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The Effects of a Dual Exchange Rate System in a Financial Crisis: A Target Zone Perspective

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Based on the modified Froot and Obstfeld (1991a) simple stochastic macro model, this paper addresses the relative stabilizing performance of a dual exchange rate system from the viewpoint of target zones. We focus on an experiment in which the central bank implements a target zone policy in the commercial exchange market to maintain the commercial exchange rate within a specific band, but does not engage in any intervention in the financial exchange market, thus allowing the financial exchange rate to float freely. In contrast to the conventional wisdom, upon the shock of a change in commodity production, we find that the inverse movement of these two rates does not always occur under the target zone perspective. The relative elasticity of the real commercial rate to income in the balance of payments is the crucial point for the desirability of targeting the commercial rate. Therefore, in deciding whether to execute the commercial rate target zone, the central bank needs to consider the country's condition and main goals; the issue may merit consideration in countries that have encountered an aggregate supply shock financial crisis situation.

Keywords: financial crisis, dual exchange rate system, exchange-rate target zones, speculative attacks, exchange regime collapse

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1 Introduction

The financial turmoil that occurred in a number of countries, for example the 1997 Asian financial crisis that affected Thailand, Indonesia, the Philippines, Malaysia and Korea, has had devastating effects on their economies. The growth rates in these countries, which had been in excess of 5% before 1997, turned sharply negative in 1998 and this state of affairs persisted for several years.[1] Consequently, the Asian financial crisis marked the end of a pegged exchange rate system. Starting with the fall of the baht in Thailand on July 2, 1997, the Philippines (July 11), Malaysia (July 14), Indonesia (August 14), and Korea (November 17) were forced to abandon their pegged exchange rate systems. Chen and So (2002, p. 415, Fig. 1) show that the switch from highly stable exchange rate regimes to floating regimes was associated with a sharp increase in exchange variability. Within one year, the value of the currencies of each of these nations nearly halved. In addition, as indicated by Mishkin (1999, p. 720), capital outflows were also referred to as a source of the foreign exchange crises, which can promote financial instability in emerging market countries. According to this viewpoint, the capital outflow which is associated with the foreign exchange crisis is a symptom of underlying fundamental problems rather than a cause of the currency crisis.

Since the financial crises that occurred in the late 1960s, many countries have resorted to a regime of dual exchange rates. Under such a system, the current and the capital accounts are separated in that each is required to form its own market. The price in the current account market is usually referred to as the commercial rate, and that in the capital account market is referred to as the financial rate. Some countries fix the former while letting the latter float, while others let both float freely[2]. As a result, a question naturally arises: Does the existing aggregate supply shock condition, such as oil supply shocks that brought about the financial crises of the

[1]There are many studies that provide a detailed discussion of this topic, such as Caporale *et al*. (2005), Chen and So (2002), Gebka and Serwa (2006), Mishkin (1999), and Menkhoff and Suwanaporn (2007), among others.

[2]According to the IMF's "Exchange arrangements and exchange restrictions" annual report, 21 of its members maintained dual exchange markets as of 30 June 1984, and this figure increased to 35 in the 1990s. Of these countries, 6 members allowed flexibility in the exchange rates of their major exchange markets. In addition, Italy and France adopted the dual floating system in 1973-74.

1970s and 1980s, support the dual exchange rate regime? Therefore, we reconsider introducing this dual exchange rate system to those countries that were struck by the aggregate supply shock's financial crisis, in order to see how the other economic variables will change if we concentrate on preventing large exchange rate variability and speculative capital movements.

The developments in the dual exchange rates literature can be roughly classified into two stages: The first stage focuses on a comparison between the dual and other exchange rate systems in the early stage. Previous studies by Argy and Porter (1972), Dornbusch (1976b), Marion (1981), and Flood and Marion (1982) have shown that, under complete separation, a dual regime provides complete insulation from most foreign disturbances as well as from monetary domestic disturbances. Later, after Dornbusch (1976a) published his pioneering paper, there emerged a substantial literature concerned with the issue of exchange rate dynamic adjustments under a dual exchange rate system, for example Cumby (1984), Aizenman (1985), Gardner (1985), Dornbusch (1986), Lai and Chu (1986a), Lai *et al*. (1989), and Lai and Chang (1990). However, in the 1980s, some economists advocated exchange rate arbitrage under the dual exchange system. Bhandari and Decaluwe (1987) used empirical data from the Belgo-Luxembourg Economic Union and found that there was a significant relationship between the price differences of the commercial and financial exchange rates. This was caused by the fact that when the financial rate is higher than the commercial rate, exchange rate arbitrage will cause a fixed ratio of international trade or labor to enter the financial market illegally. Gros (1988) has shown that exchange rate arbitrage will increase when the price difference between the commercial and financial exchange rate becomes larger, but will decrease when the penalty cost becomes larger. Guidotti (1988) supported the view that the insulation properties of dual exchange systems were extremely limited, since both incomplete segmentation as well as the presence of a non-traded goods sector are very likely to play an important role in the functioning of such a regime.

In line with the conventional dual exchange rate studies, this paper constructs a simple stochastic macro model, and uses it to evaluate whether the volatility of these two rates or other variables will be reduced under such a dual exchange rate regime. However, as stressed by Frankel and Goldstein (1986), Klein (1990), and Miller and

Weller (1991), in reality a couple of countries' central banks target exchange rates with a specific zone, rather than at a specific level. This paper thus departs from the existing dual exchange rate literature to examine the desirability of commercial exchange rate targeting from the perspective of target zones but while allowing the financial exchange rate to float freely. In contrast with the existing literature, we find that the authorities' commitment to the target ranges for the commercial exchange rate will affect the public's expectations, and in turn govern the stabilization of relevant macro variables.

