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THE USE OF FLOW ANALYSIS IN FOREIGN EXCHANGE: EXPLANATORY ANALYSIS

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ABSTRACT

The Use of Flow Analysis in Foreign Exchange: Explanatory Analysis*

This Paper provides questionnaire evidence on the role of flow analysis for professional traders and fund managers. This evidence suggests that besides fundamental information and technical analysis, the analysis of flows provides an independent third type of information for professionals. The proposition that flows can be used to learn about fundamentals is not consistent with the data. Instead, evidence indicates that flows more likely provide insight into semi-fundamental private information, suggesting support for the efficient market hypothesis only in a weak form.

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The Use of Flow Analysis in Foreign Exchange: Exploratory Evidence

1. Introduction

"A source of informational advantage to the traders is their access to, and trained interpretation of, the information contained in the order flow" (Goodhart, 1988, p.456). Although this has been common market wisdom for a long time, there have been no studies that systematically examine the use of flow analysis by foreign exchange professionals. This paper provides evidence that next to fundamental and technical analysis the analysis of flows is an independent third type of information. We thus add to the recent literature by presenting empirical evidence that the analysis of flows does affect the behavior of a significant group of professional FX market participants, at least from market participants' own perspective.

Thus our contribution complements other work about the informative role of flows. For example, Lyons (1995, 1998) presents case study evidence on the importance of flows, Osler (1998) relies on flows to characterize exchange rate changes, Ito, Lyons and Melvin (1998) provide convincing evidence for information inherent in flows and Evans and Lyons (1999), Cai, Cheung, Lee and Melvin (2001) and Evans (2001) improve exchange rate explanation by incorporating order flows.

According to Lyons (2001, p.4), "order flow is transaction volume that is *signed*" (i.e. indicating purchases or sales). From an ex ante logical point of view, flow analysis may share similarities with either technical analysis or fundamentalism. This leads to three different views about flow analysis which to some extent compete with

each other, and which we list in the order of their affinity to the efficient market hypothesis (EMH):

Proposition 1 *Flow analysis is an expression of limited rational behavior.*

In this sense flow analysis is an analogue of technical analysis (see e.g. Shleifer and Summers, 1990). This view relies heavily on the assumption of informational efficiency of markets, according to which any attempt to acquire extra information is futile or even irrational, when costly resources are invested.

Proposition 2 *Flow analysis is a manifestation of rational learning about fundamentals*.

This view regards flow analysis as a certain form of fundamental analysis. Conceding time constraints and informational heterogeneity, flow analysis can be viewed as a rational way of trying to detect the results of other participants' fundamental analysis and, thus, parallels optimal learning from order flow such as in the seminal work of Kyle (1985).

Proposition 3 *Flow analysis provides interim information about short-run price movements but little information about fundamentals*.

This view is based on the assumption that the order flow can influence the price path and thus sees flow analysis as a separate kind of analysis if it aims at forecasting prices from presently executed and planned order flows (see e.g. Ito, Lyons and Melvin, 1998). According to this view, flows also contain information about short-term trading objectives or liquidity considerations of other traders that may affect short-term price movements, but that will not affect medium-term asset prices. Such information is usefully termed semi-fundamental information.

Unfortunately, there is virtually no direct systematic information available about the importance and nature of flow analysis. Because of this lack of knowledge, it

seems worthwhile to improve our understanding by conducting a questionnaire survey study. This study is organized around three questions: is flow analysis an important tool in real world markets? Can flow users be related to certain institutional characteristics? Finally, are there beliefs of flow users about FX markets which would reveal their motivation for applying flow analysis?

This study provides several insights: it demonstrates that flow analysis is, in addition to fundamental and technical analysis, indeed a major third tool for FX professionals. Furthermore, the use of flow analysis is systematically related to some institutional characteristics and beliefs about the functioning of FX markets. Our results provide varying degrees of support for the three propositions under review: the most interesting seems to be the affinity with proposition 3, that is the view that flow analysis aims at exploiting semi-fundamental information.

The survey approach chosen was developed as a standard methodology to establish market participants' behavior in financial markets. The pioneering work by Shiller (1989) was first applied to foreign exchange markets by Allen and Taylor (1990). The latter thoroughly examined the use of technical analysis in the London FX market, and this is the reference case for our work (Taylor and Allen, 1992). The same approach was reproduced for Hong Kong based FX dealers markets by Lui and Mole (1998). Related studies on foreign exchange markets include Menkhoff (1997, 1998), Cheung and Wong (2000), Cheung and Chinn (2001) and Cheung, Chinn and Marsh (1999). However, to our knowledge, there is no survey study explicitly examining the use of flow analysis in foreign exchange markets.

Our investigation of flow analysis consists of four steps: Section 2 reviews the literature on possible explanations for the use of flow analysis. Next, in Section 3, we introduce the methodology applied and discuss the survey result. In Section 4 the

evidence on the importance of flow analysis in the FX market in relation to the two established forms of fundamentalism and chartism is presented. This is followed by Section 5, where the question whether flow users can be viewed as a distinct, coherent group of people, i.e. either more rational or less rational agents is examined. This lays the ground for Section 6, where flow users are related to certain characteristics of behavior and Section 7, where they are related to beliefs about FX market characteristics. We present a short comparison of results with an earlier survey study in Section 8 and then present our conclusions in Section 9.

2. A review of possible justifications for flow analysis

This review reflects the development of arguments which were first modeled in a stock market setting and later adapted to foreign exchange markets. The empirical finance literature largely concentrates on two types of participants in financial markets, rational investors and liquidity or noise traders. Typically, rational investors are viewed as agents who pursue strategies which are optimal given their knowledge of fundamental information concerning the assets' liquidation values, while liquidity traders' behavior is exogenously determined and either motivated as exogenous hedging demand (e.g. Spiegel and Subrahmanyam, 1992), or even completely irrational behavior with little or no relation to fundamental information which noise traders might actually have. While this approach with two polar types of agents is useful for modeling markets with incomplete revelation of inside information through prices (see e.g. Grossman and Stiglitz, 1980 and Hellwig, 1980), and, thus, for finding solutions to the information paradox,[1] it may be too rough to understand the

[1] The information paradox essentially arises when prices are adequate statistics of the underlying information. As Allen (1981) shows, the price system will generically reveal all the underlying (inside) information when there are more prices (or markets) than sources of uncertainty. If, on the other hand, there are other sources of uncertainty besides prices, the price mechanism will not generally reveal

details of real world markets and, particularly, the real world processes of price determination.

