The Impact of Flow Analysis on Exchange Rate Dynamics

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Abstract

We seek to integrate flow traders into the chartist-fundamentalist approach. While chartists extrapolate past price trends to predict exchange rates, fundamentalists expect exchange rates to return towards their fundamental values. Flow analysis suggests going with the current order flow and thus enforces the impact of both chartists and fundamentalists. Within our behavioral setup, flow traders surprisingly always destabilize foreign exchange markets, that is they decrease the area in which the path of the exchange rate is stable and increase the amplitude of exchange rate movements.

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JEL classification: D84, F31

1. INTRODUCTION

To determine the use of technical analysis in the foreign exchange market, Taylor and Allen (1992) conducted a survey among London-based chief foreign exchange dealers. They report that about 60 percent of the respondents judged technical analysis to be at least as important as fundamental analysis when it comes to predicting short-run exchange rate movements. Fundamental analysis seems to be the dominating forecast method only in the long run. But, as argued by the majority of the participants, it is the short term that matters in foreign exchange markets. These observation have been replicated several times for various markets in the literature and may thus be regarded as a stylized fact (e.g. Menkhoff, 1997, Lui and Mole, 1998).

Based on such empirical evidence, the chartist-fundamentalist approach (Day and Huang, 1990, Kirman, 1991, de Grauwe et al., 1993, Lux, 1995, Brock and Hommes, 1998, Farmer and Joshi, 2002, Rosser et al., 2003) aims at studying interactions between heterogeneous market participants. A key finding of this branch of research is that asset price changes are at least partially determined endogenously. Note that technical traders typically employ positive feedback rules which tend to push prices away from fundamental values. By contrast, fundamental traders, who expect a convergence between prices and fundamental values, induce a negative feedback. Within deterministic settings, the interplay between chartists and fundamentalists may produce complex (chaotic) price motion. Added with dynamic noise, these models are even capable of generating artificial time series which are hard to discriminate from actual time series. Overall, this framework clearly improves our understanding of asset price dynamics and may furthermore help policy makers and regulators to increase the efficiency of financial markets (see, e.g. Westerhoff, 2003).

However, Gehrig and Menkhoff (2004) recently carried out a new questionnaire among foreign exchange market participants in Germany and obtained empirical evidence showing that the analysis of flows is an independent third type of information for professionals besides technical and fundamental analysis. To be precise, flow analysis seems to be relevant for at least three quarters of the fund managers and for an even larger percentage of the dealers. Gehrig and Menkhoff (2004) estimated the average weight of technical, fundamental and flow analysis as 40.2 percent, 36.3 percent and 23.5 percent, respectively. Supporters of flow analysis argue that order flow provides insight into semi-fundamental private information. For instance, order flow reflects the trading objectives of other traders: If the majority of the market participants are buying – for whatever reason –

then it is likely that prices will indeed increase.[1] Such order flow information may, of course, neither be fundamentally justified nor relevant for medium-term asset prices.

The goal of this paper is to extend the chartist-fundamentalist approach and to explore the impact of flow analysis on exchange rate dynamics. We thus develop a simple exchange rate model with technical, fundamental and flow traders in which the law of motion of the exchange rate is given as a second-order linear difference equation. Due to the trading activity of the different types of agents, the exchange rate may circle around its fundamental value. Concerning the impact of flow traders, we derive the following results: Flow traders decrease the parameter space for which the exchange rate converges towards its fundamental value. Moreover, if the exchange rate path displays dampened fluctuations, then an increase in the impact of flow traders increases the amplitude of cycles. Overall, flow traders always seem to destabilize foreign exchange markets. At least at first sight this appears counter-intuitive since flow traders amplify the orders of both chartists and fundamentalists.

The remainder of the paper is organized as follows. In section 2, we develop a stylized exchange rate model with heterogeneous traders, in section 3, we derive some analytical results and in section 4, we numerically illustrate the dynamics of the model. The last section concludes the paper.

