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The Effect of Twin-shock on Monetary and Fiscal Policies in Indonesia

(Kesan Kejutan Berkembar terhadap Dasar Monetari dan Fiskal di Indonesia)

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ABSTRACT

The research aims to investigate whether the monetary and fiscal policies in Indonesia interact with each other as well as the effect of twin shock on the coordination. The study employs the cointegration analysis and Error Correction Model (ECM) to estimate quarterly data from 2001:1 to 2016:4. The study has found the existence of consolidated government budget constraint (GBC) that links the activities of fiscal authority (taxing, spending, and issuing the bond) with the activities of the monetary authority in the short and long run. The study also found the coordination between monetary and fiscal policies both in the short and long run. It is found that the short-run fiscal policy was influenced by the long-run shock of the exchange rate and the short-run monetary policy was influenced by the short and long-run shock of the price level. The study shows the importance of policy coordination in the currency and budget deficit management.

Keywords: Fiscal policy; monetary policy; policy coordination; policy interaction; error correction model

ABSTRAK

Kajian ini bertujuan untuk menyelidik sama ada dasar fiskal dan monetari di Indonesia bertinteraksi antara satu sama lain dan menyelidik kesan kejutan berkembar terhadap koordinasi tersebut. Kajian ini menggunakan analisis kointegrasi dan Model Pembetulan Ralat (ECM) untuk menganggarkan data suku tahun dari 2001:1 hingga 2016:4. Kajian ini mendapati wujudnya kekangan belanjawan kerajaan yang disatukan (GBC) yang menghubungkan aktiviti pihak berkuasa fiskal (mengenakan cukai, perbelanjaan, dan mengeluarkan bon) dengan aktiviti pihak berkuasa monetari dalam jangka pendek dan jangka panjang. Kajian ini juga mendapati terdapat koordinasi antara dasar monetari dan fiskal dalam jangka pendek dan jangka panjang. Didapati bahawa dasar fiskal jangka pendek dipengaruhi oleh kejutan kadar pertukaran jangka panjang dan dasar monetari jangka pendek dipengaruhi oleh kejutan tingkat harga jangka pendek dan jangka panjang. Kajian ini menunjukkan pentingnya penyelarasan dasar dalam pengurusan mata wang dan belanjawan defisit.

Kata kunci; Dasar fiskal; dasar monetari; koordinasi dasar; interaksi dasa; error correction model

INTRODUCTION

Bank Indonesia (BI) fell under the cabinet's responsibilities since its establishment in 1953 until 1999. Since Law no. 23/1999 concerning BI (effective May 17, 1999) was applied, BI has had full autonomy in terms of formulating and carrying out its duties and authorities (including autonomy from government interference) in carrying out its roles and functions as monetary authorities more effectively and efficiently. Bank Indonesia focuses on the stability of the value of the currency (Rupiah) both internally (against inflation) and externally (against the exchange rate). Since 2001 BI began to socialize inflation targeting (ITF) and in 2005 fully implemented it. The ITF framework has succeeded in reducing inflation, driving economic growth, and lowering interest rates (Warjiyo & Juhro 2016: 362).

The 2008/2009 global financial crisis fundamentally changed the mandate and monetary policy (Warjiyo & Juhro 2016: 23). In addition to maintaining price stability, BI must also pay attention to macroeconomic stability, including output growth. Warjiyo & Juhro (2016: 7) stated that BI should not only achieve price stability but also sustainable economic growth.

The objective of fiscal policy is economic growth while the monetary policy is the stability of the currency's value. In achieving economic stability and currency values, the two authorities should coordinate with one another. Coordination increases not only increase the effectiveness of fiscal but also monetary policy (Drazen 1985; Bruno & Fisher 1990; Blinder 1982; Tabellini 1986; Alesina & Tabellini 1987).

Figure 1 shows the fluctuation of policy rates and inflation (YoY). Figure 2 shows the fluctuation of output and primary deficit. The output fluctuates in a year but the inflation fluctuates in 3 years. The data shows there is a positive co-movement between the fluctuation of the policy rates and inflation as well as negative co-movement between the fluctuation of primary deficit

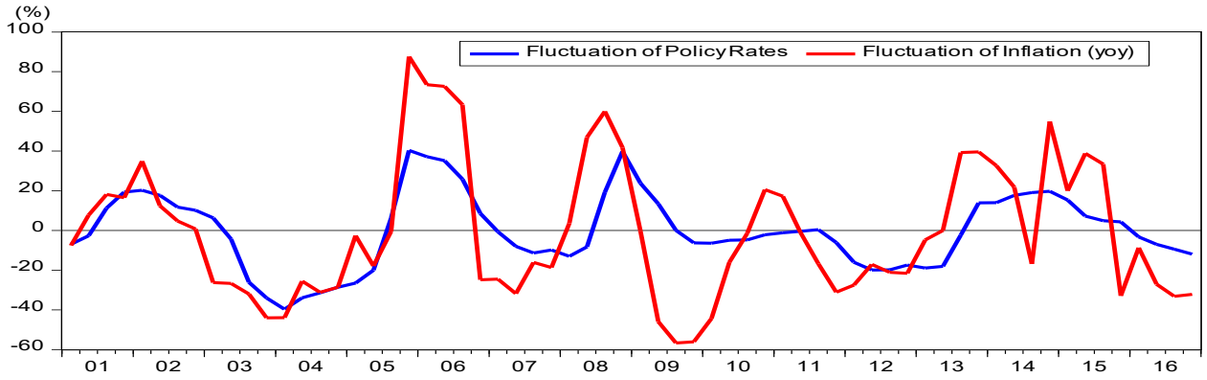

FIGURE 1. Fluctuation of policy rates and inflation (YoY)
Sources: Indonesian Bureau of Statistics (BPS) and Bank Indonesia (BI), calculated.

