Romanian Journal of Fiscal Policy
Volume 4, Issue 1(6), January-June 2013, Pages 47-66

The Dynamic Interaction between Monetary and Fiscal Policies in Indonesia*)

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ABSTRACT

The aim of this paper is to analyze the dynamic interaction between monetary and fiscal policies in Indonesia for the period of 1999-2010. First, we propose the reaction function between monetary and fiscal policies. Second, we identify the main determinants of both interaction decisions, i.e. interest rate and primary balance surplus. The results of quarterly data estimation show that in the short term monetary policy reacts as expected to the fiscal policy – in the sense that governments have the ability to run a primary surplus. This action makes fiscal sustainability easier to achieve in the long run. On the other hand, fiscal policy marginally reacts to the monetary policy (interest rate) so that fiscal sustainability will be more difficult to attain given the opposite response of governments to public debt shocks. Furthermore, the interaction matrix indicates that monetary policy is more dominant in Indonesia. In these circumstances, the active fiscal policy should be made in order to reach economic growth sustainability in the long run.

Keywords: Monetary Policy, Fiscal Policy, Interest Rates, Primary Surplus
JEL Code: E58, E62, E63

1. Introduction

The issue of fiscal deficit is well debated area in macroeconomic literature due to its effects on the indicators of macroeconomic performance such as inflation and growth and its impact on financing and proceeding debt dynamics. When the inter-temporal budget constraint is satisfied without the change in either policy or the price level, the current fiscal policy is said to be sustainable (see for example: Dihn, 1999). If the government adjusts primary deficit to limit debt

*) The earlier version of this paper has been presented in the Malaysia-Indonesia International Conference on Economics, Management, and Accounting held by University of Bengkulu Indonesia on October 13-14, 2011. The authors would like to thank all participants for invaluable comments. However, any errors, confusions, and shortcomings which may remain are our responsibility.

accumulation and the central bank does not monetize debt, such a regime is called monetary dominant or Ricardian regime (Sargent and Wallace 1981). However, fiscal deficit causes inflation because governments find money creation to finance the deficits leading to inflation as a monetary phenomenon. Such regime is called fiscal dominant or non-Ricardian regime.

The fiscal theory of price level argues that a fiscal dominant regime may arise when fiscal policy is not sustainable and government bonds are considered net wealth (Barro, 1974). These wealth effects could make difficult to meet the objective of price stability, irrespective of the central bank commitment to low inflation (Woodford, 1994 and 1998; Leeper, 1991; Sims, 1994, and Cochrane, 1998 and 2001). The implication is that in fiscal regime the government's fiscal policy is sustainable through debt deflation, that is, an increase in prices that erode the real value of public debt and in turn the real value of financial wealth until demand equals supply and a new equilibrium is reached. Therefore, prices are determined by fiscal policy, and inflation becomes a fiscal phenomenon.

Price stability is an important goal of the monetary policy in Indonesia. Since 1999, Indonesia has implemented a new law for the central bank. The law stated that the Central Bank of Indonesian must be independent from interventions of political pressure and the central government in conducting its monetary policy. Moreover, the central bank is only responsible for price stabilization as a one goal policy rather than multiple objectives which are stated in the previous law. Furthermore, since June 2005 Indonesia has implemented inflation targeting in the monetary policy frameworks.

The present study attempts to estimate the dynamic interaction of fiscal and monetary policies for economic stability in Indonesia. This seems interesting because firstly, data indicate that public debt and fiscal imbalances are on the rise causing concerns about fiscal sustainability. This suggests that some form of fiscal dominance become an issue for Indonesia. Secondly, so far, no systematic empirical work to discriminate between these two regimes monetary dominant and fiscal dominant, has been conducted. The only literature available is (De Brouwer, Ramayandi, and Turvey, 2006; Indrawati, 2007; and Ramayandi, 2007) which investigates the relative importance of fiscal and monetary policy on aggregate economic activity. A few studies devoted to analyze the interaction between monetary and fiscal policies (Artha, 2007; ADB, 2010) and fiscal sustainability (Santoso, 2004; Kuncoro, 2011a).

Thirdly, the principles of fiscal theory of price level require that it is necessary to have appropriate fiscal policy and also an adequate monetary policy to achieve price stability. Unless specific measures are taken to ensure an appropriate fiscal policy, the objective of price stability may not be achieved despite the independence of the Central Bank of Indonesia and its commitment to low inflation.

Those motivate to assess the empirical plausibility of both fiscal and monetary dominant regimes in case of Indonesia's economy. The plan of rest of study is as follows. Section 2 reviews briefly the empirical literature on the relative importance of fiscal and monetary policy for price stability. The empirical methodology to differentiate between monetary and fiscal dominance

and data are discussed in section 3. The empirical results are provided in section 4 and the last section offers conclusion.

2. Literature Review

The theoretical case for delegating monetary policy was firstly formalized by Kydland and Prescott (1977) and Barro and Gordon (1983). They concerned to the time inconsistency of a discretionary monetary policy. Barro and Gordon (1983), for example, explained that the policy maker has a cost function which consists of two elements; they are cost of inflation in quadratic form and the benefit from surprise inflation (actual inflation exceeds the expected inflation).

For authorities, the decision of either monetary or fiscal policy (or even both) is derived from the utility function of both authorities in which contains their preferences on macroeconomic variables and devotes to minimize the loss function. Simply, Taylor (1993) initiated the model of monetary policy reaction function*). He proposed that the objective function is monetary policy (i.e. federal fund rate, r) and the loss function is output gap (y, the difference between actual GDP and potential GDP, y*) and the inflation gap (p, the difference between actual inflation and projected inflation rates, p*).

