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Twin Deficit Hypothesis in Indonesia: A General Equilibrium Approach and Non-Linear Specification

Reinardus Suryandaru

School of Business and Economics, Universitas Prasetiya Mulya, Tangerang, Indonesia.

Corresponding author: reinardus.suryandaru@pmbs.ac.id

Abstract

The twin deficit problem has been persitent in Indonesia. As Indonesia gains progress with infrastructure and encourages economic growth, its twin deficit could generate external imbalance and heightened economic risk. This study aims to revisit the twin deficit hypothesis for Indonesia by using the Non-Linear Autoregressive Distributed Lag (NARDL) and deriving the empirical model from the general equilibrium perspective to highlight the different responses of the current account due to fiscal balance changes. Employing the annual dataset from 1986 to 2020, this study finds that the twin deficit is present in the long run, while in the short run, twin divergence is evident. Therefore, a reduction of fiscal deficit is necessary to reduce the current account deficit in the long run. Moreover, a more restrictive import policy and a more supportive export policy are essential to improve the current account balance in the short run.

Keywords: Twin Deficit, Indonesia, NARDL

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1. Introduction

Since the 1990s, one of the most significant issues arising in economics has been the twin deficit. The twin deficit studies of Bernheim (1988) and Abell (1990) for the US economy have become seminal works in twin deficit research. The study of twin deficit is pivotal since it highlights the deficits for both the government budget and current account balance. Such deficits to some extent influence the general macroeconomic stability.

While a current account deficit occurs when there are net financial claims among foreigners, the budget deficit refers to a negative government budget. To fund its current account deficit, a country issues external debt. To fund its budget deficit, the government can issue debts or print money. Technically, a fraction of these deficits can be funded from the net capital inflow (Salvatore, 2006). However, such a problem could pose a threat to the domestic economy if the macroeconomic fundamentals are weak (Aydın & Esen. 2015). Therefore, reducing both deficits is necessary for the economy.

From the budget deficit side, a country can follow fiscal rules to put constraints on its budget deficit. This also ensures fiscal sustainability, fiscal responsibility, and debt sustainability (Guerguil, 2013). Moreover, the government can also issue government securities.

From the current account deficit side, there are no clear-cut answers regarding the level at which the current account deficit is considered safe (Milesi-Ferrett & Razin, 1996; Clarida et al., 2007; Duncan, 2014). Moreover,

an important issue that emerges in the current account deficit is related to its sustainability, which is characterized by both domestic and international factors (Devadas & Loayza, 2018).

In the context of twin deficit in the ASEAN countries, the data in Table 1 shows an average recorded deficit for most of the ASEAN countries in 1990s and a reported fiscal balance surplus on average. In the post-1997 crisis (1998-2011), ASEAN countries with similar economic characteristics such as Indonesia, Malaysia, and Thailand on average recorded concurrent account surpluses and fiscal deficit. In the post-Global Financial Crisis era (2012-2020), Malaysia and Thailand recorded account surplus and fiscal deficit, while Indonesia recorded twin deficit. Looking at the Indonesian context, the trend of simultaneous current account balance and fiscal balance actually worsened compared to the conditions in Thailand and Malaysia.

Table 1. The Average Current Account and Fiscal Balance to GDP in ASEAN Countries

Country Name	Current Account Balance/GDP (in %)			Fiscal Balance/GDP (in %)		
	1991-1997	1998-2011	2012-2020	1991-1997	1998-2011	2012-2020
Indonesia	-2.51	2.43	-2.27	0.20	-0.86	-2.62
Malaysia	-6.12	12.60	3.47	3.34	-3.66	-2.88
Thailand	-5.98	4.23	4.80	0.50	-1.47	-0.70
Singapore	13.03	19.78	16.82	4.01	3.38	3.31
Vietnam	-6.94	-2.36	2.39	n.a	-1.58	-3.43
Lao PDR	-8.52	-1.08	-8.68	-2.48	-3.61	n.a
Brunei Darussalam	n.a	38.48	16.13	n.a	n.a	n.a
Cambodia	-5.30	-5.18	-9.64	-3.70	-3.43	-1.13
Myanmar	-6.66	0.88	-3.32	n.a	-4.05	-3.12
Philippines	-3.38	1.34	1.27	0.06	-1.96	-0.94

Note: Author's calculation. Data for Current Account Balance are taken from the World Bank (2022). Data for Fiscal Balance are taken from the International Monetary Fund (2022). The data for Fiscal Balance is unavailable for Indonesia (1991-1993), Thailand (1991-1995), Lao DPR (2011-2020), and Cambodia (1991-1996). Thus, the average for Fiscal Balance for these countries is only based on the available data within the given period.

Although the Indonesian economy is one of Asia's leading emerging markets, the problem of twin deficit has been quite persitent in Indonesia since 2011. As Indonesia gains traction with infrastructure and encourages economic growth, the twin deficit problem will place further burden on the Indonesian economy. The debt that is required to finance the fiscal deficit due to the development agendas could generate an external imbalance and heightened economic risk.

In the academic context, the research on twin deficit studies for Indonesia that has been published in reputable journals is very limited. Moreover, the majority of twin deficit papers for Indonesia use linear time series estimation (e.g VAR, VECM, ARDL), which assumes that the parameters are constant and that changes in the independent variables have the same impact on the dependent variable in the long run. However, such assumptions do not always apply for all cases (Dufrénot & Mignon, 2002).

The fact that the majority of macro-finance variables display non-linear behavior implies that the non-linear estimation is preferable for a non-linear dataset (Altintas & Yacouba, 2018). To overcome this issue, Shin et al. (2014) offer a new technique (NARDL) to capture the non-linear relationship in the model for both short and long run.

