Comment on "Interest Rate and Borrowing Defense Against Speculative Attack" by Allan Drazen

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1. Introduction

Speculative attack models can be roughly classified into two categories.[1] In the so-called first generation models the central bank decides to abandon the fixed exchange rate regime according to a mechanical exit rule: the peg is abandoned whenever foreign reserves hit zero, or some other lower bound. In these models the central bank is a passive, non-optimizing agent. In contrast, so-called second generation models, specify an objective function for the government that is used to guide its decision to maintain or abandon the exchange rate peg.[2]

While both classes of models have advanced our understanding of fixed exchange regime collapses, they fail to explain the speculative attack defences that central banks mount in the real world. In fact, in first-generation models it is generally optimal to abandon fixed exchange rate regimes as soon as the fiscal problem that drives these models arises, so there is no reason for a defence to occur.[3] What are central banks trying to accomplish when they borrow foreign reserves or raise dramatically their overnight interest rates? The current paper by Allan Drazen and its prequel, Drazen (1999), are among the first to address this question. Both papers represent important contributions to the literature that hold the promise of significantly improving our understanding of the behavior of central banks during speculative attacks. Drazen's work is motivated by the following set of facts:

- Central banks can defend against a speculative attack both by borrowing foreign reserves and by raising interest rates;

[1] See Jeanne (2000) for a recent survey of the literature.

[2] Lahiri and Vegh (1999) discuss an intermediate case. In their model the government follows an exogenous exit rule–it abandons the regime only when reserves hit a lower bound. But the government has influence over domestic interest rates which, in turn, affect the behavior of reserves. Lahiri and Vegh discuss the optimal use of this domestic interest rate in the presence of the exogenous exit rule.

[3] See Burnside, Eichenbaum and Rebelo (2000a) for a discussion.

- Not all speculative attacks are defended by the central bank (e.g. Sweden defended its September 1992 speculative attack, but not the attack that took place in November 1992);

- In some episodes the defence works (e.g. Hong Kong, 1997) while in other it fails (e.g. Korea and Thailand, 1997);

In these comments I will first review the mechanics of a speculative attack. Then, I will summarize the alternative explanations for the high interest rates that are at times associated with speculative attacks. Finally, I will discuss the key elements of Drazen's model.

2. Attacking a Fixed Exchange Rate

Suppose that Thailand has fixed its exchange rate, that is, $S_t = S$, where S_t denotes dollars per baht. How can a speculator profit from a devaluation of the baht? The most popular strategy is to "attack the spot market". This involves borrowing Thai bahts at the local interest rate, R_t^*, convert them into dollars at the spot exchange rate, S and invest the dollars in U.S. money markets at the interest rate R_t. At the end of the period the dollars are converted back to local currency. This strategy yields a profit if:

$$S(1+R_t)\frac{1}{S_{t+1}} > (1+R_t^*) \tag{2.1}$$

Profits in dollars from this operation are:

$$\text{Profits}_1 = Y_1[S(1+R_t) - S_{t+1}(1+R_t^*)] \tag{2.2}$$

where Y_1 is the amount of Thai bahts borrowed.

Equation (2.2) illustrates the well-known fact that fixed exchange rate regimes provide speculators with a one-way bet. If the fixed exchange regime survives,

the payoff to a speculator is $Y_1 S(R_t - R_t^*)$. This payoff will in general be negative since $R_t^* > R_t$, given that R_t^* reflects the probability of a Thai baht devaluation. When $R_t^* - R_t$ is small, speculators make small losses if the fixed exchange rate regime endures but stand to make large gains if a large devaluation occurs.

A second speculation strategy is to "attack the forward market" by selling bahts forward. This strategy yields profits if:

$$F_{t+1} > S_{t+1} \tag{2.3}$$

where $F_{t+1}$is the forward exchange rate (\$/Bahts). Profits in dollars from this strategy are:

$$\text{Profits}_2 = Y_2(F_{t+1} - S_{t+1}) \tag{2.4}$$

where Y_2 is the amount of baht sold forward.