Consequently, the market microstructure theory building on the seminal paper of Kyle (1985) distinguishes three types of traders: informed investors, market makers and noise traders.[2] Again, informed traders are viewed as investors with private information about fundamentals, and noise traders trade for exogenous liquidity motives. Market makers, however, can learn some of the insiders' information from observing the aggregate order flow. In fact, because market makers will make inferences from the order flow, insiders will try to conceal their information by trading less aggressively.[3] In this framework, market makers determine prices as conditional liquidation values based on the information incorporated in the aggregate order flow. Accordingly, market makers do behave fully rationally. Since they do not have access to the proprietary information of insiders they have to deduce it from observing the order flow.

Hence, market microstructure theory emphasizes the importance of the informational content of the aggregate order flow. However, information about partial order flows is also useful, as Chowdry and Nanda (1991) show in a multi-market setting, when the order flow is fragmented across markets. Chakrabarti (2000) also provides a model of the FX market where dealers only learn from observing

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inside information completely. This result has been originally established in markets with investors who receive proprietary information, and noise traders, who trade randomly for exogenous reasons. In such settings the price mechanism reveals the information of insiders only imperfectly, since high prices may e.g. signal good information or merely a high realization of liquidity demand. Partial revelation, however, does not necessarily require the existence of noise traders, and can also occur as a robust feature of equilibrium, for example, when the signal space is sufficiently rich (see Ausubel, 1990).

[2] See, in particular, Admati and Pfleiderer (1988), Spiegel and Subrahmanyam (1992) and Rochet and Vila (1994).

[3] Insiders are typically modelled as risk neutral agents. Because market makers make inferences from the order flow and insiders know about the impact of their trades on market makers' inferences, they tend to trade in "small" amounts, in order to hide behind noise traders. For example, large buying orders relative to the variance of noise trading would be interpreted predominantly as positive information by the market makers, and, thus almost reveal the insider.

idiosyncratic signals, which could usefully be interpreted as the (local) order-flow. While this literature evidently generally attributes the role of learning from the order flow to market makers only, there are no particular reasons for doing so. It appears natural that market makers' access to information about the order flow is relatively cheap and privileged, but, in principle, there may also be other traders (e.g. floor brokers) in the market with some knowledge about the order flow which they can profitably exploit.

Accordingly, theory suggests that learning from the order flow may be a rational strategy for traders who do not have access to first hand information of a security's liquidation value, or simply, fundamental information. This view is formulated in our Proposition 2 Proposition 1, in contrast, views investors or traders relying on flow information simply as liquidity or noise traders.

However, is informational asymmetry about asset fundamentals an important phenomenon in FX markets? While there may be a lot of private information about individual stocks in the markets, it appears that most fundamental information in FX markets is public information. In recent work, Ito, Lyons and Melvin (1998) have presented convincing evidence for the presence of private information in the US$-Yen market.[4] They argue that even when most fundamental information is public, traders may still possess privileged information about the short-term movements of prices, which they do exploit. For example, traders may have some privileged information about other traders' (aggregate) inventory imbalances, and they then trade on the assumption that those inventories should converge to some long run steady state level. Such information may be price relevant in the interim but irrelevant

[4] These authors analyse trading patterns before and after the abolition of trading restrictions during lunch time in Tokyo. The observed flattening of the U-shape of intra-day price variability and the reduced variability at the opening of trade cannot be explained on the basis of models with symmetric information and thus suggests the existence of private information.

in the long run. They label such information *semi-fundamental private information*. To the extent that semi-fundamental private information is relevant during the course of the trading day, the analysis of the order flow can also be informative about such semi-fundamental information. In other words, given that private information seems to play a role also in FX markets, flow analysis seems a legitimate rational learning mechanism for less informed traders.[5] In fact, Evans and Lyons (1999) even strongly suggest that order flow contains information that helps to predict exchange rates. In their sample, they can account for 50% of the variation in the DM/US$ rate and for about 30% in the Yen/US$ rate, which significantly exceeds the mere 10%, which are traditionally accounted for by publicly observable macro aggregates (Meese and Rogoff, 1983; see also Frankel and Rose, 1995, MacDonald, 1995, and Taylor, 1995). This line of reasoning underlies the view expressed in proposition 3.

Building on this view one would expect that flow analysis is mainly performed by traders with privileged access to the order flow. Moreover, since it is intended to reveal information about short-term price movements flow analysis should be used especially by agents with immediate market access. Flow analysis should be particularly helpful for smaller traders trying to acquire information about the (aggregate) trading behavior of larger institutions. On the other hand, larger trading institutions might use flow analysis in order to time their trades and minimize the impact of their trades on prices. Moreover, larger fund management institutions might have stronger interests in acquiring direct trading access and to timing their trades

[5] For example, a large fund may decide to sell foreign stocks in a rather illiquid market for pure liquidity reasons. It may take some time for other investors to bid up prices back to their equilibrium values. This "window of opportunity" may be spotted by flow analysis.

relative to smaller fund managers. We test these hypotheses explicitly in the analysis below.[6]

To the extent that flow analysis reveals more semi-fundamental private information and less fundamental private information it appears as a less attractive methodology for fund managers with lower trading frequencies. Before these hypotheses are examined, however, the question is whether flows are important for real world decision makers.[7] We have asked the respective target group.

