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**Article — Digitized Version**

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Intereconomics

*Suggested Citation:* Reszat, Beate (1987) : Technical analysis and computer trading: Foreign exchange market intervention revisited, Intereconomics, ISSN 0020-5346, Verlag Weltarchiv, Hamburg, Vol. 22, Iss. 3, pp. 107-111,  
<https://doi.org/10.1007/BF02932230>

This Version is available at:

<https://hdl.handle.net/10419/140074>

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## EXCHANGE RATES

# Technical Analysis and Computer Trading

## Foreign Exchange Market Intervention Revisited

by Beate Reszat, Hamburg\*

**The efforts of the central banks of Western industrial countries to stabilize exchange rates following the Louvre Agreement demonstrated yet again how difficult it can be to influence events in the foreign exchange markets. What factors are currently affecting exchange rates? What significance attaches to technical analysis in this context?**

As long ago as the early eighties, when the US dollar embarked upon a seemingly unending appreciation and the central banks of the countries concerned were more or less powerless to prevent it, the question arose as to what exchange market intervention could actually achieve. A lively debate soon developed about the circumstances in which intervention by the monetary authorities could succeed and those in which any attempt to have an effect on exchange rates, or at least a more than temporary one, by this means was virtually doomed to failure.<sup>1</sup>

Just when the academic world had concluded almost unanimously that intervention was effective only in exceptional cases, and then only over the short term, the trend in the exchange markets was reversed and the dollar went into a dive that was as steep as its previous climb. What was remarkable about this "about-turn" was that it was triggered not by economic fundamentals such as the inflation differential or current account balances, as might have been expected, but by central bank intervention, which had previously been scorned.

What had happened? Had the exchange market situation changed to the advantage of exchange rate policy, so that the assumptions on which the opponents of intervention had argued simply no longer applied? Or was it perhaps that the previous debate had overlooked possible exchange rate influences that create a particularly favourable monetary climate in a certain set of circumstances? One aspect that warrants attention in this connection is the discrepancy between the

theoretical treatment of information gathering and expectation formation and the corresponding activities of market participants in practice.

When theoretical works examine the effectiveness of official exchange market intervention,<sup>2</sup> they concentrate primarily on spot interventions, whose effect on the money supply of the intervening country is sterilised by corresponding open-market operations. There are two reasons for this emphasis. First, the effectiveness of non-sterilised interventions is largely beyond dispute. In a world in which exchange rate developments in the short term are determined predominantly by international capital movements, they influence the exchange rate both by altering the composition of private portfolios and generating corresponding interest rate effects and by modifying long-term exchange rate expectations via the price expectations associated with the money supply effects.<sup>3</sup> Secondly, non-sterilised interventions are the exception rather than the rule; in practice, central banks are not usually disposed to tolerate the money supply effects of their exchange market operations if they can avoid it.

<sup>1</sup> One outcome of this debate was the Jurgensen Report, a study of the effectiveness of intervention, which was commissioned by the countries participating in the economic summit in Versailles in June 1982 and which concluded that central bank intervention had only a rather limited effect. See P. Jurgensen et al.: Bericht der Arbeitsgruppe über Interventionen an den Devisenmärkten, March 1983.

<sup>2</sup> See also B. Reszat: Die kurz- und langfristige währungspolitische Effizienz von Regeln für Devisenmarktinterventionen, Berlin 1984, pp. 31 ff.

<sup>3</sup> See for example P. Bridel, K. Schiltknecht: Devisenmarktinterventionen als Mittel der Wechselkursstabilisierung? in: W. Ehrlicher, D. B. Simmert (eds.): Geld- und Währungspolitik in der Bundesrepublik Deutschland, Berlin 1982.