For monetary authority point of view, there can be other objective functions such as stabilizing exchange rate and safeguarding the balance of external payments (expressed by difference between actual exchange rate, e, and the exchange rate targeted, e*) and maintaining financial stability in money market (M exceed from its targeted, M*). Even, in some cases, the central bank is assigned to finance primary balance deficit (PB exceed from the PB targeted, PB*). The general utility function for monetary authority is as follows:

$$U_m = f\{(r-r^*), (p-p^*), (y-y^*), (e-e^*), (M-M^*), PB\} \quad (1)$$

$$U_m = \alpha_{m1}\{\max(r-r^*, 0)\}^2 - \alpha_{m2}\{\min(p-p^*, 0)\}^2 - \alpha_{m3}\{\min(y-y^*, 0)\}^2 - \alpha_{m4}\{\min(e-e^*, 0)\}^2 - \alpha_{m5}\{\min(M-M^*, 0)\}^2 - \alpha_{m6}(PB-PB^*)\}^2 \quad (2)$$

which states that the monetary authorities move the nominal interest rate (r) above (below) neutral when other macroeconomic variables are above (below) the target level respectively. In this case, the nominal interest rate is endogenous variable for central bank and would be a monetary instrument to absorb macroeconomic shocks.

The similar idea is adapted in fiscal policy. Likewise Barro and Gordon (1983), according to Beetsma and Bovenberg (1997), the surprise inflation erodes the real value of outstanding nominal public debt. Furthermore, Beetsma and Uhlig (1997) argued that government has the incentive to restraint debt accumulation. Therefore, the introduction of limit on debt will reduce the incentive of government to conduct excessive fiscal deficit and to accumulate debt.

*) After Taylor, there are many extended monetary reaction function models, such as Obstfeld and Rogoff (1995), Ball (1999), Svensson (2000), Taylor (2001), Gali and Gertler (2007), Troy and Leeper (2007) and others.

Restraint debt accumulation is one of the fiscal solvency and sustainability requirements (Dihn 1999). Therefore, the authority's objective function is fiscal sustainability as presented by primary balance surplus (total government expenditure minus debt services payment). The loss function is output gap (representing government revenues gap), inflation rising beyond a desired level, and the cost of public debt (interest rates gap). The fiscal authority utility function is as follows:

$$U_f = f\{(PB-PB^*), (p-p^*), (y-y^*), r\} \quad (3)$$

$$U_f = \alpha_{f1}\{\max(PB-PB^*, 0)\}^2 - \alpha_{f2}\{\min(p-p^*, 0)\}^2 - \alpha_{f3}\{\min(y-y^*, 0)\}^2 - \alpha_{f4}(r-r^*)^2 \quad (4)$$

subject to the government budget constraint:

$$PBt = \frac{r-y}{1+y}D_{t-1} + S_t \quad (5)$$

where PB is primary balance, RD is debt to output ratio, and S is seignorage (or equivalently M in equation (1)). Equation (5) can be interpreted as a fiscal rule to achieve fiscal sustainability, with the rule defining the primary balance/GDP ratio required to keep to such a debt/GDP target.

We assume that the monetary authority cares more for inflation hikes than the fiscal authority does. Conversely, the fiscal authority is more concerned about output drops than its monetary counterpart is. Thus, the divergent authorities' preferences reflect both the central bank's mission to contain inflation and the voters' aversion to unemployment (output gap) that the fiscal authority has to deal with. Conceivably, expansionary fiscal policy may at some stage become ineffective as a means to stimulate demand and, similarly, fiscal contractions may turn out to be expansionary. When economic agents realize that the government is borrowing too much for its own good, they will conclude that this can only lead to higher taxation levels in the future, and they may decide to compensate for that already now by saving more and consuming less. This means that the financial behavior of economic agents—on which the central banks base their monetary policy decisions—depends on their perception of fiscal sustainability.

It should be noted that the impact of fiscal policy on the central bank objectives is not automatically avoided when the central bank is independent. Even when the central bank has independence, and hence is not submitted to the fiscal needs of the government, the need to offset the impact of expansionary fiscal policy on aggregate demand and inflation in the economy could prompt the central bank to tighten monetary policy, by raising interest rates or reducing credit in the financial system. The resulting high interest rates could depress economic activity, attract short-term and easily reversible capital in flows—thereby adding to inflation and appreciation pressures on the currency, and eventually damaging macroeconomic and financial stability.

Severe budgetary problems may even lead to high real interest rates. This intensified the government's debt-servicing costs, causing a build up of short term and foreign currency-linked public debt, thus increasing the sensitivity to interest rate, exchange rate, and rollover risks, which materialized as foreign capital inflows that had helped to finance the debt were suddenly

reversed. Even in countries where such extreme conditions did not materialize, the sustainability of the monetary regimes can be challenged by fiscal policies that are too accommodating. High interest rates— required to contain inflation—attracted capital inflows that complicated the implementation of monetary policy. Sterilization of capital inflows to keep inflation under check became increasingly difficult and costly for the central bank.

Empirically, there are extensive studies regarding the interaction of monetary and fiscal policy. In 1970s, the issue was centred on the inflationary consequences of the monetary financing of the fiscal deficit. Some economists such as Kydland and Prescott (1977) and Rogoff (1985) suggested that monetary policy should be determined by rules rather than discretion strategy. They proposed that monetary policy should be controlled by independent authority. Therefore, the new environment of macro-economic policies in form of the separation between monetary and fiscal policy arose.

Fase and den Butter (1977) estimated the reaction function of the central bank in Netherlands. They found that the movement of interest rates in the domestic and foreign money market and the development of the trade cycle, measured by the rate of unemployment, were the main determinants of the discount rate policy. However, in the 1990s, economists such as Nordhaus, Schultze, and Fischer (1994) explored theoretically that the possible outcomes depend on the degree of independence or coordination between monetary and fiscal policy. According to their study, the separation of monetary and fiscal authority will provoke high fiscal deficit and high interest rates that are too high to promote a healthy level of private investment and adequate long-term growth of potential output.