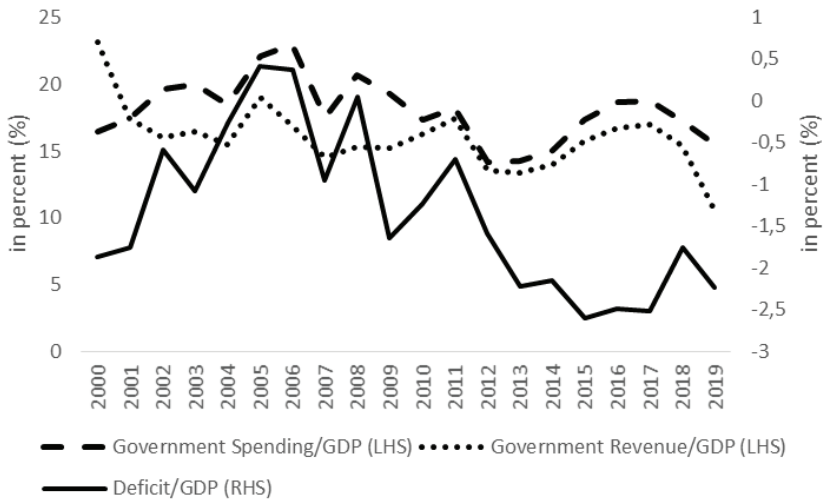
Based on the aformentioned arguments, therefore, this paper contributes not only to generate new evidence in the literature by using the non-linear estimation, but also provide insights to policy makers about the different responses of fiscal balance toward the current account balance for the Indonesian case.

The rest of this paper is organized as follows. Section 2 shows the stylized facts about twin deficit in Indonesia. Section 3 outlines the literature review. In section 4, the paper briefly illustrates the empirical model. Section 5 provides the empirical result. Section 6 concludes and offers some policy points.

2. Stylized Facts of Twin Deficit in Indonesia

The Indonesian government has been experiencing a dynamic period of government spending and revenue in the past 20 years. During this time, government spending grew by 21.94 percent, while revenue grew 17.50 percent on average. The fact that revenue growth (mainly through taxes) is less than the growth of spending (mainly for human capital, infrastructure spending, and social spending) supports the persistence of the budget deficit in Indonesia.

Figure 1. The Dynamic of Spending, Revenue, and Budget Deficit in Indonesia (2000-2019)

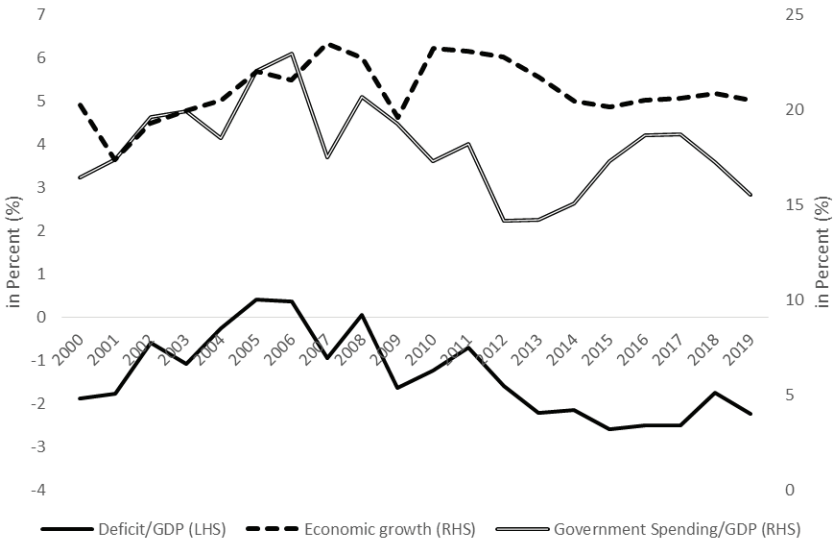


Source: Ministry of Finance Indonesia (2022)

Figure 2 shows that, between 2000 and 2006, the Indonesian government conducted fiscal consolidation (i.e, reducing its deficit) while experiencing a rise in economic growth. By contrast, from 2008 to 2019, the government maintained fiscal expansionary (i.e, increasing its deficit) while accounting for moderate economic growth. The effects of slowing economic growth and the low price of natural resources since 2008 contributed to

increased government spending to smooth the economic cycle. Subsequently, the economic trajectory was focused on stability over growth to minimize the downside risk of internal and external factors. These events led to a deficit trap after GFC 2008 to support domestic economic growth. For Indonesia, therefore, fiscal strategy is crucial in balancing the economic cycle.

Figure 2. Economic Growth, Government Spending, and Budget Deficit in Indonesia (2000-2019)

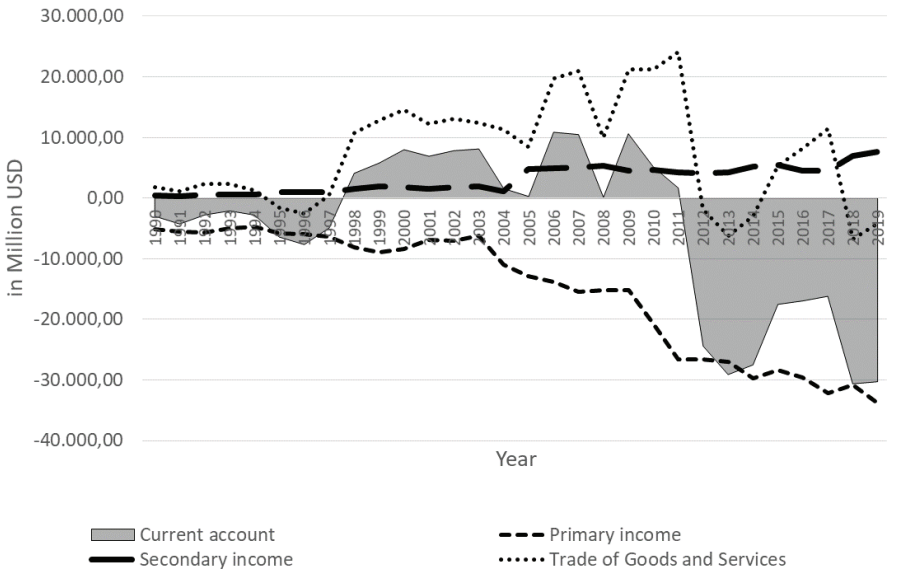


Source: Ministry of Finance Indonesia (2022), Statistics Indonesia (2022)

On the other hand, the dynamic of the current account balance can be seen in Figure 3 below. Following the 1998 Asian Financial Crisis, Indonesia's current account balance fell into deficit in late 2011. A rapid and continuous decline in primary income since 2003 has also contributed to a rise in Indonesia's current account deficit due to the structural factors caused by a mix of private investment flows and a public sector deficit. From 2011 to 2019, the public deficit on average was minus 2 percent of the GDP, representing a decline from around minus 0.77 percent of GDP between 2000 and 2011.