Essentially, the analytical method we use is similar to that of the exchange rate target zones developed by Krugman (1991). The issue of exchange rate target zones has attracted much interest since it is a more realistic alternative to pure fixed or flexible exchange regimes. In his pioneering article, Krugman (1991) sets out a monetary model embodying rational expectations, and specifies that a monetary disturbance follows a regulated Brownian motion. In addition, he assumes that the monetary authorities set the upper and lower bounds for the exchange rates. When the exchange rate touches the edge of the bands, the monetary authorities adjust the money supply to keep the exchange rates within a specified band. Given that the public know the intervention rule of the monetary authorities, Krugman (1991) shows that exchange rate target zones will make the exchange rate more stable than the underlying fundamentals. This result is dubbed the "honeymoon effect." Following the Krugman (1991) approach, there have been many studies that have focused on this topic, including Froot and Obstfeld (1991a, b), Miller and Weller (1991), Svensson (1991, 1992), Sutherland (1995), Neely *et al.* (2003), Tronzano *et al*. (2003), Lai *et al*. (2008), Bauer *et al*. (2009), Driffill and Sola (2006), Lin (2008), Flandreau and Komlos (2006) and Melvin *et al*. (2009), among others.

This paper applies the techniques of the regulated Brownian motion proposed by Krugman (1991) to study the stabilizing performance of a dual exchange rate regime. The framework we set up can be regarded as an extension of the Froot and Obstfeld (1991a) model. The main concern is to discuss whether the policy of commercial exchange rate target zones will reduce the variability of the financial exchange rate and other macro variables even when the commercial exchange rate variability is dampened.

The remainder of this paper is organized as follows. The basic framework is outlined in Section 2. Section 3 addresses the stabilizing performance of a dual exchange rate regime in which the monetary authority adopts commercial exchange rate target zones. Finally, Section 4 concludes with the main findings of our analysis.

2 The Theoretical Model

In order to sharpen the salient features of a dual exchange rate policy, the modeling strategy we adopt is to keep the model as simple as possible. Basically, except where the analysis confines the commercial exchange rate within a specific range, the theoretical model of this paper is modified from the Froot and Obstfeld (1991a) model. Assuming that economic agents form their expectations in a rational manner, domestic and foreign countries' bonds are perfectly substitutable, but domestic and foreign countries' goods are imperfectly substitutable. In addition, the barrier in this paper is reflecting rather than absorbing.[3] We can use the following equations to represent this simple stochastic macro model:

$$y = \alpha p - \varepsilon \; ; \tag{1}$$

$$y = \eta \; (e^c + p^* - p) - \beta[r - \frac{E(dp)}{dt}] \; ; \quad \eta, \beta > 0 \; ; \tag{2}$$

$$m - p = \phi y - \lambda r \; ; \quad \phi > 0 \, , \quad \lambda > 0 \; ; \tag{3}$$

$$[\eta'(e^c + p^* - p) - \theta' y] = 0 \; ; \tag{4}$$

$$r = r^* + r^*(e^c - e^f) + \frac{E(de^f)}{dt} \; ; \tag{5}$$

$$d\varepsilon = \sigma_\varepsilon dz_\varepsilon \; . \tag{6}$$

With the exception of the domestic (foreign) interest rate r (r^*), all variables are expressed in natural logarithms. The variables are defined as follows: y = real output; p (p^*)= domestic (foreign) price of goods; m = nominal money supply; e^c = commercial exchange rate, e^f = financial exchange rate, and ε = random

[3]In general, the government faces two kinds of boundaries when intervening to control its exchange rate change. If the authorities have announced that they will fix the exchange rate once it reaches a certain level (see Froot and Obstfeld, 1991b, p.242), we refer to this control as the absorbing barrier. In addition, we can see Froot and Obstfeld (1991a) and Delgado and Dumas (1993) in the related literature. However, if the authorities reflect the exchange back to bands once it reaches a certain level (see Klein, 1990, p.758, note 7), we refer to this control as the reflecting barrier. The interested reader should also refer to Froot and Obstfeld (1991a) and Ball and Roma (1994) in the related literature.

disturbance terms on the aggregate supply side. In addition, E denotes expectations operators and σ_{ε} is the instantaneous standard deviation of movement of ε.

To keep the model as simple as possible, similar to Sutherland (1995), we set equation (1) as the aggregate supply function, in which aggregate production is specified as being positively related to commodity prices. The rationale for this setting can be justified by the fact that workers have imperfect information about price changes, and wages are set with contracts.[4] Equation (2) is the aggregate demand function for commodities. It specifies that aggregate demand is the summation of the consumption, investment, government expenditure and balance of payments. Of these, we delete government expenditure for simplification, and let consumption be an increasing function of output; the investment is a decreasing function of the real interest rate, $r - E(dp)/dt$. Therefore, $y = cy - \beta'[r - E(dp)/dt] + [\eta' \ (e^c + p^* - p) - \theta' y]$, and by letting c be the marginal property of consumption, $\eta = \eta'/(1+\theta'-c)$, $\beta = \beta'/(1+\theta'-c)$, and the aggregate demand is then a function of the balance of trade and the real interest rate in (2). Equation (3) is the money market equilibrium condition, stating that real money supply equals real money demand. Equation (4) is the equilibrium equation in the current account. We set the current account as an increasing function of the commercial exchange rate and the foreign commodity price; it is also a decreasing function of the home country's income and commodity price. In addition, we assume that the Marshall-Lerner condition exists; therefore raising the relative price between foreign and domestic commodities will improve the balance of payments of the home country. Equation (5) is the capital account component of the foreign exchange market. It is worth noticing that capital movements are set as a function of the difference between the return on domestic bonds, r, and the net return on foreign bonds, $r^* + r^*(e^c - e^f) + E(de^f)/dt$.[5] Equations (6)-(8) specify that the stochastic aggregate supply shock ε follows a Brownian motion process without drift.

From equations (1)-(4), we have the following matrix form:

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[4]See Miller and VanHoose (2004, Ch. 8) for a detailed explanation.

