumstances. FRF approach is a function that shows the government's reaction, which is informed by the budget constraint (Burger, 2012). Additionally, Câmpeanu & Stoian (2010) emphasize that the FRF is more flexible when analyzing fiscal sustainability. FRF offers a valuable tool for fiscal sustainability analysis by providing a more dynamic and nuanced picture of government behavior and its impact on long-term sustainability. FRF can be formulated as follows:

$$p_t = a + \beta b_t + \delta Z_t + \varepsilon_t \quad (2)$$

Where p_t is the ratio of primary balance/nominal GDP, b_t is the ratio of debt/nominal GDP, Z_t is the control variable, a, β, δ is the coefficient, and ε_t is the error term. The explanatory or control variables themselves are variables that describe a country's economy at a macro level, such as interest rates, economic growth rates, inflation rates, exchange rates, oil prices, crude oil and gas lifting.

Equation (2) can be seen as a backward-looking function, that can assess the ability of the government in the previous period based on historical data. According to Câmpeanu & Stoian (2010), when the debt to GDP ratio (b_t) rises, fiscal sustainability could still be achieved even with flexible fiscal policy, provided that the government can reach surplus or reduce a deficit in the primary

balance to GDP ratio (p_t), when $\frac{\partial p_t}{\partial b_t} > 0$ (or, the debt/GDP ratio positively responds to the primary balance/GDP ratio). Conversely, when the debt/GDP ratio (b_t) increases but the primary balance/GDP ratio (p_t) exacerbates the deficit, it is difficult to achieve fiscal sustainability, and the fiscal policy implemented is not flexible when $\frac{\partial p_t}{\partial b_t} < 0$ (or, the debt/GDP ratio gives a negative response to the primary balance/GDP ratio).

Previous Studies

Research on fiscal sustainability has been carried out using various approaches and indicators. Among them, Marks (2004) examined the relationship between fiscal sustainability and fiscal solvency in Indonesia for the 1990–2003 period using grouping indicators due to consolidated central government stock variables, consolidated central government flow variables, and gross domestic product. Through the one-period primary gap approach, it was found that the exchange rate is a crucial factor in fiscal sustainability in Indonesia because it sometimes becomes a relative cost for paying domestic and foreign debts. Then, research on fiscal sustainability for the quarterly data from 2000 to 2008 in several Central and Eastern European countries was conducted by Câmpeanu & Stoian (2010) using a fiscal reaction function approach. Their research found that the government can produce a primary balance surplus in the short term to achieve long-term fiscal sustainability.

Unlike previous research, Kuncoro (2011) uses domestic and foreign debt to indicate fiscal solvency, which analyzes fiscal sustainability for quarterly data from 1999 to 2009 in Indonesia. Thus, the results of his research found that fiscal sustainability was not achieved, which implies that to maintain fiscal solvency, the government must manage the debt profile carefully and consider fiscal risks comprehensively. Then Burger (2012) compared the fiscal sustainability in the United States (US) in 1970-2008 and the United Kingdom (UK) in 1972-2008. Using the FRF approach estimated through smooth transition regression (STR), his research found that the estimation value of US debt to GDP ratio was 60.2% higher than UK debt to GDP ratio namely 45.6%. With this comparison, during the research period, the fiscal conditions in the United States were more vulnerable than those in the United Kingdom.

To test fiscal sustainability in Indonesia, Marisa (2015) uses several macroeconomic indicators, which serve as a reference for preparing the APBN posture. These indicators include the 3-month *Surat Perbendaharaan Negara* (SPN or treasury bills) nominal interest rate, economic growth, inflation, exchange rates, and oil prices, followed by the debt-to-GDP ratio and the primary balance to GDP ratio to represent fiscal sustainability. For information, SPN or treasury bills is government issued financial instrument similar to a short-term bond used by the Indonesian government to raise funds fo short-term financial needs. Using the vector error correction model (VECM) method, the results of Marisa (2015) research show that the fiscal conditions in Indonesia from 2000 to 2012 could be defined as sustainable. Provided that the government carefully manage its debt risk so that the state budget deficit does not increase in order to maintain fiscal sustainability. Using a value-at-risk (VaR) approach, Sriyana & Hakim (2017) modeled Indonesia's fiscal sustainability through the liabilities to assets ratio (LAR) parameter for the quarterly data from 1990 to 2014. The results of their research found that the previous period's LAR had a significant effect on the actual period's LAR, so fiscal sustainability in Indonesia was indicated to be in a safe condition.