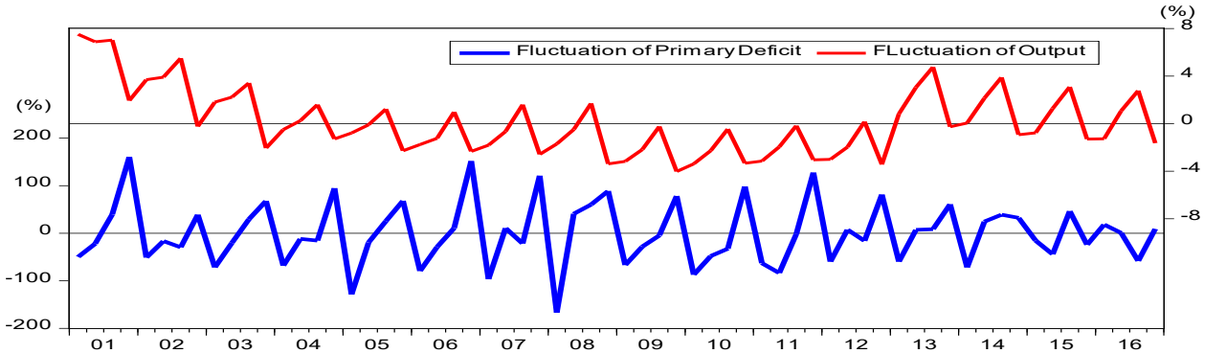

FIGURE 2. Fluctuation of Primary Deficit and Output
Sources: BPS and BI, calculated.

and output. The different pattern of co-movement and time of frequency implies the stabilization of output and inflation needs a different time horizon of policy. The characteristic of the fluctuation may cause fiscal policy and monetary policy to be uncoordinated since the objective of monetary policy is price stability or low inflation and the objective of fiscal policy is high output.

The shocks on price level or exchange rate might push the central bank to leave coordination and lose attention paid to output growth. This study investigates whether the twin shock disrupts the sustainability of macroeconomic policy coordination. If it turns out to affect policy interactions, the two authorities must be aware of the two shocks so as not to disturb the stability of the currency's value and economic output at the same time.

This research is important because the studies on the interaction of fiscal and monetary policies conducted previously did not use these shocks in the model. With the global financial crisis of 2007-2008, followed by the 2011 fiscal crisis in Europe, and the 2015 shock depreciation of the exchange rate, it has become clear that coordination between two policies is needed to avoid the economic downturn. This study investigates whether the exchange rate shocks and inflation are used by the central bank to be maintained, keeping fiscal and monetary policies away from coordination. If coordination is weakened, neither fiscal nor monetary policy objectives will be achieved.

The first step of this study is to analyze the monetary-fiscal policy interaction based on a model proposed by Chugh (2015) using the dynamic equilibrium approach. After finding the evidence of coordination, the shock of the price level and exchange rates was added to the model. The shock in price level is an internal factor while the exchange rate is an external factor that influences the real value of a domestic currency.

The paper is organized as follows: the next section discuses literature review that includes theoretical framework and previous study on the interaction between monetary and fiscal policy. This is followed by the section which discusses the data and the empirical strategies. The estimation results of this study are presented in the last section before the summary and conclusion.

LITERATURE REVIEW

THEORETICAL FRAMEWORK

There are two agents, namely fiscal and monetary authorities. The former controls government spending and taxes and the latter controls the supply of money (or interest rates). Chugh (2015: 244-245) describes each agent in turn and subsequently examines their interaction, including which authority sets the policy first and affects the policy choice of the other. In period *t*, the fiscal authority has a flow budget constraint which is formed as:

$$P_t g_t + B^T_{t-1} = T_t + P^b_t B^T_t + RCB_t \quad (1)$$

where P_t is price level, g_t is the real amount of spending, B^T_t is the nominal amount of government bond at period t, T_t is tax, P^b_t is the price of bonds, while RCB_t refers to the profits earned.

There also exists a budget constraint for a monetary authority (a central bank) that is essential for controlling the nominal supply of money in the economy (M_t) or money in circulation. The central bank can increase and decrease the supply of money by buying and selling some government bonds using open-market operations. The budget constraints of the central bank can be formulated as:

$$P^b_t B^M_t + RCB_t = B^M_{t-1} + M_t - M_{t-1} \quad (2)$$

The left-hand side consists of purchases of government bonds and the right-hand side represents income for the monetary authority. The equation consists of maturing bonds B^M_{t-1}, and the printing of new money, $M_t - M_{t-1}$. $M_t - M_{t-1} > 0$ means the central bank prints new money and $M_t - M_{t-1} > 1$ means the central bank removes money from circulation.

Chugh (2015: 243) formulate the amount from monetary authority turning over to the fiscal authority as:

$$RCB_t = B^M_{t-1} - P^b_t B^M_t + M_{t-1} \quad (3)$$

The combination of monetary and fiscal authority budget constraint can be formulated as:

$$P_t g_t + B^T_{t-1} = T_t + P^b_t B^T_t + B^M_{t-1} - P^b_t B^M_t + M_{t-1} \quad (4)$$

The difference between totaling the bond issue by the fiscal authority, B^T_t , and the bond holding by the monetary authority, B^M_t, is held by the private sector, $B_t = B^T_t - B^M_t$. The equation (4) can be rewritten into:

$$P_t g_t + B_{t-1} = T_t + P^b_t B_t + M_t - M_{t-1} \quad (5)$$

The equation (5) is the consolidated government budget constraint (GBC) that links the activity of the fiscal authority (taxing, spending, and issuing the bond) with the behavior of the monetary authority. The condition in equation (5) must always hold in the economy to make both policies consistent with each other. One of the existing situations involves coordination between two authorities, active fiscal authority and passive monetary authority (the monetary authorities just choose money supply, M_t , depending on fiscal policy), and active monetary and passive fiscal authority (the fiscal authority freely chooses only two out of the three instruments, g_t, B_t, T_t).