Forward markets are, at times, described as providing new venues for speculators. However, since covered interest parity always holds:

$$(1 + R_t) = \frac{1}{S}(1 + R_t^*)F_{t+1}, \tag{2.5}$$

condition (2.1) and (2.3) are equivalent. Whenever speculators make profits attacking the spot market they also profit from attacking the forward market and vice-versa. Equations (2.2), (2.4) and (2.5) imply that a speculator should be indifferent between borrowing Y_1 baht to attack the spot market and selling $Y_2 = Y_1(1 + R_t^*)$ baht forward.[4]

The two strategies, represented by equations (2.1) and (2.3), are also equivalent in terms of the bahts that are traded for dollars in the spot market. An attack

[4]Both central bankers and speculators may prefer to operate in the forward market because forward positions are off the balance sheet. This means that speculators can temporarily hide potential losses, while central banks can hide their true foreign reserve position. When default risk is significant speculators may prefer to attack the spot than the forward; the bank that bought the baht forward has an incentive to default if a devaluation occurs.

on the spot means that Y_1 Thai baht will immediately be traded for dollars. It may seem that when speculators sell Y_2 baht forward they generate no trade in the spot market. However, the bank that bought the Y_2 baht forward from the speculators will typically hedge its currency risk using the following strategy. First, trade $Y_2/(1+R_t^*)$ baht for dollars in the spot market. Second, invest the resulting dollars, $SY_2/(1+R_t^*)$ in the U.S. money market. The proceeds from this investment are $(1+R_t)SY_2/(1+R_t^*)$. This (minus a fee to compensate transactions costs, from which we are abstracting) is what the bank is willing to pay for the Y_2 baht sold forward by the speculators: $F_{t+1}Y_2 = (1+R_t)SY_2/(1+R_t^*)$.

When speculators attack the spot market they trade Y_1 baht for dollars in this market. When they follow the equivalent strategy of selling $Y_2 = Y_1(1+R_t^*)$ baht on the forward market, the bank that serves as their counterpart will immediately sell $Y_2/(1+R_t^*) = Y_1$ baht in the spot market. So either way, Y_1 baht are sold on the spot market.

One interesting feature of an interest rate defence is that, since (2.5) always holds, the rise in R^* leads to an automatic fall in the forward rate. The fall in F_{t+1} may be taken as a sign that a devaluation is imminent, when, in fact, it is a result of the central bank's attempt to defend the peg.

3. Defending a Speculative Attack

Suppose that the Bank of Thailand has X dollars of reserves in its vaults. We have seen that both attacks on the spot and on the forward market lead the central bank to lose foreign reserves immediately, as private agents trade their bahts for dollars. What can the Bank of Thailand do to defend its fixed exchange rate? The first line of defence is typically to use moral suasion, regulation and selective capital controls to try to prevent local banks from lending the baht to speculators. If this fails the central bank may try to borrow additional foreign reserves from

other central banks and/or raise interest rates in the overnight money market.

3.1. Borrowing Foreign Reserves

The central bank can stop the speculative attack by borrowing enough foreign reserves to buy back its outstanding money supply.[5] One important ingredient in Hong Kong's successful defense of its 1997 speculative attack is thought to have been its high level of foreign reserves, combined with the ability to borrow additional foreign reserves from People's Bank of China. What is the concept of outstanding money supply that is relevant from the standpoint of defending a speculative attack? Is it the monetary base, $M1$ or $M2$?

Consider first the case in which the attack occurs smoothly over time. To buy dollars with baht depositors write checks on their bank accounts and receive bahts from commercial banks. This reduces the baht reserves of commercial banks. In order to comply with their reserve requirement banks must call back some loans. Eventually, the unraveling of the credit multiplier mechanism reduces $M2$ to the monetary base. In this case the central bank can stem a speculative attack by pledging enough foreign reserves to buy back the monetary base.

Consider now the more realistic case in which the attack occurs suddenly, with private agents trying to convert not only their baht currency holdings but also their baht deposits into dollars. In this case there is no time for the credit multiplier mechanism to unravel and the size of the attack could, potentially, be as large as $M2$. While many countries have foreign reserve levels that are close to the monetary base, they typically cannot borrow enough foreign reserves to buy back $M2$. This means that a borrowing defence is not guaranteed to succeed.

[5] In practice the central bank only has to buy a fraction of the outstanding money supply because there is still a positive demad for real balances after the devaluation. See Burnside, Eichenbaum and Rebelo (2000c) for a discussion.

3.2. Raising the overnight interest rate

Raising the domestic interest rate, R_t^*, will moderate the one way bet nature of speculation in fixed exchange rate regimes. For high values of R_t^*, the losses made by speculators when the regime survives, $S(R_t - R_t^*)$, are no longer trivial. In addition, if the fixed exchange rate is not literally fixed, but fluctuating in a band, the domestic exchange rate may appreciate, inflicting losses on speculators.

