Monetary policy rule under inflation targeting: the case of Mongolia

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Abstract

This article aims to review the monetary policy rule under inflation targeting framework focusing on Mongolia. The empirical analysis estimates the policy reaction function to see if the inflation targeting has been linked with a monetary policy rule emphasizing on inflation stabilization since its adoption in 2007. The study contributes to the literature by examining the linkage between Mongolian monetary policy rule and inflation targeting directly and thoroughly for the first time and also by taking into account a recent progress in the inflation targeting framework toward forward-looking mode. The main findings were: the Mongolian current monetary policy rule under inflation targeting is characterized as inflation-responsive rule with forward-looking manner (one quarter ahead); the inflation responsiveness is, however, weak enough to be pro-cyclical to inflation pressure; and the rule is also responsive to exchange rate due to the "fear of floating", which weakens the policy reaction to inflation and output gap.

Keyword: Monetary policy rule, Inflation targeting, The Bank of Mongolia, Policy reaction function, and Fear of floating
JEL Classification Codes: E52, E58, O53

1. Introduction

The Central Bank of Mongolia (BOM) has adopted "inflation targeting" [1] as its monetary policy framework since 2007. The background behind introducing the inflation targeting lies in the fact that the correlation between money supply and inflation had declined, hence had come the need to reform the monetary policy method in the 2000s. The BOM had a monetary aggregate targeting framework until 2007 with reserve money as an operating target and with M2 as an intermediate target. Since the 2000s, however, the deviation of monetary aggregate from those targets has been enlarged due to a re-monetization process and a volatility of the money multiplier. The BOM has thus introduced the inflation targeting framework since 2007, which contains the policy mandate of announcing a targeted inflation rate to the public and of taking every possible measures to maintain inflation rate at the targeted rate. At the same time, the BOM has adopted one-week central bank bills' rate as a policy rate since July 2007, so that the policy rate can work as an operating target to attain its targeted inflation rate. Since introducing the inflation targeting in 2007, the BOM, having experienced the challenges of high and volatile inflation, has taken several steps to make the inflation targeting system more effective: the BOM has introduced the Forecasting and Policy Analysis System (FPAS) since 2011 as a forward-looking framework, and has established an interest rate corridor to enhance the policy rate transmission mechanism since 2013 as an operational framework.

The question then arises on how we can evaluate the performance of inflation target that has been operated for one decade since its adoption in Mongolia. In general, there seems to be a consensus in academic literature and policy discussions that inflation targeting has so far been successful to stabilize inflation in advanced economies with the history of its operation since the 1990s (e.g. Mishkin and Posen, 1998; Mishkin and Schmidt-Hebbel, 2007). As far as emerging market economies including Mongolia are concerned, however, there has been rather less evidence to support the performance of inflation targeting due to the relatively shorter history of its operation and due to some difficulties in its management.

The difficulties that emerging market economies have faced in operating their inflation targeting might come from exchange rate fluctuations for the following senses. First, inflation targeting can work well only when monetary autonomy is secured under floating exchange rate regime with capital mobility. Emerging market economies have,

[1] The essence of inflation targeting framework was clearly described in Bernanke and Mishkin (1997) and Bernanke et al. (1999), for instance.

however, the problem of "fear of floating", as suggested by Calvo and Reinhart (2002). It comes from a lack of confidence in currency value, especially given that their external debts are primarily denominated in US dollars. Their efforts to avoid exchange rate volatility prevent their monetary authorities from concentrating fully on inflation targeting. Second, as Eichengreen (2002) argued, exchange rate fluctuation itself has large influence on domestic prices through the "pass-through" effect in small, open economies. It makes it difficult for monetary authorities to control inflation and to perform inflation targeting well. There is, however, a counterargument against the pass-through effect on inflation targeting. Gagnon and Ihrig (2004) argued that an inflation targeting framework reduces the pass-through effect, in the sense that domestic agents are less inclined to change prices in response to a given exchange rate shock under the strong commitment of a monetary authority to price stability.

Another possible difficulty for inflation targeting management in emerging market economies is the lack of credibility of the central bank capacity. It might come from arbitrary policy reactions accompanied with unreliable inflation forecasting by central banks as well as the economic uncertainty and volatility. As long as agents do not believe that a monetary authority will be successful in achieving inflation target, it will be difficult for inflation targeting to have any significant impact on expectations and behaviors of private sectors with respect to wage and pricing contracts. As Eichengreen (2002) emphasized, the lack of credibility would thus lessen inflation targeting performance.

Some studies, among the limited literature, have assessed inflation targeting in emerging market economies as "conditional" success. For example, Mishkin (2000, 2004) argued that the success of inflation targeting could not be solely attributed to the actions of central banks, and that supportive policies such as the absence of large fiscal deficits and rigorous regulation and supervision of financial sector were crucial to its success. Lin and Ye (2009) also noted that the performance of inflation targeting could be affected by a country's characteristics such as the government's fiscal position, the central bank's desire to limit movements of exchange rate and its willingness to meet the preconditions of policy adoption. Ito and Hayashi (2004) presented the following two recommendations on inflation targeting management, considering the characteristics of emerging market economies: 1) emerging market countries should set an inflation with target central rate slightly higher and with a target range slightly wider than a typical advanced country; (2) small, open economies may pursue both an inflation target range and an implicit basket band in exchange rate regime, as both targets are expressed in a range (the targets work as the source of stability in expectations, while the ranges allow some flexibility).

Mongolia is not an exception in facing the aforementioned difficulties and

conditional success in inflation targeting operation as one of emerging market economies. This article, in this context, reviews the monetary policy rule under inflation targeting framework focusing on Mongolia. To be specific, this study estimates the policy reaction function to see if the inflation targeting has been linked with a monetary policy rule emphasizing on inflation stabilization since its adoption in 2007. The study samples quarterly data from the third quarter of 2007 to the fourth quarter of 2017, and the additional estimation divides the sample into the first period from the third quarter of 2007 to the fourth quarter of 2011 and the second period from the first quarter of 2012 to the fourth quarter of 2017, considering the progress made by the BOM on the inflation targeting framework.

