

The Influence of Buy-side Analysts on Mutual Fund Trading*

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Comments welcome

Abstract

We present evidence of the impact of buy-side analysts on the behavior and performance of fund managers. Using data provided by a large global asset manager, we relate buy-side analysts' recommendations to fund transactions on a daily basis. Our results show that buy-side analysts have a significant influence on trading decisions: Fund managers almost certainly follow recent recommendation revisions in their trades. Fund flows and sell-side recommendations matter as well, but to a lesser extent. Positive abnormal returns to buy-side analysts' revisions are also reflected in the performance of mutual fund trades. Trades triggered by buy-side recommendations have higher returns than other trades.

Keywords: Buy-side analysts, analyst recommendations, mutual funds, investment decisions, investment performance

JEL classification: G23, G11, G29, M41

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1 Introduction

The asset management industry is responsible for a large amount of capital invested on behalf of its clients: globally, \$ 53.4 trillion – almost 110% of world GDP – were under management in 2006, \$ 24.3 trillion invested in equities alone.¹ Professional money managers rely on various sources of information in order to guide their investment decisions. In equity markets, sell-side analysts employed by brokerage firms and investment banks as well as analysts employed by independent research providers are a prominent source of information. However, investment management firms also employ their own analysts (called buy-side analysts) as a private source of investment ideas. Although less visible than sell-side analysts, these internal analysts account for a significant share of the overall spending on equity research: According to the advisory firm The Tabb Group (2006), US and UK asset managers spent \$ 7.7 billion on internal and \$ 7.1 billion on external research in 2006. Cheng, Liu, and Qian (2006) observe that in the period 2000 to 2002, US equity funds' self-reported weight put on in-house analysts averages 73% to 75%. While sell-side analysts have been analyzed with scrutiny by investors, regulators and academics (see e.g. Boni and Womack (2003)), buy-side analysts have received far less attention. Little is known about the impact of these internal analysts relative to external analysts in money managers' investment process so far.

We empirically analyze how the information provided by buy-side analysts affects the investment decisions of professional money managers. Specifically, we approach the following key questions: To what degree do managers follow their in-house analysts' recommendations? To what degree do they follow the recommendations issued by sell side research analysts, which represent public information in the market? What are the performance implications of this behavior? Answers to these questions will provide evidence on the role and value of public versus private analyst information in the mutual fund industry. To address them, we use a proprietary data set from a large, globally active asset management firm. The data is – to our knowledge – unique in its details. We observe in-house analyst recommendations and changes therein as well as fund positions and transactions on a daily basis for a set of European equity mutual funds between 2004 and 2007.

Put generally, this paper analyzes the value of internal analysts as an important organizational aspect of many asset management firms. More specifically, it represents a first

¹These numbers are based on the estimates by The Boston Consulting Group (2007) and the World Bank.

step in quantifying the role of buy-side versus sell-side analysts in the return generating process. This sheds light on the value for investors of choosing an asset manager with internal research capabilities (at potentially higher management cost). The paper also yields detailed insight into the decision-making process of professional money managers.

We find that buy-side analysts (BSAs) have a significant (both statistically and economically) effect on the trading behavior of fund managers. Buy transactions coincide largely with more favorable internal stock recommendations: The direction of trades in a stock matches those of a prior recommendation change with almost 90% probability during the week following the new recommendation. Even after controlling for other trading influences (most notably fund flows and sell-side recommendations), we find that recent recommendation changes induce a similarly directed shift in the probability of a stock purchase of 26 to 35 percentage points. This effect is considerably larger than the effect of the sell-side analysts (SSAs) on transactions.

The relative impact of BSAs and SSAs is consistent with the two types of analysts providing fund managers with, respectively, private and public investment signals. Chen and Wilhelm (2007) and Kacperczyk and Seru (2007) show that investors receiving both types of signals react more strongly to the private signal. Public signals will be more reflected in stock prices than private ones as a larger set of investors observe and responds to public signals.² As the investor's private signal is revealed less in prices, his response to this signal should be stronger (unless its precision is too low).

The analysis of returns to recommendation revisions and fund manager transactions further strengthens the investment signal character of BSA recommendations. Recommendation upgrades by BSAs yield positive market-adjusted returns while downgrades show negative abnormal returns. The difference in returns is between 1.7 and 1.9 percentage points over a one to two months horizon. Similarly, fund transactions that are very likely to be triggered by recommendation revisions yield positive abnormal return differences during the first two months. More importantly, these transactions yield higher return differences than transactions that cannot be attributed to BSA recommendations alone. The transaction impact of BSAs thus also leads to a positive performance impact for our sample funds.

Our analysis relates to two strands of the literature. The first provides analyses of research analysts and their value for investments. Most of the contributions here focus on

²To have some investment value, the "public" signal needs to be imperfectly observable, e.g. due to liquidity trades (as in models based on Grossman and Stiglitz (1980) or Kyle (1985)).

the behavior and incentives of sell side analysts (see e.g. Womack, 1996; Barber, Lehavy, McNichols, and Trueman, 2001; Irvine, 2004; Ivkovic and Jegadeesh, 2004; Jegadeesh, Kim, Krische, and Lee, 2004; Barber, Lehavy, and Trueman, 2007). Given the private nature of the data, there is hardly any empirical work on the comparison of buy side versus sell side analysts, except for the recent paper by Groysberg, Healy, Chapman, Shanthikumar, and Gui (2007) which uses proprietary data from a US asset management firm. Their results suggest that the investment value of BSAs is less than the value of the sell side analysts.

The second strand of related literature focusses on the investment behavior of money managers, specifically on the role of (public and private) information for fund managers. Contributions in this strand are either theoretical (see e.g. Chen and Wilhelm, 2007) or try to infer the use of private information indirectly (see e.g. Cheng et al., 2006; Kacperczyk and Seru, 2007; Pomorski, 2008). In particular, Kacperczyk and Seru (2007) find that fund managers whose portfolio changes are less correlated with sell side analyst recommendations show better fund performance. The authors attribute this to higher manager skills which yield better private information (or private interpretation of public signals).

At first glance, the findings by Groysberg et al. (2007) and Kacperczyk and Seru (2007) appear contradictory: BSAs show lower performance while fund managers' private information (with internal analysts considered an important aspect thereof) yields better performance. However, the findings might be reconciled by analyzing whether and how analyst information provision enhances fund performance. Our paper shows that other investment signals, in particular sell-side recommendations and fund flows, also affect trading decisions. Additionally, recommendation revisions (not the recommendation levels) determine transaction. By singling out transactions with high likelihood of being driven by BSA revisions, we show that these revisions contribute positively to fund performance.

The paper is structured as follows. Section 2 describes our data set. In section 3, we analyze the impact of BSAs and SSAs on the trading behavior of fund managers. Section 4 then considers the performance impact of BSAs. Section 5 extends the analysis by considering the impact of a sub-sample of sell-side analysts. Section 6 concludes.

2 Sample and data

The analysis combines data from both public and private sources. A global asset management firm which belongs to the top ten global asset managers in terms of assets under management is the main data provider. From one of their European offices, we obtained a rich set of information on their mutual funds and buy-side analysts. This data is augmented by stock and sell-side analyst information from public sources.

