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The Art of Currency Manipulation

How to Profiteer by Deliberately Distorting Exchange Rates

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Abstract

A frequent charge in foreign exchange markets in developing countries is that of manipulators being at work. Since to buy is to raise prices and to sell is to lower prices, the question that naturally arises is whether the widespread charge of market manipulation is valid. The paper shows that (whether or not "widespreadness" has any merit) it is possible for a player to manipulate and profiteer. By using some simple principles of game theory, the paper outlines a strategy that a manipulator may use. The aim of this paper is not to provide a manual for the manipulator but to enable the regulator to understand the art and develop policies to curb manipulation.

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The Art of Currency Manipulation:
How to Profiteer by Deliberately Distorting Exchange Rates

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1. The Problem

The Indian rupee, which had been volatile all through this year, on August 1, 2013 stood at Rs 60.57 to the US dollar. Then it went for a sudden sharp depreciation. By August 28, it had dropped in value to Rs 68.85 to the US dollar, a depreciation of close to 14%. It recovered quickly after that, reaching Rs. 62.20 to the US dollar on September 15, 2013.

There were reasons enough for the fluctuations from the middle of 2011. There was S&P's downgrading of U.S. sovereign credit in August 2011, which caused a flight of investor money out of equity in different countries, including India, to the safety of U.S. treasuries and German bunds. There was uncertainty caused by the Greek election on June 17, 2012, taking the Eurozone to the edge of the precipice. More recently, earlier this year, the hint from the U.S. Fed that the United States would soon begin to withdraw its large Quantitative Easing injections, currently of the order of US $85 billion per month, caused interest rates to rise in the United States and money to be withdrawn from emerging economies, which resulted in depreciations of currencies across the board for emerging market economies, from South Africa, Brazil, and Indonesia to India. Nevertheless, the sharp depreciation that occurred through all of August 2013 and the sharp recovery during the first two weeks of September 2013 left many observers questioning if this was the play of competitive markets with hundreds of thousands of small players unwittingly moving the exchange rate or a case of market manipulation by a few big players, that is, of persons or firms deliberately moving prices in order to profiteer.[1]

Despite the widespread talk and suspicion of market manipulation, a natural question to ask is whether it is at all possible to move prices and profiteer, with rational market players. After all, buying will raise the price and selling will lower it. So it is legitimate to ask how anyone can profit by this. It is true that if

[1] This is distinct from shorting a currency, where one takes up a position in anticipation of a price change that is exogenous to oneself, and on which much has been written.

someone bought dollars on August 1, sold on August 28 and again bought on September 14, the person would have made a tidy profit. The question is: Could someone have manipulated to move the exchange rate first and then bought and sold at appropriate times? The answer is not immediately obvious.

The widespread view that behind every movement of a price there is someone deliberately doing this to make a profit may be dismissed as a figment of the human tendency to look for someone behind every observable phenomenon, which has led to graver existential mistakes than this simple economic one. Yet, we cannot for that very reason rule out that in the case of sharp exchange rate movements there may indeed be someone trying to profiteer at the expense of others. However, straightforward economic reasoning, as the previous paragraph suggests, cannot explain how this is possible.

The aim of this paper is to show, by using more complex reasoning, that it is indeed possible to manipulate the market so as to make a profit by deliberately making the exchange rate fluctuate. All one needs is a deep pocket, moderate intelligence, and unfussiness about moral scruples. The purpose of this short paper is to show exactly how the art of market manipulation works.

It should be clarified that I am not talking here about individuals profiteering from exogenous (that is, exogenous to these individuals) price movements, which would simply require one to have the sagacity to know when prices have bottomed out and will rise or the other way around. Then one can time one's purchase and sale to make a profit from exogenous fluctuations. This refers to speculation, which can be rational even when it is common knowledge that it will end in a crash (Abreu and Brunnermeier, 2003), but is different from manipulation. Manipulation refers to actions that *cause* an otherwise stationary price to move and enable the manipulator to make a profit out of this. It is with manipulation that this paper is concerned.

There is a substantial literature on what Allen and Gale (1992) called "information-based manipulation," where a person with insider information or simply greater sagacity can manipulate others (Kyle, 1985; Benabou and Laroque, 1992). It is possible to go a step further and consider cases where an agent has no

insider information but others believe she has. Allen and Gale (1992) showed how that can also be a basis of manipulation.

