The interdealer market and the central bank intervention

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Abstract

This paper studies the consequences of having either an interventionist or a non-interventionist central bank in the foreign exchange market, in a market microstructure framework.

Although a simple one-period model is used, it allows the characterization of the effect of the central bank intervention on the behaviour of dealers.

The model also identifies the conditions for the dealer that acts as the counterpart of the central bank to be better or worse than the other dealers.

The price is expected to be more informative with an interventionist central bank.

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INTRODUCTION

A considerable part of the market microstructure literature analyses the behaviour of dealers. Dealers are at the centre of the provision of liquidity and of the setting of the bid-ask spread. Some studies stress their inventory management function, others the way they deal with better-informed clients. Some consider only one dealer, others admit competition. Most analyse dealers interacting with non-dealer clients.

The object of our study is the influence of the central bank on the behaviour of dealers in the foreign exchange market and on the market equilibrium. This is relevant to the comprehension of the effect of the exchange rate system on the pricing and trading behaviour of dealers, which may be seen as the influence of a macro characteristic in the microstructure of the foreign exchange market.

Our main result is that, given the same fundamentals, the foreign exchange rate may be different if the exchange rate system is a free float or if the exchange rate is floating inside a band in a target zone. It may even happen that the same absence of actual intervention by the central bank and the same fundamentals coexist with different exchange rate levels, for different exchange rate regimes. This is consistent with the

stylized fact that there is little evidence of a close relationship between the exchange rate regime and the fundamentals.[*]

Another result of the paper is that the dealer who is chosen as a counterpart by the central bank is not necessarily in a better position than the other dealers in the market, even though it has access to an additional signal. This has two reasons. In the first place, it is not guaranteed that the central bank has the right information. If the central bank is mistaken, the dealer who receives its signal will be worse than if he did not receive it. In the second place, the dealer that is trading with the central bank is more confident than the others in the recognition of an undervalued or of an overvalued currency, which implies a larger intensity of trading. That happens, for instance, when the signal of the central bank is equal to the public expectations. If they are all wrong, the dealer who trades with the central bank is worse than the others because he has traded more. We derive the explicit conditions for the chosen dealer to be better or worse than the others.

Finally, and not surprisingly, the price is expected to be more informative with an interventionist central bank.

We do not expressly address the effectiveness of the intervention, in this paper.

The remainder of the paper is organised as follows. Section 1 presents a brief review of the literature. Section 2 describes the assumptions of the model. Section 3 analyses the behaviour of a dealer in a foreign exchange market with no central bank. Section 4 introduces the possibility of having a dealer trading with the central bank. Section 5 analyses the behaviour of the central bank. Sections 6 and 7 derive the equilibrium prices without and with an interventionist central bank. Section 8 extracts the implications of the model. Finally, section 9 concludes.

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[*] See, for instance, Jeanne and Rose (2002).

1. RELATED LITERATURE

Only a few papers have introduced the central bank in market microstructure frameworks.

Bossaerts and Hillion (1991) considered the intervention of the central bank in the foreign exchange market, in a market microstructure model. However, their aim was not to model the behaviour of the participants in the foreign exchange market including the central bank, but to test the effect of a central bank intervention on the forward exchange rate bias. Their model considered the existence of a bid-ask spread, but the central bank intervention was left exogenous. The intervention was introduced in the model as a change in the perceived distribution of the exchange rate variation. Our model is completely different from the one in Bossaerts and Hillion (1991). Although it also reflects the asymmetric information problem, we do not model the bid-ask spread. Instead, we explicitly model the behaviours of the dealers and of the central bank and make assumptions reflecting the foreign exchange market characteristics. We focus on information and institutions.

More in the line of our model are Bhattacharya and Weller (1997) and Vitale (1999). They also deal with the impact of central bank intervention on the foreign exchange market, in a market microstructure perspective. However, the frameworks are different.

Bhattacharya and Weller (1997) develop a model that holds several similarities with ours: it is a one-period model with asymmetric information, the objective function of the central bank has two components, the central bank is risk neutral and the

speculators (corresponding to the dealers in our model) have CARA utility functions. Nevertheless, the objective functions are different.