Recently, the debate on the optimal relationship between monetary and fiscal authorities has been a big issue in macroeconomic policy. Judd and Rudebusch (1998) reviewed previous works and maintained that the Taylor rule is a valuable guide to characterize major relationships among variables in conducting monetary policy. Romer (2001) analyzed several issues in applying the Taylor rule. The values for the coefficients of the output gap and the inflation gap would change the effectiveness of monetary policy. Thereafter, Beetsma and Bovenberg (1997) proposed the need of coordination between monetary and fiscal authority. Not only monetary authority should conduct monetary rule but also fiscal policy should set the rule for fiscal deficit.

A new approach, which allows fiscal policy to set primary surpluses to follow an arbitrary process, does not necessarily compatible with solvency. Therefore, the budget surplus path would be exogenous, and the endogenous adjustment of the price level would be required in order to achieve fiscal solvency. In this context, fiscal policy becomes “active”, with budget surpluses turning to be the nominal anchor; whereas monetary policy becomes “passive” and can only control the timing of inflation. Accordingly, some empirical studies have emerged more recently on the implications of fiscal theory of the price level on inflation targeting in open economies and for the case of monetary unions; see, e.g., Sims (1997), Woodford (1998), Bergin (2000), Canzoneri, Cumby, and Diba (2006), and Ballabriga and Martínez-Mongay (2003).

Muscatelli, Tirelli, and Trecroci (2004) examined the response of monetary and fiscal policy to the macroeconomic in a number of G7 countries. They found that, whilst monetary and fiscal

policies are increasingly used as strategic complements, the responsiveness of fiscal policy to business cycle has been decreased. From a different perspective, Dixit and Lambertini (2001) in a game theory framework argue that although they could have the same objectives, the weight fiscal and monetary authorities attribute to final targets in terms of output and inflation differs in such a way that a race between both authorities could lead to equilibrium levels far away from the targets, concluding that the coordination in targets between both authorities is essential.

In the case of emerging market countries, Tanner and Ramos (2002) evaluate whether the policy regime in Brazil during the 1990s can be better characterized as fiscal or monetary dominant. For Brazil, Loyo (2000) and Fialho and Portugal (2005) find evidence consistent with the fiscal theory of the price level where a tight monetary policy along with lose fiscal policy resulted in hyperinflation even without seignorage increase. Baldini and Ribineiro (2008) find in case of Sub-Saharan Africa a mixed e.g. some countries are dominated by fiscal regime other by monetary regime and other have no clear result. They also find the changes in nominal debt effect price variability via aggregate demand effects suggesting the fiscal outcomes could be direct source of inflation variability, as predicted by the fiscal theory of price level. Cashin et al. (2003) and Khalid, Malik, and Sattar (2007) have examined the fiscal policy sustainability for Pakistan.

In the case of Indonesia, Juhro (2008) observed the superiority of interest rate as a policy variable, or an operational target, against monetary base. De Brouwer, Ramayandi, and Turvey (2006) noted that for Indonesia the current interest rates seem to be still higher than what the rule suggested. Hsing (2008) suggested modifying the rule because the monetary policy in Indonesia does not react to the change in real exchange rate and would be more responsive to a change in the inflation rate. However, according to Ramayandi (2007), Indonesia seems to still be able to handle the inflation pressure without having to increase the interest rate. The most interesting result of his study is that the adjustment to achieve the actual interest rates is lowest compared to the selected Asian countries. Thus, the actual interest rate is representative to the inflation rate.

ADB (2010) noted that the track record of Indonesia in keeping inflation in the range was not so good. The target range is fairly narrow, and the inflation rate was more volatile than in other economies; hence the target was missed from time to time. In Indonesia, the narrow band is not only changed from year to year but also highly influenced by the budget assumptions set by the Ministry of Finance. In relation to budget assumptions, Santoso (2004) assessed fiscal sustainability using fiscal policy reaction function. He found that Indonesia's state budget is sustainable. Kuncoro (2011a), in contrast, found that Indonesia's state budget is unsustainable due to the high cost of domestic debt rather than foreign debt. Further, Kuncoro (2011b) emphasized that the unsustainable fiscal policy has negative impact of financial stability.

Linking monetary and fiscal policies, Artha (2007) found that the Central Bank independence in Indonesia really brought about a shift in monetary policy from a reaction on cyclical developments to a reaction on inflation. Moreover, monetary policy is not responsive to the

fiscal policy especially in the pre-inflation targeting periods. From the estimated fiscal authority's reaction function, he found that the movement of inflation and unemployment is not significantly determining fiscal surplus. Hermawan and Munro (2008) suggest that fiscal policy contributes meaningfully to macroeconomic stabilization in Indonesia, leading to better outcomes than monetary policy alone. Mochtar (2004) analyzed the fiscal and monetary interaction and found that the economic crisis has generated quasi fiscal activities by the central bank. Further result also shows that though it can be classified in weak form with respect to the recent fiscal reform measures introduced by the government to bring down its deficits, fiscal policy play in a dominance role in fiscal and monetary interaction in Indonesia post 1997.

Indrawati (2007), in a broader scope, investigated the relative importance of fiscal and monetary policy on aggregate economic activity. She found that fiscal shocks have negative and permanent impacts on inflation rate and responded by tight monetary policy. Meanwhile, monetary shocks have negative and permanent impacts on economic growth. The results of these studies seem to suggest that fiscal dominance might be an issue for emerging economies more than for developed ones. This motivates to test the fiscal dominance in case of Indonesia.

3. Research Method

According to theoretical framework explained in the previous section, the reaction function of monetary and fiscal authorities is derived from the utility function of both authorities in which contains their preferences on macroeconomic variables. However, the theoretical framework is not specific enough to serve as an econometric model. To develop econometric model, it is necessary to choose the relevant target variables for monetary and fiscal policy. Since monetary and fiscal policies are stabilization policy, we assume that output growth and price stability are relevant targets.