The rest of the paper is structured as follows. Section 2 gives an overview of the monetary policy framework since the 1990s in Mongolia. Section 3 reviews previous studies on monetary policy rules in emerging market economies in Asia and clarifies this paper's contribution. Section 4 conducts the empirical analyses by describing the data, the methodology, and the estimation result with its interpretation. Section 4 summarizes and concludes.

2. Overview of Monetary Policy Framework in Mongolia

This section first describes the short history of monetary policy framework since the 1990s in Mongolia, and then observes the performance in Mongolian inflation targeting in connection with the policy rate stances since its adoption in 2007.[2]

2.1 Development of Monetary Policy Framework since the 1990s

The Mongolian economic system shifted from a centrally planned economy to a market-based economy in early 1990s, and a great number of political and economic reforms were undertaken since then. In 1991, Mongolia approved a new banking law and organized the two-tier banking system: the BOM implements monetary policy as a central bank, and other banks yields commercial services. Regarding the monetary policy framework, it has the following three phases since the 1990s: monetary aggregate targeting from 1995 to 2006, transition to inflation targeting from 2007 to 2011, and inflation targeting with forward-looking framework from 2011 to the present.

In the first phase of monetary aggregate targeting for 1995-2006, the BOM set the

[2] The description on this section is based on Bayardavaa et al. (2005) and the BOM website: https://www.mongolbank.mn/eng/listmonetarypolicy.aspx?id=01.

reserve money as an operating target and M2 as an intermediate target, only through the policy instruments of operating central bank bill and reserve requirement. Since the mid-2000s, however, the relationship between reserve money and broad money, namely, the money multiplier, became unstable and the impact of money supply on inflation became ambiguous due to financial deepening, fiscal dominance and its monetization process. Hence came the necessity for the BOM to apply alternative monetary policy framework.

In the second phase from 2007, the BOM initiated inflation targeting, which contains the policy mandate of announcing the targeted inflation rate to the public and of taking every possible measures to maintain inflation rate at the targeted rate. At the same time, the BOM has adopted one-week central bank bills' rate as a policy rate since July 2007, so that the policy rate can work as an operating target to attain its targeted inflation rate through its transmission mechanism.[3] Mongolian economy was, however, hit by the wave of world financial crisis in 2009, and the BOM adopted the IMF Stand-by program in that year in order to safeguard the foreign exchange reserves and to relieve immediate pressure on exchange rate. The program's terms required BOM to target monetary aggregate by putting a ceiling on net domestic assets and setting a floor for net foreign assets. In 2011, the BOM finally completed 18 month Stand-by program.

In the third phase from 2011, the BOM has been developing the Forecasting and Policy Analysis System (FPAS), for the purpose of upgrading the inflation targeting to a forward-looking framework. The system aims at forecast-based policy formation and decision making, and effective communication with the public under the inflation targeting framework. In this phase, the BOM also have improved its operational framework by establishing an interest rate corridor since February 2013. The interest rate corridor around the policy rate consists of two standing facilities: the rate of overnight repo facility as a ceiling (policy rate plus two percent points) and the rate of overnight deposit facility as a floor (policy rate minus two percent points). Setting the corridor is expected to contribute to reducing fluctuations in short-term interest rates and to improving interest rate channel of monetary transmission mechanism.

2.2 Performance of Inflation Targeting

This section, focusing on the second and third phases above after 2007, observes the performance of inflation targeting by comparing the targeted inflation with the actual

[3] The BOM still keeps the reserve requirement ratio as a monetary policy instrument as well as the policy rate.

inflation and by associating the trend in inflation rate with the policy rate stances.[4]

Figure 1 compares the actual inflation rate with the targeted rate in terms of annual rate at each year-end, in which the targeted inflation rate is updated by the BOM's Monetary Policy Guidelines for each year. Figure 2 illustrates the central bank's policy rate and the interest rate corridor in comparison with the interbank market rate.

Soon after the adoption of inflation targeting in 2007, Mongolian economy was hit by the wave of world financial crisis in 2009, and the BOM adopted the IMF Stand-by program in that year. At that time, the main focus of the BOM was to restore the confidence in the local currency and to stop the deposit flight out of its economy, and the BOM thus raised its policy rate from 9.75 percent to 14 percent in March 2009, although the BOM afterwards reduced its policy rate gradually to 10 percent in September 2009 in accordance with the declining inflation rate.

For the period from 2010 to 2013, Mongolian economy entered the booming stage with double-digit inflation rate, which was mostly beyond the targeted rate that pursued a single-digit level. There were the following reasons behind the fueling inflation: the price elevation of food, fuel and public administrative goods in the supply side, the expansionary fiscal policy particularly in terms of the cash handout to the public from the specific government fund and the sore of capital inflows in the mining sector in the demand side. The BOM reacted to the hike of inflation by raising its policy rate continuously to 13.25 percent until January 2013. At the same time, the BOM initiated the "Medium-term Price Stabilization Program" containing the programs to stabilize food and fuel prices in October 2012 to decrease the supply side pressure on inflation. As a result of these policies, the inflationary pressure was calming down to some degree, thereby the BOM cutting again its policy rate consecutively from January to June in 2013 toward 10.5 percent. The interest rate corridor was also initiated from February 2013 as was stated before. As Figure 2 showed clearly, before the corridor adoption there was large deviations between the policy rate and the interbank market rate, but after its adoption, those deviations have been settled down within the corridor range.