From 2011 to 2019, the average of private investment to GDP was higher than the average of private savings to GDP (34 percent and 29 percent, respectively). As a result, Indonesia has experienced a net negative flow of profits, interest, and dividends from investment as shown by a consistent decline in primary income. These structural factors underline the problem of the Indonesian current account deficit due to the saving-investment gap and public dissaving practices. On the other hand, it is also worth noting that the value of trade balance also corresponded to the behaviour of the current account.

Figure 3. The Development of the Current Account in Indonesia (1990-2019)



Source: Bank of Indonesia (2022)

3. Literature Review

3.1 Theoretical background

The relationship between the budget deficit and the current account deficit can theoretically be explained through several channels.

First, according to the Keynesian Channel, the trade balance will worsen as the budget deficit increases due to a negative link between the two. The increase in the government deficit will induce demand in the domestic economy (domestic absorption). This will cause the demand to rise that also originates abroad (import expansion), causing the current account deficit to increase. As a result, the Keynesian channel suggests that the budget deficit and current account deficit could be positively correlated (Banday & Aneja, 2019). Therefore, the current account deficit will worsen as the budget deficit increases (i.e., twin deficit)

Second, the Mundell-Flemming channel outlines an adverse relationship between the budget and current deficits. This viewpoint modifies the conventional IS-LM framework to show how the budget deficit influences the current account deficit via a flexible exchange rate channel in an open economy. This viewpoint contends that a rise in the budget deficit places pressure on domestic interest rates to grow. This results in capital inflows and an increase in the exchange rate (Fleming, 1962; Mundell, 1963), which eventually deteriorates the current account balance. Therefore, this viewpoint also supports the twin deficit hypothesis.

The third channel is the twin divergence channel, which states that the fiscal deficit and current account deficit have a negative relationship. Proponents of this view, Kim and Roubini (2008), claim that a rise of the budget deficit due to an output shock trigger an interest rate hike in a domestic country. This produces a crowding-out effect on private investment and induces private savings. The current account balance increases as total demand declines. Therefore, this view sees an inverse relationship between

the current account deficit and the budget deficit (i.e., twin divergence) due to the endogenous shock of output.

Fourth is the Ricardian Equivalence channel, which states that there is no connection between the current account deficit and the budget deficit (Barro, 1976). This view holds that individuals are rational, and future tax rates will rise as a response to an increase in the budget deficit. Hence, Ricardian agents will increase their current savings to provide sufficient funds for tax payments in the future. In other words, any means of financing deficits will have no impact in terms of economic performance, since a reduction of government savings due to deficit is entirely offset by a rise in the level of private savings. Therefore, Ricardian equivalence refutes the Keynesian channel by arguing that present individual consumption is dependent on people's predicted lifetime earnings rather than their current individual incomes, as the Keynesian channel suggested (Modigliani, 1986).

3.2 Empirical Research

Globally, several studies address the twin deficit hypothesis in various ways. In the region of Europe, the twin deficit hypothesis was tested in Croatia, the Czech Republic, Hungary, Poland, Romania, Slovakia, and Slovenia by Turan and Karakas (2018) from 1999:Q1-2016:Q4 using NARDL. The results suggest that the asymmetric effect persists in the model. A significant twin deficit is present in the Czech Republic, Hungary, and Slovakia but insignificant in Poland, Croatia, Romania, and Slovenia.

Furceri and Zdzienicka (2020) evaluate the short- and medium-term reactions of the current account to the shock of government expenditure for a panel dataset of 114 EMDEs between 1990 and 2015 by utilising the local projection approach by Jordà (2005). The findings show that the twin deficit hypothesis exists in developing countries. Despite the findings also underlining the heterogeneity across the country and over time, the magnitude of twin deficit tends to be larger under the conditions of recession, lower

public debt-to-GDP ratio, rigid exchange rate movement, and a higher degree of trade openness.

In the MENA region, El-Khishin and El-Saeed (2021) observed that a twin-deficit phenomena only appears in MENA oil-rich countries, though not in MENA non-oil countries, by using Panel Vector Autoregression Generalized Methods of Moments (PVAR GMM). Using a quarterly dataset from 2000:Q1 to 2019:Q4, Okoli et al. (2021) discover a threshold relationship between the deficits in the panel ARDL modeling for the BRICS economies.

In advanced economies, Salvatore (2006) examines the twin deficit for G-7 countries. In the United States, Japan, Germany, the United Kingdom, France, Italy, and Canada, the author finds a direct link between budget and current account deficits, with budget deficits generating current account deficits. Nargelecekenler and Giray (2013) use panel cointegration tests to examine nine OECD countries between 1990 and 2007. The findings support the presence of long-term twin deficit.

In the context of Asian regions, Marimuthu et al. (2021) study the twin deficits of 10 ASEAN countries by using panel unit root tests, panel auto-regressive distributed lag (ARDL), panel fully modified ordinary least squares (FMOLS), dynamic ordinary least squares (DOLS), and causal analysis (the Dumitrescu and Hurlin technique). The authors find the existence of the current account targeting hypothesis. Shastri (2019) examine the twin deficit theory in five significant South Asian nations between 1985 and 2016 (India, Bangladesh, Pakistan, Sri Lanka, and Nepal) by using the ARDL, and the Toda Yamamoto causality test revealed that twin deficits existed in Pakistan and Sri Lanka but there was evidence of reverse causality in Nepal. By using the panel-differenced GMM Arellano-Bond model and the PMG-based error correction model, Bon (2014) finds the presence of twin divergence for ten developing economies in Asia from 1985 to 2012.

