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IS CURRENCY DEPRECIATION OR DEFICIT SPENDING EFFECTIVE FOR INDONESIA? APPLICATION OF AN EXTENDED IS-MP-AS MODEL

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ABSTRACT

Applying an extended IS-MP-AS model, the paper finds that real appreciation raised real Gross Domestic Product (GDP) during 2000.Q1-2012.Q1 whereas real depreciation increased real GDP during 2012.Q2-2016.Q4 and that a higher deficit/GDP ratio does not influence real output in Indonesia. Moreover, a lower real federal funds rate in the U.S., a higher real stock index, a lower real crude oil price or a lower expected inflation rate would help increase real output. These results suggest that either real depreciation or real appreciation of the rupiah may increase or reduce real output, depending upon the time period under consideration and that deficit-financed expansionary fiscal policy is ineffective due to complete crowding-out effect.

JEL Classifications: F41, E52, E62

Keywords: IS-MP-AS model, Exchange rates, Government deficits, World interest rates, Stock prices, Oil prices

1. INTRODUCTION

The exchange rate of the Indonesian rupiah exhibited more fluctuations than the exchange rate of some of other developing currencies. The rupiah plunged as much as 338.94% versus the U.S. dollar during the Asian financial crisis beginning in July 1997 and declined 61.06% during 2011.Q3-2015.Q3 after the 2008-2009 global financial crisis. The Indonesian central government has continued to spend more than its tax revenue and to incur budget deficits since 2005.

A weaker rupiah may increase or reduce aggregate output. Depreciation of the rupiah is likely to stimulate net exports and shift aggregate demand to the right. On the other hand, a weaker rupiah tends to raise the cost of imported goods, increase domestic inflation, and shift aggregate supply to the left. The net impact needs to be examined empirically.

Expansionary fiscal policy is expected to shift aggregate demand to the right and increase real Gross Domestic Product (GDP). However, deficit-financed expansionary fiscal policy is likely to cause the crowding-out effect on private spending. Whether the positive effect of deficit-financed government spending would be partially or completed cancelled out by the negative crowding-out effect needs to be tested empirically.

This study applies the IS-MP-AS model to examine whether real depreciation or a higher government deficit/GDP ratio would affect real output in Indonesia. Some of the previous articles use the money supply as a proxy for monetary policy (An, Kim and Ren, 2014; Bahmani-Oskooee, 1998; Bahmani-Oskooee, Chomsisengphet and Kandil, 2002; Kim, An and Kim, 2015; Kim and Ying, 2007; Morley, 1992; Moreno, 1999). Romer (2000) suggests that the IS-MP-AS model has the advantage over the IS-LM-AS model partly because an interest rate rule would be better than the LM function as many central banks including Bank Indonesia target the policy rate instead of the money supply.

2. LITERATURE REVIEW

Several studies have examined the impact of real depreciation on aggregate output based on the samples including Indonesia. Based on a cross-sectional sample of 28 LDCs including Indonesia, Morley (1992) revealed that real devaluations had a significant negative effect on capacity utilization mainly due to a huge decline in investment spending. Fiscal and monetary policies were found to play minor roles.

Using a sample of 23 LDCs including Indonesia during 1978.Q1-1988.Q4, Bahmani-Oskooee (1998) applied the cointegration technique to study the relationship between output and the exchange rate. He found that there was no cointegration or long-term relationship between real output and the exchange rate for Indonesia, suggesting that any impact of currency depreciation on output would be temporary.

Moreno (1999) examined the relationship between output and the real exchange rate for eight selected East Asian countries including Indonesia during 1975-1998. Explanatory variables considered included the real exchange rate, M2 money, real government spending, foreign output and the real federal funds rate. He showed that devaluations are contractionary and that banking crises in these countries worsened the negative impacts.

Bahmani-Oskooee et al. (2002) studied the effect of real depreciation on output for five selected Asian countries including Indonesia during 1976.Q1-1999.Q4. They indicated that real depreciation was contractionary for Indonesia and that more real government spending, a higher foreign income and a higher energy price increased output for Indonesia.