[5]See Gardner (1985), Lai and Chu (1986b), and Lai and Chang (1990) for a more detailed derivation.

$$\begin{pmatrix} 1 & -\alpha & 0 \\ 1 & 0 & \beta \\ \phi & 1 & -\lambda \end{pmatrix} \begin{pmatrix} y \\ p \\ r \end{pmatrix} = \begin{pmatrix} -\varepsilon \\ \beta(E(dp)/dt) \\ m \end{pmatrix}. \tag{7}$$

Using Cramer's rule, we obtain the following "pseudo" reduced forms:[6]

$$y = \frac{1}{\Delta}\left\{-\alpha\beta m - \alpha\beta\lambda \frac{E(dp)}{dt} + \beta\varepsilon\right\}, \tag{8}$$

$$p = \frac{1}{\Delta}\left\{-\beta m - \lambda\beta \frac{E(dp)}{dt} - (\beta\phi + \lambda)\varepsilon\right\}, \tag{9}$$

$$r = \frac{1}{\Delta}\left\{\alpha m - (1+\alpha\phi)\beta \frac{E(dp)}{dt} - \varepsilon\right\}, \tag{10}$$

$$e^c = \frac{1}{\Delta}\left\{-\beta(1+\frac{\alpha\theta}{\eta})m - \beta\lambda(1+\frac{\alpha\theta}{\eta})\frac{E(dp)}{dt} + \left[\frac{\theta}{\eta}\beta - (\beta\phi + \lambda)\right]\varepsilon\right\}, \tag{11}$$

where $\Delta = -\alpha\beta\phi - \beta - \alpha\lambda < 0$.

3 The Variability Pertaining to Commercial Exchange Rate Target Zones

If the economic system's disturbance is from the aggregate supply side,[7] under this dual exchange regime, should the monetary authorities adopt a commercial exchange rate target zone or a floating commercial exchange rate policy to combat this disturbance source? Which one is the optimal policy for stabilizing the economy? This is the main goal of the discussion in this section.

Since equation (9) is a stochastic differential equation, it states that the level of prices is related to both fundamentals and expectations of future prices. The general solution for p is:

$$p = -\frac{\beta}{\Delta}m - \frac{1}{\Delta}(\beta\phi + \lambda)\varepsilon + A_1 e^{s\varepsilon} + A_2 e^{-s\varepsilon}, \tag{9a}$$

[6] Note that $E(dp)/dt$ is an endogenous variable.

[7] We can also consider other disturbance sources, such as the aggregate demand or money demand shock, but the procedures and results of these shocks are similar to those in this condition, and so we omit them from consideration. However, the detailed procedures for these sections are available from the author upon request.

where A_1, A_2 are parameters, $s=\sqrt{-2\Delta/\beta\lambda\sigma_\varepsilon^2}>0$.

Comparing equation (9) with (9a) yields the expectation of the price movement:

$$\frac{E(dp)}{dt}=\frac{-\Delta}{\beta\lambda}(A_1e^{s\varepsilon}+A_2e^{-s\varepsilon}) . \tag{12}$$

Plugging (12) into (8), (10), and (11), we can obtain a general solution for the output, interest rate and commercial rate which are exhibited within the target zone:

$$y=-\frac{\alpha\beta}{\Delta}m+\frac{\beta}{\Delta}\varepsilon+\alpha\left(A_1e^{s\varepsilon}+A_2e^{-s\varepsilon}\right), \tag{8a}$$

$$r=\frac{\alpha}{\Delta}m-\frac{1}{\Delta}\varepsilon+\frac{(1+\alpha\phi)}{\lambda}\left(A_1e^{s\varepsilon}+A_2e^{-s\varepsilon}\right), \tag{10a}$$

$$e^c=-\frac{\beta(\eta+\alpha\theta)}{\eta\Delta}m+\left[\frac{\beta\theta-\eta(\beta\phi+\lambda)}{\eta\Delta}\right]\varepsilon+\left(\frac{\eta+\alpha\theta}{\eta}\right)\left(A_1e^{s\varepsilon}+A_2e^{-s\varepsilon}\right). \tag{11a}$$

Assume that the authorities stand ready to adjust the money supply at the level of the upper commercial rate $\bar{e}^c$ and lower commercial rate $\underline{e}^c$, while the commercial rate stays in the interior of the band, and the monetary authorities do not alter the money stock. Based on this intervention rule, the dynamic locus of e^c can be expressed as:

$$e^c=\begin{cases}\bar{e}^c & ;\varepsilon\geq\bar{\varepsilon}^+\\ -\dfrac{\beta(\eta+\alpha\theta)}{\eta\Delta}m+\Omega_0\varepsilon+\dfrac{\eta+\alpha\theta}{\eta}\left(A_1e^{s\varepsilon}+A_2e^{-s\varepsilon}\right) & ;\bar{\varepsilon}^-\geq\varepsilon\geq\underline{\varepsilon}^+\\ \underline{e}^c & ;\underline{\varepsilon}^-\geq\varepsilon\end{cases}, \tag{13}$$

where $\Omega_0=[\beta(\theta-\eta\phi)-\eta\lambda]/\eta\Delta \gtrless 0 \quad if \quad \eta\gtrless\theta/\phi$.

The terms $\bar{\varepsilon}$ and $\underline{\varepsilon}$ are the corresponding values when the monetary authorities decrease and increase the money supply, respectively. $\bar{\varepsilon}^+$ and $\bar{\varepsilon}^-$ represent the right- and left-hand side limits of $\bar{\varepsilon}$, respectively; while $\underline{\varepsilon}^+$ and $\underline{\varepsilon}^-$ represent the right- and left-hand side limits of $\underline{\varepsilon}$, respectively.

Now we proceed to solve the undetermined variables: A_1, A_2, $\bar{\varepsilon}$ and $\underline{\varepsilon}$. These unknown parameters are determined by two continuity conditions and two smooth pasting conditions. Since the agents know that the monetary authorities will intervene in the money market when the commercial rate reaches the upper and lower bounds of the commercial rate target zone, they will rebalance their portfolio in advance. Thus, the continuity condition prevents the commercial rate from jumping discretely when the monetary authorities intervene in the money market. Furthermore, the smooth pasting condition means that at the edges of the band the commercial rate dynamic locus is tangential to the horizontal lines.[8] These conditions are:

$$e^c_{\bar{\varepsilon}^+} = e^c_{\bar{\varepsilon}^-}\,, \tag{14}$$

$$e^c_{\underline{\varepsilon}^+} = e^c_{\underline{\varepsilon}^-}\,, \tag{15}$$