An examination of the behavior of fiscal financing using the fiscal reaction function was continued by Insukindro (2018) in Indonesia for the 2001–2016 period. Using the concept of an FRF estimation using the VECM method, his research examines the twin shock effects of rising economic and exchange rates. His research found that in the long term, external shocks resulting from exchange rate fluctuations and internal shocks resulting from economic fluctuations (identified using the output gap) can affect the sustainability of financing in Indonesia. Likewise, the fiscal sustainability model, which incorporates primary balance deficit, domestic debt, and foreign debt can also be affected by twin shocks. Then Widjanarko (2020) conducted a study to observe the variables that could potentially trigger the debt-to-GDP ratio changes using the decomposition of the public debt-to-GDP ratio method developed by the International Monetary Fund (IMF). His study found that the primary balance in a deficit condition triggers an increase in the debt/GDP ratio and that the high real interest rate and the depreciation of the rupiah exchange rate become a relative cost to mitigate the increase in the debt/GDP ratio. While stock-flow adjustment (SFA), or the potential for debt stocks to increase could set a deficit budget, it was also revealed that SFA has a positive impact on the debt to GDP ratio by providing debt that exceeds budget reductions. nlike previous research, Ikhsan & Virananda (2021) examine the sustainability of fiscal imbalances using the fiscal reaction function in Indonesia for the 1976–2019 period annually. Using the variable debt ratio and cyclical output estimation through the autoregressive distributed lag (ARDL) method, their research finds that fiscal sustainability is weakened by fiscal imbalances in

the long term because state revenues are smaller than expenditures. Then Juanda & Gladiola (2022) researched fiscal sustainability from 2004–2019. Fiscal sustainability is observed by analyzing the effect of government securities (SBN) and other factors on economic growth. Using simultaneous equation analysis, the results of their research show that SBN and other factor such as capital expenditure, have a positive and significant effect on Indonesia's economic growth. Therefore, Indonesia's state debt could be determined as sustainable with productive capital expenditure. On the other hand, an increase in SBN can increase the primary balance.

3. RESEARCH METHODOLOGY

To analyze fiscal sustainability through the FRF approach, this study uses an estimation vector autoregressive (VAR) technique. VAR is used to determine the relationship between two or more variables. Thus, the author will achieve research objectives through this estimation technique. To use this estimation technique, it is first necessary to carry out a stationary test, which in this study uses the Phillips-Perron (PP) technique. Second, determine the optimum lag when testing Granger causality and VAR stability based on the criteria LR test statistics (LR), final prediction error (FPE), Akaike information criterion (AIC), Schwarz information criterion (SC), and Hannan-Quinn information criteria (HQ). Third, carry out a stability test of the VAR model to ensure that the data estimated in this study can form a valid VAR model. Fourth, carry out the Granger causality test to examine causality or the direction between endogenous variables and relationships. Fifth, find out the dynamics of the system of equations in the endogenous variables through variance decomposition analysis. Sixth, find out the response of each endogenous variable to each change or shock through the impulse response function (IRF) analysis. Finally, the authors present the results of the VAR estimation for a more systematic analysis to determine the behavior of macroeconomic (exogenous) variables in influencing debt management (endogenous).

The time series data used in this study for the period of 2000–2020 was collected quarterly. The authors classify the data as indicators of debt management, including the debt/GDP ratio and primary balance/GDP ratio as endogenous variables. Meanwhile, the macroeconomic variables forming the structure of the state budget, including interest rates, economic growth, inflation rates, and exchange rate changes, are positioned as exogenous variables. The operational variable descriptions and data sourcesare as shown in Table 1.