Mutual fund data: We use a sample of 14 equity funds investing in European equities between June 2004 and December 2007. All these funds are managed by individual fund managers who belong to the firm's European equities team. Managers of a fund can change over time. Besides managing mutual funds, fund managers also manage institutional equity portfolios. Although information on these portfolios is not included, these institutional portfolios share the basic strategy in terms of equity investments. The fund data used thus proxies the full spectrum of investment strategies pursued within the company.

The daily information we use includes all trades undertaken within these funds, all fund investments, and net money flows into (out of) these funds. We also obtained basic fund information such as the ID of the fund manager, the fund benchmark relevant for fund manager evaluation as well as changes in any of this information during the sample period. We supplement this data with daily fund prices and benchmark returns.

Buy-side analyst information: Internal stock recommendations originate from two groups of analysts, research analysts and small cap fund managers. The main task of the latter group is to manage small cap equity portfolios but they also give stock recommendations for a subset of the stocks they invest in. Research analysts are sector specialists who follow stocks in the sector of their expertise. These analysts are very much alike the sell-side analysts and often worked for the sell-side previously or move to the sell-side later on. The job of a research analyst in our sample firm has a career path of its own. These analysts are hence no junior analysts who will be fund managers in the future. Although a few analysts also manage sector portfolios, their role as analyst is never secondary. Stock recommendation are analysts' key output and a major determinant for analysts' performance evaluation and hence bonus payment. Another task of the research analysts is to discuss their views and industry/company news with fund managers. Although research analysts have their own company models, unlike sell-side analysts they are not required to provide earnings estimates on a regular basis.

We use daily information on recommendations for European stocks issued by all internal research analyst.³ The information contains the stock, an analyst ID, and the current recommendation. Analyst stock recommendations are coded 1 for “sell”, 2 for “underperform”, 3 for “hold”, 4 for “buy” and 5 for “strong buy”. Changes in a recommendations are recorded in the data set for the same day as the analyst announces the change if this occurs before the market opens. Else, they are recorded as of the subsequent trading day. These timing conventions are also used in the internal evaluation of the analysts. Unless stated otherwise, when considering changes in buy-side analysts’ recommendations, we only use the direction of the change. A value of +1, 0, or -1 for a buy-side recommendation change indicates a more favorable recommendation, no change, or a less favorable recommendation, respectively.

Sell-side analyst information: For each stock traded by one of the sample funds, we collect sell-side analyst recommendations from the Thomson Reuters I/B/E/S database. These recommendations are originally coded in the opposite direction of the buy-side recommendations (from 1 for “strong buy” to 5 for “sell”) and are recoded to match the buy-side structure. A higher recommendation thus implies a more favorable view of the stock in both data sets. We use the daily mean consensus recommendation for each stock as well as the recommendation for each stock by each broker that covers that stock in the database. The change in the consensus over a period is the difference between the consensus value at the end of the period and on the trading day before the beginning of the period.

Sample description: We restrict our sample to those stocks that were covered by the buy-side analysts (i.e. where there is at least one buy-side analyst recommendation) during January 2004 and December 2007. We then collect all transactions by the mutual funds in these stocks and add buy-side recommendations, fund flows, the sell-side consensus and stock returns. To be included in the sample, a stock has to be covered at least for a subperiod by a buy-side analyst. Table 1 provides descriptive statistics for the sample.

For recommendation changes, cash flows and returns, we consider several, non-overlapping time periods. For example, we differentiate the sum of cash flows by whether they were reported on the same or previous day as the trade (Cash Flow _{$t,t-1$}) or during the remainder of the preceding trading week (Cash Flow _{$t-2,t-5$}), where t denotes the day of the transaction. Since cash flows have very immediate effect on the portfolio structure, we don’t

³We disregard recommendations issued by small cap fund managers as these are not their main task.

consider cash flows which occurred over a week ago. For buy-side analyst recommendation changes we use the period of one day prior to one day after the transaction (BSA rec. change $_{t+1,t-1}$) in order to account for fund managers receiving information about planned revisions by the BSAs. We also consider revisions during the remainder of the preceding week (BSA rec. change $_{t-1,t-5}$) and changes that happened up to a month earlier (BSA rec. change $_{t-6,t-20}$). The publicly observable consensus recommendation and return variables are included for three subperiods within the past six months.

3 Transaction impact

In this section, we consider the impact of buy-side and sell-side analyst recommendations on the trading behavior of fund managers. In the first step, we look at the structure of transactions around buy-side recommendation changes. We then turn to a more thorough analysis of the determinants of trading decisions.

3.1 Recommendations and the structure of transactions

If buy-side analyst recommendations matter for fund managers' investment decisions, we should expect to see changes in their behavior when recommendations are changed. Over the sample period, we observe 536 recommendation changes. Table 2 (Panel A) presents the distribution of these recommendation changes in a transition matrix. The table shows the distribution of new recommendation levels by the prior recommendation level. The last column in Panel A gives the percentage of recommendation revisions originating from the prior level. In contrast to sell-side analysts, the buy-side analysts in the sample firm do not issue recommendation reiterations. Hence, the main diagonal of the transition matrix is empty.

The numbers in Panel A show that most of the recommendations by buy-side analysts are either a hold (recommendation of 3) or a buy (recommendation of 4). Over 76.5% of prior recommendations are at these levels, and the transitions also mostly are towards these levels. Only very few recommendations initiate from or target the lowest recommendation level. Additionally, the transition matrix shows that most recommendation revisions are single level changes. In later analyses, we will therefore neglect the size of recommendation changes and simply differentiate between upgrades and downgrades.

Panel B of Table 2 illustrates the distribution of buy versus sell transactions in stocks

whose recommendations are changed. Specifically, the table reports the proportion of buy transactions among all transactions in a stock within the period starting one trading day prior to the recommendation change and ending one trading day afterwards. These buy proportions are averaged and presented for the same recommendation transitions as in Panel A. The results show that upgrades (numbers above the main diagonal) and downgrades (numbers below the main diagonal) go along with strongly different trading behavior: Upgrades are accompanied with mostly buy transactions, whereas sell transactions dominate for recommendation downgrades. As an example, consider an initial hold recommendation (level of 3). For the 65.3% of stock upgrades to a buy recommendations (recommendation level 4, see Panel A), buy transactions make up 86.8% of all transactions in these stocks in the three day period around the recommendation change. Conversely, for the 33.6% of stocks downgraded to underperform (recommendation level 2), 87.0% (100%-13.0%) of transactions are sells. The results in Panel B show a strong congruence between fund managers' trading decisions and buy-side recommendation revisions.

Figures 1 and 2 provide further evidence of the impact of buy-side analysts' revisions on fund manager trading. Both figures analyze trades in stocks around recommendation revisions. These revisions happen at time $t=0$. Similarly to Panel B of Table 2, Figure 1 reports the proportion of buys (in percentages) up to five weeks prior to and after the revision. The dark-shaded bars show proportions of buys around upgrades, the light-shaded bars show buy proportions around downgrades. Figure 2 looks at the trading intensity of fund managers around recommendation revisions. It shows the average number of trades observed in a stock around its revision day, again for upgrades (dark-shaded bars) and downgrades (light-shaded bars) separately. In both figures, numbers are averaged on a daily basis for the first week around revisions. For weeks -5 to -2 and 2 to 5, the figure reports weekly averages.⁴ Additionally, the dashed line in each figure gives the average across all weeks and revisions.

