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Threshold Impacts of Exchange Rate on the Current Account Sustainability[*)]

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Abstract

The issue of current account sustainability has been an intense research and heated debate in the last two decades. This study examines the sustainability of current accounts in the case of Indonesia over the period 2004(4)-2021(6). We find that exchange rate plays an important role. While the symmetric impact of the exchange rate on the current account performance holds, the effect of foreign reserves on exchange rate appreciation is greater than that on exchange rate depreciation. Allowing the domestic currency to appreciate for no more than 2.5 percent, central bank intervention in the foreign exchange market could improve the current account balance. Cointegrating regression robustness tests confirm that current account balance is weakly sustainable or even unsustainable. Those results suggest that the country has to reduce exchange rate fluctuation to restore the current account balance. Further research to treat the changes in exchange rate as a continuous variable is advisable.

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1. Introduction

Aftermaths the 1997/98 Asian monetary crisis and the 2008 global financial crisis, the relationships among foreign reserves adequacy, current account balances, and currency stability have drawn considerable attention in emerging markets. On the one hand, the lack of foreign reserves held by the developing Asian countries is claimed to be the main source of economic vulnerability from the monetary crisis (Yeyati *et al*., 2013). On the other hand, a large current account deficit is the root of the currency instability problems (Calderon *et al*., 2002).

Holding large foreign reserves could result in lower exchange rate depreciations (Arslan and Cantú, 2019). However, the effectiveness of central bank intervention in the foreign exchange market to stabilize exchange rate is questionable (Dadush and Stancil, 2011), primarily when a country has chronic current account deficits. In these relative uncompetitive circumstances, there will be a net outflow of money from a country's circular flow. Accordingly, the exchange rate in emerging markets more volatile than in advance countries (Chițu and Quint, 2018), implying the current account balances could be unsustainable in the long run.

Moreover, financing the current account deficits by capital and/or financial accounts is quite risky. In the globalization era, capital reversal or sudden stop in capital inflows primarily in developing economies could have an adverse pressure on the domestic currency. The unsustainable current account deficits induce the central bank' market intervention is asymmetric (Yeyati *et al*., 2013). The central bank is more responsive to the domestic currency appreciation rather than depreciation resulting in the exchange rates could be misaligned.

Despite foreign exchange market intervention being used to compensate for the capital market's liberalization (Steiner, 2013), the central bank interventions might raise the volatility of exchange rate (Frenkel *et al*., 2005). In contrast, the central bank interventions have a little impact on the longer-term volatility (Dominguez, 2006), whereas the stable exchange rate may explain the current accounts sustainability (Gnimassoun and Coulibaly, 2014). Accordingly, there is still no general consensus on the size or even the sign of the effects of foreign reserves and exchange rates on the current account sustainability, which needs to be further investigated in the context of developing countries.

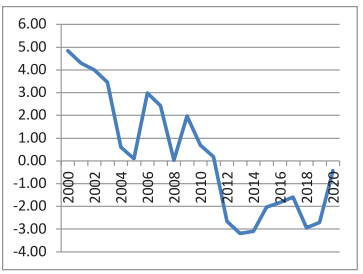
Understanding the exact links among foreign reserves, exchange rate, and current account deficits is important. From the view of policymakers, the current account plays an important role in economic progress. The large current account imbalances are associated with distortions in terms of output and employment (Engler *et al*., 2009). The external imbalances can produce significant financial disruptions. The experiences since the 1970s suggest that the excessive external imbalances in emerging markets have been responsible for balance of payment and currency instability (Edwards, 2004). Hence, recognizing some problems emerging from empirical studies connecting exchange rates to current account balance will be useful for the central bank to use an active monetary policy in managing exchange rate volatility (Cabral *et al*., 2020).

Indonesia offers a good case to discuss these issues. Since late 2011, Indonesia's current account has fallen into deficit (left-hand side of Figure 1). As a small-open economy with a floating exchange rate system, the country relies on capital and financial flows to finance current account deficits. In the same vein, Indonesia accumulates international reserves. The foreign reserves show a remarkable growth over the recent years. At the end of 2020 the foreign reserve was approximately around 12.7 percent of GDP and could cover at least 9 months of imports – much greater than the conventional wisdom of

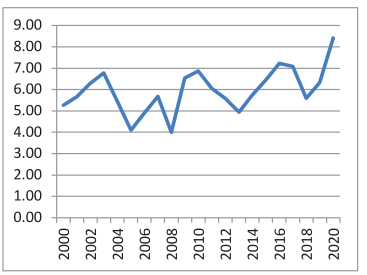
three-month minimum sufficiency standard (right-hand side of Figure 1). Our question in mind here is whether the foreign reserves are adequate enough to safeguard the exchange rate in order to face chronic current account deficits.