$$\frac{de^c_{\bar{\varepsilon}^+}}{d\varepsilon} = 0\,, \tag{16}$$

$$\frac{de^c_{\underline{\varepsilon}^+}}{d\varepsilon} = 0\,. \tag{17}$$

Substituting equation (13) into (14)-(17) yields:

$$\bar{e}^c = \frac{-\beta(\eta+\alpha\theta)}{\eta\Delta} m + \Omega_0 \bar{\varepsilon} + \frac{\eta+\alpha\theta}{\eta}\left(A_1 e^{s\bar{\varepsilon}} + A_2 e^{-s\bar{\varepsilon}}\right), \tag{14a}$$

$$\underline{e}^c = \frac{-\beta(\eta+\alpha\theta)}{\eta\Delta} m + \Omega_0 \underline{\varepsilon} + \frac{\eta+\alpha\theta}{\eta}\left(A_1 e^{s\underline{\varepsilon}} + A_2 e^{-s\underline{\varepsilon}}\right), \tag{15a}$$

$$\Omega_0 + \frac{\eta+\alpha\theta}{\eta}\left(sA_1 e^{s\bar{\varepsilon}} - sA_2 e^{-s\bar{\varepsilon}}\right) = 0\,, \tag{16a}$$

$$\Omega_0 + \frac{\eta+\alpha\theta}{\eta}\left(sA_1 e^{s\underline{\varepsilon}} - sA_2 e^{-s\underline{\varepsilon}}\right) = 0\,. \tag{17a}$$

It follows from equations (16a) and (17a) that the smooth pasting conditions can be solved for A_1 and A_2 as functions of $\bar{\varepsilon}$ and $\underline{\varepsilon}$:

$$A_1 = A_1\left(\bar{\varepsilon}, \underline{\varepsilon}\right) = \frac{-\Omega_0 \eta\, [e^{-s\underline{\varepsilon}} - e^{-s\bar{\varepsilon}}]}{s(\eta+\alpha\theta)[e^{s(\bar{\varepsilon}-\underline{\varepsilon})} - e^{-s(\bar{\varepsilon}-\underline{\varepsilon})}]}\,, \tag{18}$$

$$A_2 = A_2\left(\bar{\varepsilon}, \underline{\varepsilon}\right) = \frac{\Omega_0 \eta [e^{s\bar{\varepsilon}} - e^{s\underline{\varepsilon}}]}{s(\eta+\alpha\theta)[e^{s(\bar{\varepsilon}-\underline{\varepsilon})} - e^{-s(\bar{\varepsilon}-\underline{\varepsilon})}]}\,. \tag{19}$$

With the assumption of $\bar{e}^c = -\underline{e}^c$ and $m = 0$ initially and equations (18) and (19), the continuity conditions in equations (14a) and (15a) can be rewritten as:

[8] Flood and Garber (1991) provide an intuitive explanation for the smooth pasting condition.

$$\bar{e}^c = \Omega_0\bar{\varepsilon} + \frac{\eta+\alpha\theta}{\eta}\left[A_1(\bar{\varepsilon},\underline{\varepsilon})e^{s\bar{\varepsilon}} + A_2(\bar{\varepsilon},\underline{\varepsilon})e^{-s\bar{\varepsilon}}\right], \tag{14b}$$

$$-\bar{e}^c = \Omega_0\underline{\varepsilon} + \frac{\eta+\alpha\theta}{\eta}\left[A_1(\bar{\varepsilon},\underline{\varepsilon})e^{s\underline{\varepsilon}} + A_2(\bar{\varepsilon},\underline{\varepsilon})e^{-s\underline{\varepsilon}}\right]. \tag{15b}$$

Substituting equation (18) and (19) into (24b) and (25b), we can infer that:

$$\bar{\varepsilon} = -\underline{\varepsilon}\,. \tag{20}$$

Equation (20) reveals an important implication: when the random market fundamentals follow a Brownian motion without drift and $m=0$ initially, the symmetrical commercial exchange rate bounds can be alternatively expressed by the symmetrical market fundamental bounds.[9]

Substituting $\bar{\varepsilon} = -\underline{\varepsilon}$ into equation (18) and (19), we have:

$$A_1 = -A_2 = \frac{-\Omega_0\eta}{s(\eta+\alpha\theta)[2\cosh(s\bar{\varepsilon})]}\,. \tag{21}$$

Combining equation (21) with (8a)-(11a) and remembering $m=0$ initially yields the closed dynamic loci of output, prices, the interest rate, and the commercial rate within the bands:

$$y = \frac{\beta}{\Delta}\varepsilon - \frac{\alpha\,\Omega_0\eta\sinh(s\varepsilon)}{s(\eta+\alpha\theta)\cosh(s\bar{\varepsilon})}\,, \tag{22}$$

$$p = -\frac{(\beta\phi+\lambda)}{\Delta}\varepsilon - \frac{\Omega_0\eta\sinh(s\varepsilon)}{s(\eta+\alpha\theta)\cosh(s\bar{\varepsilon})}\,, \tag{23}$$

$$r = -\frac{1}{\Delta}\varepsilon - \frac{\Omega_0\eta(1+\alpha\phi)\sinh(s\varepsilon)}{\lambda s(\eta+\alpha\theta)\cosh(s\bar{\varepsilon})}\,, \tag{24}$$

$$e^c = \Omega_0\varepsilon - \frac{\Omega_0\sinh(s\varepsilon)}{s\cosh(s\bar{\varepsilon})}\,. \tag{25}$$

Based on equations (22)-(25), we can graph the output, price, interest rate, and commercial rate loci within the bands, which are labeled as the TZ schedule in the relevant figures.

