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Fiscal Sustainability in Indonesia with Asymmetry

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Abstract

The management of fiscal balance determines public debt sustainability, where a positive response of primary balance towards the debt ratio indicates a sustainable path. However, there might be asymmetry in the government's fiscal management between different phases of the debt trajectory and business cycle. This study examines the sustainability of fiscal imbalance and public debt in Indonesia using the fiscal reaction function with annual fiscal data from 1976 to 2019. We incorporate asymmetry by decomposing the lagged debt ratio and cyclical output variables into their positive and negative partial sums. We find that Indonesia's fiscal imbalance is on a path of weak sustainability as revenue grows more slowly than expenditure in the long run, with the bi-directional Granger causality between the two indicating fiscal synchronization. Long-run public debt sustainability is on a more sustainable path as primary surplus responds positively to the debt ratio. However, our asymmetric analysis suggests that this might be a false impression as primary balance decreases only in response to debt ratio decrease but increases less or fails to increase when the debt ratio rises, which is potentially dangerous.

Keywords: debt sustainability; fiscal imbalance; fiscal reaction function; policy asymmetries

JEL classifications: E620; H620; H630

1. Introduction

The management of fiscal balance crucially determines public debt sustainability, which is a long-standing fiscal challenge for Indonesia. Since the debt ratio worsened during the Asian Financial Crisis, Indonesia has instituted various reforms to improve fiscal management, including the 2003 State Financial Law, which imposes a maximum limit of debt-to-GDP ratio at 60% and budget deficit at 3%. The debt ratio has reversed and stayed well below the threshold since then, though it has been argued that Indonesia's safe debt limit should be lower (Fournier & Bétin 2018; Figure 1). While the headline fiscal deficit remains below the official limit, the primary balance has turned from surplus to deficit since 2011. The persistence of the primary deficit in the following years reflects a policy shift towards greater spending despite the struggle to improve Indonesia's comparatively low tax ratio.

Fiscal condition is also susceptible to significant shocks, which disrupt the fiscal balance in the short run although it may adjust in the long run. Therefore, understanding Indonesia's path of fiscal and debt sustainability will assist in assessing the country's ability to overcome various shocks in the future. This analysis is especially relevant to the COVID-19 crisis, which is expected to hike the debt ratio to around 40% for a while. Indonesia's historical path of fiscal sustainability could help inform the effectiveness of past fiscal response measures prior to determining the relevant approach during the new normal level of debt ratio post-COVID-19.

A number of studies have assessed Indonesia's fiscal sustainability and found various results, notably under a symmetric framework. Marks (2004) uses the single indicator of the 'one-period primary gap,' which measures the gap between the actual

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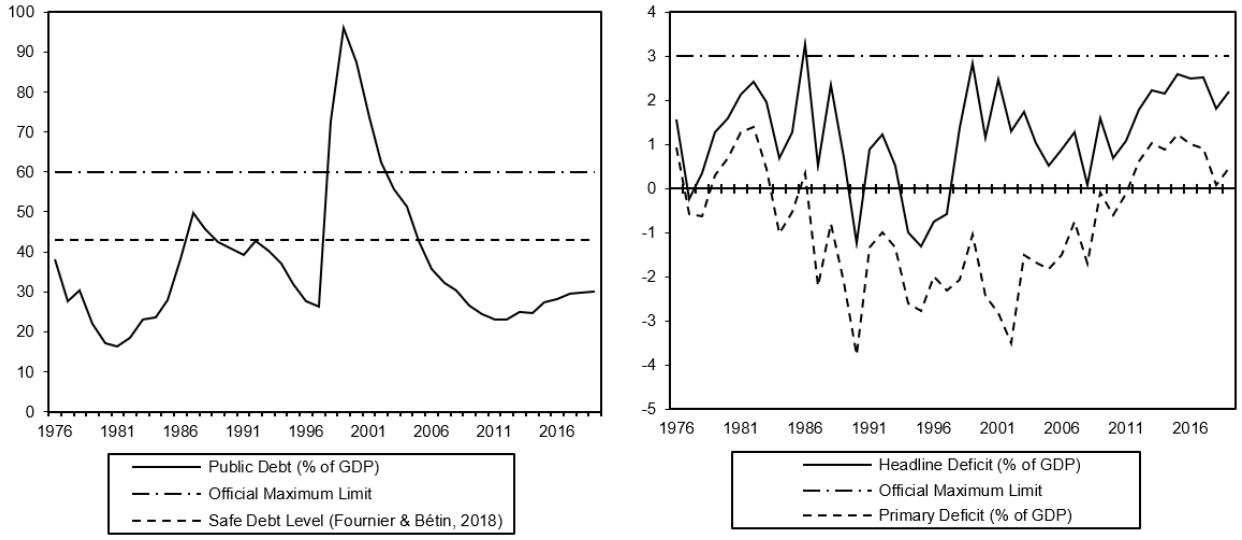

Figure 1. Indonesia's Public Debt and Fiscal Imbalance from 1976 to 2019

augmented primary surplus with the debt-stabilizing augmented primary surplus. The study finds that Indonesia's fiscal position was sustainable for most of the 1991–2003 period although the indicator is highly sensitive to yearly changes in the economic condition. The IMF regularly publishes its debt sustainability analysis of Indonesia, which also reports risks based on stress tests (IMF 2019). In addition to these mechanistic approaches, other studies have employed econometric estimation to analyze Indonesia's fiscal sustainability. Simanjuntak & Panjaitan (2007) apply the Branson model and conclude that fiscal condition became unsustainable after the Asian Financial Crisis. However, their data only cover up to 2001 before substantial fiscal reforms were implemented. Lestari (2014) and Pamungkas (2016) estimate Indonesia's fiscal reaction function with more recent data and reported weak sustainability of public debt, with primary balance responding positively but mildly to the debt-to-GDP ratio.

These studies are yet to address potential asymmetry in the government's fiscal management. The government may implement fiscal policy asymmetrically due to different incentives arising between different business cycle phases or the public debt trajectory. Rathnayake (2020) discovers that Sri Lanka has been implementing fiscal consolidation asymmetrically only when the debt ratio is on the rise. Neglecting this asymmetry also risks misrepresenting fiscal management's sustainability if the positive response of primary balance to the debt ratio is only driven by reaction to change in one direction. This could have misleading policy implications if actual developments are on the reverse, forcing the government to reform its approach and depart from the historical long-run path.

