CURRENT ACCOUNT IMBALANCES AND EXCHANGE RATE VOLATILITY: EMPIRICAL EVIDENCE FROM INDONESIA

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Whether macroeconomic fundamentals affect the exchange rate volatility in emerging markets with an inflation-targeting regime or not is highly challenging. In this paper, the impact of the current account deficits and foreign reserves on the volatility of real exchange rates. Applying threshold quantile regression models related to Indonesia over the period from 2005(7) to 2021(12), it is concluded that both variables play an important role in controlling the exchange rate instability. Both coefficients are also found to have an upward linear pattern. The asymmetric impact of current account balance holds. Claiming that a two-percent current account deficit in the GDP is the safe amount of the deficit that will not significantly affect the foreign-exchange rate is justified as such. The asymmetric behavior of the current account balance has the potential to trigger real exchange rate volatility, thereby undermining the monetary policy within the framework of the inflation targeting regime. Accordingly, the optimal stock of foreign reserves might avoid imposing dual goals of inflation targeting and exchange rate stability.

Keywords: current account, foreign reserves, exchange rate, asymmetric response, quantile regression

INTRODUCTION

The 1997-1998 Asian Currency Crisis and the 2008 Global Financial Crisis made emerging markets pay more attention to external economic factors. Alongside successful stabilization programs, the main external factors determining the fluctuation of exchange rates are challenging. On the one hand,

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huge current account deficits underlie the financial instability problem (Kaminsky, Lizondo & Reinhart, 1997; Calderon, Chong & Loayza, 2002). In relatively noncompetitive environments, the emerging market's exchange rates are more volatile than those in developed economies (Chițu & Quint, 2018).

Additionally, the main cause for the currency/ monetary crisis is the shortage of foreign reserves in developing countries in Asia (Edwards, 2004; Levy-Yeyati, Sturzenegger & Gluzmann, 2013). Countries

preserve foreign reserves as a surprise absorber to cope with sudden brief fluctuations in worldwide payments (Aizenman & Lee, 2007). High international reserves reduce vulnerability to speculative attacks (Cheung & Qian, 2009) and limit exchange rate depreciation (Arslan & Cantú, 2019). The growth and level of foreign reserves are also a signal to global financial markets for the credibility and solvency of those countries' monetary policies (Andriyani, Marwa, Adnan & Muizzuddin, 2020).

Others argue that the current account deficits should be less of an issue when financed by capital and/ or financial inflows (Frankel & Rose, 1996; Chinn & Prasad, 2003). Capital market liberalization can compensate for current account imbalances (Steiner, 2013) and therefore lower exchange rate instability. Hence, liquid currencies and stable financial markets are necessary to attract capital and/or financial inflows (Verma & Bhakri, 2021), which in turn boosts foreign exchange in supply and eventually softens exchange rate volatility.

However, holding huge foreign reserves is not risk-free in terms of the opportunity cost (Green & Torgeson, 2007), lost aggregate income or welfare (Chan, 2007), or even the disruption of financial markets (Mohanty & Turner, 2006). In a similar fashion, covering a current account deficit after capital and/or financial inflows suffers a capital reversal or a sudden stop in capital inflows, which may exert adverse pressure on exchange rate volatility. Therefore, optimal foreign reserves in relation to a benefit and a cost is desirable for exchange rate stabilization (Islam, 2021).

Indonesia is a good example to discuss those issues on. Suffering a sky-rocketing inflation rate, dropped economic growth and the heavy currency depreciation during the 1997-1998 Asian financial crisis enforced Indonesia' monetary authority to implement various economic recovery agendas. In relation to the stabilization programs, the Central Bank switched the monetary policy frameworks to and fully adopted the inflation targeting (IT) regime in July 2005. All the fundamental changes made were aimed at achieving a stable currency (the Indonesian rupiah) both in terms of inflation and exchange rates,

the single goal as mandated by the new Law on the Central Bank.

In line with the independence of the Central Bank, the monetary authority discarded capital flow restrictions, removed interest rate limitations, replaced fixed exchange rates with a flexible exchange rate system, and deregulated almost the entire financial system. As a result, during the 2008 global financial crisis, Indonesia enjoyed relatively low inflation and stable exchange rates compared to the previous crisis. Unfortunately, Indonesia's current account has fallen into deficit since late 2011. The target of the two-percent current account deficit to the GDP ratio often was not reached. M. N. Nugroho, I. Ibrahim, T. Winarno and M. I. Permata (2014) show that the exchange rate depreciated 12.7 percent month-on-month once the current account deficit exceeded the GDP threshold of two percent.

