EXCHANGE RATE POLICY COORDINATION UNDER INFLATION

TARGETING BETWEEN JAPAN AND KOREA

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ABSTRACT

Both Japan and Korea are very sensitive to changes in their exchange rate against the U.S dollar as they are trade rivals in the world market. Due to domestic political pressure, the central bank of each country is tempted to devalue its currency. In this paper we demonstrate, based on game theory, that the two rival countries can become better off if they conduct exchange rate policy coordination. To seek mutual benefit, we propose mutually agreeable rules of exchange rate intervention for Japan and Korea. Also we suggest that a range target is better than a point target. This claim is based on theoretical and practical considerations.

Key words: *policy coordination, inflation targeting, exchange-rate targeting, monetary targeting, point targets, and a range target.*

JEL Classification Codes: F31, F36, and F42

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1. Introduction

Both Japan and Korea are very sensitive to changes in the exchange rate against the U.S. dollar. They are trade competitors in the U.S. and world markets. Exporters in each country get angry when their home currency starts rising. Politicians tend to put pressure on the government and the central bank to resolve the problem of the nation's export competitiveness weakening. However, an aggressive and drastic devaluation by one country can easily trigger retaliatory devaluations by export rivals. Then all will end up worse off than before.

In this paper we focus on exchange rate policy coordination under inflation targeting between Japan and Korea, and propose mutually acceptable rules for exchange rate intervention.

The structure of the paper is as follows. Section 2 reviews critical issues of inflation targeting. Section 3 presents a game-theoretic framework to derive reasons why Japan and Korea should adopt exchange-rate policy coordination. Section 4 examines the relationships between the targets for inflation, the exchange rate, and money supply. Section 5 discusses the reasons why range-targeting rather than point-targeting strategy is needed. Section 6 concludes the paper.

2. Review of Literature on Inflation Targeting

New Zealand became the first country to adopt inflation targets in 1990. After New Zealand, other countries began to adopt inflation targeting. These include Canada (Feb. 1991), Israel (Dec. 1991), Finland (Feb. 1993), Australia (Sep. 1993), the U.K. (Oct 1992), Sweden (Jan. 1993), Spain (Jan. 1995), and Korea (Dec. 1999). Bernanke et al. (1999) claim that inflation targeting countries have achieved lower inflation.

Regarding inflation targeting, one can pose two essential questions: (1) "What is it?" and (2) "What does it do?" Bernanke and Mishikin (1997) explain that inflation targeting is a framework for monetary polity characterized by the public announcement of official quantitative targets or target ranges, and that the inflation targeting framework serves two functions. One is to improve communication between policy makers and the public, and the other is to provide discipline and accountability in the formulation of monetary policy. Inflation targeting helps to provide monetary policy with a "nominal anchor." This nominal anchor is to

tie down the price level to a fixed value at a given time and it can take the form of a quantity constraint on fiat money.

Kydland and Prescott (1977) interpreted monetary targeting as a rule, not as discretionary policy. Later economists, however, compromised – inflation targeting is something between the discipline and accountability of rigid rules, and the flexibility of the discretionary approach. In other words, inflation targeting is a framework that combines the advantages of rules with those of discretion.

One should note that monetary policies have other macroeconomic objectives such as price stability, high growth, balance of payments equilibrium, low unemployment, and financial stability. The emphasis on price stability through inflation targeting does not mean that it excludes other objectives. It is based on the consensus that even moderate rates of inflation are harmful to economic efficiency and growth. Milton Friedman (1977) states in his Nobel lecture that there is no long-run tradeoff between inflation and unemployment and that inflation inhibits economic growth and efficiency. He also states that an increase in inflation may in fact lead to slightly higher unemployment in the long run. Table 1 reports the experiences of the inflation targeting countries. The U.S. and Japan have not explicitly adopted inflation targeting as yet but Korea did in December 1999. The inflation target was initially set at 2.5% and later changed to 3±1%. The measure of inflation was core inflation, which excludes the prices of non-grain farm products and petroleum-based fuels whose prices are subject to large temporary fluctuations depending on changes in weather, harvests, and international oil prices. So far Korea's inflation targeting has been successful as evidenced by its record of price stability maintained over the last 10 years. The Korean experience of inflation targeting may be copied by other emerging countries in Asia.