The problem with this defence is that, by raising interest rates, the central bank may reduce the profitability of the banking system (which may, for example, lend at fixed interest rates and borrow at variable interest rates) and reduce the credit available to the economy, potentially inducing a recession. For this reason a high interest rate defence is typically short lived. Central banks raise interest rates to extraordinary levels (1,300% in Thailand during May 1997) for only a few days. One dramatic example of the effects of an interest rate defence on economic activity is provided by the September 1992 speculative attack against the Swedish Krona. During this episode the Swedish central bank raised the overnight rate to 500%. As a result the number of housing starts fell by roughly 70% in the third quarter, recovering fully in the following two quarters after the overnight rate was back to its normal level.

4. Why Do Overnight Interest Rates Rise?

What are central banks trying to achieve when they raise short term interest rates? I will discuss four possible of answers to this question. These answers are not mutually exclusive, more than one of the mechanisms described below may be at work in some episodes.

1 - Signaling

This is the explanation pursued both in this paper and in Drazen (1999). In

both models interest rate movements signal fundamentals, including the central bank's commitment to maintaining fixed exchange rates. One appealing feature of this explanation is that it is consistent with the notion that interest rate increases are temporary. In the current paper the central bank can defend its currency both by borrowing and by raising interest rates. In Drazen (1999) the bank's only defence was to raise interest rates. One potential problem with that setup is that Kraay (1999) documents that many interest rate defences fail. However, many of the attacks included in Kraay's data involve moderate interest rate increases that, as we discuss below, do not necessarily represent an interest rate defence.

2 - Speculator Squeeze

When the exchange rate is not literally fixed but fluctuates within a band a rise in interest rates may lead to an appreciation of the local currency. This appreciation may inflict margin calls on speculators, forcing them to close their positions at a loss.

3 - Buying Time

The central bank may raise interest rates to try to buy time. This time may be used to borrow foreign reserves from other central banks or to ensure that commercial banks have hedged their currency risks before the devaluation. Commercial banks often expose themselves to currency risk by borrowing in dollars and lending in local currency, thus incurring large losses when a devaluation takes place.[6]

4 - Automatic Response

The rise in interest rates may not represent an active defence by the central bank, but simply an automatic response of the domestic interest rate. There are two mechanisms that can generate this response. The first mechanism is an in-

[6] See Burnside, Eichenbaum and Rebelo (2000b) for an explanation of why commercial banks choose to expose themselves to exchange rate risk.

crease in the probability of an imminent devaluation. In stochastic first-generation models (e.g. Flood and Garber (1984) and Drazen and Helpman (1988)) the interest rate can rise before a devaluation, even though the central bank is not defending the fixed exchange rate regime.[7] The second mechanism is the liquidity effect emphasized in the macro literature (Fuerst (1992), Christiano and Eichenbaum (1992), Aiyagari and Braun (1998)). In models where this effect is present, the decline in real balances associated with the speculative attack will automatically raise interest rates. In most speculative attacks the rise in interest rates before a devaluation is small. I suspect that these small interest rate increases are automatic effects, rather than actual interest rate defences.

5. The Interest Rate Defence Model

In order to understand the mechanisms at work in Drazen's paper it is useful to review his earlier model (Drazen (1999)). The model has two types of players, the central bank and the speculators, both with a finite horizon. The objective function of both player is specified directly as depending on the interest rate and the exchange rate, instead of being derived from first principles. This is a significant shortcut that eliminates two difficult modelling issues. First, the monetary transmission mechanism does not have to be specified. Second, the costs of abandoning the fixed exchange regime (e.g. foreign reserves lost in the attack, lost credibility on the part of the central bank, costs of bailing out commercial banks that go bankrupt as a result of the devaluation) are not explicitly modelled. Some of these costs are often difficult to incorporate in standard models, since a

[7] One objection to this explanation for the rise in interest rates is that models such as Flood and Garber (1984) and Drazen and Helpman (1988) predict a simultaneously rise in interest rate and fall in foreign reserves. Even though reserve positions are difficult to measure, one may argue that this is counterfactual. However, this objection does not apply to first-generation models driven by prospective deficits (e.g. Burnside, Eichenbaum and Rebelo (2000a)). In those models reserves do not fall before the devaluation.

flexible exchange rate regime can always deliver the same exchange rate path as a fixed exchange rate regime. Given the difficulty of the signaling problem considered by Drazen it is reasonable to adopt a reduced form approach at this stage of the research.