Besides the above target, the other variables which are expected to play a role in explaining the central Bank of Indonesia behavior in determining domestic interest rate are foreign interest rate, money supply growth, and government policy. To set domestic interest rate (i.e. SBI, Sertifikat Bank Indonesia), the Central Bank of Indonesia always refers to US interest rate. So, it is necessary to introduce the relative interest rate, SBI/R.

The government policy is represented not only by government budget surplus but also debt stock to incorporated fiscal stance. The two measurements of fiscal stance are presented in the relative terms to GDP. Due to the inflation rate in Indonesia is closely related to oil price, we enter the later to be explanatory variable. As explained previously, since June 2005 Indonesia has implemented inflation targeting in the monetary policy frameworks. To accommodate the shift in monetary policy and referring to the study of Artha (2007), Hsing (2008), Ramayandi (2007), and ADB (2010), we also add dummy variable to capture inflation targeting implementation (DIT). We set d = 0 for the period before June 2005 and d = 1 for the rest periods. The econometric model for monetary reaction function is postulated as the following linear specification:

$$SBI/R = \alpha_{M0} + \alpha_{M1} INF + \alpha_{M2} GAP + \alpha_{M3} DM + \alpha_{M4} DEP + \alpha_{M5} OP + \alpha_{M6} RPB + \alpha_{M7} RD(-1) + \alpha_{M8} (SBI/R)(-1) + \alpha_{M9} DIT \quad (6)$$

where:

SBI/R = SBI to US interest rate ratio
INF = inflation rate
GAP = output gap
DM = relative change of real money supply
DEP = depreciation rate Rupiah against US Dollar
OP = oil price
RPB = ratio primary balance to GDP
RD = Debt to GDP ratio
DIT = dummy for inflation targeting

Since the Central Bank of Indonesia concerns to price stabilization, we assume that α_{M1} is positive or > 0 means that if the inflation rate increases, the Central Bank of Indonesia will conduct tight monetary policy by raising SBI rate as its instrument. With regard to output gap, we assume that $\alpha_{M2} < 0$, the higher output gap, the lower SBI rate set by the Central Bank of Indonesia. Theoretically, the difference between actual GDP and potential GDP shows cyclical situation of economy. When actual GDP is higher than potential GDP, unemployment decreases. On the other hand, when actual GDP is lower than potential GDP, unemployment increases. The latter means an inverse relationship between inflation and unemployment, as postulated by the Phillips curve.

The money supply variable also plays important role in determining behaviour of SBI rate. When money supply increases, the Central Bank of Indonesia will raise SBI rate to attain targeted money supply. Therefore, α_{M3} is expected to have positive sign. The slope of fiscal and monetary reaction function can be determined by the sign of α_{M6}. According to the game, the reaction function of both authorities is negative ($\alpha_{M6} < 0$) and the slope of the reaction function of fiscal authority is less in absolute value than that of the monetary authority.

As SBI rate should follow foreign interest rate, we assume that $\alpha_{M8} < 0$. The lagged SBI/R rate is introduced because we allow a partial adjustment of the actual to the optimal SBI/R rate, with α_{M8} the coefficient of adjustment. If $\alpha_{M8} = 0$ means a complete adjustment within each period. The other coefficients of regression could have negative or positive sign.

Monetary policy (represented by BI Certificates relative to US interest rate (SBI/R)), foreign exchange rate, oil price, and money supply growth are also expected to have significant role in explaining government policy. The foreign exchange rate and oil price is accompanied to the model because they are used as basic assumption to set budget state.

Refer to equation (5), the econometric model for fiscal reaction function is postulated as the following linear specification:

$$RPB = \alpha_{F0} + \alpha_{F1} INF + \alpha_{F2} GAP + \alpha_{F3} DM + \alpha_{F4} DEP + \alpha_{F5} OP + \alpha_{F6} (SBI/R)(-1) + \alpha_{F7} RD(-1) + \alpha_{F8} RPB(-1) \quad (7)$$

where:

RPB = ratio primary balance to GDP
INF = inflation rate
GAP = output gap
DM = relative change of real money supply
DEP = depreciation rate Rupiah against US Dollar
OP = oil price
SBI/R = SBI to US interest rate ratio
RD = Government debt to GDP ratio

The sign of α_{F1} is ambiguous depends on the preference of fiscal policy to inflation. If fiscal authority is inflation averse, α_{F1} will be expected to have positive sign meaning that fiscal surplus (RPB) will be enlarged when inflation increases. However, if fiscal authority does not concern to inflation, the sign of α_{F1} is expected negative which cause excessive fiscal deficit.

Since fiscal policies conduct stabilization policy, we assume that $\alpha_{F2} < 0$. The higher output gap, the lower fiscal surplus (RPB) or we can say that fiscal authority will conducted fiscal expansion when output gap (unemployment) increases. The expected sign of α_{F6} will determine the interaction of fiscal and monetary authority. According to the theoretical framework, the reaction function of fiscal policy to monetary policy has negative slope. Therefore, α_{F6} is expected to have negative sign.

The stock of debt in the previous period gives impact on primary balance budget through its effect on interest rate and output growth. In this case, budget surplus is required to attain fiscal solvency if the real rate of interest exceeds output growth, i.e., $(r–y) > 0$ (see equation 5). The fiscal authority has to make debt service payment at least equal to PB, or equivalently, it should have a primary surplus equal to PB. A primary fiscal surplus less than that amount (or a primary fiscal deficit) in that case implies perpetual public sector borrowing and debt accumulated indefinitely. For a country whose rate of output growth exceeds the real rate of interest, $(r–y) < 0$, incurring a primary deficit is still consistent with solvency. However, a deficit higher than PB implies that the country is moving away from a fiscal solvency position. Thus we assume that α_{F7} is positive.

The lagged RPB is introduced because we allow a partial adjustment of the actual to the optimal RPB, with α_{F8} the coefficient of adjustment. The other coefficients of regression could have negative or positive sign.