This study employs the intertemporal government budget constraint based on the consolidated GBC. The GBC can be formulated in real form as:

$$\frac{B_{t-1}}{P_t} = sr_t + \left(t_t - g_t + P^b_t b_t\right) \quad (6)$$

where $sr_t = \frac{M_t - M_{t-1}}{P_t}$, the government earns by expanding the money supply known as *seignorage* revenue, $t_t = \frac{T_t}{P_t}$, and $b_t = \frac{B_t}{P_t}$. In period *t+1* the equation (6) can be rewritten as:

$$\frac{B_t}{P_{t+1}} = sr_{t+1} + \left(t_{t+1} - g_{t+1} + P^b_{t+1} b_{t+1}\right) \quad (7)$$

The equation (7) can be multiplied by P_{t+1}, and since $\frac{P_{t+1}}{P_t} = 1 + \pi_{t+1}$ or $\pi_{t+1} \equiv (P_{t+1} - P_t)/P_t$ then it can be rewritten as:

$$\begin{aligned} B_t = \; & (1 + \pi_{t+1})\, sr_{t+1} + [(1 + \pi_{t+1}) t_{t+1} - (1 + \pi_{t+1}) \\ & g_{t+1} + P^b_{t+1} (1 + \pi_{t+1}) b_{t+1} \end{aligned} \quad (8)$$

The equation (8) is GBC for the *t+1* period. The equation (8) can be inserted into the period-*t* flow GBC, and using several algebraic manipulations GBC is formulated as:

$$\begin{aligned} \frac{B_{t-1}}{P_t} = \; & \left[sr_t + P^b_t \left(1 + \pi_{t+1}\right) sr_t\right] + \left[\left(t_t - g_t\right) + \right. \\ & \left. P^b_t \left(1 + \pi_{t+1}\right)\left(t_{t+1} - g_{t+1}\right)\right] + P^b_t \left(1 + \pi_{t+1}\right) \\ & P^b_{t+1} b_{t+1} \end{aligned} \quad (9)$$

Bearing in mind the relation between the nominal price of a bond and the nominal interest rate, $P^b_t = \frac{1}{1 + i_t}$, and the Fisher equation, $1 + r = \frac{1 + i_t}{1 + \pi_t}$, than Chugh (2015:247) defines $P^b_t \left(1 + \pi_{t+1}\right) = \frac{1 + \pi_{t+1}}{1 + i_t} = \frac{1}{1 + r_t}$. Using the expression $P_t{}^b(1+\pi_{t+1})$ the period-*t* GBC can be expressed as:

$$\frac{B_{t-1}}{P_t} = \left[\left(t_t - g_t\right) + \left(\frac{t_{t+1} - g_{t+1}}{1+r_t}\right)\right] + \left[sr_t + \frac{sr_{t+1}}{1+r_t}\right] + \frac{P^b_{t+1} b_{t+1}}{1+r_t} \quad (10)$$

Finally, Chugh (2015:249) formulates the infinite-period version of GBC as

$$\frac{B_{t-1}}{P_t} = \sum_{s=0}^{\infty}\left[\frac{sr_{t+s}}{\prod_{s=0}^{\infty}\left(1+r_{t+s}\right)} + \frac{t_{t+s} - g_{t+s}}{\prod_{s=0}^{\infty}\left(1+r_{t+s}\right)}\right] \quad (11)$$

Chugh (2015: 249) states equation (11) as intertemporal government budget constraint (in the infinite-period version) from period *t* into the infinite future.

EMPIRICAL EVIDENCE

Chugh (2015: 241) states that in developed countries (in the author's opinion in emerging countries as well), monetary policy-setting is effectively "independent" from fiscal policy-setting, in the sense that separate authorities control the two types of policies. Simorangkir (2007:6-7) argues there is a debate about independence between the two authorities. Some agree the monetary and fiscal policy must be coordinated with one another to obtain a positive impact on macroeconomic stability. Others argue that financing the fiscal deficit by the central bank as a result of the robust link between the government and the central bank can be harmful to the economy. The central bank can be dictated by the government to increase money to fiscal deficit funding. The experience of countries in Latin America in the late 1980s and Indonesia in the 1960s shows that the fiscal deficits financing through the creation of new money results in hyperinflation and deep economic recession.

In practice, the government and central bank can coordinate the policies to achieve their goal. Chugh (2015: 244-245) states there are 2 conditions that can exist in coordination between two authorities: active fiscal authority and passive monetary authority, and active monetary policy and passive fiscal authority

Many studies of fiscal-monetary policy interaction have been performed using various methods in different countries. Simorangkir (2007) has studied the interaction between monetary and fiscal policy in Indonesia covering the period from 1969 until 2002 by using the game theory approach, both in the form of the cooperative and non-cooperative game. Simulation results show that cooperative games provide the result of the smallest loss (lost function) compared with the non-cooperative game. In achieving that goal, they can either work together or not. Simulation results show that cooperative games provide the result of the smallest loss (lost function) compared with the non-cooperative game. This study differs from the research conducted by Simorangkir (2007) that used a game theory approach. This study is based on a dynamic equilibrium macroeconomic approach to study monetary-fiscal interaction.

Other studies conducted in Indonesia show that policy coordination is better suited to achieve optimal and effective fiscal and monetary policies rather than uncoordinated policies (Yunanto & Medyawati 2013; Hermawan & Munro 2008; Rahutami 2011; Kuncoro et al. 2013; Mochtar 2004). Simorangkir & Adamanti (2010:169) state that the multiplier is high when monetary and fiscal coordination and monetary expansion have existed. On the other hand, Santoso (2011) and Simorangkir (2007) show the minimum social costs cause an economic shock when policies are coordinated. Yuan and Nuryakin (2018) employ a game theory, finding that in the 2014-2015 period the SBI rate and government spending produced a non-Nash balance and a non-Pareto efficiency balance. As such, there is plenty of room to improve policy, especially the arrangement of government spending throughout the year; that is, increasing absorption of government spending in the second quarter and moderating in the third and fourth quarters, as well as reducing the SBI rate.

