The Use of Flow Analysis in Foreign Exchange: Exploratory Evidence

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Abstract: This paper provides questionnaire evidence on the role of flow analysis for professional traders and portfolio 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 hypothesis that flows could be used to learn about fundamentals is rejected by the data. The evidence indicates that flows are more informative about semifundamental private information, suggesting support for the efficient market hypothesis only in a weak form.

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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 knowledge has been in the market 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 besides fundamental and technical analysis the analysis of flows is an independent third type of information. We thus add to the recent literature suggesting that the analysis of flows seems to affect the behavior of a significant group of professional FX market participants. For example, Lyons (1995) 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) and Evans (2001) improve exchange rate explanation by incorporating order flows.

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 are to some extent competing, and which we order according to their intellectual affinity to the efficient market hypothesis (EMH):

- Proposition 1 relates flow analysis to some kind of limited rational behavior, such as technical analysis (see e.g. Shleifer and Summers, 1990). This view relies

heavily on the 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 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 (Kyle, 1985).
- Proposition 3 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 semifundamental 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?

The study provides several insights: it can be demonstrated that flow analysis indeed is a major third tool for FX professionals besides fundamental and technical

analysis. Furthermore, the use of flow analysis is systematically related to some institutional characteristics and beliefs about FX markets. This information provides varying degrees of support to 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 semifundamental information.

The survey approach chosen has 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 these markets, and this is the reference case for our work (Taylor and Allen, 1992). The same approach was reproduced for other foreign exchange markets by Lui and Mole (1998). Related studies on foreign exchange markets include Menkhoff (1997, 1998), Cheung and Wong (1999), Cheung, Chinn and Wong (1999) and Cheung, Chinn and Marsh (1999). However, to our knowledge, there is no survey study examining the use of flow analysis in foreign exchange markets.

The agenda to learn about flow analysis consists of four steps: Section 2 reviews the literature on possible justifications for the use of flow analysis. Next, in Section 3, we introduce the methodology applied and then present the evidence on the importance of flow analysis in the FX market in relation to the two established forms of fundamentalism and chartism. Section 4 examines the question whether flow users can be viewed as a distinct, coherent group of people, i.e. either more rational or less rational agents. This lays the ground for Section 5, where flow users are related to beliefs about FX market characteristics. Section 6 concludes.

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, 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 to model markets with incomplete revelation of inside information through prices (see e.g. Grossman and Stiglitz, 1980 and Hellwig, 1980), and, thus, solutions to the information paradox,[1] it may be too coarse to understand the 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.

[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 more sources of uncertainty than prices, the price mechanism will not generally reveal 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).

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 reveal their information by trading less aggressively.[3] In this framework, market makers determine prices as the 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 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 whom 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

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[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 buy orders

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 established 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 interim price relevant but irrelevant in the long run. They label such information *semifundamental private information*. To the extent that semifundamental private information is relevant during the course of the trading day, the analysis of the order flow can also be informative about such semifundamental 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

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relative to the variance of noise trading would be interpreted predominantly as positive information by the market makers, and, thus almost reveal the insider.

[4] These authors analyze trading patterns before and after the abolition of trading restrictions during lunch time in Tokyo. The observed flattening of the U-shape of intraday 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.

[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.

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 institutions may use flow analysis in order to time their trades and minimize the impact on prices. We test these hypotheses explicitly in the analysis below.[6]

To the extent that flow analysis reveals more semifundamental 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 first question is whether flows are important for real world decision makers.[7]

3. Methodology and the importance of flow analysis

The basis of the following analyses is a mailed questionnaire sent to professional market participants in Germany in July 1992.[8] The target group consists of all relevant

[6] Hypothesis 3 (below) tests whether flow analysis is more relevant to fund managers or traders. Hypothesis 9 (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.

trading banks and international fund management companies at that time. Several ways have been applied to ensure the quality of the survey, such as intensive interviewing prior to mailing, consistency checks and cross-checks with other similar studies. The 205 received and useful responses represent an unusually successful response rate of 41.3%. Additional information indicates that the methodological requirements of this research approach seem to be fulfilled (for more details see Menkhoff, 1998).

The interview phase already revealed that market participants tended towards three, rather than only two, independent forms of information acquisition, namely fundamental, technical 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 testable with these data is derived from proposition 3. If flows provide "semifundamental private information", then short-term oriented dealers

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

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 1. The upper part of Table 1 states the average importance of fundamentals, technical analysis and flows, both for all respondents, or separated into FX dealers and international fund managers.[9] The response of an average weight of 17.9% given to flows rejects hypothesis 1.

The importance of flows is presented with increasing degree n the lower part of Table 1: 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 information for FX professionals; for a major group they are more important than fundamentals or technical analysis, or even both of them together.