To estimate the policy reaction function of the Central Bank of Indonesia and Indonesian government, we use quarterly data covering the period 1999: QI – 2009: QIV. All data used in the estimation are provided by International Financial Statistic (IMF), Central Board of Statistics, Central Bank of Indonesia, and Ministry of Finance.

The relative interest rate (SBI/R) in the model (6) and (7) stands for 3-month SBI rate which is used by the Central Bank of Indonesia in conducting open market operation. Meanwhile, foreign interest rate (R) is presented by federal fund rate of USA as a benchmark of the Central Bank of Indonesia to set SBI rate in stabilizing the value of Rupiah relative to US dollar. Inflation, one of

target variables for monetary and fiscal authority, is available in quarterly period. It is measured by the percentage change of GDP deflator per quarter.

To estimate the potential GDP, we performed Hodrick-Prescott filter technique, a widely used smoothing parameter among macroeconomists. The operational variables are specified as follows. Debt stock that is analyzed here is the central government debt only (excluding the Central Bank of Indonesia, state-owned enterprises, or local government debts). The foreign debt is stated as net adjusted by principal payment and denominated in million US dollar. To convert to Indonesian currency (Rupiah), we use the official exchange rate issued by the Central Bank of Indonesia. The domestic debt comprises short and long term debts and stated in trillion Rupiah. Eventually, we can derive the total debt as ratio to GDP.

Depreciation is calculated as a percentage change of the Rupiah against the US Dollar. Similarly, economic growth is calculated as the percentage change in GDP at constant prices in 2000. Inflation rate is derived from the GDP deflator that is ratio nominal GDP (in trillion Rupiah) to constant price GDP. The difference of narrow money (M1) supply growth and inflation rate (in percent) is used to identify seignorage. For variable primary balance, we used the ratio of fiscal surplus per GDP. This data unfortunately is available only in yearly period and provided by Ministry of Finance. The data is then interpolated linearly from annual basis to fit the other data on the model.

4. Empirical Results

Basically, equation (6) is similar with the previous researchers in Indonesia (Artha (2007), Hsing (2008), Ramayandi (2007), and ADB (2010)) except the oil price and RPB as explanatory variables. Equation (7) is closely related to Kuncoro (2011b) to access fiscal sustainability and its implication for financial system stability. As required by standard econometrics of time series (see for example: Enders, 2009), all of variables are first tested whether they have unit roots respectively. The test is conducted for both level and first-difference by imposing intercept without trend and using automatic lags selection based on Schwartz and Akaike info criterion. The results of the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit roots tests are presented in Table 1.

Table 1 Unit Roots Test

Variable to be Tested	Level		First Difference		Conclusion
	ADF	PP	ADF	PP	
RPB	-1.70075	-1.24309	-4.04858	-4.10342	I(1)
SBI/R	-2.58531	-3.79961	-4.67294	-4.67465	I(1)
INF	-32.00175	-24.25623	-40.19748	-48.79715	I(0)
GAP	-5.72767	-2.71642	-8.98224	-16.84351	I(0)
DEP	-10.36075	-2.90569	-10.19866	-23.61770	I(0)
OP	-0.90323	-1.41771	-5.46118	-7.71728	I(1)
DM	-14.79170	-12.95467	-7.91940	-42.58043	I(0)
RD	-1.68840	-0.42020	-3.83114	-6.61046	I(1)

At the level data, the series of INF, GAP, DEP, and DM have a unit roots at 95 percent level of confidence. At the first difference data, all of variables under study have a unit roots. Their t-statistics values are much greater than the critical value at 5 percent significance. They imply that the series data are stationary at the first difference [I(1)] and the behaviour of the variables vary around to the mean value and invariant overtime (Enders, 2009).

As shown in Table 1, the degree of integration of all variables is different from each other. According to Engle and Granger (1987), if X and Y have the same degree of integration, they will perform co-integration. To check the possibility of co-integration among all variables, we apply Johansen's co-integration test. The result is summarized in Table 2. Using rank test of eight variables, the trace statistics value of seven variables rejects the null hypotheses at 5 percent level. The result implies that they are the co-integrated variables even though they are not at the same degree of stationary. In other words, all of series data have a long-run relationship. As a consequence, they can be modelled as specified before to find out parameter estimate using empirical data.

Table 2 Multi Co-integration Test

Series: SBI/R INF DEP OP DM GAP RPB RD				
Hypothesized No. of CE(s)	Eigen value	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.907260	347.0362	156.00	168.36
At most 1 **	0.814529	247.1621	124.24	133.57
At most 2 **	0.701941	176.3981	94.15	103.18
At most 3 **	0.652400	125.5586	68.52	76.07
At most 4 **	0.586393	81.1771	47.21	54.46
At most 5 **	0.511130	44.0979	29.68	35.65
At most 6	0.178460	14.0402	15.41	20.04
At most 7 *	0.128655	5.7841	3.76	6.65
*(**) denotes rejection of the hypothesis at the 5%(1%) level				
Trace test indicates 6 cointegrating equation(s) at both 5% and 1% levels				

The estimation results of interaction between monetary and fiscal policies in Indonesia are presented in Table 3. The regression equation (6) and (7) is individually estimated using ordinary least squares (OLS) because there is no simultaneous relationship among variables in the model. The values of R^2 (around 0.91 and 0.96) in the regression estimates are relatively high. Even though, the correlation between DM and Inflation, especially in Monetary Policy Model, is almost the same, the multi-colinearity problem does not exist since the pair wise correlations among all dependent variables are lower than the R^2. The models indicate that our model adequately explain the influence of the set of variables given above on monetary and fiscal policies in Indonesia.