This study examines the sustainability of fiscal imbalance and public debt in Indonesia using the fiscal reaction function. First, we estimate fiscal imbalance sustainability by estimating one form of the government intertemporal budget constraint using the regular ARDL. Second, we test the sustainability of public debt by estimating a fiscal reaction function using both the regular ARDL and the nonlinear ARDL (NARDL) models to account for possible asymmetries. We find that the government's fiscal imbalance is on a path of weak sustainability as revenue grows more slowly than expenditure in the long run, with the causal nexus between the two indicating fiscal synchronization. Long-run public debt sustainability is on a more sustainable path as primary surplus responds positively to the debt ratio. However, our asymmetric analysis suggests

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that this might be a false impression, as primary balance decreases in response to reducing the debt ratio but fails to increase when the debt ratio rises. As the COVID-19 crisis ushers in a new phase of higher debt ratios, our results affirm that the fiscal authority would need to respond to debt ratio increases more aggressively than in the past as soon as the economy has reverted to normal.

This paper proceeds as follows. Section 2 reviews some theoretical and empirical literature on fiscal sustainability assessment models. Section 3 outlines the data and the econometric methodology employed. Section 4 presents and discusses the results, while section 5 concludes.

2. Literature Review

Models to assess fiscal sustainability are generally based on the government intertemporal budget constraint. It starts with an identity that equates the net issuance of debt with interest payments minus the primary balance and seignorage (Burnside 2005). As we focus on the fiscal aspect, we can assume that there is no seignorage and rearrange the identity into an equation that shows the relationship between government revenue and expenditure.

$$\mathrm{D_t} - \mathrm{D_{t-1}} = \mathrm{D_{t-1}r_t} - (\mathrm{R_t} - \mathrm{Gx_t}) - (\mathrm{M_t} - \mathrm{M_{t-1}}) \quad (1)$$

$$\mathrm{Gx_t} + (1 + \mathrm{r_t})\mathrm{D_{t-1}} = \mathrm{R_t} + \mathrm{D_t} \quad (2)$$

where $\mathrm{D_t}$ is government debt ratio, $\mathrm{r_t}$ is the real interest rate, $\mathrm{R_t}$ is government revenue, $\mathrm{Gx_t}$ is government expenditure excluding interest payments, and $\mathrm{M_t}$ is the monetary base, all at time t.

Following Hamilton & Flavin (1986), the fiscal sustainability condition is obtained by applying a recursive iteration to eq. (3) to yield the equation of motion for fiscal policy.

$$\mathrm{D_0} = \sum_{\mathrm{t}=1}^{\infty} \delta_{\mathrm{t}}(\mathrm{R_t} - \mathrm{Gx_t}) + \lim_{\mathrm{n}\to\infty} \delta_{\mathrm{n}}\mathrm{D_n} \quad (3)$$

where $\delta_{\mathrm{t}} = \prod_{\mathrm{s}=1}^{\mathrm{t}} 1/(1 + \mathrm{r_s})$ is the discount factor. The limit term on the right-hand side denotes whether government debt rises faster on average than the interest rate. Fiscal policy is sustainable if this term is equal to zero, a condition typically dubbed the "present value budget constraint" or the "no-Ponzi game" transversality condition.

The literature has used various transformations of the government intertemporal budget constraint for empirical testing. Several past studies check fiscal imbalance sustainability by adapting it into a cointegration equation for government revenue and expenditure.

$$\mathrm{R_t} = \mathrm{c_0} + \beta_1 \mathrm{G_t} + \varepsilon_{1\mathrm{t}} \quad (4)$$

The equation denotes how much government revenue grows in response to a rise in expenditure. Based on this relation, the fiscal deficit is strongly sustainable if $\beta_1 = 1$, weakly sustainable if $0 < \beta_1 < 1$, and not sustainable if $\beta_1 = 0$. The fiscal deficit is either weakly sustainable or strongly sustainable for the United States, depending on the period as determined by estimated breakpoints (Hakkio & Rush 1991; Haug 1991; Quintos 1995; Trehan & Walsh 1988). Meanwhile, Baharumshah & Lau (2007) assess the deficit sustainability of five Asian countries, finding strong sustainability for Thailand and South Korea and weak sustainability for the Philippines and Malaysia, while Singapore is on a path of fiscal surplus ($\beta_1 > 1$). Following the same framework, Rathnayake (2020) reports that Sri Lanka's deficit is weakly sustainable.

Related to cointegration is the causality nexus between government revenue and expenditure. Baharumshah & Lau (2007) outline that Granger causality between the two variables reflects four hypotheses from the fiscal literature: (i) one-way causation from expenditure to revenue indicates 'spend and tax' dynamics; (ii) one-way causation from revenue to expenditure indicates 'tax and spend' dynamics; (iii) two-way causality reflects fiscal synchronization; and (iv) no causality means neutrality between the two, which may hint at sustainability problems. This approach reports that Singapore,

South Korea, and Thailand exhibit 'spend and tax' behavior while Malaysia and the Philippines display fiscal synchronization. Rathnayake (2020) also finds bidirectional causality in the case of Sri Lanka. It should be noted that the countries with fiscal synchronization are also on a weakly sustainable path of fiscal imbalance from the cointegration analysis.

Fiscal sustainability assessments then analyze how fiscal imbalance affects the stock of public debt, in which the fiscal reaction function is the latest emerging framework from recent literature. Bohn (1995) introduces a reaction function for the primary balance towards the debt-to-GDP ratio with the following form

$$\mathrm{s_t} = \rho \mathrm{d_t} + \alpha \mathrm{Z_t} + \varepsilon_\mathrm{t} \tag{5}$$

where $\mathrm{s_t}$ is the primary surplus at time t. The fiscal policy feedback rule states that public debt's fiscal management is sustainable if the primary balance responds positively to public debt, which Bohn finds to be the United States' case. This model has the advantage of being stochastic and modifiable with alternative specifications that allow for asymmetries, such as non-linearity (Bohn 1998) and regime-switching (Afonso 2008; Aldama & Creel 2019; Ricci-Risquete, Ramajo & de Castro 2016). Rathnayake (2020) introduces asymmetry by including positive and negative-sum decompositions based on the nonlinear ARDL analysis developed by Shin to distinguish fiscal reaction between different business cycle phases and public debt trajectory. The study discovers that Sri Lanka's fiscal policy suffers from asymmetry as debt stabilization is only pursued when the debt ratio is rising or when the economy is expanding.

Among the various studies that assess Indonesia's fiscal sustainability, only a few have employed the fiscal reaction function. Lestari (2014) uses the vector error correction model to estimate fiscal policy response to debt with annual data from 1992 to 2012 and finds that a one percent increase in the debt-to-GDP ratio leads to a 0.046 increase in the primary balance-to-GDP ratio the next year. Pamungkas (2016) estimates Indonesia's Bohn fiscal reaction function using ARDL with quarterly data, with additional determinants for the primary balance, including inflation, real interest rate, exchange rate, oil price, as well as dummies for elections and financial crises. The result affirms that Indonesia adheres to sustainable fiscal management in which primary balance responds positively to the debt-to-GDP ratio. Both studies find a positive coefficient estimate for the output variable in terms of cyclicality, indicating that Indonesia's fiscal policy is procyclical, although it is not statistically significant in the latter study. Nevertheless, these results should be scrutinized as they have not accounted for possible asymmetries in Indonesia's fiscal management.