The result of studies conducted in Indonesia supports the argument of Hall and Mankiw (1994) and Woodford (2001) which stated that coordination is better than having fiscal and monetary policies isolated from each other. Other studies made in various countries by Auerbach (2003), Favero and Monacelli (2005), Drazen (1985), Bruno and Fisher (1990), Blinder (1982), Tabellini (1986), Alesina and Tabellini (1987), and Janků and Kappel (2014) also find that coordination makes for a more effective fiscal and monetary policy.

The previous literature only studies the effect of the monetary and fiscal interaction on the policy objectives. None of them investigated the actual impact of the currency's internal and external shock on the coordination itself. This study investigates the effect of price level and the exchange rate shock on the policy interaction.

DATA AND METHODOLOGY

DATA

The information of variables is defined in table 1. The variables are valued at a constant market price (2002=100). The real primary deficit (*pd*) is the central government's expenditure (*g*) and the transfer payment to the province, district-city, and village (*tr*) minus real tax revenue (*t*). The real domestic debt (*bd*) and

external debt (*bf*) are the values of internal financing and gross foreign loans in a constant price. The real supply of money, *m*, is a real currency and demand deposit (M1). Finally, the exchange rate, *K,* is the value of the domestic currency per US Dollar (RP/USD). The increase in the exchange rate means IDR or Rupiah (Rp) depreciation. The study uses quarterly data in 2001Q1-2016Q4.

METHODOLOGY

First, the empirical model is formulated to examine the interaction between monetary and fiscal authorities. The criteria measure the interaction, as can be seen in table 2. There are three variables, the change of real primary deficit that is obtained by the formula $\Delta pd_t = (g_t – t_t) – (g_{t-1} – t_{t-1})$, the change of real debt is obtained by formula $\Delta b_t = b_t – b_{t-1}$, and the change of *seignorage* revenue is obtained by formula $\Delta sr_t = sr_t – sr_{t-1}$. There are two fiscal variables, Δpd_{t-1} and Δb_t, and one monetary variable in the model, Δsr_t. The increase of primary deficit demands the new debt, so the relation between Δpd and Δb_t is expected to be positive. Furthermore, the rise of the debt also increases the interest rates that can be anticipated by the expansion of the money creation by *seignorage*. The coordination exists when there is a positive relationship between fiscal and monetary variables in the model (the complete explanation can be seen in Janků and Kappel (2014), Bianchi & Ilut (2017), and Bianchi and Melosi (2017, 2019)).

Janků and Kappel (2014:377) propose a method that shows the meaning of coefficients of reaction functions to describe the relationship between monetary and fiscal policies. Table 2 explains the expected relationships among variables in the model.

The author use the three-step procedure estimation made by Insukindro (2018: 78-79).

TABLE 1. Definition of variables

Variables	Description	Unit	Sources
Real Central government expenditure *(g)*	Constant price 2002=100	Billion Rp	MoF
Real tax revenue *(t)*	Constant price 2002=100	Billion Rp	MoF
Real transfer to province, district-city, and and village *(tr)*	Constant price 2002=100	Billion Rp	MoF
Real primary deficit *(pd)*	$pd = g+tr-t$	Billion Rp	MoF
Domestic debt *(Bd)*	Domestic financing	Billion Rp	MoF
External debt *(Bf)*	Withdrawal of gross external loans	Billion Rp	MoF
Government debt *(B)*	Debt accumulation is started 2001Q1, $b = bd+bf$	Billion Rp	MoF
Real Government debt *(b)*	Constant price 2002=100		
Real supply of Money *(m)*	Real currency and demand deposit	Billion Rp	BI
Seignorage revenue *(Sr)*	$sr_t = (M_t – M_{t-1})/P_t$	Billion Rp	BI
Price level *(p)*	Consumer price index 2002=100		BPS
Trend of price level *(p*)*	Obtaining by using HP Filter		
Shock of price level *(Sp)*	$sp = p-p^*$	Billion Rp	
Exchange rate *(K)*	Rp/USD	Rp/USD	BI
Value of exchange rate trend *(K*)*	Obtaining by using HP Filter	Rp/USD	
Exchange rate shock *(SK)*	SK = K-K*	Rp/USD	

BPS: Badan Pusat Statistik (National Bureau of Statistics of Indonesia), MoF: Ministry of Finance; BI: Bank Indonesia (Central Bank of Indonesia)

TABLE 2. Estimated coefficients of the independent variables

Fiscal policy Δpd_t		Fiscal policy Δb_t		Monetary policy Δsrt_t	
Variable	Expected relation	Variable	Expected relation	Variable	Expected relation
Δpd_{t-1}	-	Δb_{t-1}	-	Δsrt_{t-1}	-
Δb_t	+	Δpd_t	+	Δpd_t	+(coordination) -(conflict)
Δsrt_t	+(coordination) -(conflict)	Δsrt_t	+(coordination) -(conflict)	Δb_t	+(coordination) -(conflict)

The first is a unit root test, namely the Augmented Dickey-Fuller (ADF) test, to find out whether the variables used in this study are stationary {I(0)} or not stationary {I(1)}. In the second step, the study used the Johansen Cointegration test to find the long-run relationship among variables. Furthermore, if there is cointegration between variables, the Vector Error Correction Model (VECM) of monetary and fiscal reaction functions could be estimated to detect short-term relationships.