The value of Durbin-Watson (DW) statistic in the two regression results are 1.72 and 1.93 respectively. Those are supported by the results of BG test for 2 lags which shows that the variables are not serially correlated. Most of the t-statistics confirm that the coefficients of our model are significant at 10, 5, or even 1 percent level of significance. The F-statistics are (37.05

and 108.53 correspondingly) thereby confirming that all the variables in our model sufficiently explain the monetary and fiscal policies in Indonesia.

As shown in Table 3, the coefficient of inflation has a negative sign and significant. It is different from hypothesis which expects α_{M1} is positive. That is due to the foreign interest as denominator. In such a case, the rise in inflation rate is not fast as that in foreign interest rate. As SBI rate should follow foreign interest rate, the inflation rate has negative impact on SBI/R. However, the coefficient of dummy on inflation targeting α_{M9} has positive sign and statistically significant at 10 percent confidence level, strongly suggesting that the behaviour of the Central Bank of Indonesia toward inflation has been changed after inflation targeting period. At this period, the Central Bank of Indonesia seems to be more responsive and concern to inflation.

Table 3 Estimation Results of Interest Rates and Primary Surplus

Regressor	Monetary Policy		Fiscal Policy	
	Regressand: $(SBI/R)_t$		Regressand: $(RPB)_t$	
	Coefficient	t-stat	Coefficient	t-stat
C	-1.055390	-2.57098 **	-2.739348	-3.76688 *
INF	-0.020011	-2.54867 **	-0.047576	-3.05562 *
GAP	0.214751	1.12908	0.223702	0.54580
DM	-0.041781	-1.96485 ***	-0.090922	-2.12647 **
DEP	0.009726	1.93362 ***	0.024781	2.44048 **
OP	0.005937	1.81346 ***	0.023058	3.77532 *
RPB	0.073431	2.93429 *	-	-
SBI/R	-	-	0.255549	1.54746
RD(-1)	0.021682	1.95220 ***	0.102728	5.63905 *
(SBI/R)(-1)	0.828810	11.04527 **	-	-
RPB(-1)	-	-	0.842287	16.47020 *
DIT	0.335706	1.98568 ***	-	-
R-sq	0.90748		0.96125	
SEE	0.25634		0.54662	
DW	1.72357		1.92989	
F	37.05419		108.53090	
Normality (JB test)	17.39814 (0.000167)		0.21925 (0.896167)	
Linearity (2)	0.52541 (0.596322) 1.42167 (0.491232)		0.11110 (0.895180) 0.29528 (0.862741)	
ARCH (1)	1.32008 (0.257236) 1.34129 (0.246806)		0.70782 (0.405049) 0.72975 (0.392964)	
Serial correlation BG test (2 lags)	0.67517 (0.516169) 1.78156 (0.410336)		0.04069 (0.960167) 0.10826 (0.947308)	
Heteroscedasticity White test	2.40774 (0.021217) 26.90793 (0.059432)		2.34740 (0.024432) 25.59807 (0.059952)	
Q - LB test (4 lags)	1.7336 (0.7850) 3.0719 (0.5460)		3.5833 (0.4650) 1.2438 (0.8710)	

*Notes: *, **, and ***indicate significance at 1, 5, and 10 percent. Figure in parentheses are the probability value for F and $\chi 2$ tests*

The output gap rate which represents the cyclical situation in economy does not play an important rule in determining monetary policy. It is verified by the coefficient α_{M2} which is statistically insignificant at 10 percent confidence level. When we include dummy interaction

with output gap, the coefficient remains being statistically insignificant, indicating that the enacting of the inflation targeting has not given significant impact on the behaviour of monetary policy toward output stabilization.

Regarding to interaction of monetary and fiscal policy, the expected coefficient α_{M6} and α_{M7} can explain the reaction function of monetary policy to fiscal policy. The estimation result shows that both have positive sign and statistically significant. These indicate that monetary policy is responsive to the fiscal policy. According to the theoretical framework explained in the previous section, the positive sign of α_{M6} and α_{M7} suggests the Central Bank of Indonesia and government play coordination game. When we include dummy interaction with both RPB and RD, the coefficients are statistically insignificant. It verifies cooperative game implemented by the Central Bank of Indonesia before and after the inflation targeting periods.

The other variables which play significant role in determining monetary policy are growth of real money supply, foreign exchange rate, and oil price. The positive sign of DEP and OP variables explains that the Central Bank of Indonesia tends to raise SBI/R rate when both increase. In contrast, the growth of real money supply has negative sign. The negative sign of DM variable explains that central Bank of Indonesia tends to reduce SBI rate when the DM increases. It is important to note that the Central Bank of Indonesia is more concern with maintaining financial stability relative to output stabilization.

It is remarkable that the adjustment coefficient α_{M8} has small value of 0.17. This indicates the speed of adjustment of the actual to the optimal SBI/R rate is low. There was only 83 percent of desired target could be achieved so that the current interest rates seem to be still higher. This finding supports to the results of Ramayandi (2007) and De Brouwer, Ramayandi, and Turvey (2006).

In summary, we may conclude that the movement of inflation rate, real money supply growth, depreciation, and oil price are the main determinants of monetary policy in Indonesia over period 1999-2009. At this period, the Central Bank of Indonesia seems more concern to inflation and financial stability than output gap (unemployment). With regard to interaction of monetary and fiscal policy, the Central Bank of Indonesia considered fiscal policy in conducting monetary policy. It is supported by the coefficient of fiscal surplus which is statistically significant in determining SBI rate relative to US rate.

The estimation result of fiscal policy reaction function shows that the movement of inflation, depreciation, and oil price is significantly determining fiscal surplus. In the opposite direction, real money supply also plays an important role in determining fiscal surplus. It indicates after the inflation targeting period, government was responsive to financial and price stabilization in economy as found from monetary reaction function analysis.