3. Method

Our data encompasses annual fiscal data for the period of 1976–2019. Time series of government revenue, government expenditure, and primary balance is obtained from budget summaries published by the Ministry of Finance. Nominal GDP data is taken from BPS, public debt to GDP ratio from IMF, and GDP price deflator from the World Bank. The nominal series is deflated using the consumer price index (CPI) into real GDP following Baharumshah & Lau (2007). The result is not materially different from constant price GDP based on the GDP deflator. For cyclicality calculation, trend values are obtained by applying the Hodrick-Prescott filter.

The empirical assessment is divided into fiscal imbalance and public debt, following Rathnayake (2020). The fiscal imbalance sustainability assessment involves estimating the causality nexus between expenditure revenue using the Toda-Yamamoto non-causality test, which allows different integration orders and revenue response to expenditure using asymmetric ARDL. The steps are as follow (1) unit root test to check the order of integration; (2) Gregory-Hansen cointegration test to test cointegration and identify years of structural break; (3) Toda-Yamamoto Granger test to check for Granger causality between government revenue

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and expenditure; and (4) symmetric ARDL estimation using the conditional error correction form. The general ARDL form and its transformation for this model are as follows

$$\mathrm{R_t} = \mathrm{c_0} + \sum_{\mathrm{j}=1}^{\mathrm{p_1}} \alpha_{\mathrm{j}} \mathrm{R_{t-j}} + \sum_{\mathrm{j}=0}^{\mathrm{q_1}} \beta_{\mathrm{j}} \mathrm{G_{t-j}} + \varepsilon_{3\mathrm{t}} \quad (6)$$

$$\begin{aligned} \Delta \mathrm{R_t} &= \mathrm{c_0} + \gamma_1 \mathrm{R_{t-1}} + \theta_1 \mathrm{G_{t-1}} + \sum_{\mathrm{j}=1}^{\mathrm{p_1}-1} \varphi_{1\mathrm{j}} \Delta \mathrm{R_{t-j}} \\ &\quad + \sum_{\mathrm{j}=0}^{\mathrm{q_1}-1} \varphi_{2\mathrm{j}} \Delta \mathrm{G_{t-j}} + \varphi_3 \mathrm{dummy_t} + \varepsilon_{3\mathrm{t}} \quad (7) \end{aligned}$$

where α_{j} is a scalar and β_{j} is a row vector of regressors where $\mathrm{j} = 0, 1, \ldots, \mathrm{k}$ and $\varepsilon_{3\mathrm{t}}$ is a random disturbance term. For the second equation, of interest is the long-run coefficient for expenditure $\beta_{\mathrm{j}} = -\frac{\theta_1}{\gamma_1}$ where $\theta_1 = \sum_{\mathrm{j}=0}^{\mathrm{q_1}} \beta_{\mathrm{j}}$, with $\gamma_1 = -(1 - \sum_{\mathrm{j}=1}^{\mathrm{p_1}} \alpha_{\mathrm{j}})$ being the speed of adjustment parameter.

The second part of public debt sustainability runs a similar ARDL model for primary surplus response to a debt-to-GDP ratio based on Eq. 5. The equation is added with an unrestricted intercept and a restricted time trend with the following general form and transformation:

$$\begin{aligned} \mathrm{s_t} &= \mathrm{c_1} + \mathrm{c_2 trend} + \sum_{\mathrm{j}=1}^{\mathrm{p_2}} \tau_{\mathrm{j}} \mathrm{s_{t-j}} + \sum_{\mathrm{j}=0}^{\mathrm{q_2}} \rho_{\mathrm{j}} \mathrm{d_{t-j}} \\ &\quad + \sum_{\mathrm{j}=0}^{\mathrm{q_3}} \sigma_{1\mathrm{j}} \mathrm{Yvar_{t-j}} + \sum_{\mathrm{j}=0}^{\mathrm{q_4}} \sigma_{2\mathrm{j}} \mathrm{Gvar_{t-j}} \\ &\quad + \varepsilon_{4\mathrm{t}} \quad (8) \end{aligned}$$

$$\begin{aligned} \Delta \mathrm{s_t} &= \mathrm{c_1} + \mathrm{c_2 trend} + \gamma_2 \mathrm{s_{t-1}} + \theta_2 \mathrm{d_{t-1}} \\ &\quad + \theta_3 \mathrm{Yvar_{t-1}} + \theta_4 \mathrm{Gvar_{t-1}} \\ &\quad + \sum_{\mathrm{j}=1}^{\mathrm{p_2}-1} \varphi_{4\mathrm{j}} \Delta \mathrm{s_{t-j}} + \sum_{\mathrm{j}=1}^{\mathrm{q_2}-1} \varphi_{5\mathrm{j}} \Delta \mathrm{d_{t-j}} \\ &\quad + \sum_{\mathrm{j}=0}^{\mathrm{q_3}-1} \varphi_{6\mathrm{j}} \Delta \mathrm{Yvar_{t-j}} + \sum_{\mathrm{j}=0}^{\mathrm{q_4}-1} \varphi_{7\mathrm{j}} \Delta \mathrm{Gvar_{t-j}} \\ &\quad + \varphi_8 \mathrm{dummy_t} + \varepsilon_{4\mathrm{t}} \quad (9) \end{aligned}$$

where τ_{j} is a scalar and ρ_{j}, $\sigma_{1\mathrm{j}}$ and $\sigma_{2\mathrm{j}}$ are row vectors of regressors where $\mathrm{j} = 0, 1, \ldots, \mathrm{k}$ and $\varepsilon_{4\mathrm{t}}$ is a random disturbance term. The speed of adjustment parameter is $\gamma_1 = -(1 - \sum_{\mathrm{j}=1}^{\mathrm{p_1}} \alpha_{\mathrm{j}})$. For the second equation, of interest is the long-run coefficient for debt-to-GDP ratio $\rho = -\frac{\theta_2}{\gamma_2}$ where $\theta_2 = \sum_{\mathrm{j}=0}^{\mathrm{q_2}} \rho_{\mathrm{j}}$, for cyclical output $\sigma_1 = -\frac{\theta_3}{\gamma_2}$ where $\theta_3 = \sum_{\mathrm{j}=0}^{\mathrm{q_3}} \sigma_{1\mathrm{j}}$, and for expenditure cycles $\sigma_2 = -\frac{\theta_4}{\gamma_2}$ where $\theta_4 = \sum_{\mathrm{j}=0}^{\mathrm{q_4}} \sigma_{2\mathrm{j}}$.