The present paper analyzes a very different kind of manipulation, one where the manipulator may have no information or belief-in-information advantage. The argument is more relevant to foreign exchange markets where special information is more difficult to obtain and where the market structure is more like the one that will presently be assumed. The model shows that by cleverly gaming other players on the market, you can actually lower the price of dollars, even when buying up dollars, and you can raise the price of dollars while selling dollars. The next section spells out the strategy that achieves this. This so-called art of currency manipulation is known, at least subliminally, to those who indulge in such practices. Since the manipulator already knows the art, the reason for writing this paper, which tries to lay bare the art of market manipulation, is to educate the regulators, such as central banks and stock market regulators, so that they can curb market manipulation.

Most regulators have an inadequate understanding of what currency manipulators do. This lack of clarity results in two ubiquitous mistakes. The first is to regulate so inadequately as to have no impact and to allow currency manipulators to continue to create exchange rate fluctuations and profiteer from that. The second is to use poorly-targeted and far-reaching controls that inflict a lot of collateral damage on legitimate and socially-useful activities and bring wealth-creating exchange to a halt in an effort to excise manipulation.

2. The Model

The kind of market where the manipulator's art could work is one where there are some small price-taking agents and also some larger strategic agents (Cournot firms). The foreign exchange markets in most nations mimic this well. There are ordinary people who buy and sell at bureaus of exchange with no hope of affecting the exchange rate posted on the board by their acts of buying or selling currencies. Then there are the foreign exchange dealers and banks that can

reasonably expect to influence the exchange rate by their own actions. In India, for instance, several of the 99 members of the Foreign Exchange Dealers' Association of India (FEDAI), consisting of banks and financial institutions, are strategic agents on the forex market and the millions of individuals, including tourists who buy and sell small quantities of currency, are the price-taking agents. In other words, exchange rate manipulation is, in principle, possible in India. That is what I am about to demonstrate.

Modeling markets of this kind is a simple exercise in extending the standard Cournot model; and this has a history dating back to Stigler (1950)—see also Encaoua and Jacquemin (1980), Dixit and Stern (1982), and Basu (1993).

Let me begin by sketching such a model for the foreign exchange market. Let the domestic currency be called the rupee and the foreign currency the dollar. The price of 1 dollar expressed in rupees is denoted by p. If p rises, the rupee depreciates; if it falls, the rupee appreciates.

Let the demand for dollars from price-taking agents (henceforth, agents) be

$$d = d(p), d'(p) < 0 \qquad (1)$$

and the supply of dollars for agents be given by

$$s = s(p), s'(p) > 0. \qquad (2)$$

Hence, if the exchange rate is p, the net demand, x, for dollars from agents is given by $x(p) = d(p) - s(p)$. Note that as p rises, $x(p)$ declines.

The market, as already explained, has these (price-taking) agents but also some big foreign-exchange dealers (henceforth, dealers), that operate like Cournot agents, buying and selling dollars and each having an impact on the exchange rate. The model works equally well whether these dealers buy and sell dollars or if some buy and some sell dollars.[2] But purely for expositional ease, I

[2] The modeling of markets where there are oligopolistic (and oligopsonistic) players on the two sides of the market, some buying dollars because they can put them to high-valued use and some selling dollars because they have access to cheap dollars, requires an adaptation of the standard model of either oligopoly or oligopsony.

shall make assumptions so that these large dealers in this domestic market are all sellers of dollars. They buy dollars in the United States or Singapore, where they are (again for simplicity) price-takers, and sell in India, where they have market power.

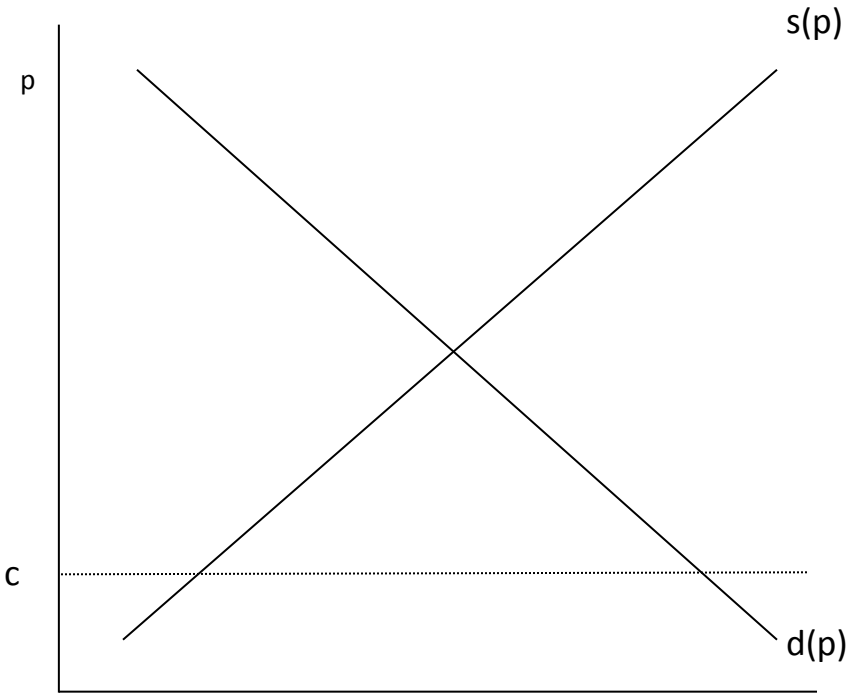

Figure 1

It will be assumed that there are *n* dealers. Each dealer has access to some international forex market where they buy dollars at price *c*. Assume *x(c) > 0*. A picture of what has been described thus far is captured in Figure 1.[3]

