



The impact of FX central bank intervention in a noise trading framework

Michel Beine^{a,*}, Paul De Grauwe^b, Marianna Grimaldi^c

^a University of Luxembourg, University of Brussels (Belgium) and CES-Ifo, 162A, avenue de la Faiencerie, Luxembourg

^b Katholieke Universiteit Leuven, Naamsestraat 69-3000, Leuven, Belgium

^c Sveriges Riksbank, SE-103 37 Stockholm, Sweden

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ABSTRACT

In this paper, we analyse the effectiveness of the direct central bank interventions using a new effectiveness criterion. To this aim, we investigate the effects of central bank interventions (CBI) in a noise trading model with chartists and fundamentalists. We first estimate a model in which chartists extrapolate past returns and fundamentalists forecast a mean reverting dynamics of the exchange rate towards a fundamental value. Then, we investigate the role of central bank interventions for explaining the switching properties between the two types of agents. We find evidence that in the medium run, interventions increase the proportion of fundamentalists and therefore exert some stabilizing influence on the exchange rate.

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1. Introduction

Direct interventions in the foreign exchange (FX) market have often been used as a policy instrument by the major central banks. By sterilizing their operations, monetary authorities have used these interventions as a stabilisation tool independent of monetary policy. While some authorities like the US Federal Reserve have been increasingly reluctant to use central bank interventions (CBIs hereafter), other major central banks like the European Central Bank (ECB) or the Bank of Japan (BoJ) have conducted several rounds of interventions over the last 5 years.

Despite the wide use of direct interventions by the central banks, researchers (as well as policy makers) have questioned the effectiveness of such an instrument. Within the literature devoted to the conduct of foreign exchange rate policies, the issue of effectiveness is the one which has received the greatest attention. Recent surveys (see [Humpage, 2003](#)) offer a useful review of this strand of the literature. One problem in assessing whether interventions have delivered the intended goal is that the objectives followed by the central banks are rarely known by external researchers. Several possible objectives have been mentioned including influencing trend movements, reversing past trends,

smoothing exchange rate volatility or creating monetary base through unsterilized operations. While a couple of international agreements like the Plaza agreement in 1985 and the Louvre agreement in 1987 provide some insight about the ultimate goal of these interventions, the objectives are likely to change over time and to differ across central banks.¹

In this paper, we develop an analysis directly consistent with a new criterion of effectiveness. A direct criterion of effectiveness used in the empirical literature is whether the exchange rate level reacts to the central bank purchases or sales of foreign currency in the intended direction the day of the intervention ([Beine et al., 2002](#)). The adoption of this criterion stems from the fact that the most frequent objective followed by central banks concerns the dynamics of the first moment of exchange rate returns. In general, the bulk of the empirical studies found that central bank interventions did not induce the intended changes in the exchange rate level. Some studies found even some moderate evidence of perverse results, which is difficult to rationalize (see nevertheless [Bhattacharya and Weller, 1997](#)). Quite recently however, new empirical approaches have provided more support for efficiency in the sense that the exchange rate was found to react significantly (and in the intended direction) to the central bank operation. Using

* Corresponding author. Tel.: +352 4666446752; fax: +352 4666446336.

E-mail addresses: michel.beine@uni.lu (M. Beine), Paul.DeGrauwe@econ.kuleuven.be (P.D. Grauwe), marianna.grimaldi@riksbank.se (M. Grimaldi).

¹ Lack of transparency in the FX policy is clearly one major source for identifying the explicit goals. The use of imprecise terms in central bank's statements also leads to some difficulty of interpretation.

intradaily data, Dominguez (2003) as well as Payne and Vitale (2003) indeed show that such an effect might show up in the very short run, i.e. within a few minutes after the occurrence of the operations.

While simple and straightforward, the use of this criterion of effectiveness raises two questions. First, the objective followed by the central bank might be less simple than influencing the level within the day or the hour of the intervention. For instance, the central bank might be willing to break a past depreciating or appreciating trend of its currency. In this case, insignificant results in terms of returns might lead to overemphasizing the poor performance of the operations. To tackle this point, some authors Fatum and Hutchison (2003) have conducted event studies that allow to introduce more flexibility in terms of the possible objectives followed by the central bank(s).² The second issue is the optimal horizon followed by central banks. While this horizon might differ across central banks and over time, central bank surveys (Neely, 2001) tend to show that central banks also care about the developments of the exchange rate beyond the day of the intervention. Promising outcomes generated by the intervention in the very short run might thus be meaningless for central bankers if they are reversed later on. Conversely, the use of successive interventions that might signal commitment of the central bank to defend the currency might lead to more favourable results that can be difficult to identify in the (very) short run.