Kim and Ying (2007) investigated the effect of real depreciation on output for nine selected developing countries including Indonesia. Variables considered include real output, capital flows, relative prices, real money supply, the current account balance and the exchange rate. For Indonesia, currency depreciation was found to be contractionary during the pre-crisis period.

An et al. (2014) employed the VAR model to study the effect of currency depreciation on output for 13 selected countries including Indonesia. Five endogenous variables considered consist of real output, the current account balance, the consumer price index, the real effective exchange rate, and real money supply. They reported that contractionary depreciation could happen in the developed and the developing countries. For Indonesia, real depreciation resulted in reduced output.

Based on a sample of six developed and seven developing countries including Indonesia, Kim et al. (2015) used the VAR model to study the impact of depreciation on output. They considered six endogenous variables including the capital account balance, the current account balance, the nominal effective exchange rate, real income, real money supply, and the relative price. They found that currency depreciation was likely to be contractionary in developing countries and expansionary in developed countries.

3. THE THEORETICAL MODEL

Extending Romer's model, we can state the IS, the monetary policy (MP) and the aggregate supply (AS) functions as:

(1) $Y = f(Y, G, T, L, S, E)$
(2) $R = g(\pi - \pi^*, Y - Y^p, E, R^w)$
(3) $\pi = h(\pi^e, Y - Y^p, E, O)$
(4) $L = w(R)$

where

Y = Real GDP in Indonesia
G = Government spending
T = Government tax revenue
L = The real lending rate
S = The real stock price
E = The real exchange rate
R = The real policy rate
π = The inflation rate
π^* = The inflation target
Y^p = Potential real GDP
R^w = The world real interest rate
π^e = The expected inflation rate
O = The real oil price

Equation (2) is an extended Taylor rule (Taylor, 1993, 1999) and Equation (3) is an extended expectations-augmented aggregate supply function. Assuming that the inflation target and potential real GDP are constants in the short run, we can solve for the simultaneous equation model and express equilibrium Y as:

(5) $Y^* = x(E, G - T, R^w, S, O, \pi^e)$

The Jacobian is given by:

(6) $|J| = [(1 - f_Y) - f_L w_R g_\pi h_Y - f_L w_R g_Y] > 0$

The partial derivative of the equilibrium Y with respect to the real exchange rate can be written as:

(7) $\partial Y^* / \partial E = (f_E + f_L w_R g_\pi h_E + f_L w_R g_E) > or < 0$

The sign in Eq. (7) is ambiguous. Real depreciation tends to increase exports, reduce imports, and shift aggregate demand to the right. Real depreciation is likely to raise import costs, cause domestic price or

inflation to rise, and reduce short-run aggregate supply. The net effect on equilibrium Y needs to be tested empirically. Previous empirical findings for Indonesia are inconclusive. Bahmani-Oskooee (1998) shows that real output and real depreciation are not cointegrated. Christopoulos (2004) finds that real devaluation is expansionary in the long run whereas Morley (1992), Moreno (1999), Bahmani-Oskooee et al. (2002), Kim and Ying (2007), An et al. (2014), and Kim et al. (2015) find that real depreciation has a negative effect on real output.

According to the Ricardian equivalence theory, the effect of deficit- or debt-financed government spending is neutral in the long run (Barro, 1974, 1989). Cebula (1997), Cebula and Cuellar (2010) and Cebula (2014a, 2014b) indicate that more deficit spending raises the interest rate and results in the crowding-out effect. Aisen and Hauner (2013) show that the budget deficit would raise the interest rate significantly if a country has huge budget deficits, large domestic debt, high domestic borrowing, low capital mobility or low financial depth.

A higher real crude oil price is expected to reduce short-run aggregate supply and real output. Nonetheless, when a higher real crude oil price is due to demand factors, the impact on real GDP may be positive in the short run (Hamilton, 1996; Kilian, 2008a, 2008b).