For 2014-2015, under the background of the slowdown in the world economy including Chinese economy, the net inward foreign direct investment to Mongolia fell down sharply (in 2014 by 17 times less than its peak in 2011), thereby the balance of payment facing difficulties. To improve external balance, the BOM turned to tight monetary policy by raising its policy rate to 12 percent in July 2014 and further to 13 percent in January 2015. At the end of 2015, the inflation rate fell down to 1.9 percent as

[4] The description in this section is based on the annual report of the BOM in each year.

year-on-year rate, which was far below the targeted rate.

After 2016, the BOM eased its monetary policy by cutting its policy rate to 12 percent in January 2016 and further to 10.5 in May 2016, considering that the inflation rate remained below the targeted rate. The BOM, however, raised its policy rate again to 15 percent in August 2016, since during July to August the shortage of foreign reserves incurred the rapid currency depreciation, which endangered the capital flight. After avoiding a currency crisis, the BOM started to reduce its policy rate gradually and continuously from December 2016 through 2017. The inflation rates in 2016 and 2017 were still below the targeted rate at the year-end.

To sum up, in the early stage of inflation targeting for 2007-2013, the actual inflation rate tended to exceed the targeted rate in spite of tight monetary policies due to fiscal and supply-side pressures. In the latter stage for 2015-2017, on the contrary, the inflation rate has been will-restrained under the targeted rate. The critical issue is that even under such a stagnant economic condition for that period, the BOM has still kept its policy rate at rather high level, namely, more than ten percent. As the aforementioned story told us, the constraint in the BOM monetary policy comes from the difficulty in balance of payment caused mainly by the sharp decline in inward foreign direct investment and at the same time the difficulty in the fluctuation of local currency value, so-called, "fear of floating".

3. Literature Review and Contributions

This section reviews previous studies on monetary policy rules under inflation targeting in emerging market economies in Asia and clarifies this paper's contribution. On this issue, there are very few empirical studies, because only less than two decades have passed since their adoptions of inflation targeting. In fact, East Asian emerging market countries initiated inflation targeting after the 1997-1998 Asian currency crisis: Korea instituted it in 1998, followed by Indonesia and Thailand in 2000, and the Philippines in 2002. Later in these countries, Mongolia started inflation targeting in 2007, as mentioned before. Some of these countries have, however, been targeted as a quantitative study of inflation targeting: their monetary policy rules have been examined by monetary policy reaction functions to see if their rules under inflation targeting have really taken inflation-responsive policy stances. Kim and Park (2006) examined the mode of operation of inflation targeting by the Bank of Korea through a monetary reaction function and found that the Bank adjusted interest rates in response to changes in inflationary pressure as well as to output gaps. Siregar and Goo (2008) assessed the implementation of inflation targeting in Indonesia and Thailand by employing a Markov-

switching approach to monetary reaction functions, and showed that controlling inflationary expectations has indeed been the focus of monetary policies in these economies; but its commitment has only prevailed during stable regimes in Thailand, whereas it has prevailed during stable and volatile periods in Indonesia.

Regarding a choice between interest rate rule and exchange rate rule as monetary policy rule, Cavoli (2010) argued that the interest rate rule would be suited for inflation targeting, but the exchange rate rule could be an alternative due to "fear of floating" given the openness of emerging market economies. The study estimated a simple open macroeconomic model to analyze the effectiveness of alternative monetary policy rules in East Asian emerging market economies adopting inflation targeting, and found that the interest rate rule was more dominant in Korea and Thailand than in Indonesia and the Philippines. As for the forward-looking or backward-looking mode of monetary policy rule, Taguchi and Kato (2011) examined it focusing on East Asian emerging market economies adopting inflation targeting: Indonesia, Korea, the Philippines and Thailand. They found that Korea took an inflation-responsive and forward-looking policy stance while Indonesia and Thailand had inflation-responsive but backward-looking stances and the Philippines under the de facto pegged currency regime did not follow even inflation-responsive rule.

Although there are several studies focusing on individual economies such as Thailand, e.g. Lueangwilai (2012), there are no studies of Mongolian monetary policy rule under inflation targeting.[5] This study's contribution is thus to examine the linkage between Mongolian monetary policy rule and inflation targeting directly and thoroughly by applying policy reaction functions for the first time, and further to evaluate a progress in the inflation targeting framework toward forward-looking mode by dividing the total sample into the first and second periods. The followings are three main research focuses on Mongolian policy rule: whether the rule is inflation-responsive and countercyclical to inflationary pressure; whether the rule has forward-looking or backward-looking stance; and whether the rule contains an exchange rate-responsive reaction due to the "fear of floating".

4. Empirical Analyses

This section conducts the empirical analyses in order to examine the monetary policy rule under inflation targeting focusing on Mongolia. For examining it, the study estimates

[5] Buyandelger (2015) investigated the relationship between exchange rate pass-through effect and monetary policy in Mongolia, but did not examine Mongolian monetary policy rule itself.

policy reaction functions to see if the adoption of inflation targeting has been linked with an inflation-responsive policy rule. The section first represents sample data and key variables for the estimation, followed by the estimation methodology and the estimation outcome with its interpretation.

4.1 Sample Data and Key Variables

The analysis here samples the quarterly data running from the third quarter of 2007 to the fourth quarter of 2017 during which the BOM has operated the inflation targeting. The source of all the data used for the estimation is the International Financial Statistics (IFS) of the International Monetary Fund (IMF).[6] The analytical indicators are selected as follows: "Central Bank Policy Rate" for policy interest rate (denoted by *por*); "Consumer Prices Index (2010=100)" for price index, which is transformed into its year-on-year change rate as inflation rate for the estimation (π); "Industrial Production, Seasonally adjusted, Index (2010=100)" for industrial production, which is further processed into production gap (*gap*) by subtracting from the industrial production a Hodrick-Prescott-filter of that series as a proxy of potential production level; and "National Currency per US Dollar, Period Average" for exchange rate, which is expressed as its year-on-year change rate (*exr*). The combination between policy interest rate and the other variables of inflation rate, production gap and exchange rate, are simply displayed in Figure 3. This observation itself does not tell us clear correlations and causalities in any combinations since the variables interact each other, and so they should be statistically tested in the more sophisticated way in the later section.