Figure 1 shows that the congruence between recommendation revisions and fund managers' trades extends over a longer period. Recommendation upgrades (downgrades) shift post-revisions trades towards buys (sells) for at least three weeks, with weakening effect over time. Even five weeks after a revision, trading behavior appears to differ for upgrades and downgrades. Trading activity also increases in the wake of recommendation revisions, as Figure 2 illustrates. However, the effect appears not to be long-lasting as it vanishes

⁴The change from weekly to daily (to weekly) averaging is also highlighted in the figure by changes in the background shading.

after the first week. Still, both figure strongly highlight the impact of buy-side analysts' recommendations on fund manager behavior.

A surprising feature in Figures 1 and 2 is that transactions prior to a revision show very similar structures to transactions after the revision. This is not overly surprising for one to two days ahead of the revision: The timing convention and internal communication channels can lead to fund managers knowing of a recommendation change before it is recorded in the company's system. However, it seems unlikely that there is more than two days delay between the day of an analyst's decision to change a recommendation and its recorded date. The strong pre-revision effect (seen particularly in Figure 1) is thus due to other interactions between fund managers and buy-side analysts. Most likely, fund managers and buy-side analysts share and discuss their views about stocks. These discussions can be around specific events, such as company meetings, company announcements, or institutionalized meetings between analysts and fund managers.⁵ Whether this enables analysts to communicate early their plans to revise a recommendation or whether fund managers are able to convince analysts and simply trade according to their view is not discernible from the data. However, the maximum impact at date $t=0$ suggests that it is not only fund managers (and their trades) that influence buy-side analysts' revisions.

3.2 Explaining the direction of trades

The previous analysis has shown that buy-side recommendations have a strong effect on whether fund managers buy or sell a specific stock. Therefore, we look at this decision in more detail. We will show that buy-side analyst recommendation changes and fund flows have a high impact on the trade direction even after controlling for other investment signals. We then analyze whether buy-side analyst recommendations are more than a compound signal of these investment signals.

Table 3 (Panel A) presents the results of a logit regression of buys versus sells on various internal and public trading signals. The dependent variable takes on a value of one (zero) if a stock transaction by a single mutual fund during a day is a buy (sell) transaction. The explanatory variables include the internal information about buy-side analyst recommendations (both current levels and past changes) and cash flow information. As publicly observable explanatory variables, we use the consensus recommendation of the

⁵For example, fund managers specialize within the team on certain industries. This ensures that analysts know whom to approach when there is any new information or upcoming events. Also, sector analysts and the fund management team meet on a regular basis.

sell-side (current levels and past changes) as well as past stock returns. The former provides a signal of the average analyst's recommended transaction and should take into account all relevant stock information up to the day of transaction. The return variable is included to capture potential momentum or contrarian trading by the fund managers. Past returns are normalized to units of ten percentage points.

The results of the logit analysis show that all explanatory variables are statistically significant at the 5% level. Recommendation upgrades by either the sell-side or buy-side as well as cash inflows positively affect the propensity to buy a stock for all the periods considered. This is consistent with our earlier results and with fund managers considering recommendation changes to contain investment value. Recommendation levels and past returns show less clear results. While they increase the propensity to buy when issued by a buy-side analyst, better recommendation levels have a negative effect when issued by the sell side. Portfolio managers also show no consistent behavior with respect to past returns.

The last columns of Table 3 report the average marginal effects of changes in the explanatory variables. The results show that the internal signals have the highest economic impact on trade directions. Most notably, a buy-side analyst's recommendation upgrade (downgrade) at the same or previous day increases (decreases) the propensity that fund managers buy that stock by 43 (28) percentage points. Although the effect decreases over time it is still economically high (between 13 and 15 percentage points) if the recommendation change happened between two to four weeks before the transaction. As a comparison, the maximum effect that a similar change in the consensus recommendation has is 19 percentage points. Although it generally depends on the coverage of a stock, a one-unit change within a single week is highly unlikely. The effect of a one standard-deviation change in the consensus is below two percentage points ($0.19 \times 0.098 \approx 0.019$). Nevertheless, the sell-side information signal has an impact that persists even for periods of up to six months. A cash flow of one percent of a fund's asset value over the same or previous trading day changes the buy propensity by 16 percentage points in the same direction. The effect is reduced to five percentage points if the cash flow occurs during 5 to 3 days before the trading date. Finally, past returns and recommendation levels, although statistically significant, show low economic impact on trade directions.

3.3 The direction of BSA recommendation changes

In order to gauge whether buy-side analyst recommendation changes are more than a combination of the public investment signals considered by fund managers, we now turn to the recommendation upgrade or downgrade decision. Similar to the trade direction analysis, we perform a logit regression of each analyst decision to change a stock recommendation. The dependent variable thus takes on a value of one (zero) if the analyst upgrades (downgrades) the stock. For the independent variables, we use the same set of public signals as before.

The results and average marginal effects of the logit analysis are presented in Table 4. Only three variables turn out to be statistically significant (at the 5% and 10% level): Consensus and stock price changes over the previous week as well as stock price changes during the preceding month. The two variables for the preceding week also appear to be of economic significance, as shown in the marginal effects. An increase in the consensus recommendation by one unit during the previous week increases the likelihood of an upgrade by 58 percentage points. Again the effect for a one standard-deviation change is much smaller ($0.58 \times 0.052 \approx 0.030$). The marginal effects of both variables (consensus change and return) are larger than in the trade analysis. Yet, the overall explanatory power of the analysis is fairly low.

In sum, our results suggest that buy-side analysts' changes in recommendations play an important role in terms of private investment signals. Their impact is also larger than that of the sell-side consensus. And even though buy-side analysts might follow a few similar investment signals as fund managers do, their recommendation changes appear largely to have additional information content.

4 Performance impact

Having seen that buy-side analyst recommendations affect trading decisions, we now turn to the analysis of their impact on fund performance. Before analyzing the performance of fund transactions, we first consider the performance of buy-side analysts' recommendation changes.

4.1 Buy-side analysts' performance

We measure buy-side analyst performance by calculating the percentage return of each stock upgrade and downgrade for holding periods of one, five, 10, 15, 20, 40, 60 and 120 trading days as of the day of the recommendation change. We compute both raw returns as well as market-adjusted returns, using the MSCI Europe return as the market return. Stock performance numbers are averaged for all upgrades and downgrades with equal weighting. Table 5 presents the performance results of recommendation changes as well as the difference in performance between upgrades and downgrades.

Looking at raw returns, Panel A shows that stocks that have been upgraded have almost steadily increasing performance over time. The same holds for those stocks that have been downgraded, with the exception that they initially have negative returns. The general increase in stock prices is not overly surprising, given the time period of our analysis. However, the results also show that the return difference between recommendation upgrades and downgrades is positive and significant for the first two to three months. This return difference builds up from 0.43 to 1.74 percentage points over the first weeks and reaches a maximum of 2.26 percentage points after one month. The latter structure of returns is also visible in market-adjusted returns (Panel B). The difference in excess returns between upgrades and downgrades increases from 0.56 to 1.86 percentage points within one month and decreases thereafter. Overall, it is possible to generate positive returns by following buy-side analysts recommendation changes. These returns accord well with returns measured for a different set of buy-side analysts (see Groyberg et al. (2007)) or sell-side analysts (e.g. in Busse, Green, and Jegadeesh (2008)).