For the Indonesian case, Handoyo et al. (2020) study the twin deficit using the ARDL method from 2004:Q1-2017:Q4. The authors only take into account 2 variables: the current account deficit and the budget deficit. Their results underpin the presence of a twin deficit for the Indonesian economy in the long run but twin divergence in the short run. The estimation method of ARDL is also used in a study by Wirasti and Widodo (2017) by employing a quarterly dataset between 2000:Q1 and 2021:Q2. The authors incorporate the investment level proxied by gross capital formation in addition to the deficit dataset. The results support the twin deficit hypothesis. Several studies also implement a nonconventional method to prove the existence of a twin deficit. A study by Kuncahyo (2016) using a quantitative phenomenological approach proves the presence of a twin deficit in Indonesia through the interest rate channel. Hasanah et al. (2019) study the twin deficit hypothesis using path analysis and find no significant result.

While most of the prior studies for Indonesia in the reputable journals are very limited, they only focus on linear estimations and apply ad hoc empirical models. Moreover, such approaches are unable to highlight the changes in parameters under different settings. Karras (2019) argue that the use of asymmetric technique is pivotal to clarify the asymmetric impact of the deficits. On the other hand, it is also necessary to derive the twin deficit model specification by incorporating the behavioral structure from the relevant theory (Tang, 2015; Bhat & Sharma, 2018).

For that reason, this study tries to reexamine the twin deficit hypotheis to close the gap in the literature by deriving the empirical model from the general equilibrium perspective and using asymmetric estimation (NARDL) for the Indonesian case. To the best of the author's knowledge, this is the first paper to examine the twin deficit theory in Indonesia by using the asymmetric specification and general equilibrium approach.

4. Empirical Model

4.1 Model specification

The model for this study is derived from the general equilibrium perspective following Tang (2015) and Shastri (2019). The general equilibrium framework is built based on the equilibrium in the market of goods and services. In this condition, the planned expenditure (E_t) must be equal to the actual expenditure (Y_t)

$$E_t = Y_t \tag{1}$$

in which

$$E_t = C_t + I_t + G_t + X_t - M_t \tag{2}$$

$$Y_t = C_t + S_t^P + T_t \tag{3}$$

where C_t is the consumption of goods and services, I_t is investment, G_t is government expenditure, $(X_t - M_t)$ is the international trade, S_t^P is the total domestic private saving, and T_t is the tax revenue of the domestic government. From equation (2-3) above we can rearrange into the three balances' identity equation:

$$X_t - M_t = (S_t^P - I_t) + (T_t - G_t) \tag{4}$$

in which $X_t - M_t$ relates to the current account balance[1]; $(S_t^P - I_t)$ is private savings minus private investment, which represents the private sector balance; and $(T_t - G_t)$ is tax minus government expenditure that shows the public sector balance. From equation (4) above, we can capture the relationship between fiscal and current account balance:

$$CurrentAccountBalance_t = (S_t^P - I_t) + (Fiscal\ Balance)_t \tag{5}$$

[1] Figure 3 shows that both trade balance and current account move in tandem. By contrast, both primary and secondary income do not move in tandem with the current account. Therefore, the current account balance can be represented by $X_t - M_t$.

By this accounting logic, any deterioration of fiscal balance (FB) will worsen the external balance, holding the private sector balance constant. Since the private sector balance has a dynamic characteristic, the equilibrium in this market can be explained by the variables that affect the behavior of the private sector balance, which are S_t^P and I_t. In doing so, we can analyze some of the factors in which the change of fiscal balance works on the current account balance.

Conventional economic theory suggests that the variable of economic growth has a positive impact on private saving. Simultaneously, economic growth also has a positive influence on investment (Kumari & Sharma, 2017; Saini & Singhania, 2018). The behavior of private savings can also be determined by the rate of inflation (Deaton, 1977; Stockman, 1981). Rising inflation leads to a savings reduction due to a reduction in purchasing power (Dash & Kumar, 2018) and a savings promotion due to a higher degree of uncertainty and macro instability (Serres & Pelgrin, 2002; Bernanke, 2005).

The behavior of investment can also be determined by the scale of trade openness. The studies of Liargovas and Skandalis (2012), Kim, et al. (2013), Saini and Singhania (2018), and Bandaya et al. (2020) propose that trade openness contributes positively as the pull factor of FDI and fosters domestic investment in developing countries. By contrast, a higher degree of trade openess can also have detrimental effects on the domestic investment due to inefficiency problems (Mudiyanselage, et al., 2021). On the other hand, trade openness can also be benefecial by improving domestic private savings through the poverty alleviation channels (Gnangnon, 2021). In addition, a higher trade openness also ease capital capital flow (AmirKhalkhali & Dar, 2007) and increase the saving rate (Umer & Alam, 2015).

Based on the above argument, the mediating variables to be included in this study are economic growth, inflation, and trade openness. The theoretical equation (5) can thus be rewritten as:

$$CAB = \left(S_t^P\left[y^{(+)}, inf^{(+/-)}, to^{(+)}\right] - I_t\left[y^{(+)}, to^{(+/-)}\right]\right) + (FB)_t$$

(6)

where *y* stands for economic growth, *inf* stands for the inflation rate, and *to* represents trade openness. Based on equation (6), this study hypothesizes that output growth has a favorable influence on the behavior of both private savings and investment. Moreover, the variable of inflation can positively or negatively affect private savings. On trade openness, this variable could have a positive or negative impact on private investment while exerting a positive influence on private saving.

Therefore, the twin deficit econometric model in this study can be represented as:

$$CAB_t = \beta_0 + \beta_1 FB_t + \beta_2 TO_t + \beta_3 GDP_t + \beta_4 INF_t + \varepsilon_t \quad (7)$$

where ε represents the error term. According to Tang (2015), the presence of the long-term relation of variables is necessary in testing the twin deficit hypothesis. Moreover, the sufficient condition should satisfy at least one of the independent variables that influence the behavior of $(S_t^P - I_t)$ in equation (7) to be statistically significant.