In addition, the International Financial Statistics page on IMF website provides secondary data in quarterly frequency for GDP_t, R_t, T_t, i_t,

Table 1. Variable Definitions

Endogenous Variables			
Variable	**Sign**	**Description**	**Source**
Primary Balance/GDP Ratio (in %)	p_t	$p_t = \left(\frac{R_t - T_t}{GDP_t}\right) \times 100\%$	IMF, and computed by the author
Debt/GDP Ratio (in %)	b_t	Annual data from the IMF is interpolated into quarterly	IMF, and computed by the author
Exogenous Variables			
Variable	**Sign**	**Description**	**Source**
Interest rate (in %)	i_t	Financial, interest rates, lending rate	IMF
Economic growth (in %)	y_t	$y_t = \left(\frac{RGDP_t - RGDP_{t-1}}{RGDP_{t-1}}\right) \times 100\%$	IMF, and computed by the author
Inflation (in %)	π_t	$\pi_t = \left(\frac{CPI_t - CPI_{t-1}}{CPI_{t-1}}\right) \times 100\%$	IMF, and computed by the author
Exchange rate changes (in Rupiah)	er_t	$er_t = ER_t - ER_{t-1}$	IMF, and computed by the author

Where:
$\boldsymbol{R}$ = Revenue, cash (in Million Rupiahs)
$\boldsymbol{T}$ = Compensation of Employers + Use of Goods and Service + Subsidies and Transfers + Grants + Social + Other Expense (in Million Rupiahs)
$\boldsymbol{GDP}$ = Gross domestic product, nominal, seasonally adjusted, domestic currency (in Million Rupiahs)
$\boldsymbol{RGDP}$ = Gross domestic product, real, seasonally adjusted, domestic currency (in Million Rupiahs)
$\boldsymbol{CPI}$ = Consumer price index, all items (in Index)
$\boldsymbol{ER}$ = National currency per US$ dollar, end of period (in Rupiah)
$\boldsymbol{t}$ = Time series period 2000Q1-2020Q4

Source: Author's data

$RGDP_t$, CPI_t and ER_t. Based on these available informations the authors can compute variable indicators such p_t (primary balance/GDP ratio), y_t(economic growth), π_t (inflation), and er_t (exchange rate changes). For i_t (interest rates), the website provides brief information that the published data is the lending rate. However, for b_t (debt/GDP ratio) data, the IMF only provides this secondary data on an annual basis. Therefore, the authors extracted the annual data using linear interpolation to produce the quarterly data frequency.

Based on the techniques mentioned in the first paragraph and the explanation of variable definitions in the second paragraph, then modified the methodology compiled by Marisa (2015) and applied it using different technique. Thus, the methodology is modified by the authors for the VAR model in Equations (3) and (4) as follows:

$$p_t = \sum_{j=1}^{n} \emptyset_j b_{t-j} + \sum_{k=i}^{n} \varphi_k p_{t-k} + \lambda_1 i_t + \lambda_2 y_t + \lambda_3 \pi_t + \lambda_4 er_t + \varepsilon_t \quad (3)$$

$$b_t = \sum_{j=1}^{n} \dot{\varphi}_j p_{t-j} + \sum_{k=i}^{n} \dot{\emptyset}_k b_{t-k} + \dot{\lambda}_1 i_t + \dot{\lambda}_2 y_t + \dot{\lambda}_3 \pi_t + \dot{\lambda}_4 er_t + \dot{\varepsilon}_t \quad (4)$$

Where $\emptyset_{j-n}$ and $\dot{\emptyset}_{k-n}$ is the coefficient of the lag of debt/GDP ratio (b_t), then φ_{k-n} and $\dot{\varphi}_{j-n}$ is the lag of the primary balance/GDP ratio (p_t). While $\lambda_{1,2,3,4}$ and $\dot{\lambda}_{1,2,3,4}$ is the coefficient of each exogenous variable, namely the macroeconomic variable consisting of interest rates (i_t), economic growth (y_t), inflation (π_t), and exchange rate changes (er_t).

4. RESULT AND DISCUSSION

Descriptive Statistics of Research Variables

Table 2 attach the descriptive statistics for all variables including observations (Obs.), mean, standard deviation (Std. Dev.), minimum (Min.), and maximum (Max.). It shows that for 83 quarters, the primary balance was a deficit of 8.12%, with debt/GDP involved at 37.86%. Then, the average interest landing seen is 13.58%, with average economic growth and inflation of 1.20% and 1.56% respectively. Finally, the average exchange rate change is 78.49 Rupiah.