3. Methodology and data

The following analyses is based on the feedback obtained from a questionnaire mailed in June 2001 to professional foreign exchange market participants in Germany, one of the major centers for foreign exchange transactions.[8] The target group consists of all relevant trading banks and international fund management companies at that time. The relevance of banks in this business was identified with the help of several experienced participants and resulted in 50 institutions. Those 15 institutions which belong to the respective working group in the association of public banks (Bundesverband Öffentlicher Banken) received as many questionnaires as dealers taking own positions were expected to trade there. Each of the other 35 banks received between two and six questionnaires, according to their size. Regarding fund management companies, all appropriate members of the respective association in Germany (Bundesverband Deutscher Investment-Gesellschaften)

[6] Hypothesis 3 (below) tests whether flow analysis is more relevant to fund managers or traders. Hypothesis 10 (below) tests for size effects across traders and fund managers separately.

[7] Hypotheses 1 and 2 below test explicitly the significance of flow analysis as an independent source of information.

[8] Germany's market share in the world foreign exchange market is 5.4% according to the last Bank for International Settlements (2001) survey. To be more exact, the survey of foreign exchange dealers – but not that of fund managers – includes the Austrian market where 10% of the questionnaires were allocated. This accords with Austria's worldwide market share in FX transactions of 0.5%. More

were addressed.[9] Again, between two questionnaires for the small companies and up to six questionnaires for the largest ones were sent.

We received 203 useful responses. The feedback implies an unusually successful response rate of 51.9%. The detailed structure of the mailing of thequestionnaires and the respective responses are documented in Table 1. The different response rates can be explained due to differences in approaching each group. The best response came from members of the association, a direct result of the association's helpful assistance, consisting in mailing the survey, collecting it, and performing intensive follow-ups to improve the response. Regarding the other banks all assumed non-respondents were contacted by mail or telephone, often several times, motivating many of them to cooperate. The lower response rate for fund managers is a consequence of comparatively fewer efforts: only some selective phone calls were made to find out whether there might be systematic reasons for non-response - no systematic reasons were detected.

As we also use data of an earlier survey questionnaire (1992) which was, from a methodological standpoint, carried out in the same way (for more details see Menkhoff, 1998), it is interesting to look at differences.[10] First, distinctly fewer banks were addressed in 2001 reflecting the ongoing process of mergers, removal of FX business to London, and, finally, a more precise elimination of banks which intermediate customer deals but do not take own positions. Second, the larger number of fund management companies in the recent survey shows the rising importance of capital markets and in particular fund business in Germany. Third, the

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important than the market share is the fact that major national differences have not been identified so far.

[9] The funds managed are mutual funds and other funds which mostly serve purposes similar to pension funds.

[10] The exact date of the survey was largely arbitrary and was not supposed to cover any extraordinary events. On the contrary and by coincidence, the turbulent EMS crisis started on 14. September 1992, two weeks after the completion of the survey in August.

even better response rate – up from 41.3% – has two origins: more effort in contacting non-responding "other banks" and a promise to reward respondents with feedback on the results of the survey.

Several ways were applied to ensure the quality of the survey. This started with a phase of intensive interviewing prior to mailing and a pretest of the questionnaire to ensure appropriate issues and wording. The incoming questionnaires were strictly anonymous but respondents did not seem to care too much about this as only some used the suggested possibility to split their response into one anonymous mail for the questionnaire and another mail ordering the promised feedback. The usually fully filled out questionnaires indicate adequate presentation of the items.

Problematic may be, as a referee remarks, the question whether the core persons in the dealing departments really responded or whether the questionnaires were passed on to less decisive, e.g. supporting, staff. This can never be outruled when using an anonymous questionnaire survey. We are confident, however, for three reasons: first, the senior persons answer similarly to the less senior ones (see the later Section 5). Second, many phone conversations with trading departments gave the impression that we had reached the target group of dealers who take positions in own responsibility. Third, the two channels of distributing the questionnaire, where in the one case the association may provide an incentive to cooperate, produced very similar results.

An important methodological objective of a survey questionnaire is to realize a representative response. However, this quality indicator cannot be checked strictly as no statistical survey of the total population is available. It is therefore warranted to realize a high response rate and economically sensible characteristics of the responses. Regarding the response rate our survey attained a result matched among

the several studies in this field mentioned above only by Taylor and Allen (1992). They received feedback from 60% of the chief dealers addressed. In addition, we had the advantage of being able to use the survey of the members of the association of public banks as a kind of benchmark as originally intended and comes close to a full coverage with a response rate of 73.7%. Statistical comparison of the two channels for distributing the questionnaires to foreign exchange dealers reveals no differences indicating a distortion of the private banks' sample.

Finally, the recent survey can be compared to the earlier study and to studies in other countries. Regarding the 1992-study a few structural characteristics of respondents have changed in a systematic manner. In line with growing markets, volumes asked for have gone up. Furthermore, the average age of FX dealers has increased as can be expected for a maturing "industry", whereas the average age in the boom market of fund management has decreased. Regarding the comparison with other survey studies, our results do not contradict earlier findings, and differences can be reasonably explained.

4. On the importance of flow analysis

The interview phase already revealed that market participants tended towards three, rather than only two, independent sources of information, namely fundamental analysis, technical analysis, and flow analysis. This information is considered when professionals were asked about the "information type" they used in substantiating their decision making when taking open positions. If only fundamentalism and chartism were relevant, one might expect that the share attracted by flow analysis is negligible. It is also an implication of proposition 1 that professionals do not intensively use a tool that requires imperfect markets to a larger extent. To translate

this into figures, irrelevant shares for flows-based decision making can be stated in two hypotheses:

H1 *The average importance of flows for decision making is below 10% in competition with fundamentals and technical analysis.*

H2 *There are no professionals who pay the same or more attention to flows than to fundamentals or technical analysis.*

Another hypothesis which can be tested with this data is derived from proposition 3. If flows provide "semi-fundamental private information", then short-term oriented dealers would use this tool more intensively than more longer-term oriented fund managers (see also Section 2):

H3 *FX dealers give a higher importance to flows than international fund managers.*

The results of the questionnaire are shown in Table 2. The upper Panel A of Table 2, shows the average importance of fundamental, technical and flow analysis, both for all respondents, or separated into FX dealers and international fund managers.[11] The response of an average weight of 23.5% given to flows means evidence is rather against hypothesis 1.