If the monetary authorities do not set a commercial rate band in the dual exchange rate regime, implying $\bar{e}^c \to \infty$ and $\underline{e}^c \to -\infty$, the edges of the market fundamentals have the properties $\bar{\varepsilon} \to \infty$ and $\underline{\varepsilon} \to -\infty$. With this relationship,

[9]See Svensson (1992) for a detailed intuitive explanation.

from equations (18) and (19) we have $A_1 = A_2 = 0$. It then follows from equations (8a)-(11a) that the dynamic behavior of y, p, r and e^c in the regime of a dual exchange rate is:

$$y = \frac{\beta}{\Delta}\varepsilon \, , \tag{22a}$$

$$p = -\frac{(\beta\phi + \lambda)}{\Delta}\varepsilon \, , \tag{23a}$$

$$r = -\frac{1}{\Delta}\varepsilon \, , \tag{24a}$$

$$e^c = \Omega_0 \varepsilon \, . \tag{25a}$$

Equations (22a)-(25a) reveal that, if the monetary authorities do not set any edge for the commercial rate, public agents will expect the instantaneous change in price to be nil. Then it follows from equations (8)-(11) that y, p, r and e^c are determined by the market fundamentals completely. According to equations (22a)-(25a), we can depict the dynamic loci of y, p, r and e^c under the floating commercial rate regime, which are labeled as the FF schedule in the relevant figures.

The effect of the output disturbance on the commercial rate ($\Omega_0 = [\beta(\theta - \eta\phi) - \eta\lambda]/\eta\Delta \gtrless 0 \;\; if \;\; \eta \gtrless \theta/\phi$) is ambiguous, since it depends on the relative elasticity of the real commercial rate (η) to income (θ) in the balance of payments. Therefore, when the government executes a commercial rate target zone policy under the dual exchange rate regime, the relative elasticity of the real commercial rate to income in the balance of payments will affect this policy's stability capability. The reason for this is that the execution of the target zone policy will make the public agents change their expectation of the price movement, and this expectation is central to the story. From (12) and (21), we know:

$$\frac{E(dp)}{dt} = \frac{-\Omega_0 \eta \Delta[\sinh(s\varepsilon)]}{\beta\lambda s(\eta + \alpha\theta)[\cosh(s\bar{\varepsilon})]} \, . \tag{26}$$

From (26), we can see how the positive or negative Ω_0 goes through the expectation of price movement to affect the variability of the relevant macro variables as follows. If the effect of the output disturbance on the commercial rate is positive (i.e., $\eta > \theta/\phi$), based on equations (22)-(25) we can graph the output, price, interest rate, and commercial rate loci within the bands, which are labeled as the

TZ schedule in Figure 1, Figure 2, Figure 3, and Figure 4, respectively. Similarly, according to equations (22a)-(25a), we can depict the dynamic loci of y, p, r and e^c under the float commercial rate regime, which are labeled as the FF schedule in Figures 1-4, respectively.

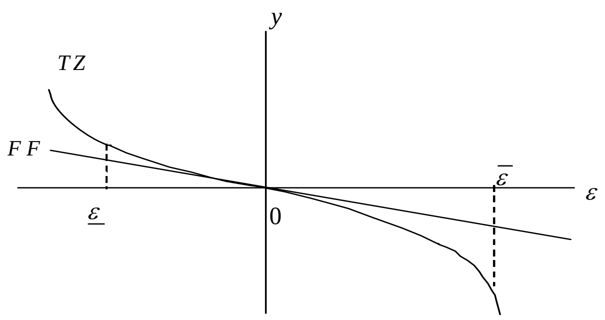

Figure 1: The output loci between the TZ **and** FF **regimes under** $\Omega_0 > 0$

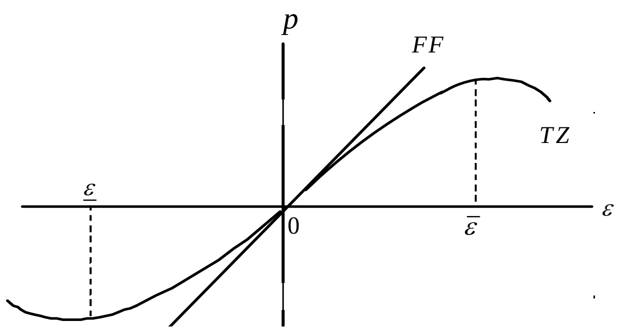

Figure 2: The price loci between the TZ **and** FF **regimes under** $\Omega_0 > 0$

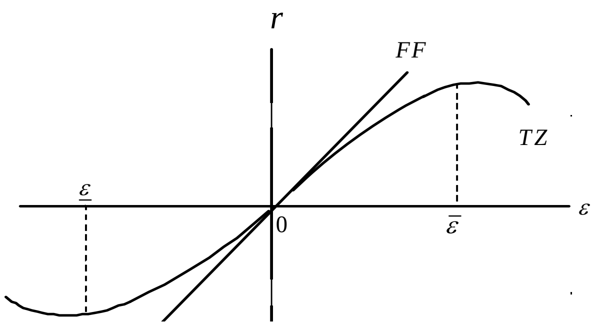

Figure 3: The interest rate loci between the TZ **and** FF **regimes under** $\Omega_0 > 0$

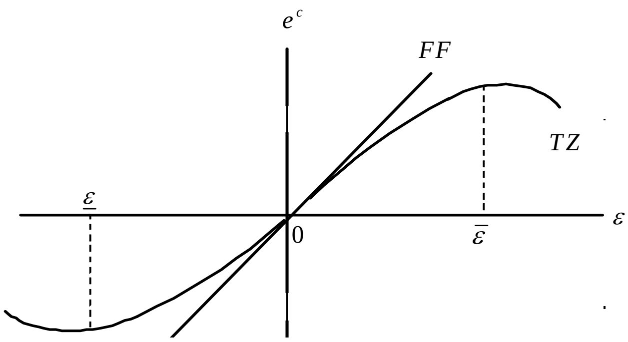

Figure 4: The commercial rate loci between the TZ **and** FF **regimes under** $\Omega_0 > 0$

In Figures 1-4, for a given fluctuation in ε within the interval $\bar{\varepsilon}$ and $\underline{\varepsilon}$, the price, interest rate, and commercial rate variability under a regime of the commercial rate target zone are smaller than those under the regime of a floating commercial rate. Hence, the commitment of the monetary authorities to defend a commercial rate zone will stabilize p, r and e^c. This is the famous "honeymoon effect" in the target zone literature. However, it is clear from Figure 1 that in response to a change in ε, the output variability under the regime of a commercial rate target zone is greater than that under the regime of a floating commercial rate. More precisely, a commercial rate target zone tends to destabilize, rather than stabilize y only. These results give rise to an important policy implication in that, when the monetary authorities implement a commercial rate target zone policy, the economy benefits from the lower price, interest rate, and commercial rate variability at the expense of higher output variability.