Table 2 Descriptive Statistics

Variables	Obs.	Mean	Std. Dev.	Min.	Max.
p_t	83	-8.12	3.85	-17.92	1.72
b_t	83	37.86	16.69	22.72	89.23
i_t	83	13.58	2.67	9.24	19.32
y_t	83	1.20	1.08	-6.98	3.36
π_t	83	1.56	1.40	-0.21	10.34
er_t	83	78.49	669.68	-2065	2446

Source: Processing results by Eviews 10

Table 3 Stationary Phillips-Perron (PP) Test Results

Variable	PP Test Statistic	Critical Values (0.1)	I(0) Probability
p_t	-10.95	-2.58	0.00*
b_t	-5.01	-2.58	0.00*
i_t	-1.99	-1.61	0.04*
y_t	-9.24	-2.58	0.00*
π_t	-7.36	-2.58	0.00*
er_t	-11.25	-2.58	0.00*

(*) significant at the 10% (or 0.1) level that adjusts for probability

Source: Processing results by Eviews 10

Table 4 VAR Lag Order Selection Criteria

Endogenous Variable: p_t, b_t
Exogenous Variable: Constant, i_t, y_t, π_t, er_t

Lag	LR	FPE	AIC	SC	HQ
1	292.06	18.62	8.59	9.02	8.77
2	30.27	13.18	8.25	8.80	8.47
3	8.83	12.81	8.22	8.89	8.49
4	47.89	6.67	7.56	8.36	7.88
5	18.07	5.53	7.37	8.29*	7.74
6	10.66	5.15*	7.30	8.34	7.71*
7	1.17	5.64	7.38	8.55	7.85
8	11.16*	5.16	7.28*	8.57	7.80

The author chose the 6th lagged following the FPE and HQ criteria.

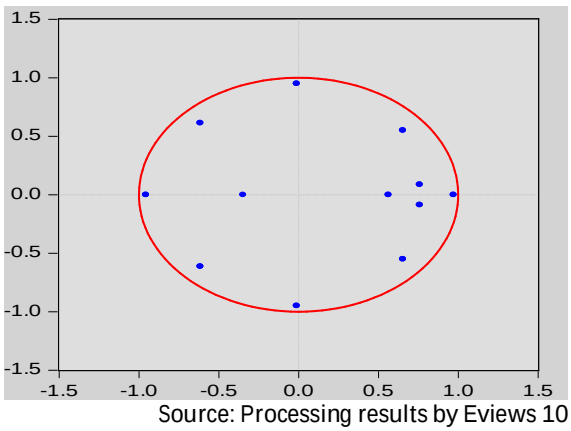
Source: Processing results by Eviews 10

Stationary Test Results

To achieve the research objectives, the authors gradually conducted various tests to use the VAR technique. The VAR technique requires that all data analyzed be stationary at the integrated level or I (0). The authors conducted a stationary test using the Phillips-Perron (PP) method. Table 3 shows that all the data analyzed in this study were stationary at the integrated level with a significance level of 10%.

Optimum Lag Test Results

Figure 1 Inverse Roots of AR Characteristic Polynomial



Source: Processing results by Eviews 10

To determine the optimal lag when carrying out the Granger causality test, the VAR stability test and the VAR estimation results refer to the lag test criteria that have been explained by the authors (see Section 3, in the first paragraph). Table 4 presents the lag test, which in this study follows the criteria for the smallest value of the final prediction error (FPE) and Hannan-Quinn (HQ). Thus, the authors use six lags in the Granger causality test, the VAR stability test, and the VAR estimation results (see Equations 3 and 4).

VAR Stability Test Results

A VAR stability test needs to be carried out to ensure that the data used to model the VAR is declared valid. Figure 1 shows that no modulus values exceed number one or all inside the circle. Thus, the data used to model the VAR is stable, and the VAR model is declared valid.

Granger Causality Test Results

To show the direction between endogenous variable relationships such as the primary balance/GDP (p_t) and debt/GDP ratio (b_t), the test of Granger causality needs to be carried out. Based on Table 5, a significance level of 10%, shows that there is no two-way or one-way relationship between the two variables. Therefore, the authors assume a potential relationship between the primary balance/GDP and the debt/GDP ratio, which is influenced by macroeconomic indicators, which the author characterize as exogenous variables. On the other hand, the causality test reveals that the primary balance/GDP ratio is more likely to be influenced by the debt/GDP ratio. For this reason, the authors will present the results of the VAR estimation, which will later be raised (see Table 7) for systematic analysis.