Finally, we incorporate asymmetry into the estimation by decomposing the lagged debt ratio and cyclical output variables into their positive and negative partial sums, based on Shin, Yu & Greenwood-Nimmo (2014). The NARDL (pi, qi) specification, decomposition, and transformation are as follows:

$$\begin{aligned} \mathrm{s_t} &= \rho^+ \mathrm{d_t^+} + \rho^- \mathrm{d_t^-} + \sigma_1^+ \mathrm{Yvar_t^+} + \sigma_1^- \mathrm{Yvar_t^-} \\ &\quad + \sigma_1^- \mathrm{Yvar_t^-} + \sigma_2 \mathrm{Gvar_t} + \varepsilon_{5\mathrm{t}} \quad (10) \end{aligned}$$

$$\begin{aligned} \mathrm{s_t} &= \sum_{\mathrm{j}=1}^{\mathrm{p_3}} \phi_{\mathrm{j}} \mathrm{s_{t-j}} + \sum_{\mathrm{j}=0}^{\mathrm{q_5}} (\delta_{1\mathrm{j}}^+ \mathrm{d_{t-j}^+} + \delta_{1\mathrm{j}}^- \mathrm{d_{t-j}^-}) \\ &\quad + \sum_{\mathrm{j}=0}^{\mathrm{q_6}} (\delta_{2\mathrm{j}}^+ \mathrm{Yvar_{t-j}^+} + \delta_{2\mathrm{j}}^- \mathrm{Yvar_{t-j}^-}) \\ &\quad + \sum_{\mathrm{j}=0}^{\mathrm{q_7}} \delta_{3\mathrm{j}}^+ \mathrm{Gvar_{t-j}} + \varepsilon_{5\mathrm{t}} \quad (11) \end{aligned}$$

$$\begin{aligned} \Delta \mathrm{s_t} &= \mathrm{c_3} + \gamma_3 \mathrm{s_{t-1}} + \theta_5^+ \mathrm{d_{t-1}^+} + \theta_5^- \mathrm{d_{t-1}^-} \\ &\quad + \theta_6^+ \mathrm{Yvar_{t-1}^+} + \theta_6^- \mathrm{Yvar_{t-1}^-} + \\ &\quad + \theta_7 \mathrm{Gvar_{t-1}} + \sum_{\mathrm{j}=1}^{\mathrm{p_3}-1} \omega_{\mathrm{j}} \Delta \mathrm{s_{t-j}} \\ &\quad + \sum_{\mathrm{j}=0}^{\mathrm{q_5}-1} (\emptyset_{1\mathrm{j}}^+ \Delta \mathrm{d_{t-j}^+} + \emptyset_{1\mathrm{j}}^- \Delta \mathrm{d_{t-j}^-}) \\ &\quad + \sum_{\mathrm{j}=0}^{\mathrm{q_6}-1} (\emptyset_{2\mathrm{j}}^+ \Delta \mathrm{Yvar_{t-j}^+} + \emptyset_{2\mathrm{j}}^- \Delta \mathrm{Yvar_{t-j}^-}) \\ &\quad + \sum_{\mathrm{j}=0}^{7-1} \emptyset_{3\mathrm{j}}^{\Delta} \mathrm{Gvar_{t-j}} + \varepsilon_{5\mathrm{t}} \quad (12) \end{aligned}$$

where $\omega_{\mathrm{j}} = -\sum_{\mathrm{i}=\mathrm{j}+1}^{\mathrm{p_3}} \phi_{\mathrm{i}}$ for $\mathrm{j} = 1, ..., \mathrm{p_3} - 1$; $\theta_5^+ = \sum_{\mathrm{j}=0}^{\mathrm{q_5}} \delta_{1\mathrm{j}}^+$; $\theta_5^- = \sum_{\mathrm{j}=0}^{\mathrm{q_5}} \delta_{1\mathrm{j}}^-$; $\theta_6^+ = \sum_{\mathrm{j}=0}^{\mathrm{q_6}} \delta_{2\mathrm{j}}^+$; $\theta_6^- = \sum_{\mathrm{j}=0}^{\mathrm{q_6}} \delta_{2\mathrm{j}}^-$; and $\theta_7 = \sum_{\mathrm{j}=0}^{\mathrm{q_7}} \delta_{3\mathrm{j}}$. The speed of adjustment parameter is $\gamma_3 = -(1 - \sum_{\mathrm{j}=1}^{\mathrm{p_3}} \emptyset_{\mathrm{j}})$. The coefficients of interest are $\rho^+ = -\frac{\theta_5^+}{\gamma_3}$ for increas-

ing debt ratio and $\rho^- = -\frac{\theta_5^-}{\gamma_3}$ for decreasing the debt ratio. To test asymmetry from the NARDL results, we conduct a bounds test with the hypotheses: $\rho^+ = \rho^-$ for the long-run reaction to the debt ratio and $-\frac{\theta_6^+}{\gamma_3} = -\frac{\theta_6^-}{\gamma_3}$ for the long-run reaction to cyclical output. As a preliminary estimation for this asymmetric model, we also run NARDL but with only the debt ratio variable decomposed into its positive and negative partial sums, restricting both cyclical output and expenditure as symmetric. Standard diagnostics tests including joint significance F-test, cointegration test, and Jarque-Bera test on normality are conducted to check for dynamic stability and other assumptions. To illustrate the asymmetric fiscal reaction, we also plot the dynamic multiplier effect of the variables. This shows the cumulative sums of each variable's partial effect, for positive and negative changes separately, on primary balance to GDP each year, with 95% confidence interval from 100 bootstrap replications.

4. Result

4.1. Fiscal Imbalance Sustainability

The ADF unit root test (Table 1) indicates that real government revenue and expenditure are I(1) series. The results are consistent when using the KPSS stationarity test. This result directs us to apply the Gregory-Hansen test to establish cointegration with structural breaks. By estimating VAR and checking the lag length criteria, it is suggested that two lags are optimal for both of the variables.

The Gregory-Hansen cointegration test result (Table 2) offers evidence of cointegration between government revenue and expenditure. The null hypothesis of no cointegration is rejected in all three models. The result from the Johansen Cointegration Test, which does not consider structural breaks and overlooks the order of integration, confirms cointegration at the 10% significance level. This cointegration relationship between revenue and expenditure means estimating Eq. (6) and (7) to test the fiscal imbalance sustainability condition. The result also indicates the strongest structural break in 2011, which will be included as a binary step dummy variable in the subsequent analysis. The regime shift corresponds to the increase in fiscal imbalance after the year 2010, marking the government's turn towards less conservative fiscal policy.