Before conducting the estimation below, the study investigates the stationary property of the data for each variable, by employing the Ng-Perron unit root test[7] on the null hypothesis that each variable has a unit root in the test equation including "trend and intercept". This test constructs four test statistics: modified forms of Phillips and Perron (1988) statistics (MZa, MZt), the Bhargava (1986) statistic (MSB), and the Point Optimal statistic (MPT). Table 1 reports the test results for the data for all the indicators, i.e., policy interest rate (*por*), inflation rate (π), production gap (*gap*) and exchange rate (*exr*) for their level data. The test rejected a unit root in all the data at the conventional level of significance by more than 95 percent, thereby their data showing stationary property. Their data are thus justified to be used for the subsequent estimation.

[6] The data are retrieved from the website: http://www.imf.org/en/data.

[7] Ng and Perron (2001) introduced a new unit root test, which used detrended data and a lag selection procedure that improved on previous methods.

4.2 Methodology: Policy Reaction Function

The policy reaction function is one of the useful analytical tools to describe a monetary policy rule in practices managed by a central bank. Its standard specification is that a central bank adjusts the nominal policy interest rate in response to the gaps between expected inflation and output, and their respective targets. It can be interpreted as a more generalized rule of the Taylor rule (see Taylor, 1993) – the simple backward-looking policy reaction function. The estimable policy reaction functions were presented for the first time by Clarida and Gertler (1997) for the Bundesbank monetary policy, Clarida et al. (1998a) for the US monetary policy, and Clarida et al. (1998b) for monetary policies of two sets countries: the G3 (Germany, Japan, and the US) and the E3 (UK, France, and Italy). Among them, Clarida et al. (1998b) demonstrated the most comprehensive estimation of policy reaction functions. For estimating the G3 monetary policy rules, they took the forward-looking specification as the baseline and the backward-looking function as an alternative for their comparison, and they found that the G3 pursued forward-looking rules, responding to anticipated inflation as opposed to lagged inflation. As for the E3 estimation, they added such explanatory terms as German interest rate and exchange rate in their functions, to examine how the constraints of the European Monetary System that collapsed in late 1992 influenced the E3 monetary policy rules.

This study applies the methodology of Clarida et al. (1998b) to estimate the policy reaction function for Mongolia during the third quarter of 2007 to the fourth quarter of 2017. The analysis employs both of forward-looking and backward-looking specifications for the estimation, since emerging market economies may face the difficulties in forecasting inflation rate as Eichengreen (2002) pointed out. The analysis also includes the exchange rate term as one of the monetary policy determinants, since emerging market economies may fall into the "fear of floating" as Calvo and Reinhart (2002) suggested.

The original policy reaction function presented by Clarida et al. (1998b) is shown as the following equation (1).

$$por_t^* = \bar{r} + \beta * (E[\pi_{t+n}|\Omega_t] - \pi^*) + \gamma * (E[y_t|\Omega_t] - y_t^*) \qquad (1)$$

where por_t^* is a target for nominal short-term interest rate; $\bar{r}$ is the long-run equilibrium nominal interest rate; π_{t+n} is the inflation rate at the period $t+n$; y_t is the real output, π^* and y_t^* are respective bliss points for inflation and real output; E is the expectation

operator; and Ω is the information available to the central bank at the time when it sets the interest rate.

Equation (1) can be rewritten for empirical specification by defining $\alpha \equiv \bar{r} - \beta\pi^*$ and $gap_t \equiv y_t - y_t^*$, and by replacing the unobserved forecast variables with realized variables as follows.

$$por_t^* = \alpha + \beta * \pi_{t+n} + \gamma * gap_t + \varepsilon_t \quad (2)$$

where ε_t is a linear combination of the forecast errors of inflation and real output. Then the equation (2) is modified in accordance with our analytical concerns into the forward-looking specification in equation (3) and the backward-looking specification in equation (4), and the equation (3) and (4) also include the exchange rate term, *exr*, as follows.

$$por_t^* = \alpha + \beta * \pi_{t+n} + \gamma * gap_t + \delta * exr_t + \varepsilon_t \quad n = 1, 2 \text{ and } 3 \quad (3)$$
$$por_t^* = \alpha + \beta * \pi_{t-n} + \gamma * gap_t + \delta * exr_t + \varepsilon_t \quad n = 0, 1 \text{ and } 2 \quad (4)$$

The coefficients of β, γ and δ are expected to be positive at the significant level.[8] The magnitude of β is also a critical yardstick: if $\beta > 1$, it means that the policy rate reacts to more than inflation rate, thereby the increase in real policy rate adjusting to stabilize inflation in a counter-cyclical way. With $\beta < 1$, on the other hand, the decline in the real rate still accommodates inflation in a pro-cyclical manner even if a central bank raises nominal policy rate. According to Clarida et al. (1998b), the β magnitudes of the Bundesbank, the Bank of Japan and the Federal Reserve System in USA are 1.31, 2.04, and 1.79, respectively, all of which are more than unity.