4.2 Data and Variables

Based on equation (7), the variables in this paper consist of dependent and independent variables. The dependent variable is Current Account Balance. The independent variables are Fiscal Balance, Trade Openness, Growth Rate of GDP, and Inflation. The definition of each variable used in this study is as follows:

1. Current Account Balance (CAB) (as a % of GDP) is the net international transaction value of goods, services, and investments.

2. Fiscal Balance (FB) (as a % of GDP) represents the indicator of the fiscal stance. This variable is calculated by subtracting government revenue (including taxes, social contributions, and other revenues such as fines, fees, rent, and income from property or sales) from government expenses

(including compensation of employees, interest and subsidies, grants, social benefits, rent, and dividends).

3. Trade Openness (TO) (as % of GDP) measures how well the domestic economy is integrated with the world market.

4. Real Gross Domestic Product growth rate (GDP) is the constant price GDP in Indonesia, and the percentage change from a year ago is used to measure economic output.

5. Inflation (INF) measures the dynamic change in domestic price.

This study uses secondary data taken from the World Development Indicators (WDI) of the World Bank by using an annual dataset from 1986 to 2020 with 35 observations for each variable. The descriptive analysis for each variable is also provided in Table 2 below.

Table 2. Descriptive Statistics

Variables	Observation	Mean	Standard Deviation	Minimum	Maximum
CAB	35	-0.4943087	2.774822	-4.891558	4.843064
FB	35	2.377357	3.836598	-2.913022	8.170693
TO	35	52.63063	11.5611	33.19059	96.1862
GDP	35	4.86496	3.642906	-13.12673	8.220007
INF	35	10.89597	12.36097	-0.4561301	75.27117

Note: Author's calculation. Data are taken from the World Bank (2022)

4.3 Methodology: Asymmetric Specification

To account for asymmetries, this study employs the Non-Linear Autoregressive Distributed Lag (NARDL) developed by Shin et al. (2014). Technically, it decomposes the regressors into the positive and negative partial sums for both the short run and long run, that is

$$x_t = x_0 + x_t^+ + x_t^- \quad (9)$$

where:

$$x_t^+ = \sum_{j=1}^{t} \Delta x_j^+ = \sum_{j=1}^{t} \max(\Delta x_j, 0) \quad \text{and} \quad x_t^- = \sum_{j=1}^{t} \Delta x_j^- = \sum_{j=1}^{t} \max(\Delta x_j, 0) \tag{9}$$

such that the long-run asymmetry relationship can be expressed as:

$$y_t = \beta^+ x_t^+ + \beta^- x_t^- + u_t \tag{10}$$

where β^+ and β^- are the asymmetric long-run parameters for both positive and negative impacts of X_t on Y_t, respectively. Following Shin, et al. (2014), the NARDL (p,q) empirical model for this study is:

$$\Delta CAB_t = \gamma + \sum_{j=1}^{p-1} \vartheta_j \Delta CAB_{t-j} + \sum_{j=0}^{q-1} \left(\pi_{1j}^+ \Delta FB_{t-j}^+ + \pi_{1j}^- \Delta FB_{t-j}^- + \pi_{2j}^+ \Delta TO_{t-j}^+ + \pi_{2j}^- \Delta TO_{t-j}^- + \pi_{3j}^+ \Delta GDP_{t-j}^+ + \pi_{3j}^- \Delta GDP_{t-j}^- + \pi_{4j}^+ \Delta INF_{t-j}^+ + \pi_{4j}^- \Delta INF_{t-j}^-\right) + \rho \mathrm{CAB}_{t-1} + \omega_1^+ FB_{t-1} + \omega_1^- FB_{t-1} + \omega_2^+ TO_{t-1} + \omega_2^- TO_{t-1} + \omega_3^+ GDP_{t-1} + \omega_3^- GDP_{t-1} + \omega_4^+ INF_{t-1} + \omega_4^- INF_{t-1} + u_t \tag{11}$$

where γ is for a constant regressor, Δ is for the first-differenced operator, p and q are the choice of lag for the dependent and independent variables, ρ is the autoregressive parameter, and u_t is the residuals. The long-run coefficients are $\omega_1^+, \omega_1^-, \omega_2^+, \omega_2^-, \omega_3^+, \omega_3^-, \omega_4^+, \omega_4^-$. The short-run coefficients are $\vartheta_j, \pi_{1j}^+, \pi_{1j}^-, \pi_{2j}^+, \pi_{2j}^-, \pi_{3j}^+, \pi_{3j}^-, \pi_{4j}^+, \pi_{4j}^-$. The empirical model in equation (11) gives the effects of positive or negative fiscal balance will have different impact and magnitude on the current account.

With respect to equations (9-10), therefore, the associated asymmetric long-run parameters for both positive and negative impacts of x_t on y_t can be calculated as $\beta_i^+ = -\omega_i^+/\rho$ and $\beta_i^- = -\omega_i^-/\rho$, respectively. The signs + and − show the positive and negative effects of x_t on y_t around a threshold of zero.

Following Shin, et al. (2014), the presence of asymmetric cointegration in equation (11) is being tested againts the joint null hypothesis of no cointegration (H0: $\rho = \omega_1^+ = \omega_1^- = \omega_2^+ = \omega_2^- = \omega_3^+ = \omega_3^- = \omega_4^+ = \omega_4^-$) by using the F type statistics (F_{PSS}) as sugessted by Pesaran, et al. (2001). Moreover, the null hypothesis of no cointegration ($\rho = 0$) can be checked by using the t_{BDM} statistics (Banerjee et al., 1998). The choice of an appropriate lag structure uses the strategy of general to specific choice following Shin, et al. (2014)

by setting the maximum lag of $q = 4$ and $p = 4$.

Furthermore, the standard Wald test to validate both the long-run and short-run asymmetric impacts in the model are also employed following Shin, et al. (2014). The rejection of the null hypothesis of $\beta_i^+ = \beta_i^-$ implies a presence of a long-run asymmetric relationship between each regressor on y_t. On the other hand, the rejection of the null hypothesis of $\sum_{j=0}^{q-1} \pi_i{}^+ = \sum_{j=0}^{q-1} \pi_i{}^-$ for each regressor on y_t suggests that a short-run asymmetric relationship is present.