Table 1. Adoption of Inflation Targeting by Country

Country	Adoption Time	Object of Inflation Target	Target Level (% annual inflation)
Australia	**Sep. 1993**	**Underlying CPI** [1]	2–3
Canada	**Feb. 1991**	**Core CPI** [2]	1–3
Finland	**Feb. 1993**	**Underlying CPI** [3]	2
Israel	**Dec. 1991**	**CPI**	8–11
Korea	**Dec. 1999**	**Core CPI** [4]	2.5
New Zealand	**Mar. 1990**	**Underlying CPI** [5]	0–3
Spain	**Jan. 1995**	**CPI** [6]	0–3
Sweden	**Jan. 1993**	**CPI**	2 ± 1
U.K.	**Oct. 1992**	**RPIX** [7]	1–4 , 2.5

Notes: 1) Excluding fruit and vegetables, interest costs and other volatile prices.

2) Excluding food, energy and first-round effects of indirect taxes.
3) Excluding subsidies, indirect taxes, housing prices and mortgage interest payments.
4) Excluding from CPI non-grain farm products and petroleum-based fuels.
5) Excluding indirect taxes, significant change in import or export prices, interest costs and natural disasters.
6) Excluding first-round effects of indirect tax changes.
7) Excluding mortgage interest payments.

3. 3. Why Coordinate Exchange Rates?

It is intuitively evident that policy coordination can bring much benefit to the coordinating nations. In this section we demonstrate how exchange rate policy coordination between Japan and Korea will bring about large mutual benefits. To reach this conclusion, we employ game-theoretic framework. If the two competing countries attempt to devalue their currency at the same time, neither country will expand exports, but will incur costs in terms of higher inflation. Devaluation has two contrasting effects. One is to improve the country's trade balance, thereby increasing employment and growth. The other is to raise prices through increased costs of imported materials. The rival's counter-devaluation will negate the export effect, thereby only causing prices to rise in the two countries.

Figure 1 demonstrates the strategic form of the devaluation game between Japan and Korea, with its payoff matrix. There are three strategies that each country can adopt in relation to devaluation. They are rule-based intervention, hands off, and self-centered intervention. Rule-based intervention is the most desirable, as the devaluation rule is determined by mutual agreement between the two player countries. Rule-based intervention may include a set of rules specifying the magnitude, timing, and frequency of devaluation. Hands-off strategy is simply no intervention in the foreign exchange market and it does not use the exchange rate as a policy tool. The self-centered devaluation strategy leads to retaliation from the other player. This entails both players ending up losing in terms of increased prices.

There can be nine different combinations of devaluation strategy for the two countries taken together. The numbers in pairs in each cell indicate the payoffs for Korea and Japan and the payoffs are symmetrical. For example, A11 (10, 10) indicates that Korea and Japan will each gain by 10 if both countries adopt the rule-based intervention strategy. A32 (5, −5) indicates that Korea will gain 5 while Japan will lose 5 if Korea adopts self-centered devaluation and Japan adopts hands-off strategy at the same time. If each player adopts the self-centered devaluation strategy, the payoffs will be given as A33 (−10, −10). Let us suppose that at the outset, the players are in the state of hands-off policy. Now Korea and Japan agree upon a set of rational devaluation rules. If Korea starts moving toward rule-based intervention while Japan does not,

then the payoff pair will change from A22 (0, 0) to A12 (5, 0). Then it is very likely that Japan will follow Korea since A11 (10, 10) is preferred to A22 (0, 0) by both players. If Japan initiates, Korea will follow Japan and they will reach the same state where both countries become better off.

Starting off from the hands-off state, if any player chooses a selfish devaluation scheme, both players will end up with the worst state A33 (−10, −10). If Japan switches to self-centered intervention, they will enter the state A23 (−5, 5) where Korea loses by 5 while Japan gains by 5. Then it is very likely that Korea will take the selfish devaluation strategy thereby reaching the state where both players suffer from losses. Based on this game-theoretic framework, we can conclude that rule-based intervention through exchange rate policy coordination will lead the two countries to a better state where both can enjoy benefits.