The equation (3) and (4) are further modified for obtaining estimable equations since the central bank tends to conduct smooth changes in its policy interest rate in their practices. By assuming that the actual rate partially adjusts to the target as $por_t = (1-\rho) * por_t^* + \rho * por_{t-1} + \upsilon_t$ where ρ is the degree of smoothing with $0 < \rho < 1$ and υ is the disturbance term, equations (3) and (4) can be further rewritten into equation (5) and (6) as follows.

$$por_t = (1-\rho)\alpha + (1-\rho)\beta * \pi_{t+n} + (1-\rho)\gamma * gap_t + (1-\rho)\delta * exr_t + \rho * r_{t-1} + \varepsilon_t \quad (5)$$

[8] The coefficient of exchange rate, δ, is expected to be positive. The exchange rate here is expressed by national currency per US Dollar, and so the large number represents currency depreciation. In that case, the policy rate should be raised to prevent its depreciation following the "fear of float" argument.

$$por_t = (1-\rho)\alpha + (1-\rho)\beta * \pi_{t-n} + (1-\rho)\gamma * gap_t + (1-\rho)\delta * exr_t + \rho * r_{t-1} + \varepsilon_t \quad (6)$$

For the technique to estimate the parameter vector [$\alpha, \beta, \gamma, \delta, \rho$], we adopt generalized method of moments, since the equations above entail endogeneity problem in that the policy interest rate may also affect explanatory variables. The instrumental set includes one-, two- and three-quarter lagged values of inflation rate π, production gap *gap*, and exchange rate *exr*, in the estimation equation (5) and (6). The J-statistic implies that these instrumental variables are valid in the sense that the over-identifying restrictions cannot be rejected in the models (see Table 2 and 4).

4.3 Estimation Outcome and its Interpretation

Table 2 reports the estimation outcomes of policy reaction functions in two kinds of specifications: the forward-looking specification in the equation (5) and the backward-looking specification in the equation (6). Based on the estimated short-term coefficients in the equations of (5) and (6), the long-term coefficients are worked out in the equations of (3) and (4), which are displayed in the lower part of each table.

When we focus on the long-term coefficients, it is only in the case of π_{t+1} that the coefficient of inflation rate is positive at the significant level of 95 percent as expected although the coefficient of production gap is insignificant and that of exchange rate is negative, contrary to the expectation; the case of π_{t+3} has no significant coefficients; and the other cases are excluded in the calculation of the long-term coefficients since the degree of smoothing ρ is beyond unity against the expectation. Thus the case of π_{t+1} (the forward-looking specification with one quarter ahead) could be tentatively a benchmark for the total sample from the third quarter of 2007 to the fourth quarter of 2017 when the BOM has operated the inflation targeting.

As was described in Section 2.1, however, the inflation targeting itself has made a progress by introducing the FPAS in 2011 as a forward-looking framework. Suppose that the FPAS came into effect after 2012, the sample can be divided into the first period from the third quarter of 2007 to the fourth quarter of 2011 and the second period from the first quarter of 2012 to the fourth quarter of 2017. The sample division could also be justified statistically by the Chow's breakpoint test to diagnose a breakpoint by the statistics with probabilities for the hypothesis of parameter stability over different periods. Table 3 identified the existence of a breakpoint in the first quarter of 2012 in the benchmark case. Thus the estimations for the different periods are justified by the breakpoint of the first quarter of 2012.

Table 4 reports again the estimation outcomes of policy reaction functions for the first and second periods on the benchmark case. The first period estimation of policy reaction function shows no significant coefficients. In the second period estimation, on the other hand, the coefficients of inflation rate and exchange rate are significantly positive whereas that of production gap is negative; and the magnitude of inflation coefficient, β, is less than unity, 0.444. All in all, among the estimated policy reaction functions, the one of the forward-looking specification with one quarter ahead for the second period seems to be the best illustration of the current monetary policy rule in Mongolia.

We interpret the estimation results above as follows. First, the current BOM appears to have adopted the inflation-responsive and forward-looking (one quarter ahead) monetary policy rule under its inflation targeting framework. It might reflect the progress in inflation targeting framework toward forward-looking mode by adopting the FPAS since 2011. Second, the current BOM inflation-responsiveness is, however, not powerful enough to stabilize inflation in the sense that the real policy rate tends to be still pro-cyclical to inflation pressure. The Mongolian β magnitude, just 0.444, is in contract to those of advanced nations with more than unity that Clarida et al. (1998b) estimated. It should also be noted, however, that the policy rate is not the only instrument but often supplemented by the reserve requirement ratio in Mongolian monetary policy. Third, the Mongolian monetary policy rule is also responsive to exchange rate movement. The policy reaction to exchange rate is typically represented by the fact that the BOM has still kept its policy rate at more than ten percent even under the inflation rate below the targeted rate after 2015 to prevent currency value from falling. This kind of exchange-rate reaction, so-called "fear of floating", tends to sacrifice monetary autonomy: the "fear of floating" might weaken the policy reaction to inflation and output gap. As a matter of fact, the estimation result in this study shows the less-than-unity β magnitude and the negative reaction of production gap.

To sum up, the Mongolian current monetary policy rule under inflation targeting is characterized as inflation-responsive rule with forward-looking manner (one quarter ahead); the inflation responsiveness is, however, weak enough to be pro-cyclical to inflation pressure; and the rule is also responsive to exchange rate due to the "fear of floating", which weakens the policy reaction to inflation and output gap.

4.4 Policy Implications

The purpose of this section is to provide some strategic policy implications to improve monetary autonomy in the Mongolian monetary policy. Although emerging

market economies cannot avoid the problem of "fear of floating" perfectly, some economies are keeping their monetary autonomy by allowing exchange rate fluctuations in a similar way to advanced economies. According to Taguchi and Wanasilp (2018), for instance, the Thailand policy reaction function is similar to those of advanced nations in the sense that the Thailand β magnitude is more than unity just like advanced economies. The followings are some possible suggestions for Mongolia economy to enhance its monetary autonomy by extracting some lessons from forerunners' economies.

First, Mongolian economy should have more foreign reserves to cope with foreign capital mobility. There have been several studies to argue that the accumulation of foreign reserves has contributed to retaining monetary autonomy. Aizenman et al. (2010) provided empirical evidence, for instance, that a higher level of foreign reserves enables a country to pursue a higher level of monetary independence even under the constraint of impassible trinity. Taguchi (2011) interpreted this contribution of foreign reserves as the anchoring role for retaining monetary autonomy in emerging market economies facing the "fear of floating." Looking at the trend in total reserves in months of imports of Mongolia in comparison with those of Indonesia, Thailand and lower middle incomers in Figure 4, Mongolian foreign reserves are far less than the other economies' ones so that the BOM should sensitively manage its policy rate against foreign capital flights. Hence comes the need to accumulate foreign reserves at least to the average level in lower middle incomers to improve monetary autonomy in Mongolia.