The results of asymmetric model parameters are subject to the diagnostic tests: the Breusch– Godfrey LM test for serial correlation, the Breusch–Pagan–Godfrey test for heteroskedasticity, the Ramsey Reset for specification test, and the stability test for parameters (Cummultaive Sum/ CUSUM test and Cummulative Sum of Squares/CUSUMSQ).

In addition, the NARDL also provides the dynamic multipliers associated with the unit changes in x_t^+ and x_t^- towards the y_t. These calculations are:

$$m_h^+ = \sum_{j=0}^{h} \frac{\partial y_{t+j}}{\partial x_t^+} \text{ and } m_h^- = \sum_{j=0}^{h} \frac{\partial y_{t-j}}{\partial x_t^-} \quad (12)$$

for and x_t^+, x_t^- respectively. It is worth to note that as $h \to \infty$, then m_h^+ converges to β^+ and m_h^- converges to β^-. In other word, this study utilizes the dynamic multipliers to trace the path of disequilibrium and the duration of disequilibrium following the perturbations in the regressors.

5. Results

5.1 Stationary Test

Asymmetric modelling requires that all of the independent variables do not exhibit an order of integration higher than *I*(1) and the dependent variable must be *I*(1). The results from Table 3 show that the variables of CAB, FB, and TO are stationary in *I*(1), while the variables of GDP and INF are already stationary in level or *I*(0). These results already satisfy the

requirement for NARDL modeling.

Table 3. Unit root test of stationarity

	Phillips–Perron		ADF Test	
Variable	Intercept	Trend	Intercept	Trend
CAB	-2.363	-2.255	-2.234	-2.180
ΔCAB	-5.114***	-4.967***	-5.147***	-5.035***
FB	-1.280	-2.521	-1.000	-2.452
ΔFB	-6.241***	-6.127***	-6.183***	-6.077***
TO	-2.502	-3.054	-1.001	-1.799
ΔTO	-9.525***	-10.065***	-3.763***	-4.102**
GDP	-3.891***	-3.885**	-3.466**	-3.470*
ΔGDP	-7.206***	-7.100***	-4.443***	-4.361***
INF	-4.937	-5.219	-4.859***	-5.198***
ΔINF	-11.162***	-11.033***	-4.339***	-4.318**

Note: Δ is the first difference operator. ***, **, * are the significance levels (1, 5, 10 percent). The lag length structure is determined using AIC

5.2 Asymmetric Model

The results of the cointegration test for the NARDL model are shown in Table 4. The results of both F_{PSS} and the t_{BDM} statistics are significant, indicating that a long-run relationship exists in the model. In other words, the independent variables of FB, TO, GDP, and INF impact the CAB differently in the case of positive and negative shocks present in the long run. This result also satisfies the necessary condition for modeling the Twin Deficit Hypothesis following Tang (2015).

Table 5 also presents the Wald Test for testing both short- and long-run asymmetric cointegration from each regressor towards the dependent variable. The results suggest that the relationship between FB and the CAB shows a presence of both short- and long-run asymmetric cointegration. This is true for the relationship between INF and CAB. On the other hand, the variables

of GDP and TO only indicate a short-run asymmetric relationship toward CAB, respectively.

Table 4. Bound Testing

Bound Testing for Asymmetric Cointegration
FPSS = 19.530***
t_{BDM} = -4.230**

Note: This study uses $k = 5$ and bound testing specification of case 3 (unrestricted intercept and no trend) to test the null hypothesis. The 1% (5%) level of significance for FPSS (Pesaran, et al., 2001) and t_{BDM} (Banerjee, et al., 1998) is 4.257 (-2.860) and 6.040 (-4.190), respectively. *** and ** indicate significance at the 1 and 5 percent levels.

Table 5. Individual Long-run and Short-run Asymmetric Test

Null Hypothesis	Long-run	Short-run
Symmetric effect of FB on CAB	27.34***	8.36**
Symmetric effect of TO on CAB	1.88	5.43**
Symmetric effect of GDP on CAB	2.58	21.61***
Symmetric effect of INF on CAB	2.83*	19.03***

Note: Numbers in the table are the statistic from the Wald Test. ** and *** show significance at the 5 and 1 percent levels, respectively.

The calculated parameters for the NARDL model are shown in Table 6. Remarkably, the value of Error Correction Term (ECT) that defines the speed of adjustment in the model as shown by is -0.943 and significant. In other words, the associated short-run shocks are corrected in less than one year of returning to their long-run equilibrium and are statistically significant.

Table 6. Long-Run and Short-Run Estimation of NARDL

Dependent Var: CAB	Coefficient	Standard Error	*t*-statistic
CAB_{t-1}	-0.943***	0.223	-4.23
FB^{+}_{t-1}	1.571**	0.420	3.74
FB^{-}_{t-1}	-2.212**	0.691	-3.20

TO^{+}_{t-1}	-0.265	0.166	-1.59
TO^{-}_{t-1}	0.348**	0.105	3.29
GDP^{+}_{t-1}	-0.596	1.030	-0.58
GDP^{-}_{t-1}	-2.422**	0 .809	-2.99
INF^{+}_{t-1}	-0.245	0.284	-0.86
INF^{-}_{t-1}	0.261	0.187	1.39
ΔCAB_{t-1}	-0.168	0.234	-0.72
ΔFB^{+}_{t}	1.270	0.357	3.56
ΔFB^{+}_{t-1}	0.998***	0.259	3.85
ΔFB^{-}_{t}	-2.220***	0.489	-4.53
ΔFB^{-}_{t-1}	-1.275***	0.249	-5.11
ΔTO^{+}_{t}	-0.494**	0.175	-2.82
ΔTO^{+}_{t-1}	0.212	0.109	1.94
ΔTO^{-}_{t}	0.128	0.086	1.49
ΔTO^{-}_{t-1}	-0.100*	0.048	-2.07
ΔGDP^{+}_{t}	-0.126	0.758	-0.17
ΔGDP^{+}_{t-1}	0.030	0.207	0.15
ΔGDP^{-}_{t}	-0.665***	0.135	-4.93
ΔGDP^{-}_{t-1}	2.254***	0.480	4.69
ΔINF^{+}_{t}	0.163**	0.060	2.69
ΔINF^{+}_{t-1}	0.306*	0.127	2.40
ΔINF^{-}_{t}	0.096	0.166	0.58
ΔINF^{-}_{t-1}	-0.116*	0.058	-1.99
Cons	-9.159***	1.961	-4.67

Note: ***, **, and * show significance levels (1, 5, and 10 percent, respectively)

The superscripts "+" and "–" denote positive and negative partial sums, respectively.