4.2 Performance of fund managers' transactions

Given that BSAs generate valuable investment signals and that fund managers appear to trade consistently with these signals, we should expect to see positive performance

of trades induced by BSA recommendation changes. We thus turn to analyzing fund managers' transactions and consider the returns to buy and sell transactions as well as their difference. Table 6 presents the performance of two transaction samples: The first sample (in columns two and three, six and seven, ten and eleven) contains all transactions where a same-directional revision by the BSA is observed in the period of one trading day prior to one trading day after the transaction. From the analysis in 3, we know that these transactions are very likely to be driven by the internal investment signal. The second set of trades contains those with no recommendation change by the BSA during the three days around the transaction. The sample thus contains transactions that are not solely driven by the BSA recommendation but might be based on other information too.

We compute raw (Panel A) and market-adjusted returns (Panel B) over the same time-horizons as in Table 5. Although the funds in our sample have different, fund-specific benchmarks (given their differences in investment focus and style), we use the MSCI Europe index as the market return. Unreported calculations using fund-specific benchmarks for market-adjusted returns yield very similar results. We present returns for buy and sell transactions as well as the (within-sample) difference in these returns.

The results for the raw returns show again positive returns for both buys and sells over the longer return periods. Raw returns are highest for buys without an accompanying revision and lowest for sells triggered by downgrades. For both samples, the difference in returns is positive and significant during the first month. Thereafter, only the sample without revisions has positive differences in returns.

Looking at market-adjusted returns allows some more assessment of the structure of transaction returns. Most notably, the results suggest that the return to transactions is mostly affected by the negative market-adjusted returns of fund managers' sells. These returns are almost all significantly negative, particularly those triggered by BSA downgrades. Stocks sold around downgrades underperform the market by 1.21% within the first week and by 3.34% after 6 months. Sells without a BSA revision on the other hand underperform the market by less than 0.5% – still, the returns are significantly different from zero. Buy transactions show much weaker evidence of positive abnormal returns. Only those buys without revisions have positive and statistically significant returns (over the two-month period), whereas BSA driven buys show statistically insignificant differences from zero.

The differences in returns between buys and sells are positive and significant for both samples during the first two to three months after the trade. The transactions driven by BSA revisions reach a maximum difference of 2.08 percentage points after two weeks

and the difference remains significantly positive for two months. The time horizon for those trades to be profitable is thus the same as for the BSA revisions themselves. The results thus suggest that the return potential of BSAs' revisions is captured by fund managers. In particular, fund managers seem to profit from negative revisions, whereas trades implementing upgrades surprisingly show returns not significantly different from zero.

Table 7 presents a comparison of the return differences between buys and sells for the two samples. While the return difference is mostly higher for transactions potentially driven by BSA revisions, the difference (in return differences) is only statistically significant during the first two to three weeks. Although fund manager trades seem to be more profitable if triggered by BSA revisions, this can only be confirmed for a relatively short return horizon. Still, overall the return analysis of transactions shows that BSAs positively affect fund managers' transaction returns and thus improve fund performance.

5 The performance impact of key sell-side brokers

In the following, we provide some evidence on the performance impact of the sell-side. Although the market consensus appears to have some effect on the trading decision, it appears unlikely that fund managers react to recommendation changes disregarding the identity of the analyst or his employer. Rather, one should expect some sell-side analysts or brokers to be followed more closely than others. Instead of considering the full set of SSAs in the market via the consensus, we therefore try to identify the key brokerage firms for our sample firm and analyze the impact of SSAs employed by these firms.

We measure the relevance of a sell-side firm for our sample firm by the overlap between the stocks traded by the mutual funds and stocks covered by the sell-side firm. Hence, sell-side brokers which cover a higher number of stocks that were also traded by the mutual funds are deemed more important. We rank all brokers covered in the I/B/E/S database and consider only the top 10 brokers in this ranking.⁶ The overlap between these firms' coverage and mutual fund trades ranges from 226 to 242 stocks.

⁶Although we know which brokers are considered most relevant by our sample firm, we disregard this information but employ our own criterium for identifying key sell-side firms.

5.1 Key sell-side analysts' performance

We first consider the performance of the top 10 brokers' analyst recommendation revisions. Similarly to the analysis in table 5, we calculate percentage returns of each stock upgrade and downgrade for the various holding periods. However, in contrast to our other performance analyses, we measure the analyst return based on the closing price prior to the revision day. As SSA revisions have price impacts starting with the announcement day (see Francis and Soffer (1997) or Ivkovic and Jegadeesh (2004)), disregarding the day of the revision would miss out an important part of this revision's return.

Table 8 presents the performance results of key SSA recommendation changes as well as the difference in performance between upgrades and downgrades. The results show that SSAs provide valuable investment recommendations beyond the first day of the announcement. Both raw and market-adjusted returns of upgrades are highly significant and positive for all return periods considered. Recommendation downgrades yield negative raw returns initially, and significantly negative market-adjusted returns. The return differences are highly statistically significant and positive and increase from 1.18 percentage points to 2.24 percentage points for market-adjusted returns.

Although the patterns of returns for SSA and BSA revisions are similar, the returns to SSA revisions appear slightly stronger and are also longer lasting than BSA revisions. Our findings are comparable with the findings by Groysberg et al. (2007) that SSA recommendations outperform their sample firm's BSA recommendations.

5.2 Performance impact on fund managers' transactions

We now consider the performance of transactions which occur during the same day or one day after a recommendation revision by one of the key SSAs. Although SSA revisions tilt transactions in the direction of the revision, the effect is much weaker than for BSAs. For example, the same-day percentage of buys following SSA upgrades versus downgrades is 50.7% versus 22.4%. We therefore compare the performance of both buy and sell transactions for recommendation upgrades and downgrades separately (see Busse et al. (2008) for a similar analysis). Trades that are in the same direction as SSA revisions should not only contribute positively to the overall fund performance. Rather, if fund managers are also able to discern profitable and unprofitable stock recommendations, the return difference between buy and sell transactions should be positive both for transactions following upgrades as well as following downgrades.

Table 9 presents returns to buy and sell transactions as well as return differences for stocks that were traded on the announcement day of a recommendation upgrade (Panels A and B) and downgrade (Panels C and D) or one day afterwards. If more than one key SSA revision occurs from different brokers during those two days, the majority decides.⁷

For trades following recommendation upgrades, raw returns to buy transactions are positive and significant. However, market-adjusted returns as well as raw returns to sell transactions are mostly not significantly different from zero. Overall, the return differences following upgrades are only positive up for returns periods of up to one month. This is different for transactions following downgrades. In particular, sell transactions following downgrades show significantly negative performance and there are positive return differences for periods of up to two months that also appear to be at higher levels than transactions following upgrades. For example, the one-month difference in market-adjusted returns is 0.58 percentage points following upgrades and 1.68 percentage points following downgrades.

In sum, the top 10 sell-side brokers (by coverage overlap) provide valuable investment signals to fund managers. At the same time, fund managers appear able to distinguish profitable from less profitable recommendation revisions. If we compare the performance of same-directional transactions and SSA revisions with those following BSA revisions in Table 6, the effects appear very similar. The major performance contribution of analyst recommendations in the sample period thus stems from sell transaction following downgrades.

⁷In case of an equal number of upgrades and downgrades, the transaction is discarded.