4. EMPIRICAL RESULTS

The sources of the data came from Bank Indonesia, the Federal Reserve Bank of St. Louis, and IMF's *International Financial Statistics*. Real GDP is measured in billions of rupiah. The real exchange rate is measured as units of the rupiah per U.S. dollar times relative prices in the U.S. and Indonesia. The choice of the real exchange rate over the real effective exchange rate is due to a higher correlation coefficient between the real exchange rate and real GDP. A higher real exchange rate indicates depreciation of the Indonesian rupiah. The government deficit is expressed as a percentage of gross domestic product. The world real interest rate is represented by the federal funds rate minus the inflation rate in the U.S. The real stock price is calculated as the nominal equity index adjusted by the consumer price index in Indonesia. The real crude oil price is measured as the rupiah per barrel adjusted by the consumer price index in Indonesia. The expected inflation rate is estimated as the average inflation rate in the past four seasons. The sample period runs from

2000.Q1 to 2016.Q4 because earlier data for government deficits are unavailable.

Figure 1 shows the scatter diagram between Real GDP (REALGDP) and the Real Exchange Rate (REXCRATE). It appears to suggest that real appreciation raised real GDP up to 2012.Q1, but real depreciation increased real GDP after 2012.Q1.

FIGURE 1
Scatter Diagram between Real GDP (REALGDP)
and the Real Exchange Rate (REXCRATE)

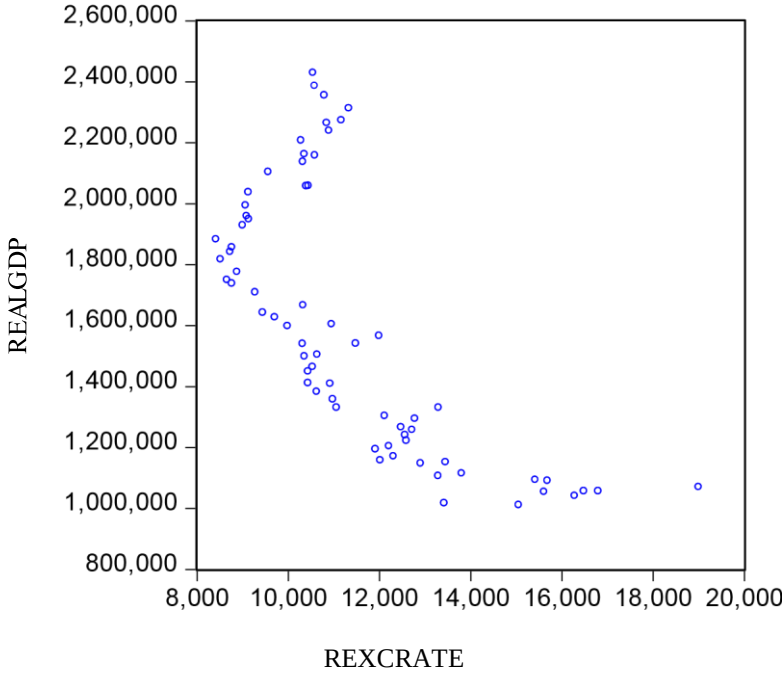
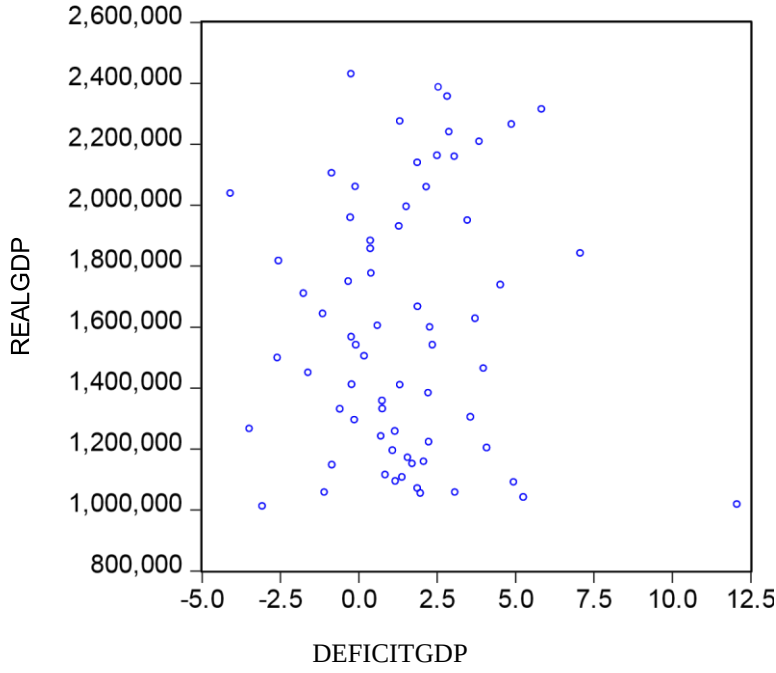