Many researchers found that the Indonesia' current account deficits are unsustainable (Nurmalindah & Safuan, 2013; Asmarani & Falianty, 2015) or even insolvent (Garg & Prabheesh, 2022). To finance the unsustained current account imbalances, the country relies on the capital and financial flows accumulated in foreign reserves. The growth of international reserves has been remarkable in recent years. The foreign currency reserves have amounted to about 12.7 percent of the GDP at the end of 2020 and were capable of covering imports for nine months ahead, which is much longer than the conventional minimum standard of the three months' import.

Despite the substantial progress of the sectoral economy and the monetary policy management in Indonesia so far, the current account deficit remains chronic in nature. Indonesia's most exported products are raw materials, whereas manufactured export products are supported by raw materials, intermediate goods, and capital equipment derived from imports. The strong correlation between exports and imports implies that the debt service payment plays a more dominant role in the current account imbalance. As will be shown, the current account imbalances and the foreign reserves are separately analyzed in conjunction with exchange rate movements, and some studies have not taken into account their joint effect yet.

Accordingly, the purposes of this article include the investigation of (a) whether there are sufficient foreign exchange reserves to finance current account imbalances in order to hedge exchange rate instabilities or not; and (b) whether the maximum two percent current account deficit to the GDP ratio is empirically justified to maintain exchange rate performance and satisfy the optimal hoarding of foreign exchange reserves. Hence, the hypotheses to be tested in this study are as follows:

H1: Current account imbalances provoke exchange rate volatility.

H2: The accumulation of foreign reserves has a positive significant effect on the alleviation of exchange rate volatility.

H3: A two-percent current account deficit to the GDP ratio has no discernible impact on the declining of exchange rate volatility.

This article adds to the empirical literature on the international monetary policy in emerging markets with an IT regime. Combining the two fundamental macroeconomic variables in a unified method, quantile regression, which permits the outlier observations that often emerge in developing countries, is used. A nonlinear threshold quantile regression model is also designed so as to capture the asymmetric change in the exchange rate volatility position throughout the distribution.

This paper is organized as follows: in Section 2, a review of the empirical literature is given; the research methodology and the data used for the estimation are described in Section 3; Section 4 contains the estimates and the discussion of the results obtained, while conclusions are presented in Section 5.

REVIEW OF EMPIRICAL LITERATURE

The current account balance comprises the balance of trade in goods/services and net investment earnings from foreign assets plus net transfers. In general, a current account deficit is a consequence of an increasing net trade deficit where the value of imports is greater than the value of exports. As a result, there will be a leakage in terms of the net money outflow from a home's income circulation. Consumers and producers pay for the imported goods/services in their own currency, which in turn is converted into the counterpart country's currency. Hence, an increasing current account deficit causes an increased supply of a home currency in foreign exchange markets, resulting in the external value of the domestic currency drops.

Persistent exchange rate depreciation can be induced by fundamental factors, such as low productivity growth in the traded goods/services industry or the unexpected terms of a trade shock (Roubini & Wachtel, 1999). In a free-floating exchange rate regime, the increasing net trade deficit might also have been generated by a fall in the value of exports, which will lead to the supply of foreign currency shifts to the left, which causes the home currency depreciation. In a managed or fixed exchange rate regime, this could reflect the mismatch between the monetary policy in place and the exchange rate policy, resulting in an overvalued exchange rate (Bubula & Ötker-Robe, 2003).

An overvalued exchange rate may trigger a decrease in savings when domestic residents intertemporally substitute current consumption for future consumption. It will further broaden the current account imbalance and decrease foreign reserves. A decline in foreign reserves can be reinforced by the expectations of the future devaluations that will drive capital outflows. Large capital outflows may also induce exchange rate depreciation in a flexible exchange rate system. If it is not accompanied by long-term fundamental factors, it can cause undervaluation. Eventually, the weakening of external imbalances retards a country's ability to achieve the conditions of exchange rate stability.

The empirical studies concerning the impact of current account imbalances on exchange rate fluctuations offer a diverging result. D. K. Das (2016) points out the fact that current account imbalances have a negative impact on the real effective exchange rate in the case of developed countries. For developing

countries, current account imbalances distort the stability of the exchange rate. In contrast, S. T. Jawaid and S. A. Raza (2013) observe that there is a long-term positive association, as well as a reciprocal causal relationship, between current account deficits and the exchange rate. However, P. Dybka and M. Rubaszek (2017) find that the exchange rate has a very limited effect on the current account balance for the largest number of developing countries.