Next, the Toda-Yamamoto causality test result presented in Table 3 indicates bi-directional Granger causality between government revenue and expenditure. The null hypothesis of no Granger causality is rejected at the 5% significance level for both revenues towards expenditure and expenditure towards revenue. This result implies fiscal synchronization, in which the government makes simultaneous decisions on expenditures and revenues. It reflects the government's prudence as it considers revenue realization in making spending decisions. At the same time, the government also determines its tax policy based on past expenditures to ensure that future revenues are adequate to finance its deficits. The Granger causality from expenditure to revenue might also bespeak the government's confidence that fiscal expansion could yield future tax revenue gains. Indonesia's case is not unique among Asian countries; Granger causality results for Malaysia, the Philippines, and Sri Lanka also suggest fiscal synchronization (Baharumshah & Lau 2007; Rathnayake 2020). This contrasts with Singapore, South Korea, and Thailand, where fiscal policy leans more towards the spend and tax hypothesis, reflecting the government's more developed capacity in generating tax revenues to finance the planned spending. Note that the causality result does not necessarily indicate sustainability, though it serves as a useful indicator for historical fiscal dynamics.

The symmetric ARDL estimation shown in Table 4 suggests that Indonesia's fiscal imbalance is on a weak sustainability path. The long-run coefficient estimate of expenditure is significant with a magnitude of 0.922, suggesting that for every Rp1.000,- rupiah increase in expenditure, revenue increases by only Rp922,- rupiah. In other

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Table 1. ADF Unit Root Test Results

	Level		First Difference	
	Intercept	Intercept and Trend	Intercept	Intercept and Trend
Real Government Revenue	0.176	-2.295	-8.566***	-8.683***
Real Government Expenditure	0.907	-1.637	-7.505***	-7.880***
Primary balance-to-GDP	-2.595	-2.640	-8.641***	-6.675***
Headline deficit-to-GDP	-3.772***	-3.946**	-9.290***	-9.166***
Debt-to-GDP	-2.926**	-2.862	-4.754***	-4.700***
Yvar	-5.877***	-5.800***	-7.079***	-6.985***
Gvar	-6.127***	-6.149***	-6.807***	-6.673***

Table 2. Gregory-Hansen Cointegration Test Results

Model	Test Statistic	BreakPoint
Level Shift (GH_C)		
ADF	-4.557055*	1992
Zt	-5.357071***	2011
Za	-35.35472	2011
Level Shift with Trend (GH_C/T)		
ADF	-5.116698**	2004
Zt	-5.357538**	2011
Za	-35.36926	2011
Regime Shift (GH_C/S)		
ADF	-5.050992**	2004
Zt	-5.551843***	2006
Za	-36.71933	2006

Table 3. Toda-Yamamoto Granger Non-Causality Test Results

Null hypothesis	Chi-sq	p-value	Decision
Government expenditure does not Granger cause government revenue	16.01882	0.0137	Rejects null
Government revenue does not Granger cause government expenditure	12.76335	0.0470	Rejects null

words, revenue grows more slowly than government expenditure, which perpetuates a weakly sustainable fiscal deficit. The implication is that public debt's undiscounted value does not tend to zero in the long run (Rathnayake 2020).

In addition to the main results, it is found that the binary step dummy marking the years 2011–2019 is significant with a negative value. This suggests a negative level shift of government revenue after that point, which warrants further investigation. This structural break happens to closely coincide with the change of the Finance Minister in mid-2010. Panel A from Figure 2 shows that real government revenue began to falter behind expenditure since 2011, leading to a substantially increased deficit in absolute terms. Finally, the error correction term's estimated coefficient implies that government revenue would adjust 60.4% per year back to the long-run steady-state after a disturbance. This long-run relationship is supported by the F-statistic, which is significant at a 1% level.

4.2. Public Debt Sustainability

4.2.1. Symmetric ARDL Estimation

The symmetric ARDL estimation for the sustainability of Indonesia's public debt path, which concerns public debt and primary surplus, gives a more positive view of Indonesia's fiscal management. Table 5 presents this estimation. In the long run, the sufficient condition for fiscal balance is fulfilled as the coefficient for lagged debt is positive and statistically significant, meaning that primary balance to GDP improves in response to an increase in the debt-to-GDP ratio. This could explain how Indonesia has managed to contain its debt-to-GDP ratio fluctuating around the same level, apart from