The more basic question is whether the current account balance is permanent or temporary in nature. The temporary current account deficits mean that they are just short-run phenomena and will return to their mean and then are balanced by future surpluses in the long-run. In contrast, the permanent account deficits need stronger efforts to restructure in order to satisfy the intertemporal solvency condition (Shastri, *et al*., 2018). Many studies (Nurmalindah and Safuan (2013); Asmarani and Falianty (2015); Grag and Prabheesh (2022)) found that Indonesia's current account deficits do not return to their mean, implying the current account balance is unsustainable. The answer of those questions bring back the discussion on the exchange rate to manipulate the changes in export and import which further determine the current account balance sustainability.

The purpose of this study is to re-examine the relationship among current account sustainability, exchange rate, and foreign reserve. Different from the previous studies, we specify a threshold for which the central bank can intervene in the foreign exchange market to stabilize the exchange rate. The threshold allows the central bank to improve the sustainability of current account balance. The study is organized as follows. In section 2, we outline a brief review of empirical literature on the relationship among current account development, foreign reserves, and exchange rate. Section 3 describes the methodology and data used in the estimation. Section 4 provides the estimates and discussion of findings. Some concluding remarks are drawn in Section 5.



Current Account Balance to GDP Ratio



Month Import of Foreign Reserves

Source: IMF

Figure 1. Current Account Balances and Foreign Reserves

2. Literature Review

Current account sustainability can be analyzed using intratemporal approach and intertemporal approach (Dybka and Rubaszek, 2017). According to the first approach, persistent appreciation of the exchange rate can be driven by fundamental factors such as high productivity growth in the traded goods sector or the desired surprise terms of trade. However, in the managed or fixed exchange rate system, this may reflect a fundamental inconsistency between the monetary policy being implemented and the exchange rate policy, resulting in overvaluation (Bubula and Ötker-Robe, 2003).

An overvalued exchange rate can trigger a decrease in savings when domestic residents intertemporally substitute current consumption for future consumption. It will further widen the current account imbalance and decrease foreign exchange reserves. The decline in foreign exchange reserves can be reinforced by expectations of future devaluations that will trigger capital outflows. In the end, the weakening of the export sector hinders a country's ability to achieve conditions of sustainability of external imbalances (Bon, 2014).

In a flexible exchange rate system, the appreciation of the exchange rate can also be caused by large capital inflows. If it is not driven by long-term fundamental factors, it can cause overvaluation. The lack of domestic financial intermediation and supervision can prevent efficient allocation of capital inflows between consumption and investment and result in overvaluation (Khatat *et. al*., 2020). Regardless of the exchange rate regime, domestic currency appreciation declines the current account sustainability.

Empirical studies of the impact of exchange rate on the current account sustainability offer a diverging result. Das (2016) found that current account balance has a positive relationship with exchange rate stability and has a negative relationship with real effective exchange rate in developed countries. For emerging economies it has a negative relationship with exchange rate stability. In contrast, Aristovnik (2008) argues that appreciation of the exchange rate causes deterioration in current account balance. Javaid and Raza (2013) observe a positive relationship between exchange rate and the current account deficit in the long term and also bidirectional causality between exchange rate and the current account deficit. However, Dybka and Rubaszek (2017) observed that the exchange rate has a very limited impact on the current account.

The second is intertemporal approach incorporating assets and liabilities generated by current account deficits financing. The two central issues of intertemporal model is (1) to identify whether a country is able to meet its long-run intertemporal budget constraint, (2) if the above answer is yes, the next question is whether the country will face some fundamental policy changes, so that the domestic absorption will also drastically change (Hakkio and Rush, 1991). If the intertemporal budget constraint holds, the current account balance will revert to its mean, i.e. the economy is able to create future trade surpluses to meet all its external liabilities.

Early studies in this strand (pioneered by Trehan and Walls, 1991) examine whether a large or persistent current account imbalance would revert

to its mean. Various unit root tests or stationary tests of the current account-to-GDP ratio are used (Chen, 2011). Since the current account balance mainly consists of net exports (or net imports), initiated by Husted (1992), the latter studies also test the sustainability of current accounts by examining their time series properties (Cuestas, 2013) for transition economies; Chen and Xie (2015) for selected nations; Tastan and Aric (2016) for BRICS countries; and Dybka and Rubaszek (2017) for emerging economies.