Figure 2 shows the scatter diagram between Real GDP (REALGDP) and the Government Deficit as a Percent of GDP (DEFICITGDP). It appears to indicate that it is difficult to detect whether real GDP and the deficit/GDP ratio had a positive or a negative relationship. To determine whether the coefficients of the real exchange rate and the intercept might have changed to different values during 2012.Q2-2016.Q4, an interactive dummy variable (E x D) and an intercept dummy variable (D) were included in the estimated

regression where D has a value of zero during 2000.Q1-2012.Q1 and 1 during 2012.Q2-2016.Q4:

(8) $Y^* = (E, E \times D, D, G - T, R^w, S, O, \pi^e)$

FIGURE 2
Scatter Diagram between Real GDP (REALGDP) and the Government Deficit as a Percent of GDP (DEFICITGDP)



The impact of a change in E on Y^* can be expressed as $\partial Y^*/\partial E = \beta_1 + \beta_2$ where β_1 and β_2 are the estimated coefficients for E and $E \times D$, respectively. Thus, $\partial Y^*/\partial E = \beta_1$ during 2000.Q1-2012.Q1 when the dummy variable has a value of zero, and $\partial Y^*/\partial E = \beta_1 + \beta_2$ during 2012.Q2-2016.Q4 when the dummy variable has a value of 1.

The ADF test reveals that these time series variables have unit roots in the level form and are stationary in first difference. The ADF test on the residuals show that the test statistic of -4.3089 is less than the critical value of -4.1032 at the 1% level, suggesting that these variables have a long-term stable relationship. In the cointegration test, the Scharwz information criterion is used to find the lag length to

be 1. Thus, $d(\varepsilon_t)$ is a function of ε_{t-1}, $d(\varepsilon_{t-1})$, a constant and a trend, where ε is the regression residual. The critical value comes from MacKinnon (1996). The unit root and cointegration tests with structural breaks are employed to detect whether there are unit roots and cointegration. The conclusion remains the same.

Table 1 presents the estimated regression. The GARCH process is employed because of the existence of potential autoregressive conditional heteroscedasticity and because it imposes fewer restrictions on the coefficients in the variance equation. A major reason to use a reduced-form equation is that the estimated coefficient in the reduced-form equation includes both the direct and indirect effects of a change in an exogenous variable on equilibrium real GDP.

TABLE 1
Estimated Regression of Log (Real GDP) in Indonesia
(2000.Q1-2016.Q4)

Variable	Coefficient	***z***-Statistic	Probability
Intercept	17.0720	118.3881	0.0000
Log(real exchange rate)	-0.31998	-9.3658	0.0000
Log(real exchange rate)* dummy variable	1.12427	6.4134	0.0000
Dummy variable	-10.1297	-6.2866	0.0000
Government deficit as a percent of GDP	-0.0018	-0.9470	0.3437
U.S. real federal funds rate	-0.0123	-3.1195	0.0018
Log(real stock price)	0.1897	9.2298	0.0000
Log(real oil price)	-0.0494	-2.2141	0.0268
Expected inflation rate	-0.0060	-3.6500	0.0003
R-squared	0.9575		
Adjusted *R*-squared	0.9518		
Akaike information criterion	-3.1705		
Schwarz criterion	-2.8115		
MAPE	3.8679		
Number of observations	68		

Notes: The real exchange rate is measured as units of the rupiah per U.S. dollar multiplied by relative prices in the U.S. and Indonesia. An increase means real depreciation of the rupiah, and a decrease means real appreciation of the rupiah. The dummy variable has a value of 0 during 2000.Q1-2012.Q1 and 1 during 2012.Q2-2016.Q4. MAPE is the means absolute percent error.