The fiscal reaction function would be chosen based on the model monetary-fiscal authority interaction by Chugh (2015:245-249). The reaction function also considers the model that is developed by Wyplosz (1999), Melitz (2000), Janků and Kappel (2014), Asiama et al. (2014), and Insukindro (2018). The fiscal reaction function is stated as:

$$\Delta pd_t = \sum_i \alpha_i L_i \Delta b_t + \sum_i \beta_{i-1} L_i \Delta pd_t + \sum_i \beta_i L_i \Delta sr_t - \gamma L\eta_{1t} + \varepsilon_{1t} \quad (12)$$

$$\Delta b_t = \sum_i \alpha_i L_i \Delta pd_t + \sum_i \beta_{i-1} L_i \Delta b_t + \sum_i \beta_i L_i \Delta sr_t - \gamma L\eta_{1t} + \varepsilon_{2t} \quad (13)$$

The basic monetary reaction function is compiled as:

$$\Delta sr_t = \sum_i \alpha_i L_i \Delta pdD_t + \sum_i \beta_{i-1} L_i \Delta sr_t + \sum_i \beta_i L_i \Delta b_t - \gamma L\eta_{1t} + \varepsilon_{3t} \quad (14)$$

The fiscal reaction function would be chosen based on the model monetary-fiscal authority interaction by Chugh (2015: 245-249). The reaction function also considers the model developed by Wyplosz (1999), Melitz (2000), Janků and Kappel (2014). The cointegration equation can be seen clearly in Insukindro (2018: 79). However, since three variables are used as well as the Johansen cointegration method, the cointegration equations are not shown in this study. Furthermore the γ is error correction term which must be $-1<\gamma<0$. The lack of the criterion of γ is the reason that the models show no convergence.

The study also estimates the fiscal and monetary reaction function with the shock variable (S) in equation (15), (16), and (17). The same procedure, adding shock variables in the ECM, has been employed by Cuthbertson (1988), Insukindro (1992), Insukindro & Sahadewo (2010), and Insukindro (2018).

$$\Delta pd_t = \sum_i \alpha_i L_i \Delta b_t + \sum_i \beta_{i-1} L_i \Delta pd_t + \sum_i \beta_i L_i \Delta sr_t - \gamma L\eta_{1t} + e_{1i}\Delta S_t + e_{2i} LS_t + \varepsilon_{4t} \quad (15)$$

$$\Delta b_t = \sum_i \alpha_i L_i \Delta pd_t + \sum_i \beta_{i-1} L_i \Delta b_t + \sum_i \beta_i L_i \Delta sr_t - \gamma L\eta_{1t} + e_{1i}\Delta S_t + e_{2i} LS_t + \varepsilon_{5t} \quad (16)$$

$$\Delta srt_t = \sum_i \alpha_i L_i \Delta pd_t + \sum_i \beta_{i-1} L_i \Delta sr_t + \sum_i \beta_i L_i \Delta b_t - \gamma L\eta_{1t} + e_{1i}\Delta S_t + e_{2t} LS_t + \varepsilon_{6t} \quad (17)$$

where $e_{1i}\,\Delta S_t = e_{11}\,\Delta sp_t + e_{12}\,\Delta SK_t$ and $e2_i\,LS_t = e_{21}\,Lsp + e_{22}\,LSK_t$, and L is the lag operator.

In the model with shock, the hypothesis testing runs as follows:

Ho: $e_{11} = 0$ Ho: $e_{12} = 0$ Ho: $e_{21} = 0$ Ho: $e_{22} = 0$

Ha: $e_{11} \neq 0$ Ha: $e_{12} \neq 0$ Ha: $e_{21} \neq 0$ Ha: $e_{22} \neq 0$

Insukindro (2018: 80) states that if only e_{11} and e_{12} are different from zero and statistically significant, it means that shock occurred only in the short term. However, if only e_{21} and e_{22} are different from zero and statistically significant, it means shocks continuously occur for the long term. The study uses the shock of price level since monetary authority attaches importance to it. Furthermore, the study uses the shock of the exchange rate in the model since it is important for government debt financing and the external value of Rupiah (IDR) that is a matter of concern for the central bank, namely *Bank Indonesia*.

FINDINGS AND ANALYSIS

The first step to examine the interaction between the fiscal and monetary policy is the stationary test of variables. The Augmented Dickey-Fuller (ADF) test has been employed to find whether the variables are stationary, I(0), or not stationary I(1). The percentages of α=5% or α=1% have been used in the test.

Based on the ADF test, with α=5% or α=1%, it can be concluded that the real primary deficit, pd_t, the real government debt, b_t, and the *seignorage* revenue are not stationary, I(1).

The Johansen method is used, in the next step, to test the cointegration. The estimation results in Table 4 reports that the Johansen cointegration test includes trace statistic and maximum Eigenvalue. The trace statistic shows the possibility of long-term relationships or cointegration. However, the Max-eigenvalue indicates no cointegration at the 0.05 level.

Based on the estimation, it can be concluded that there is one cointegration equation. The ADF and Johansen cointegration results indicate that the consolidated government budget constraint (GBC) means there are links between fiscal authority (taxing, spending, and issuing the bond) and the monetary authority (changing supply of money) activities (Chugh 2015: 243) in the long-run. The result is consistent with the previous studies that show there are long-run relations between fiscal and monetary policy.

Since all variables are I(1) and cointegration exists, the fiscal and monetary reaction function can be estimated using VECM to find out the appropriate short-term relationship between the three variables. The fiscal and monetary reaction functions are estimated using equations (12), (13), and (14).

The Error Correction Model (ECM) has been selected using the criteria that the coefficient of the lag residual of cointegrating regression or error correction term (η) is between -1 and 0 as well as statistically significant. The following Table 5 shows the estimated results of the VECM of the fiscal reaction function and monetary reaction function. The error correction term (η) coefficient for both the fiscal reaction function is between 0 and -1 and is statistically significant (for regression Δpd_t, the regression coefficient = -0.7147 and its t-statistic = -2.97111 as well as for the regression coefficient = -0.4559 and its t-statistic = -2.81696). However, the error correction term (η) for monetary reaction function is also between 0 and -1 but it is not statistically significant (regression coefficient = -0.2708 and its t-statistic =-1.64060).