The unit roots test has also been implemented in an individual economy, Brissimis *et al*. (2012) for Greece, Corsetti and Konstantinou (2012) for US, Shuaibu and Oyinlola (2017) for Nigeria, Behera and Yadav (2019) for India, and Kouadio and N'Guessan (2021) for Côte d'Ivoire. A current account sustainability analysis then evolves by including a cointegration test to explain the long run relationship (sustainability conditions) between exports and imports for specific goods and services (Camarero *et al*., 2013). Some works use both unit root tests and cointegration tests (Holmes, 2006) along with error correction models (ECM) (Bajo-Rubio *et al*., 2014) to check whether the net exports react to the net foreign asset position.

The above methodology has been extended on the panel data. Wu (2000) discovered that the sustainability hypothesis holds for 10 OECD observed countries. In the subsequent paper, Wu *et al*. (2001) found the same result for G7 countries. By employing panel unit root test, Baharumshah *et al*. (2005) found that 3 out of 12 observed Asian countries, including Indonesia, hold the sustainability constraint. Chu *et al*. (2007) found that 37 of 48 African countries satisfied the constraint. More recently, Shastri *et al*. (2018) found support for the long-run relationship between the current account outflows and inflows for 5 major South Asian countries, i.e. the growth of export in the long-run can catch up the import growth.

Purely in the case of Indonesia, empirical research regarding the current account balance sustainability is limited. The findings of the existing literature do not offer decisive evidence whether Indonesia's current account

balance is sustainable or not. Nurmalindah and Safuan (2013) and Asmarani and Falianty (2015) obtain that external sustainability conditions in Indonesia are not sustainable. However, slightly different results are found by Baharumsah *et al*. (2005). They state that the sustainability of current account balances experienced before, but unsustainability happened in the period after, the 1997/1998 Asian financial crisis instead. Grag and Prabheesh (2022) suggest that Indonesia's current account is not solvent in the pre- and post-financial crisis of 2008.

The huge empirical evidence above mostly fails to indicate the presence of current account imbalance stationary in its level. The absence of current account unit roots may be caused by structural breaks. To solve this critical issue, some authors involve unit roots and fractional integration (Cunado *et al*., 2010), and Granger causality, VECM (vector ECM), Johansen cointegration, ARDL (autoregressive distributed lag) bound tests, and simultaneous equation system (Behera and Yadav, 2017). Others use nonlinear approaches to account for structural breaks (Chen, 2014), regime shifts, or threshold values (Afonso *et al*., 2019). Cointegrating regression analysis is also employed to address those econometric issues (Ozdamar, 2015).

Regarding the diverging results above, Hakkio and Rush (1991) point out that, if export and import are non-stationary variables in level data, the estimated coefficient relating import and export which approaches to unity is a sufficient condition for the intertemporal budget constraint, but it is weak. The low sustainability is in line with the intertemporal budget constraint. In the case of weak sustainability, the undiscounted value of the debt will infinitely rise and the incentive for government default enlarges (Ordoñez-Callamand *et al*., 2018). Moreover, this model implicitly assumes that the export is treated as a policy option. Estimating import on export (each variable is integrated of order one) in the absence of cointegration leads to the issue of spurious regression (Narayan, 2005).

Furthermore, most studies focusing on intertemporal approach neglected the exchange rates conditions. Little of the previous studies incorporate central bank intervention in foreign exchange market in their analytical models. Accordingly, what is sustainable for a particular country is not for another due to current account sustainability depends on a country's specifics (Roubini and Wachtel, 1999). This study contributes to the empirical literature in at least two ways. First, we elaborate intratemporal and intertemporal approaches in an integrated model. Second, we use threshold regression methods to clearly determine how intense the exchange rate stabilization policy (primarily through foreign reserves) should be conducted to maintain current account balance being sustainable. The threshold regression methods allow us to address asymmetric, non-linear link, or even regime shift issues which have emerged in the current account balance determination models.

3. Research Method

The intertemporal analysis of current account sustainability is based on the accounting rule. According to Hakkio and Rush (1991) and Husted (1992), the intertemporal budget constraint of a country is derived from national income identity:

$$C_t = Y_t - I_t - G_t - (X_t - M_t) \quad (1)$$

where C is consumption level, Y equates to income, I denotes investment, and $(X - M)$ represents foreign trade (export and import), respectively. A representative agent is assumed to live infinitely and smoothly consume over time by unrestrictedly lending or borrowing in international financial markets.