The output gap (unemployment), unfortunately, does not significantly influence primary fiscal surplus. The result does not change when we impose the dummy interaction with output gap (or even inflation rate). It seems that the fiscal authority did not perform a stabilization policy. It is probably caused by the implementation of the new Act of Government Financial in 2001 which

restricted fiscal deficit at maximum 3 percent per GDP. This finding supports the conclusion of Gali and Perotti (2003) which found that fiscal policy had become more countercyclical in the post-Maastricht period. They concluded that there was a global trend in fiscal policy towards countercyclical.

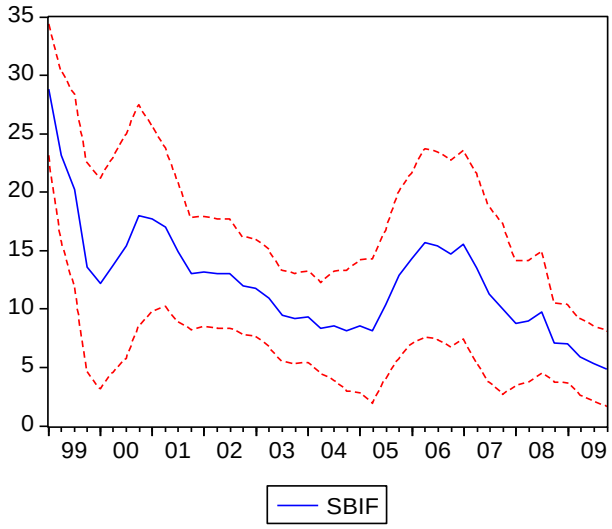
The reaction function of fiscal authority to monetary authority can be explained by the sign and significance of coefficient α_{F6}. Base on the above estimation result, α_{F6} has positive sign and statistically insignificant at 10 percent level. When the dummy interaction with RPB entered in the model, the result does not change. It does not coincide with the theoretical framework which explained that fiscal authority as a leader will consider monetary policy in maximizing its utility. It indicates that fiscal policy is not responsive to monetary policy during this period.

The debt stock in the previous period tends to induce primary balance surplus as theoretical requirement in equation (5). Statistical evaluation on α_{F7} shows that it is significantly different from zero. It seems that when the debt stock increases, the central government will induce RPB to maintain fiscal soundness. Furthermore, the coefficient α_{F7} greater than zero while the coefficient α_{F6} equals zero implies that the fiscal policy is unsustainable. The fiscal policy marginally reacts to the monetary policy so that fiscal sustainability will be more difficult to attain given the opposite response of governments to public debt shocks. This is consistent with the finding of Kuncoro (2011a and 2011b).

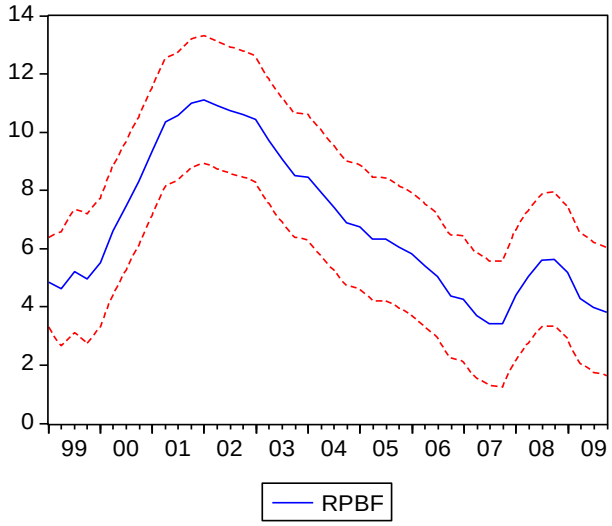
Figure 1 presents the scatter plot of the forecasted values of SBI/R and RPB respectively within 2 times standard deviation bands. The projected SBI/R is quite fluctuating. Meanwhile, the contour of RPB projected is rather straightforward. The root mean squared error for SBI/R and RPB is 0.3816 and 0.5977 and the mean absolute error is 0.29996 and 0.4877 respectively. Based on the root mean squared error, the monetary policy model is better to explain the actual values than the fiscal policy.

The ultimate goal of this research is to identify the optimal interaction between monetary policy and fiscal policy. Refer to the idea of Pareto optimal in microeconomics (see for example: Varian, 1992), here, optimal is defined as a stable position that if one of the policy (because, among other things) changed to achieve certain objectives, the policy will harm the other policies in order to achieve other goals. We assume that the main objective of monetary policy is assumed to focus on price stability, while fiscal policy is the main goal of output stabilization.

Figure 1 Scatter Plot of Interest Rates and Primary Surplus Projected



Forecast: SBIF	
Actual: SBI	
Forecast sample: 1998:4 2009:4	
Adjusted sample: 1999:1 2009:4	
Included observations: 44	
Root Mean Squared Error	2.435505
Mean Absolute Error	1.796192
Mean Abs. Percent Error	17.72503
Theil Inequality Coefficient	0.094769
Bias Proportion	0.089514
Variance Proportion	0.000485
Covariance Proportion	0.910001



Forecast: RPBF	
Actual: RPB	
Forecast sample: 1998:4 2009:4	
Adjusted sample: 1999:1 2009:4	
Included observations: 44	
Root Mean Squared Error	0.597678
Mean Absolute Error	0.487668
Mean Abs. Percent Error	8.645164
Theil Inequality Coefficient	0.041205
Bias Proportion	0.005082
Variance Proportion	0.007702
Covariance Proportion	0.987216

In achieving the main goal each, both policies will always have a deviation from the intended target in spite of the adjustments have been held. The negative deviation means that the policy is too high (expansive) from the target. Conversely, a positive deviation means that the policy had been pursued too low (contractive) from the target. The policy is said to be appropriate and optimal if there is no deviation. Plot of deviations of monetary (RES1) and fiscal (RES2) policies during the study period is presented in Figure 2.