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The effectiveness of sterilised interventions depends on the extent to which private holders of capital regard domestic and foreign financial assets as substitutes and on the influence central banks can exert on expectations. The situation is generally regarded from the point of view of a small country, whose inhabitants hold their wealth in the form of cash, a domestic security and a foreign security. Sterilised interventions, whereby the central bank purchases foreign exchange resulting from sales of foreign securities and at the same time sells domestic securities to the equivalent value or vice versa, appear to private individuals as an exchange of domestic and foreign securities that leaves their cash balances unchanged. If this exchange is not to cause dissatisfaction and thus trigger countervailing capital movements, the central bank's transactions must either alter the yields on domestic financial assets in relation to those abroad or modify expectations in this regard.<sup>4</sup>

If domestic and foreign securities are perfect substitutes and if at the same time international capital mobility is high – both assumptions are often made in view of the high degree of interdependence and rapid adjustability of international financial and foreign exchange markets – the return on financial investments in the small country will be determined by interest rates abroad. That being so, the exchange rate and the domestic money supply can be manipulated independently of one another only if the central bank

succeeds in influencing yield expectations; since domestic and foreign interest rates are given, this entails influencing expectations of future exchange rate changes.

### The Role of Expectations

Among the various possibilities for modelling expectations, the concept of rational expectations came to the forefront long ago.<sup>5</sup> It is essentially based on the assumption that exchange market participants have a given amount of information on "fundamental" economic determinants of exchange rates at the time when expectations are formed. In the extreme case, it is even assumed that they know the "true" structural model of the economy.<sup>6</sup> Developments that are explicable and foreseeable within the model have thus already been taken into account in past investment decisions and are incorporated, in a discounted form, in the present exchange rate. If the central bank intervenes to alter the exchange rate, it merely disturbs the existing portfolio equilibrium and triggers opposing capital movements that continue until the status quo ante has been restored.

Rational expectations do not mean, however, that individuals possess perfect foresight. Stochastic influences or unexpected developments may well throw their predictions out, but sooner or later they will cease to make systematic predictive errors, since it would be irrational if they did not learn from their mistakes and become better at forecasting.<sup>7</sup> Hence even though market participants do not all at any one time reach the same conclusions about future exchange rates on the basis of the information at their disposal, the expectations that are formed in the market are generally unanimous, single-valued and explicable from the information available.

If in these circumstances the central bank can take

<sup>4</sup> See H. G e n b e r g : Monetary Policy and Short Run Fluctuations in Exchange Rates, in: *Außenwirtschaft*, Vol. 37, No. II/III 1982.

<sup>5</sup> An excellent review of the concept of rational expectations and its application to different economic issues is to be found in David K. H. B e g g : The Rational Expectations Revolution in Macroeconomics, Oxford 1982.

<sup>6</sup> In practice it is often assumed implicitly that the "true" model is identical with the envisaged approach.

<sup>7</sup> See Margaret B r a y : Rational Expectations, Information and Asset Markets: An Introduction, in: *Oxford Economic Papers*, Vol. 37, 1985, pp. 188 f.

## KONJUNKTUR VON MORGEN

The short report on domestic and world business trends and raw materials markets published every fortnight by HWWA – Institut für Wirtschaftsforschung – Hamburg  
Annual subscription rate DM 120,- ISSN 0023-3439

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action that gives the market a signal, in other words reveals surprising new information that causes market participants to revise their future yield expectations, intervention may well have permanent exchange rate effects, in contrast to the case described above; if the market modifies its expectations of future exchange rate behaviour in such a way that the change in expectations just balances the exchange rate change brought about by intervention, leaving the expected yields on domestic and foreign assets unchanged, offsetting capital movements will not occur. Nevertheless, it is doubtful whether official intervention alone can have such an influence on yield expectations without the support of economic measures aimed at modifying the "fundamentals".

It should be stated that the assumptions used here are not universally accepted, particularly as regards the perfect substitutability of domestic and foreign financial assets. This assumption is the reason why it can be argued that unlimited and, in extreme cases, infinitely large capital movements can ultimately defeat every effort by the central bank to influence the exchange rate. Given this threatened inflow of capital from anywhere and everywhere, the scale of central bank intervention in the market is of no consequence for the success of intervention; it is too little in any case when the going gets tough.<sup>8</sup>

### Spot versus Forward Intervention

In the circumstances depicted above, it is unnecessary to enquire whether intervention in different markets, such as the spot market or the forward market, has different effects. Even if the existence of a forward exchange market were taken into account, which is not usually the case, the assumption of perfect substitutability would preclude any difference in the exchange rate effects of spot and forward interventions.