Although current account imbalances adversely affect exchange rate stability, the effect of foreign reserves on exchange rate fluctuations in IT regimes provides ambiguous results. Foreign reserves accumulation has a limited impact on exchange rate volatility (Petreski, 2012). Foreign reserves might potentially turn the exchange rate into a nominal anchor and support inflation targets (Osawa, 2006). Unexpected changes in financial dollarization greatly influence nominal exchange rates (Fabris & Vujanovic, 2017). Nevertheless, foreign reserves mitigate exchange rate volatility in the IT period compared to the pre-IT period (Fermo & Lemence, 2014).

For individual IT countries, foreign reserves have a mixed impact on exchange rate stability. The decrease in Slovakia's foreign reserves has a greater impact on the exchange rate than the increase in its foreign reserves (Banerjee, Zeman, Ódor & Riiska Jr, 2018). S. Stevanovic, I. Milenkovic and S. Paunovic (2022) note that, for Albania and Romania, the adoption of the IT regime has no meaningful impact on macroeconomic instability. Declining South Korean foreign reserves boost exchange rate volatility in the long run (Law, 2019). The sufficiency of foreign reserves in Chile is more sound to manage exchange rate volatility primarily when the level of the exchange rate is high (Hansen & Morales, 2019). Meanwhile, the foreign reserves stock in Turkey is completely ineffective to overcome exchange rate volatility and its movements (Tümtürk, 2019).

Purely in the case of Indonesia, the related studies are limited. Most studies pay more attention to exchange rate misalignment rather than exchange rate volatility. Indeed, exchange rate misalignment may ultimately create exchange rate volatility (Grossmann & Orlow, 2022). S. Sidiq and H. Herawati (2016), for example, say that, against the US dollar, the rupiah is undervalued during free floating exchange rate regime. Based on the Big Mac index, T. S. Nababan (2016) shows that rupiah is undervalued against the US dollar. There is the evidence that the mismatch of the rupiah as a currency is underestimated for the largest number of the observation periods (Rasbin, Ikhsan, Gitaharie & Affandi, 2021).

While adequate foreign reserves induce the exchange rate to return to the long-term equilibrium levels (Kuncoro & Santoso, 2022), the policy rate (as the main instrument in the IT regime to anchor a future inflation expectation) fails to cope with exchange rate volatility (Kuncoro, 2020). Exchange rate stabilization in Indonesia seems to put too big an emphasis on controlling foreign reserves, thus leading to neglecting the improvement of current account imbalances, ultimately resulting in persistent exchange rate volatility. The failure of market intervention to reduce exchange rate deviation from its equilibrium level is harmful towards the likelihood of currency crises (Heriqbaldi, Widodo & Ekowati, 2020).

Accordingly, there is no widespread agreement on how foreign reserves affect exchange rate volatility and a further consideration is needed. It is worth noting that most studies analyzing exchange rate volatility have ignored current account conditions. Only few studies put foreign reserves in their analytical approaches. Therefore, the exchange rate is volatile for a particular country and not necessarily always for another since both current account imbalances and foreign reserves are a country's specifics. This study fills these empirical gaps and explores the role of current account imbalances and foreign reserves on exchange rate volatility in Indonesia, one of the biggest developing countries with the IT regime.

RESEARCH METHOD AND DATA

The foregoing empirical studies on the foreign exchange market generally rely on the GARCH

model (Generalized Autoregressive Conditional Heteroscedasticity) to measure volatility. Models such as GARCH focus on estimating the conditional mean function. The mean effect is obtained by the conditional inversion of the mean. The standard deviation from the conditional mean regression is interpreted as a measure of volatility. As a result, the distributional effects are not fully characterized and covariate influences are distorted, especially when the independent variables are highly heterogeneous.

These issues seem to be relevant to current account imbalances. Indonesia's current account deficit (as many researchers have pointed out) is unsustainable and the current account imbalance will rarely return to its mean. In other words, current account imbalances do have unit roots or are nonstationary. The presence of current account data stationarity suggests that the economy can generate a future trade surplus to meet all of its external debt. The non-stationarity of the current account imbalance may result from a structural collapse and country-specific characteristics (Roubini & Wachtel, 1999).

To address this fundamental issue, some authors involve two-regime threshold cointegration (Hansen & Seo, 2002), unit roots and fractional integration (Cunado, Gil-Alana & de Gracia, 2010), and Granger causality, Johansen cointegration, ARDL (autoregressive distributed lag) bound tests, and the simultaneous equation system (Behera & Yadav, 2019), whereas others use different approaches, such as nonlinear models to capture structural breaks (Chen, 2011), regime change or threshold (Afonso, Huart, Jalles & Stanek, 2019), and vector autoregression (Jin, Wang & Zhao, 2021). Cointegrating regression analysis is also employed to solve those econometric obstacles (Ozdamar, 2015) but with divergent results.