6 Conclusion

Equity research analysts provide financial market information that can be sold in two ways, directly and indirectly (see Admati and Pfleiderer (1988, 1990); Biais and Germain (2002)). Sell-side analysts are direct sellers of information whereas buy-side analysts and asset managers sell their information indirectly. However, in many asset management firms the task of gathering and producing investment information and the task of making investment decisions are separated. Fund managers may hence rely on both information sources and decide for themselves on the use of the information. This paper analyzes how fund managers use private (buy-side) and public (sell-side) information by directly observing recommendations from both sources.

Our results show that fund managers react most strongly to recommendation changes by buy-side analysts. Jegadeesh et al. (2004) have already documented that the information content of sell-side stock recommendations is highest in recommendation changes. The response of fund managers suggests that the same is true for buy-side recommendations. Additionally, the private nature of buy-side recommendations probably ensures that prices will not (instantly) reflect the information. It is thus more profitable to respond to a signal if it is private. The higher impact of buy-side recommendations, particularly in comparison with the sell-side consensus, found in our analysis is consistent with these intuitions.

The analysis of the returns to buy-side analyst recommendations shows that following buy-side analysts' revisions can be profitable for fund managers. Our results suggest that this is indeed the case: Transactions triggered by buy-side analyst recommendation changes yield positive abnormal returns that exceed or are comparable to other transactions. In sum, the behavior of fund managers and impact of buy-side analysts found in the analysis accords well with models of investment decisions and market microstructure under public and private information.

Since our data come from a single firm, our results are clearly not generally applicable to the overall asset management industry. However, our results show a consistency of the sample firm's business model of using sell-side information while at the same time employing buy-side analysts. As this is a widely adopted business model, our analysis can be of interest to other firms in the industry as well as fund investors.

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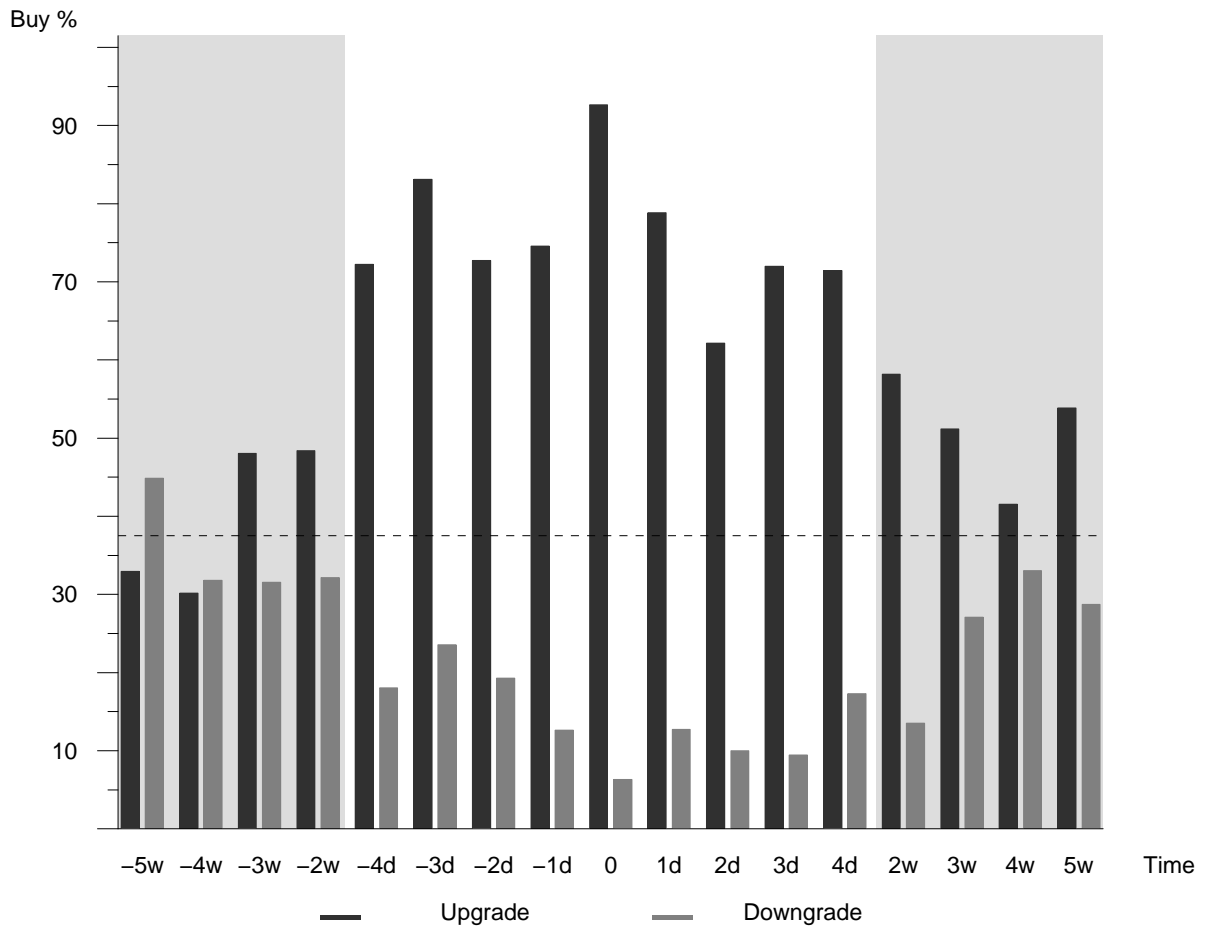