Second, from the long-term perspective, Mongolian economy should diversify manufacturing industries to maximize the advantage of currency depreciation in export side and to minimize its disadvantage in import side. Currency depreciation, as far as it does not lead to a crisis, push up exports and, this export recovery can be a growth momentum of total economy in case the export activities involve diversified industries in an economy. The depreciation is also not so harmful in import side in case an economy does not depend too much on imports under domestic production capacities enough in diversified industries. Regarding the Mongolian trading items, the exports concentrate on mining products and Animal husbandry products, and the imports concentrate on machinery and consumption goods. Looking at the trade indices of Mongolia in comparison with those of Indonesia, Thailand, developing economies and the world in Table 5, the Mongolian trade structure shows the highest concentration on a few products by Product Concentration Indices, and the highest diversification from the world average structure by Product Diversification Indices.[9] The industrial diversification may provide

[9] The Product Concentration Indices are measured by a Herfindahl-Hirschmann Index, and the Product Diversification Indices measure the absolute deviation of the trade structure of a country from world

a resilience against currency depreciation so that the BOM care for "fear of floating" can be mitigated and its monetary autonomy can be recovered to some extent.

5. Concluding Remarks

This article reviewed the monetary policy rule under inflation targeting framework focusing on Mongolia. The empirical analysis estimated the policy reaction function to see if the inflation targeting has been linked with a monetary policy rule emphasizing on inflation stabilization since its adoption in 2007. The study contributed to the literature by examining the linkage between Mongolian monetary policy rule and inflation targeting directly and thoroughly for the first time and also by taking into account a recent progress in the inflation targeting framework toward forward-looking mode.

The main findings through the estimation outcomes of policy reaction functions were as follows. First, the Mongolian current monetary policy rule under inflation targeting is characterized as inflation-responsive rule with forward-looking manner (one quarter ahead). It might reflect the progress in inflation targeting framework toward forward-looking mode by adopting the FPAS since 2011. Second, the inflation-responsiveness is, however, not powerful enough to stabilize inflation in the sense that the real policy rate tends to be still pro-cyclical to inflation pressure. It would be quite different from the monetary policy reactions of advanced economies. Third, the Mongolian monetary policy rule is also responsive to exchange rate movement, due to the "fear of floating". The policy reaction to exchange rate is typically represented by the fact that the BOM has still kept its policy rate at more than ten percent even under the inflation rate below the targeted rate after 2015 to prevent currency value from falling. The "fear of floating" might weaken the policy reaction to inflation and output gap.

The strategic policy implication to enhance monetary autonomy in the Mongolian monetary policy would be the serious necessities to have more foreign reserves to cope with foreign capital mobility and to diversify manufacturing industries to acquire a resilience against currency depreciation in the long run.

structure. Both indices are retrieved from UNCTAD Stat and are defined in UNCTAD Handbook of Statistics 2016.

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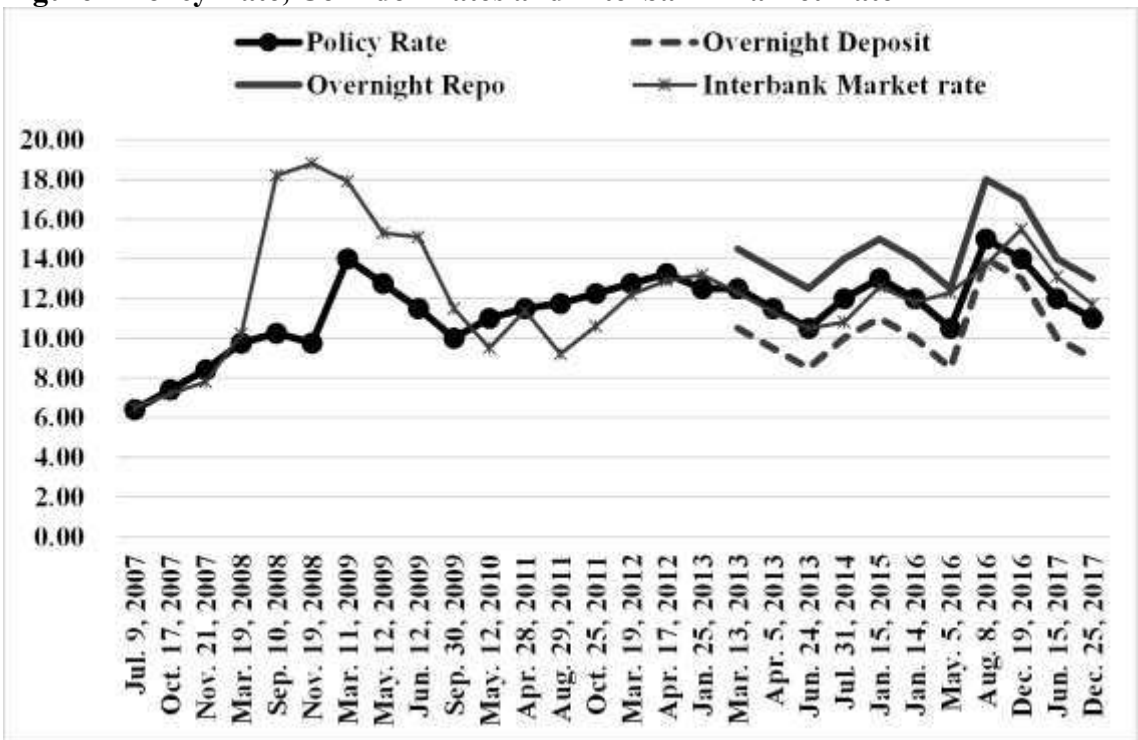
Figure 1 Actual Inflation and Targeted Inflation