A. Y. Huang, S-P. Peng, F. Li and C-J. Ke (2011) and Ü. O. Tümtürk (2022) employ quantile regression to forecast exchange rate volatility without incorporating the current account balance or foreign reserves in their analytical models. The application of quantile regressions in the current account balance and foreign reserves analysis offers some advantages.

Quantile regression produces a robust estimator even if the set data on the dependent variable contain some outlier observations. Quantile regression is also a good choice when the set data observations suffer highly heterogeneous conditions. Quantile regression can yield the unique estimator for each quantile. It is therefore possible to assess the position of established data on the distribution of the dependent variables with the most effective policy choices available.

Current account balances have deteriorated in terms of currency depreciation as developing countries have not taken steps to stimulate export growth and are heavily dependent on imports, such as Indonesia (Kandil, 2009). G. Adler, K. S. Chang and Z. Wang (2021) emphasize the fact that monetary authorities with the dual goals of the IT and exchange rate stability make foreign exchange reserves more inclined to exceed the exchange rate. They imply that most unconditional exchange rate volatility distributions are typically right-skewed. Right-skewed exchange rate volatility and a pervasive current account imbalance and foreign reserves distributions suggest that the corresponding coefficient increases with quantiles, which further implies that the impact of the current account imbalance and foreign reserves on exchange rate volatility is greater for upper quantiles.

Unconditional quantile regression models can be applied to examine the volatility of the exchange rate (Koenker & Bassett, 1978). The exchange rate refers to the real term (*RER*):

$$RER_t \frac{ER_t}{P_t} \tag{1}$$

Real exchange rate volatility (*XV*) is assumed to be affected by the current account balance (*CA*), foreign reserves (*FR*), and other control variables (*Z*):

$$XV_t = a + b\ ca_t + c\ fr_t + d\ Z_t + \varepsilon_t \tag{2}$$

where the lower-case represents the ratio to the GDP and ε is the disturbance term.

Real exchange rate volatility is the standard deviation divided by its mean. Each variable is calculated by

moving the average for the 12 consecutive months:

$$XV_t = \sqrt{\frac{\sum_i^{12}(RER_i - \overline{RER})^2}{n-1}} \div \overline{RER} \qquad (3)$$

The coefficients a, b, c, and d are the unknown parameters to be estimated for various quantile values. The signs b and c are expected to be negative, the other coefficients also potentially negative or positive. By changing the quantile value from 0 to 1, it is possible to conditionally see the full distribution of the explanatory variables across the regressors.

The current account balance could be a deficit, a balance, or a surplus. The current account balance is rarely met in the real world. The deficit and surplus states have different impacts on exchange rate volatility. In line with B. E. Hansen and B. Seo (2002), unconditional exchange rate volatility is estimated by splitting up the current account balance into a deficit and a surplus:

$$d_1 = \frac{1 - if\ ca_t > 0}{0 - if\ ca_t \le 0} \text{ and } d_2 = \frac{1 - if\ ca_t < 0}{0 - if\ ca_t \ge 0} \qquad (4)$$

where d is a dummy variable. Substituting (4) for (2), it follows that:

$$XV_t = a + b_1[d_1 \times ca_t] + b_2[d_2 \times ca_t] + c\ fr_t + d\ Z_t + \varepsilon_t \quad (5)$$

The symmetric impact of the deficit and surplus states ($b_1 = b_2$) on exchange rate volatility can be exerted using the Wald test. To solve the asymmetric and nonlinearity problems often arising on financial markets and being comparable to the GARCH method, refer to Equation (5).

Similarly to (4), a tolerable current account imbalance ratio can also be set, let us say l percent is set as the threshold:

$$d_3 = \frac{1 - if\ ca_t > l_1}{0 - if\ ca_t \le l_1} \text{ and } d_4 = \frac{1 - if\ ca_t < l_2}{0 - if\ ca_t \ge l_2} \qquad (6)$$

and then

$$XV_t = a + b_1[d_3 \times ca_t] + b_2[d_4 \times ca_t] + c\ fr_t + d\ Z_t + \varepsilon_t \quad (7)$$

Because the focus is on volatility, reliable long-term historical data on current account balances, exchange rates, and international reserves are needed. The exchange rate is the US dollar price against the local currency (the Indonesian rupiah). Current account balances record a country's transactions with the rest of the world, primarily its net trade in goods and services, as well as its net income from cross-border investments and payments, and its net transfer over a period of time. Current account balances are stated in millions of US dollars. The international reserve basket contains various foreign financial assets under control of the Central Bank. Denominated in millions of US dollars, it can be used to finance any balance of payments.