In this paper, we adopt another criterion for efficiency of the FX central bank interventions. We consider a given central bank intervention as efficient if it moves the exchange rate in a direction consistent with the fundamental equilibrium exchange rate. Central banks often claim that their interventions aim at restoring the value of exchange rates to a level consistent with the fundamentals. While central banks pursue other goals, the specific objective of minimizing the degree of misalignment has been extensively included in loss functions used in theoretical analyses (see Vitale, 1999 as well as De Grauwe and Grimaldi, 2006 among others). The adoption of such a policy has been advocated by several authors including for instance Neely (2004) claiming that the central bank should act as a long-term speculator in the FX market. Theoretical analyses such as De Grauwe and Grimaldi (2006) also suggest that central bank interventions might drive the exchange rate in a direction consistent with fundamentals. In contrast to the analysis of simple regression coefficients capturing some contemporaneous impact, the adoption of this criterion allows for some role for central bank interventions in the medium run. To this aim, we assess the impact of interventions conducted by the Bundesbank (ECB after the inception of the Euro) and the Federal Reserve within a noise trading framework, i.e. a model allowing for the presence of two types of agents, namely chartists and fundamentalists. The noise trading framework has successfully been applied by authors to explain the discrepancy between the short and long-run exchange rate dynamics (De Grauwe and Dewachter, 1995). It reflects the complex dynamics produced by the interaction of two types of agents whose existence has been empirically supported by the results of surveys of practitioners (Cheung and Chinn, 2001 for instance). As originally done by Vigfusson

² While interesting, we do not follow here this kind of approaches that in turn raise some questions about their implementation. There are in particular two critical issues associated to the use of event studies for assessing the impact of FX interventions. The first one is the definition of an event and in particular the definition of clustered operations that should be considered as one single event. The second point concerns the endogenous definition of the event. For instance, if a particular central bank keeps intervening until the objective is reached, the use of event studies might lead to a bias in favour of efficiency. Interestingly, this general conclusion turns out to be more supported by this strand of the literature.

(1996), the use of a two-regime Markov-switching regime allows to conduct an econometric analysis consistent with the theoretical assumption of two types of agents. Our analysis of central bank intervention in the context of a chartist-fundamentalist framework is related to the recent analysis of Reitz and Taylor (2008) but exhibits noticeable and important differences.³

The paper is organized as follows. In Section 2 we present a model of the foreign exchange market in which two types of agents, chartists and fundamentalists, interact. In Section 3 we test the prediction of this model and identify the effects of interventions. Section 4 briefly concludes.

2. The underlying theory

2.1. The theoretical framework

In this section we present a simple exchange rate model. The model is based on De Grauwe and Grimaldi (2006a) and is explained there in greater detail. It starts from utility maximising agents selecting their optimal portfolio using a mean-variance utility framework. This allows to derive the standard optimal holding of foreign assets by agent i , $d_{i,t}$ ⁴

$$d_{i,t} = \frac{(1+r^*)E_t^i(s_{t+1}) - (1+r)s_t}{\mu\sigma_{i,t}^2}, \tag{1}$$

where s_t is the exchange rate (the price of the foreign currency in units of domestic currency) in period t , E_t^i is the forecast made about next period's exchange rate by agent i in period t , μ is the coefficient of risk aversion, r and r^* are the domestic and foreign interest rates respectively (assumed to be constant) and $\sigma_{i,t}^2 = (1+r^*)^2 V_t^i(s_{t+1})$. Aggregating the individual demands and setting market demand equal to the market supply of net foreign assets, Z_t , allows us to derive the market clearing exchange rate:

$$s_t = \left(\frac{1+r^*}{1+r} \right) \frac{1}{\sum_{i=1}^N \frac{w_{i,t}}{\sigma_{i,t}^2}} \left[\sum_{i=1}^N w_{i,t} \frac{E_t^i(s_{t+1})}{\sigma_{i,t}^2} - \Omega_t Z_t \right], \tag{2}$$

where $w_{i,t} = \frac{n_{i,t}}{\sum_{i=1}^N n_{i,t}}$ is the weight (share) of agent i , and $\Omega_t = \frac{\mu}{(1+r^*) \sum_{i=1}^N n_{i,t}}$.

Thus the market clearing exchange rate is determined by the forecasts of the agents, E_t^i , about the future exchange rate, their respective weights $w_{i,t}$ and by the net supply of foreign assets Z_t . The latter is determined by the current account and the official interventions in the foreign exchange market. Note also that the forecasts are weighted by their respective variances $\sigma_{i,t}^2$. When agent's i forecasts have a high variance the weight of this agent in the determination of the market exchange rate is reduced.

³ Using a smooth transition model, Reitz and Taylor (2008) find evidence in favour of a coordination channel, i.e. the fact that interventions can move the exchange rate towards its equilibrium value. While we also conclude in favour of such a channel, our two-regime Markov Switching econometric analysis is, unlike their model, based on a structural model of chartist and fundamentalist agents. The proportion of those agents depend on the profitability of their respective forecasting rules. In our model, intervention will alter the dynamics of the exchange rate by changing the relative profitability of the rules, while in the Reitz and Taylor approach, intervention affects the confidence attached by the informed traders to the misalignment value of the exchange rate for processing their orders.

⁴ If the model is interpreted as an asset pricing model of one risky asset (shares) and a risk free asset, the corresponding optimal holding of the risky asset becomes

$$d_{i,t} = \frac{E_t^i(s_{t+1} + y_{t+1}) - (1+r)s_t}{\mu\sigma_{i,t}^2},$$

where s_{t+1} and y_{t+1} are the price and the dividend at $t+1$, respectively, and $\sigma_{i,t}^2 \equiv V_t^i(s_{t+1} + y_{t+1})$ where s_{t+1} and y_{t+1} are the price and the dividend at $t+1$, respectively, and $\sigma_{i,t}^2 \equiv V_t^i(s_{t+1} + y_{t+1})$.

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