Table 7 shows the asymmetric long-run relationship in the NARDL model. The positive partial shock of β^{+}_{FB} is 1.665 while the negative partial shock of β^{-}_{FB} is 2.344. Both values are statistically significant. Therefore, a 1 percent increase of FB (i.e, deficit reduction) leads to an improvement of 1.67 percent of CAB. On the other hand, a 1 percent decrease of FB (i.e, deficit

widening) deteriorates the CAB by 2.34 percent. Interestingly, the responses of the current account to a negative shock of fiscal balance are greater and more sensitive compared to its positive shock of fiscal balance. This result not only indicates the asymmetric relationship in the nexus between the CAB and FB but also suggests the presence of the twin deficit hypothesis in the long run.

By contrast, we can see that the short-run asymmetry between FB and the CAB in Table 6 indicates a significant twin divergence hypothesis. The parameters of ΔFB_t^- and ΔFB_{t-1}^- are -2.220 and -1.275, respectively, which suggests that the CAB will respond positively to the negative shocks of FB within 1-2 periods.

In Table 7, the variable of TO only shows a significant effect of its negative shock toward the CAB in the long run. The parameter of β_{TO}^- suggests that a decline of 1 percent trade openness increases the CAB position by 0.37 percent. According to this result, if Indonesia has less integration in the global marketplace, then it should improve its CAB, because Indonesia is highly dependent on the import of capital goods and consumer goods. Therefore, less trade openness will likely improve the CAB in the long run. However, as suggested from the result of the Wald test in Table 5, the variable TO only indicates a significant asymmetric relationship in the short run. From the short-run side in Table 6, the positive shock (ΔTO_t^+) and negative shock (ΔTO_{t-1}^-) have a negative and positive impact on CAB, respectively. Therefore, the increase of TO worsens the CAB while the decline of TO improves the CAB position in the short run.

In Table 5, the variable of GDP does not produce significant long-run asymmetric parameters. The Wald test for GDP suggests a significant result only for the short-run asymmetry. Table 6 indicates that, when economic growth declines by 1 percent, the CAB will improve by 0.66 percent in the short run. This might be driven by an initial sharp decline in investment and consumption of imported goods in the aftermath of the economic deterioration.

In Table 5, the variable of INF also does not indicate significant long-run asymmetry toward CAB. Nevertheless, the result from the Wald test in Table 5 underlines the significant asymmetric relationship between INF and the CAB in the short run. The short-run parameters in Table 6 suggest that both positive and negative shocks of inflation produce a significant improvement of the CAB position. The magnitude of the CAB improvement is higher when there is a positive shock rather than a negative shock of INF. This implies that, when the positive shock occurs in the short run (i.e., economic stability is getting worse), there is less private capital inflow and more national savings, which bring an improvement to the CAB.

Table 7. Asymmetric Long-Run Relationship

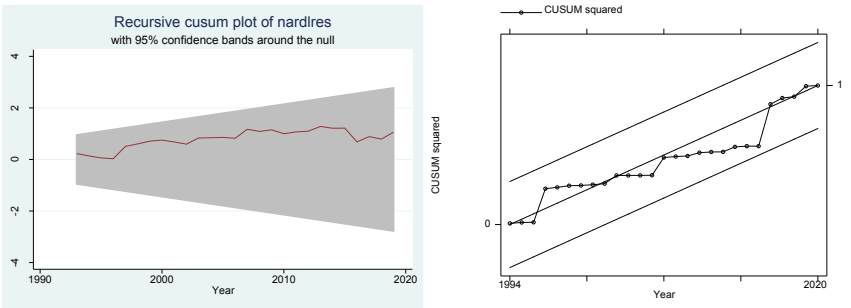
Response	Parameters	Statistic and Diagnostic Test
β^{+}_{FB}	1.665 (0.049)***	R-Squared = 0.9883
β^{-}_{FB}	2.344 (0.029)***	HET = 0.04 (0.835)
β^{+}_{TO}	-0.281 (0.218)	SC = 2.076 (0.149)
β^{-}_{TO}	-0.369 (0.011)***	RESET = 0.57 (0.637)
β^{+}_{GDP}	-0.631 (0.623)	CUSUM = 0.5547
β^{-}_{GDP}	2.566 (0.100)	CUSUMSQ = Strongly Stable
β^{+}_{INF}	-0.260 (0.355)	
β^{-}_{INF}	-0.277 (0.310)	

Note: *p*-value estimates are represented in parentheses. β^{+} ($-\hat{\theta}^{+}/\hat{\rho}$) and β^{-} ($-\hat{\theta}^{-}/\hat{\rho}$) are the calculated asymmetric long-run parameters linked to positive and negative changes, respectively. SC is the LM Breusch–Godfrey tests for serial correlation. HET is the Breusch–Pagan–Godfrey heteroscedasticity test. RESET indicates the Ramsey Reset test to conduct the specification-error for omitted variables. CUSUM and CUSUMSQ are for the parameter stability tests.

In Table 7, the outcomes of the diagnostic tests are quite satisfactory. The results indicate that the model has no serial correlation issue and is free from omitted variable bias, despite showing heteroscedasticity of the residuals. Moreover, Figure 4 shows the results of both the Cummultaive Sum

(CUSUM) test and Cummulative Sum of Squares (CUSUMSQ) test, which asses the stability of the parameters in the model. The visual inspection for both CUSUM and CUSUMSQ indicate that all parameters are not drifting away from the 95% confidence band, suggesting that the stability of parameters is valid in the model.