In Bhattacharya and Weller (1997), one of the components of the objective function of the central bank measures its gain/loss with the intervention, and the other component captures the preference for a certain target value of the foreign exchange spot rate. The optimal intervention is equivalent, in their model, "to the optimal choice of the current spot exchange rate", because the size of the intervention must be such that, combined with the rest of the trades in the Forex, it clears the market. The current spot exchange rate influences both the gain/loss of the central bank and the speculative demand of the rest of the participants in the market. In our model, there is also a component related to profit obtained with the intervention – and that may also be interpreted as a low volatility objective -, but we add a component that incorporates a target for the level of reserves. Therefore, in our model, the target is not the level of the spot rate but the level of foreign reserves. The central bank wants to limit volatility as long as it does not depart too much from its desired level of reserves.

In Bhattacharya and Weller (1997), the dealers' problem is similar to ours. The main difference is that where we use F (fundamental value), they use P_1, (the exchange rate next period). If we make $P_1 = F$ - which is admissible in a one period model -, it is the same objective function.

In Vitale (1999), the model has a Kyle (1985) structure, with only one modelled market maker, and the price equal to the expected fundamental value of the foreign currency given the total order flow. In our model, the order flow is not observed before the price is set, but the opposite happens[†], which is consistent with the functioning of the foreign exchange market. We explicitly consider the existence of several dealers (or

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[†] *A la* Lyons. See, for instance, Lyons (1997).

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market makers). Also, the objective functions of the central bank are different, although both include a purely speculative motive, and another kind of motive.

D'Souza (2002) also uses a model of the interdealer foreign exchange market that is based on the simultaneous trade model in Lyons (1997). However, in his model, the central bank is just another customer "type", and has not a different kind of objective function.

2. THE MODEL

This is a one period model.

There are two assets: the foreign currency and the national currency. The national currency is the numeraire. The foreign currency is the risky asset. The knowledge of the fundamental value of the risky asset (F) is made public after the trade takes place, at the end of the period.

There are n dealers, one central bank and an indefinite large number of clients.

In the foreign exchange market, the n dealers post their quotes before they know the flow of orders they are going to receive. They act in competition.

Even though the information any particular client possesses is unknown, the market as a whole is able to capture the fundamental value of the foreign currency, with a margin of error. This means that the investors' errors somehow compensate themselves so that the market as a whole is able to grasp the fundamental value of the foreign currency.

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Each dealer receives a private signal through the order flow from clients. The exogenous order flow dealer i receives from clients, without being observed by the others, is:

$$c_i = c + x_i \qquad (1)$$

c_i represents net clients' purchases: a positive c_i means that the dealer i clients want to purchase more than to sell.

c is a component that is common to the entire market and is:

$$c = F + v \qquad (2)$$

$$x_i \sim N(0, s_x)$$

$$F \sim N(f, s_F)$$

$$v \sim N(0, s_v)$$

The second element inside brackets is the variance.

x_i, v and F are uncorrelated with each other.

The central bank does not receive an order flow from clients, but has some superior knowledge of certain variables that may influence the value of the foreign currency. So, the central bank gets a private signal:

$$b = F + e \qquad (3)$$

$$e \sim N(0, s_e)$$

s_e is, consistently, the variance of e.

Since the central bank considers the fundamental value of the foreign currency as given, we are implicitly assuming that the foreign exchange policy is no determinant of other policies that may influence F. The same assumption is made in Vitale (1999).

The n dealers and the central bank maximise different functions.

Each dealer maximises a negative exponential function of his profit.

The dealer i's problem is:

$$Max_{Q_i} \; E\{-\exp(-\theta.(F-P).Q_i) \mid \Omega_i\} \tag{4}$$

Ω_i is the information set of dealer i. This information set may include only the flow of orders from clients or may also include the order of the central bank if the central bank chooses to trade with this dealer.

Q_i is dealer i's desired foreign currency position.

P is the foreign exchange rate quoted by dealer i. It is not a P_i because, as we will see in section 6, each dealer quotes the same price.

θ is the coefficient of risk aversion.

The central bank maximises a function that has two components. The first one may be seen as a profit maximisation component, which is present in the management of reserves central banks do. It may also be interpreted as a low volatility objective, since if the central bank sells when the price is high compared to the fundamental value and buys when the price is low, its action should contribute to avoid large deviations from the fundamental value. The second component of the objective function reflects the intent of not getting far from an adequate (exogenously defined) level of foreign reserves.