The GDP is also stated in millions of US dollars. The real term of the exchange rate is converted from the price levels that deal with the CPI (consumer price index, 2012 = 100). Transforming exchange rate volatility into a real term means that our model inherently incorporates the inflation rate. In a similar fashion, dividing current account imbalances and foreign reserves by the GDP means that our model inherently takes into account growth rates (Figure 1). The sample periods range from 2005(M7) to 2021(M12), capturing the IT regime adoption. The total observations include 198 sampling points. All monthly data were obtained from Bank Indonesia, whereas the other data were obtained from the IMF.

RESULTS AND DISCUSSION

All the variables of interest are summarized in Table 1. The descriptive statistics indicate that each mean is close to the corresponding median. The close proximity of the mean to the midpoint value indicates that all the considered variables are normally distributed. While the real exchange rate volatility to reserves ratio peaks and troughs are relatively small, the data about the current account series vary to a great extent. The high variability of the current account balance is supported by the high standard deviation around its mean.
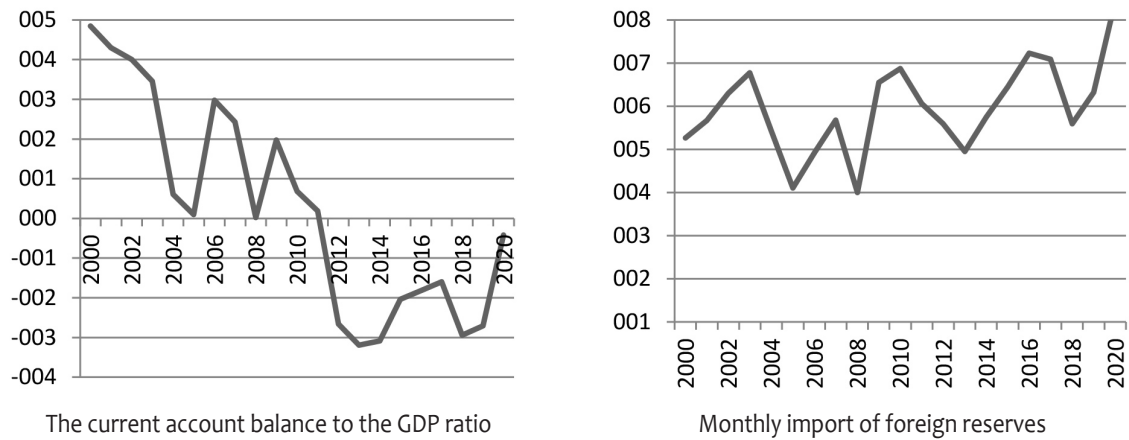
The current account balance to the GDP ratio

Monthly import of foreign reserves

Figure 1 The current account balance and foreign reserves in Indonesia

Source: Authors

Separating the current account imbalance into a deficit and a surplus offers a clearer explanation about the source of that variability. The biggest portion of the current account imbalance over the period of observation is not equitably distributed. The current account surplus and deficit are evident in 75 and 123 cases, respectively. The mean value of the deficit is also slightly higher than that of the surplus. Moreover, the biggest portion of the current account deficit values are stationed in the lower tail, as is indicated by the negative value of skewness. High current account volatility is a common feature of many developing countries (Kandil, 2009).

The non-zero skewness value indicates that all the series data are asymmetrically distributed. For example, the bottom of the foreign reserve distribution is thicker than the top of it. Also, the kurtosis coefficient is greater than 3. This indicates that the shape of the real exchange rate volatility to foreign reserves ratio distributions are sparser (moderate) than the normal distribution. The synchronous distributions among the current account, foreign reserves, and the exchange rate volatility series data raise plausible questions about how closely related they are.