Figure 1.The Strategic Form of the Devaluation Game between Korea and Japan

Japan's strategy / Korea's strategy	Rule-based intervention	Hands-off	Self-Centered intervention
Rule-based intervention	$A_{11}(10,10)$	$A_{12}(5,0)$	$A_{13}(3,7)$
Hands-off	$A_{21}(0,5)$	$A_{22}(0,0)$	$A_{23}(-5,5)$
Self-Centered intervention	$A_{31}(7,3)$	$A_{32}(5,-5)$	$A_{33}(-10,-10)$

4. Monetary Targeting Strategies

In this section, we attempt to analyze the relationships between economic goals and the relationships between policy instruments. Specifically, we attempt to analyze how inflation targeting is related to other macro-variables and analyze the effects of inflation targeting on monetary and exchange rate policy. We begin with Irving Fisher's identity, as in equation (1).

$$MV \equiv PT \tag{1}$$

M, V, P, and *T* in (1) refer to nominal money supply, velocity of money circulation, the price level, and volume of transactions respectively.

If we replace the volume of transactions by real GNP and take the percentage change in each variable, equation (1) turns into equation (2).

$$m = \pi + (g - v) \tag{2}$$

Here m, π, g, and v refer to growth of money supply, inflation rate, GNP growth rate and the percentage change in velocity which includes institutional factors.

To successfully implement inflation targeting, the central bank must adopt the most appropriate inflation target. According to (2), if the predicted values of v and GNP growth target are given, the inflation target will determine the growth rate of the money supply. If the public trusts the government's GNP growth target, the central bank's money supply policy will receive credibility from the public and from the markets.

Due to uncertainties associated with domestic and foreign shocks, a point target for inflation is not rational. Instead, a range target is necessary. A range target between the lower limit, π_l and the upper limit, π_h will determine the range for the money supply between m_l and m_h. This is depicted in Figure 2. When GNP growth and velocity growth are given as g_0 and v_0, the range target for inflation will determine the range target for money supply growth.

There are three linkages which connect inflation to the exchange rate. They are purchasing power parity, money market equilibrium, and interest rate parity. The first linkage can be found when purchasing power parity (PPP) shown in (3) holds. However, one may wonder whether PPP holds in terms of consumer goods prices or producer goods prices. The answer to this depends upon empirical investigation

$$e = \pi - \pi^* \tag{3}$$

The second linkage can be derived by using the conditions for money market equilibrium. Equation (4) states that the exchange rate is a function the difference in nominal money supply, the difference in GNP growth rate, and the difference in the inflation rate between the domestic and foreign country.

$$e = (m - m^*) + \alpha(g^* - g) + \beta(\pi - \pi^*) \tag{4}$$

The third linkage is found in the interest rate parity plus Fisher's nominal interest rate equation. Equation (5) indicates that the forward premium is related to the interest rate differential between the domestic and foreign countries, which in turn is related to the differentials in real interest rate and in expected inflations between countries.

$$\frac{F - S}{S} = i - i^* = (r - r^*) + (\pi - \pi^*) \tag{5}$$

In equation (5) "r" is the real interest rate and "π" expected domestic inflation rate whereas "r^*" and "π^*" are the real interest rate and expected inflation, respectively, in foreign countries.

F denotes either the forward exchange rate or the expected future exchange rate. S denotes the spot exchange rate. Equation (5) indicates that the spot exchange rate is affected by the real interest differential and the expected inflation differential between the domestic and foreign country. This implies that inflation-targeting stabilizes expected inflation and thus helps to stabilize prices and the financial market system.

Equation (3) can yield a straight line with an intercept, $-\pi^*$, as shown in Figure 3. Changes in relative money supply and relative GNP growth as reflected in (4) will make the line shift around. As shown in equations (3), (4) and (5), inflation targeting is related to exchange rate determination. We can demonstrate graphically the relationship between the exchange rate and inflation. Figure 2 is a simple graph drawn based on equation (3). It shows a line with an intercept labeled as $-\pi^*$. When foreign inflation π, falls, the exchange rate band will move down, given the inflation target. We can repeat, drawing lines for equations (4) and (5) and its result is obvious.

Working through equations (3), (4) and (5), we can find several points. First, due to uncertainties in macro-variables, inflation-range targeting works better than inflation-point targeting. Second, equation (3) indicates that domestic inflation directly and fully affects the exchange rate, whereas equation (4) indicates that inflation partially affects the exchange rate. Third, according to equation (5), it is expected inflation that affects the spot exchange rate. If expectations are unstable, the foreign exchange market becomes unstable, too. Inflation targeting, however, stabilizes inflationary expectations and helps to keep the foreign exchange market stable. Finally, once the inflation target is established, the government can implement better monetary or exchange rate policy.