The intuition behind these results is obvious. When the economy experiences a shock in output supply (for example, the oil price rises abruptly), as indicated in (8)-(11), p, r and e^c will increase in response, and only the output, y, will decrease significantly. When e^c is higher and closer to the upper bound of the commercial rate band, the probability that it will reach the upper edge is higher. Accordingly, the probability of a future intervention to decrease the money supply to defend the band is higher, implying that a lower price in the future is expected by the public agents (i.e., $E(dp)/dt < 0$). Therefore, the most important channel is the public expectations, and this change in expectations will in turn lead to a decrease in y, p, r and e^c since it will reduce the commodity demand.[10] Obviously, the adjustment of p, r and e^c originating from expectations will lessen the adjustment of both variables originating from the change in fundamentals, thereby narrowing the range of the variation. However, the adjustment of y originating from expectations will enhance the adjustment originating from the change in fundamentals, and hence the range of the variation of y is increased. The same reasoning must hold at the bottom of the band.

By contrast, from equations (22)-(25) and (22a)-(25a) in the $\Omega_0 < 0$ condition (i.e., $\eta < \theta/\phi$), we can depict the dynamic loci of y, p, r and e^c under the two different regimes as described above, which are labeled as TZ and FF schedules in Figure 1a, Figure 2a, Figure 3a, and Figure 4a, respectively. It is quite clear in Figures 1a-4a that, if the economy faces aggregate supply shocks, the commercial rate target zone policy will stabilize output as well as the commercial rate at the expense of high prices and interest rate variability.

The inferences in Figures 1-4 can be applied to Figures 1a-4a. Given that the economy experiences an increase in aggregate supply, p and r will increase in response. However, as indicated in equations (8) and (11), y, e^c will decrease based on this condition. When e^c is lower and closer to the lower bound of the commercial rate band, the probability that it will reach the lower edge is higher. Accordingly, the probability of a future intervention to increase the money supply to defend the band is higher, implying that a future higher price is expected by the

[10]Equations (8)-(11) reveal that a fall in $E(dp)/dt$ will reduce p, r and e^c.

public agents (i.e., $E(dp)/dt > 0$). Therefore, the most important channel is the public expectations, and this change in expectations further leads to an increase in y, p, r and e^c, since it will boost commodity demand.[11] Obviously, the adjustment of y and e^c emerging from the expectations will lessen the adjustment of both variables emerging from the change in fundamentals, thereby narrowing the range of variation. However, the adjustment of p and r originating from the expectations will enhance the adjustment originating from the change in fundamentals, and hence the range of variation of p and r are increased. The same reasoning must hold at the ceiling of the band.

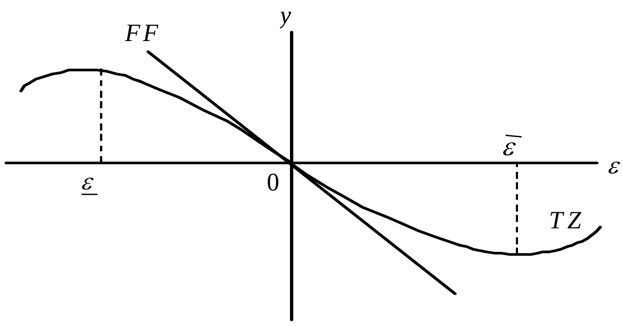

Figure 1a: The output loci between the TZ and FF regimes under $\Omega_0 < 0$

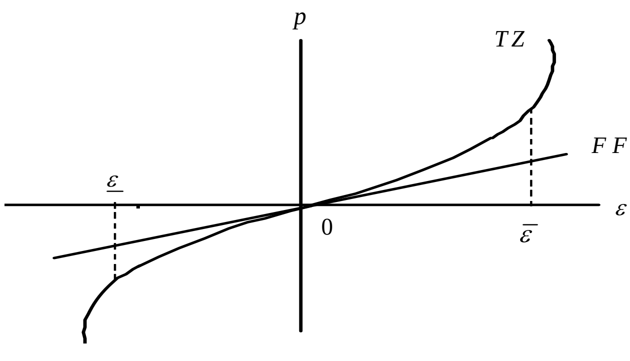

Figure 2a: The price loci between the TZ and FF regimes under $\Omega_0 < 0$

[11]Equations (8)-(11) reveal that an upper bound in $E(dp)/dt$ will increase y, p, r and e^c.

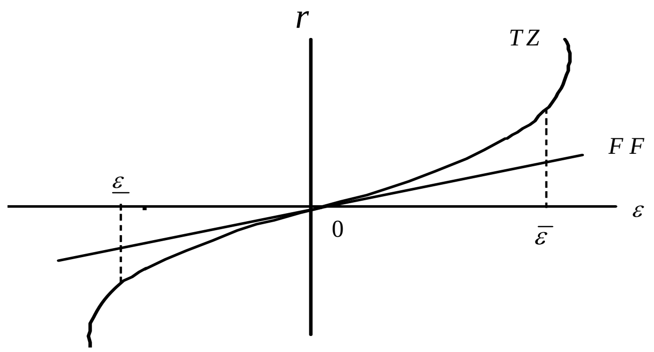

Figure 3a: The interest rate loci between the TZ and FF regimes under $\Omega_0 < 0$

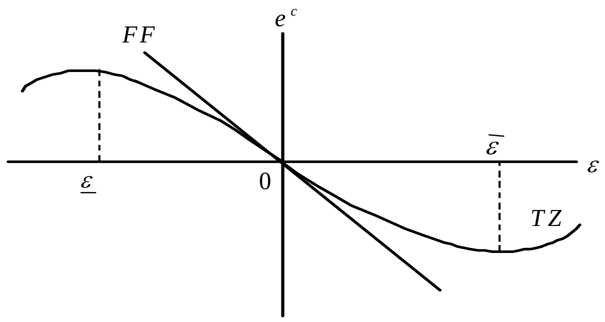

Figure 4a: The commercial rate loci between the TZ and FF regimes under $\Omega_0 < 0$

Finally, we will continue discussing what the adjustment path of the financial exchange rate is. By substituting the value of r in (10) into (5), we obtain:

$$e^f = 1 - \frac{\alpha}{r^*\Delta} m + \frac{1}{r^*\Delta}\varepsilon + e^c + \frac{1}{r^*}\frac{E(de^f)}{dt} + \frac{1}{r^*}[\beta(1+\alpha\phi)\frac{E(dP)}{dt}]. \qquad (27)$$

From equation (27), we can clearly understand that the dynamic path of the commercial rate will also affect the dynamic path of the financial rate.