However, if it is assumed that there are indeed limits to international capital movements, forward interventions do have certain advantages over spot interventions:

□ They entail no immediate expenditure of foreign exchange reserves, so that in certain circumstances they can be sustained longer. Moreover, by the time the contracts fall due the movement in exchange rates may have reversed, so that in the meantime it may have been possible to close off forward positions by concluding transactions in the opposite direction, thus avoiding any loss of reserves.

□ With forward transactions, the liquidity effects of (non-sterilised) spot interventions can be avoided, though possibly only temporarily.

□ As a rule, the market in which forward interventions take place is much narrower than the spot market, so that a given volume of intervention can generally be expected to produce clearer exchange rate effects. On the other hand, there is a disadvantage in that intervention cannot be carried out as "discreetly" as in the spot market, precisely because the market is so narrow. Hence the forward market seems particularly well-suited as an arena for interventions if the authorities intend to give the market a signal at the same time.

Forward interventions can be seen to offer further advantages if the information activities of market participants as they present themselves in practice are taken into consideration.

### Fundamentalists versus Chartists

Exchange rate theorists have fairly precise notions of the economic factors they should observe if they wish to pronounce upon future exchange rate developments – interest rate differentials, relative prices, and so forth – but the situation is less clearcut for operators in the foreign exchange markets, who attempt to form an opinion on the basis of a multitude of different pieces of information from a wide variety of sources.

Basically, two kinds of "operator" can be identified: the so-called fundamentalists, who observe supply and demand conditions in the foreign exchange markets and the economic and political factors that affect them, and the advocates of technical analysis, often called chartists, who heed only the signals deriving from past price or exchange rate developments, on the basis of which they draw conclusions about the trends to expect in future.

Fundamentalists base their decisions primarily on potential economic determinants of exchange rates and thus come closest to the ideas underlying the theorists' attempts to describe the behaviour of market participants. However, they do not assume such comparatively simple and clearcut relationships as the theorists are wont to do but generally consider a multitude of conceivable causes of exchange rate movements when forming a judgement. As well as prices and interest rates, current account balances and foreign currency reserves, they follow the economic cycle and the factors influencing it, leading and lagging

<sup>8</sup> The central bank is prevented from sustaining an intervention strategy either by its limited foreign exchange reserves if it is selling foreign exchange to support its own currency or by the money supply effects and the attendant danger of domestic inflation if it is intervening as a buyer of foreign exchange.

indicators, political developments, and much more besides.<sup>9</sup>

There is practically no limit to the indicators from which the fundamentalists may choose; in principle, there are countless conceivable determinants that could arguably be considered. One can keep abreast of some of them at little or no cost from the daily newspapers, for example. Other information may come expensive; one has only to think of comprehensive market analyses and

costly stock exchange newsletters or the econometric forecasting services that are offered worldwide.<sup>10</sup>

In the light of this plethora of information, the advocates of technical analysis who concentrate solely on historical market data have a relatively easy life. Figure 1 attempts to show in broad terms how a chartist operates.

For every working day on which trading takes place the highest and lowest prices for the good in question – in this instance the currency – are recorded on a graph and joined together by a bar. In Chart 1 the day's closing rate is also marked on the bar as a horizontal dash. By doing this for each day, the chartist builds up a picture of past exchange rate performance from which he hopes to gain indications of future developments. The procedure is based on the premise that characteristic patterns of price or exchange rate movements recur repeatedly.<sup>11</sup>

Chartists attach particular importance to so-called support and resistance lines. Lines of this kind have been drawn in Chart 2. A support line represents the exchange rate below which the currency has not descended, despite repeated falls, while a resistance line marks the exchange rate above which it has not yet managed to rise. Support and resistance lines are not necessarily horizontal; as in Chart 3, they may be the boundaries of an upward or downward trend path. The attention they attract is explained by the fact that the breaching of a resistance line is seen by market participants as a sign of a further substantial appreciation and a fall below a support line as an indication of a future slide in the exchange rate. If operators act accordingly and buy or sell the currency in question to profit from the expected shift, it is highly probable that their expectations will be fulfilled.