The current account balance determination is based on the accounting rules linking the foreign trade and debt conditions. If the current account deficit $(X - M)$ is financed by debt, D, the amount of debt in the next period $(t+1)$ will equal to D itself plus the interest rate (r) payment and the current account deficit in the current period.

$$D_{t+1} = (1 + r_t)\, D_t + (X_t - M_t) \tag{2}$$

Equation (2) can be extended by accommodating both solvency principles and intertemporal budget constraint. Incorporating a discount factor on the forthcoming debt, we have the present value constraint approach of the debt. Rearrange Equation (2)

$$M_t - r_t\, D_t = X_t + D_t - D_{t+1} \tag{3}$$

Following Husted (1992), the innovation in this method is by making the next iteration until *k* period for Equation (3), as follows:

$$M_t - r_t\, D_t = X_t + D_t - \lim_{k \to \infty} \left(\frac{1}{(1 + r_t)^{1+k}} \right) (D_{t+1+k}) \tag{4}$$

The left-hand side of Equation (4) describes the import spending and the payment (receipt) of interest on net foreign debt (assets).

Assuming that the limit in Equation (4) equals to zero, we have:

$$M_t - r\, D_t = X_1 + D_t \tag{5}$$

Separating *M* in the left-hand side and *X* in the right-hand side as (5) does not seem to be the case for Indonesia. Most Indonesia's export products are raw materials whereas the manufactured export products are supported by raw materials, semi-finished goods, and capital goods derived from imports. In other words, there is a strong correlation between export and import, implying the debt service payment plays a more important role in the current account balance. Modifying (5), we obtain:

$$(X_t - M_t) - r\, D_t = D_t \tag{6}$$

Equation (6) can be transformed into a long-run regression equation model as follows:

$$CAD_t^* = \alpha + \beta\, D_t + \epsilon_t \tag{7a}$$

Dividing both sides by national income, we obtain

$$RCAD_t^* = \alpha + \beta\, RD_t + \epsilon_t \tag{7b}$$

where α is a constant, $\beta = 1$ and ϵ_t is disturbance term which is normally distributed ~ $N(0, \sigma^2)$. The error term also represents the difference between the estimated values and the actual current account balances. The current balance is said to be highly sustainable if $\beta = 1$. In the case $0 < \beta < 1$, the current account balance is weakly ar low sustainable.

According to the World Bank and IMF (2005), current account level is determined by the exchange rate temporary fluctuations which are expected to be sustainable in the long-term. Adding the exchange rate (*er* in logarithmic form) as a control variables, we get:

$$RCAD_t^* = \alpha + \beta_1 RD_t + \beta_2 er_t + \epsilon_t \quad (8)$$

The standard intertemporal macroeconomic models postulate that debtor countries will let the home currency depreciate to create adequate foreign trade surpluses necessary to comply with their external liabilities (Lee *et al*., 2008).

Equation (8) is then transformed into the ARDL model. The ARDL is compatible with ECM. The use of the ARDL model is supported in that it makes it possible to easily appraise current account position both in the short-run and the long-run. Another benefit of the ARDL specification model is the consistency and efficiency of estimates in the presence of endogenous explanatory variables. Moreover, the conventional unit root tests are very sensitive to misleading results. Pesaran *et al*. (2001) put forward that the ARDL models produce consistent estimates of the coefficients, regardless of whether the underlying explanatory variable series data are *I(1)* or *I(0)*. The unrestricted ARDL form is as follows:

$$\Delta RCAD_t^* = \alpha + \beta_1 \Delta RD_t + \beta_2 \Delta er_t + \varphi_1 RD_{t-1} + \varphi_2 er_{t-1} + \varphi_3 RCAD_{t-1}^* + \epsilon_t \quad (9)$$

In a broader scope, the current account deficit is a measure of relative uncompetitiveness (Melvin dan Norrbin, 2017). To overcome the relative uncompetitiveness, the central bank could manipulate the exchange rate by intervening in the foreign exchange market. Due to the fact that data on central

bank operation in many cases are confidential, we use the relative change in foreign reserves (*FR*) as an indicator of the degree of market intervention (Daude *et al*., 2016). As suggested by Lin and Wang (2009), the operation of central bank intervention is expressed by an equation as follows:

$$\Delta\, er_t = k\, \Delta\, fr_t \tag{10}$$

The central bank could purchase foreign currency in the foreign exchange market, thus increasing international reserves holding, to allow foreign currency appreciate (or home currency depreciate); that is $k > 0$. In line with Hansen and Seo (2002), we set the central bank will intervene the foreign exchange market when the home currency depreciates and appreciates more than a certain value, let say *l* percent:

$$d_1 = \begin{matrix} 1 - if\ \Delta\, er_t > l_1 \\ 0 - if\ \Delta\, er_t \leq l_1 \end{matrix} \text{ and } d_2 = \begin{matrix} 1 - if\ \Delta\, er_t \geq l_2 \\ 0 - if\ \Delta\, er_t < l_2 \end{matrix} \tag{11}$$