Figure 1: Percentage of buy transactions around BSA recommendation revisions

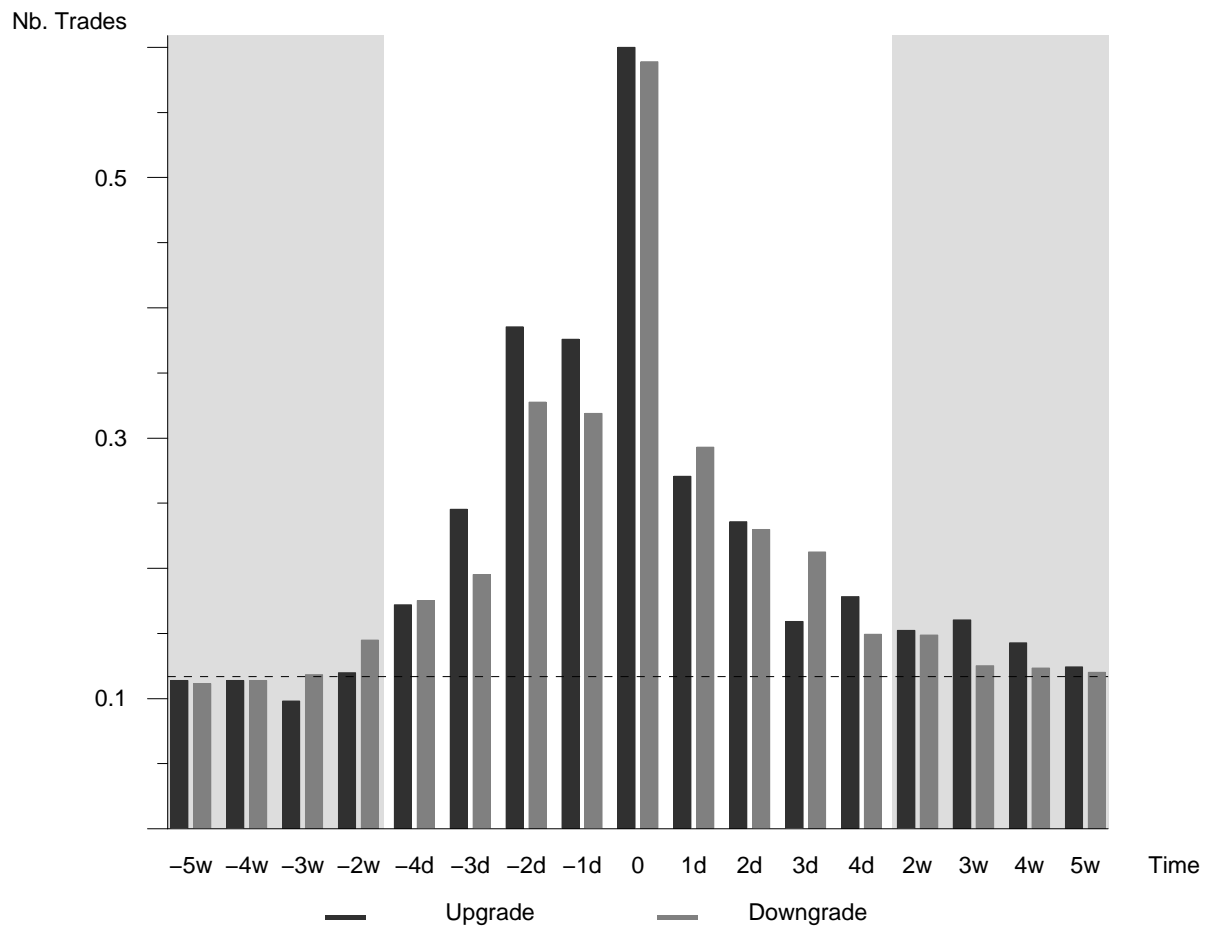


Figure 2: Trading activity around BSA recommendation revisions

Table 1: Descriptive Statistics

This table reports summary statistics for all transactions in stocks that have at least one buy-side recommendation between January 2004 and December 2007. *Sign of transaction_t* indicates whether the transaction is a buy (+1) or sell (-1). *t* denotes the day of the transaction. *BSA rec. change_{τ,τ-i}* is an indicator whether the BSA stock recommendation has been reduced (-1), increased (+1) or is unchanged (0) within the period $\tau - i$ to τ . *Cash Flow_{τ,τ-i}* is the total net cash flow of the fund trading the stock over the period. *Consensus rec. change_{τ,τ-i}* is the difference between the consensus recommendation value in τ and its value in $\tau - i - 1$. *Return_{τ,τ-i}* is the percentage change between the closing stock price in τ and $\tau - i$. *BSA rec._t* and *Consensus rec._t* denote the buy-side and consensus recommendation level, respectively, of the stock on day *t*. BSA and consensus recommendations are coded from 1 for “sell” to 5 for “strong buy”.

	Mean	Median	StdDev	Min	Max
Sign of transaction _t	-0.280	-1.000	0.960	-1.0	1.0
BSA rec. change _{t+1,t-1}	0.000	0.000	0.162	-1.0	1.0
BSA rec. change _{t-2,t-5}	-0.001	0.000	0.113	-1.0	1.0
BSA rec. change _{t-6,t-20}	-0.002	0.000	0.212	-1.0	1.0
Cash Flow _{t,t-1}	-0.189	-0.088	2.284	-40.8	24.9
Cash Flow _{t-2,t-5}	-0.445	-0.184	2.163	-40.7	25.2
Consensus rec. change _{t,t-5}	0.001	0.000	0.052	-1.0	0.6
Consensus rec. change _{t-6,t-20}	0.003	0.000	0.098	-1.0	1.0
Consensus rec. change _{t-21,t-120}	0.035	0.040	0.227	-1.1	1.1
Return _{t-1,t-5}	0.232	0.227	4.961	-62.4	41.0
Return _{t-6,t-20}	1.150	1.176	6.055	-53.7	48.5
Return _{t-21,t-120}	7.538	6.949	15.194	-65.6	157.2
BSA rec. _t	3.634	4.000	0.711	1.0	5.0
Consensus rec. _t	3.673	3.710	0.381	2.2	4.8
No. of observations	21,944				

Table 2: The distribution of recommendation changes and associated transactions

This table reports in Panel A the distribution of recommendation changes for each prior recommendation level. The last column of Panel A shows the distribution of all prior recommendations. Panel B reports the percentage of buy transactions in stocks with a recommendation change by prior and new recommendation. Percentages are calculated for all transactions in the stock in the period one trading day prior to one trading day after the recommendation change. BSA recommendations are coded from 1 for “sell” to 5 for “strong buy”.

Panel A: BSA recommendation changes: Transition matrix (%)

from rec.	to recommendation					Sample (%)
	1	2	3	4	5	
1	.	50.0	50.0	.	.	0.3
2	0.9	.	83.0	15.1	0.9	16.2
3	0.4	33.6	.	65.3	0.8	39.9
4	0.4	7.5	79.2	.	12.9	36.6
5	.	.	21.7	78.3	.	7.0

No. of observations: 536

Panel B: Buy percentage around recommendation changes

from rec.	to recommendation				
	1	2	3	4	5
1	.	.	100.0	.	.
2	.	.	70.9	90.9	100.0
3	0.0	13.0	.	86.8	100.0
4	0.0	16.0	8.0	.	64.5
5	.	.	6.9	10.5	.

Table 3: Logit analysis of transaction sign

This table reports parameter estimates and average marginal effects for the logit analysis of fund managers' trading direction. The dependent variable is each transaction's sign and takes on a value of 1 (0) for a buy (sell) transaction. t denotes the day of the transaction. The explanatory variables are described in Table 1. The *Return* variable is normalized to units of 10 percentage points. Standard errors are given in parentheses. The Change column presents the unit of the change underlying the marginal effect calculation. The R^2 reported is the maximum re-scaled R^2 . BSA and consensus recommendations are coded from 1 for "sell" to 5 for "strong buy".

Variable	Estimate		Marginal Effects		
			Change	Effect	
Intercept	-0.25	(0.16)	na	na	na
BSA rec. change $_{t+1,t-1}$	2.18	(0.13)	+1	0.43	(0.02)
			-1	-0.28	(0.01)
BSA rec. change $_{t-2,t-5}$	1.34	(0.16)	+1	0.28	(0.03)
			-1	-0.21	(0.02)
BSA rec. change $_{t-6,t-20}$	0.70	(0.07)	+1	0.15	(0.02)
			-1	-0.13	(0.01)
Cash Flow $_{t,t-1}$	0.77	(0.03)	$\pm 1\%$	0.16	(0.01)
Cash Flow $_{t-2,t-5}$	0.23	(0.02)	$\pm 1\%$	0.05	(0.00)
Consensus rec. change $_{t,t-5}$	0.67	(0.29)	± 1	0.13	(0.06)
Consensus rec. change $_{t-6,t-20}$	0.96	(0.16)	± 1	0.19	(0.03)
Consensus rec. change $_{t-21,t-120}$	0.31	(0.07)	± 1	0.06	(0.01)
Return $_{t-1,t-5}$	0.31	(0.03)	$\pm 10\text{pp}$	0.06	(0.01)
Return $_{t-6,t-20}$	-0.12	(0.02)	$\pm 10\text{pp}$	-0.02	(0.00)
Return $_{t-21,t-120}$	-0.06	(0.01)	$\pm 10\text{pp}$	-0.01	(0.00)
BSA rec. $_t$	0.08	(0.02)	± 1	0.02	(0.00)
Consensus rec. $_t$	-0.12	(0.04)	± 1	-0.02	(0.01)
R^2	0.1859				
No. of observations	21,944				