Table 1 The descriptive statistics

	XV	ca	ca > 0	ca < 0	fr
Mean	0.0362	-0.0073	0.0175	-0.0224	0.0141
Median	0.0300	-0.0107	0.0165	-0.0214	0.0140
Maximum	0.1025	0.0567	0.0567	-0.0002	0.0189
Minimum	0.0060	-0.0597	0.0000	-0.0597	0.0103
Std. Dev.	0.0237	0.0231	0.0135	0.0120	0.0012
Skewness	1.3153	0.3932	0.9445	-0.6468	0.2070
Kurtosis	4.0066	2.6907	3.5178	3.4438	4.2826
Jarque-Bera	65.4469	5.8908	11.9877	9.5852	14.9853
Probability	0.0000	0.0526	0.0025	0.0083	0.0006
Observations	198	198	75	123	198

Source: Authors

To assess the pattern of the harmonic movement among exchange rate volatility, foreign reserves, and the current account balance, the correlation matrix is calculated as shown in Table 2. The opposite synchronous pattern is between the reserves and real exchange rate volatility (-0.18), whereas the correlation between the current account balances and real exchange rate volatility is pairwise positive (0.47). Based on these figures, real exchange rate volatility can be said to be tied to the current account dynamics. Since the current account balance is deficit-dominated, real exchange rate volatility is more directly related to growing current account deficits. They will be explored in more detail using econometric methods, as discussed in the previous section.

Table 2 The correlation matrix

	XV	ca	fr
XV	1.0000	0.4707	-0.1843
ca	0.4707	1.0000	-0.0205
fr	-0.1843	-0.0205	1.0000

Source: Authors

Does a high current account imbalance variability imply stationarity? Does relatively low instability in foreign reserves and real exchange rate volatility pretend to be non-stationary? Table 3 performs the Augmented Dickey-Fuller (ADF) and ADF with structural breaks unit roots test results for the basic series data. The null hypothesis that there is a unit root can be rejected for each variable, which implies that the series data are stationary. This implies that all the variables are integrated in the order of zero ($I(0)$).

The same test is applied to the first-difference series data. Structural breaks are found in 2007, 2008, and 2011. High current account imbalance variability arose in 2007 in accordance with the peak of the commodity boom. As a natural resource exporting country, the peak commodity boom triggered foreign exchange reserves. However, the foreign exchange reserves dropped in 2011, when the current account balance began to be a deficit. The high volatility of the

real exchange rate in 2008 took place in connection with the Global Financial Crisis of 2008. The capital outflows induced a lack of foreign exchange in the domestic financial market, resulting in the nominal exchange rate being sharply depreciated.

Table 3 The unit roots test

	Level		First-difference		
	t-stat	Prob.	t-stat	Prob.	Break point
XV	-3.3005	0.0161	-9.0339	< 0.01	2008M11
ca	-2.9193	0.0449	-13.5492	< 0.01	2007M01
fr	-4.6661	0.0001	-16.1140	< 0.01	2011M12

Source: Authors

Although there is a structural rupture in all the series data, the null hypothesis that there is a unit root in the time series for each variable can be rejected at the 5% or even 1% significance level. These stationary series data tests are important in order to ensure that the analytical model is an error-free regression and produces time-invariant estimates. They also suggest that the impact of the shock disappears over time and that the data for the three series evolve towards the long-term average. Ultimately, the three variables tend to approximate the long-term equilibrium relationship predicted by the related theory.

Different results are obtained for the foreign reserves. The coefficient of foreign reserves is found to be negative and significant only for the upper quantiles. The coefficients c in the quantiles of 0.50, 0.75, and 0.90 in the conditional median are statistically significant (Table 4). The quantile process estimate shows an upward linear trend. The higher foreign reserves stockpiling, the lower exchange rate volatility. This result is similar to many researchers' findings, as is highlighted in the review of the empirical literature section. They suggest that the efficacy of foreign reserves accumulation is different depending on the degree of real exchange rate volatility.

Separating the current account imbalances with respect to the surplus and the deficit as specified in Equation (4) generates an interesting result. As presented in Table 5, the regression results display

that the current account deficit ratio ($ca < 0$) affects the real exchange rate volatility for all quantiles. Surprisingly, the current account surplus ($ca > 0$) provokes real exchange rate volatility, in particular the quantiles 0.75 and 0.90, which is consistent with the studies of S. T. Jawaid and S. A. Raza (2013) and D. K. Das (2016). Compared to those studies, this study empirically proves that the impact of the current account deficit shows an upward linear trend throughout the unconditional real exchange rate volatility distribution.

A similar result is obtained for the foreign reserves. The stock of foreign reserves lowers exchange rate volatility in the higher quantiles, primarily in the quantile 0.75. This result confirms the study by E. Hansen and M. Morales (2019). The impact of the foreign reserves is stronger when the real exchange rate suffers high volatility rather than low volatility.

In addition, most symmetric tests infer that there is no different effect of the deficit and surplus countries on real exchange rate volatility. Hence, the effectiveness of the availability of foreign reserves differs depending on the degree of accumulation. Considering each current account imbalance state, this allows the Central Bank or the monetary authority to further achieve optimal foreign reserves.