Should the government implement its currency band policy, it faces currency speculation. For example, when the actual exchange rate is about to touch the upper limit of the exchange rate band, speculative attacks may occur. If the currency speculators expect the currency band to be expanded, they will take the buying position for foreign exchange and the actual exchange rate will go up even higher. Next, we will discuss how the authority can deal with the exchange rate band policy when such a risk prevails. The inflation target, $\bar{\pi}$ determines the monetary target, $\bar{m}$ and the exchange rate target $\bar{e}$. The fluctuations in output growth, g and in foreign inflation, π^*, make the inflation target fluctuate.

Figure 2. Three Targets for Inflation, the Exchange Rate and Money Supply
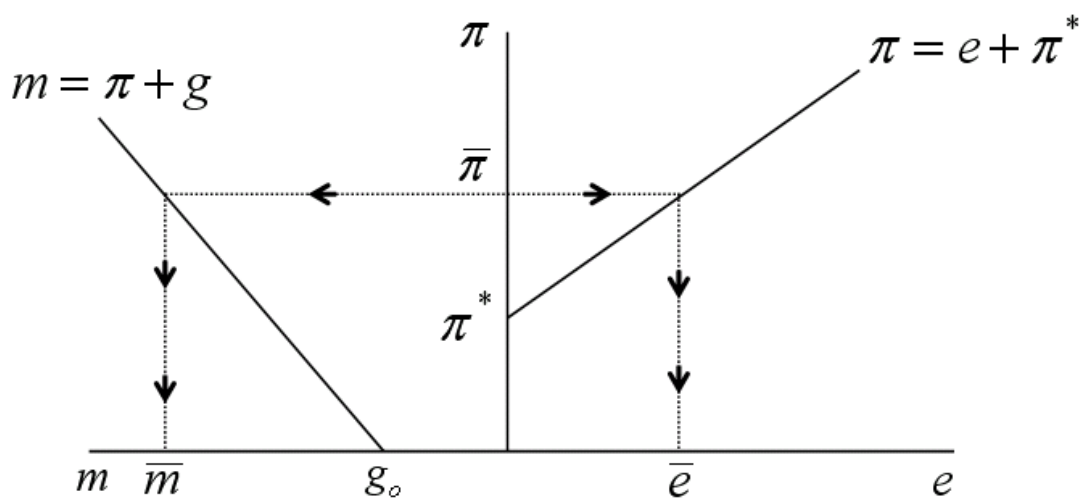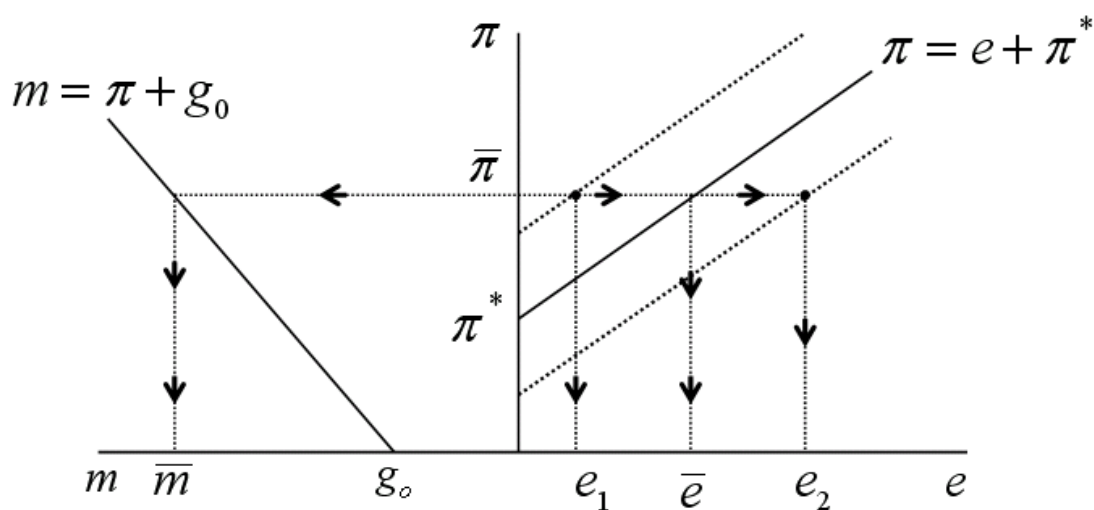