Substituting Equations (10) and (11) to (9), we have:

$$\begin{aligned} \Delta\, RCAD_t^* = {} & \alpha + \beta_1\, \Delta\, RD_t + \beta_{21}\, \Delta\, er_t + \beta_{22}\, d_1[\Delta\, er_t \leq l_1] \times \Delta\, fr_t \\ & + \beta_{23}\, d_2[\Delta\, er_t \geq l_2] \times \Delta\, fr_t + \varphi_1\, RD_{t-1} \\ & + \varphi_2\, er_{t-1} + \varphi_3\, RCAD_{t-1}^* + \varepsilon_t \end{aligned} \tag{12}$$

The symmetric impact of central bank intervention on the current account balance can be examined whether $\beta_{22} = \beta_{23}$. Regarding cointegration, the Wald test is carried out to test the null hypothesis whether $\varphi_1 = \varphi_2 = \varphi_3 = 0$.

All variables to be used in this research are specified as follows. The exchange rate is defined as the price of US Dollar against Rupiah. The current account records a nation's transactions with the rest of the world – specifically its net trade in goods and services, its net earnings on cross-border investments, and its net transfer payments – over a defined period. The current account balance is recorded in million US Dollar. The reserve basket of Indonesia comprises various foreign currencies, which are under control of the central bank. Stated in billion US Dollar, they are readily available for any balance of payments financing.

The sample periods extend from 2004(M4) to 2021(M6). The discussion of exchange rates fluctuations ideally covers the daily data. Unfortunately, the data of daily central bank intervention in foreign exchange market is confidential. Hence, we explore the foreign reserves and exchange rate data on a monthly basis with caution to evaluate their impact on the current account balance performance. Most of the monthly data are taken from the central bank of Indonesia, the Central Board of Statistics, and IMF. In the case where monthly data are unavailable, linear interpolation from quarterly data is used.

4. Results and Discussion

Table 1 presents the descriptive statistics. Each mean value is close to the corresponding median. The closeness of the mean to the median value preliminary presents that all of the variables under consideration are normally distributed. While the differences between maximum and minimum values for the exchange rate and foreign reserve are relatively small, the current account and debt ratios series data substantially vary. The high dispersion of current account balances is confirmed by its standard deviation. The high variability of the current account balances is a common feature in many developing countries (Kandil, 2009).

The non-zero value of skewness confirms that each series data is asymmetrically distributed. The upper tail of the foreign reserves distribution, for example, is thicker than the lower tail. In addition, the coefficients of kurtosis are less than 3. They suggest that the shape of the distribution of exchange rate and foreign reserve is thinner (moderate) than the normal distribution. The harmony distribution between series data of foreign reserves and exchange rates raises a logical question of how closely related they are.

Table 1. Descriptive Statistics

	RCAD*	RD	er	fr
Mean	0.02	1.35	9.32	11.33
Median	0.01	1.34	9.26	11.56
Maximum	0.21	2.27	9.70	11.90
Minimum	-0.09	0.67	9.05	10.32
Std. Dev.	0.04	0.26	0.19	0.46
Skewness	1.96	1.07	0.17	-0.77
Kurtosis	9.02	4.89	1.34	2.11

To evaluate further the synchronous movement patterns among exchange rates, foreign reserves, debt, and current account balances, we employ the Granger causality test. As presented in Table 2, the bi-directional causality exists, running from debt to current account balance. Debt is used to finance the current account deficits. Rising import exceeds export implies the country is losing its competitiveness in the global market. The need for debt financing is required to meet the current account imbalance. A large current account imbalance will pressure the domestic currency. However in the second round, a depreciation of the domestic currency will make the price of exports cheaper and imports more expensive. The latter factors help to improve the current account imbalances (Calderon *et al*., 2002).

Those above results suggest that current account imbalance is growing in significance in the exchange rate complexity. As a result, the exchange rate may have a little impact on the current account imbalance compared to the foreign reserves. This is plausible since the foreign reserves run to exchange rate only in a unidirectional causality. It means that foreign reserve is the cause and otherwise the exchange rate is the effect. In other words, the change in foreign reserves determine the exchange rate dynamics and further affect the current account balance. Consequently, exchange rate directly determines the current account balance improvement, while the foreign reserves performance indirectly affects the current account balance.