2. A SIMPLE EXCHANGE RATE MODEL INCLUDING FLOW TRADERS

The exchange rate is determined on an order-driven market in which four types of agents are active: market makers, technical traders, fundamental traders and flow traders.[2] As, for instance, in Day and Huang (1990), all orders are initiated against market makers who stand ready to absorb imbalances between buyers and sellers. To be precise, market makers supply excess demand from their inventory or accumulate inventory when there is an excess supply. Depending on the sign and the volume of aggregated order flow, market makers quote the log exchange rate for period t+1 as

$$S_{t+1} = S_t + a(D_t^C + D_t^F + D_t^O),$$ (1)

where a is a positive price adjustment coefficient. The orders of chartists, fundamentalists and flow traders are given as D^C, D^F and D^O, respectively. According to (1), excess buying drives the exchange rate up and excess selling drives it down.

Technical traders derive trading signals out of past price movements. As reported by Murphy (1999), the main goal of technical analysis is to exploit the current price trend. Since technical analysis suggests buying (selling) if the price increases (decreases), the orders of chartists may be formalized as

$$D_t^C = b(S_t - S_{t-1}).$$ (2)

The strength of positive feedback trading is captured by the positive reaction coefficient b. In addition, the larger the price trend, the more orders are submitted by the chartists.

Fundamental analysis first requires an estimation of the exchange rate's fundamental value. In practice, criteria such as the purchasing power parity may be used to identify misalignments. For simplicity, and in agreement with the related literature, we assume that the agents know the true (constant) fundamental value.[3] Fundamental analysis predicts that the exchange rate reverts towards its fundamental value so that the demand of the fundamentalists may be written as

$$D_t^F = c(F - S_t).$$ (3)

The reaction coefficient c is positive and F denotes the log of the fundamental value of the exchange rate. Hence, if the exchange rate is below its fundamental value, fundamental analysis generates buying orders and vice versa. Such a formulation is, for example, also applied by Lux (1995).

The novel idea of this paper is to include flow traders into the chartist-fundamentalist approach. Flow traders believe that order flow can influence the evolution of prices, at least in the short run. Indeed, order flow contains information about short-term trading objectives of other traders. Suppose, for instance, that the market

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[1] The view that information is incorporated into exchange rates via order flow is also supported by Evans and Lyons (2002, 2003).
[2] We only consider market orders, i.e. orders that are immediately executed at the best available price.
[3] An interesting exception is developed by de Grauwe et al. (1993), who assume that the fundamentalists´ perception of the fundamental value is normally distributed around the true fundamental value.

is strongly dominated by buying orders. One reason for this could be that chartists are extremely bullish. Since it is likely that they will drive the price up, it seems reasonable for the flow traders to join the bandwagon. Another reason could be that the fundamentalists think that the exchange rate is significantly below its fundamental value. Again, it seems reasonable to follow the buying behavior. In the end it does not matter to the flow traders whether the buying pressure results from bullish chartists or from optimistic fundamentalists. What matters is that the mass of traders thinks that the exchange rate will go up and thus the flow traders are eager to follow the crowd.[4] Summarizing, one may formalize the orders of the flow traders as

$$D_t^O = d(D_t^C + D_t^F).$$ (4)

The positive coefficient d captures the market impact of flow traders. Flow analysis obviously enforces the net impact of chartists and fundamentalists.

Inserting (2)-(4) in (1) yields the law of motion of the exchange rate. Without loss of generality we can set the scaling parameter $a=1$. Then we obtain

$$S_{t+1} + (c(1+d) - b(1+d) - 1)S_t + (b(1+d))S_{t-1} = c(1+d)F,$$ (5)

which is a second-order linear difference equation.

3. SOME ANALYTICAL RESULTS

In this section, we characterize the impact of flow traders within our setup. Remember that b, c and d are positive parameters. For model (5), the following propositions hold:

- Flow traders do not distort the long-run equilibrium value of the exchange rate, i.e. for all $d>0$ the fixed point of (5) is given as $S=F$.