This may be an objective function of a central bank in a target zone: it buys when the price is low and sells when the price is high, but, simultaneously, it must pay attention to the level of reserves in order not to trigger a crisis.

We assume that the central bank places its order (Q_B, net purchases) with only one dealer.

The central bank's problem is

$$Max_{Q_B} \; E\{ (F - P).Q_B - \beta.(Q_B)^2 \mid \Omega_B\} \tag{5}$$

Ω_B is the information set of the central bank.

Q_B is the order placed by the central bank. A positive value is a purchase and a negative value is a sale.

β is the (positive) parameter that expresses the degree of commitment of the central bank to the reserves target.

For simplicity, the central bank does not want to get very far from a zero foreign exchange position and it is in that position at the beginning of the period.

So, the sequence of actions runs as follows:

1) Every dealer quotes a price, which is valid for orders of any dimension.

2) Every dealer observes his order flow from clients and one of them observes the order from the central bank, if the central bank intervenes.

3) Every dealer decides what order to place in the interdealer market and place it simultaneously.

3. DEALER i'S PROBLEM WHEN HE RECEIVES NO ORDER FROM THE CENTRAL BANK ($\Omega_i = \{c_i\}$)

In order to solve dealer i's problem, it is necessary to calculate $E(F \mid \Omega_i)$ and $Var(F \mid \Omega_i)$.

$$E\{ F \mid \Omega_i \} = f + (cov(F, c_i)/ var(c_i)).(c_i - f) =$$

$$f + \{ [E(c.F + x_i.F) - f^2]/ [var(c) + s_x] \}.(c_i - f) =$$

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$$f + (s_F / (s_F + s_v + s_x)).(c_i - f) \qquad\qquad (6)$$

$$Var(F \mid \Omega_i) = s_F - (s_F)^2 / (s_F + s_v + s_x) \qquad\qquad (7)$$

Setting $Z_1 \equiv s_F / (s_F + s_v + s_x)$, dealer i's problem is:

$$Max_{Q_i} \{ \theta.(f + Z_1.(c_i - f) - P).Q_i - 0,5.\theta^2. Q_i^2.s_F.(1 - Z_1) \} \qquad\qquad (8)$$

The first order condition is:

$$\theta.(f + Z_1.(c_i - f) - P) - \theta^2. s_F.(1 - Z_1).Q_i = 0 \qquad\qquad \Leftrightarrow$$

$$Q_i = \frac{f + Z_1.(c_i - f) - P}{\theta. \ s_F.(1 - Z_1)} \qquad\qquad (9)$$

Expression (9) is, therefore, dealer i's desired foreign currency position, when he receives no order from the central bank. It is larger:

- the larger the signal received from the order flow from clients compared to the common expected value of the foreign currency;

- the cheaper the foreign currency;

- the smaller the risk aversion.

4. DEALER i'S PROBLEM WHEN HE RECEIVES AN ORDER FROM THE CENTRAL BANK $(\Omega_i = \{c_i, Q_B\})$

In order to solve dealer i's problem, it is necessary to calculate $E(F \mid \Omega_i)$ and $Var(F \mid \Omega_i)$ once again. Now this is a more complex calculation, since the information set that conditions expectations is larger.

$$E\{ F|\, \Omega_i \} = f + \frac{(Cov(c_i,Q_B).Cov(F,Q_B) - Var(Q_B).s_F).(c_i - f)}{(Cov(c_i,Q_B))^2 - Var(Q_B).(s_F + s_v + s_x)} +$$

$$+ \frac{(Cov(c_i,Q_B).s_F - Cov(F,Q_B).(s_F + s_v + s_x)).(Q_B - E(Q_B))}{(Cov(c_i,Q_B))^2 - Var(Q_B).(s_F + s_v + s_x)} \quad (10)$$

$$Var(F|\Omega_i) = s_F \ -$$

$$- \frac{-(s_F)^2.Var(Q_B) + 2s_F.Cov(c_i,Q_B).Cov(F,Q_B) - (Cov(F,Q_B))^2.(s_F + s_v + s_x)}{(Cov(c_i,Q_B))^2 - Var(Q_B).(s_F + s_v + s_x)} \quad (11)$$