The importance of flows is illustrated by the increase in the lower Panel B of Table 2: it starts being just more than a share of 0% and then becomes more exclusive until flow analysis is seen as the preferred kind of information, becoming second to none. Again, the hypothesis, here number 2, is clearly rejected. Flows are an important source of information for FX professionals; for a major group they are more important than either fundamentals or technical analysis, or even both of them together.

[11] The fundamentals include political events which are determinants of the country risk premium. Moreover, political changes may influence the course of economic policy making and thus the expected values of economic fundamentals.

Finally, one can see from the figures for dealers and fund managers that the latter rely significantly less on this information which is in accordance with proposition 3.[12] Thus, hypothesis 3 can not be rejected.

An interesting side-aspect of the results of Table 2 is that fundamentals and charts seem more important than flows if one looks at the aggregate of all respondents. This justifies the limitation to these two "traditional" categories in earlier studies. Furthermore, it leads to the consideration whether the use of flows could be related to the use of fundamentals or technical analysis. From the viewpoint of proposition 1, both the application of technical and flow analysis should be interpreted as boundedly rational behavior. One could thus expect a positive correlation between both information types, as they are motivated by the same type of user. At least, from this viewpoint, the share of technical analysis to the sum of non-flow analysis should increase. In contrast, proposition 2 which statesa familiarity of flow analysis with fundamental analysis would claim the opposite hypothesis; the expected positive correlation of flow use and fundamental analysis implies a negative relation between flows and technical analysis and thus a negative sign in hypothesis 4. If, however, flow analysis is rather a different type of information, such as claimed by proposition 3, then there would be no close relationship to the use of both other types of information. The implication is then the intensity of flow use and the other kinds of analysis are independent of each other. These considerations lead to three competing expectations regarding the sign of the relation expressed in hypothesis 4 which is formulated from the position of proposition 1:

H4 *The more intensive use of flow analysis is positively related to a more intensive use of technical analysis in comparison to fundamental analysis*.

[12] Significance tests in this paper are always non-parametric as the underlying data can not be described by a normal distribution.

The results are plotted in Figure 1. The figure sorts all respondents according to how intensively they of use flow analysis, going up to a share of 95% for flow analysis as part of the three kinds of analysis. As the second piece of information the share of technical analysis to the sum of technical pus fundamental analysis is plotted as a line for groups of respondents. We form groups of respondents for every ten percentage points of flow use, starting for the first group from 0% to below 10%, then from 10% to below 20% and going up to 60% and more. Hypothesis 4 states that the line in Figure 1 should have a positive slope. It can be seen, however, that with an increasing share of flow analysis both other forms are decreasing in similar fashion. Thus, neither hypothesis 4 nor the implication of proposition 2 is supported by the evidence. It is proposition 3, that flow analysis is an independent kind of information, which best explains Figure 1.

In summary, Section 3 provides clear evidence for the relevance of flows in foreign exchange markets as an independent source of information. It further supports the interpretation of proposition 3 and rejects the implications of propositions 1 and 2. What can be said about the characteristics of the flow users? Are there indications of rationality or institutional differences?

5. On institutional characteristics of flow users

From an efficient markets perspective, representing an interpretation of flow analysis as formulated in proposition 1, one may argue that the institutional characteristics of FX markets, such as high liquidity and true international trading, do not allow sufficient room for reasonable flow analysis: shocks will be absorbed quickly, as will large orders and important news. A consequence of this view is that

those who pay more attention to flow analysis can be seen as less rational market participants.

As rationality can not be observed directly, we search for indicators which should be correlated with rational behavior (see also Menkhoff, 1997). In this sense, it may be expected that those who have a better education, and, thus, better prerequisites to distinguish useful from noisy information, behave more rationally than others. Furthermore, efficient markets can be expected to differentiate over time between more or less successful participants. If one accepts that market success is related to rationality, then success indicators, such as pure survival in the market, proxied by age, and career progress, proxied by reaching a superior position, indicate rationality.[13] This leads to the following hypotheses to be confronted with survey data:

H5 *A more intensive use of flow analysis is negatively related to a higher degree of education.*

H6 *A more intensive use of flow analysis is negatively related to a higher age.*

H7 *A more intensive use of flow analysis is negatively related to a superior position.*

The results of rank correlations are given in Table 3. The sign of the coefficients is mostly negative, i.e. supporting the hypotheses and thus proposition 1. However, there is some heterogeneity and mostly insignificance. Regarding the characteristics education and age, the sign is different for dealers and fund managers. Interestingly, the use of flow analysis has a more rational "appeal" among fund managers. Only the characteristic "position" provides similar results for both groups of agents: higher position reduces the likelihood of flow analysis. Concentrating on statistically significant coefficients, hypothesis 5 seems to be rather rejected by the survey and

hypothesis 6 rather supported. Note, however, that the more intensive use of flows by younger FX dealers could have a rational motivation, if flow analysis has true value – as stated by propositions 2 and 3 – and if flow analysis is a newer kind of analysis which is therefore more easily grasped by new market entrants.

To check the robustness of these results, the same questions were investigated by concentrating on the characteristics of intensive flow users to others. For this purpose, those 35 respondents who use flows as preferred information, and in a second analysis those 90 respondents who use flows at least as a second most important source of information (see Table 2), were compared to the others by applying Chi-square tests. Results confirm the earlier correlation analyses and are thus not reported here.