Figure 3. The Effects of Change in Foreign Inflation

5. The Range-Targeting Strategy

There have been debates on whether an inflation target should be expressed as a single point or as a range of acceptable outcomes. Naturally, a target range allows for flexibility in

responding to shocks to the economy and reflects the uncertainty in achieving any inflation target. Critics of the range target argue that under a range-targeting policy, the central bank tends to focus too much on keeping inflation just within the bands rather than trying to hit the midpoint of the range.

In this paper we advocate range targeting rather than point targeting on theoretical as well as practical grounds. In the implementation of inflation targeting, the central bank faces a serious problem. It is as if the central bank is trying to hit an erratically moving target with a malfunctioning rifle.

As examined in the previous section, exchange-rate targeting is directly related to the exchange rate and monetary-aggregate targets. Given the GDP growth rate, the inflation target determines both the monetary and exchange-rate targets. In the real world, the domestic economy faces various uncertainties, risks, and unanticipated shocks from abroad. Consequently, domestic GDP and inflation rates are subject to fluctuation. For example, changes in foreign inflation directly affect domestic inflation. This in turn causes the target exchange rate to fluctuate as depicted in Figure 3. Likewise, changes in the growth rate cause the domestic inflation rate to fluctuate. This, in turn, leads to the fluctuation of the exchange rate. This explains why the inflation target can move irregularly.

Even if the target is fixed, the central bank cannot hit the target with its policy instruments. Take a look at Figure 4. The central bank can hardly get away from the notorious three-lag problems: problem recognition, policy implementation, and policy effectiveness. The most serious problem for the central bank is loss in policy credibility associated with policy failure. To avoid this problem requires range-targeting for inflation. In fact, many countries have adopted range targeting instead of point targeting.

Another compelling reason for the inflation target is that by adopting the range-targeting strategy, the central bank can hit two other monetary targets. Due to macroeconomic constraints, the targets for inflation, the exchange rate, and money supply are all interdependent. By adopting the point-targeting strategy, the central bank can hardly hit the three targets simultaneously. With range targeting, however, it becomes a little easier to hit the multiple targets because of the room for an overlapped zone for the three targets. This is illustrated in Figure 5. Even if it cannot achieve the three policy objectives, it still can achieve one or two. Zones A, B, and C refer to the three separate target zones. Zones E, G, and F indicate the overlapping range for the two targets. Zone D is the overlapping range for the three targets. By adopting the range-targeting strategy, the central bank can maintain some degree of credibility.