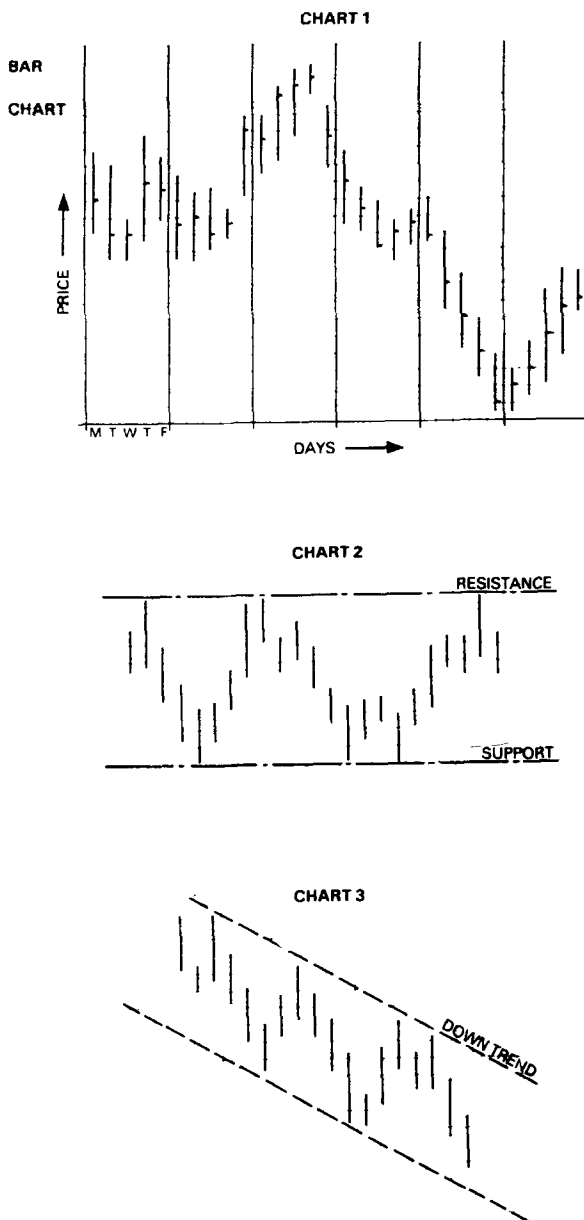
Advocates of technical analysis usually justify their method with the argument that no-one is in a position to take account of all fundamental economic determinants of exchange rates and to appreciate and assess their relative impact correctly. Fundamental analysis therefore runs the risk of making serious errors of judgement, so that it is smarter to reject such ideas from

<sup>9</sup> See for example Mark J. Powers: *Inside the Financial Futures Markets*, New York 1984, pp. 71 ff.

<sup>10</sup> The cost of econometric forecasting services varies widely, depending on the information and services offered. See in this regard "The Times are A-Changing", in: *Euromoney*, August 1986, pp. 198 ff.

<sup>11</sup> The chartist looks for characteristic exchange rate patterns, which are described as "head and shoulders", "flags and pennants", "triangles", and so forth. A detailed description of classic chart analysis can be found in Jack D. Schwager: *A Complete Guide to the Futures Markets*, New York 1984, pp. 333 ff.; see also John J. Murphy: *Bar Charting*, in: Perry J. Kaufman: *The Concise Handbook of Futures Markets*, New York 1986, Chapter 14.

