



# Announcements are not Enough: Foreign Exchange Intervention under Imperfect Credibility

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## Abstract

Central banks in emerging countries frequently build-up (diminish) reserves while attempting to depreciate (appreciate) their domestic currencies. Even if these interventions are effective, they often entail various costs. Basu (2012), nonetheless, proposes a model in which the sole announcement of an intervention schedule leads to a desired exchange rate without actually buying or selling foreign currency. In this paper we present a generalization that allows for imperfect credibility of foreign exchange intervention. Namely, market dealers know that the central bank carries strategic incentives when announcing its schedule and may not perfectly believe it. We show that, under this setup, it may be impossible for central banks to achieve the desired exchange rate level without changing their position of international reserves.

Keywords: Exchange rate; Foreign exchange intervention; Central bank Credibility; Credibility function

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# 1 Introduction

There has been a long-standing debate in the literature on the effectiveness of foreign exchange intervention. Recently, a growing number of papers have suggested that central banks, especially those in emerging market economies, play a key role in exchange rate stabilization, with potential benefits to international trade, foreign direct investment and the development of the financial sector (see Rigobon, 2008 and Paul and Lahiri, 2008). For instance, Garcia et al.(2011) show that financially underdeveloped economies benefit the most from exchange rate stabilization policies, especially when handling risk premium shocks. Similarly, Héricourt and Poncet (2015) argue that exporting firms benefit from intervention that is able to mitigate exchange rate volatility.

However, intervention is often costly. Central banks require a sizable reduction or accumulation of international reserves, coupled with just-as-large open market operations when deciding to sterilize interventions. Most importantly, managing the exchange rate while allowing for free capital flows and maintaining monetary policy autonomy is an impossible trilemma due to arbitrage by foreign investors. Hence, the effectiveness and credibility of foreign exchange intervention is always at stake.

Basu (2012), nonetheless, presents a model in which foreign exchange intervention can be costless. The author proposes an intervention schedule, consisting of a promise to buy or sell a specific amount of foreign currency for every predominating exchange rate level. In equilibrium, the sole announcement of the central bank is able to shift the exchange rate to a desired level without actually having to intervene. In this sense, Basu's work relates to the literature on the signaling channel, in which monetary authorities convey information regarding the future stance of policy.

In this paper we present a generalization of Basu (2012) that allows for imperfect credibility of foreign exchange intervention. Thus, Basu (2012) becomes a particular case of our model in which central bank announcements are fully credible. Our main motivation in allowing for imperfect credibility is based on the fact that market dealers know that the central bank carries strategic incentives when announcing its schedule. Specifically, we introduce a credibility function that depends on how the announced schedule responds to exchange rate variations.

Our contribution is two-fold. First, we show that under imperfect credibility, it can be impossible for the central bank to obtain the desired exchange rate level without changing its position of international reserves. We characterize this equilibrium and provide some insights on the amount of foreign currency to be traded. Second, we show that as private agents gain complete credibility on the central bank, any desired exchange rate level can be attained without actual intervention, which replicates the result found in Basu (2012).

## 2 The Model

Our theoretical framework is based on Basu (2012), but modified so as to incorporate imperfect credibility. In particular, we analyze the situation in which the Central Bank (CB) of a small open economy wants to depreciate the exchange rate by purchasing foreign currency (US dollars). Analogously, our analysis carries through to the case of currency appreciation.

In the model, two types of private agents demand dollars. The first type of agents are denoted as price-takers, not large enough to affect the exchange rate  $p$  (the domestic price of one dollar). The aggregate demand of dollars for this type is  $d(p)$ , where  $d'(p) < 0$ . The second type of agents carry out large foreign exchange transactions which affect the exchange rate (dealers hereafter). There are  $n \geq 2$  dealers, each of them demands  $x_i(p)$  dollars, where  $x'_i(p) < 0$ . Hence, the market is an oligopsony in which dealers have some special use for dollars (not available for the other type of agents) and, as a result, are able to make profits from each dollar purchased. Finally, the supply of dollars is given by the function  $s(p)$ , where  $s'(p) > 0$ .

In the absence of CB intervention the equilibrium in the foreign exchange market is described by the following relation:

$$\sum_{i=1}^n x_i(p) = \psi(p), \quad (1)$$

where  $\psi(p) \equiv s(p) - d(p)$  is the net supply function of the price-taker agents.