Let us set $\boldsymbol{D_1} \equiv (Cov(c_i,Q_B))^2 - Var(Q_B).(s_F + s_v + s_x)$,

$$\boldsymbol{Z_2} \equiv \frac{(Cov(c_i,Q_B).Cov(F,Q_B) - Var(Q_B).s_F)}{D_1}$$

$$\boldsymbol{Z_3} \equiv \frac{(Cov(c_i,Q_B).s_F - Cov(F,Q_B).(s_F + s_v + s_x))}{D_1}$$

$$\boldsymbol{Z_4} \equiv$$

$$\frac{-(s_F)^2.Var(Q_B) + 2s_F.Cov(c_i,Q_B).Cov(F,Q_B) - (Cov(F,Q_B))^2.(s_F + s_v + s_x)}{D_1} \ .$$

The dealer i's problem may be written as:

$Max_{Q_i} \{ \ \theta.(f + Z_2.(c_i - f) + Z_3.(Q_B - E(Q_B)) - P).Q_i - \ 0{,}5.\theta^2. Q_i^2.(s_F - Z_4) \}$.

$$(12)$$

The solution is:

$$Q_i = \frac{f + Z_2.(c_i - f) + Z_3.(Q_B - E(Q_B)) - P}{\theta.(s_F - Z_4)} \quad . \tag{13}$$

Q_i is the foreign exchange position desired by dealer i, when the central bank is expected to trade.

In the same period that a dealer decides how much of the foreign currency he is willing to have, he receives his clients' orders and also the other dealers' orders. Therefore, the decision of how much dealer i is going to purchase or sell has to take the order flow dealer i receives from the others into account.

$$T_i = Q_i + c_i + E\{T'_i|\ \Omega_i\} + Q_{Bi} \tag{14}$$

T_i denotes dealer i's net purchases. They are orders placed by the dealer i.

T'_i denotes net purchases by other dealers from dealer i. A positive value means that dealer i is receiving more purchasing orders than selling orders.

Q_{Bi} is the order placed by the central bank with dealer i. If the central bank intervenes and trades with dealer i, then $Q_{Bi} = Q_B \neq 0$. If the central bank does not intervene at all, $Q_B = 0$. If the central bank intervenes but does not trade with dealer i, $Q_B \neq 0$ and $Q_{Bi} = 0$.

5. THE CENTRAL BANK'S PROBLEM

What is the order placed by the central bank? As was seen above, the central bank's problem is:

$$Max_{Q_B} E\{ (F - P).Q_B - \beta.(Q_B)^2\ |\ \Omega_B\} \tag{15}$$

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with $\Omega_B = \{b\}$

In order to solve this problem, it is necessary to calculate $E(F|\Omega_B)$.

$$E(F|\Omega_B) = f + (cov(F, b)/var(b)).(b - f) = \tag{16}$$

$f + ((s_F)/(s_F + s_e)).(b - f)$

Making $Z_5 \equiv s_F/(s_F + s_e)$,

$$Q_B = 0,5.(f + Z_5.(b - f) - P)/\beta. \tag{17}$$

The central bank does not intervene if its perception of the fundamental value of the foreign exchange coincides with the common expectation of the fundamental value and additionally, the price quoted also coincides with the common expectation of the fundamental value of the foreign exchange. That is equivalent to saying that the central bank does not intervene when it sees that the price coincides with the weighted average of its perception of the fundamental value and the common expectation of it, where the weights are given by the confidence in its private signal.

Introducing the behaviour of the central bank into the desired quantity of the dealer that trades with the central bank, the desired foreign currency position turns out to be:

$$Q_i = \frac{f + Z_2.(c_i - f) + Z_3.Z_5(b - f)/(2\beta) - P}{\theta.(s_F - Z_4)}. \tag{18}$$

The consideration of another signal - the order from the central bank - instead of just the one from the clients' order flow, is the responsible for a term in $(b - f)$. The

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impact of one unit of order flow from clients on the desired position of a dealer i is still $(\theta.(s_v + s_x))^{-1}$. The impact of a price variation on the desired foreign currency position is now more negative. For a dealer who does not trade with the central bank, the impact of the price variation is $-(s_F + s_v + s_x)/[\theta.s_F.(s_v + s_x)]$. For a dealer who trades with the central bank, the impact of the price variation is the same expression plus $-(\theta.s_e)^{-1}$. That is, the fact that the dealer is trading with the central bank gives him more confidence in the recognition of an undervalued or of an overvalued currency.