Moreover, we need to derive the closed dynamic locus of the financial rate from (27). First, by plugging a general solution for the commercial rate of equation (11a) into equation (27) and solving it, we can derive the general solution for the financial rate:

$$e^f = 1 - \frac{1}{\Delta}[\frac{\alpha}{r*} + \frac{\beta(\eta + \alpha\theta)}{\eta}]m + \Lambda\varepsilon + \frac{\eta + \alpha\theta}{\eta}(A_1 e^{s\varepsilon} + A_2 e^{-s\varepsilon}) + (B_1 e^{\delta\varepsilon} + B_2 e^{-\delta\varepsilon}), \tag{28}$$

where A_1, A_2, B_1, B_2 are parameters, and $\Lambda = \Omega_0 + 1/r*\Delta$, $\delta = \sqrt{2r*/\sigma_\varepsilon^2}$.

Secondly, since we have obtained the solutions for A_1 and A_2 from equation (21), the same procedure could be used to solve the remaining undetermined variables B_1 and B_2. By plugging (21) into (28), these unknown parameters are also determined by two continuity conditions and two smooth pasting conditions which are similar to those described above, and their values are as follows:

$$B_1 = B_2 = 0 . \tag{29}$$

Equation (29) shows that the financial rate's expectations will not affect the dynamic path of the financial rate under the dual exchange rate regime. This result does not surprise us, since the movement of the financial rate is not restricted under this commercial rate target zone, and the expectations of the financial rate are still fixed even if the public have expectations of a regime collapse.

By letting $m = 0$, and plugging the values of A_1, A_2, B_1, and B_2 which are shown in (21) and (29) into equation (28), we will obtain the closed dynamic locus of the financial rate as follows:

$$e^f = \begin{cases} 1 + \frac{1}{r*\Delta}\varepsilon + \bar{e}^c; & \varepsilon \geq \bar{\varepsilon}^+ \\ 1 + \Lambda\varepsilon - \frac{\Omega_0 \sinh(s\varepsilon)}{s\cosh(s\bar{\varepsilon})}; & \bar{\varepsilon}^- \geq \varepsilon \geq \underline{\varepsilon}^+ \\ 1 + \frac{1}{r*\Delta}\varepsilon + \underline{e}^c; & \underline{\varepsilon}^- \geq \varepsilon \end{cases} , \tag{30}$$

Similar to the procedure above, from equation (30), we can graph the dynamic locus of e^f under the commercial rate target zones or floating commercial rate regime, which is labeled as the TZ or FF schedule in Figure 5a and Figure 5b. Moreover, the effect of the output disturbance on the financial rate (Λ) is ambiguous: since $1/r*\Delta$ is negative, the value of Λ will depend on the value of Ω_0. If $\Omega_0 > 0$ (i.e., $\eta > \theta/\phi$), it will make Λ positive or negative, otherwise it will always make $\Lambda < 0$. Therefore, similar to the effect for the other variables as discussed above, when the government implements a commercial rate target zone policy in the dual exchange rate regime, the positive or negative value of Ω_0 will also affect this policy's ability to stabilize the financial rate. The reason is obvious. Since from (29) the financial rate's expectations will not be affected under the dual exchange rate regime, then the execution of the commercial rate target zone policy will only make the public agents change their expectations regarding price movements, and this expectation is central to the story.

From one of the conditions above, if $\Omega_0 > 0$ (i.e., $\eta > \theta/\phi$), the slope of the financial rate locus's market fundamental (Λ) will become positive or negative. Based on equation (30), we can graph this locus within the bands, which is labeled as the TZ schedule in Figure 5 and Figure 5a. Similarly, we can depict the dynamic locus of the e^f under the floating commercial rate regime, which is labeled as the FF schedule in Figure 5 and Figure 5a. In Figure 5, for a given fluctuation in ε within the interval $\bar{\varepsilon}$ and $\underline{\varepsilon}$, the financial rate variability under a regime of the commercial rate target zone is smaller than that under the regime of a floating commercial rate. Hence, the commitment of the monetary authorities to defend a commercial rate zone will stabilize e^f. This is the famous "honeymoon effect" in the target zone literature. However, it is clear from Figure 5a that, in response to a change in ε, the financial rate variability under the regime of a commercial rate target zone is greater than that under the regime of a floating commercial rate. More precisely, a commercial rate target zone tends to destabilize, rather than stabilize, e^f in this situation. These results lead to an important policy implication which is that, when the monetary authorities implement a commercial rate target zone policy, whether or not the economy benefits from lower financial rate variability is uncertain.

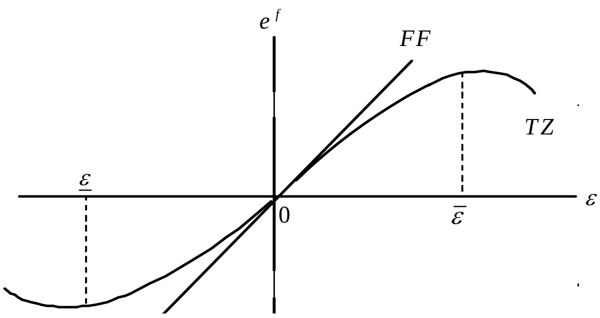

Figure 5: The financial rate loci between the TZ and FF regimes under $\Omega_0 > 0$ & $\Lambda > 0$