Table 2. Granger Causality Test

Null Hypothesis:	Lags	F-Stat	Prob.
Δ RD does not Granger Cause Δ RCAD*	3	3.7813	0.0114
Δ RCAD* does not Granger Cause Δ RD		0.0117	0.9983
Δ RCAD* does not Granger Cause Δ er	4	0.9631	0.4289
Δ er does not Granger Cause Δ RCAD*		5.9023	0.0002
Δ fr does not Granger Cause Δ er	3	2.5225	0.0590
Δ er does not Granger Cause Δ fr		0.8065	0.4916

Before executing the ARDL models, we observe the time series property of the variables to ensure that all variables are not integrated of order two (*I(2)*). Table 3 performs the Augmented Dickey-Fuller unit roots test results for the underlying series data. The null hypothesis of nonexistence of unit roots can be accepted for each variable in the level (except the debt ratio), implying the series data are non-stationary. The non-rejection of the null hypothesis of unit roots may be induced by the deterministic trend embedded in the data series.

The interesting result is that the current account balance series data do not have unit roots at the level form. The absence of unit roots preliminary indicates that the current account deficit does not revert to the mean, implying that the current account deficit is unsustainable. However, the null hypothesis can be denied even at the 1 percent of significance level for all of series data in the first-difference. This explains that after first-differencing, stationary is reached, i.e. all the series data are *I(1)*. Since there is no series data performing *I(2)*, the ARDL is applicable.

Table 3. ADF Unit Roots Tests

	Level		First-Difference		Conclusion
	t-stat	Prob.	t-stat	Prob.	
RCAD*	-1.8608	0.3504	-11.0725	0.0000	*I(1)*
RD	-3.6198	0.0061	-	-	*I(0)*
er	-1.0659	0.7292	-11.7705	0.0000	*I(1)*
fr	-1.3552	0.6036	-12.1645	0.0000	*I(1)*

The ordinary least squares (OLS) estimation results are reported in Table 4. Estimation of Equation (9) is considered as a base-line (Model (1)). Model (2) and Model (3) based on Equation (12) are the extended ones. As presented in Table 4, all the coefficients estimated in the equation short-run model are mostly statistically significant, verified by t-statistics value that exceeds the related t-table at 5 percent or even 1 percent significance levels. Other statistical indicators, such as coefficient of determination (R^2), F-test, standard error of regression, and DW-test are reliable. The low R^2 indicates excessiveness of actual current account balance relative to the optimal one.

In the short-run models, the sign of each parameter estimate is as theoretically expected. The debt to GDP ratio positively influences the current account deficit to GDP ratio. A one basis point increase in the debt to GDP ratio in the short-run induces the current account deficit to GDP ratio for about 0.04 basis point on the average. Meanwhile, A one basis point increase in the debt to GDP ratio in the long-run induces the current account deficit to GDP ratio for about 0.02 basis point on the average. Based on those figures, we can infer that the current account balance is low sustainable or even unsustainable, i.e. the change in debt ratio is not proportionally followed by the change in current account balance.

Unfortunately, the short-run effect of the exchange rate is insignificant. The market players perceive that domestic currency depreciation or appreciation is temporary, resulting in it not changing the decision to export or import. In contrast, the long-run impact of exchange rate statistically

determines the improvement of current account balance. As noted by Bon (2014), a depreciation of the domestic currency can make the current account deficit to GDP ratio better. Accordingly, the improvement of current account balance strongly requires the exchange rate stabilization both in level and the rate of change.

The estimation of the lagged dependent variable produces significant coefficients. The corresponding coefficient shows persistence. The current account balance persistence can be viewed as a measure of the degree of dependence of current account balance behavior on its past developments. The coefficient of lagged dependent variables is quite the same, spanning from 0.35 to 0.4, implying that a change in the current account balance between month *t-1* and *t* drives up the current account balance process in *t* only 0.35 to 0.4 percent partial adjustments to improve toward the desired levels. As a consequence, the current account balance tends to be more persistent rather than to respond to the exchange rate fluctuation.