In addition to these characteristics of FX professionals further institutional characteristics have been related to the use of flow analysis. Focusing on FX dealers a referee has claimed that proprietary traders of larger banks (with huge customer business) in particular rely on flow analysis. We have examined this idea – which best fits the viewpoint of proposition 3 – using a step by step approach, as our limited database does not really allow for grouping respondents into the required fine cluster. Thus, the single elements of this idea are correlated with the use of flows leading to three hypotheses:

H8 *Proprietary dealers use flow analysis more than other FX dealers.*

H9 *The share of customer business of a bank is positively related to the intensity of flow use of the dealers in this bank.*

A third analysis in this respect also draws on the considerations in Section 2 and examines the possible relation of the use of flows and the institutions' size in

[13] Even if one is not prepared to accept our interpretation of education, age and position as meaningful indicators of rationality, at least the indicator education is statistically related to the use of

which the respondents work. Whereas on the basis of proposition 1 one would not expect any systematic relationship, the following implications are derived from propositions 2 and 3: the incentive in smaller institutions may be stronger to watch trading flows with the aim of drawing inferences from this about better informed, larger institutions which can invest in extensive fundamental research (proposition 2). On the other hand, if there really is semi-fundamental private information in the FX market, then the bigger institutions, measured via larger FX transactions' volume and larger international funds under management respectively, have a better chance of profiting from flow analysis (proposition 3). Thus, both propositions compete directly with each other and can be tested by a single hypothesis which is formulated from proposition 3, to argue consistently:

H10 *A more intensive use of flow analysis is positively related to the size of a trading or fund management institution*.

The evidence in Table 4 on hypotheses 8 and 9 provides clear information that neither the job of proprietary versus liquidity dealer nor the share of customer business indicate a more intensive use of flows. However, the absolute size of an institution is tentatively positively related with flow use as can be seen from Panel A in Table 5. Size is even significantly related to the use of flow analysis for fund managers and clearly positively related for FX dealers (see Panel B). This implies evidence in favor of hypothesis 10 and, hence, rather for proposition 3 than proposition 2.

In summary, proposition 1, which regards flow analysis as a sign of less rational behavior, receives some empirical support. There is also slight evidence that the role of flow analysis may be related to indicators of rationality in the field of international fund management which states an affinity towards proposition 3. Finally, the more

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flow analysis, which requires explanation.

intensive use of flows in larger institutions is expected from the viewpoint of proposition 3 but not from proposition 2.

6. On the individual behavior of flow users

The last section has shown that flow users share some institutional characteristics. However, most empirical relations have not been tight which leaves a lot of room for other possible influences, e.g. individual behavior. Seen from proposition 1, one would expect that reliance of flow analysis is – analogously to the use of technical analysis (see Taylor and Allen, 1992) – positively related to a shorter forecasting horizon. Proposition 2, however, reflects no clear view on this relation as the learning process about fundamentals may be short-term oriented while the focus on fundamentals requires a longer horizon. Proposition 3 finally proposes a very short-term horizon for flow analysis as the value of this semi-fundamental information quickly disappears over time. Hypothesis 11 is formulated from the viewpoint of propositions 1 and 3:

H11 *Flow analysis is more intensively used at shorter forecasting horizons*.

The description of responses in Panel A of Table 6 as well as the rank correlation in Panel B clearly support this hypothesis. Whereas proposition 2 is not supported by this result, both proposition 1 and proposition 3 fit the result but offer very different explanations. Thus, additional information is required for a more far reaching judgment about the reasons for this short-term oriented forecasting horizon. It would be of particular importance to know which sources of information are highly regarded by flow users. Different propositions s lead us to expect different things: proposition 1 leads us to expect that less fundamentally oriented sources of information are important for flow users, such as telephone conversations with other

market participants or customer deals; proposition 2, with its affinity towards fundamental analysis, suggests that a combination of fundamental information and analyses, e.g. interest rates or in-house produced analyses, with channels gaining possible informational advantage, such as telephone talks is favored. Finally, proposition 3 suggests a primary focus on customer deals. The respective hypothesis 12 is somewhat loosely formulated from the viewpoint of proposition 1:

H12 *The more intensive use of flow analysis is positively related to "irrelevant" sources of information, such as talks and customer deals, and negatively related to fundamental information, such as interest rates.*

The answers of respondents to the respective questions are documented in Table 7. The left hand column contains the complete list of sources of information, including both core sources and others sources which have more the character of a control variable. The figures in the first two columns present the average level of importance listed for FX dealers and international fund managers respectively. The other two columns show the coefficient of correlation which is most interesting for our purpose. Regarding the level of importance for the distinguished sources of information, FX dealers and fund managers show a somewhat different pattern. Whereas dealers rely mostly on talks and large, own customer deals, fund managers prefer traditional fundamental information. Regarding our hypothesis, however, the great importance of talks for FX dealers is a general phenomenon independent of the use of flows. In contrast, the customer deals are important in particular for flow users. Finally, some fundamental information, such as money market rates and quotes of FX-futures are more important for flow users than others (see rank correlation in Table 7) but are not important in absolute terms (see average response in Table 7). These three pieces of information taken together allow a discrimination between the

three competing propositions: the missing link of talks with flow analysis is inconsistent with proposition 1. The insignificance or even unimportance of some fundamental sources of information for flow users is inconsistent with proposition 2. Proposition 3 conforms best with the evidence since own customer deals are seen as a competitive advantage. Note that quotes between dealers are regarded as informative but not so for the strong implementation of flow analysis. As the core and specific source of flow users only one item stands out, which is large, own customer deals. How do market participants themselves view the functioning of the market?

7. On the flow users' beliefs about FX markets

This last empirical section aims at achieving a better understanding of the beliefs of market professionals about the functioning of FX markets that flow users may have in common and may distinguish them from those who use flows less. If there are some "shared beliefs", this might point towards the users' motivation and thus indicate the relevance of propositions 1 to 3.

It is well known that according to many market participants psychological influences play a major role in defining exchange rate prices (Taylor and Allen, 1992, Cheung and Wong, 2000). From the viewpoint of proposition 1, the less rational behavior of flow users may be indicated in this belief. This leads to hypothesis 13.