Table 4: Logit analysis of BSA recommendation changes

This table reports parameter estimates and average marginal effects for the logit analysis of buy-side analysts' recommendation changes. The dependent variable is the direction of the recommendation change and equals 1 (0) for an upgrade (downgrade). t denotes the day of the recommendation change. The explanatory variables are described in Table 1. The *Return* variable is normalized to units of 10 percentage points. Standard errors are given in parentheses. The Change column presents the unit of the change underlying the marginal effect calculation. The R^2 reported is the maximum re-scaled R^2 . BSA and consensus recommendations are coded from 1 for "sell" to 5 for "strong buy".

Variable	Estimate		Marginal Effects		
			Change	Effect	
Intercept	-0.07	(0.84)	na	na	na
Consensus rec. _{t}	-0.01	(0.24)	± 1	-0.00	(0.06)
Consensus rec. change _{$t,t-5$}	2.49	(1.31)	± 1	0.58	(0.31)
Consensus rec. change _{$t-6,t-20$}	0.10	(0.98)	± 1	0.02	(0.23)
Consensus rec. change _{$t-21,t-120$}	0.22	(0.40)	± 1	0.05	(0.09)
Return _{$t-1,t-5$}	0.83	(0.18)	± 10 pp	0.19	(0.04)
Return _{$t-6,t-20$}	-0.29	(0.16)	± 10 pp	-0.07	(0.04)
Return _{$t-21,t-120$}	-0.07	(0.06)	± 10 pp	-0.02	(0.01)
R^2	0.0857				
No. of observations	536				

Table 5: Performance of BSA recommendation changes

This table reports % returns of stocks upgraded and downgraded by the buy-side analysts as well as the difference in returns (in percentage points). Stock returns are calculated using closing prices, starting with the closing price on the event day, and are averaged over each return period. Panel A reports raw returns, Panel B reports market-adjusted returns using the MSCI Europe index for the market returns.

	Upgrades		Downgrades		Difference	
	Returns	t-stat	Returns	t-stat	Returns	t-stat
Panel A: Raw Returns						
1 day	0.165	1.43	-0.266	-2.12	0.431	2.53
1 week	0.513	2.19	-0.342	-1.47	0.855	2.58
2 weeks	1.420	4.46	-0.324	-0.96	1.744	3.77
3 weeks	1.920	4.75	-0.060	-0.19	1.981	3.82
1 month	1.842	4.19	-0.416	-1.15	2.258	3.96
2 months	3.173	3.69	1.271	2.32	1.902	1.87
3 months	3.828	4.40	1.903	2.79	1.925	1.74
6 months	6.147	5.62	4.486	5.04	1.661	1.18
Panel B: Returns relative to MSCI Europe						
1 day	0.198	1.92	-0.365	-3.07	0.563	3.58
1 week	0.377	1.80	-0.414	-2.02	0.791	2.70
2 weeks	0.778	2.71	-0.683	-2.28	1.461	3.52
3 weeks	0.849	2.37	-0.800	-2.86	1.649	3.63
1 month	0.585	1.49	-1.270	-4.14	1.855	3.73
2 months	0.800	0.95	-0.901	-1.86	1.702	1.76
3 months	0.280	0.33	-1.353	-2.27	1.633	1.58
6 months	0.059	0.06	-1.342	-1.71	1.400	1.07

Table 6: Performance of transactions

This table reports % returns of fund managers' buy and sell transactions as well as the difference in returns (in percentage points). Transactions used are either those with same-directional recommendation revision -1 to +1 trading days around the trade date (columns headed *Upgrade in [-1,+1]*, *Downgrade in [-1,+1]* and *Revision in [-1,+1]*) or those without a revision -1 to +1 trading days around the trade date (*No Revision in [-1,+1]*). Stock returns are calculated using closing prices, starting with the closing price on the event day, and are averaged over each return period. Panel A reports raw returns, Panel B reports market-adjusted returns using the MSCI Europe index.

	Buy transactions				Sell transactions				Difference Buy/Sell			
	Upgrade in [-1,+1]		No Revision in [-1,+1]		Downgrade in [-1,+1]		No Revision in [-1,+1]		Revision in [-1,+1]		No Revision in [-1,+1]	
	Returns	t-stat	Returns	t-stat	Returns	t-stat	Returns	t-stat	Returns	t-stat	Returns	t-stat
Panel A: Raw Returns												
1 day	0.157	1.32	0.112	5.49	-0.629	-3.54	0.022	1.54	0.786	3.68	0.089	3.59
1 week	-0.246	-1.03	0.253	6.44	-1.088	-3.64	0.118	3.79	0.842	2.20	0.135	2.68
2 weeks	0.276	0.81	0.563	10.46	-1.686	-4.42	0.253	5.79	1.962	3.84	0.310	4.47
3 weeks	0.339	0.85	0.946	14.32	-0.800	-2.19	0.370	7.10	1.139	2.11	0.575	6.84
1 month	0.086	0.16	1.100	14.24	-1.150	-2.88	0.543	9.25	1.235	1.86	0.558	5.75
2 months	1.352	1.46	2.014	19.25	0.181	0.27	1.317	16.04	1.172	1.03	0.697	5.24
3 months	1.154	1.27	2.597	22.12	1.039	1.21	2.308	23.16	0.115	0.09	0.289	1.87
6 months	2.530	2.32	5.590	33.30	2.082	1.86	4.851	34.53	0.448	0.29	0.739	3.38
Panel B: Returns relative to MSCI Europe												
1 day	0.189	1.72	0.082	4.49	-0.772	-4.49	-0.006	-0.43	0.961	4.71	0.088	3.93
1 week	-0.000	-0.00	0.062	1.81	-1.206	-4.29	-0.127	-4.55	1.206	3.42	0.189	4.28
2 weeks	0.041	0.14	0.098	2.08	-2.040	-5.47	-0.219	-5.71	2.080	4.36	0.317	5.22
3 weeks	0.010	0.03	0.220	3.75	-1.415	-4.02	-0.326	-7.08	1.425	2.90	0.546	7.33
1 month	-0.342	-0.72	0.213	3.09	-1.708	-4.53	-0.344	-6.75	1.366	2.26	0.558	6.50
2 months	0.145	0.16	0.377	3.95	-1.606	-2.67	-0.476	-6.58	1.751	1.63	0.853	7.13
3 months	-0.734	-0.87	-0.038	-0.36	-2.111	-2.67	-0.380	-4.28	1.376	1.19	0.341	2.48
6 months	-1.385	-1.34	0.093	0.62	-3.431	-3.47	-0.075	-0.59	2.046	1.43	0.168	0.86

Table 7: Return differences for transactions with or without BSA revision

This table reports the difference in returns (in percentage points) between fund managers' buy and sell transactions for stocks with same-directional recommendation change during the period -1 to +1 trading days around the trade date and for stocks with no recommendation change in that period. The last two columns present the difference in these differences between the two samples. Stock returns are calculated using closing prices, starting with the closing price on the event day, and are averaged over each return period. Panel A reports raw returns, Panel B reports market-adjusted returns using the MSCI Europe index.