Table 4. The Short-run Regression Results

	(1)		(2)		(3)	
	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
C	0.2533	0.0126	0.2479	0.0116	0.2681	0.0077
Δ RD	0.0443	0.0430	0.0471	0.0268	0.0460	0.0341
RD(-1)	0.0192	0.0134	0.0219	0.0038	0.0208	0.0071
Δ er	-0.0045	0.9468	0.1015	0.1528	0.0727	0.3164
er(-1)	-0.0291	0.0091	-0.0291	0.0070	-0.0309	0.0052
RCAD*(-1)	-0.3521	0.0000	-0.3957	0.0000	-0.3844	0.0000
d(Δ er ≥ 0.00) × Δ fr	-	-	0.1603	0.0345	0.1555	0.0448
d(Δ er ≤ 0.00) × Δ fr	-	-	0.3065	0.0004	-	-
d(Δ er ≤ -0.025) × Δ fr	-	-	-	-	0.3231	0.0452
R^2	0.1923		0.2534		0.2215	
Adj R^2	0.1724		0.2274		0.1944	
S.E.R	0.0269		0.0260		0.0266	

S.S.R	0.1472		0.1361		0.1419	
F	9.6687		9.7467		8.1700	
DW	1.4065		1.3994		1.4174	
Unit roots test of residuals	-2.8498	0.0533	-2.8967	0.0475	-11.3934	0.0000
	Non cointegrated		Cointegrated		Cointegrated	

Splitting the exchange rate into depreciation and appreciation – in which the central bank can intervene by deploying foreign reserves – offers a better result. As shown in Model (2), interestingly the effect of exchange rate on the current account operates in a non linear manner. The impact of home currency appreciation is stronger than depreciation, indicated both by its magnitude and significance level. While the currency depreciation improves the current account deficit for about 0.16, the appreciation of domestic currency induces it for about 0.31 on the average. In such a case, the exchange rate stabilization strongly requires extra efforts to structurally address the current account deficits, which supports Gnimassoun and Coulibaly (2014).

Furthermore, imposing 2.5 percent*) tolerable threshold for exchange rate to appreciate as Model (3) provides an optimal level. The impact of the central bank' intervention to safeguard the exchange rate from appreciating more than 2.5 percent becomes higher. The foreign reserves deployment can improve the current account balance for about 0.32 basis point compared to 0,16 basis point when the foreign reserves deployment is used to maintain currency depreciation even though the two impacts are symmetric.

Table 5 presents the symmetric test of central bank response. Using Wald test, it seems that 'fear of floating' and 'fear of capital flight' concurrently hold. The central bank to conduct foreign exchange market intervention to maintain domestic currency from deeper depreciation is intensive to keep the current account balance performance. The need for capital and/or financial

*) We have tried imposing a combination of percentage of currency depreciation and appreciation. A 0 percent depreciation and 2.5 percent appreciation thresholds statistically give the optimal result.

inflows to finance the current account deficits also makes the central bank more responsive to domestic currency appreciation.

Table 5. Symmetric Response Test

Model	(2)			(3)		
Test	Value	df	Prob.	Value	df	Prob.
t-stat	1.3257	201	0.1864	-0.9738	201	0.3313
F-stat	1.7575	(1, 201)	0.1864	0.9483	(1, 201)	0.3313
χ2-stat	1.7575	1	0.1849	0.9483	1	0.3301
Conclusion	Symmetric			Symmetric		

Concerning the cointegration issue, Table 4 also depicts the cointegration test. Applying ADF unit roots test on the residual for each model, we can conclude that debt ratio, exchange rate, and current account balances in Model (1) are not cointegrated. However, after incorporating foreign reserves as Model (2) and Model (3), the three variables would be cointegrated. Cointegration is a fundamental concept to investigate the long-term behavior of the data. Cointegration deals with the long-run analysis of the relationship among variables with the different order of integration that tend to evolve towards the long-run equilibrium relationship.

The significance of coefficients of lagged dependent variables also performs the presence of cointegration. To convince the existence of cointegration, we examine the possibility of cointegration by conducting the bound test. The result is reported in Table 6. The result of the F-test values falls outside the upper bound in the lower (0.01) probability value. It seems that the null hypothesis of no cointegration is denied, implying the existence of cointegrating relation. In other words, the debt, foreign reserves, exchange rates, and current account balance are said to be cointegrated.