At this point, it is possible to explicitly calculate Z_2, Z_3 and Z_4. Table 1 shows the expressions for all Z_i's.

6. THE EQUILIBRIUM WITHOUT CENTRAL BANK OR WHEN THE CENTRAL BANK IS KNOWN NOT TO INTERVENE

In this case, $T_i = Q_i + c_i + E\{T'_i|\ \Omega_i\}$.

Because the market is decentralised, the prices dealers quote could be different from each other. However, the existence of competition, together with the existence of electronic systems that publicise the quotes lead to a common quote. So, as in Lyons (1997), if the quote is to be common, it has to be based on common information, that is, on public information.

In order to find the equilibrium price that the dealers quote, we must require that the price satisfies the condition above in expectation. Because there is symmetry among dealers, this ensures that the clients' order flows are absorbed by the net trade volume of the dealers.

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Because of symmetry, the unconditional expectation of T_i is equal to the unconditional expectation of $E\{T'_i|\,\Omega_i\}$. So, the price condition is:

$$(f - P)/\,(\theta.\, s_F.(1 - Z_1)) + f = 0 \qquad (19)$$

which leads us to

$$P = f.(1 + \lambda_1), \quad \text{with } \lambda_I \equiv \theta.\, s_F.(1 - Z_1) \qquad (20)$$

7. THE EQUILIBRIUM WHEN THE CENTRAL BANK MAY INTERVENE

When the central bank intervenes, the symmetry seems to be lost since we have assumed that the central bank trades with only one dealer. However, the symmetry may be reintroduced if we assume that the probability of trading with any dealer is the same. Then, taking unconditional expectations of (14),

$$(1/n).(f - P)/(\,\theta.(s_F - Z_4)) + ((n-1)/n).((f-P)/(\,\theta.s_F.(1 - Z_1)) + f + (f - P)/(2\beta.n) = 0 \,,$$

$$(21)$$

which leads us to

$$P = f (1 + \lambda_2), \qquad (22)$$

with $\lambda_2 \equiv 2\beta.n.\,\theta.(s_F - Z_4).(1 - Z_1)/$

$/\{2\beta.(1-Z_1) + 2\beta.(n-1).(1 - Z_4/s_F) + \theta.(s_F - Z_4).(1 - Z_1) \}.$

It is easily shown that $s_F - Z_4 > 0$.

Together with $(1 - Z_1) > 0$, we find that the numerator of λ_2 is positive.

$1 - Z_4/s_F > 0$

Together with $(1 - Z_1) > 0$ and $s_F - Z_4 > 0$, we find that the denominator of λ_2 is positive.

Therefore, λ_2 is undoubtedly positive.

8. RESULTS

R1. <u>Even if the central bank does not intervene, the mere possibility of an intervention makes a difference</u>.

If it is possible that the central bank operates in the market but it chooses not to do so – that is, $Q_B = 0$ – the equilibrium price is $P = f(1 + \lambda_2)$ instead of $P = f(1 + \lambda_1)$.

Since, from equation (9), the dealers' orders in the interdealer market are a function of the price level, the fact that the price is different in both situations also generates different trade volume in the interdealer market.

The rationale for this result is obviously related to the reason why the price changes with the mere possibility of central bank intervention.

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The price all dealers quote must be the one the dealers expect to be the equilibrium price. Since they have to decide on the price before they know the order flow they will receive, they use their expectations about the order flow when they quote the price. If they know in advance that the central bank does not operate in the market, any dealer attaches an expected value of zero to an order received from the central bank. However, if a central bank intervention is *a priori* admissible, the expected value of an order received from the central bank is different from zero, as long as $P \neq f$.

It may be that $P \neq f$ and the central bank does not intervene in the market. This happens when the private signal the central bank gets takes the value $b = f + (1/Z_5).(P-f)$. Therefore, if a central bank intervention is *a priori* admissible, a non-intervention outcome is compatible with the positive expectation of an intervention. Since it is the expectation that determines the price, the central bank non-intervention is compatible with two different price levels, depending on whether the absence of the central bank in the market is or is not known in advance.

R2. <u>The price informativeness is larger with an interventionist central bank .</u>

The price informativeness is the extent to what the price reflects the asset fundamental value. In order to investigate if the price is, on average, closer to the asset fundamental value with or without an interventionist central bank, we have to compare λ_1 with λ_2.