The objective function of the central bank has two properties. There is a cost to raising interest rates to defend the peg and there is a cost, x, of abandoning the fixed exchange regime. The latter cost plays a crucial role in the analysis because it cannot be observed by private agents. By raising the interest rate the central bank can signal to speculators what the value of x is. The central bank faces a lower bound on foreign reserves, once this lower bound is reached the central bank has to abandon the fixed exchange rate regime.

Speculators are risk neutral and face convex borrowing costs: their cost of borrowing rises with the amount they borrow. The assumption of convex borrowing costs can capture the fact that in practice arbitrageurs are specialized investors who have limited capital. These speculators cannot take arbitrarily large short positions because, if prices move against them, they may get margin calls that force them to close their position at a loss (see Shleifer and Vishny (1997) for a discussion). In the model speculators take one period positions to maximize a static objective, so the only state variable they carry across periods is their belief about x. All speculators are atomistic and take the evolution of information as given. As a result speculators never follow a strategy of attacking the fixed exchange rate to try to extract information about x.

The remaining elements of the model are two publicly observable stochastic shocks: (i) a shock to foreign reserves; and (ii) a shock to the cost of raising interest rates to defend the peg.

In the beginning of the period the cost of the interest rate defence is publicly observed and the central bank decides whether to devalue the currency and incur

the devaluation cost x, or to defend the regime. In case of defence the central bank chooses the optimal level of the interest rate. This decision is the solution to a complicated dynamic problem. The interest rate decision influences the extent to which the speculators will short the currency, and hence the central banks reserve position next period. In addition, since the speculators understand the problem faced by the central bank, the choice of R_t^* will allow speculators to update their beliefs about x. This signaling effect is taken into account by the central bank in making its interest rate decision.

There are several interesting results that emerge from this model.

- A interest rate defense is always a good sign, it means that the cost of abandoning the regime, x, is relatively high.

- Agents learn most about x when there are large shocks to foreign reserves or to the cost of raising interest rate. When foreign reserves are high or the cost of raising interest rates is low, an interest rate defence does not change speculator's views on the value of x. There is a benefit to defending in difficult circumstances, since this will cause a large update in speculators beliefs about x that will make future attacks less likely.

- Comparing two attacks that are close in time (such as the two attacks that Sweden suffered in 1992), it may be optimal to defend the first attack but not the second because fundamentals have deteriorated.

- A small deterioration in fundamentals may lead the government to abandon the fixed exchange rate.

One issue with the model that is not discussed in detail in the paper is that there are multiple equilibrium. This is a desirable features in the sense that it

allows changes in speculator sentiment to play a role. On the other hand, multiple equilibria may make the predictions of the model less sharp.

6. Interest Rate and Borrowing Defences

The current paper extends Drazen (1999) to allow for both borrowing and interest rate defences. This complicates the problem considerably, forcing the analysis to be restricted to two periods and leading to a more intensive use of reduced form assumptions. The key new assumptions are that: (i) to defend the peg by borrowing is less costly than an interest rate defense if the defence succeeds; (ii) a borrowing defence is more costly than an interest rate defense, when the defence fails; (iii) either foreign reserves of the fiscal position are unobservable.

The main new result that emerges from these assumptions is about the signal conveyed by an interest rate defence. In Drazen (1999) an interest rate defence is always a positive signal. The defence means that x is high, and this should help deter future speculation. In contrast, in this paper, an interest rate defense can be a positive or a negative signal. A borrowing defence generally means that both foreign reserves and x are high, in other words, the central bank wants to avoid a devaluation and is confident that the defense will work. In contrast, an interest rate defense means that the central bank reserve position may be weak. This weak position leads the central bank to prefer the interest rate defense which is less costly in case of failure.

Both Drazen models yield interesting insights. But if I had to choose one model, I would choose the one that emphasizes interest rate defences. Since this model implies that interest rate defences are a positive signal about the central bank's aversion to a devaluation, it does not square well with the evidence provided by Kraay (1999) that many interest rate defences fail. But I suspect that many interest rate rises that are classified as defences, simply reflect an automatic

response of interest rates. Further empirical work along the lines of Kraay (1999) seems essential to clarify the potential role of signaling during speculative attacks.

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