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.[10] Thus, hypothesis 3 can not be rejected.

An interesting side-aspect of Table 1 is that fundamentals and charts seem more important than flows. 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 either a positive corre-

[9] The fundamentals include political events which are a 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.

lation between both information types, as they are motivated by the same type of user, or a substitutional relationship, stressing the fact that both information types have something in common. In the second case, there should be no impact on the intensity of using technical analysis. The respective hypotheses are formulated with the suffix "a". In contrast, proposition 2 would claim analogous hypotheses; thus replacing technical analysis by fundamentals and vice versa leads to hypotheses 4b and 5b:

H4a The more intensive use of technical analysis is positively related to a more intensive use of flows.

H5a The more intensive use of flow analysis is characterized by a declining use of technical analysis and an unchanged use of fundamentals.

If, however, flow analysis is rather a different type of information, such as claimed by proposition 3, then there would be no tight relationship to the use of both other types of information. The implication is then a rejection of hypotheses 4a to 5b.

The relevant calculations are documented in Table 2. It can be seen in the upper part of Table 2 that the use of the three information types is always strongly negatively correlated, which rejects hypotheses 4a and 5a. Moreover, the lower part of Table 2 shows the share of flow use being almost identical for preferred users of fundamental analysis (13.7%) or technical analysis (14.0%). With an increasing share of flow analysis both other forms are decreasing in similar fashion. Thus, the hypotheses 5a and 5b are rejected.

In summary, Section 3 provides clear evidence for a relevant use 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.

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[10] Significance tests in this paper are always non-parametric as the underlying data can not be descri-

What can be said about the characteristics of the flow users? Are there indications of rationality or institutional differences?

4. 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 truly 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. This leads to the following hypotheses to be confronted with survey data:

H6 A more intensive use of flow analysis is negatively related to a higher degree of education.

H7 A more intensive use of flow analysis is negatively related to a higher age.

H8 A more intensive use of flow analysis is negatively related to a superior position.

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bed by a normal distribution.

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 insignificance. Regarding the characteristics age and position, the sign is different for dealers and fund managers. Interestingly, the use of flow analysis has a more rational "appeal" among traders. This observation accords well with the viewpoint of proposition 3. Only the characteristic "education" provides similar results for both groups of agents: longer education reduces the likelihood of flow analysis in a statistically significant way. Thus, hypothesis 6 seems to be supported by the survey. In contrast, there is no consistent relationship between age or position and the use of flows. Hence, hypotheses 7 and 8 are neither clearly rejected nor do they receive support. The signs of the test, however, and the rejection of hypothesis 8 for the subgroup of dealers support the understanding of proposition 3.

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 26 respondents who use flows as preferred information, and in a second analysis those 68 respondents who use flows at least as second most important information (see Table 1), were compared to the others by applying Chi-square tests. Results confirm the earlier correlation analyses and are thus not reported here.

A final analysis in this section draws on the considerations in Section 2 and examines the possible relation of the use of flows and the institutions' size in 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 semifundamental private information in the FX market, then the bigger institutions, measured via larger FX transactions volume and larger international funds under management respectively, have better chances to profit from flow analysis (proposition 3). Thus, both propositions compete directly and can be tested by a single hypothesis which is formulated from proposition 2, which is closer to the EMH:

H9 A more intensive use of flow analysis is negatively related to the size of an institution.

The evidence in Table 4 does not offer overwhelmingly clear evidence. However, in FX trading the share of flow information becomes consistently larger with increasing trading volume. In the field of fund management, this relation is "disturbed" by the few cases in the second smallest group of fund management companies.[11] Thus, the picture tends to reject and definitely not support hypothesis 9. If we examine the institutions' size of the 26 preferred flow users, this group is significantly more often (10% level of significance) employed by larger institutions. This implies evidence rather in favor of proposition 3 than in favor of 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 foreign exchange dealing but to less rationality in international fund management which states an affinity towards proposition 3. Finally, the more intensive use of flows in larger institutions is expected from the viewpoint of proposition 3 but not from proposition 2. How do market participants themselves view the functioning of the market?

5. On the flow users' beliefs about FX markets

This last empirical section aims at 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 many market participants see a major role for psychological influences on exchange rate prices (Taylor and Allen, 1992, Cheung and Wong, 1999). From the viewpoint of proposition 1, the less rational behavior of flow users may be indicated in this belief. This leads to hypothesis 10.

H10 A more intensive use of flow analysis is positively related to a higher belief about 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 10. Further evidence on the relevance of proposition 2 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.

H11 A more intensive use of flow analysis is positively related to a longer time of fundamentals information processing seen.

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[11] The probably "disturbing" character of this group with only five responses can be recognized by inte-

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:

H12 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 5. 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 11), rejection of the hypotheses requires a statistically positive sign in the correlation. In fact, however, the signs are almost always negative, indicating some support for the hypotheses. At a more detailed level, some remarkable differences become evident.