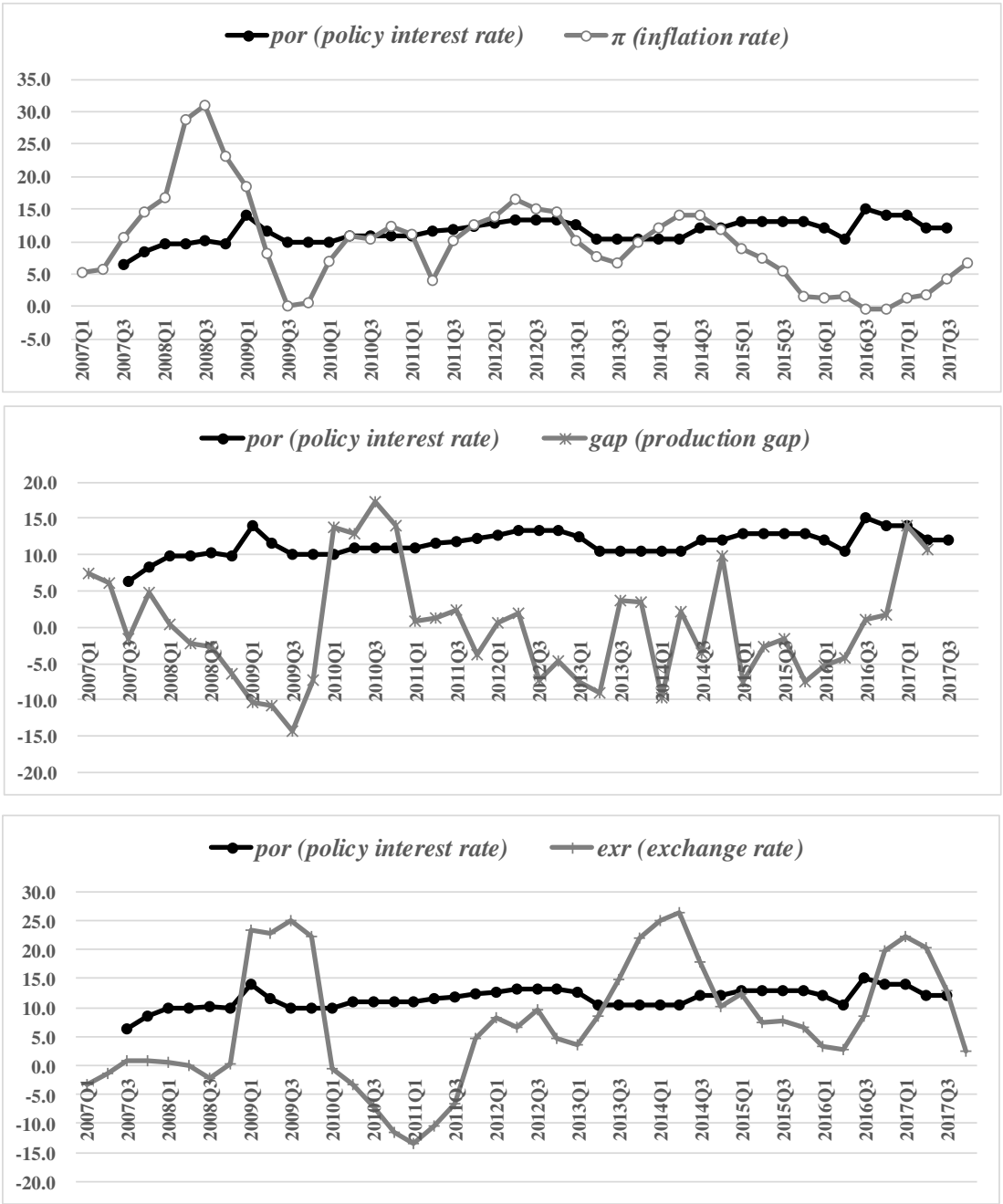
Source: Author's description based on the website of the Bank of Mongolia

Figure 2 Policy Rate, Corridor Rates and Interbank Market Rate



Source: Author's description based on the website of the Bank of Mongolia

Figure 3 Observation of Analytical Indicators



Source: IFS of IMF

Table 1 Unit Root Test

	MZa	MZt	MSB	MPT
por	-42.202 ***	-4.560 ***	0.108 ***	2.332 ***
π	-26.613 ***	-3.647 ***	0.137 ***	3.426 ***
gap	-22.719 **	-3.306 **	0.145 **	4.389 **
exr	-24.853 ***	-3.487 ***	0.140 ***	3.888 ***

Note: ***, ** denote the rejection of null hypothesis at the 99% and 95% level of significance.
Sources: IFS of IMF

Table 2 Policy Reaction Functions

Forward-looking	π_{t+1}	π_{t+2}	π_{t+3}
$(1-\rho)*\alpha$	0.288	-2.687	0.545
	(0.129)	(-0.996)	(0.329)
$(1-\rho)*\beta$	0.054 **	0.075 **	0.038
	(2.278)	(2.458)	(1.312)
$(1-\rho)*\gamma$	0.001	-0.005	0.042
	(0.100)	(-0.228)	(1.301)
$(1-\rho)*\delta$	-0.023 **	-0.022 **	-0.007
	(-2.721)	(-2.255)	(-0.535)
ρ	0.934 ***	1.177 ***	0.930 ***
	(5.065)	(5.575)	(7.010)
J-statistics	3.546	2.588	3.846
	(0.616)	(0.763)	(0.571)
Long-term Coefficients			
α	4.428	-	7.861
β	0.831 **	-	0.560
γ	0.027	-	0.607
δ	-0.368 **	-	-0.103