Panel A: Raw Returns

	Revision in [-1,+1]		No Revision in [-1,+1]		Difference	
	Returns	t-stat	Returns	t-stat	Returns	t-stat
1 day	0.786	3.68	0.089	3.59	0.697	3.24
1 week	0.842	2.20	0.135	2.68	0.708	1.83
2 weeks	1.962	3.84	0.310	4.47	1.652	3.20
3 weeks	1.139	2.11	0.575	6.84	0.563	1.03
1 month	1.235	1.86	0.558	5.75	0.678	1.01
2 months	1.172	1.03	0.697	5.24	0.475	0.42
3 months	0.115	0.09	0.289	1.87	-0.174	-0.14
6 months	0.448	0.29	0.739	3.38	-0.291	-0.18

Panel B: Returns relative to MSCI Europe

	Revision in [-1,+1]		No Revision in [-1,+1]		Difference	
	Returns	t-stat	Returns	t-stat	Returns	t-stat
1 day	0.961	4.71	0.088	3.93	0.874	4.25
1 week	1.206	3.42	0.189	4.28	1.016	2.86
2 weeks	2.080	4.36	0.317	5.22	1.763	3.67
3 weeks	1.425	2.90	0.546	7.33	0.879	1.77
1 month	1.366	2.26	0.558	6.50	0.808	1.32
2 months	1.751	1.63	0.853	7.13	0.898	0.83
3 months	1.376	1.19	0.341	2.48	1.035	0.89
6 months	2.046	1.43	0.168	0.86	1.878	1.30

Table 8: Performance of key SSA recommendation changes

This table considers the recommendation revisions by sell-side analysts employed by the 10 brokers with highest overlap of their coverage with the stocks covered and traded by the buy-side firm. The table reports % returns of stocks upgraded and downgraded by these analysts as well as the difference in returns (in percentage points). Stock returns are calculated using closing prices, starting with the closing price prior to the event day, and are averaged over each return period. Panel A reports raw returns, Panel B reports market-adjusted returns using the MSCI Europe index for the market returns.

	Upgrades		Downgrades		Difference	
	Returns	t-stat	Returns	t-stat	Returns	t-stat
Panel A: Raw Returns						
1 day	0.576	16.30	-0.602	-12.59	1.178	19.81
1 week	1.077	16.58	-0.745	-10.14	1.821	18.57
2 weeks	1.270	14.80	-0.625	-6.46	1.895	14.66
3 weeks	1.545	15.01	-0.337	-2.94	1.882	12.21
1 month	1.856	15.87	-0.051	-0.40	1.907	11.09
2 months	2.908	18.42	0.786	4.64	2.122	9.16
3 months	4.061	20.64	1.639	8.05	2.422	8.55
6 months	7.078	24.47	4.399	14.80	2.679	6.46
Panel B: Returns relative to MSCI Europe						
1 day	0.560	17.63	-0.622	-13.58	1.182	21.21
1 week	0.807	14.31	-0.954	-14.01	1.760	19.92
2 weeks	0.696	9.44	-1.056	-11.95	1.752	15.22
3 weeks	0.670	7.62	-1.073	-10.31	1.742	12.79
1 month	0.654	6.42	-1.117	-9.92	1.771	11.66
2 months	0.745	5.39	-1.217	-8.00	1.962	9.54
3 months	0.760	4.39	-1.535	-8.38	2.295	9.11
6 months	0.781	3.04	-1.462	-5.56	2.242	6.10

Table 9: Performance of transactions following key SSA recommendation changes

This table reports % returns of fund managers' buy and sell transactions as well as the difference in returns (in percentage points). Transactions used are those with recommendation revision by sell-side analysts employed by the 10 brokers with highest overlap of their coverage with the stocks covered and traded by the buy-side firm -1 to 0 trading days around the trade date. If there are multiple revisions, the majority of upgrades or downgrades determines the revision direction; for equal numbers of upgrades and downgrades, the transactions are discarded. Stock returns are calculated using closing prices, starting with the closing price on the event day, and are averaged over each return period. Panel A reports raw returns following upgrades, Panel B reports market-adjusted returns (using the MSCI Europe index) following upgrades. Panel C reports raw returns following downgrades, Panel D reports market-adjusted returns following downgrades.

	Buy transactions		Sell transactions		Difference Buy/Sell	
	Returns	t-stat	Returns	t-stat	Returns	t-stat
Panel A: Raw Returns Following Upgrades						
1 day	0.030	0.27	-0.037	-0.43	0.067	0.47
1 week	0.832	3.63	-0.119	-0.72	0.951	3.36
2 weeks	1.093	3.76	0.196	0.80	0.897	2.36
3 weeks	1.201	3.69	0.258	1.02	0.942	2.29
1 month	1.399	3.95	0.576	1.94	0.823	1.78
2 months	1.619	3.40	1.223	2.84	0.396	0.62
3 months	2.546	4.38	1.018	1.71	1.528	1.83
6 months	4.916	4.82	2.130	2.49	2.786	2.09
Panel B: Returns Relative to MSCI Europe Following Upgrades						
1 day	0.059	0.68	-0.032	-0.43	0.092	0.80
1 week	0.537	2.71	-0.395	-2.70	0.932	3.78
2 weeks	0.251	1.03	-0.423	-1.94	0.673	2.06
3 weeks	0.193	0.70	-0.590	-2.68	0.783	2.21
1 month	0.123	0.40	-0.452	-1.84	0.576	1.46
2 months	-0.464	-1.12	-0.526	-1.47	0.062	0.11
3 months	-0.885	-1.74	-1.568	-2.84	0.684	0.91
6 months	-1.097	-1.19	-2.458	-3.10	1.361	1.12
Panel C: Raw Returns Following Downgrades						
1 day	0.109	0.79	-0.350	-2.64	0.460	2.40
1 week	0.031	0.14	-0.771	-2.26	0.802	1.96
2 weeks	0.479	1.62	-2.004	-5.20	2.483	5.11
3 weeks	-0.217	-0.60	-2.301	-5.94	2.084	3.92
1 month	0.229	0.54	-1.822	-4.92	2.051	3.63
2 months	0.540	0.82	-1.720	-3.16	2.261	2.64
3 months	0.293	0.24	-1.164	-1.82	1.457	1.06
6 months	1.770	1.24	-0.021	-0.02	1.791	1.08
Panel D: Returns Relative to MSCI Europe Following Downgrades						
1 day	0.030	0.25	-0.444	-3.53	0.474	2.72
1 week	-0.444	-2.19	-0.995	-2.79	0.551	1.34
2 weeks	-0.489	-1.89	-2.469	-6.22	1.979	4.18
3 weeks	-1.280	-4.33	-2.920	-7.74	1.640	3.42
1 month	-1.062	-2.92	-2.746	-7.90	1.684	3.35
2 months	-1.390	-2.58	-3.121	-6.20	1.731	2.35
3 months	-2.553	-2.37	-4.035	-6.80	1.482	1.21
6 months	-2.971	-2.47	-4.775	-6.27	1.805	1.27