If the price informativeness is larger with an interventionist central bank,

$\lambda_1 > \lambda_2 \qquad\qquad \Leftrightarrow$

$\theta. s_F.(1 - Z_1) \quad > \quad 2\beta.n.\theta.(s_F - Z_4).(1 - Z_1)/$

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$/\{2\beta.(1-Z_1) + 2\beta.(n-1).(1 - Z_4/s_F) + \theta.(s_F - Z_4).(1 - Z_1)\}$ $\Leftrightarrow$

$1 > 2\beta.n.(1 - Z_4/s_F)/\{2\beta.(1-Z_1) + 2\beta.(n-1).(1 - Z_4/s_F) + \theta.(s_F - Z_4).(1 - Z_1)\}$

As we have seen, the denominator of λ_2 is positive. This allows us to write

$2\beta.(1-Z_1) + 2\beta.(n-1).(1 - Z_4/s_F) + \theta.(s_F - Z_4).(1 - Z_1) > 2\beta.n.(1 - Z_4/s_F)$ $\Leftrightarrow$

$2\beta.(1-Z_1) - 2\beta.(1 - Z_4/s_F) + \theta.(s_F - Z_4).(1 - Z_1) > 0$ $\Leftrightarrow$

$2\beta.(Z_4/s_F - Z_1) + \theta.(s_F - Z_4).(1 - Z_1) > 0$

As we have seen, $s_F - Z_4 > 0$ and $1 - Z_1 > 0$.

$Z_4/s_F - Z_1$ is also positive.

Therefore, it is guaranteed that the left member of the inequation is positive. The condition for the price informativeness to be, on average, larger with an interventionist central bank always holds, since β is a positive parameter. The price informativeness is always expected to be larger when the central bank intervenes.

This is due to the fact that the central bank has superior information of its own. Its participation in the market leads to the incorporation of its private information in the price, resulting in a more informative price. This is so, despite the central bank having an objective function that is not exclusively dependent on the relation between the expected fundamental value of the foreign currency and its price.

R3. <u>It may be that the dealer who trades with the central bank has a larger utility than the others do</u>

The utility of a dealer who does not trade with the central bank is:

$- \exp(-\theta.(F - P).Q_i) =$

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$$-\exp\{-\theta.(F - f(1 + \lambda_2)).\frac{f + Z_1.(c_i - f) - f(1 + \lambda_2)}{\theta.s_F.(1 - Z_1)}\}\ .$$

The utility of the dealer who trades with the central bank is:

$$-\exp(-\theta.(F - P).Q_i) =$$

$$-\exp\{-\theta.(F - f(1 + \lambda_2)).\frac{f + Z_2.(c_i - f) + Z_3.Z_5(b - f)/(2\beta) - f.(1 + \lambda_2)}{\theta.(s_F - Z_4)}\}.$$

Let us assume that $F > P$. In this case, the utility of a dealer who does not trade with the central bank is larger than the utility of the dealer who trades with the central bank if

$$\frac{f + Z_1.(c_i - f) - f(1 + \lambda_2)}{\theta.s_F.(1 - Z_1)} >$$

$$\frac{f + Z_2.(c_i - f) + Z_3.Z_5(b - f)/(2\beta) - f.(1 + \lambda_2)}{\theta.(s_F - Z_4)} \qquad \Leftrightarrow$$

$$[f - f.(1 + \lambda_2)].\ [\frac{1}{\theta.s_F.(1 - Z_1)} - \frac{1}{\theta.(s_F - Z_4)}]\ +$$

$$(c_i - f).[\ \frac{Z_1}{\theta.s_F.(1 - Z_1)} - \frac{Z_2}{\theta.(s_F - Z_4)}]\ +$$

$$(b-f).[-\frac{Z_3.Z_5}{2\beta.\theta.(s_F - Z_4)}] > 0 \qquad \Leftrightarrow$$

$$[f - f.(1 + \lambda_2) + (b-f)].(-1/(\theta.s_e)) > 0 \qquad (23)$$

For a dealer to be better when he is not the one who is trading with the central bank, it is necessary that $f - f.(1+\lambda_2) + (b - f) < 0$. That is, on average, people expect F to be smaller than P because dealers, who define the price level, are risk averse traders. But if it happens that F > P, the private signals the dealers receive may let them have the right expectations. The signal they receive from their clients will not change by trading with the central bank. Therefore, it is irrelevant here, and that is why $(c_i - f)$ does not appear in the expression (23).