Furthermore, imposing two percent as a tolerable threshold for the current account deficit ratio as in Equation (7) provides an optimal level. As depicted in Table 6, the impact of a more than two percent current account deficit ratio could lower real exchange rate volatility by about 0.8 basis points in the top 10 percent of the distribution. This finding supports the study by M. N. Nugroho *et al* (2014). While they show that the exchange rate at level will drop after a current account deficit exceeding the threshold of the

Table 4 The estimation results of the simple quantile regression

	Quantile				
	0.10	0.25	0.50	0.75	0.90
C	0.05[*]	0.05[**]	0.07[***]	0.09[***]	0.13[***]
ca	0.19[***]	0.18[**]	0.31[***]	0.66[***]	0.87[***]
fr	-2.23	-1.72	-2.58[**]	-2.68[*]	-3.91[***]
Pseudo R^2	0.04	0.06	0.08	0.18	0.30
Adj R^2	0.03	0.05	0.07	0.17	0.29
S.E.R	0.03	0.03	0.02	0.02	0.04

Note: [***], [**], and [*] denote significance at the 1%, 5%, and 10% levels, respectively; S.E.R. denotes Standard Errors Residuals
Source: Authors

Table 5 The estimation results of the extended quantile regression

	Quantile				
	0.10	0.25	0.50	0.75	0.90
C	0.06[***]	0.05[**]	0.07[***]	0.10[***]	0.10[***]
ca < 0	0.48[***]	0.28[*]	0.29[**]	0.42[***]	0.66[***]
ca > 0	-0.14	0.06	0.36	1.14[***]	1.52[***]
fr	-2.65[*]	-1.78	-2.50[*]	-3.61[**]	-2.34[*]
Pseudo R2	0.06	0.06	0.08	0.20	0.31
Adj R2	0.05	0.05	0.06	0.19	0.30
S.E.R	0.03	0.03	0.02	0.02	0.04
Symmetric	No[**]	Yes	Yes	No[**]	Yes

Note: [***], [**], and [*] denote significance at the 1%, 5%, and 10% levels, respectively; S.E.R denotes Standard Errors Residuals
Source: Authors

Table 6 The estimation results of the threshold quantile regression

	Quantile				
	0.10	0.25	0.50	0.75	0.90
C	0.05**	0.05**	0.08***	0.09***	0.08***
ca < -0.02	0.47***	0.41***	0.34***	0.43***	0.80***
-0.02 < ca < 0	0.78***	0.93***	0.78***	0.91***	2.03***
ca > 0	-0.22	-0.19	0.28	1.05***	1.22*
fr	-2.10	-1.65	-2.73**	-2.82**	-0.73
Pseudo R²	0.08	0.09	0.09	0.21	0.34
Adj R²	0.06	0.07	0.07	0.20	0.32
S.E.R	0.03	0.03	0.02	0.02	0.04
Symmetric	No**	No*	Yes	No***	No***
Slope equality test	Quantile	0.25	0.50	0.75	0.90
	0.10	2.12	5.03	34.47***	55.95***
	0.25		4.83	32.72***	53.17***
	0.50			14.95***	37.97***
	0.75				20.64***

Note: ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively; S.E.R denotes Standard Errors Residuals

Source: Authors

two percent of the GDP, this paper is more concerned with volatility.

Allowing the current account deficit ratio to be no less than two percent of the GDP could lower real exchange rate volatility by about 2.03 basis points in the top 10 percent of the distribution. Meanwhile, the current account surplus tends to induce real exchange rate volatility. It seems that the 'fear of capital mobility' (Steiner, 2013) works together with the 'fear of appreciation' (Levy-Yeyati *et al*, 2013). Foreign exchange market players are sensitive to the foreign reserve stock. At the same time, capital needs and/ or capital inflows to finance current account deficits also make foreign exchange market participants responsive to the local currency appreciation.

Accordingly, the Central Bank's target of maximum two percent Indonesia's current account deficit to GDP ratio is justified here. The current account deficit ratio no lower than two percent seems to be desired. In this position, the existing stock of the foreign reserves enables it to maintain the exchange rate against instability. Moreover, the symmetry test results show that the slope coefficients are quite different.

The slope coefficients substantially differ across the 0.75th and 0.90th pairwise quantiles, implying that adequate foreign reserves are required to overcome the excessive exchange rate volatility induced by the current account imbalances.