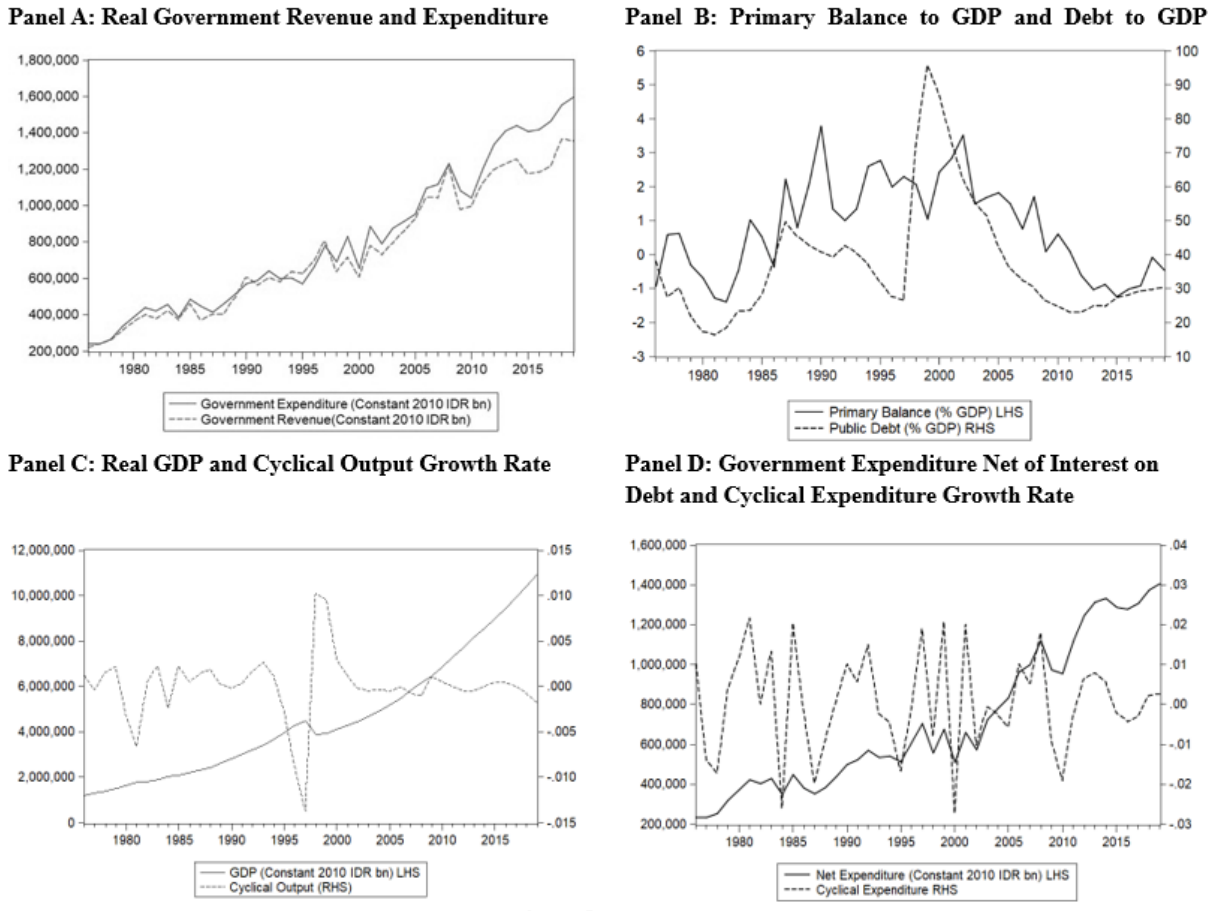

Figure 2. Time Series Plot of the Main Variables

the spike during the Asian Financial Crisis.[1] The magnitude of 0.048 in primary balance response is close to the 0.046–0.047 range in past studies (Lestari 2014; Pamungkas 2016). This implies that our finding is higher than the range of estimates for several emerging countries, which are reported at 0.016-0.040 by multiple studies (Asiama, Akosah & Owusu-Afriyie 2014; Burger et al. 2012; De Mello 2008; Mendoza & Ostry 2008).

Apart from the qualitative assessment, the magnitude of the government's fiscal policy response also seems to satisfy fiscal sustainability. The equation for debt-stabilizing primary balance, derived from the intertemporal budget constraint in eq. (2), stipulates that public debt is sustainable if the fiscal policy response parameter exceeds the ratio $\frac{(r-g)}{(1+g)}$. Figure 3 shows an estimate of this ratio over the sample period, calculated using the government's effective interest rate as a proxy for r since government bond yields were not available in earlier years. The government's fiscal response parameter of 0.048 is higher than the ratio in all years except during the Asian Financial Crisis in 1998–1999 when growth plunged to negative territory. This affirms how the government has been able to keep the debt ratio at relatively healthy levels. Although

[1] Indonesia's central government debt-to-GDP ratio rose dramatically from its pre-crisis level at 26% in FY1996/1997 to a peak at 96% in FY1999/2000. Aside from crisis-struck GDP on the denominator side, Indonesia faced large fiscal pressures, such as the depreciation of the exchange rate, falling tax revenues, declining oil prices, and escalating bank restructuring costs (Harvie 2000). Rosengard (2004) noted the issuance of Rp740 trillion of government bonds (around two-thirds of the 1999 GDP) to cover various bank support costs.

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Table 4. Symmetric ARDL Estimation Results for Fiscal Imbalance Sustainability (Dependent Variable: Government Revenue)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Long-run estimations				
Expenditure	0.922***	0.026	35.318	0.000
Short-run estimations				
2011 Step Dummy	-66297.860***	19653.020	-3.373	0.002
Constant	3314.007	8153.647	0.406	0.687
ECT	-0.604***	0.118	-5.131	0.000
R-squared	0.887	Mean dependent var		28183.910
Adjusted R-squared	0.875	S.D. dependent var		70802.140
S.E. of regression	25025.640	Akaike info criterion		23.202
Sum squared resid	2.38E+10	Schwarz criterion		23.407
Log-likelihood	-493.846	Hannan-Quinn criteria.		23.278
F-statistic	74.545	Durbin-Watson stat		2.472
Prob(F-statistic)	0.000			

Table 5. Symmetric ARDL Estimation Results for Public Debt Sustainability (Dependent Variable: Primary Surplus)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Long-run estimations				
Lagged debt	0.048***	0.017	2.869	0.007
Yvar	-81.813	71.831	-1.195	0.240
Gvar	-7.807	16.098	-0.485	0.631
Trend	0.014	0.027	0.520	0.606
Short-run estimations				
2011 Step Dummy	-1.092	0.666	-1.640	0.110
Constant	-0.585	0.451	-1.295	0.204
ECT	-0.678***	0.155	-4.382	0.000
R-squared	0.386	Mean dependent var		0.011
Adjusted R-squared	0.283	S.D. dependent var		1.020
S.E. of regression	0.864	Akaike info criterion		2.693
Sum squared resid	26.851	Schwarz criterion		2.979
Log-likelihood	-50.890	Hannan-Quinn criteria.		2.798
F-statistic	3.765	Durbin-Watson stat		2.011
Prob(F-statistic)	0.005			

this estimate promises public debt sustainability for Indonesia, we have not considered potential asymmetry, which is to be discussed shortly.

Apart from the response to debt, there is a lack of evidence regarding Indonesia's fiscal stance's cyclicality. Despite not being statistically significant, the coefficient for cyclical output Yvar is positive, suggesting procyclicality. Abdurohman & Resosudarmo (2017) found that Indonesia's fiscal policy for the period 1970–2009 tended to be procyclical. This is not unique to Indonesia, with Singapore possibly being the only country in ASEAN able to exercise fiscal policy countercyclically. Talvi & Végh (2005) also observed fiscal procyclicality in a wider sample of developing countries, which they attribute to pressures for public spending and fluctuating tax base. However, the lack of statistical significance in our result might reflect how Indonesia's fiscal policy approach has undergone shifts throughout the past four decades. There have been several political regimes and changing macroeconomic conditions with various cyclicalities in fiscal reaction. It might also allude to possible asymmetry in fiscal policy reaction to the business cycle.

The binary step dummy indicates a negative level shift in the primary balance to GDP ratio since 2011, in line with the result from Model 1, but it is not statistically significant. On the other hand, the error coefficient term is statistically significant, suggesting that short-run disequilibrium in the primary balance is corrected at the speed of 67.8% per year.

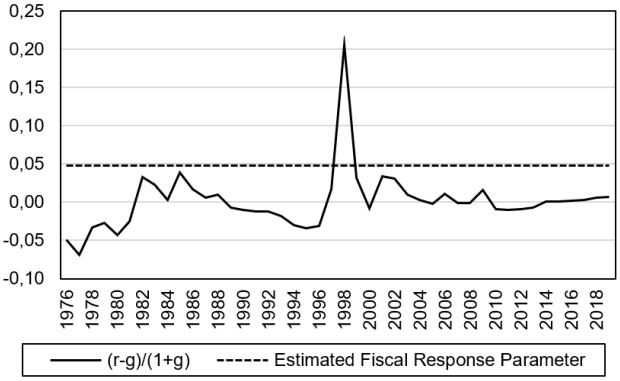

Figure 3. Indonesia's (r-g)/(1+g) ratio, 1976–2019

4.2.2. Asymmetric NARDL Estimation

The NARDL estimation reveals asymmetries in the long-run implementation of fiscal management in Indonesia. We start with a preliminary NARDL estimation where only the debt ratio is decomposed into its positive and negative partial sums. Table 6 displays the result, which shows that fiscal reaction to debt ratio is mostly symmetric in terms of statistical significance. Although the coefficient magnitude cannot be compared with the previous ARDL results due to different model specifications, it seems to affirm that the primary balance responds positively to the debt-to-GDP level both when it rises and falls. Meanwhile, the other variables of cyclical output, cyclical expenditure and now the step dummy are not statistically significant. However, the symmetric positive reaction to debt ratio suggested by this preliminary NARDL estimation should not be considered the final verdict as we have not included the possibility of an important asymmetry in our model, which is asymmetric reaction to cyclical output.