Variance Decomposition Test Results

Variance decomposition shows the dynamics of the system of equations contained in the endogenous variables. The dynamics of responses to these variables can be seen through the percentages presented in the variance decomposition results in Table 6 as below.

Table 6 Variance Decomposition of Primary Balance/GDP and Debt/GDP Ratio

Period	$b_t \rightarrow p_t$	$p_t \rightarrow b_t$
1	0.00	0.01
2	0.06	0.86
3	2.58	0.62
4	3.42	0.38
5	5.93	0.28
6	6.33	0.31
7	6.41	0.46
8	7.06	0.78
9	6.26	1.15
10	7.28	1.41

Source: Processing results by Eviews 10

Table 5 VAR Granger Causality

Causality Direction	Chi-square	Probability	Result
$b_t \rightarrow p_t$	8.21	0.22	Does not have Granger causality
$p_t \rightarrow b_t$	4.12	0.65	

(*) significant at the 10% (or 0.1) level that adjusts for probability

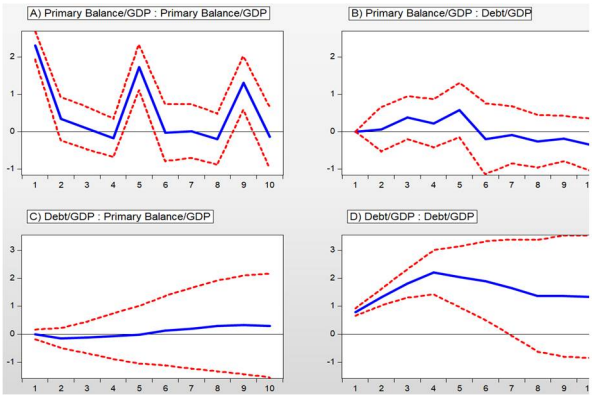
Source: Processing results by Eviews 10

Based on the variance decomposition, two findings were obtained. First, the debt/GDP ratio (b_t) explains the variance of the primary balance/GDP ratio (p_t) of around 7.28%, predicted in 10 periods. Second, within the same prediction range, the primary balance/GDP ratio (p_t) can only explain the debt/GDP ratio (b_t) variance of around 1.41%. From the results of this variance decomposition, it can be inferred that the condition of the debt/GDP ratio is a factor that makes it more possible to determine changes in the condition of the primary balance/GDP ratio. Thus, this is not in line with what Widjanarko (2020) said, "if the primary balance conditions experience a deficit, it can trigger an increase in the debt/GDP ratio through the issuance of new debt". Therefore, to maintain Indonesia's fiscal sustainability, management of the primary balance/GDP ratio must be done carefully, and the government needs to control the debt/GDP ratio more carefully.

Impulse Response Function Results

The impulse response function (IRF) shows the dynamics between endogenous variables through their shock, such as the variance decomposition. However, the advantages of this impulse response function can help determine changes in shock patterns between endogenous variables based on

Chart 2 Impulse Response Function Primary Balance to GDP Ratio and Debt to GDP Ratio