Each dealer obtains a value  $u$  (equal for all dealers by assumption) for each dollar purchased, greater than the equilibrium price that results from (1). A dealer  $i$  maximizes the following profit function:

$$\pi_i(p) = ux_i(p) - px_i(p)$$

The demand function of agent  $i$  is then given by

$$x_i(p) = (u - p) \left( \frac{dp}{dx_i} \right)^{-1}$$

and the aggregate demand of the  $n$  dealers (since in the symmetric equilibrium  $x_i = \bar{x}$ ,  $\forall i$ ) is hence

$$x(p) = \sum_{i=1}^n \bar{x}(p) = n(u - p) \left( \frac{dp}{dx_i} \right)^{-1} \quad (2)$$

The CB announces a schedule intervention  $f^a(p)$  which states the quantity of dollars that it will buy at every market price  $p$ . We incorporate the superscript  $a$  to distinguish between what the CB announces and what it effectively does,  $f(p)$ . The equilibrium in the foreign

exchange market with CB intervention is described by

$$\sum_{i=1}^n x_i(p) + f(p) = \psi(p) \quad (3)$$

From this equation we can derive an expression for  $dp/dx_i$ :

$$\frac{dp}{dx_i} = [\psi'(p) - f^{e'}(p)]^{-1} \quad (4)$$

where  $f^e(p)$  corresponds to the CB demand of dollars expected by the dealers when the price of the currency is  $p$ . This function may be different from  $f^a(p)$ , the announced schedule. For the latter we use the same functional form as in Basu (2012):

$$f^a(p) = \psi(p) - \alpha - \beta p \quad (5)$$

such that the difference between the net supply function  $\psi(p)$  and the announced schedule  $f^a(p)$  takes a linear form.

In Basu (2012), since there is perfect credibility,  $f^e(p) = f^a(p)$  so the CB is able to set its desired price  $p^*$  in the foreign exchange rate market without buying a dollar in such market, that is, the announcement of the schedule is enough to obtain the desired equilibrium. The CB exploits the fact that the dealers care about how the announced intervention reacts to exchange rate changes ( $f^{a'}(p)$ ). As a result, if a higher exchange rate is desired, the CB only needs to announce a function with a higher  $\beta$  to meet its target with a zero purchase of dollars ( $f(p^*) = 0$ ).

In our model, instead, the dealers know that the CB has strategic incentives to announce and, consequently, assign a level of credibility to the announced schedule. Specifically, we assume that

$$f^e(p) = \gamma(\beta) f^a(p) \quad (6)$$

where  $0 \leq \gamma(\beta) \leq 1$ . The level of credibility of a specific intervention varies according to  $\beta$ . For instance, the dealers could consider that for small values of  $\beta$ , the promised intervention is highly credible ( $\gamma \rightarrow 1$ ) but for high values, the promised intervention would require a purchase of dollars that the CB is not willing or able to make, and therefore they would assign low credibility ( $\gamma \rightarrow 0$ ) to this kind of promises.

Substituting (2) and (4) into (3) yields

$$n(u-p) [\psi'(p) - (f^e)'] + f(p) = \psi(p) \quad (7)$$

and from (5) and (6)  $f^{e'}(p) = \gamma(\beta) [\psi'(p) - \beta]$ , then using this equation we can rewrite

Equation (7) as follows:

$$\gamma(\beta) [\beta - \psi'(p)] - \frac{\psi(p) - f(p)}{n(u - p)} + \psi'(p) = 0 \quad (8)$$

This equation describes the market equilibrium, given a credibility function and an announced intervention schedule.

Let us start by considering Basu's (2012) particular case in which there is full credibility i.e.  $\gamma(\beta) = 1$ , for all  $\beta$ . The CB intends to drive the market price to a specific value  $p^*$  with a zero purchase of dollars ( $f(p^*) = 0$ ). Then, from Equation (8) it can be seen that it is enough for the CB to announce an intervention schedule of the form (5), where  $\beta$  is equal to

$$\bar{\beta} = \frac{\psi(p^*)}{n(u - p^*)} \quad (9)$$

and  $\alpha$  can be calculated as  $\alpha = \psi(p^*) - \bar{\beta}p^*$  since  $f(p^*) = 0$ .

In contrast, under imperfect credibility, it may be not possible to drive the market price to  $p^*$  with a zero intervention in the equilibrium. Suppose, as a particular example that the left hand side of (8) is negative for low values of  $\beta$  and that setting higher values of  $\beta$  leads credibility to zero, i.e.  $\gamma(\beta) \rightarrow 0$ . In that case there would be no  $\beta$  for which both (8) and  $f(p^*) = 0$  hold. In contrast, with a positive intervention ( $f(p^*) > 0$ ) Equation (8) could be satisfied.