The result indicates there is only a fiscal reaction function that shows convergence in the short run. The shock of the variables is adjusted if different from the equilibrium in the long run. However, the monetary reaction function shows that the shock of variables is not significantly adjusted in the long run.

Furthermore, both fiscal reaction functions and monetary reaction functions with shock variables, price shock, and exchange rate shock have been re-estimated, as shown in table 6. The fiscal reaction functions and monetary reaction function with shock are estimated using equations (15), (16), and (17). Table 6 shows the error correction term (η) for both fiscal reaction functions is between 0 and -1 and statistically significant (for regression Δpd_t, regression coefficient = -0.99743 and its t-statistic = -4.4107 as well as for the regression coefficient = -0.345 and its t-statistic =-2.01067). Furthermore, the coefficient η for monetary reaction function is also between 0 and -1 and statistically

TABLE 3. Stationary test

	pd_t	b_t	sr_t
t-stat	-3.4736	-0.4393	-3.0170
Prob.	0.0515	0.9839	0.1364
	Δpd_t	Δb_t	Δsr_t
t-stat	-8.5896**	-8.7672**	-16.1312**
Prob.	0.0000	0.0000	0.0000

The variable is stationer at *(**) α=5% (1%),

TABLE 4. Cointegration test

H_0 H_1	$r = 0$ $r = 1$	$r \leq 1$ $r = 2$	$r \leq 2$ $r = 3$
Eigen value	0.2807	0.2199	0.1574
Trace statistic	44.1915*	24.7560	10.1074
Max. Eigen value	19.4355	14.6486	10.1074
Critical value (5%):			
Trace Statistic	42.9152	25.8721	12.5180
Max-Eigen Stat.	19.4355	14.6486	10.1074

*(**) indicates the rejection of the null hypothesis (no cointegration) at 5% (1%) of significance level. The author assume there are intercept and linier deterministic trends in the cointegration equation (CE).

significant (regression coefficient =-0.506 and its t-statistic =-3.31297). All reaction functions meet the criteria of ECM that the coefficient of cointegrating regression residual or η is between -1 and 0 as well as being statistically significant. The result shows that both the fiscal authority and monetary authority pay attention to the shock of the value of the domestic currency.

The sign of all coordination coefficient hypothesized in table 2 is confirmed by table 6 that shows the existence of the coordination among fiscal (primary deficit) and monetary authorities in the short run. Furthermore, monetary policy plays a dominant role in the interaction between the monetary policy and the movement of the debt. The result is similar to the study of Janků & Kappel (2014). The result also finds the shock of price and exchange rate make the monetary reaction function converge.

The Granger causality based on VECM without shock variable (table 5) and with shock variable (table 6) is estimated and presented in table 7. The result shows that the shock variables make the model better than without shock variables to explain the relationship between fiscal and monetary variables since the signification of the causality relation is better with the shock. The VECM with shock variable shows there is bi-directional causality between Δsr_t and Δpd_t. Table 6 also shows the positive coefficient of the causality relationship. The result indicates there is coordination between the primary deficit and *seignorage* in the short run.

The Granger causality based on VECM with twin shock also shows the causality relation from Δsr_t to Δb_t. The positive coefficient from Δsr_t to Δb_t shows that the increase of money (that reduces interest rates) will increase the government debt. The result also indicates the bi-directional causality between Δpd_t and Δb_t. The VECM coefficient with twin shock shows that the increase of primary deficit will increase the debt. However, the increased debt will decrease the primary deficit.

TABLE 5. Result of VECM estimation

Cointegration Equation:						
	Coef.	t-stat.				
pd_{t-1}	1.0000					
b_{t-1}	0.0417	0.61528				
sr_{t-1}	1.5710***	2.85284				
@TREND	-2053.429*	-1.94379				
C	-2011.451					
Error Correction:						
	Δpd_t		Δb_t		Δsr_t	
	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.
η	-0.7147**	-2.97111	-0.4559**	-2.81696	-0.2708	-1.64060
Δpd_{t-1}	-0.3827	-1.86406	0.4289**	3.10462	0.1624	1.15288
Δpd_{t-2}	-0.5266**	-2.8557	0.2936*	2.3661	-0.1232	-0.9740
Δpd_{t-2}	-0.6474**	-5.0135	0.0340	0.3909	-0.1569	-1.7707
Δb_{t-1}	-0.3094	-1.4655	-0.0319	-0.2246	0.0324	0.2237
Δb_{t-2}	-0.1888	-0.9157	0.1597	1.1512	-0.0845	-0.5970
Δb_{t-3}	-0.3166	-1.5234	-0.1365	-0.9759	-0.1377	-0.9657
Δsr_{t-1}	0.6897*	1.9994	0.5026*	2.1654	-0.878**	-3.7094
Δsr_{t-2}	0.3648	1.2828	0.4405*	2.3018	-0.5762**	-2.9529
Δsr_{t-3}	0.2314	1.1963	0.3039*	2.3346	-0.454**	-3.4204
C	15716.4*	2.4327	18114.64**	4.1671	3860.047	0.8708
Adj. R^2	0.8212		0.2068		0.8679	
Sum sq. res.	211E+8		954E+7		992E+7	
S.E. eq.	20950.2600		14096.8900		14375.5600	
F-statistic	27.6382		2.5123		39.1202	

*(**) indicates the rejection of the null hypothesis at 5% (1%) of the significance level . The author assume there are intercept and linier deterministic trends in the cointegration equation (CE).