Figure 1



Source: John Heywood: *Using the Futures, Forward and Options Markets*, London 1984, pp. 121, 122.

the outset. Hence instead of asking *why* exchange rates behave in a particular way, one should investigate *how* they behaved in the past so that the necessary conclusions can be drawn. According to this view, past exchange rate movements in principle contain all the information needed to shape expectations.<sup>12</sup>

Technical analysis of exchange rate developments has increased considerably in importance in recent years for two main reasons. First, the substantial expansion in trading in currency futures – standardised forward exchange contracts traded on a stock exchange – has contributed to this development, especially in the United States. Currency futures are essentially a form of forward commodity contract, so that it is not surprising that, as they become more widespread, information activities and trading techniques that are more common in forward commodity trading, such as technical analysis, are becoming increasingly popular. The second reason is the increasing computerisation of foreign exchange trading. The development of new technology now makes it possible to capture and process a far greater volume of data more quickly than was the case previously. Computer programmes based on the principles of technical analysis are commonplace and participants in foreign exchange trade throughout the world are letting the signals they give determine their buying and selling decisions.<sup>13</sup>

### Implications for Exchange Rate Policy

The factors described above mean that certain parts of foreign exchange trading take place almost mechanically; if the charts show that in the past exchange rate movements have followed a particular pattern, market participants take this as an indication of a (stronger or weaker) continuation or reversal of the previous trend and may react to corresponding buy or sell signals without so much as a glance at the economic fundamentals that may be influencing the exchange rate. Such reactions are particularly prevalent if resistance or support lines have just been breached, since in general this is followed immediately by a marked exchange rate movement irrespective of the economic situation at the time.

Even if the charts are not always interpreted in the same way by all the market participants that follow them,

transactions based on technical analysis and corresponding computer programmes may well reinforce an incipient exchange rate movement or even become the main force behind the trend, particularly if nothing in the economic or political environment indicates any other development. In general, the result of the exchange rate formation process is determined both by chartists as well as by operators who concentrate on fundamentals. Which group wields the greater influence depends on the relative size of their commitment in the case in point.<sup>14</sup>

In contrast to the processes of expectation formation assumed in theoretical approaches, at least two kinds of foreign exchange market participant can therefore be distinguished who base their judgement of future exchange rates on two fundamentally different types of information but both of whom are in principle convinced of the correctness of their method and show little willingness to “learn” from the other group. As a result, no single-value exchange rate expectation usually develops in the market; the rate that ultimately emerges is more a compromise between the different opinions.

This may give far greater latitude for exchange rate policy than is often assumed; if part of the market has its expectations shaped solely by past exchange rate trends and if there are times when this group of operators dominates market developments, the monetary authorities can influence exchange rate expectations by using intervention to give the appropriate signals. For example, there are indications that the dollar interventions by the Group of Five after the Plaza Agreement in 1985 hit upon just such a propitious climate for exchange rate policy.<sup>15</sup> The central bank can consider reinforcing certain chart formations that coincide with its intentions. It is also conceivable, however, that it will use intervention in an attempt to breach or defend resistance or support lines and thus exert a lasting influence. Forward exchange market intervention might prove particularly successful in this regard too, for when it is a question of giving a signal it may make sense to exploit the relative narrowness of these markets.

<sup>12</sup> This reasoning bears a strong resemblance to the theory of efficient markets, which in its weak form states that on certain assumptions past price developments reflect all the necessary information. However, the two should not be confused; whereas according to the theory of efficient markets unusual profits based on price patterns are not possible, in practice chart analysis aims precisely at identifying such price patterns. On the theory of efficient markets, see Eugene F. Fama, “Efficient Capital Markets: A Review of Theory and Empirical Work”, in: *The Journal of Finance*, May 1970.

<sup>13</sup> This applies not only to foreign exchange trading but to financial transactions in general. See also “Computers Challenge the Stockmarket Gurus”, in: *The Economist*, 21st March 1987, pp. 90 f.

<sup>14</sup> A recent theoretical approach to explain exchange rate movements that also emphasises the interplay of fundamentalists and chartists originates with J. A. Frankel and K. Froot. See J. A. Frankel: *Exchange Rates*, in: *NBER Reporter*, Winter 1985/86, p. 9.

<sup>15</sup> In recent weeks and months, too, it often appeared that fundamentalists had no idea of future exchange rate trends and were adopting a wait-and-see attitude, so that any stimuli for exchange rate developments came from the charts or from official sources.