An NARDL model with asymmetric reaction to cyclical output should be a more accurate representation of the Indonesian government's fiscal reaction function, which may not symmetrically respond to the business cycle due to the political economy of fiscal policy among other factors. For example, it is common for the government to deploy fiscal stimulus during economic downturns without phasing them out when the economy improves, for reasons such as the populace growing too dependent and political opportunism, as in the case of energy subsidies. At the same time, Indonesia's persistently low tax ratio hinders cyclical improvements in the primary balance. On the other hand, it is also possible that prudent fiscal balance is maintained throughout the business cycle due to the narrow tax base. Mixed evidence of Indonesia's fiscal cyclicality from previous studies also hints at possible asymmetries in the government's fiscal reaction to cyclical output.

Table 7 shows the results of the full NARDL model with both the debt ratio and cyclical output treated as asymmetric. It turns out that when we consider asymmetries more comprehensively, primary surplus only responds positively to a decrease in the debt-to-GDP level, but not to its increase. In the long-run, the government appropriately loosens its fiscal stance when debt-to-GDP decreases but fails to increase its primary surplus when debt-to-GDP increases. This asymmetry is confirmed with the Wald test statistics. The null hypothesis of a long-run summative symmetric relationship between primary balance and debt is rejected at a 5% significance level. This result adds an important caveat to the previous finding of a sustainable public debt path from the symmetric ARDL estimation and the NARDL estimation with no cyclical output asymmetry. Indonesia's sustainable debt path seems to be driven by fiscal expansion during decreases in debt-to-GDP levels, mostly in the period of 2000–2011. Meanwhile, since 2012, debt-to-GDP has been on

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Table 6. NARDL Estimation Results for Public Debt Sustainability with Debt Ratio Asymmetry (Dependent Variable: Primary Surplus)

Long-run estimations					
Variable	Coefficient	F-stat	Variable	Coefficient	F-stat
Lagged debt +	0.104***	10.71	Lagged debt -	0.106***	9.356
Yvar	-78.555	0.407			
Gvar	-7.380	0.146			
Short-run estimations					
Variable	Coefficient	Std. Error	Variable	Coefficient	Std. Error
Primary Surplus (-1)	-0.638**	0.238			
Debt + (-1)	0.066**	0.026	Debt - (-1)	-0.068**	0.026
Yvar (-1)	-50.128	83.147	Gvar (-1)	-4.709	12.246
D(Primary Surplus (-1))	-0.139	0.205	D(Primary Surplus (-2))	-0.103	0.179
D(Debt +)	0.000	0.028	D(Debt -)	0.075	0.094
D(Debt + (-1))	-0.059	0.037	D(Debt - (-1))	0.010	0.077
D(Debt + (-2))	-0.030	0.034	D(Debt - (-2))	0.104	0.063
Constant	1.594***	0.566	2011 Step Dummy	-1.143	0.742
R-squared	0.741		Mean dependent var	0.844	
Adjusted R-squared	0.634		S.D. dependent var	1.407	
S.E. of regression	0.851		Akaike info criterion	2.765	
Sum squared resid	21.017		Schwarz criterion	3.302	
Log-likelihood	-45.056		Hannan-Quinn criteria.	2.962	
F-statistic	6.913		Durbin-Watson stat	1.946	
Prob(F-statistic)	0.000				

an upward trajectory and could threaten public debt sustainability if Indonesia does not substantially reform its fiscal management approach. Interestingly, this is the opposite of Rathnayake's (2020) finding in the case of Sri Lanka, where the fiscal authority consolidates in response to rising debt ratio but dawdles in the absence of such pressure.

In terms of fiscal policy cyclicality, the NARDL results again suggest procyclicality. However, the coefficient magnitudes, although short of statistical significance, imply that procyclicality might not be fully symmetric; the government prudently raises its primary balance during economic upcycles but relaxes it by a lesser amount when economic growth falls. This result might be influenced by the 1998 Asian Financial Crisis episode when fiscal policy was forced to tighten in response to the crisis instead of responding countercyclically. While some studies have indicated that Indonesia's fiscal policy has been procyclical, our results suggest that the long-term historical picture might also be subject to asymmetry. More recent experience seem to indicate that Indonesia's fiscal policy might become more countercyclical looking forward. The government's stimulus response to the COVID-19 crisis attests to this trend, going as far as suspending the deficit limit (however, the stimulus package could also be viewed as relatively restraint, since it is lower than many other countries as a percentage of GDP and is hindered by absorption issues). It also remains to be seen if the fiscal authority will maintain this extent of countercyclicality in less exceptional circumstances post-COVID-19.

Lastly, we illustrate the dynamics of Indonesia's asymmetric fiscal reaction by plotting the dynamic multiplier effects in Figure 4. This represents primary surplus's cumulative response to a one-unit shock of the variable. The first plot shows the sharp asymmetry in fiscal reaction to debt-to-GDP within the first two years. In response to a decrease in the debt ratio, the government is quick to relax its primary balance by a significant amount. On the other hand, the government improves its primary balance only modestly at the threat of rising public debt. In fact, fiscal expansion is still pursued in the second year after a positive debt ratio shock, where primary balance slightly decreases before returning to the new equilibrium. This dynamic response analysis suggests that the fiscal balance reaches its new equilibrium around four years after

Table 7. NARDL Estimation Results for Public Debt Sustainability with Debt Ratio and Cyclical Output Asymmetries
(Dependent Variable: Primary Surplus)