TABLE 6. Result of VECM with shock

Cointegration Equation:						
	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.
pd_{t-1}	1.0000					
b_{t-1}	0.050709	0.96787				
sr_{t-1}	2.528883**	4.33202				
@TREND	-2115.35*	-2.57473				
C	-7786.97					
Error Correction:						
	Δpd_t		Δb_t		Δsr_t	
	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.
η	-0.99743**	-4.4107	-0.345*	-2.01067	-0.506**	-3.31297
Δpd_{t-1}	-0.09694	-0.47022	0.332376*	2.12491	0.362192*	2.60133
Δpd_{t-2}	-0.24327	-1.28347	0.211473	1.47042	0.033948	0.26518
Δpd_{t-2}	-0.50461**	-4.09226	-0.01541	-0.16464	-0.0857	-1.029
Δb_{t-1}	-0.33096	-1.74278	-0.01243	-0.08625	-0.062	-0.48341
Δb_{t-2}	-0.22657	-1.23815	0.232033	1.67113	-0.09235	-0.74722
Δb_{t-3}	-0.30708	-1.58176	-0.16486	-1.11918	-0.20111	-1.53381
Δsr_{t-1}	1.620089**	3.49226	0.711786*	2.02213	-0.18198	-0.58079
Δsr_{t-2}	0.872193**	2.72335	0.577862*	2.37798	-0.22013	-1.01769
Δsr_{t-3}	0.411615*	2.05384	0.416159**	2.7367	-0.26683	-1.9713
C	16984.29**	2.98349	16887.63**	3.90966	6725.181	1.74912
ΔSp_t	1198.374	0.93029	-1861.9	-1.90491	-2183.27*	-2.50941
Sp_{t-1}	-1592.24	-1.43414	-605.227	-0.71844	-1729.21*	-2.30604
ΔSK_t	7.019651	1.25738	0.065464	0.01545	-5.12368	-1.35885
ΔSK_{t-1}	-10.912*	-2.36651	2.366339	0.67635	-2.40242	-0.77142
Adj. R^2	0.858579		0.202255		0.898805	
Sum sq. res.	1.53E+10		8.79E+09		6.97E+09	
S.E. eq.	18632.08		14137.38		12584.12	
F-statistic	26.15158		2.050355		37.7964	
	0.858579		0.202255		0.898805	

*(**) indicates the rejection of the null hypothesis at 5% (1%) of the significance level. The author assume there are intercept and linear deterministic trends in the cointegration equation (CE).

SUMMARY AND CONCLUSIONS

The study has established the role of twin shock, the shock of the price level and the exchange rate in the fiscal and monetary interaction. Significant interaction was observed when the twin shock entered the model. Furthermore, without twin shock, the short-run monetary policy reaction function is not convergent. The study shows that the primary deficit is affected by long-run exchange rate shock. The currency depreciation reduces the primary deficit since it increases the cost of deficit financing. Furthermore, the monetary policy is influenced by the shock of the price level in the short run and long run since the central bank's objective is price stability.

The study has found the long run and the short-run relationship between fiscal and monetary variables in Indonesia. The research shows the existence of consolidated government budget constraint (GBC) that links the activity of fiscal authority (taxing, spending, and issuing bonds) with the behavior of monetary authority in the long run. The GBC condition in the economy makes the monetary and fiscal authority consistent with each other.

The result also shows there is short-run coordination between fiscal and monetary policy in Indonesia. The coordination can be discerned in the relation between short-run primary deficit and monetary policy. The debt is issued to finance the primary deficit as well as the government's stabilizing it when it increases by

TABLE 7. Granger causality test based on VECM

Based on VECM without twin shock		
	Chi-sqr	Prob.
$\Delta b_t \rightarrow \Delta pd_t$	6.4400	0.0921
$\Delta sr_t \rightarrow \Delta pd_t$	5.6820	0.1281
$\Delta pd_t \rightarrow \Delta b_t$	13.1537**	0.0043
$\Delta sr_t \rightarrow \Delta b_t$	7.4403	0.0591
$\Delta pd_t \rightarrow \Delta sr_t$	14.5535**	0.0022
$\Delta b_t \rightarrow \Delta sr_t$	1.3110	0.7265
Based on VECM with shock		
$\Delta b_t \rightarrow \Delta pd_t$	9.0754*	0.0283
$\Delta sr_t \rightarrow \Delta pd_t$	13.2779**	0.0041
$\Delta pd_t \rightarrow \Delta b_t$	8.7387*	0.0330
$\Delta sr_t \rightarrow \Delta b_t$	7.8780*	0.0486
$\Delta pd_t \rightarrow \Delta sr_t$	25.2977**	0.0000
$\Delta b_t \rightarrow \Delta sr_t$	3.7948	0.2845

The left variables are significant influence right variables at *(**) α=5% (1%),

reducing the primary deficit. There also uni-direction causality from monetary policy to the debt. The increase of primary deficit and government debt is stabilized by monetary policy by making monetary expansion. The study supports Bianchi & Ilut (2017: 138), and Bianchi & Melosi (2017: 1055, 2019: 16)) which state that the monetary authority can coordinate with the government to stabilize the budget used in their policy. The result of the study also supports the previous research conducted in Indonesia by Simorangkir (2007), Yunanto and Medyawati (2013), Hermawan and Munro (2008), Rahutami (2011), Kuncoro et al. (2013), Mochtar (2004), Simorangkir and Adamanti (2010), and Yuan and Nuryakin (2018).

The study shows the importance of coordination between fiscal and monetary policies. The monetary policy helps the government manage the cost of deficit financing by the money and interest rates policy as well as exchange rates management. The government must also coordinate with the central bank in the primary deficit and debt management since it affects the inflation and exchange rate.

This study still uses a backward-looking approach. In reality, the behavior of policymakers is not only based on past information but also relies on future prospects. Policymakers can coordinate based on the expectation of what policies other authorities will take in the future (forward-looking approach). To carry out a study of forward-looking coordination, the author must develop different models and estimation techniques.