Figure 4. CUSUM and CUSUM Square Test Graphs for the Asymmetric Model

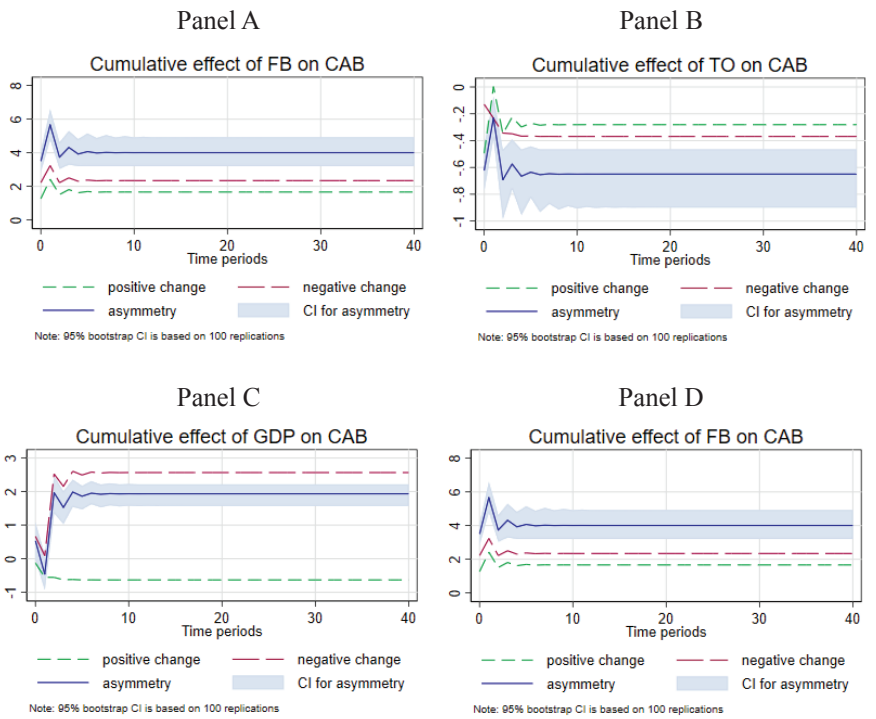


Note: Author's calculation

Finally, Figure 5 shows the dynamic multiplier that shows the visual long-run adjusment pattern of CAB following a negative and positive shock on the independent variables. The results in Panel A show that it takes about four to five years for FB increases and decreases to work through their effects on the CAB until a relatively stable state is reached.

In addition, the negative shock of FB has a larger impact on CAB improvement, which indicates that a positive shock of FB is more sensitive than its negative shock on the CAB. Moreover, Panels B, C, and D show the asymmetric multiplier in the CAB due to shocks in TO, GDP, and INF, respectively. For the variables TO and INF, their negative shocks are more sensitive toward the CAB than their positive shocks. The overall results of the dynamic multiplier confirm the asymmetric impact of FB, GDP, TO, and INF on the CAB of Indonesia. Moreover, the disequilibrium of CAB is corrected within four to five years after the shocks of each independent variable.

Figure 5. Dynamics Multiplier

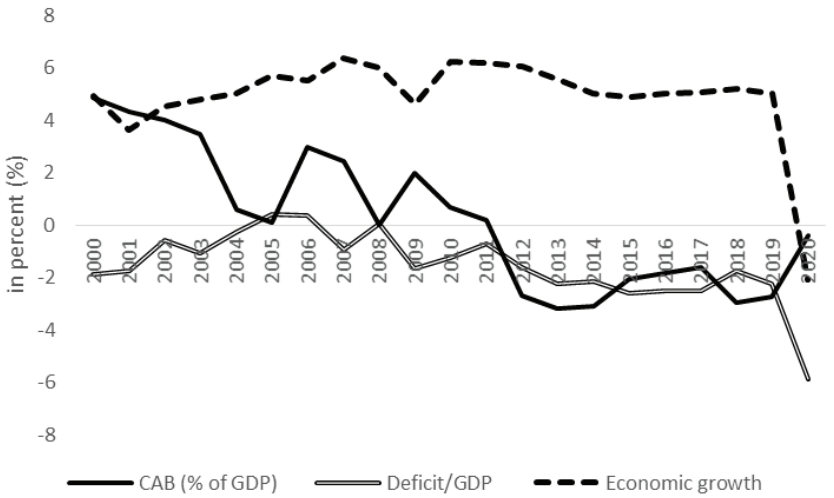


Note: The results of dynamic multiplier

6. Conclusion

The results from the asymmetric model indicate that a twin deficit is noticeable in the long run, while in the short run, twin divergence is evident. This result is consistent with the study by Handoyo et al. (2020), although they employ different methodology and variables. The visual inspection from Figure 6 shows the tendency of twin deficit after 2011 and the tendency of twin divergence from 2001 to 2011.

Figure 6. Twin Deficit Long-Run and Twin Divergence Short-Run



Source: Ministry of Finance Indonesia, Bank of Indonesia, Indonesian Statistics (2022)

The results of this study provide key important policy points for the government:

1. A reduction of the fiscal deficit in Indonesia is necessary to trim down the current account deficit in the long run. This is because, according to the estimations, the responses of the CAB to a negative shock of FB are greater and more sensitive compared to its positive shock of FB.

2. A more restrictive import policy and a more supportive export policy are pivotal to minimize the current account deficit in the short run. The results of estimation underline that the increase of trade openess will worsen the current account balance in the short run.

However, such findings and policy offers are subject to limitations due to the nature of this study. The asymmetric responses in the NARDL methodology assume no threshold. Therefore, the NARDL method in this study cannot distinguish between small and large fluctuations in the independent variables and capture the response of the dependent variable. Moreover,

this study only uses limited variables to explain the link between the current account deficit and fiscal deficit.

The investigation of the twin deficit study using a threshold NARDL and the inclusion of more macro variables is a promising avenue for future research.

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