- Flow traders decrease the parameter space (b, c) for which the exchange rate converges towards its fundamental value.

- If the exchange rate path displays dampened oscillations, then an increase in the impact of flow traders always increases the amplitude of cycles.

Note that inserting $S_{t+1} = S_t = S_{t-1} = S$ into (5) reveals that $S=F$, i.e. the unique steady state of the model is equal to the exchange rate's fundamental value and is independent of b, c, and d. Moreover, a second-order linear difference equation $X_{t+1} + a_1 X_t + a_2 X_{t-1} = Z$ is stable if (i) $1 + a_1 + a_2 > 0$, (ii) $1 - a_1 + a_2 > 0$, and (iii) $1 - a_2 > 0$. Hence, the exchange rate path is stable if (i) $c > 0$, (ii) $c < 2b + 2/(1+d)$, and (iii) $b < 1/(1+d)$. Obviously, the larger the market impact of flow traders (i.e. the larger d), the smaller the parameter space (b, c) that ensures stability.

Furthermore, a second-order linear difference equation generates cycles if $4a_2 > a_1^2$. For our model, this is true if $\dfrac{1 + b + bd - 2\sqrt{b(1+d)}}{1+d} < c < \dfrac{1 + b + bd + 2\sqrt{b(1+d)}}{1+d}$. As shown by Baumol (1961), in the case of dampened fluctuations an increase of a_2 always yields a higher amplitude. Since $a_2 = b(1+d)$, flow traders always increase the amplitude of exchange rate cycles.

Figure 1 presents the stability conditions and the requirements for cyclical motion in parameter space (b, c). In the left-hand panel, all lines are plotted for $d=0$. The outer four straight lines constitute the stability conditions. All parameter values within this region produce exchange rate fluctuations which converge towards the fundamental value. Moreover, if parameters b and c are located within the two inner curves, dampened cycles emerge. The right-hand panel shows the same but now we have set $d=0.2$. As can be seen, the area of stability shrinks.

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[4] Of course, as in the case of technical and fundamental traders our description of the behavior of flow traders is stylized. However, we think that (4) captures the main principles of flow analysis. For more empirical details on the behavior of flow traders refer to Gehrig and Menkhoff (2004) and the relevant literature therein.
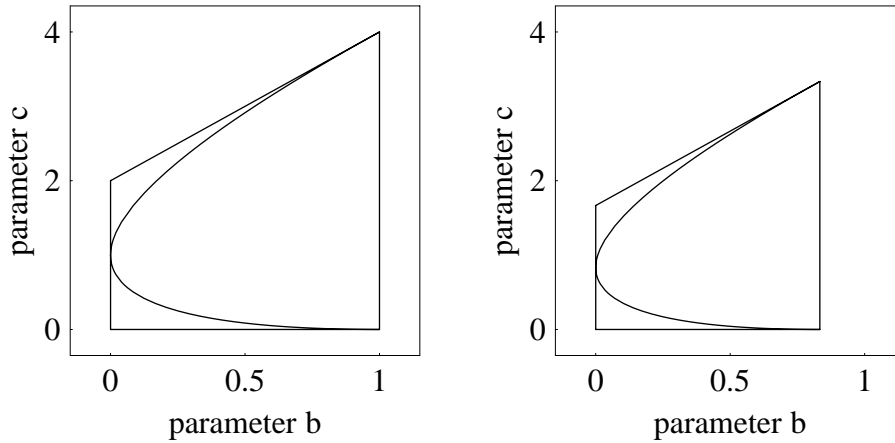
Figure 1: Conditions for stability and oscillations. The four straight lines and the two curves limit the area for stability and oscillations, respectively. In the left-hand (right-hand) panel d=0 (d=0.2).