Figure 4. The Three Separate Targets

The Inflation Target

The Exchange Rate Target   The Monetary Target
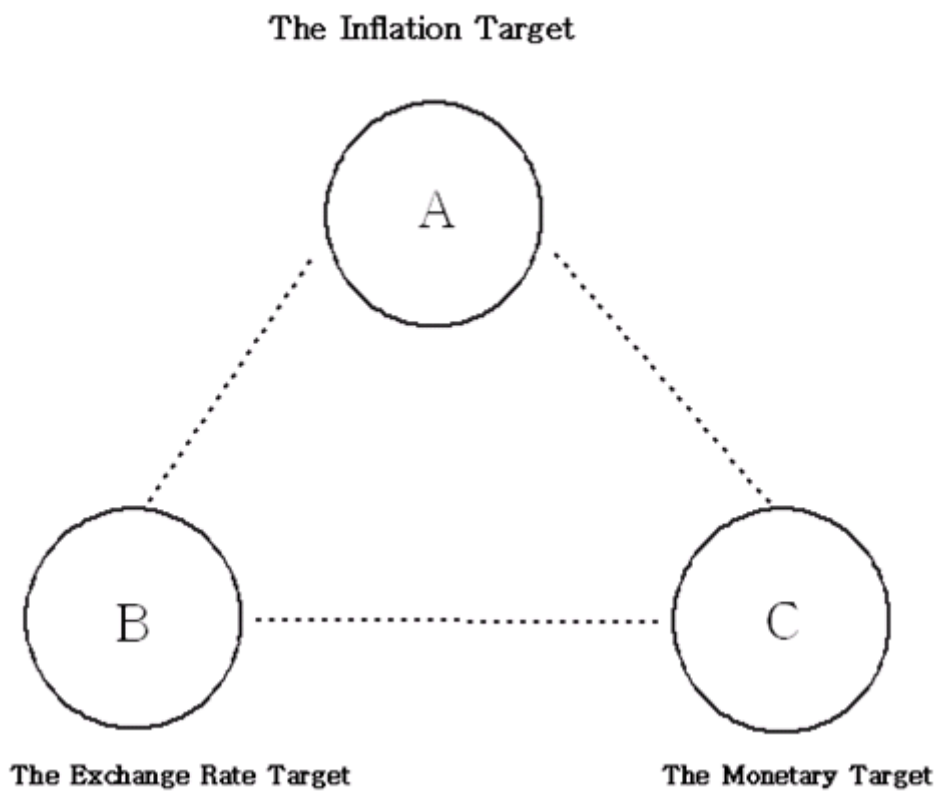
Figure 5. The Overlapped Zones for Multiple Targets
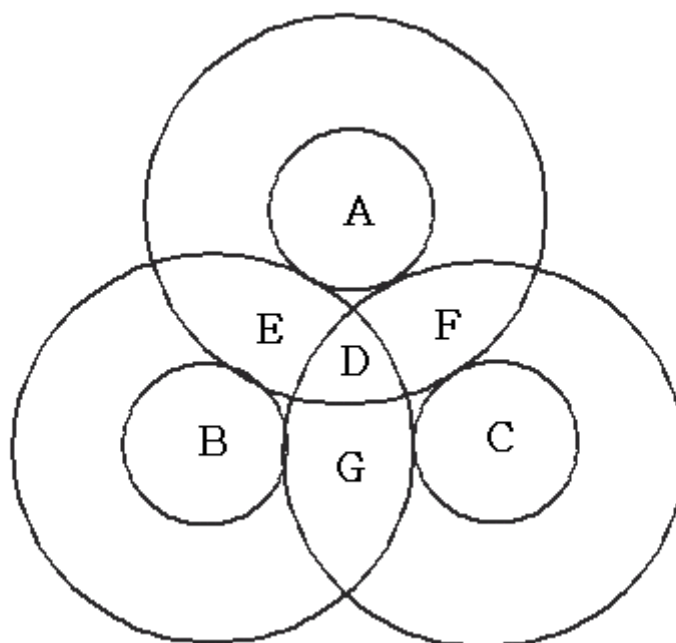
   The three small circles A, B, and C represent three separate target points. Areas E, F, and G represent double-target zones and area D the triple-target zone. The probability of hitting the three targets with one bullet can be high if price stability is secured. It is possible to hit two targets: A and B, or B and C, or A and C, simultaneously. Areas E, F, and G are double target zones. It is quite possible to hit zone D to achieve the three objectives at the same time.

6. Conclusion

   In this paper we have argued that Japan and Korea should coordinate their exchange rate policy to obtain mutual benefit. By using a game-theoretic model, we demonstrated that the two player countries would end up choosing rule-based intervention as the dominant strategy. In this game, each player can choose one strategy out of three: rule-based intervention, hands-off, and self-centered intervention.

   With exchange rate policy coordination, the two countries can pursue mutually acceptable exchange rate intervention rules. As part of exchange rate coordination, the two countries may pursue inflation targeting. In the early 1990s, countries began to adopt the inflation targeting strategy and many of them have been successful.

Due to interdependence of the key macroeconomic variables, the central bank cannot focus on exchange rate policy only. It should consider other related variables such as the inflation differential, growth differential, the real interest rate differential, and the money supply differential. The exchange rate target may move up and down according to changes in foreign inflation and to unexpected fluctuations in GDP growth. We pointed out that due to macroeconomic constraints, inflation targeting, exchange-rate targeting, and money-supply targeting are all interdependent. To avoid credibility impairment, the central bank should adopt range targets for inflation and the exchange rate. By taking a range target, the central bank can hit multiple targets simultaneously. Even if the central bank cannot achieve the three targets at once, it can still hit one or two.

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