Adapting some pre-existing work of a very different nature (e.g., Armstrong, 2006), this is not hard to do. But in this paper I shall confine our attention to a case where all big players happen to be on the same side of the market.

[3] I am also ruling out here the presence of foreign exchange hedging. In reality, when there is expectation of some fluctuation in the exchange rate market, many players do go in for complex hedging strategies (see, e.g., Ware and Winter, 1988; Brown, 2001). But for reasons of simplicity, this is ruled out in the present model.

It is easy to describe the equilibrium is this model. Suppose dealer *i* sells q_i dollars. Then the price that will occur in the market is implicitly given by

$$d(p) - s(p) = q_1 + \cdots + q_n. \qquad (3)$$

Inverting this function, write

$$p = \emptyset(q_1 + \cdots + q_n). \qquad (4)$$

The profit earned by dealer *i* is given by:

$$\pi_i(q_1, \ldots, q_n) = [\emptyset(q_1 + \cdots + q_n) - c]q_i. \qquad (5)$$

The equilibrium in this market is simply the Nash equilibrium of this game. Let us describe $(q_1^*, \ldots, q_n^*)$ as the equilibrium. The exchange rate in equilibrium is then given by $p^* = \emptyset(q_1^* + \cdots + q_n^*)$.

Note that at the equilibrium, (price-taking) agents demand and supply, respectively *d(p*)* and *s(p*)* and the dealers supply *d(p*) – s(p*)*.

3. The Claim

It will now be shown that in a market such as the above one, it is possible for an agent with a deep pocket to come in and manipulate the exchange rate to her advantage. This essentially involves not playing the game like a Cournot player who basically chooses an amount of foreign exchange it will sell. Instead, the "manipulator" chooses a strategy of "conditional sale." A manipulator's strategy is best described as a function, *f(p)*. The function states how much the manipulator will buy if the exchange rate happens to be *p*. The function *f(p)* can take negative values, which means for certain prices the manipulator offers to sell dollars. Fortunately, to analyze the impact of this somewhat unusual strategy, we do not have to start from scratch, since there is a literature on which we can draw (see, for instance, Bresnahan, 1981; Klemperer and Meyer, 1989).

Let us suppose that a manipulator arrives on the scene. It can be shown that she can game the existing foreign exchange dealers and small agents in a way

so as to cause the exchange rate to move in a particular way and make a profit in the process.

I shall illustrate this in a very simple way. Let p^* be the equilibrium price in the model described in Section 2 where all dealers are basically Cournot agents. I will show that for the manipulator it is possible to buy dollars and still leave the exchange rate unchanged. Then in the next period she can sell these dollars and, at the same time, have the price p rise above p^*. In other words, she causes a depreciation of the currency and profits by it.

Consider a number $x(p^*) > y > 0$. I shall first show that there exists a strategy, $f^1(.)$, that the manipulator can use to make sure the exchange rate is p^* and she gets to buy y dollars. The superscript on f reminds us that this is what the manipulator does in period 1, when she is trying to buy y dollars without altering the price of the original equilibrium, p^*. In period 2, she will off-load the y dollars but in such a manner that the price of dollars actually rises to a level above p^*.

Without burdening the reader with how I got there, let me straight away present the strategy, $f^1(.)$, that does the job for dealer 1, that is, the manipulator.

$$f^1(p) = x(p) - \frac{[(p^* - c)n - p^* + p][x(p^*) + y]}{(p^* - c)n} \qquad (6)$$

It is important to understand what the manipulator's strategy says. It says that, in case the market price of dollars is p, she will buy $f^1(p)$ dollars as defined by (6). Observe that (6) is a well-defined function. Recall $x(p)$ is the net demand for dollars after the price-taking agents have bought and sold what they would like at price p. And p^* is the price that prevailed in the original equilibrium before the currency manipulator arrived on the scene.[4]

It is laborious but easy to check that if the n dealers face the net demand function for dollars, $x(p) = d(p) - s(p)$, and take as given the manipulator's

[4] It is being assumed the currency manipulator is a new agent that comes into the foreign exchange market. It is entirely possible to think, instead, in terms of one of the dealers turning manipulator. This simply entails changing n to (n-1) in equation (6) and also in (7).

strategy, (6), described above,[5] then, in equilibrium, they will end up selling $x(p^*) + y$ dollars. The price will be p^* and the manipulator will buy y dollars since $f^1(p^*) = y$.