It is also necessary to test whether the results of the simple model are equal to the extended models that incorporate the classification of the current account imbalances. Table 6 also presents the Wald test for the equality of slope coefficients across the quantiles. Obviously, there are some different slope coefficients across quantiles. All the slope coefficients in the quantiles 0.75 and 0.90 pairwise substantially differ from the others, as is found in the individual symmetric tests. These results show that the different slope coefficients are not only intra-quantile but inter-quantile coefficients as well.

Overall, the sign, magnitude, and significance of the current account imbalances and foreign reserve coefficients do not substantially alter. The current account imbalances and the stock of foreign reserves successfully explain the dynamics of exchange rate volatility. Although there is a structural break, real

exchange rate volatility remains predictable with respect to the disequilibrium process. Therefore, the conclusions presented in this paper are robust independently of the control variables to be added in the econometric model.

CONCLUSION

This paper aims to evaluate the impact of current account imbalances and foreign reserves availability on real exchange rate volatility in the IT regime. To the best of the authors' knowledge, this study could be considered as a pioneer investigating the effectiveness of the IT regime to curb exchange rate volatility by connecting it to current account imbalances and foreign reserves. Considering the case of Indonesia over the period from 2005(7) to 2021(12), the results of quantile regression show that the current account imbalance enhances exchange rate fluctuations, and that the availability of foreign exchange reserves moderates exchange rate volatility. Thus, the hypotheses H1 and H2 can be accepted. It is also found that the coefficients of the two main macroeconomic variables tend to increase linearly. The estimate of the regression quantile is greater at higher quantiles than at lower quantiles.

Current account imbalances differently affect real exchange rate volatility. The quantile process estimates for the deficit state are significantly lower than those for the surplus states. However, allowing the current account deficit ratio to be no less than 2 percent of the GDP has a greater effect on the upper quantile of the real exchange rate volatility distribution. This confirms the third hypothesis. The corresponding slope coefficient can be interpreted as the increasing effect of both variables on exchange rate volatility. In this position, capital and/or financial inflows enable keeping the exchange rate against instability.

Given the different effect of current account imbalances on real exchange rate volatility holds not only intra-quantile but also inter-quantile, improving external competitiveness should be an integral part of the macroeconomic stabilization policy. Current account imbalances will stimulate imported inflation. It then seriously boosts the domestic inflation rate and thereby ruins the credibility of the IT monetary policy. Foreign reserves accumulation generated from capital and/or financial inflows can control exchange rate volatility. Accordingly, the optimal stock of foreign reserves might avoid imposing dual goals of IT and exchange rate stability.

The issue of current account imbalances and foreign reserves in relation to exchange rate volatility is open to reinvestigation. The current account imbalances (i.e. the deficit and the surplus) referred to in this study are treated as a discrete variable. Further research is advisable to accommodate continuous change in current account imbalances. Since exchange rate fluctuations consist of both appreciation and depreciation, the distinction of changes in foreign reserves to accommodate each state is also strongly recommended. Eventually, those methodological improvements allow the implementation of the better-specified monetary policies oriented towards minimizing the economy's vulnerability to external shocks in the IT regime.

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DEBALANSI TEKUĆEG RAČUNA I NESTABILNOST DEVIZNOG KURSA: EMPIRIJSKI DOKAZI IZ INDONEZIJE

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Pitanje da li makroekonomska kretanja utiču na nestabilnost deviznog kursa na novonastajućim tržištima sa režimom ciljanja inflacije predstavlja veliki izazov. U ovom radu, razmatraju se uticaji debalansa tekućeg računa i deviznih rezervi na nestabilnost realnog kursa. Primenom graničnih kvantilnih regresionih modela za Indoneziju u periodu od 2005(7) do 2021(12), zaključuje se da obe promenljive igraju važnu ulogu u kontrolisanju nestabilnosti kursa. Takođe se došlo do saznanja da koeficijenti pokazuju uzlazni linearni trend. Prisutan je asimetričan uticaj bilansa tekućeg računa. Opravdana je tvrdnja da je racio deficita tekućeg računa prema BDP-u od dva procenta siguran. Asimetrično ponašanje bilansa tekućeg računa ima potencijal da inicira nestabilnost realnog kursa, podrivajući time monetarnu politiku u okviru režima ciljanja inflacije. U skladu sa tim, optimalnim zalihama deviznih rezervi može se izbeći nametanje dvostrukih ciljeva usmerenih na suzbijanje inflacije i stabilnost kursa.

Ključne reči: tekući račun, devizne rezerve, devizni kurs, asimetrični odziv, kvantilna regresija