Long-run estimations					
Variable	Coefficient	F-stat	Variable	Coefficient	F-stat
Lagged debt +	0.115	2.115	Lagged debt -	0.121***	21.610
Yvar +	-241.249	1.044	Yvar -	-251.730	2.174
Gvar	-13.701	0.508			
Short-run estimations					
Variable	Coefficient	Std. Error	Variable	Coefficient	Std. Error
Primary Surplus (-1)	-0.944***	0.281	Gvar (-1)	-12.940	17.372
Debt + (-1)	0.109	0.074	Debt - (-1)	-0.114***	0.032
Yvar + (-1)	-227.852	218.946	Yvar - (-1)	-237.750	166.548
D(Primary Surplus (-1))	-0.058	0.222	D(Primary Surplus (-2))	-0.055	0.193
D(Debt +)	0.054	0.066	D(Debt -)	0.020	0.109
D(Debt + (-1))	-0.091	0.071	D(Debt - (-1))	0.064	0.091
D(Debt + (-2))	-0.148**	0.060	D(Debt - (-2))	0.140**	0.079
D(Yvar +))	-124.679	153.748	D(Yvar -)	-104.862	162.096
D(Yvar + (-1))	23.967	144.464	D(Yvar - (-1))	50.520	155.466
D(Yvar + (-2))	194.071	141.684	D(Yvar - (-2))	138.645	173.640
Constant	1.943*	0.058	2011 Step Dummy	-1.419	0.848
R-squared	0.785		Mean dependent var	0.849	
Adjusted R-squared	0.610		S.D. dependent var	1.424	
S.E. of regression	0.889		Akaike info criterion	2.907	
Sum squared resid	17.395		Schwarz criterion	3.701	
Log-likelihood	-40.600		Hannan-Quinn criteria.	3.196	
F-statistic	4.475		Durbin-Watson stat	2.330	
Prob(F-statistic)	0.001				

the debt ratio shock. The speed of adjustment is comparable to the only prior NARDL estimation of the fiscal reaction function by Rathnayake (2020), which shows that Sri Lanka's primary balance fully adjusts to the new equilibrium in around four years, although with opposite asymmetries. Meanwhile, Indonesia's dynamic response of primary balance to cyclical output shows only slight asymmetry in the second year, which implies a more consistent procyclical response to economic upswings than downswings.

5. Conclusion

Despite recent fiscal management improvements due to various institutional reforms, Indonesia's fiscal sustainability remains uncertain as the country struggles to increase its tax ratio to support growing spending needs. This paper approaches this issue from two perspectives. First, we assess fiscal imbalance sustainability by estimating revenue adjustment in response to expenditure shock based on the intertemporal budget constraint. Second, we investigate public debt sustainability by modeling primary balance adjustment in response to the debt-to-GDP ratio based on the fiscal reaction function. We apply various tests and models, including the NARDL, to incorporate asymmetry on the country's annual fiscal data from 1978–2019.

There is fiscal synchronization between the government's revenue and expenditure in Indonesia, although revenue tends to fall behind expenditure. Both the presence of cointegration and the bi-directional Granger causality between the two variables attest to this result. The ARDL result also shows weak sustainability as revenue grows at a slower pace than expenditure in the long run. These findings reflect the country's growing fiscal imbalance, especially since 2011, which marks a structural break and calls for more aggressive reforms to raise the country's tax ratio while reining inefficient spending.

Meanwhile, Indonesia's public debt is weakly sustainable as the primary balance responds positively

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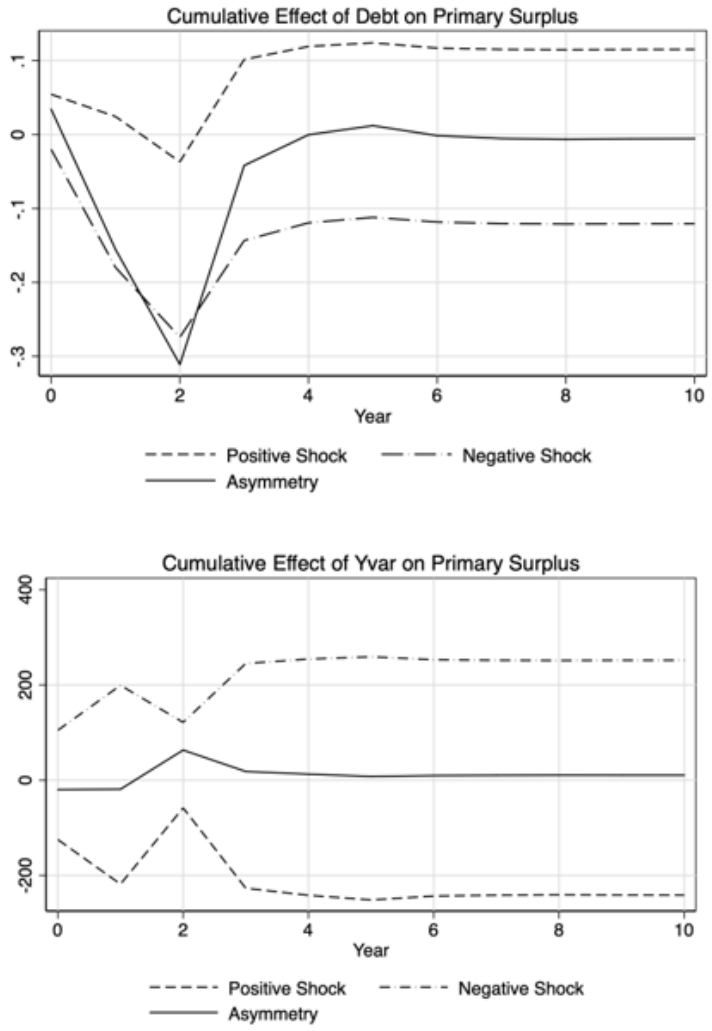

Figure 4. Cumulative Dynamic Multiplier Effect on Primary Balance to GDP

to the lagged debt-to-GDP ratio, based on the symmetric ARDL estimation. However, this initial result masks the asymmetry in the government's fiscal management. Our full NARDL model shows that this positive response is driven only by primary balance increases during declining debt ratio periods. Meanwhile, the government fails to lower its primary balance when the debt ratio is on the rise, which is potentially more dangerous. The dynamic multiplier analysis shows that this asymmetry can be quite sharp. The asymmetric lack of reaction to public debt increase could be caused by Indonesia's narrow tax base as well as political factors in the fiscal policy decisions, which may be common among developing countries (Talvi & Végh 2005). This finding sounds an alarm since Indonesia's public debt ratio has been on an upward trend since 2011, in parallel with declining primary balance.

The urgency increases with the COVID-19 crisis in 2020, which is expected to hike the debt ratio by as much as 10% of GDP based on projections using the debt sustainability analysis framework. While our NARDL estimation using historical data suggests that Indonesia's fiscal policy has not been particularly cyclical, it has lacked response to rising public debt ratio. Simultaneously, Indonesia might

have less room to fiscally consolidate in response to this higher debt ratio level if the COVID-19 slump lasts longer than expected. In this case, countercyclical fiscal policy might still be needed to stimulate the economy and premature fiscal consolidation could cost future economic growth. Nevertheless, the fiscal authority would eventually need to commit to a positive primary balance response, both when the debt ratio rises and when it falls, to put the country's public debt on a more sustainable path. Future research with data after the COVID-19 crisis should also consider a possible new structural break which may reveal changes in the government's fiscal reaction function.

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