Table 6. Bound Cointegration Test

Model	Test Statistic	Value	df	Prob.	Conclusion
1	F-stat	13.9080	(3, 203)	0.0000	Cointegrated
	χ2-stat	41.7240	3	0.0000	
2	F-stat	17.8916	(3, 201)	0.0000	Cointegrated
	χ2-stat	53.6746	3	0.0000	
3	F-stat	15.5514	(3, 201)	0.0000	Cointegrated
	χ2-stat	46.6542	3	0.0000	

So far we have discussed stationary, cointegration, and the role of exchange rate on the current account balance. The time series data stationary properties are compulsory to establish cointegration. This presence of cointegration means that there is a long-run and stable relationship among the current account balance and its determinants. While the stationary is required for sustainability, cointegration is a necessary condition for solvency in the frame of intertemporal budget constraint. At this point, analyzing merely the long-run relationship between current account imbalance and debt cannot yet conclude definitively that the external deficit is unsustainable.

To achieve a robust conclusion about the issue, it is necessary to check the stability of the cointegrated regression equation. We employ FMOLS (fully modified OLS), DOLS (dynamic OLS), and CCR (cointegration canonical regression) as robustness tests. FMOLS is suitable where the series are cointegrated at first difference '*I(1)*'. FMOLS is attributed to Phillips and Hansen (1990) to provide optimal estimates of cointegrating regressions. DOLS (Saikkonen, 1991; Stock and Watson, 1993) is a simple approach to constructing an asymptotically efficient estimator that eliminates the feedback in the cointegrating system. The CCR estimator (Park, 1992) is based on a transformation of the variables in the cointegrating regression that removes the second-order bias of the OLS estimator. Those methodologies have the ability to produce reliable estimates in small sample sizes.

Table 7 presents the long-run current account sustainability test using cointegrating regression. FMOLS, DOLS, and CCR methods yield similar estimation results, the existence of cointegration among current account balance, debt, exchange rate, and central bank intervention. There is a positive relationship among current account balance, debt, and central bank intervention. The exchange rate is negatively related to the current account balance. The impact of the exchange rate is much higher than that in the short-run. Overall, despite Indonesia not being in violation of its intertemporal budget constraint, the current account imbalances of the country are unsustainable in the long-run. The net export enables us to react to the net foreign asset position. However, they grow slower than the debt growth. This result confirms Nurmalindah and Safuan (2013), Asmarani and Falianty (2015), Baharumsah *et al*. (2005), and Garg and Prabheesh (2022).

Table 7. Long-run Current Account Sustainability Test

	FMOLS		DOLS		CCR	
	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
C	0.7308	0.0000	0.6839	0.0000	0.7253	0.0000
RD	0.0446	0.0004	0.0455	0.0011	0.0447	0.0004
er	-0.0826	0.0000	-0.0780	0.0000	-0.0821	0.0000
Δ fr	0.3595	0.0001	0.6260	0.0015	0.4036	0.0014
R^2	0.2759		0.3401		0.2705	
Adj R^2	0.2653		0.2993		0.2598	
S.E.E	0.0333		0.0326		0.0335	
Long run variance	0.0021		0.0020		0.0021	
Sustainability Test						
t-stat	-76.64	0.0000	-69.65	0.0000	-77.45	0.0000
F-stat	5873.33	0.0000	4850.95	0.0000	5998.48	0.0000
χ2-stat	5873.33	0.0000	4850.95	0.0000	5998.48	0.0000
Conclusion	Unsustainable		Unsustainable		Unsustainable	

5. Conclusion

Current account balance is one of the prominent macroeconomic fundamentals in emerging markets. The presence of a large and persistent current account deficit is continually looked at with great attention. A large current account deficit usually brings a country to an excessive net foreign debt. A persistent current account deficit leads a country to a state of insolvency. An economy with high indebtedness tends to be more vulnerable toward any external shocks.

The empirical research focusing on the role of exchange rate and foreign reserves seems to be neglected for filling this empirical gap, this study examines the effect of exchange rates on the current account balance. Applying the autoregressive distributed lag model for Indonesia over the period of 2004(4)-2021(6), we conclude that the exchange rate remains the important determinant of the long-run current account balance movements. However, Indonesia's current account balance is persistent, confirmed by the absence of unit roots. The change in current account balance is not proportional with the change in debt ratio. Cointegrating regression analysis confirms that the current account balance is weakly sustainable or even unsustainable.

In the case of Indonesia, where the current account deficit is financed by capital and financial accounts, the stable exchange rate plays a critical role to improve the current account performance. Allowing the domestic currency to appreciate for no more than 2.5 percent, the central bank intervention in the foreign exchange market could improve the current account balance. The impact of central bank intervention on the current account balance is higher when the domestic currency is appreciating rather than depreciating. Accordingly, good exchange rate management would support the sustainability of current account balance. The exchange rate depreciation and appreciation in this study is treated as a discrete variable. Further research is advisable to accommodate the continuous change in exchange rates.

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