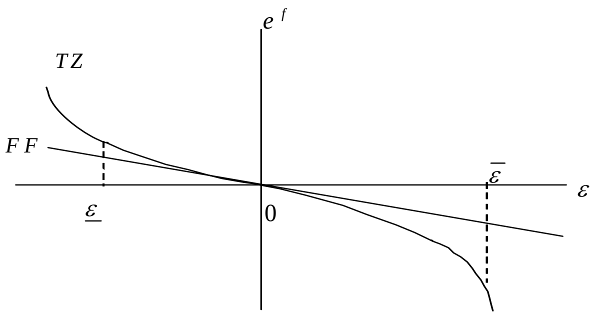

Figure 5a: The financial rate loci between the TZ and FF regimes under $\Omega_0 > 0$ & $\Lambda < 0$

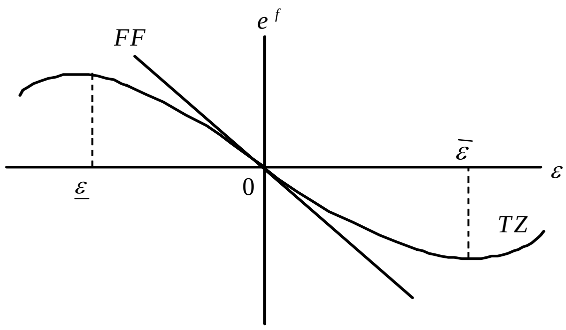

Figure 5b: The financial rate loci between the TZ and FF regimes under $\Omega_0 > 0$ & $\Lambda < 0$

By contrast, from equation (30) based on the $\Omega_0 < 0$ (i.e., $\eta < \theta/\phi$)

condition, we can depict the dynamic locus of e^f under the two different regimes shown above, which are labeled as the TZ and FF schedules in Figure 5b. It is quite clear in Figure 5b that, if the economy faces aggregate supply shocks, the commercial rate target zone policy will always stabilize the financial rate.

Finally, in order to easily read the figures and make further comparisons, we have constructed Table 1 to summarize all the different conditions which are discussed above.

Table1: The important role played by the relative elasticity in the dual exchange rate system

Condition \ Variable	Y	P	r	e^c	e^f
$\Omega_0 > 0$ & $\Lambda > 0$	X	O	O	O	O
$\Omega_0 > 0$ & $\Lambda < 0$	X	O	O	O	X
$\Omega_0 < 0$ & $\Lambda < 0$	O	X	X	O	O

Note: "O" means that there is a honeymoon effect, and "X" means that there is no honeymoon effect.

Since the figure and intuitive explanation of the dynamic locus of e^f is similar to that described above, we do not include it to maintain brevity.

In their often-cited papers, Gros (1988) and Dornbusch and Kuenzler (1993) compare the variability of the commercial rate and the financial rate at the announcement of different government policies under the traditional dual exchange rate regime, and conclude that the movement of these two rates must be absolutely inversed to maintain interest rate parity. Based on the observation in this section, we find that, running in contrast to the channel emphasized in the former literature, the crucial point regarding the desirability of a target commercial rate concerns the relative elasticity of the real commercial rate to income in the balance of payments. Since the relative elasticity will affect a country's balance of payments, the greater the elasticity of the real commercial rate in the balance of payments, the more will the variability of prices, interest rates, and the commercial rate tend to decline, while the variability of output will tend to rise. The financial rate's variability will tend to be uncertain, which means that if $\Omega_0 > 0$ (i.e., $\eta > \theta/\phi$), the commercial rate target zones will cause p, r, e^c, and e^f (with $\Lambda > 0$) to have a honeymoon effect, but y, and e^f (with $\Lambda < 0$) will not. By contrast, when the elasticity of the real commercial rate in the balance of payments is smaller, there will be less output, the commercial rate will be lower, and the financial rate will fluctuate more at the expense of larger price and interest rate fluctuations. This means that if $\Omega_0 < 0$ (i.e., $\eta < \theta/\phi$), the commercial rate target zones will make y, e^c, and e^f have a honeymoon effect, but p and r will not.

Therefore, determining which is the optimal policy for the monetary authority will require that the condition as well as the main goal of the country be carefully considered.

4 Conclusion

The occurrence of financial crises has not only been disastrous for the economies of countries in particular regions, but has also subjected the global financial system to tremendous stress. If we take the more recent Asian Financial Crisis as an example, the value of these countries' currencies nearly halved and their positive growth rates turned sharply negative within a period of just one year. In response to these financial crises that have taken place since the late 1960s, many countries have resorted to a regime of dual exchange rates. Therefore, we have reconsidered introducing this dual exchange rate system to those countries that have recently been affected by financial crises, in order to see how the other economic variables will change if we concentrate on preventing greater exchange rate variability and speculative capital movements.

However, in reality a couple of these countries' central banks have targeted exchange rates with a specific zone, rather than at a specific level. This paper thus departs from the existing literature to examine the desirability of commercial exchange rate targeting from the perspective of target zones while allowing the financial exchange rate to float freely. In contrast to the existing literature, we find that the authorities' commitment to the target ranges for the commercial exchange rate will affect the public's expectations, and in turn govern the stabilization of relevant macro variables. Therefore, the main goal of this paper is to analyze what kind of adjusted path will result based on these two exchange rates and other variables, and accordingly test the robustness of the honeymoon effect under this dual exchange rate regime.

In contrast to the conclusion in the traditional dual exchange rate results, upon the shock of a change in commodity production, we also find that the inverse movement in these two rates does not always hold under the target zone perspective. The relative elasticity of the real commercial rate to income in the balance of payments is the crucial point for the desirability of a target commercial rate. Since the relative elasticity will affect one country’s balance of payments, with the greater elasticity of the real commercial rate in the balance of payments, it will tend to lower the variability of prices, interest rates, and the commercial rate, and to raise the variability of output, while the financial rate’s variability is uncertain. However, with less elasticity of the real commercial rate in the balance of payments, it will lead to asmaller output, commercial rate, and financial rate fluctuations at the expense of larger price and interest rate fluctuations.

Therefore, in deciding whether to implement the commercial rate target zone, the central bank needs to consider the situation and the main goal for the country. Some countries that have encountered aggregate supply shock financial crises may find this issue worth reconsidering.

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