The test of hypothesis 11 does not provide any significant result or even different signs for dealers and fund managers. Hypothesis 10 receives slight support, and only hypothesis 12 receives high statistical significance and identical signs for both subgroups. 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 2, but fits better to proposition 1 and best to proposition 3.

From a methodological point of view it should be noted that Section 5 presents the opinions of flow users, i.e. the view 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

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grating it into either of the neighboring groups, which would in both cases show an "undisturbed" positive relation between institution size and share of flows.

would be surprising if successful professionals are handicapped by a systematic misunderstanding of real market processes.[12]

6. 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 a better substantiated knowledge in two fields, regarding the importance of flow analysis and regarding the appropriate understanding about the nature of flow analysis as captured 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. About every third respondent spent more than 25% of her analytical budget on flow analysis.
- 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 to 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

[12] See also Section 3 on this.

are compiled in summarized form in Table 6. They provide a clear picture of the explanatory power of three competing propositions:

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

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TABLE 1. 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 (liquidity, who is doing what, which orders are existing)

	All respondents		FX dealers		Fund managers		Test for significant differences[2]
	n	in %[1]	n	in %[1]	n	in %[1]	W
Fundamental analysis	202	44.7	150	41.6	52	53.7	-3.926***
Technical analysis	202	37.4	150	37.6	52	36.8	-0.047
Flow analysis	202	17.9	150	20.8	52	9.5	4.752***
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 %	158	78.2	129	86.0	29	55.8	20.713***
Share of flows ≥ 10 %	147	72.8	120	80.0	27	51.9	15.363***
Flows ≥ the lowest other and ≥ 25 %	69	34.2	62	41.3	7	13.5	13.338***
Flows as preferred information and ≥ 40 %	26	12.9	24	16.0	2	3.8	5.086**

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
[3] Share of total sample
Stars refer to level of significance, *: 10 per cent, **: 5 per cent, ***: 1 per cent

TABLE 2. The relation of flow analysis to fundamentals and charts

	Fundamental analysis	Technical analysis	Number n
Spearman rank correlation of flow analysis with:			
Total sample	-0.365*** (0.000)	-0.301*** (0.000)	202
Shares of other analyses (in per cent) depending on the share of flow analysis:			
Share of flows > 0 %	41.7	35.4	159
Share of flows ≥ 10 %	41.6	34.2	147
Flows ≥ the lowest other	35.0	29.1	69
Flows as preferred information	30.1	25.4	26
Share of flows for preferred users of ...	13.7 (n = 101)	14.0 (n = 57)	

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)	-0.318*** (0.000) [199]	-0.159* (0.053) [148]	-0.326** (0.020) [51]
Higher age (5 categories)	-0.059 (0.405) [201]	0.035 (0.668) [150]	-0.084 (0.557) [51]
Superior position (2 categories)	0.074 (0.302) [199]	0.145* (0.080) [147]	-0.081 (0.570) [52]

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. The influence of institution size on the use of flows

Institution size in bn. DM		FX dealers share of flows	FX dealers number n	Fund managers share of flows	Fund managers number n
Daily transaction volume	< 0.2	18.32 %	25		
	0.2 - 1.0	20.90 %	40		
	1.0 - 5.0	20.92 %	73		
	> 5.0	26.67 %	9		
International funds under management	< 0.3			1.43 %	7
	0.3 - 1.0			13.00 %	5
	1.0 - 3.0			7.27 %	11
	> 3.0			11.72 %	29
Number n		20.82 %	147	9.52 %	52

TABLE 5. 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 no 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 the foreign exchange market?"
[1: always immediately,...,6: > 12 months]

Question: "Do you belief that market market makers influence the formation of exchange rates?"
( ) Yes, they can temporarily "make" exchange rates 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	-0.122*	0.005	-0.186
	(0.086)	(0.948)	(0.202)
	[199]	[150]	[49]
Longer time of fundamentals information processing	-0.043	-0.044	0.191
	(0.543)	(0.593)	(0.183)
	[199]	[149]	[50]
Higher importance of market makers on prices	-0.212***	-0.037	-0.222
	(0.003)	(0.657)	(0.117)
	[200]	[149]	[51]

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 6. Evidence from hypotheses tests regarding propositions 1 to 3

hypotheses		proposition 1	proposition 2	proposition 3
no.	description	flow analysis as sign of non-optimal behavior	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	substitution of other information types	-	-	+
6	relation to education	+		
7	relation to age			+
8	relation to position			+
9	relation to company size		-	+
10	belief in psychological factors	+	-	
11	belief in longer time for information processing		-	
12	belief in importance of large market participants			+

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