NOTES

1. The fluctuation describes the gap ratio of the variable to their trend (long-run movement). The fluctuation of x (fx) can be formulated as:

$$fx = \frac{\left(x - x^*\right)}{x^*} \times 100\%$$

where x is the actual value of x and is the value of the trend. The trend of the variable is estimated using the Hodrick-Prescott filter (HP filter).

REFERENCES

Alesina, A., & Tabellini, G. 1987. Rules and discretion with noncoordinated monetary and fiscal policies. *Economic Inquiry* 25(4): 619-630.

Asiama, J., Akosah, N., & Owusu-Afriyie, E. 2014. An Assessment of Fiscal Sustainability in Ghana. *Bank of Ghana Working Paper, WP/BOG/2014/09*.

Auerbach, A. J. 2003. Is there a role for discretionary policy? in rethinking stabilization policy. *Federal Reserve Bank of Kansas City*.

Bianchi, F., Ilut, C. L. 2017. Monetary/Fiscal policy mix and Agent's beliefs. *The Review of Economic* 26:113-139.

Bianchi, F., & Melosi, L. 2017. Escaping the great recession. *American Economic Review* 107(4): 1030-58.

Bianchi, F., & Melosi, L. 2019. The Dire Effects of the Lack of Monetary and Fiscal Coordination. *Journal of Monetary Economics* 104: 1-22.

Blinder, A. S. 1982. *Issues in the Coordination of Monetary and Fiscal Policy* (No. 0982). National Bureau of Economic Research, Inc.

Bruno, M., & Fisher, S. 1990. Seigniorage, operating rules, and the high inflation trap. *Quarterly Journal of Economics* 105(2): 353-374.

Chugh, S. K. 2015. *Modern Macroeconomics.* Cambridge and London: The MIT Press.

Cuthbertson, K. 1988. The demand for M1: A forward looking buffer stock model. *Oxford Economic Papers* 40: 110-131.

Drazen, A. 1985. Tight money and inflation: further results. *Journal of Monetary Economics* 15(1): 113-120.-

Favero, C., & Monacelli, T. 2005. Fiscal policy rules and regime (in)stability: evidence from the U.S. *Mimeo, University of Bocconi*.

Hall, R. E., & Mankiw, N. G. 1994. Nominal income targeting. In *Monetary policy* (pp. 71-94). The University of Chicago Press.

Hermawan, D. & Anella Munro, May 2008, Monetary-Fiscal Interaction in Indonesia, Asian Office Research Paper, Bank for International Settlement.

Insukindro. 1992. Dynamic specification of demand for money: A survey of recent developments. *Indonesian Economic Journal* 1: 8-23.

Insukindro. 2018. The Effect of Twin Shock on Fiscal Sustainability in Indonesia. *Economics and Sociology* 11(1): 75-84.

Insukindro, & Sahadewo, G. A. 2010. Inflation Dynamic in Indonesia: Equilibrium Correction and Forward-Looking Phillips Curve Approch. *Gadjah Mada International Journal of Business* 12(1): 117–133.

Janků, J., & Kappel, S. 2014. The Interaction of Monetary and Fiscal Policy. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis* 62(2): 373–381.

Kuncoro, H., Sebayang, K., & Dianta, A. 2013. The dynamic interaction between monetary and fiscal policies in Indonesia. *Romanian Journal of Fiscal Policy (RJFP)* 4(1): 47-66.

Melitz, J. 2000. Some Cross-Country Evidence about Fiscal Policy Behavior and Consequences for EMU [Mimeo]. *CREST-INSEE and CEPR.*

Mochtar, F. 2004. Fiscal and Monetary Policy Interaction: Evidences and Implication for Inflation Targeting in Indonesia. *Buletin Ekonomi Moneter dan Perbankan* 7(3): 359-386.

Rahutami, A. I. 2011. Interaksi Kebijakan Moneter Dan Fiskal: Pendekatan Sistem Ekonomi Simultan (1980.1-2006.4). *Jurnal Ekonomi Indonesia* 1:1-20.

Santoso, W. 2012. Interaksi kebijakan moneter dan fiskal di Indonesia. In S. Adiningsih, *Koordinasi dan Interaksi Kebijakan Fiskal-Moneter:Tantangan ke Depan* (pp. 225-262). Yogyakarta: Kanisius.

Simorangkir, I. 2007. Koordinasi kebijakan fiskal dan moneter di Indonesia: suatu kajian dengan pendekatan game theory. *Buletin Ekonomi Moneter dan Perbankan* 9(3): 5-30.

Simorangkir, I., & Adamanti, J. 2010. Peran stimulus fiskal dan pelonggaran moneter pada perekonomian Indonesia selama krisis finansial global: dengan pendekatan finansial computable general equilibrium. *Buletin Ekonomi Moneter dan Perbanka* 13(2): 169-192.

Tabellini, G. 1986. Journal of Economic Dynamics and Control, 10(4). *Money, debt and deficits in a dynamic game* 10(4): 427-442.

Warjiyo, P & Juhro, S. M. 2016. K*ebijakan Bank Sentral: Teori dan Praktik*. Jakarta: Rajawali Pers.

Woodford, M. 2001. Fiscal Requirements for Price Stability. *Journal of Money, Credit and Banking* 33: 669-728.

Wyplosz, C. 1999. Economic Policy Coordination in EMU: Strategies and Institutions. In: Financial Supervision and Policy Coordination in the EMU. *Working paper B 11. Bonn: ZEI – Center for European Integration Studies, University of Bonn.*

Yuan, E. Z. W., & Nuryakin, C. (2018). Fiscal and monetary dynamics: A policy duo for the Indonesian economy. *Competition and Cooperation in Economics and Business*. Gani et al. (Eds). 369-380. Taylor & Francis Group, London.

Yunanto, M., & Medyawati, H. 2013. Macroeconomic Structural Change in Indonesia: in The Period of 1990 to 2011. *International Journal of Trade, Economics and Finance* 4(3): 98-103.

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