Backward-looking	π_t	π_{t-1}	π_{t-2}
$(1-\rho)*\alpha$	-1.392	-1.491	0.669
	(-0.451)	(-0.434)	(0.731)
$(1-\rho)*\beta$	0.037	0.019	-0.075 **
	(1.493)	(0.866)	(-2.493)
$(1-\rho)*\gamma$	0.002	0.006	-0.023
	(0.134)	(0.290)	(-0.722)
$(1-\rho)*\delta$	-0.038 **	-0.025 *	-0.031 ***
	(-2.442)	(-1.887)	(-4.188)
ρ	1.115 ***	1.109 ***	1.022 ***
	(4.246)	(3.922)	(11.414)
J-statistics	2.753	5.788	3.499
	(0.727)	(0.327)	(0.623)
Long-term Coefficients			
α	-	-	-
β	-	-	-
γ	-	-	-
δ	-	-	-

Note: ***, **, * denote the rejection of null hypothesis at the 99%, 95% and 90% level of significance.
Sources: IFS of IMF

Table 3 Chow Breakpoint Test

	Breakpoint	Andrews-Fair Wald Stat.	Probability
Benchmark Case of π_{t+1}	2012Q1	43.660	0.000

Sources: IFS of IMF

Table 4 Policy Reaction Functions for First and Second Periods

Forward-looking π_{t+1}	2007Q3-2011Q4	2012Q1-2017Q4
$(1-\rho)*\alpha$	-1.714 (-0.214)	1.026 (0.606)
$(1-\rho)*\beta$	0.064 (0.889)	0.096 *** (4.266)
$(1-\rho)*\gamma$	0.011 (0.217)	-0.100 ** (-2.871)
$(1-\rho)*\delta$	0.0025 (0.069)	0.068 *** (3.773)
ρ	1.119 (1.677)	0.783 *** (7.132)
J-statistics	0.403 (0.525)	4.923 (0.425)
Long-term Coefficients		
α	-	4.739
β	-	0.444 ***
γ	-	-0.465 **
δ	-	0.317 ***

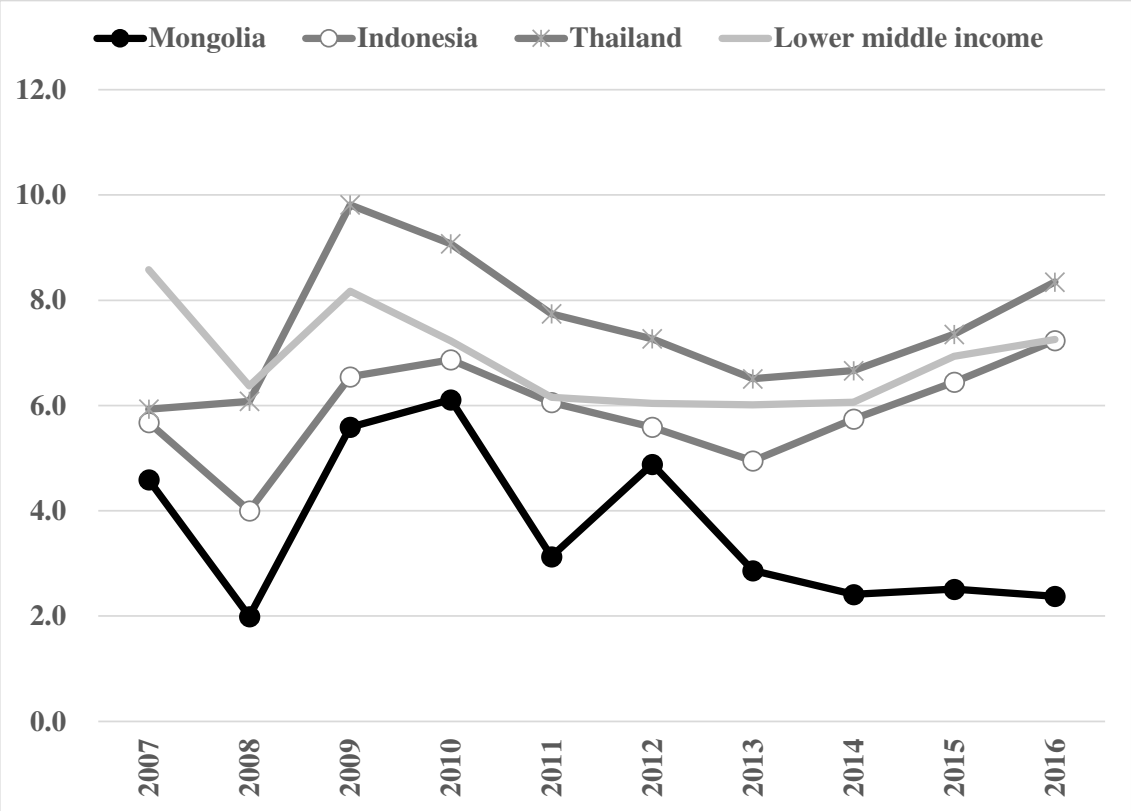
Note: ***, **, * denote the rejection of null hypothesis at the 99%, 95% and 90% level of significance.
Sources: IFS of IMF

Table 5 Trade Indices

2016	Product Concentration Indices			Product Diversification Indices		
Economies	Number of products	Exports	Imports	Number of products	Exports	Imports
Mongolia	110	0.401	0.137	214	0.842	0.449
Indonesia	245	0.128	0.065	254	0.549	0.065
Thailand	251	0.073	0.083	255	0.361	0.266
Developing Economies in Asia	260	0.099	0.108	260	0.241	0.202
Developing Economies	260	0.089	0.089	260	0.197	0.159
World	260	0.062	0.065	260	0.000	0.000

Sources: UNCTAD Stat

Figure 4 Total reserves in months of imports



Source: World Bank Open Data