Since there is imperfect credibility, the announcement, the expectation and the action might be different. However, for the sake of rationality, expectations should be consistent, at least in the equilibrium, and therefore we impose an additional restriction and assume that  $f^e(p^*) = f(p^*)$  which implies that

$$\gamma(\beta) [\psi(p^*) - \alpha - \beta p^*] = f(p^*) \quad (10)$$

and hence the equation that must be satisfied to meet the exchange rate target in the equilibrium is<sup>1</sup>

$$\gamma(\beta) [\beta - \psi'(p^*)] - \frac{\psi(p^*) - \gamma(\beta) [\psi(p^*) - \alpha - \beta p^*]}{n(u - p^*)} + \psi'(p^*) = 0 \quad (11)$$

Under these conditions it is possible that meeting the target  $p^*$  requires a positive intervention in the exchange rate market as shown in the next proposition.

**Proposition 1** *In the model described in this section, under imperfect credibility a positive*

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<sup>1</sup>It can be easily seen that when there is full credibility we still have Basu's (2012) case, with  $f(p^*) = 0$  and  $\alpha = \psi(p^*) - \beta p^*$ .

intervention is required so as to meet the exchange rate target  $p^*$ , if and only if

$$\forall \beta, \gamma(\beta) [\beta - \psi'(p^*)] < \frac{\psi(p^*)}{n(u - p^*)} - \psi'(p^*) \quad (12)$$

**Proof.** Solving for  $\alpha$  in (11) and substituting it into (10) we obtain an expression for  $f(p^*)$  from which it is easy to see that Equation (12) is equivalent to  $f(p^*) > 0$  for any  $\beta$ . ■

Equation (12) can be easily satisfied as the example below illustrates. Since the RHS of (12) is positive<sup>2</sup>, then it is enough that credibility decreases rapidly with  $\beta$ . When  $\beta$  is small, the LHS of (12) is negative and as  $\beta$  increases,  $\gamma(\beta)$  goes rapidly to zero such that the LHS of (12) tends to zero.

## 2.1 An example with explicit functions

Suppose  $\psi(p) = A_1 p - A_0$ . In the absence of intervention  $x(p) = n(u - p) A_1$  and therefore the equilibrium price would be

$$\tilde{p} = \frac{A_0 + nuA_1}{A_1(1 + n)}$$

Let us incorporate the intervention schedule and assume it is fully credible. The CB intends to drive the market price to  $p^*$ ,  $\tilde{p} < p^* < u$ , with the minimum intervention. The announced schedule is

$$f^a(p) = f(p) = f^e(p) = \psi(p) - \alpha - \beta p$$

and the aggregate demand

$$x(p) = n(u - p) [A_1 - (f^e)'(p)] = n(u - p) \beta$$

The equilibrium price can be obtained from

$$n(u - p) \beta - \alpha - \beta p = 0$$

then it is easy to verify that when  $\beta = (A_1 p^* - A_0) / [n(u - p^*)]$  and  $\alpha = A_1 p^* - A_0 - \beta p^*$ , the target is met with a zero purchase of dollars i.e.  $p = p^*$  and  $f(p^*) = 0$ .

The result is different when we incorporate imperfect credibility, i.e.  $\gamma(\beta) = 1/\exp(\beta)$ ,  $\beta > 0$ . In this case, the problem can be stated as minimizing the purchase of dollars, i.e.

$$f(p^*) = e^{-\beta} [(A_1 - \beta) p^* - A_0 - \alpha] \quad (13)$$

subject to

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<sup>2</sup>Since we analyze the situation in which the CB wants to depreciate the exchange rate by purchasing dollars, it should be the case that in the absence of an announced schedule, the CB purchase of dollars required to drive the market price to the target level, say  $D$ , should be positive:  $D = \psi(p^*) - n(u - p^*) \psi'(p^*) > 0$ .

$$e^{-\beta}(\beta - A_1) - \frac{A_1 p^* - A_0 - e^{-\beta}(A_1 p^* - A_0 - \alpha - \beta p^*)}{n(u - p^*)} + A_1 = 0 \quad (14)$$

Figure 1 ( $A_1 = 0.5, A_0 = 1, n = 4, u = 15, p^* = 14$ ) illustrates that the market needs a nonzero intervention in order to meet the target.<sup>3</sup> For this particular case, the minimum intervention required to drive the market price to  $p^*$  is  $f(p^* = 14) = 3.11$  when  $\beta = 1.5$  ( $\beta = 1 + A_1$ ). Although greater than zero, it is smaller than the intervention required if, rather than announcing a schedule, the CB simply buys the amount of dollars to drive the market price to  $p^*$  ( $D = A_1 p^* - A_0 - n(u - p^*) A_1 = 4.0$ , see footnote 2).