Except for the variables with negative or zero values, other variables are measured on a log scale. As shown, the independent variables with significant coefficients can explain approximately 95.75% of the change in real GDP. Except for the coefficient of the government deficit/GDP ratio, the coefficients of other independent variables are significant at the 1% or 5% level. The forecast error is relatively small as evidenced by the mean absolute percentage error of 3.87%.

Real GDP is positively influenced by the real exchange rate during 2012.Q2-2016.Q4 and the real stock price and adversely affected by the real exchange rate during 2000.Q1-2012.Q1, the U.S. real federal funds rate, the real crude oil price and the expected inflation rate. These empirical results imply that real depreciation (appreciation) of the rupiah would reduce (increase) real GDP during 2000.Q1-2012.Q1 but would raise (reduce) real GDP during 2012.Q2-2016.Q4. Real appreciation tends to reduce exports and aggregate demand but reduce import prices and domestic inflation and increase aggregate supply. On the other hand, real depreciation tends to stimulate exports and increase aggregate demand but raise import prices and domestic inflation and reduce aggregate supply. Hence, during 2000.Q1-2012.Q1, the positive effect of real appreciation would overwhelm the negative effect of real appreciation whereas during 2012.Q2-2016.Q4, the positive effect of real depreciation would dominate the negative effect of real depreciation.

To be specific, when the rupiah has a 1% real depreciation, real GDP would reduce by 0.32% during 2000.Q1-2012.Q1 but would rise by 0.80% during 2012.Q2-2016.Q4. The insignificant coefficient of the deficit/GDP ratio suggests that the negative crowding-out effect on private spending tends to cancel out the positive effect of deficit-financed government spending. If the federal funds rate increases 1 percentage point, the log of the real GDP would decrease by 0.01. A 1% increase in the real stock price would cause real GDP to rise by 0.19%. A 1% rise in the real crude oil price would cause real GDP to decline by 0.05%.

In comparison, the result of contractionary depreciation in Indonesia during 2000.Q1-2012.Q1 found in this study is similar to the results in Morley (1992), Moreno (1999), Bahmani-Oskooee et al. (2002), Kim and Ying (2007), An et al. (2014), and Kim et al. (2015). The finding of expansionary depreciation in Indonesia during 2012.Q2 to 2016.Q4 found in this paper is consistent with Christopoulos (2004).

Two other versions are estimated. If the real effective exchange rate is used, similar results are found: Real appreciation raised real GDP during 2000.Q1-2010.Q1, and real depreciation increased real GDP during 2010.Q2-2016.Q4. Note that the time periods for the dummy variable are slightly different from the ones when the real exchange rate is used in Table 1. If the real federal funds rate in the U.S. is replaced with the real lending rate in the U.S., its negative coefficient of -0.0099 is significant at the 1% level.

5. SUMMARY AND CONCLUSIONS

This article has examined whether real depreciation or more government deficit spending would affect real GDP in Indonesia. Other related variables are considered as well. Real depreciation hurt real GDP during 2000.Q1-2012.Q1 but raised real GDP during 2012.Q2-2016.Q4. A higher deficit/GDP ratio has no impact on real GDP. In addition, a lower U.S. real federal funds rate, a higher real stock index, a lower real crude oil price or a lower expected inflation rate would be conducive to economic growth.

There may be some policy implications. Real depreciation or appreciation may help or hurt real GDP depending on the sample period under consideration. Therefore, it is essential to assess their relationship periodically to examine if real appreciation or depreciation of the rupiah would benefit aggregate output. When the government considers to increase deficit spending, fiscal prudence would be needed as deficit-financed government spending is ineffective in raising real GDP. In conducting monetary policy, Bank Indonesia would need to pay attention to U.S. monetary policy in order to link Indonesia's real interest rate to the U.S. real interest rate.

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