Source: Processing results by Eviews 10

Table 7 Vector Autoregression Estimates

			Endogenous Variable	
			p_t Equation (3)	b_t Equation (4)
Exogenous Variable	p_{t-1}	Coefficient	0.14	-0.05
		[t-statistic]	[1.20] *	[-1.30] *
	p_{t-2}	Coefficient	0.021	0.05
		[t-statistic]	[0.18] *	[1.41] *
	p_{t-3}	Coefficient	-0.05	0.02
		[t-statistic]	[-0.65] *	[0.68] *
	p_{t-4}	Coefficient	0.75	-0.00
		[t-statistic]	[7.97]	[-0.23] *
	p_{t-5}	Coefficient	-0.21	0.05
		[t-statistic]	[-1.77]	[1.28] *
	p_{t-6}	Coefficient	-0.07	-0.03
		[t-statistic]	[-0.64] *	[-0.92] *
	b_{t-1}	Coefficient	0.07	1.66
		[t-statistic]	[0.20] *	[12.90]
	b_{t-2}	Coefficient	0.33	-0.46
		[t-statistic]	[0.52] *	[-2.11]
	b_{t-3}	Coefficient	-0.52.	-0.21
		[t-statistic]	[-0.85] *	[-1.01] *
	b_{t-4}	Coefficient	0.57	-0.64
		[t-statistic]	[0.91] *	[-2.95]
	b_{t-5}	Coefficient	-1.28	0.99
		[t-statistic]	[-1.83]	[4.14]
	b_{t-6}	Coefficient	0.81	-0.34
		[t-statistic]	[1.77]	[-2.18]
	Constant	Coefficient	-4.71	2.40
		[t-statistic]	[-1.14] *	[1.70]
	i_t	Coefficient	0.09	-0.12
		[t-statistic]	[0.26] *	[-0.98] *
	y_t	Coefficient	-0.03	-0.06
		[t-statistic]	[-0.14] *	[-0.70] *
	π_t	Coefficient	0.03	-0.06
		[t-statistic]	[0.14] *	[-0.74] *
	er_t	Coefficient	0.00	-0.00
		[t-statistic]	[0.50] *	[-0.62] *

$t_{table} = t\frac{\alpha}{2},df = t\frac{\alpha}{2},n-k = t\frac{0,1}{2},78-17 = t\ 0.05,61 = 1.67$

Note: The notation n is the observation after adjustments, and k is the number of coefficients in the equation model.

(*) the *t-statistic* is significant at the 10% (or 0.1) level adjusting for t_{table}.

Source: Processing results by Eviews 10

graphically predicted period ranges. The IRF results given in Chart 2 are as follows:

Chart 2 (B) shows the primary balance to GDP ratio shocks to the debt to GDP ratio in the predicted 10 period range. It is known that in the predictions ranging from 1 to 10 periods, the primary to GDP ratio gives a negative shock to the debt to GDP ratio, indicating that to reduce the debt to GDP ratio, it needs to reach a surplus primary balance to GDP ratio. As explained by Kuncoro (2011), the primary balance in a surplus condition must be maintained to achieve fiscal sustainability. Chart 2 (C) shows the debt to GDP ratio shocks to the primary balance to GDP ratio in the predicted 10 period range. It is known that in the predictions ranging from 1 to 10 periods, the debt to GDP ratio gives a positive shock to the primary balance to GDP ratio, indicating that the debt to GDP ratio has little potential to reach a surplus in the primary balance to GDP ratio. According to Câmpeanu & Stoian (2010), fiscal sustainability can be achieved, and fiscal policy is flexible if an increase in debt can produce a primary balance in a surplus condition or reduce the deficit.

VAR Estimation Results

To determine the effect of exogenous variables, including interest rates (i_t), economic growth (y_t), inflation (π_t), and exchange rate changes (er_t), along with the lag of the endogenous variables themselves ($p_{t-1\ldots6}$ and $b_{t-1\ldots6}$), the VAR estimation results need to be presented for systematic analysis.

In addition, the VAR estimation results follow the formulation of the model equations (3) and (4). In this section, the authors focus on the behavior of macroeconomic variables that are positioned as exogenous in the VAR model to examine their effect on debt management variables (debt/GDP ratio and primary balance/GDP ratio). We observe this behavior through the coefficients and t-statistic values in Table 7.

Based on equation (3) in Table 7, if the primary balance/GDP ratio at the previous period (p_{t-1}) is in deficit, it has the potential to exacerbate the deficit in the primary balance/GDP ratio at the current period (p_t). The government needs to increase the debt/GDP ratio for the previous period (b_{t-1}) by issuing new debt to support the actual primary balance/GDP ratio (p_t), which is expected to achieve a surplus. Here, fiscal sustainability was achieved when the government reacted to increasing debt in several previous periods (see parameters b_{t-1}, b_{t-2}, b_{t-4}, and b_{t-6}), in other periods not achieved. However, the government's efforts to achieve a surplus in the primary balance/GDP ratio (p_t) pose a challenge in realizing fiscal sustainability because interest rates (i_t), inflation (π_t), and changes in exchange rates (er_t) need to be addressed. With a higher loan interest rate (i_t), it can maintain the primary balance/GDP ratio (p_t) in a deficit condition, potentially hindering the achievement of a surplus condition. On the other hand, when inflation (π_t) increases as people's purchasing power decreases, government intervention in the economy becomes very important, so it is undeniable that the condition of the primary balance/GDP ratio (p_t) remains in deficit because of a large amount of government expenditures are used for subsidies. However, achieving fiscal sustainability requires an appreciation of exchange rate changes (er_t) to achieve a surplus condition in the primary balance/GDP ratio (p_t), which can increase government revenue. Regarding economic growth (y_t), the government's strategy in stimulating the economy can trigger the primary balance ratio/GDP (p_t) to a deficit condition due to the large amount of expenditure for development purposes, which, of course, will exceed state income.