4. EXAMPLE

Let us briefly illustrate the dynamics of the model. The top panel of figure 2 shows the evolution of the exchange rate in the time domain after a one percent shock in the first period. Since b=0.75, c=0.75 and d=0, the exchange rate displays dampened fluctuations. To be precise, the exchange rate needs about 40 trading periods until it converges towards its long-run equilibrium value. The bottom panel depicts the same except that now d=0.2. Visual inspection reveals that the amplitude of the exchange rate fluctuations is much larger and that the trajectory therefore needs much more time until it settles on its fixed point.
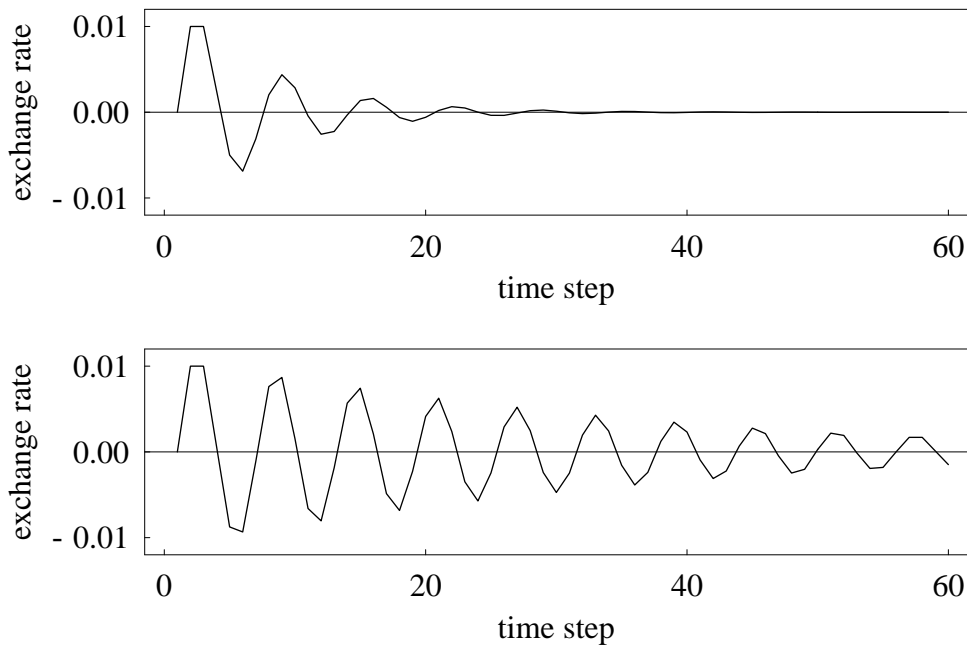

Figure 2: The exchange rate in the time domain. The two panels show the evolution of the exchange rate for 60 time steps after a one percent shock in the first period. In the top panel b=c=0.75 and d=0 and in the bottom panel b=c=0.75 and d=0.25

5. Conclusions

What is the impact of flow analysis on exchange rate dynamics? Since flow traders mimic the transactions of both chartists and fundamentalists one is tempted to conclude that this question cannot be answered. If one is less risk averse one may construct the following train of thought: The exchange rate converges in the long run towards its fundamental value so that stabilizing fundamental traders must have a more pronounced price impact than destabilizing technical traders. Hence, flow traders who amplify the orders of both fundamentalists and chartists presumably increase the stability of exchange rates. However, this paper indicates the opposite: Flow traders always destabilize foreign exchange markets, in the sense that they shrink the parameter space guaranteeing a long-run convergence between prices and fundamental values, and they increase the amplitude of exchange rate cycles. In this paper we have opted for a very simple setup to obtain an initial insight into the implications of flow analysis. However, to further clarify the role of flow analysis, more research is needed. For instance, one may inspect flow analysis within nonlinear models. In addition, some kind of random elements, such as the arrival of new information, also seems worth looking into. We hope our paper will stimulate research in this exciting direction.

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