The signal the central bank receives, which is transmitted to the dealer that acts as a counterpart, is the other possible source of correction of the expectations. In the first place, however, that signal must be in the right direction, that is, b > f. If b < f, the dealer who trades with the central bank is getting a wrong signal. But that is not completely necessary for the dealer who does not trade with the central bank to be better. Even when b = f, that is, when the central bank's signal does not change the common expectations, the dealers who do not trade with the central bank have a larger utility level than the dealer who trades with the central bank. This is because $[f - f.(1+\lambda_2)].(-1/(\theta.s_e))$ reflects the larger intensity of trade as a result of the larger confidence in the recognition of an undervalued or of an overvalued currency, for the dealer who trades with the central bank. If f < P, but F > P, for the same level of P, the dealer who trades with the central bank would want a smaller foreign currency position than the other dealers, to his disadvantage.

Now, let us assume that $F < P$. The utility of a dealer who does not trade with the central bank is larger than the utility of the dealer who trades with the central bank if $[f - f.(1+\lambda_2) + (b-f)].(-1/(\theta.s_e)) < 0$. In this case, the dealers who do not trade with the central bank are better than the dealer who trades with the central bank if the last

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one gets a wrong signal, and furthermore, if the effect of the mistake is larger than the effect of the larger intensity of trading in face of a certain difference between f and P, on part of the dealer who trades with the central bank.

We can see that $F > P$ is more propitious than $F < P$ for the dealers who do not trade with the central bank to have a larger utility than the dealer who trades with the central bank.

9. CONCLUSIONS

The purpose of this paper was to study the effect of the presence of an interventionist central bank in the foreign exchange market, in a market microstructure framework, that is, considering how it affects the dealers' behaviour. Since the interdealer market trade volume amounts to a large proportion of the total foreign exchange trade volume, it was important to model the functioning of the interdealer market.

Dealers were identified with better-informed traders, who have indirect access to several signals. This gave the opportunity to look at the central bank as an economic agent who has the potential to transmit superior information to the dealer chosen as a counterpart in the trade.

We showed that the mere possibility of a central bank intervention changes the market equilibrium.

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The price is expected to be more informative with an interventionist central bank, even though its objective function includes a targeting motive for intervention, that is not based on information about the fundamental value of the currency.

The dealer that is trading with the central bank is more confident than the others in the recognition of an undervalued or of an overvalued currency.

Although having access to more information, it is not guaranteed for a dealer who trades with the central bank to have larger utility than the other dealers do. We derived the explicit conditions under which that dealer has a larger utility level.

REFERENCES

Bhattacharya U and P Weller (1997) On the advantage to hiding one's hand: speculation and central bank intervention in the foreign exchange market. Journal of Monetary Economics 39: 251-277.

Bossaerts P and P Hillion (1991) Market microstructure effects of government intervention in the foreign exchange market. Review of Financial Studies 4: 513-541.

D'Souza C (2002) A market microstructure analysis of foreign exchange intervention in Canada. Bank of Canada WP 2002-16.

Jeanne O and A Rose (2002) Noise trading and exchange rate regimes. The Quarterly Journal of Economics 117: 537-569.

Kyle A (1985) Continuous auctions and insider trading. Econometrica 53: 1315- 1335.

Lyons R (1997) A simultaneous trade model of the foreign exchange hot potato. Journal of International Economics 42: 275-298.

Vitale P (1999) Sterilized central bank intervention in the foreign exchange market. Journal of International Economics 49: 245-267

Table 1

Z_i's Values

Z_1	$\dfrac{s_F}{s_F + s_v + s_x}$
Z_2	$\dfrac{-s_e . s_F}{s_F^2 - (s_F + s_e)(s_F + s_v + s_x)}$
Z_3	$\dfrac{-(s_e + s_F).(s_v + s_x)}{\left[s_F^2 - (s_F + s_e)(s_F + s_v + s_x)\right]/(2\beta)}$
Z_4	$\dfrac{-s_F^2 .(s_e + s_v + s_x)}{s_F^2 - (s_F + s_e).(s_F + s_v + s_x)}$
Z_5	$\dfrac{s_F}{s_F + s_e}$