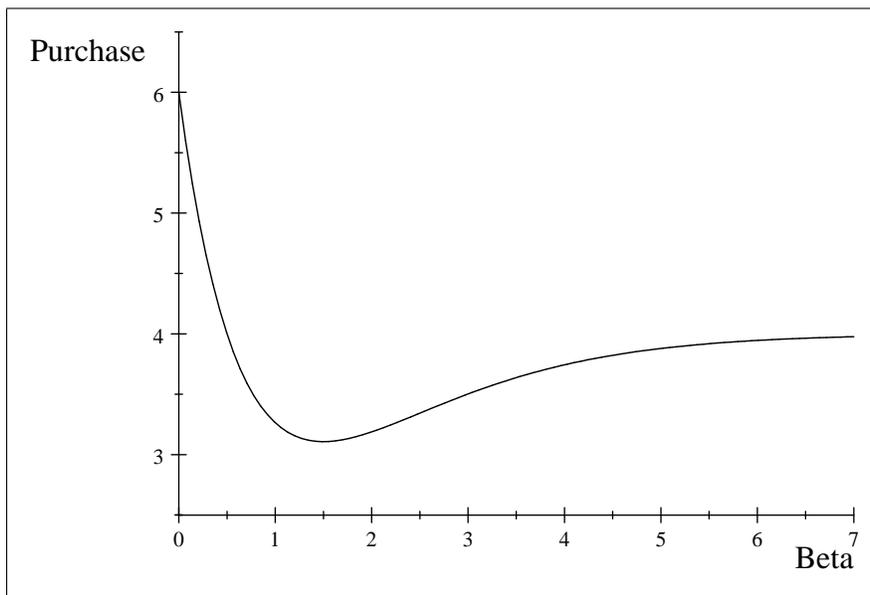


Fig. 1

### 3 Final Remarks

There has been a general lack of consensus in the literature regarding the effectiveness of foreign exchange intervention. Nonetheless, central banks, especially those in emerging market economies, frequently change their international reserves' positions when targeting the exchange rate. These interventions are often costly in terms of operability and credibility.

Basu (2012) presents a model in which intervention can be costless. In his setup, the central bank announces an intervention schedule, consisting of a promise to buy or sell amounts of foreign currency for every level of the exchange rate. In equilibrium, the announcement alone is able to shift the exchange rate to the desired level without actually having to intervene.

In this paper we introduce a generalization of Basu (2012) that allows for imperfect credibility of foreign exchange intervention. Hence, Basu (2012) becomes a particular case of our

<sup>3</sup>To construct Figure 1 we have solved for  $\alpha$  in Equation (11) and substitute it into Equation (13).

model in which central bank announcements are fully credible. Our main motivation in allowing for imperfect credibility is based on the fact that market dealers know that the central bank carries strategic incentives when announcing its schedule.

Our results show that under imperfect credibility, it may be impossible for the central bank to obtain the desired exchange rate level without changing its international reserves' position. Despite imperfect credibility, the required intervention is lower than the one that would prevail in the absence of the announcement.

## REFERENCES

Basu, K. (2012): "How to devalue exchange rates, without building up reserves: Strategic theory for central banking," *Economics Letters*, 117(3), 758-761.

Devereux, M. B. (2004): "Should the exchange rate be a shock absorber?," *Journal of International Economics* 62(2), 359-377.

Engel, C. (2011): "Currency misalignments and optimal monetary policy: a reexamination," *American Economic Review* 101(6), 2796-2822.

Garcia, C. J.; J. E. Restrepo; and, S. Roger (2011): "How much should inflation targeters care about the exchange rate?," *Journal of International Money and Finance* 30(7), 1590-1617.

Hericourt J. and S. Poncet (2015): "Exchange rate volatility, financial constraints and trade: Empirical evidence from Chinese firms," *World Bank Economic Review*, 29(3), 550-578.

Paul, M. and S. Lahiri (2008): "The effect of temporary devaluation on foreign investment," *Journal of International Trade and Economic Development* 17.

Rigobon, R., (2008): "Exchange Rate Volatility," S. N. Durlauf, L. E. Blume, *The New Palgrave Dictionary of Economics*.