H13 *A more intensive use of flow analysis is positively related to a stronger belief in the importance of psychological factors on prices.*

As the importance of psychological factors necessarily rivals the influence from fundamentals, proposition 2, which relates the use of flows to gaining fundamental information, would better fit with a rejection of hypothesis 13. Further evidence on the relevance of propositions 2 and 3 can be gained from additional statements. Thus it

is a necessary condition for learning from better informed investors that the revelation of news in FX prices takes time. The more time that is needed for this process, the better the chances are to profit from flow analysis. The respective hypothesis is formulated as follows.

H14 *A more intensive use of flow analysis is positively related to a lengthier period of processing fundamental information.*

The third proposition, emphasizing market imperfections in the trading process, seems to implicate that larger market participants could have an influence on prices. The more important large market institutions are seen to be for the price discovery process, the more rational it becomes to apply flow analysis:

H15 *A more intensive use of flow analysis is positively related to a higher attributed influence by large market participants on prices.*

The result of the rank correlations is given in Table 8. As the answers on the respective statements range between 1 for complete agreement and 6 for complete disagreement (logically similar in the case of hypothesis 14), rejection of the hypotheses requires a statistically positive sign in the correlation. In fact, however, the signs are mostly negative, indicating some support for the hypotheses. At a more detailed level, some remarkable differences become evident.

The test of hypothesis 13 does not provide any significant result. Hypothesis 14 is clearly rejected by fund managers, indicating support for propositions 2 and 3. Only hypothesis 15 receives high statistical significance and identical signs for both subgroups, strengthening the claim that the use of flow analysis is connected to imperfect markets. This interpretation is substantiated by a comparison of the subgroup of respondents that assign first preference for flow analysis with others, as preferred flow users' answers are only significantly different with respect to

hypothesis 15. These results have some implication for the relevance of the three competing propositions: the motivation of flow users as revealed by the survey does not seem to fit well with the idea of proposition 1, but correspond more with proposition 2 and best with proposition 3.

From a methodological point of view it should be noted that Section 7 presents flow users' opinions, i.e. the views that they have on FX markets. When they see a major influence of market makers, for example, it makes sense to apply flow analysis but it does not prove that market makers are really important. On the other hand it would be surprising if successful professionals are handicapped by a systematic misunderstanding of real market processes.[14]

8. Were there systematic changes over time?

Finally in our work the question arose, whether the use of flow analysis shows any systematic change over time. This issue can be analyzed for some questions which have been asked in both similar surveys, in 1992 and 2001. Seen from a methodological point of view, it could seem reassuring if the earlier results were to be confirmed, but, since markets tend to develop over time, it would perhaps be even more appropriate if a certain pattern of change were to be identified. One referee suggested for example that the importance of flow analysis should have increased during the 1990s.

A comparison of the two studies indeed confirms this suggestion. We have found that the use of flow analysis has gained relevance in relation to technical analysis and in particular relative to fundamental analysis. Further recognizable changes include a weakening of the former strong relation of flow use with lower education and with important psychology. Another stronger change is now the clear

relation of flow use with market imperfection. A complete list of all changes of significant relations between the two surveys is listed in Table 9. This confirms the briefly sketched pattern that while proposition 1, giving flow analysis a less rational appeal, loses ground in the face of empirical evidence, proposition 3, stressing the semi-fundamental character of flow analysis, rather gains ground. This move accentuates the already clear picture based on the earlier data, documented in the working paper version (see Gehrig and Menkhoff, 2001). It is further supported by the additional evidence drawn from the new questions exclusively asked in the recent survey.

9. Conclusions

Flow analysis in foreign exchange markets has not been a subject of systematic examination so far. In this respect it shares the fate of technical analysis which was also quite neglected until a few years ago when Allen and Taylor (1990) conducted their survey. Compared to the wide area of anecdotal and accidental information our questionnaire establishes better substantiated knowledge in two fields, i.e. regarding on the one hand the importance of flow analysis and on the other, the appropriate understanding of the nature of flow analysis as reflected by three competing propositions. The importance of flows may be highlighted by two facts:

- First, it becomes obvious that there is a third form of analysis in the market besides fundamental and technical analysis. In the group of respondents, about every second FX dealer and every third fund manager allocated 25% or more of information used to flow analysis.

[14] See also Section 4 on this.

- Second, the relationship with the other two forms of market analysis shows that flow analysis is neither closely related to a preference for "fundamentalism" or "chartism", nor is it a substitute for either of them: it rather represents an independent third form of analysis relevant for professionals.

The survey results have also shed some light on our understanding of the role of flow analysis in foreign exchange markets. Several hypotheses have been tested revealing evidence on the explanatory power of three competing hypotheses. The results are compiled in summarized form in Table 10. They provide a clear picture of the explanatory power of three competing propositions:

- Flow analysis does not seem to be basically used as a tool to learn about the fundamental information of others, as claimed in proposition 2.
- Moreover, the use of flow analysis does not appear to be clearly related to indicators of less rational behavior, thus slightly opposing the view of efficient markets, as stated in proposition 1.
- However, the evidence seems to accord best with proposition 3. This is the view that flow analysis aims at exploiting semi-fundamental private information.

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FIGURE 1. The ratio of fundamental to technical analysis depending on the use of flow analysis