All that the manipulator now has to do is to think of strategy $f^2(p)$ in period 2 so that the price in period 2 ends up being greater than p^* and she manages to sell off the y dollars at that price. In short, she would have made a tidy profit, buying y dollars at p^* rupees per dollar in one period and selling y dollars at a higher price in another period.

To demonstrate this, define $\hat{\hat{p}}$ implicitly by $d(\hat{\hat{p}}) = s(\hat{\hat{p}})$. Now choose any price level $\hat{p}$ such that $\hat{\hat{p}} > \hat{p} > p^*$. I shall show that the manipulator can choose a strategy $f^2(p)$, which enables her to sell off y dollars at a price of $\hat{p}$ rupees per dollar.

Again, without burdening the reader on how I get to this, let me directly specify they strategy, $f^2(p)$, that does the job.

$$f^2(p) = x(p) - \frac{[(\hat{p} - c)n + \hat{p} - p][x(\hat{p}) + y]}{(\hat{p} - c)n} \qquad (7)$$

Faced with dealer 1's strategy, which is described in (7), and the demand and supply functions of the price-taking agents, the n dealers will get to an equilibrium such that the price of dollars is $\hat{p}$ and the manipulator gets to sell off the y dollars she had bought at a lower price in the previous period.

The proof of my claim is easy to establish as follows. In period 1, assume that the price-taking agents behave as specified above, demanding and supplying as per the functions described in (1) and (2); assume that the manipulator plays the strategy described in (6). Let now the dealers play the standard Cournot oligopoly game taking (1), (2), and (6) as given. It is easy to check that equilibrium price will be p^* and the manipulator will be buying y dollars in equilibrium. Now in period 2, say the following month, when the game is being played again, assume

[5] In this sense the manipulator is like a Stackelberg leader (as in, for instance, Basu and Singh, 1990). However, in this paper we do not work out the sub-game perfect equilibrium but simply show how the manipulator or the Stackelberg leader can make a profit.

everything else remains the same except that the manipulator now uses the strategy described in (7). It can be easily checked that in the Cournot equilibrium the price will be $\hat{p}$ and the manipulator will be selling y dollars. Since $\hat{p}$ > p*, she would have made a profit.

4. Discussion

Intuitively, the manipulator works by making contingent plans for how many dollars she will buy and sell at out-of-equilibrium prices. This is what drives ordinary dealers, playing a Cournot game, to behave in a way that allows the manipulator to profiteer.

The central bank and regulator, especially in emerging economies, have little notion of how the currency manipulator works and so have dealt with this problem inadequately. The first step in rectifying this is to study the dubious art of currency manipulation and to get a firm understanding of how the manipulator works. That is what this paper tried to do. As must be evident, the manipulator's art is not as straightforward as popular discourse makes it out to be. Lack of scruples may be a necessary condition but it is by no means sufficient. The manipulation requires a level of sophistication and a deep pocket (to make the out-of-equilibrium behavior credible) that all may not have. Moreover, it should be evident from the model that the scope for market manipulation arises in the first place because of the presence of oligopolistic agents on the market. So the promotion of greater competition is the first step to take to deter manipulation of exchange rates. But this action may not always be open to a national regulator because operations on foreign exchange deals typically take place globally and in regions where the national regulator's arm does not reach.

As do many theory papers, this one opens up several follow-up research questions. One may wish to ask, what would happen if more than one manipulator enters the market or what if the central bank uses strategic interventions with contingent buying and selling plans? It can be shown that, given strategic substitutability among dealers (*a la* Singh and Vives, 1984), central

banks can intervene to move exchange rates in desirable directions without altering their foreign exchange reserves (Basu, 2012; Basu and Varoudakis, 2013). It will be interesting to investigate whether such central bank interventions can be used to neutralize the manipulator.

Although this paper does not go into what the regulator should do when faced with the manipulation problem (although it does the spade work for such an exercise), it casts an interesting light on futures trading in currency. Since the manipulator needs somehow to convey to the market her contingent plans—"I will buy so much, if the price is such and such; I will sell so much, if the price is something else" and so on—and contingent plans are like commitments on futures trade, restrictions on futures trade could curb the manipulator's domain of function. Given that futures markets serve other valuable functions, we must not jump to policy conclusions. This simply shows the kinds of policy issues that can open up with the kind of analysis done in this paper.

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