Figure 2 Deviation of Monetary and Fiscal Projection

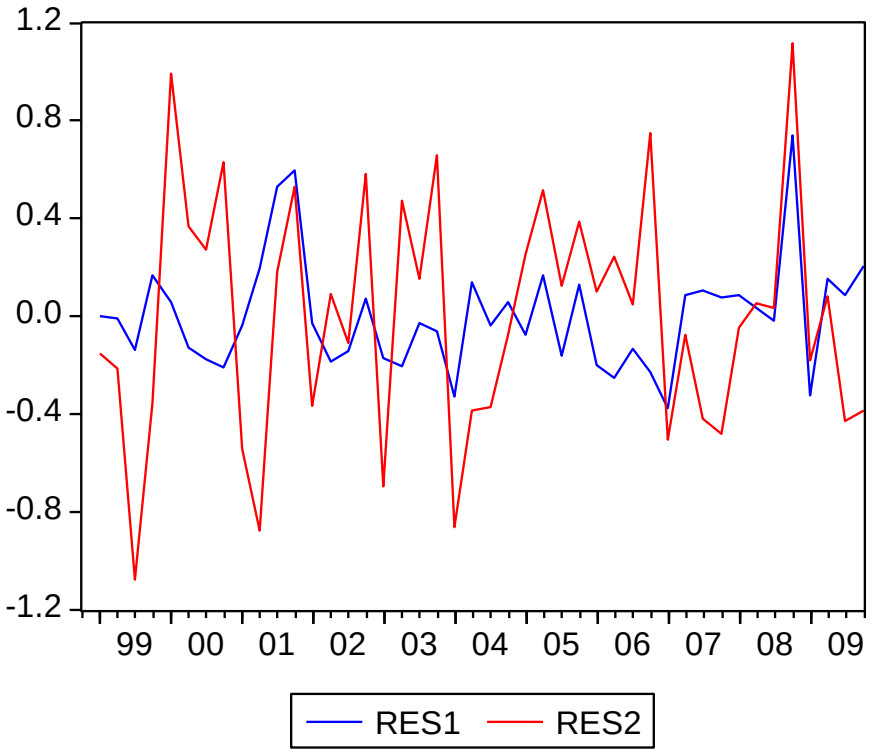


Figure 2 shows that monetary policy has more deviations smaller than fiscal policy. This still can be understood conceptually. The monetary policy is more quickly taken despite a time lag. Instead fiscal policy can not be immediately taken, although the time lag it can be felt more immediately. The optimal point that could be investigated from Figure 2 is in early 2002, mid 2005, and the first half of 2008. The explanation can be posited is that early 2002 is the disbanding of the CGI (Consultative Group on Indonesia), a group of donors who give Indonesia's debt. Mid-2005 is the start of inflation targeting and the first half of 2008 was the issuance of fiscal stimulus to mitigate that impact the financial crisis.

Overall, the deviation of interaction between monetary and fiscal policies is summarized in Table 4. It includes an active monetary/fiscal policy (expansive) and passive (contractive). Of the 44 samples, monetary policy occurs 19 times passive and the remaining 25 cases are active. The active fiscal policy comprises 24 cases and 20 other cases are passive. The combination of active and passive policies between the monetary and fiscal policy generate the optimal pay-off that is 11 based on the mini-max and maxi-min criteria. Pay off 11 is in the active column. In general, monetary policy is more dominant for the case in Indonesia. Therefore, the optimal interaction is when both monetary and fiscal policies are active (expansive). In this circumstance, the prudent monetary policy followed by sound fiscal policy would probably be the best choice of an optimal policy mix in Indonesia.

Table 4 Interaction Matrix and Pay off between Monetary and Fiscal Policy

Interaction		Monetary Policy		Total	Maxi-min Criteria
Fiscal Policy	Pay off	Passive	Active		
	Passive	10	14	24	14
	Active	9	11	20	11
Total		19	25	44	-
Mini-max criteria		9	11	-	11

5. Concluding Remarks

The present study provides quantitative evidence for the relative importance of fiscal and monetary sources of inflation and traces out the dynamic response of interest rate and primary balance surplus to different shocks, including the public debt. For Indonesia, the evidence is clear to infer that authorities are following a certain type of monetary regime during the sample period 1999-2009. The debt stocks respond positively to the innovation in surpluses, that is in the subsequent period the liabilities decreases in the face of decrease in surplus. This characterizes MD regime, the events that give rise to surplus innovation are likely to persist causing the rise in the future surpluses and surpluses pay-off some of the debt causing the change in the liabilities.

By analyzing the behaviour of monetary and fiscal authorities, an innovation in surplus induces interest rates and the later does not increase the surplus ratio in the corresponding period; this analysis confirms the non-Ricardian analysis. On the other hand, the study finds that, as predicted by the fiscal theory of price determination, the occurrence of wealth effects of changes in nominal public debt may pass through to prices by increasing inflation variability. In addition, the results show that as predicted by fiscal theory of price determination the discount rate is decreasing in response to positive shock in inflation.

The reverse also happens as the reserve money growth also responds negatively as predicted by the MD regime. Therefore, the implication that comes out of this study is that nominal public liabilities, as reflected either in money growth or in nominal public debt, matter for price stability in case of Indonesia. However, the monetary and fiscal policies significantly do not consider the output gap. Furthermore, the application of game theory indicates that monetary dominance exists in Indonesia. Given that, the prudent expansionary fiscal and monetary policies should be made as an optimal choice in order to reach output growth sustainability in the long run.

There are certain limitations of the approach. For instance, it does not allow to identify a predominant regime if both FD and MD regimes are alternating during the sample period covered. It would be appropriate to apply Markov chain technique that allows identifying the probability when the regimes are switching for a general model. The use of different econometric tests and approaches to underpin the relative importance of monetary and fiscal determinants of inflation should improve the reliability of the results.

Acknowledgement

I am greatly thankful to anonymous referee and RJFP Editor for the supports and constructive comments they have provided during the revising of this paper.

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