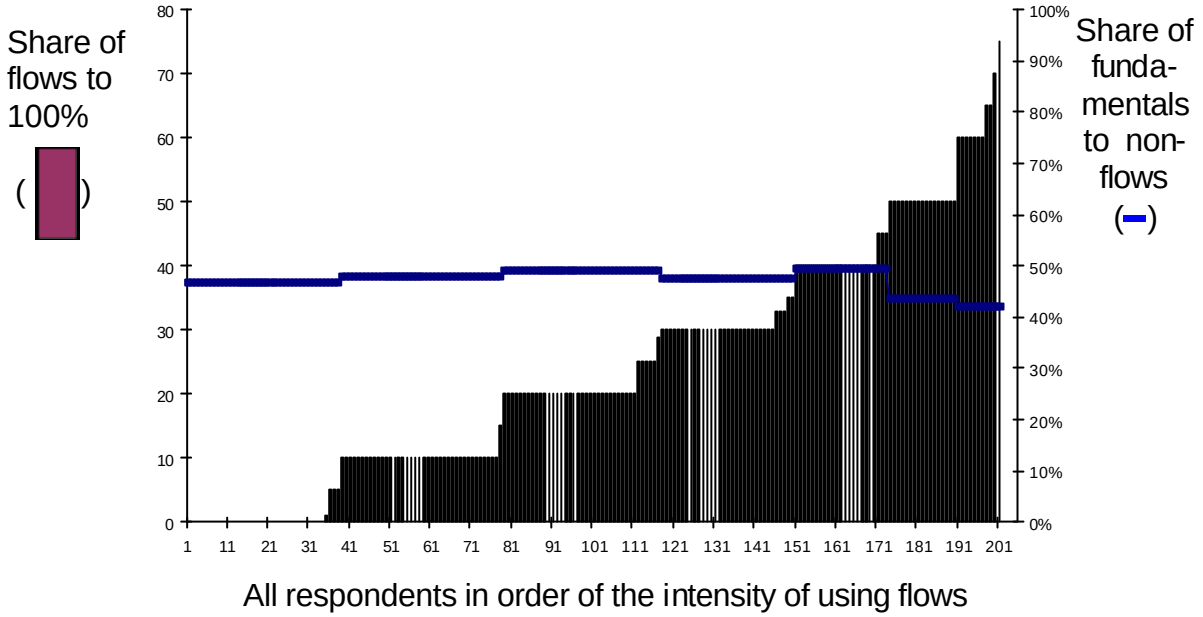

TABLE 1. Coverage and response rates

Institutions	Addressed	Addressed		Response		Response rate	
		Inst.	Quest.	Inst.	Quest.	Inst.	Quest.
Banks	Directly	35	112	28	72	80.0%	64.3%
Banks	via Association	15	99	14	73	93.3%	73.7%
Fund manag. companies	Directly	57	180	29	58	50.9%	32.2%
Total	All	107	391	71	203	66.4%	51.9%
(Subtotal)	Banks only	50	211	42	145	84.0%	68.7%
(Subtotal)	Directly only	92	292	57	130	62.0%	44.5%

Notes: 7 banks which were directly addressed and received 22 questionnaires are located in Austria

TABLE 2. On the importance of flow analysis

Question: "Please evaluate the importance of the three following information types for your typical decision making, by distributing a total of 100 points. For information types which you do not use, please give 0 points."

… Fundamentals (economic, political)
… Technical Analysis (charts, quantitative methods)
… Flows (who is doing what, which customer orders are existing)

	All respondents		FX dealers		Fund managers		Test for significant differences[2]
	n	in %[1]	n	in %[1]	n	in %[1]	W
Fundamentals	201	36.3	144	32.4	57	46.2	-4.108***
Technical analysis	201	40.2	144	41.4	57	37.0	-1.696*
Flows	201	23.5	144	26.2	57	16.8	-3.080***
Share of persons with following characteristics of use of flows:							
	n	in %[3]	n	in %[3]	n	in %[3]	χ^2
Share of flows > 0 %	167	83.1	124	86.1	43	75.4	3.310*
Share of flows ≥ 10 %	163	81.1	121	84.0	42	73.7	2.850*
Flows ≥ the lowest other and ≥ 25 %	90	44.8	71	49.3	19	33.3	4.213**
Flows as preferred information and ≥ 40 %	35	17.7	32	22.1	3	5.2	8.289***

Note: The number of cases may be different from the total sample due to incomplete responses.

[1] Average weight of information type

[2] Wilcoxon rank sum test, null hypothesis: use of information types is identically distributed for both groups, i.e. FX dealers and fund managers.

[3] Share of total sample

Stars refer to level of significance, *: 10 per cent, **: 5 per cent, ***: 1 per cent

TABLE 3. Rank correlations of flow use and users characteristics

	All respondents	FX dealers	Fund managers
Higher degree of education (4 categories)	-0.067 (0.352) [196]	-0.010 (0.911) [144]	0.297** (0.025) [57]
Higher age (5 categories)	-0.088 (0.214) [201]	-0.147* (0.078) [144]	0.027 (0.842) [57]
Superior position (2 categories)	-0.022 (0.726) [200]	-0.045 (0.595) [144]	-0.045 (0.741) [56]

Significance (p-value) in parenthesis
Number of responses in squared brackets
Stars refer to level of significance, *: 10 per cent, **: 5 per cent. ***: 1 per cent

TABLE 4. On the importance of flow analysis for certain dealing activities

PANEL A: SHARE OF INFORMATION TYPES						
	All FX dealers		Liquidity dealers		Proprietary dealers	
	n	in %	n	in %	n	in %
Fundamental analysis	144	32.4	55	34.4	71	30.4
Technical analysis	144	41.4	55	34.1	71	44.9
Flow analysis	144	26.2	55	31.5	71	24.8

PANEL B : RANK CORRELATIONS OF FLOW USE AND SHARE OF CUSTOMER BUSINESS			
Coefficient	-0.001	-0.016	0.121
Significance (p-value)	0.993	0.907	0.323
Number of responses	139	53	69

TABLE 5. Institution size and the use of flows analysis

PANEL A: Flow use in different groups of institution size					
Institution size in bn. Euro		FX dealers		Fund managers	
		share of flows	number n	share of flows	number n
Daily transaction volume	<0.5	22.07%	41		
	0.5 – 2.0	27.00%	51		
	>2.0	27.77%	47		
International funds under management	<0.5			9.59%	17
	0.5 – 2.0			16.92%	13
	>2.0			21.69%	26
Number n		25.62	139	16.91%	56

PANEL B: Rank correlation of flow use and institution size		
Coefficient	0.134	0.351***
significance (p-value)	(0.117)	(0.009)
number	[138]	[55]

Stars refer to level of significance, *: 10 per cent, **: 5 per cent. ***: 1 per cent