Meanwhile, for the analysis based on equation (4) in Table 7, when the primary balance to GDP ratio at the previous period (p_{t-1}) are deficit, the government reacted by issuing new debt to cover the deficit, which could trigger an increase in the debt/GDP ratio at the current period (b_t). However, the debt/GDP ratio in several previous periods were relatively small. In that case, the government issues large amounts of debt to increase the debt/GDP ratio (b_t). The same applied when the loan interest rate (i_t) is relatively low; the government can issue debt with small interest rate on a large scale to increase the debt to GDP ratio (b_t). Nevertheless, with increasing economic growth (y_t) Indonesia can help the government minimize the scale of debt to be issued. Ultimately, it will reduce the debt/GDP ratio (b_t). The opposite condition occurs when inflation (π_t) increases, which can trigger an increase in the debt/GDP ratio (b_t) to maintain people's purchasing power. The same goes for changes in the exchange rate (er_t); if it depreciates, it will become a cost burden for the government, which has the potential to increase the debt/GDP ratio (b_t) through debt issuance.

5. CONCLUSION

This study examines fiscal sustainability in Indonesia during the 2000/Q1–2020/Q4 period, accompanied by macroeconomic indicators as exogenous variables, using the FRF approach, which is estimated using vector auto regression (VAR) techniques. Using the VAR technique, the authors provide four findings obtained from the Granger causality result, variance decomposition (VD), the impulse response function (IRF), and the VAR estimation results. First, based on the Granger causality result, it shows that the debt/GDP ratio is more likely to affect the primary balance/GDP ratio. Second, the results from VD and IRF analysis further indicate that the condition of primary balance to GDP ratio determines changes in the debt to GDP ratio. If the state budget is in deficit, the government reacts by issuing new bonds to cover the deficit.

Third, the IRF shows that fiscal sustainability in Indonesia can be achieved under two conditions. The first condition is that the primary balance/GDP ratio needs to achieve or maintain a surplus to reduce the debt/GDP ratio. The second condition is that increasing the debt/GDP ratio can support the primary balance/GDP ratio to achieve a surplus or reduce a deficit.

Fourth, the VAR estimation results are from Equation (3) and (4). Based on Equation (3), the higher the interest rate, inflation, the cost of stimulating economic growth, and the depreciation of exchange rate changes, the more difficult it is for the government to strive for the primary balance/GDP ratio to achieve a surplus or at least reduce a deficit. In addition, fiscal sustainability is achieved when the debt/GDP ratio gives a positive response to the primary balance/GDP ratio for several previous periods (such as b_{t-1}, b_{t-2}, b_{t-4}, and b_{t-6}). Then, based on the estimation of model Equation (4), these macroeconomic variables become the relative costs for the government to maintain the debt/GDP ratio. Both models convey the same message: striving for a primary balance/GDP ratio to achieve a surplus or reduce a deficit and maintaining a debt/GDP ratio are necessary to maintain fiscal sustainability.

Based on the estimation results explained, the authors suggest that the government needs to be careful in managing debt by implementing good risk management to support the state budget, which is currently in deficit. The government also needs to pay attention to macroeconomic developments, such as interest rates, economic growth, inflation, and exchange rate changes, because these variables can affect the quality of spending originating from the state budget and the quality of managing state debt. Therefore, to maintain fiscal sustainability, debt management needs to be done as well as possible so that the burden on the government's budget does not get bigger or exacerbate the deficit.

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