TABLE 6. The relation of flow use and individual forecasting horizon

Question: "How far in advances do you take into account possible influences on the exchange rates when opening a position?
Please, only one answer:" [1: intra-day, …, 6:> 12 months]

PANEL A: The use of flow analysis at different individual forecasting horizons (in %)

Forecasting horizon	All respondents	n	FX dealers	n	Fund managers	n
Intra-day	34.0	51	34.0	51	-	-
Few days	21.8	75	23.5	61	14.6	14
Few weeks	20.4	44	18.9	23	22.1	21
> 2 months	14.7	31	18.3	9	13.2	22
Total	23.5	201	26.2	144	16.8	57

PANEL B: Rank correlation of flow use and individual forecasting horizon

Coefficient	- 0.313***	- 0.299***	- 0.112
Significance (p-value)	0.000	0.000	0.407

Stars refer to level of significance, *: 10 per cent, **: 5 per cent, ***: 1 per cent

TABLE 7. The importance of different sources of information

Question: "How important are for your decision-making the following sources of information? Please, evaluate its importance with a number from 1 to 6:" [1: very important, …, 6: completely unimportant]

	Average response		Rank correlation with flow use	
	FX dealers	Fund managers	FX dealers	Fund managers
Direct (telephone) talks with other market participants	2.70 (1.32) [143]	3.48 (1.45) [58]	-0.022 (0.795) [142]	-0.146 (0.277) [57]
Level of money market rates	3.90 (1.48) [138]	3.25 (1.23) [57]	0.055 (0.520) [137]	0.282** (0.035) [56]
Changes of stock market prices	3.55 (1.30) [139]	3.40 (1.12) [57]	-0.079 (0.359) [138]	0.001 (0.996) [56]
Inhouse produced analyses	3.62 (1.43) [140]	3.16 (1.64) [56]	-0.026 (0.758) [1399	-0.215 (0.112) [56]
Externally published exchange rate analyses	3.23 (1.31) [141]	3.25 (1.26) [57]	0.064 (0.452) [140]	-0.150 (0.269) [56]
Bid-ask spread	4.18 (1.68) [142]	-	-0.100 (0.239) [141]	-
Quotes between dealers (e.g. in Reuters D2002-2)	3.08 (1.48) [139]	-	-0.059 (0.489) [138]	-
Large, own customer deals	2.96 (1.49) [140]	-	-0.428*** (0.000) [139]	-
Number of own customer deals	4.01 (1.53) [135]	-	-0.232*** (0.007) [134]	-
Quotes of FX-futures	4.40 (1.61) [134]	-	0.198** (0.023) [133]	-

Notes regarding average response: standard deviation in parenthesis ; number of responses in squared brackets.
Notes regarding rank correlation: significance (p-value) in parenthesis; number of responses in squared brackets; stars refer to level of significance, *: 10 per cent, **: 5 per cent, ***: 1 per cent.

TABLE 8. Rank correlations of flow use and beliefs about FX markets

Question: "How much importance do fundamentals and psychology have for exchange rate movements?"
() People are not machines; thus psychology is clearly more important than fundamentals.
[1: agree completely, …, 6: disagree completely]

Question: "How long does it sometimes need that fundamentals succeed in foreign exchange markets?"
[1: always immediately, …, 6: > 12 months]

Question: "Do you belief that big market participants have an influence on price formation?"
() Yes, they can "make" exchange rates for a while via own position taking or customer orders.
[1: agree completely, …, 6: disagree completely]

	All respondents	FX dealers	Fund managers
Higher importance of psychological factors on prices	-0.008 (0.910) [200]	0.073 (0.383) [143]	-0.105 (0.435) [57]
Longer time of fundamentals information processing	0.017 (0.810) [191]	-0.023 (0.795) [134]	0.268** (0.044) [57]
Higher importance of market makers on prices	-0.193*** (0.006) [201]	-0.132 (0.114) [144]	-0.76 (0.575) [57]

Significance (p-value) in parenthesis
Number of responses in squared brackets
Stars refer to level of significance, *: 10 per cent, **: 5 per cent. ***: 1 per cent

TABLE 9. Items with significant change over time

Questions or relations	See Table	Response in 1992	Response in 2001	Impact on propositions
Importance of flow analysis	2	17.9%	23.5%	Prop. 1: ↓
Flow use and higher degree of education	3	Negative correlation for all, dealers and fund managers	Positive correlation for fund managers	Prop. 1: ↓ Prop. 3: ↑
Flow use and higher age	3	-	Negative correlation for dealers	Prop. 1: ↑
Flow use and superior position	3	Positive correlation for dealers	-	(Prop. 3: ↓)[1]
Flow use and institution size	5	-	Positive correlation for fund managers	Prop. 2: ↓ Prop. 3: ↑
Flow use and importance of psychology	8	Positive correlation for all	-	Prop. 1: ↓
Flow use and longer time of information processing	8	-	Positive correlation for fund managers	Prop. 2: ↑ Prop. 3: ↑

Note: "-" indicates no significant relation. [1] The disconnection of flow use and superior position may be influenced by the younger dealers relying stronger on the more modern technique of "flow analysis" (see Section 5).

TABLE 10. Evidence from hypothesis tests regarding propositions 1 to 3

	Hypotheses	Proposition 1	Proposition 2	Proposition 3
No.	Description	flow analysis as sign of non-optimal behaviour	flow analysis as instrument to learn about fundamental news	flow analysis as instrument to exploit semifundamental private information
1	Absolute importance	-		
2	Relative importance	-		
3	Subgroup importance			+
4	Correlation with other information types	-	-	+
5	Relation to education	-		+
6	Relation to age	+		
7	Relation to position			
8	Relation to proprietary dealers			
9	Relation to share of customer business			
10	Relation to company size		-	+
11	Relation to forecasting horizon	+	(-)	+
12	Relation to sources of information	-	-	+
13	Belief in psychological factors			
14	Belief in longer time for information processing		+	+
15	Belief in importance of large market participants			+

"+" indicates supporting and "-" refusing evidence from the test